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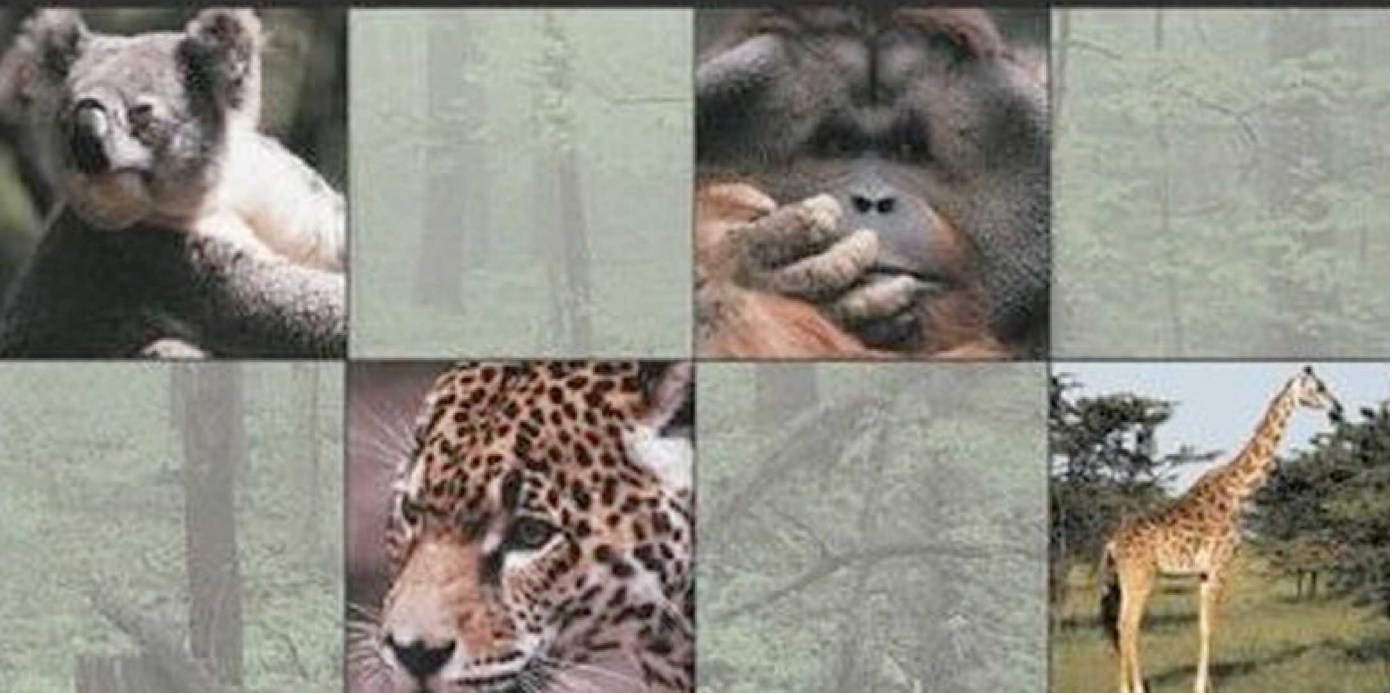
Student Animal Life Resource

mammals



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Mammals

Project Editor
Melissa C. McDade

Editorial
Julie L. Carnagie, Madeline Harris, Elizabeth Manar, Heather Price

Indexing Services
Synapse, the Knowledge Link Corporation

Rights and Acquisitions
Sheila Spencer, Mari Masalin-Cooper

Imaging and Multimedia
Randy Bassett, Michael Logusz, Dan Newell, Chris O'Bryan, Robyn Young

Product Design
Tracey Rowens, Jennifer Wahi

Composition
Evi Seoud, Mary Beth Trimper

Manufacturing
Wendy Blurton, Dorothy Maki

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Reader's Guide

Grzimek's Student Animal Life Resource: Mammals offers readers comprehensive and easy-to-use information on Earth's mammals. Entries are arranged by taxonomy, the science through which living things are classified into related groups. Order entries provide an overview of a group of families, and family entries provide an overview of a particular family. Each entry includes sections on physical characteristics; geographic range; habitat; diet; behavior and reproduction; animals and people; and conservation status. Family entries are followed by one or more species accounts with the same information as well as a range map and photo or illustration for each species. Entries conclude with a list of books, periodicals, and Web sites that may be used for further research.

ADDITIONAL FEATURES

Each volume of *Grzimek's Student Animal Life Resource: Mammals* includes a pronunciation guide for scientific names, a glossary, an overview of Mammals, a list of species in the set by biome, a list of species by geographic location, and an index. The set has 540 full-color maps, photos, and illustrations to enliven the text, and sidebars provide additional facts and related information.

NOTES

The classification of animals into orders, families, and even species is not a completed exercise. As researchers learn more about animals and their relationships, classifications may change. In some cases, researchers do not agree on how or whether to

make a change. For this reason, the heading "Number of species" in the introduction of an entry may read "About 36 species" or "34 to 37 species." It is not a question of whether some animals exist or not, but a question of how they are classified. Some researchers are more likely to "lump" animals into the same species classification, while others may "split" animals into separate species.

Grzimek's Student Animal Life Resource: Mammals has standardized information in the Conservation Status section. The IUCN Red List provides the world's most comprehensive inventory of the global conservation status of plants and animals. Using a set of criteria to evaluate extinction risk, the IUCN recognizes the following categories: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Near Threatened, Least Concern, and Data Deficient. These terms are defined where they are used in the text, but for a complete explanation of each category, visit the IUCN web page at http://www.iucn.org/themes/ssc/redlists/RLcats2001booklet.html.

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COMMENTS AND SUGGESTIONS

We welcome your comments on *Grzimek's Student Animal Life Resource: Mammals* and suggestions for future editions of this work. Please write: Editors, *Grzimek's Student Animal Life Resource: Mammals*, U•X•L, 27500 Drake Rd., Farmington Hills, Michigan 48331-3535; call toll free: 1-800-877-4253; fax: 248-699-8097; or send e-mail via www.gale.com.



Pronunciation Guide for Scientific Names

Abrocoma cinerea AB-ruh-KOH-muh sin-EAR-ee-uh
Abrocomidae ab-ruh-KOH-muh-dee
Acomys cahirinus ak-OH-meez kay-hih-RYE-nuhs
Acrobates pygmaeus ak-CROW-bah-teez pig-MEE-uhs
Acrobatidae ak-crow-BAH-tuh-dee
Agouti paca ah-GOO-tee PAY-cuh
Agoutidae ah-GOO-tuh-dee
Ailuropoda melanoleuca AYE-lur-uh-POD-uh MEL-uh-noh-LYOO-kuh
Ailurus fulgens AYE-lur-uhs FULL-jens
Alces alces AL-ceez AL-ceez
Alouatta seniculus ah-loo-AH-tuh se-NIH-kul-uhs
Anomaluridae ah-nuh-mah-LOOR-uh-dee
Anomalurus derbianus ah-nuh-MAH-loor-uhs der-BEE-an-uhs
Antilocapra americana AN-til-uh-KAP-ruh uh-mer-uh-KAN-uh
Antilocapridae an-til-uh-KAP-ruh-dee
Antrozous pallidus an-tro-ZOH-uhs PAL-uh-duhs
Aotidae ay-OH-tuh-dee
Aotus trivirgatus ay-OH-tuhs try-VER-gah-tuhs
Aplodontia rufa ap-loh-DON-shuh ROO-fah
Aplodontidae ap-loh-DON-tuh-dee
Arctocephalus gazella ARK-tuh-SEFF-uh-luhs guh-ZELL-uh
Artiodactyla AR-tee-uh-DAK-til-uh
Asellia tridens ah-SELL-ee-uh TRY-denz
Ateles geoffroyi ah-TELL-eez JEFF-roy-eye
Atelidae ah-TELL-uh-dee

Babyrousa babyrussa bah-bee-ROO-suh bah-bee-ROO-suh
Balaena mysticetus bah-LEE-nuh mis-tuh-SEE-tuhs
Balaenidae bah-LEE-nuh-dee
Balaenoptera acutorostrata bah-lee-NOP-teh-ruh uh-KYOOT-uh-ROS-trah-tuh
Balaenoptera musculus bah-lee-NOP-teh-ruh muhs-KU-luhs
Balaenopteridae bah-lee-nop-TEH-ruh-dee
Barbastella barbastellus bar-buh-STELL-uh bar-buh-STELL-uhs
Bathyergidae bath-ih-ER-juh-dee
Bettongia tropica bee-ton-JEE-uh TROP-ik-uh
Bison bison BI-sun BI-sun
Bovidae BOH-vuh-dee
Bradypodidae brad-ih-POD-uh-dee
Bradypus variegatus BRAD-ih-puhs vair-ee-uh-GAH-tuhs
Bubalus bubalis BYOO-bal-uhs BYOO-bal-is
Burramyidae bur-ruh-MY-uh-dee
Cacajao calvus KA-ka-jah-oh KAL-vuhs
Caenolestes fuliginosus kee-NOH-less-teez fyoo-li-JEH-noh-suhs
Caenolestidae kee-noh-LESS-tuh-dee
Callicebus personatus kal-luh-SEE-buhs per-SON-ah-tuhs
Callimico goeldii kal-luh-MEE-koh geel-DEE-eye
Callitrichidae kal-luh-TRIK-uh-dee
Camelidae kam-EL-uh-dee
Camelus dromedarius KAM-el-uhs drom-uh-DARE-ee-uhs
Canidae KAN-uh-dee
Canis lupus KAN-is LYOO-puhs
Caperea marginata kay-per-EE-uh mar-JIN-ah-tuh
Capricornis sumatraensis kap-rih-KOR-nis soo-mah-TREN-sis
Capromyidae kap-roh-MY-uh-dee
Capromys pilorides KAP-roh-meez pi-LOH-ruh-deez
Carnivora kar-NIH-voh-ruh
Castor canadensis KAS-tor kan-uh-DEN-sis
Castoridae kas-TOR-uh-dee
Caviidae kave-EYE-uh-dee
Cebidae SEE-buh-dee
Cebuella pygmaea see-boo-ELL-uh pig-MEE-uh
Cebus capucinus SEE-buhs kap-oo-CHIN-uhs
Cebus olivaceus SEE-buhs ah-luh-VAY-see-uhs
Ceratotherium simum suh-rah-tuh-THER-ee-um SIM-um
Cercartetus nanus ser-kar-TEE-tuhs NAN-uhs

Cercopithecidae ser-koh-pith-EEK-uh-dee
Cervidae SER-vuh-dee
Cervus elaphus SER-vuhs EL-laff-uhs
Cetacea sih-TAY-she-uh
Cheirogaleidae KY-roh-GAL-uh-dee
Cheiromeles torquatus ky-ROH-mel-eez TOR-kwah-tuhs
Chinchilla lanigera chin-CHILL-uh la-NIJ-er-uh
Chinchillidae chin-CHILL-uh-dee
Chironectes minimus ky-roh-NECK-teez MIN-ih-muhs
Chiroptera ky-ROP-ter-uh
Chlamyphorus truncatus klam-EE-for-uhs TRUN-kah-tuhs
Choloepus hoffmanni koh-LEE-puhs HOFF-man-eye
Chrysochloridae krih-soh-KLOR-uh-dee
Chrysocyon brachyurus krih-SOH-sigh-on bra-kee-YOOR-uhs
Civettictis civetta sih-VET-tick-tis SIH-vet-uh
Coendou prehensilis SEEN-doo prih-HEN-sil-is
Condylura cristata KON-dih-LUR-uh KRIS-tah-tuh
Connochaetes gnou koh-nuh-KEE-teez NEW
Craseonycteridae kras-ee-oh-nick-TER-uh-dee
Craseonycteris thonglongyai kras-ee-oh-NICK-ter-is thong-LONG-ee-aye
Cricetomys gambianus kry-see-TOH-meez GAM-bee-an-uhs
Cricetus cricetus kry-SEE-tuhs kry-SEE-tuhs
Crocuta crocuta kroh-CUE-tuh kroh-CUE-tuh
Cryptomys damarensis krip-TOH-meez DAM-are-en-sis
Cryptoprocta ferox krip-TOH-prok-tuh FAIR-oks
Cryptotis parva krip-TOH-tis PAR-vuh
Ctenodactylidae ten-oh-dak-TIL-uh-dee
Ctenomyidae ten-oh-MY-uh-dee
Ctenomys pearsoni TEN-oh-meez PEAR-son-eye
Cyclopes didactylus SIGH-kluh-peez die-DAK-til-uhs
Cynocephalidae sigh-nuh-seff-UH-luh-dee
Cynocephalus variegatus sigh-nuh-SEFF-uh-luhs VAIR-ee-uh-GAH-tus
Cynomys ludovicianus SIGH-no-mees LOO-doh-vih-SHE-an-uhs
Dasypodidae das-ih-POD-uh-dee
Dasyprocta punctata das-IH-prok-tuh PUNK-tah-tuh
Dasyproctidae das-ih-PROK-tuh-dee
Dasypus novemcinctus DAS-ih-puhs noh-VEM-sink-tuhs

Dasyuridae das-ih-YOOR-uh-dee
Dasyuromorphia das-ih-yoor-oh-MOR-fee-uh
Daubentoniidae daw-ben-tone-EYE-uh-dee
Daubentonia madagascariensis daw-ben-TONE-ee-uh mad-uh-GAS-kar-EE-en-sis
Delphinapterus leucas del-fin-AP-ter-uhs LYOO-kuhs
Delphinidae del-FIN-uh-dee
Dendrohyrax arboreus den-droh-HI-raks are-BOHR-ee-uhs
Dendrolagus bennettianus den-droh-LAG-uhs BEN-net-EE-an-uhs
Dermoptera der-MOP-ter-uh
Desmodus rotundus dez-MOH-duhs ROH-tun-duhs
Dicerorhinus sumatrensis die-ser-uh-RHY-nuhs soo-mah-TREN-sis
Didelphidae die-DELF-uh-dee
Didelphimorphia die-delf-uh-MOR-fee-uh
Didelphis virginiana DIE-delf-is ver-JIN-ee-an-uh
Dinomyidae die-noh-MY-uh-dee
Dinomys branickii DIE-noh-meez BRAN-ick-ee-eye
Dipodidae dih-POD-uh-dee
Dipodomys ingens dih-puh-DOH-meez IN-jenz
Diprotodontia dih-pro-toh-DON-she-uh
Dipus sagitta DIH-puhs SAJ-it-tuh
Dolichotis patagonum doll-ih-KOH-tis pat-uh-GOH-num
Dromiciops gliroides droh-MISS-ee-ops gli-ROY-deez
Dugong dugon DOO-gong DOO-gon
Dugongidae doo-GONG-uh-dee
Echimyidae ek-ih-MY-uh-dee
Echinosorex gymnura EH-ky-noh-SORE-eks JIM-nyoor-uh
Echymipera rufescens ek-ee-MIH-per-uh ROO-fehs-sens
Ectophylla alba ek-toh-FILE-luh AHL-buh
Elephantidae el-uh-FAN-tuh-dee
Elephas maximus EL-uh-fuhs MAX-im-uhs
Emballonuridae em-bal-lun-YOOR-uh-dee
Equidae EK-wuh-dee
Equus caballus przewalskii EK-wuhs CAB-uh-luhs prez-VAL-skee-eye
Equus grevyi EK-wuhs GREH-vee-eye
Equus kiang EK-wuhs KY-an
Eremitalpa granti er-uh-MIT-ahl-puh GRAN-tie

Erethizon dorsatum er-uh-THY-zun DOR-sah-tum
Erethizontidae er-uh-thy-ZUN-tuh-dee
Erinaceidae er-ih-nay-SIGH-dee
Erinaceus europaeus er-ih-NAY-shuhs yoor-uh-PEE-uhs
Eschrichtiidae ess-rick-TIE-uh-dee
Eschrichtius robustus ess-RICK-shuhs roh-BUHS-tuhs
Eubalaena glacialis yoo-bah-LEE-nuh glay-SHE-al-is
Felidae FEE-luh-dee
Furipteridae fur-ip-TER-uh-dee
Galagidae gal-AG-uh-dee
Galago senegalensis GAL-ag-oh sen-ih-GAHL-en-sis
Galidia elegans ga-LID-ee-uh EL-uh-ganz
Gazella thomsonii guh-ZELL-uh TOM-son-ee-eye
Genetta genetta JIN-eh-tuh JIN-eh-tuh
Geomyidae gee-oh-MY-uh-dee
Giraffa camelopardalis JIH-raf-uh KAM-el-uh-PAR-dal-is
Giraffidae jih-RAF-uh-dee
Glaucomys volans glo-KOH-meez VOH-lans
Glossophaga soricina glos-SUH-fag-uh sore-ih-SEE-nuh
Gorilla gorilla guh-RILL-uh guh-RILL-uh
Hemicentetes semispinosus hemi-sen-TEE-teez semi-PINE-oh-suhs
Herpestidae her-PES-tuh-dee
Heterocephalus glaber HEH-tuh-roh-SEFF-uh-luhs GLAH-ber
Heteromyidae HEH-tuh-roh-MY-uh-dee
Hexaprotodon liberiensis hek-suh-PRO-tuh-don lye-BEER-ee-en-sis
Hippopotamidae HIP-poh-pot-UH-muh-dee
Hippopotamus amphibius HIP-poh-POT-uh-muhs am-FIB-ee-uhs
Hipposideridae HIP-poh-si-DER-uh-dee
Hominidae hom-IN-uh-dee
Homo sapiens HOH-moh SAY-pee-enz
Hyaenidae hi-EE-nuh-dee
Hydrochaeridae hi-droh-KEE-ruh-dee
Hydrochaeris hydrochaeris hi-droh-KEE-ris hi-droh-KEE-ris
Hydrodamalis gigas hi-droh-DAM-uhl-is JEE-guhs
Hylobates lar hi-loh-BAY-teez lahr
Hylobates pileatus hi-loh-BAY-teez pie-LEE-ah-tuhs
Hylobatidae hi-loh-BAY-tuh-dee

Hylochoerus meinertzhageni hi-loh-KEE-ruhs MINE-ertz-hah-gen-eye
Hyperoodon ampullatus hi-per-OH-uh-don am-PUH-lah-tuhs
Hypsiprymnodontidae HIP-see-PRIM-nuh-DON-shuh-dee
Hypsiprymnodon moschatus hip-see-PRIM-nuh-don MOS-kah-tuhs
Hyracoidea HI-rah-koy-DEE-uh
Hystricidae hiss-TRIK-uh-dee
Hystrix africaeaustralis HISS-triks AF-rik-ee-au-STRA-lis
Hystrix indica HISS-triks IN-dik-uh
Indri indri IN-dri IN-dri
Indriidae in-DRY-uh-dee
Inia geoffrensis in-EE-uh JEFF-ren-sis
Iniidae in-EYE-uh-dee
Insectivora IN-sek-TIV-uh-ruh
Kerodon rupestris KER-uh-don ROO-pes-tris
Kogia breviceps koh-JEE-uh BREV-ih-seps
Lagomorpha LAG-uh-MOR-fuh
Lagothrix lugens LAG-uh-thriks LU-jens
Lama glama LAH-muh GLAH-muh
Lama pacos LAH-muh PAY-kuhs
Lemmus lemmus LEM-muhs LEM-muhs
Lemur catta LEE-mer KAT-tuh
Lemur coronatus LEE-mer KOR-roh-nah-tuhs
Lemuridae lee-MYOOR-uh-dee
Lepilemur leucopus lep-uh-LEE-mer LYOO-koh-puhs
Lepilemur ruficaudatus lep-uh-LEE-mer ROO-fee-KAW-dah-tuhs
Lepilemuridae LEP-uh-lee-MOOR-uh-dee
Leporidae lep-OR-uh-dee
Lepus americanus LEP-uhs uh-mer-uh-KAN-uhs
Lepus timidus LEP-uhs TIM-id-uhs
Lipotes vexillifer lip-OH-teez veks-ILL-uh-fer
Lipotidae lip-OH-tuh-dee
Lorisidae lor-IS-uh-dee
Loxodonta africana LOK-suh-DON-tuh AF-rih-kan-uh
Loxodonta cyclotis LOK-suh-DON-tuh SIGH-klo-tis
Lutra lutra LOO-truh LOO-truh
Lynx rufus LINKS ROO-fuhs
Macaca mulatta muh-KAY-kuh MYOO-lah-tuh

Macroderma gigas ma-CROW-der-muh JEE-guhs
Macropodidae ma-crow-POD-uh-dee
Macropus giganteus ma-CROW-puhs jy-GAN-tee-uhs
Macropus rufus ma-CROW-puhs ROO-fuhs
Macroscelidea MA-crow-sel-uh-DEE-uh
Macroscelididae MA-crow-sel-UH-duh-dee
Macrotis lagotis ma-CROW-tis la-GO-tis
Macrotus californicus ma-CROW-tuhs kal-uh-FORN-uh-kuhs
Madoqua kirkii ma-DOH-kwah KIRK-ee-eye
Mandrillus sphinx man-DRILL-uhs SFINKS
Manidae MAN-uh-dee
Manis temminckii MAN-is TEM-ink-ee-eye
Marmota marmota MAR-mah-tuh MAR-mah-tuh
Massoutiera mzabi mas-soo-TEE-er-uh ZA-bye
Megadermatidae meg-uh-der-MUH-tuh-dee
Megalonychidae meg-uh-loh-NICK-uh-dee
Megaptera novaeangliae meg-uh-TER-uh NOH-vee-ANG-lee-dee
Meles meles MEL-eez MEL-eez
Mephitis mephitis MEF-it-is MEF-it-is
Microbiotheria my-crow-bio-THER-ee-uh
Microbiotheriidae my-crow-bio-ther-EYE-uh-dee
Microcebus rufus my-crow-SEE-buhs ROO-fuhs
Micropteropus pusillus my-crop-TER-oh-puhs pyoo-SILL-uhs
Miniopterus schreibersi min-ee-OP-ter-uhs shry-BER-seye
Mirounga angustirostris MIR-oon-guh an-GUHS-tih-ROS-tris
Molossidae mol-OS-suh-dee
Monachus schauinslandi MON-ak-uhs SHOU-inz-land-eye
Monodon monoceros MON-uh-don mon-UH-ser-uhs
Monodontidae mon-uh-DON-shuh-dee
Monotremata mon-uh-TREEM-ah-tuh
Mormoopidae mor-moh-UP-uh-dee
Moschus moschiferus MOS-kuhs mos-KIF-er-uhs
Muntiacus muntjak mun-SHE-uh-kuhs MUNT-jak
Muridae MUR-uh-dee
Mustela erminea MUS-tuh-luh er-MIN-ee-uh
Mustelidae mus-TUH-luh-dee
Myocastor coypus MY-oh-KAS-tor COI-puhs
Myocastoridae MY-oh-kas-TOR-uh-dee
Myotis lucifugus my-OH-tis loo-SIFF-ah-guhs

Myoxidae my-OKS-uh-dee
Myoxus glis MY-oks-uhs GLIS
Myrmecobiidae mur-mih-koh-BYE-uh-dee
Myrmecobius fasciatus mur-mih-KOH-bee-uhs fah-SHE-ah-tuhs
Myrmecophaga tridactyla mur-mih-KOH-fag-uh try-DAK-til-uh
Myrmecophagidae mur-mih-koh-FAJ-uh-dee
Mystacina tuberculata miss-tih-SEE-nuh too-ber-KYOO-lah-tuh
Mystacinidae miss-tih-SEE-nuh-dee
Myzopoda aurita my-zoh-POD-uh OR-it-uh
Myzopodidae my-zoh-POD-uh-dee
Nasalis larvatus NAY-zal-is LAR-vah-tuhs
Natalidae nay-TAL-uh-dee
Natalus stramineus NAY-tal-uhs struh-MIN-ee-uhs
Neobalaenidae nee-oh-bah-LEE-nuh-dee
Noctilio leporinus nok-TIHL-ee-oh leh-por-RYE-nuhs
Noctilionidae nok-tihl-ee-ON-uh-dee
Notomys alexis noh-TOH-meez ah-LEK-sis
Notoryctemorphia noh-toh-rik-teh-MOR-fee-uh
Notoryctes typhlops noh-TOH-rik-teez TIE-flopz
Notoryctidae noh-toh-RIK-tuh-dee
Nycteridae nik-TER-uh-dee
Nycteris thebaica NIK-ter-is the-BAH-ik-uh
Nycticebus pygmaeus nik-tih-SEE-buhs pig-MEE-uhs
Nyctimene robinsoni nik-TIM-en-ee ROB-in-son-eye
Ochotona hyperborea oh-koh-TOH-nuh hi-per-BOHR-ee-uh
Ochotona princeps oh-koh-TOH-nuh PRIN-seps
Ochotonidae oh-koh-TOH-nuh-dee
Octodon degus OK-tuh-don DAY-gooz
Octodontidae ok-tuh-DON-tuh-dee
Odobenidae oh-duh-BEN-uh-dee
Odobenus rosmarus oh-DUH-ben-uhs ROS-mahr-uhs
Odocoileus virginianus oh-duh-KOI-lee-uhs ver-JIN-ee-an-nuhs
Okapia johnstoni oh-KAH-pee-uh JOHNS-ton-eye
Ondatra zibethicus ON-dat-ruh ZIB-eth-ih-kuhs
Onychogalea fraenata oh-nik-uh-GAL-ee-uh FREE-nah-tuh
Orcinus orca OR-sigh-nuhs OR-kuh
Ornithorhynchidae OR-nith-oh-RIN-kuh-dee
Ornithorynchus anatinus OR-nith-oh-RIN-kuhs an-AH-tin-uhs
Orycteropodidae or-ik-ter-uh-POD-uh-dee
Orycteropus afer or-ik-TER-uh-puhs AF-er

Otariidae oh-tar-EYE-uh-dee
Otolemur garnettii oh-tuh-LEE-mer GAR-net-ee-eye
Ovis canadensis OH-vis kan-uh-DEN-sis
Pagophilus groenlandicus pa-GO-fil-luhs GREEN-land-ih-cuhs
Pan troglodytes PAN trog-luh-DIE-teez
Panthera leo PAN-ther-uh LEE-oh
Panthera tigris PAN-ther-uh TIE-gris
Paucituberculata paw-see-too-ber-KYOO-lah-tuh
Pedetidae ped-ET-uh-dee
Peramelemorphia per-uh-mel-eh-MOR-fee-uh
Peramelidae per-uh-MEL-uh-dee
Perameles gunnii PER-uh-MEL-eez GUN-ee-eye
Perissodactyla peh-RISS-uh-DAK-til-uh
Perodicticus potto per-uh-DIK-tuh-kuhs POT-toh
Perognathus inornatus PER-ug-NAH-thuhs in-AWR-nah-tuhs
Peropteryx kappleri per-OP-ter-iks KAP-ler-eye
Peroryctidae per-uh-RIK-tuh-dee
Petauridae pet-OR-uh-dee
Petauroides volans pet-or-OY-deez VOH-lanz
Petaurus breviceps PET-or-uhs BREV-ih-seps
Petrogale penicillata pet-ROH-gah-lee pen-ih-SIL-lah-tuh
Petromuridae pet-roh-MUR-uh-dee
Petromus typicus PET-roh-muhs TIP-ih-kuhs
Phalanger gymnotis FAH-lan-jer jim-NOH-tis
Phalangeridae fah-lan-JER-uh-dee
Phascogale tapoatafa fas-KOH-gah-lee TAP-oh-uh-TAH-fuh
Phascolarctidae fas-koh-LARK-tuh-dee
Phascolarctos cinereus fas-KOH-lark-tuhs sin-EAR-ee-uhs
Phocidae FOE-suh-dee
Phocoena phocoena FOE-see-nuh FOE-see-nuh
Phocoena spinipinnis FOE-see-nuh SPY-nih-PIN-is
Phocoenidae foe-SEE-nuh-dee
Pholidota foe-lih-DOH-tuh
Phyllostomidae fill-uh-STOH-muh-dee
Physeter macrocephalus FY-se-ter ma-crow-SEFF-uh-luhs
Physeteridae fy-se-TER-uh-dee
Piliocolobus badius fill-ee-oh-KOH-loh-buhs BAD-ee-uhs
Pithecia pithecia pith-EEK-ee-uh pith-EEK-ee-uh
Pitheciidae pith-eek-EYE-uh-dee
Plantanista gangetica plan-TAN-is-tuh gan-JET-ik-uh

Platanistidae plan-tan-IS-tuh-dee
Pongo pygmaeus PON-goh pig-MEE-uhs
Pontoporia blainvillei pon-toh-POR-ee-uh BLAIN-vill-ee-eye
Pontoporiidae PON-toh-por-EYE-uh-dee
Potoroidae pot-uh-ROY-dee
Primates PRY-maytes
Proboscidea proh-BOS-see-uh
Procavia capensis proh-CAVE-ee-uh KAP-en-sis
Procaviidae proh-kave-EYE-uh-dee
Procyon lotor proh-SIGH-on LOH-tor
Procyonidae proh-sigh-ON-uh-dee
Proechimys semispinosus proh-EK-ih-meez sem-ih-SPY-noh-suhs
Propithecus edwardsi proh-PITH-eek-uhs ED-werds-eye
Proteles cristatus PROH-tell-eez KRIS-tah-tuhs
Pseudocheiridae soo-doh-KY-ruh-dee
Pseudocheirus peregrinus soo-doh-KY-ruhs PEHR-eh-GRIN-uhs
Pteronotus parnellii ter-uh-NOH-tuhs PAR-nell-ee-eye
Pteropodidae ter-uh-POD-uh-dee
Pteropus giganteus ter-OH-puhs jy-GAN-tee-uhs
Pteropus mariannus ter-OH-puhs MARE-ih-an-uhs
Pudu pudu POO-doo POO-doo
Puma concolor PYOO-muh CON-kuh-luhr
Puripterus horrens PYOOR-ip-TER-uhs HOR-renz
Pygathrix nemaeus PIG-uh-thriks neh-MEE-uhs
Rangifer tarandus RAN-jih-fer TAR-an-duhs
Rhinoceros unicornis rye-NOS-er-uhs YOO-nih-KORN-is
Rhinocerotidae rye-NOS-er-UH-tuh-dee
Rhinolophidae rye-noh-LOH-fuh-dee
Rhinolophus capensis rye-noh-LOH-fuhs KAP-en-sis
Rhinolophus ferrumequinum rye-noh-LOH-fuhs FEHR-rum-EK-wy-num
Rhinopoma hardwickei rye-noh-POH-muh HARD-wik-eye
Rhinopomatidae rye-noh-poh-MAT-uh-dee
Rhynchocyon cirnei rin-koh-SIGH-on SIR-neye
Rodentia roh-DEN-she-uh
Rousettus aegyptiacus ROO-set-tuhs ee-JIP-tih-kuhs
Saccopteryx bilineata sak-OP -ter-iks BY-lin-EE-ah-tuh
Saguinus oedipus SAG-win-uhs ED-uh-puhs
Saimiri sciureus SAY-meer-eye sigh-OOR-ee-uhs
Sarcophilus laniarius SAR-kuh-FIL-uhs lan-ee-AIR-ee-uhs

Scalopus aquaticus SKA-loh-puhs uh-KWAT-ik-uhs
Scandentia skan-DEN-she-uh
Sciuridae sigh-OOR-uh-dee
Sciurus carolinensis SIGH-oor-uhs kar-uh-LINE-en-sis
Sigmodon hispidus SIG-muh-don HISS-pid-uhs
Sirenia sy-REEN-ee-uh
Solenodon paradoxus so-LEN-uh-don PAR-uh-DOCKS-uhs
Solenodontidae so-len-uh-DON-shuh-dee
Sorex palustris SOR-eks PAL-us-tris
Soricidae sor-IS-uh-dee
Stenella longirostris steh-NELL-uh LAWN-juh-ROS-tris
Suidae SOO-uh-dee
Sus scrofa SOOS SKRO-fuh
Sylvilagus audubonii SILL-vih-LAG-uhs AW-duh-BON-ee-eye
Symphalangus syndactylus SIM-fuh-LAN-guhs sin-DAK-til-uhs
Tachyglossidae TAK-ih-GLOS-suh-dee
Tachyglossus aculeatus TAK-ih-GLOS-suhs ak-YOOL-ee-ah-tuhs
Tadarida brasiliensis ta-DARE-ih-dah bra-ZILL-ee-en-sis
Talpidae TAL-puh-dee
Tamias striatus TAM-ee-uhs stry-AH-tuhs
Tapiridae tay-PUR-uh-dee
Tapirus indicus TAY-pur-uhs IN-dih-kuhs
Tapirus terrestris TAY-pur-uhs TER-rehs-tris
Tarsiidae tar-SIGH-uh-dee
Tarsipedidae tar-sih-PED-uh-dee
Tarsipes rostratus TAR-si-peez ROS-trah-tuhs
Tarsius bancanus TAR-see-uhs BAN-kan-uhs
Tarsius syrichta TAR-see-uhs STRIK-tuh
Tasmacetus shepherdi taz-muh-SEE-tuhs SHEP-erd-eye
Tayassu tajacu TAY-yuh-soo TAY-jah-soo
Tayassuidae tay-yuh-SOO-uh-dee
Tenrec ecaudatus TEN-rek ee-KAW-dah-tuhs
Tenrecidae ten-REK-uh-dee
Thomomys bottae TOM-oh-meez BOTT-ee
Thryonomyidae thry-oh-noh-MY-uh-dee
Thryonomys swinderianus THRY-oh-NOH-meez SWIN-der-EE-an-uhs
Thylacinidae thy-luh-SEEN-uh-dee
Thylacinus cynocephalus THY-luh-SEEN-uhs sigh-nuh-SEFF-uh-luhs

Thyroptera tricolor thy-ROP-ter-uh TRY-kuh-luhr
Thyropteridae thy-rop-TER-uh-dee
Tragulidae tray-GOO-luh-dee
Tragulus javanicus TRAY-goo-luhs jah-VAHN-ih-kuhs
Trichechidae trik-EK-uh-dee
Trichechus manatus TRIK-ek-uhs MAN-uh-tuhs
Trichosurus vulpecula TRIK-uh-SOOR-uhs vul-PEK-yoo-luh
Tubulidentata toob-yool-ih-DEN-tah-tuh
Tupaia glis too-PUH-ee-uh GLIS
Tupaiidae too-puh-EYE-uh-dee
Tursiops truncatus tur-SEE-ops TRUN-kah-tuhs
Uncia uncia UN-see-uh UN-see-uh
Ursidae UR-suh-dee
Ursus americanus UR-suhs uh-mer-uh-KAN-uhs
Ursus maritimus UR-suhs mar-ih-TIME-uhs
Vespertilionidae ves-puhr-TEEL-ee-UHN-uh-dee
Viverridae vy-VER-ruh-dee
Vombatidae vom-BAT-uh-dee
Vombatus ursinus VOM-bat-uhs ur-SIGH-nuhs
Vulpes vulpes VUHL-peez VUHL-peez
Xenarthra ZEN-areth-ruh
Yerbua capensis YER-byoo-uh KAP-en-sis
Zalophus californianus ZA-loh-fuhs kal-uh-FORN-uh-kuhs
Zalophus wollebaeki ZA-loh-fuhs VOLL-back-eye
Ziphiidae ziff-EYE-uh-dee



Words to Know

A

Aborigine: Earliest-known inhabitant of an area; often referring to a native person of Australia.

Adaptation: Any structural, physiological, or behavioral trait that aids an organism's survival and ability to reproduce in its existing environment.

Algae: Tiny plants or plantlike organisms that grow in water and in damp places.

Anaconda: A large snake of South America; one of the largest snakes in the world.

Aphrodisiac: Anything that intensifies or arouses sexual desires.

Aquatic: Living in the water.

Arboreal: Living primarily or entirely in trees and bushes.

Arid: Extremely dry climate, with less than 10 inches (25 centimeters) of rain each year.

Arthropod: A member of the largest single animal phylum, consisting of organisms with segmented bodies, jointed legs or wings, and exoskeletons.

B

Baleen: A flexible, horny substance making up two rows of plates that hang from the upper jaws of baleen whales.

Biogeography: The study of the distribution and dispersal of plants and animals throughout the world.

Bipedal: Walking on two feet.

Blowhole: The nostril on a whale, dolphin, or porpoise.

Blubber: A layer of fat under the skin of sea mammals that protects them from heat loss and stores energy.

Brachiation: A type of locomotion in which an animal travels through the forest by swinging below branches using its arms.

Brackish water: Water that is a mix of freshwater and saltwater.

Burrow: Tunnel or hole that an animal digs in the ground to use as a home.

C

Cache: A hidden supply area.

Camouflage: Device used by an animal, such as coloration, allowing it to blend in with the surroundings to avoid being seen by prey and predators.

Canine teeth: The four pointed teeth (two in each jaw) between the incisors and bicuspids in mammals; designed for stabbing and holding prey.

Canopy: The uppermost layer of a forest formed naturally by the leaves and branches of trees and plants.

Carnivore: Meat-eating organism.

Carrion: Dead and decaying animal flesh.

Cecum: A specialized part of the large intestine that acts as a fermentation chamber to aid in digestion of grasses.

Cervical vertebrae: The seven neck bones that make up the top of the spinal column.

Clan: A group of animals of the same species that live together, such as badgers or hyenas.

Cloud forest: A tropical forest where clouds are overhead most of the year.

Colony: A group of animals of the same type living together.

Coniferous: Refers to evergreen trees, such as pines and firs, that bear cones and have needle-like leaves that are not shed all at once.

Coniferous forest: An evergreen forest where plants stay green all year.

Continental shelf: A gently sloping ledge of a continent that is submerged in the ocean.

Convergence: In adaptive evolution, a process by which unrelated or only distantly related living things come to resemble one another in adapting to similar environments.

Coprophagous: Eating dung. Some animals do this to extract nutrients that have passed through their system.

Crepuscular: Most active at dawn and dusk.

Critically Endangered: A term used by the IUCN in reference to a species that is at an extremely high risk of extinction in the wild.

D

Data Deficient: An IUCN category referring to a species that is not assigned another category because there is not enough information about the species' population.

Deciduous: Shedding leaves at the end of the growing season.

Deciduous forest: A forest with four seasons in which trees drop their leaves in the fall.

Deforestation: Those practices or processes that result in the change of forested lands to non-forest uses, such as human settlement or farming. This is often cited as one of the major causes of the enhanced greenhouse effect.

Delayed implantation: A process by which the fertilized egg formed after mating develops for a short time, then remains inactive until later when it attaches to the uterus for further development, so that birth coincides with a better food supply or environmental conditions.

Den: The shelter of an animal, such as an underground hole or a hollow log.

Dentin: A calcareous material harder than bone found in teeth.

Desert: A land area so dry that little or no plant or animal life can survive.

Digit: Division where limbs terminate; in humans this refers to a finger or toe.

Digitigrade: A manner of walking on the toes, as cats and dogs do, as opposed to walking on the ball of the feet, as humans do.

Dingo: A wild Australian dog.

Diurnal: Refers to animals that are active during the day.

Domesticated: Tamed.

Dominant: The top male or female of a social group, sometimes called the alpha male or alpha female.

Dorsal: Located in the back.

Dung: Feces, or solid waste from an animal.

E

Echolocation: A method of detecting objects by using sound waves.

Ecotourist: A person who visits a place in order to observe the plants and animals in the area while making minimal human impact on the natural environment.

Electroreception: The sensory detection of small amounts of natural electricity by an animal (usually underwater), by means of specialized nerve endings.

Elevation: The height of land when measured from sea level.

Endangered: A term used by the U. S. Endangered Species Act of 1973 and by the IUCN in reference to a species that is facing a very high risk of extinction from all or a significant portion of its natural home.

Endangered Species Act: A U. S. law that grants legal protection to listed endangered and threatened species.

Endemic: Native to or occurring only in a particular place.

Erupt: In teeth, to break through the skin and become visible.

Estivation: State of inactivity during the hot, dry months of summer.

Estuary: Lower end of a river where ocean tides meet the river's current.

Eutherian mammal: Mammals that have a well-developed placenta and give birth to fully formed live young.

Evergreen: In botany, bearing green leaves through the winter and/or a plant having foliage that persists throughout the year.

Evolve: To change slowly over time.

Extinct: A species without living members.

Extinction: The total disappearance of a species or the disappearance of a species from a given area.

F

Family: A grouping of genera that share certain characteristics and appear to have evolved from the same ancestors.

Feces: Solid body waste.

Fermentation: Chemical reaction in which enzymes break down complex organic compounds into simpler ones. This can make digestion easier.

Forage: To search for food.

Forb: Any broad-leaved herbaceous plant that is not a grass; one that grows in a prairie or meadow, such as sunflower, goldenrod, or clover.

Fragment: To divide or separate individuals of the same species into small groups that are unable to mingle with each other.

Frugivore: Animal that primarily eats fruit. Many bats and birds are frugivores.

Fuse: To become joined together as one unit.

G

Genera: Plural of genus.

Genus (pl. genera): A category of classification made up of species sharing similar characteristics.

Gestation: The period of carrying young in the uterus before birth.

Gland: A specialized body part that produces, holds, and releases one or more substances (such as scent or sweat) for use by the body.

Gleaning: Gathering food from surfaces.

Grassland: Region in which the climate is dry for long periods of the summer, and freezes in the winter. Grasslands are characterized by grasses and other erect herbs, usually without trees or shrubs, and occur in the dry temperate interiors of continents.

Grooming: An activity during which primates look through each other's fur to remove parasites and dirt.

Guano: The droppings of birds or bats, sometimes used as fertilizer.

Guard hairs: Long, stiff, waterproof hairs that form the outer fur and protect the underfur of certain mammals.

Gum: A substance found in some plants that oozes out in response to a puncture, as plant sap, and generally hardens after exposure to air.

H

Habitat: The area or region where a particular type of plant or animal lives and grows.

Habitat degradation: The diminishment of the quality of a habitat and its ability to support animal and plant communities.

Hallux: The big toe, or first digit, on the part of the foot facing inwards.

Harem: A group of two or more adult females, plus their young, with only one adult male present.

Haul out: To pull one's body out of the water onto land, as when seals come out of the water to go ashore.

Herbivore: Plant-eating organism.

Hibernation: State of rest or inactivity during the cold winter months.

Hierarchy: A structured order of rank or social superiority.

Home range: A specific area that an animal roams while performing its activities.

I

Ice floe: A large sheet of floating ice.

Incisor: One of the chisel-shaped teeth at the front of the mouth (between the canines), used for cutting and tearing food.

Indigenous: Originating in a region or country.

Insectivore: An animal that eats primarily insects.

Insulate: To prevent the escape of heat by surrounding with something; in an animal, a substance such as fur or body fat serves to retain heat in its body.

Invertebrate: Animal lacking a spinal column (backbone).

IUCN: Abbreviation for the International Union for Conservation of Nature and Natural Resources, now the World Conservation Union. A conservation organization of government agencies and nongovernmental organizations best known for its Red Lists of threatened and endangered species.

K

Keratin: Protein found in hair, nails, and skin.

Krill: Tiny shrimp-like animals that are the main food of baleen whales and are also eaten by seals and other marine mammals.

L

Lactate: To produce milk in the female body, an activity associated with mammals.

Larva (pl. larvae): Immature form (wormlike in insects; fishlike in amphibians) of an organism capable of surviving on its own. A larva does not resemble the parent and must go through metamorphosis, or change, to reach its adult stage.

Leprosy: A disease of the skin and flesh characterized by scaly scabs and open sores.

Lichen: A complex of algae and fungi found growing on trees, rocks, or other solid surfaces.

Litter: A group of young animals, such as pigs or kittens, born at the same time from the same mother. Or, a layer of dead vegetation and other material covering the ground.

M

Malaria: A serious disease common in tropical countries, spread by the bites of female mosquitoes, that causes complications affecting the brain, blood, liver, and kidneys and can cause death.

Mammae: Milk-secreting organs of female mammals used to nurse young.

Mammals: Animals that feed their young on breast milk, are warm-blooded, and breathe air through their lungs.

Mangrove: Tropical coastal trees or shrubs that produce many supporting roots and that provide dense vegetation.

Marsupial: A type of mammal that does not have a well-developed placenta and gives birth to immature and underdeveloped young after a short gestation period. It continues to nurture the young, often in a pouch, until they are able to fend for themselves.

Matriarchal: Headed by a dominant female or females; said of animal societies.

Mechanoreceptor: Sensory nerve receptor modified to detect physical changes in the immediate environment, often having to do with touch and change of pressure or turbulence in water or air. In the platypus, mechanoreceptors in its bill may detect prey and obstacles.

Megachiroptera: One of the two groups of bats; these bats are usually larger than the microchiroptera.

Melon: The fatty forehead of a whale or dolphin.

Membrane: A thin, flexible layer of plant or animal tissue that covers, lines, separates or holds together, or connects parts of an organism.

Microchiroptera: One of two categories of bats; these make up most of the bats in the world and are generally smaller than the megachiroptera.

Migrate: To move from one area or climate to another as the seasons change, usually to find food or to mate.

Migratory pattern: The direction or path taken while moving seasonally from one region to another.

Molar: A broad tooth located near the back of the jaw with a flat, rough surface for grinding.

Mollusk: A group of animals without backbones that includes snails, clams, oysters, and similar hard-shelled animals.

Molt: The process by which an organism sheds its outermost layer of feathers, fur, skin, or exoskeleton.

Monogamous: Refers to a breeding system in which a male and a female mate only with each other during a breeding season or lifetime.

Muzzle: The projecting part of the head that includes jaws, chin, mouth, and nose.

Myxomatosis: A highly infectious disease of rabbits caused by a pox virus.

N

Near Threatened: A category defined by the IUCN suggesting that a species could become threatened with extinction in the future.

Nectar: Sweet liquid secreted by the flowers of various plants to attract pollinators (animals that pollinate, or fertilize, the flowers).

Neotropical: Relating to a geographic area of plant and animal life east, south, and west of Mexico's central plateau that includes Central and South America and the West Indies.

New World: Made up of North America, Central America, and South America; the western half of the world.

Nocturnal: Occurring or active at night.

Non-prehensile: Incapable of grasping; used to describe an animal's tail that cannot wrap around tree branches.

Noseleaf: Horseshoe-shaped flap of skin around the nose.
Nurse: To feed on mother's milk.

O

Old World: Australia, Africa, Asia, and Europe; in the eastern half of the world.
Omnivore: Plant- and meat-eating animal.
Opportunistic feeder: An animal that eats whatever food is available, either prey they have killed, other animals' kills, plants, or human food and garbage.

P

Pack ice: Large pieces of ice frozen together.
Patagium: The flap of skin that extends between the front and hind limbs. In bats, it stretches between the hind legs and helps the animal in flight; in colugos this stretches from the side of the neck to the tips of its fingers, toes, and tail.
Phylogenetics: Field of biology that deals with the relationships between organisms. It includes the discovery of these relationships, and the study of the causes behind this pattern.
Pinnipeds: Marine mammals, including three families of the order Carnivora, namely Otariidae (sea lions and fur seals), Phocidae (true seals), and Odobenidae (walrus).
Placenta: An organ that grows in the mother's uterus and lets the mother and developing offspring share food and oxygen through the blood.
Placental mammal: Any species of mammal that carries embryonic and fetal young in the womb through a long gestation period, made possible via the placenta, a filtering organ passing nutrients, wastes, and gases between mother and young.
Plantigrade: Walking on the heel and sole of the foot, instead of on the toes. Plantigrade species include bears and humans.
Plate tectonics: Geological theory holding that Earth's surface is composed of rigid plates or sections that move about the surface in response to internal pressure, creating the major geographical features such as mountains.
Poach: To hunt animals illegally.
Pod: In animal behavioral science (and in some zoology uses) the term pod is used to represent a group of whales, seals, or dolphins.

Pollen: Dust-like grains or particles produced by a plant that contain male sex cells.

Pollination: Transfer of pollen from the male reproductive organs to the female reproductive organs of plants.

Pollinator: Animal which carries pollen from one seed plant to another, unwittingly aiding the plant in its reproduction. Common pollinators include insects, especially bees, butterflies, and moths; birds; and bats.

Polyandry: A mating system in which a single female mates with multiple males.

Polyestrous: A female animal having more than one estrous cycle (mating period) within a year.

Polygamy: A mating system in which males and females mate with multiple partners.

Polygyny: A mating system in which a single male mates with multiple females.

Predator: An animal that eats other animals.

Prehensile: Able to control and use to grasp objects, characteristically associated with tails. Prehensile tails have evolved independently many times, for instance, in marsupials, rodents, primates, porcupines, and chameleons.

Prey: Organism hunted and eaten by a predator.

Primary forest: A forest characterized by a full-ceiling canopy formed by the branches of tall trees and several layers of smaller trees. This type of forest lacks ground vegetation because sunlight cannot penetrate through the canopy.

Promiscuity: Mating in which individuals mate with as many other individuals as they can or want to.

Puberty: The age of sexual maturity.

Q

Quadruped: Walking or running on four limbs.

R

Rabies: A viral infection spread through the bite of certain warm-blooded animals; it attacks the nervous system and can be fatal if untreated.

Rainforest: An evergreen woodland of the tropics distinguished by a continuous leaf canopy and an average rainfall of about 100 inches (250 centimeters) per year.

Regurgitate: Eject the contents of the stomach through the mouth; to vomit.

Rookery: A site on land where seals congregate to mate and raise the young.

Roost: A place where animals, such as bats, sit or rest on a perch, branch, etc.

S

Savanna: A biome characterized by an extensive cover of grasses with scattered trees, usually transitioning between areas dominated by forests and those dominated by grasses and having alternating seasonal climates of precipitation and drought.

Scavenger: An animal that eats carrion, dead animals.

Scent gland: Formed from modified, or changed, sweat glands, these glands produce and/or give off strong-smelling chemicals that give information, such as marking territory, to other animals.

Scent mark: To leave an odor, such as of urine or scent gland secretions, to mark a territory or as a means of communication.

Scrotum: The external pouch containing the testicles.

Scrub forest: A forest with short trees and shrubs.

Scrubland: An area similar to grassland but which includes scrub (low-growing plants and trees) vegetation.

Seamount: An underwater mountain that does not rise above the surface of the ocean.

Seashore: When referring to a biome, formed where the land meets the ocean.

Secondary forest: A forest characterized by a less-developed canopy, smaller trees, and a dense ground vegetation found on the edges of forests and along rivers and streams. The immature vegetation may also result from the removal of trees by logging and/or fires.

Semiaquatic: Partially aquatic; living or growing partly on land and partly in water.

Semiarid: Very little rainfall each year, between 10 and 20 inches (25 to 51 centimeters).

Sexually mature: Capable of reproducing.

Solitary: Living alone or avoiding the company of others.

Species: A group of living things that share certain distinctive characteristics and can breed together in the wild.

Spermaceti: A waxy substance found in the head cavity of some whales.

Steppe: Wide expanse of semiarid relatively level plains, found in cool climates and characterized by shrubs, grasses, and few trees.

Streamline: To smooth out.

Succulent: A plant that has fleshy leaves to conserve moisture.

Suckle: To nurse or suck on a mother's nipple to get milk.

Syndactyly: A condition in which two bones (or digits) fuse together to become a single bone.

T

Tactile: Having to do with the sense of touch.

Talon: A sharp hooked claw.

Taxonomy: The science dealing with the identification, naming, and classification of plants and animals.

Teat: A projection through which milk passes from the mother to the nursing young; a nipple.

Temperate: Areas with moderate temperatures in which the climate undergoes seasonal change in temperature and moisture. Temperate regions of the earth lie primarily between 30 and 60° latitude in both hemispheres.

Terrestrial: Relating to the land or living primarily on land.

Territorial: A pattern of behavior that causes an animal to stay in a limited area and/or to keep certain other animals of the same species (other than its mate, herd, or family group) out of the area.

Thicket: An area represented by a thick, or dense, growth of shrubs, underbrush, or small trees.

Threatened: Describes a species that is threatened with extinction.

Torpor: A short period of inactivity characterized by an energy-saving, deep sleep-like state in which heart rate, respiratory rate and body temperature drop.

Traction: Resistance to a surface to keep from slipping.

Tragus: A flap of skin near the base of the external ear.

Tributary: A small stream that feeds into a larger one.

Tropical: The area between 23.5° north and south of the equator. This region has small daily and seasonal changes in temperature, but great seasonal changes in precipitation. Generally, a hot and humid climate that is completely or almost free of frost.

Tundra: A type of ecosystem dominated by lichens, mosses, grasses, and woody plants. It is found at high latitudes (arctic tundra) and high altitudes (alpine tundra). Arctic tundra is underlain by permafrost and usually very wet.

Turbulent: An irregular, disorderly mode of flow.

U

Underfur: Thick soft fur lying beneath the longer and coarser guard hair.

Understory: The trees and shrubs between the forest canopy and the ground cover.

Ungulates: Hoofed animals, such as deer and elk.

Urine washing: A monkey behavior in which it soaks its hands with urine, then rubs the liquid on its fur and feet so as to leave the scent throughout its forest routes.

Uterus: A pear-shaped, hollow muscular organ in which a fetus develops during pregnancy.

V

Vertebra (pl. vertebrae): A component of the vertebral column, or backbone, found in vertebrates.

Vertebrate: An animal having a spinal column (backbone).

Vertical: Being at a right angle to the horizon. Up and down movements or supports.

Vestigial: A degenerate or imperfectly developed biological structure that once performed a useful function at an earlier stage of the evolution of the species.

Vibrissae: Stiff sensory hairs that can be found near the nostrils or other parts of the face in many mammals and the snouts, tails, ears, and sometimes feet of many insectivores.

Vocalization: Sound made by vibration of the vocal tract.

Vulnerable: An IUCN category referring to a species that faces a high risk of extinction.

W

Wallaby: An Australian marsupial similar to a kangaroo but smaller.

Wean: When a young animal no longer feeds on its mother's milk and instead begins to eat adult food.

Wetlands: Areas that are wet or covered with water for at least part of the year and support aquatic plants, such as marshes, swamps, and bogs.

Woodlands: An area with a lot of trees and shrubs.

Y

Yolk-sac placenta: A thin membrane that develops in the uterus of marsupials that does not fuse with the mother's uterus and results in short pregnancies with the young being born with poorly developed organs.



Getting to Know Mammals

MAMMALS

Mammals are found on all continents and in all seas. It isn't easy to tell that an animal is a mammal. A combination of special features separates mammals from other animals.

Mammal milk

Only mammals can feed their young with milk produced by their body. This milk comes from special glands called mammae. A female may have two mammary glands or as many as a dozen or more. Mammal milk is very healthy for infants and immediately available.

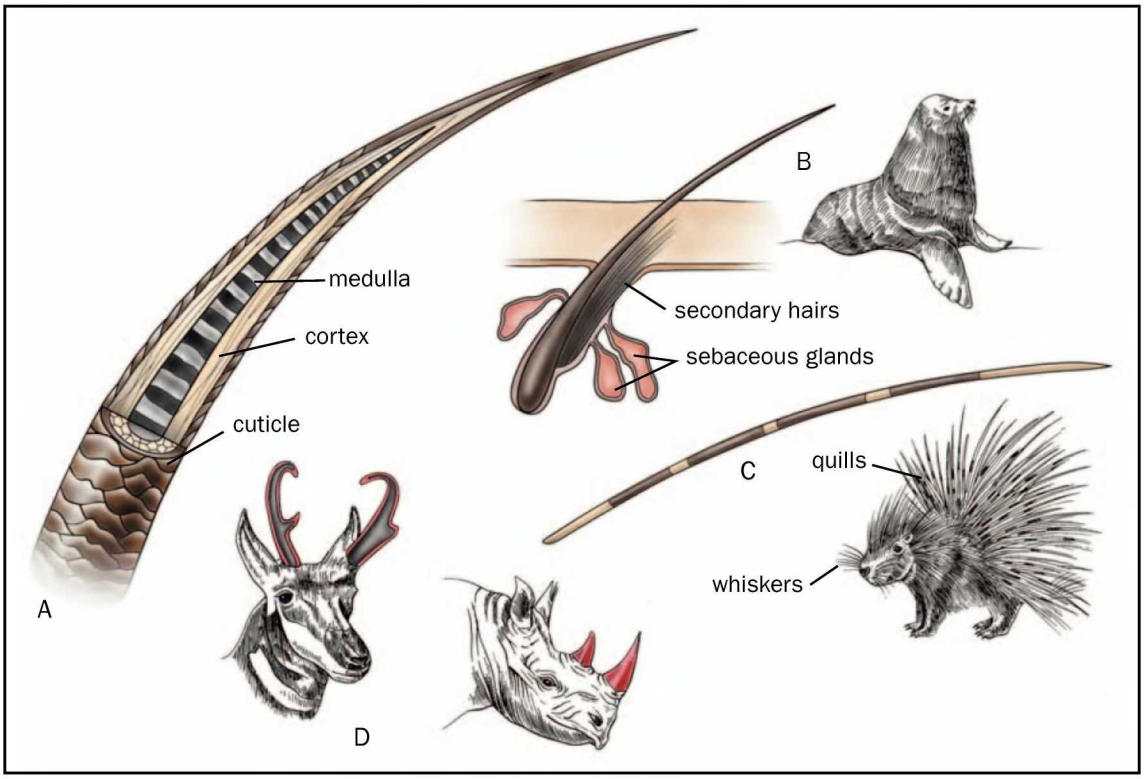
Body temperature

Mammals are warm-blooded, meaning they keep a constant body temperature. To keep their temperature fairly constant, a mammal needs some protective covering. Hair, made of a protein called keratin, serves several functions. One function is insulation, controlling the amount of body heat that escapes into the mammal's environment through the skin.

Mammal hair

All mammals have hair at some time of their life. Some have a lot, such as gorillas, and some have very little, such as the naked mole rats. There are three types of hair: a coarse long topcoat, a fine undercoat, and special sensory hairs, or whiskers.

In some mammals, hair has unusual forms. Porcupines have stiff, sharp, and thickened hairs called quills. Anteaters have



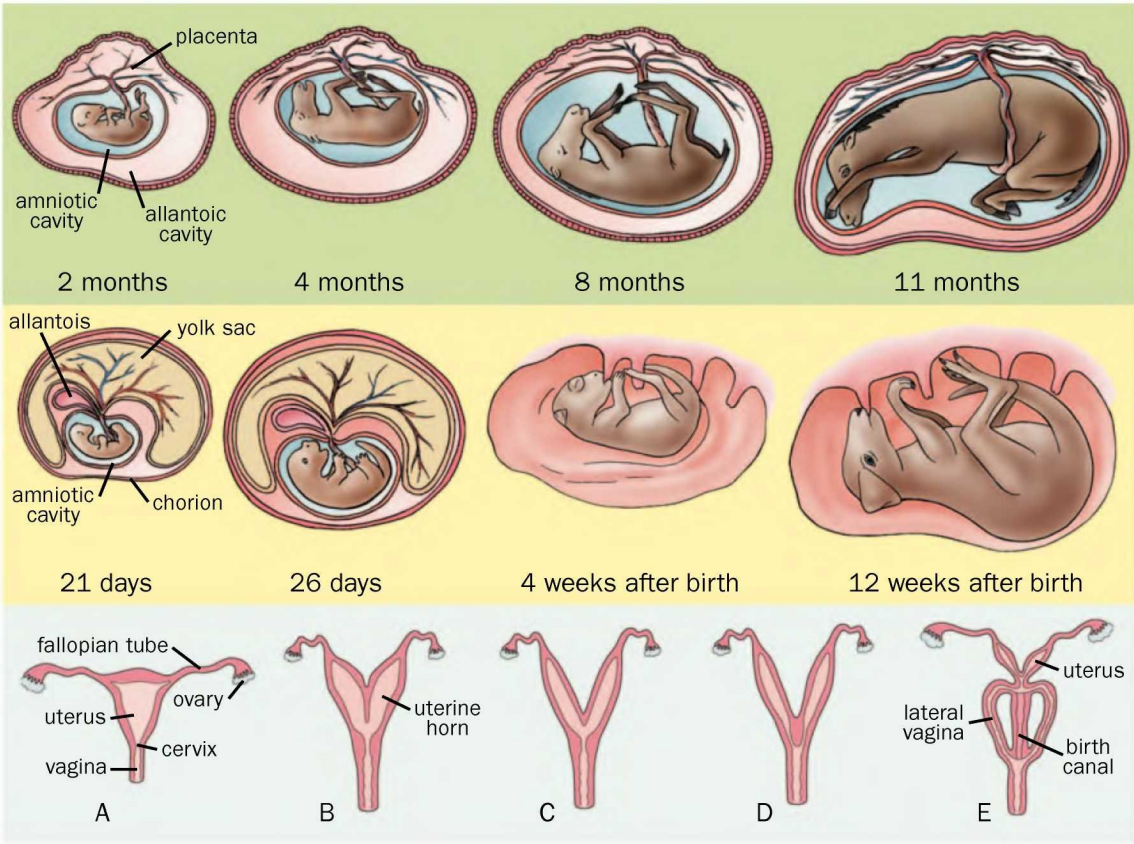
A. Cross section of a hair. B. Hairs may provide insulation and waterproofing. Specialized hair includes quills, whiskers (C), and horns (D). (Illustration by Patricia Ferrer. Reproduced by permission.)

sharp-edged scales made of modified hairs. These modified, or changed, hairs are protective against predators.

Mammals that live all or most of their lives in water, such as sea otters, may have a lot of dense, long hair, or fur. Others have much less hair, but a very thick hide, or skin, plus a thick layer of fat or blubber underneath the hide.

Hair color and pattern may vary. Males and females may have different fur colors. Special color patterns, such as a skunk's black and white fur, act as warnings. Hair color can also serve as camouflage, enabling the mammal to blend into its background.

Some mammals have fur color changes in summer and winter. Colors can be entirely different. Snowshoe rabbits and weasels can be brownish in summer, and almost pure white in winter. But this only happens if there is snow where they live. If it seldom snows, weasels and snowshoe rabbits stay brown.



Reproduction

Mammals have two genetic sexes, male and female. Ninety percent of mammals are placental (pluh-SENT-ul). In placental mammals, the baby develops, or grows, within the mother's body before it enters the world. What about the other 10 percent? These mammals lay eggs. There are only three egg-laying mammals alive today.:

Top: Placental mammal development. Middle row: Marsupial mammal development. Types of uterus: A. Simplex; B. Bipartite; C. Bicornuate; D. Duplex; E. Marsupial. (Illustration by Patricia Ferrer. Reproduced by permission.)

Other mammal features

Other bodily mammal features include their ability to breathe air through their lungs. Water-dwelling mammals, such as the whale and porpoise, do this too. Mammals have jaws, usually with teeth. Mammals usually have four limbs. Mammals have a four-chambered heart. Mammals have vertebrae, or back bones, unlike invertebrates such as insects, in which there is an outside shell or structure called an exoskeleton.

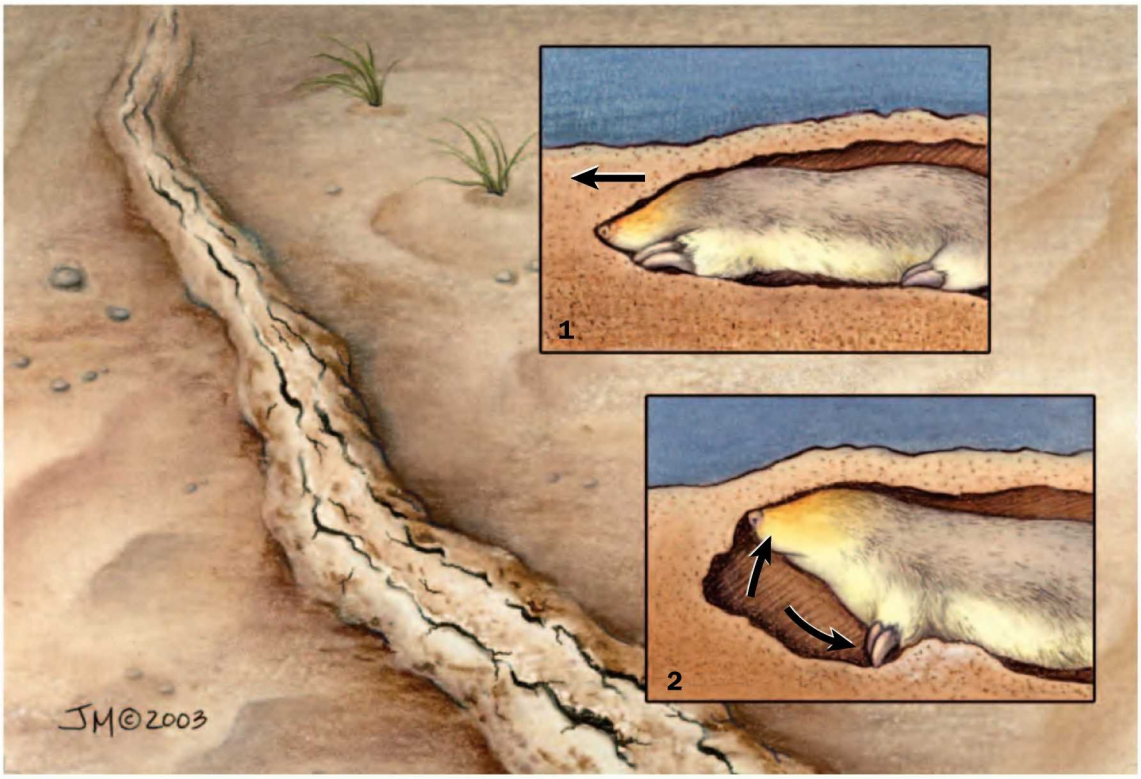


This life-sized woolly mammoth model is kept in the Royal British Columbia Museum. Woolly mammoths were as tall as 10 feet (3 meters). (© Jonathan Blair/Corbis. Reproduced by permission.)

FOSSIL MAMMALS

Fossils are body parts of animals that lived very long ago. Not many long-ago mammals are preserved as fossils. But some entire mammal fossils have been discovered, such as a 10-foot (3-meter) woolly mammoth preserved in Siberian frozen ground, and an Ice Age woolly rhinoceros discovered in Poland, preserved in asphalt.

Many long-ago mammals lived in a warm, wet world. They ate soft, leafy plants. The earliest known mammals were possibly shrew-like creatures living about 190 million years ago. Later larger mammals occurred, then disappeared, or became extinct. These include the mesohippus, a three-toed horse only 24 inches (60 centimeters) high; a giant pig with a head that was 4 feet (1.22 meters) in length; and the smilodon, a huge saber-toothed cat with canine teeth that were 8 inches (20.3



The Grant's desert mole uses its powerful forelimbs to burrow through the sands of the Namib Desert in southern Africa. The golden mole moves forward (1), and enlarges the tunnel by pushing dirt up with its head and back with its claws (2). (Illustration by Jacqueline Mahannah. Reproduced by permission.)

centimeters) in length. By about 15,000 years ago, long-ago people were hunting mammals with stone-pointed spears. Most of the animals they hunted are extinct for various reasons, some known, and some unknown.

WHERE MAMMALS LIVE

Underground mammals

Some small mammals spend all or most of their lives living underground. These include many species of prairie dogs, chipmunks, moles, groundhogs, Greenland collared lemmings, and Peruvian tuco-tucos. Each of these mammals has a special body design enabling it to survive underground.

Moles have large, powerful shoulders and short, very powerful forelimbs. Spade-like feet have claws, enabling quick digging. Hind feet have webbed toes, enabling the mole to kick soil backwards effectively. Velvety-type fur enables a mole to slip easily through its tunnels. And, although moles

A RECENT DISCOVERY

A bright orange, mouse-like mammal, weighing 0.5 ounces (15 grams) and measuring 3.12 inches (8 centimeters) plus a long tail, has recently been discovered in the Philippines. It has whiskers five times longer than its head. It can open and eat very hard tree nuts that no other mammal in the area can eat.

have almost no eyes, they can rely on touch, smell, and sensitivity to vibration to find underground insects and earthworms.

Sea mammals

Some mammals live in the sea, including manatees, whales, seals, and dolphins. While some need air every few minutes, a sperm whale can remain underwater for an hour and a half. How is this possible? Some sea mammals have a very low metabolism. They don't use up the their oxygen quickly and can store large amounts of oxygen in their bodies.

Tree mammals

Some mammals spend all or most of their lives in trees. Tree-dwelling mammals are often hidden from sight by leaves, vines, and branches. Tree-dwelling mammals include the Eastern pygmy possum, which nests in small tree hollows; the koala; Lumholtz's tree kangaroo, which leaps from branch to branch; the three-toed sloth; and the clouded leopard.

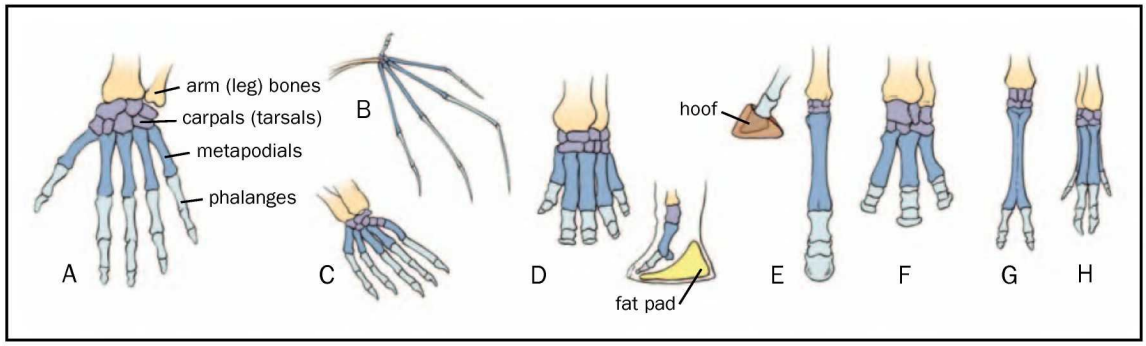
Flying mammals

The only truly flying mammals are bats. The sound of bat wings was first heard about 50 million years ago. Some bats are large, with a wingspan almost 7 feet (21.3 meters) wide. Some are small, as the Philippine bamboo bat, whose body is just 2 inches (5.08 centimeters) long.

Other mammals only appear to fly, such as the southern flying squirrel and the colugo, or Malayan flying lemur. These mammals have gliding membranes, skin folds from body front to legs, that, when spread out, act almost like a parachute. For example, the feathertail glider, a tiny possum, crawls along narrow branches. At branch end, it leaps out and slightly downward. Spreading its gliding membranes, it speeds through the air, landing on a nearby tree.

Mountain mammals

Some mammals spend most of their lives on mountain peaks. These include Asian corkscrew-horned markhor goats, North



Mammals' hands and feet differ depending on where the animal lives and how it gets around. A. A hominid hand is used for grasping objects; B. A bat's wing is used for flight; C. A pinniped's flipper helps move it through the water. Hoofed animals move around on all fours: D. Elephant foot; E. Equid (horse family) foot; F. Odd-toed hoofed foot; G. Two-toed hoofed foot; H. Four-toed hoofed foot. (Illustration by Patricia Ferrer. Reproduced by permission.)

American Rocky Mountain bighorn sheep, and Siberian ibex. Siberian ibex can stand anyplace on any pinnacle with just enough room for its four feet. North American mountain goats can climb up a mountain peak, almost going straight up. Specially shaped hooves help.

Other high mountain dwelling mammals include snow leopards and Asian pikas that can survive at 19,685 feet (6,000 meters). Gunnison's prairie dogs do well up to 11,500 feet (3,505 meters).

Desert mammals

Some mammals spend most of their lives in arid, or very dry areas. Not all deserts are sandy like Death Valley or the Sahara. Some are rocky. Other arid areas are mountainous. Desert dwelling mammals include the North African elephant shrew, white-tailed antelope squirrel, and the desert kangaroo rat. No mammal can live without water. Desert rodents have a way to extract, or get, water from their own body functions. Rodents may also get water by eating plants, seeds, roots, and insects that contain water.

Larger mammals live in arid regions too. The striped hyena can survive in stony desert as long as it is within 6 miles (9.7 kilometers) of water. Fennecs, a very small fox living near sand dunes, can go a long time without drinking. Camels can use body fluids when no water is available.

WHAT DO MAMMALS EAT?

Insect-eaters

Some mammals have mostly insect meals. Insect-eating mammals include the moles, aye-ayes and aardvarks. The aardvark



Animals, such as these Rocky Mountain goats, may visit a salt lick to get some of the nutrients they need. (© Raymond Gehman/Corbis. Reproduced by permission.)

has a sticky tongue that can reach out as long as 1 foot (0.3 meters) to capture its ant and termite meals.

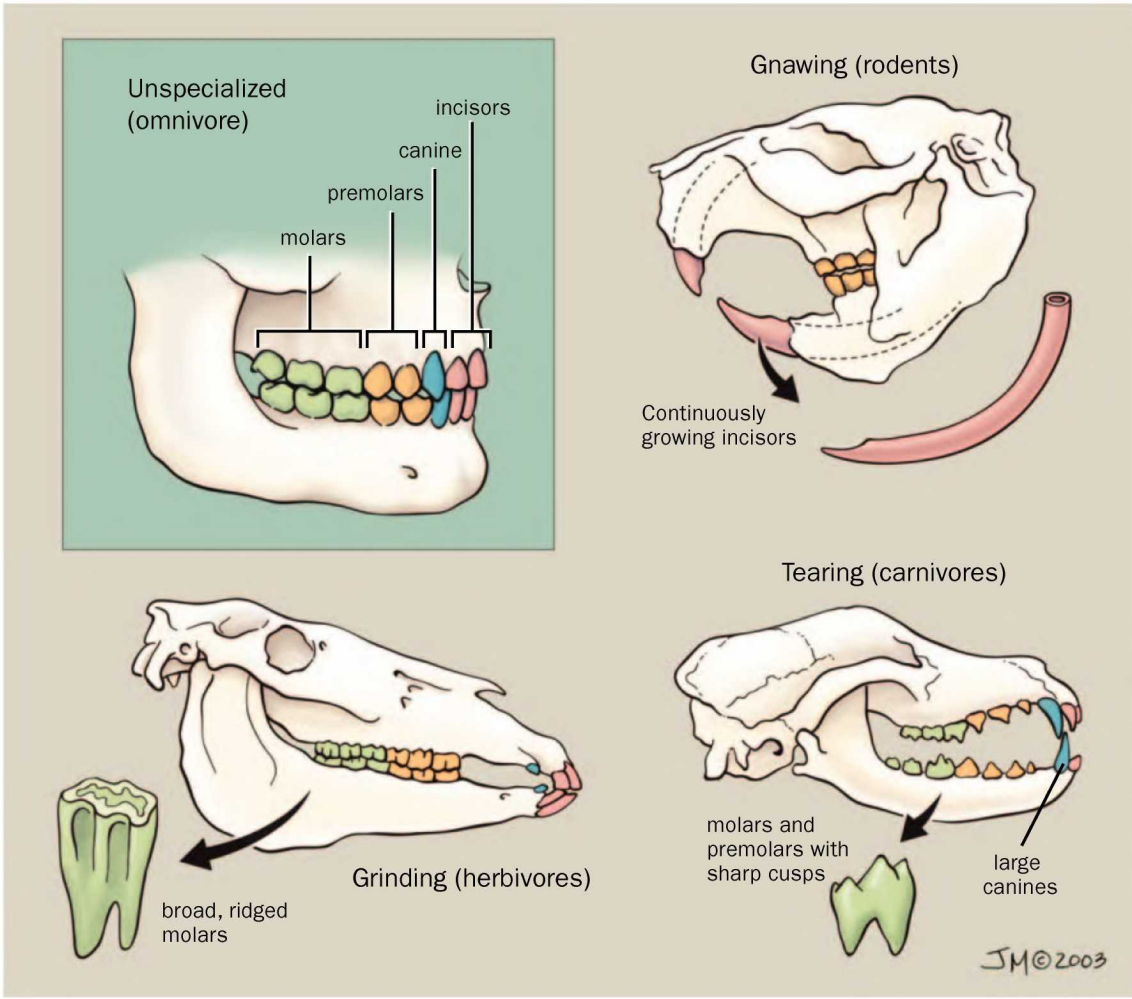
Plant eaters

Some mammals eat nothing but plants. Plant eaters include pandas, the West Indian manatee, and the red-bellied wallaby. Some mammals have a single stomach that breaks the plant food down into small pieces. Other mammals, such as cows and camels, have a large stomach made of several parts. Each part does a separate job of breaking down difficult-to-digest plants.

Some mammals eat both plants and fruit. These include the 14-ounce (400-gram) Eurasian harvest mouse, the 100-pound (45-kilogram) South American capybara, and the African elephant. An elephant can eat up to 500 pounds (227 kilograms) of grass, plants, and fruit per day.

Meat eaters

Mammals eating mostly meat or fish are carnivorous. Carnivorous mammals have long, pointed, and very strong incisor teeth. Carnivores include polar bears, hyenas, walruses, and Eu-



ropean wild cats. The European wild cat may be an ancestor of our house cats.

Omnivores

Some mammals eat just about anything. They are omnivorous. Omnivorous mammals include wolverines, raccoons, and wild pigs. Wild pigs are the ancestors of our domestic pigs.

MAMMAL SLEEPING HABITS

Day or night

Some mammals sleep during the night, others sleep during the day. The night sleepers are diurnal, active during the day.

Mammals have different tooth shapes for different functions. Herbivores typically have large, flattened teeth for chewing plants. Rodents' ever-growing incisors are used for gnawing. Carnivores have teeth for holding and efficiently dismembering their prey. (Illustration by Jacqueline Mahannah. Reproduced by permission.)

THE BIGGEST, THE TALLEST, AND THE SMALLEST

The largest and heaviest mammal alive today is the blue whale. One adult female measured 110.2 feet (33.6 meters). Blue whale weight can reach 268,400 pounds (121,853 kilograms).

The largest living land animal is the African bush elephant. From trunk tip to tail tip, a male has measured 33 feet (10 meters). Body weight was 24,000 pounds (10,886 kilograms).

The smallest non-flying mammal is the Savi's white-toothed pygmy shrew. An adult's head and body together measure only 2 inches (5.1 centimeters) long. Maximum weight is 0.09 ounces (2.5 grams). How small is this? This pygmy shrew can travel through tunnels left by large earthworms!

The smallest flying mammal is the rare Kitti's hog-nosed bat, or "bumblebee bat," from Thailand. Head and body length is just 1.14 to 1.29 inches (29 to 33 millimeters). Weight is just 0.06 to 0.07 ounces (1.75 to 2 grams). This tiny bat was only discovered in 1973.

The tallest living animal is the giraffe. The average adult male, or bull, is 16 feet (4.9 meters) high, from front hoof to head horn tip. This size male weighs 2,376 to 2,800 pounds (1,078 to 1,270 kilograms).

The day sleepers are nocturnal, active at night. They may have special night vision. Many desert animals are nocturnal, moving about when it is cooler.

Hibernation

Some bat species hibernate through an entire winter. Hibernation is like a very long deep sleep. When a mammal hibernates, it uses up body fat that has accumulated from food eaten in good weather. Hibernators include the North African jird, groundhogs or woodchucks, and several dormice species. Dormice enter a tree hollow or ground burrow in autumn, and don't come out until springtime.

Bears don't truly hibernate. Their sleep isn't deep. They slow down quite a bit, and nap a lot, but do not sleep through an entire winter.

A new hibernating pattern has just been discovered. Madagascar fat-tailed lemurs hibernate in tree holes when winter day-

time temperatures rise above 86° Fahrenheit (30° Celsius). They sleep for seven months. Scientists belief these dwarf lemurs find less food in what is the dry season in Madagascar, so they go to into deep sleep to preserve energy until a better food supply appears.

REPRODUCTION

Mating

Some mammals mate for life, such as wolves and sometimes coyotes. More commonly, a male may mate with several females each breeding period. Or a female may mate with several males.

Some mammals have one litter each year. Others have a litter only every two or three years. But the North American meadow mouse can have seventeen litters per year. That's a group of babies about every three weeks!

There may be one or more infants in a litter. Bats, giraffes, and two-toed sloths have just one baby per year. However, the Madagascar tenrec can produce thirty-two babies in just one litter.



Opossums are marsupial animals. The mother has a pouch in which the young continue to develop after they're born. (© Mary Ann McDonald/Corbis. Reproduced by permission.)

Child care

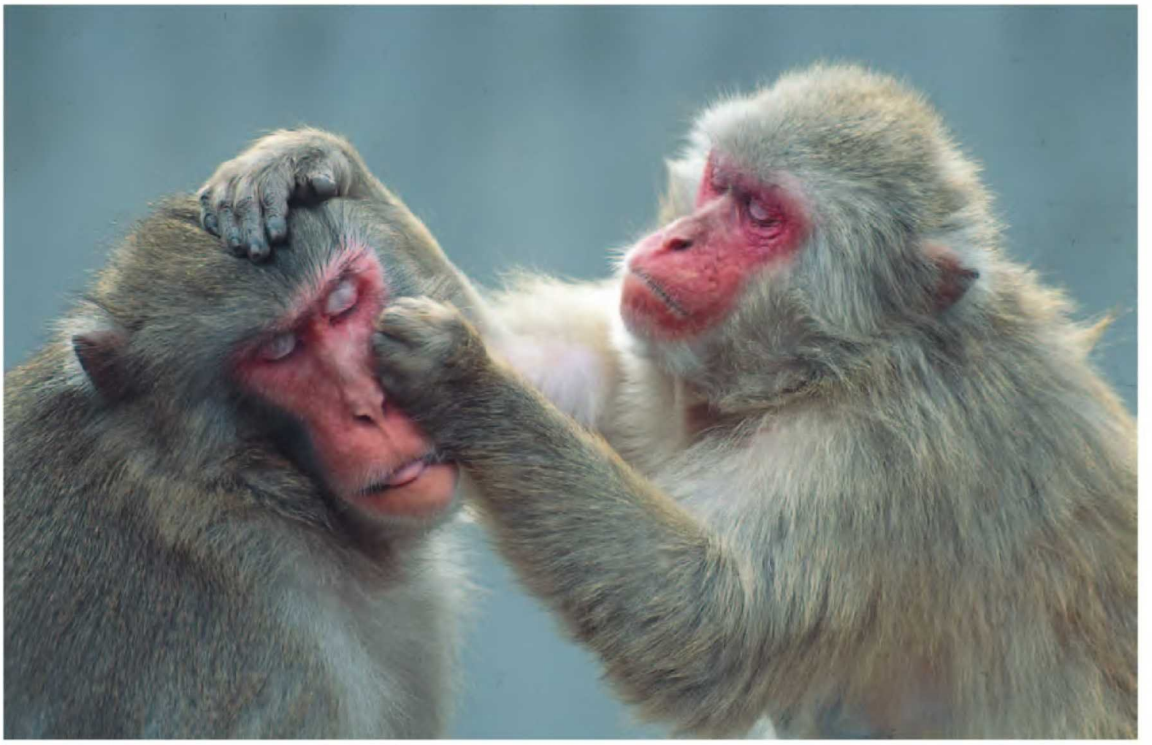
All mammal infants need protection. They are very small compared to their parents. They may be blind and hairless. Usually females provide care. However, in a few mammal species, such as the golden lion marmoset, the male does most of the care.

Female marsupial mammals, such as opossums, koalas, and kangaroos, have a pouch, like a pocket, on the front or under the body. Their tiny babies are incompletely developed when they are born. At birth, an opossum baby is about the size of a dime. It crawls immediately into its mother's pouch and stays there until ready to survive outside. The pouch contains mammary glands so babies can feed.

SOCIAL LIFE

Solitary mammals

Some mammals are solitary. They keep company with another of the same kind only when mating or when raising young. Solitary mammals include the giant anteaters, European bison, and right whales.



Japanese macaques are social animals, and groom each other regularly. (© Herbert Kehrer/OKAPIA/Photo Researchers, Inc. Reproduced by permission.)

Group living

Many mammals live in groups. In large groups, some eat, some rest, and some keep guard. Baboons, for example, may have from twenty to 300 animals in a group. One or more adult males lead each group. If a predator, such as a leopard, approaches, the males take action against it, while the females and young escape.

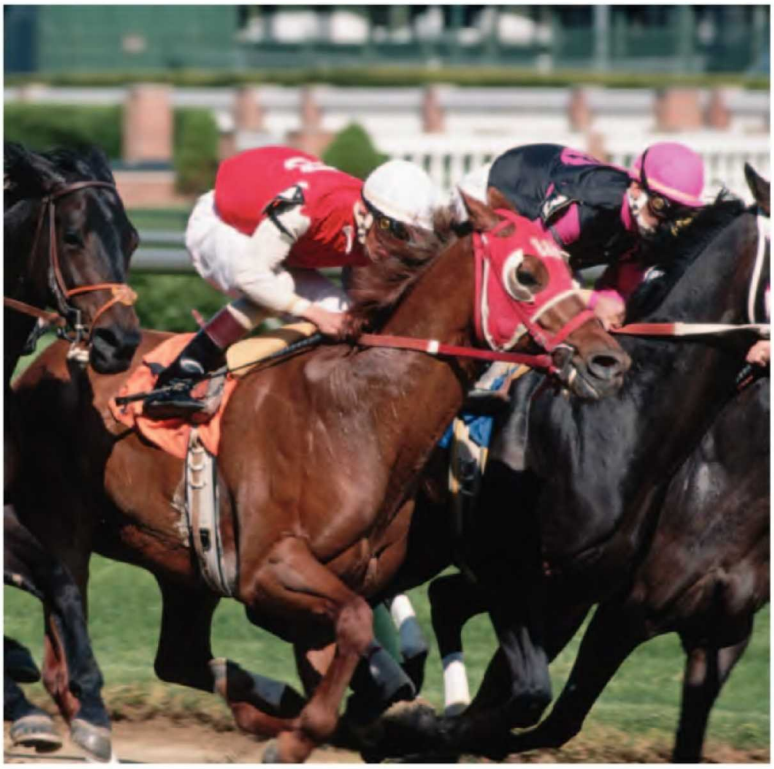
Some mammals travel in herds. Musk oxen travel in closely packed herds of fifteen to 100 individuals. These herds include males and females. Bighorn sheep females travel in herds of five to fifteen, with a dominant ewe, or female, as the leader.

Pack mammals get their food by cooperation. They work together to bring down much larger prey. Dingoes, killer whales, and lions hunt in packs.

MAMMALS AND PEOPLE

Domesticated mammals

About 14,000 years ago, humans began controlling, or domesticating, certain animals. This made humans' lives easier.



Horses have been domesticated for practical uses, such as transportation, and for entertainment, such as horse riding and racing. (© Kevin R. Morris/Corbis. Reproduced by permission.)



Rats can spread diseases that affect livestock and people. In addition, they eat and contaminate feed and their gnawing destroys buildings. (Jane Burton/Bruce Coleman, Inc. Reproduced by permission.)

The earliest domesticated mammal was probably the dog. Some scientists think hunters adopted wolf cubs and trained them to smell out game, animals they hunted for food.

People use mammals for many purposes. Cows provide meat, milk, cheese, butter, and hide. Camels, yaks, and Indian elephants carry or pull heavy items. Water buffaloes do hauling and can provide milk. Horses provide transportation and racing activities. Other domesticated animals include rabbits, pigs, goats, sheep, cavies, and capybaras.

People keep animals as pets. Common mammal pets are dogs, cats, guinea pigs, and hamsters.

Pest mammals

Some mammals are considered pests. These include rats, mice, and, depending where they live, gophers, rabbits, and ground squirrels. Rats can transmit disease-carrying fleas. Rabbits and gophers eat garden and food plants.

ENDANGERED MAMMALS

Mammals in danger

Of about 5,000 mammal species currently existing, over 1,000 are seriously endangered. Few wild mammals can live

outside their natural habitat. When land is cleared for farming or housing, animals making homes there must leave, if there is any place for them to go. If not, they die from starvation or (because they are easily seen) from predators. Slowly, or quickly, the mammal species disappears.

Many human habits lead to endangerment. Hunting for amusement, killing for fur or body parts, native and commercial killing for food, fishing gear entrapment, land-destructive wars, and the illegal pet trade all take their toll. So do chemicals.

Some mammals are probably on the way to extinction, or total elimination. There are only about sixty Java rhinoceros left in the world. The Seychelles sheath-tailed bat has only about fifty individuals remaining. Yellow-tailed woolly monkeys number no more than 250 individuals. Mediterranean monk seals may be killed by scuba divers, and number only 600 individuals.

Saving endangered animals

Today many people are trying to save endangered animals. Methods include zoo breeding, establishing forest reserves, and training native populations that animals can be an economic benefit. Ecotourism, people visiting a country to see its animals in their natural habitat, is increasing. There are laws against importing and exporting endangered species. And, in some parts of the world, there are laws against land destruction.

Some mammals have possibly been rescued from immediate extinction. The American bison once roamed the North American prairies, numbering about 50 million. After slaughter by soldiers and settlers for food and sport, by 1889 only 541 remained alive. Now, in the United States, there are about 35,000 in protected areas. California northern elephant seals were once reduced to fewer than 100 members due to hunting. Today, protected, there are about 50,000. The ibex was once hunted for supposedly curative body parts and few were left. But in 1922, a National Park was established in the Italian Alps, where several thousand now live. The Mongolian wild horse, once thought to be extinct, now has a special reserve in Mongolia.

Too late to save

Some mammals became extinct only recently. Recently extinct animals include Steller's sea cows, which became extinct in about 1768. The Tasmanian wolf was last seen in 1933, eliminated by bounty hunters. The African bluebuck disappeared

from Earth in 1880. The quagga, from southern Asia, was hunted for hides and meat. The last known quagga, a relative of the zebra, died in a Dutch zoo in 1883.

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MONOTREMES
Monotremata

Class: Mammalia
Order: Monotremata
Number of families: 2 families

order
CHAPTER

PHYSICAL CHARACTERISTICS

"Monotreme" means "one opening" and refers to the single rear orifice, or opening, that these animals have for getting rid of wastes, laying eggs, and mating. The lower intestine, excretory system (system that gets rid of wastes), and reproductive system all end at this opening, called the cloaca (kloh-AY-kah). This feature is common in reptiles and birds but extremely rare among mammals.

Trying to describe a "typical" monotreme (MAHN-ah-treem) is difficult, since the only two living types, the platypus and the echidna (ih-KID-nah), do not look much alike at first glance. The platypus is built in a streamlined manner, like an otter, has soft fur, and its snout resembles a duck's bill, while the echidna looks like a pudgy, waddling watermelon covered with fur and sharp spines, with a narrow, hornlike snout. Although echidnas may look overweight, most of the soft tissue mass that might be mistaken for blubber is muscle, lots of it. The platypus is semi-aquatic, hunting animal food underwater but sheltering in a dry burrow, but the echidnas are land animals that forage, or search, in the soil for insects and worms.

Adult platypus are about the size of house cats, while echidnas range from twice to three times as large as a house cat. An adult platypus weighs from 3 to 5 pounds (1.4 to 2.3 kilograms), and its adult head and body length runs 12 to 18 inches (30 to 46 centimeters), the tail adding another 4 to 6 inches (10 to 15 centimeters). The short-beaked, or short-nosed, echidna can grow up to 14 pounds (6.4 kilograms), with a head and body

phylum
class
subclass
order
monotypic order
suborder
family

length of up to 21 inches (53 centimeters), the stubby tail adding another 3 or 4 inches (7.6 to 10 centimeters). The long-beaked, or long-nosed, echidna weighs up to twenty pounds, with a head and body length ranging from 18 to 31 inches (45 to 77.5 centimeters), while the tail, like that of the short-nosed echidna, is a mere stubby shoot. Male platypus and male echidnas are larger than females.

Platypus and echidnas are often called "primitive" because they carry a number of reptilian, or reptile-like, characteristics along with typically mammalian features. Ever since the first discovery of monotremes by Europeans in the late 1700s, zoologists, scientists who study animals, have been busy studying this mix of details in order to place the monotremes properly in the framework of mammalian evolution. Even more confusing is that the living monotremes have a number of modified, or changed, features all their own, examples being the snouts of platypus and echidnas.

The most well-known and special feature of the monotremes, and the one that seems most reptilian, is that the females lay eggs rather than giving live birth. Monotremes are the only living, egg-laying mammals. Other characteristics that platypus and echidnas have in common are similar skeletons and highly modified snouts equipped with nerves whose endings are sensitive to pressure and to natural electricity. Monotremes have fur, but not whiskers, while the echidnas, in addition to fur, have sharp, defensive spines, which are modified hairs, scattered over their backs and sides.

Monotremes walk in a reptilian manner, like alligators and crocodiles. Like the arms of someone in the middle of doing a pushup, the upper bones of monotreme forelimbs and hindlimbs go straight out from the body, horizontal to the ground, and the lower limb bones go straight down. Other lines of mammal evolution have abandoned this clumsy sort of movement and now carry their entire legs vertically beneath their bodies. Zoologists are not yet sure if the push-up style of legs and walking in monotremes is something left over from their reptilian ancestors or if they are more recent changes to fit their lifestyles.

Another odd monotreme characteristic is that male and female platypus, and male echidnas, have short, sharp, hollow, defensive spurs on the inner sides of the ankles of their rear limbs. The spurs of the male platypus connect with poison glands and are fully functional as stingers.

GEOGRAPHIC RANGE

Monotremes are found in Australia and New Guinea. Platypus are found in Australia, including the southern island of Tasmania. Echidnas are found in Australia, Tasmania, and New Guinea. Fossil evidence from sixty-three million years ago confirms that monotremes once lived in South America, dating back to a remote time when the continents of Australia, Antarctica, and South America were closer to one another and connected by dry land.

HABITAT

Platypus live alongside bodies of fresh water, in tropical and temperate (mild) regions of eastern Australia. Echidnas live in most of the wet and dry biomes of Australia, and in the lowland and highland tropical forests of New Guinea.

DIET

Platypus hunt underwater, snagging and eating various small water creatures. The short-beaked echidna shovels soil and tears up logs for ants and termites, while the long-beaked echidna digs up and eats mainly earthworms.

BEHAVIOR AND REPRODUCTION

The most well-known feature of monotremes is their method of reproduction. They are the only living mammals in which females lay eggs instead of giving live birth. The length of time the egg remains within the mother is short, only twelve to twenty days. While the egg is still within the mother's oviduct (the tube leading from the ovaries to the cloaca), the tissues of the oviduct secrete a shell onto the egg, as happens in birds and egg-laying reptiles. The monotreme eggshell is soft and leathery, and porous enough to soak up nutrients secreted into the oviduct from the mother's circulatory system.

The embryo begins its development before the egg is laid. When the mother lays her egg, the embryo has already developed to about the same degree as a newborn marsupial. The eggshell is leathery, like a reptile's, spherical, and small, 0.5 to 0.6 inches (13 to 15 millimeters) in diameter, or the size of a grape. After about ten days of the egg's incubation, the young hatches by tearing at the shell by means of a temporary egg tooth on its snout. When the youngster is fully hatched, it nestles close to the mother and feeds on her milk. The young are weaned at four to six months of age.

Female echidnas and platypus may lay up to three eggs at a time, but one is normal, and monotreme females usually bear and raise only one young per year. Females do all the raising of the young. Except during the mating season, individual platypus and echidnas of both sexes lead solitary lives.

A platypus mother incubates her eggs by curling her tail and holding the eggs between the tail and her warm underbelly. She incubates and nurses her young in a "birth chamber" burrow, which she digs and lines with moist leaves and water plants to maintain humidity. Echidna mothers form simple, temporary pouches by constricting special long muscles of their underbellies, and in which they incubate the eggs and later carry the developing young.

The monotremes are unique in yet another way. They are the only mammals to carry a sensory system that detects electricity, along with their usual senses of sight, hearing, etc. The platypus bill contains tiny electroreceptors, specialized sensory nerve endings arranged in rows along the length of the bill, on the upper and lower surfaces. These detect electricity from the muscular systems of underwater animals that the platypus hunts, and even from the electricity created by water as it flows over rocks on the bottom of the lake or river. The electroreceptors are located together with mechanoreceptors that detect underwater turbulence. Together, the two senses allow the platypus to put together a three-dimensional "picture" of its underwater hunting territory.

The bills of echidnas also have electroreceptors, though much fewer than in platypus. Biologists have confirmed the platypus's use of the electrosense, while this has not been found working in echidnas. Most likely the echidnas are gradually losing the electrosense while platypus have developed it into one of nature's most complex sensory systems.

MONOTREMES AND PEOPLE

The special features of monotremes that set them apart from other mammals make them subjects of fascination and curiosity. Nearly everyone has heard about the platypus and knows that it is an egg-laying mammal. The reptilian features of the living monotremes provide a valuable window back in time to when reptiles were evolving into mammals.

Platypus fur was once a valued commodity because of its softness and fine texture. Hunting of the platypus in the late

1800s and early 1900s nearly drove the animals to extinction. Strict laws within Australia now protect platypus and echidnas, and the animals are fairly abundant today.

Echidnas in New Guinea are sometimes considered pests because they dig up gardens and farmland in their unending search for ants, termites, and earthworms. Habitat loss threatens the long-nosed echidna because it is confined to upland New Guinean forest, a limited habitat. The New Guinean echidnas are also hunted for food.

CONSERVATION STATUS

Platypus and short-nosed echidnas are protected by law in Australia. Platypus are fairly plentiful in their somewhat limited area. Short-nosed echidnas are plentiful and widespread, because they can live in many different types of biome. Long-nosed echidnas are Endangered, and under serious threat in New Guinea from loss of habitat and being hunted for food with the help of trained dogs.

Probably the most serious problem facing these animals is being hunted, killed, and eaten by carnivorous mammals introduced to Australia and New Guinea by Europeans, such as dogs, cats, rats, and foxes. Native animals prey on the monotremes as well, including some of the larger lizards and the dingo, a breed of dog that the ancestors of the Aborigines brought with them when they colonized Australia thousands of years ago.



FOUR WORDS

One of the shortest telegrams ever sent was the one that confirmed the fact that platypus and echidnas lay eggs instead of giving live birth. Aboriginals and white settlers had been asserting this for decades, but it seemed so improbable that zoologists insisted on proof. The Scottish zoologist William Hay Caldwell traveled to Australia in 1884 to study platypus and echidnas in the wild. Aboriginals, with their excellent tracking skills, helped by catching the animals in the wilderness and bringing them to Caldwell. When he finally did confirm that echidnas and platypus are egg-layers, he sent the following telegram, on September 2, 1884 to the British Association for the Advancement of Science, which was holding its annual meeting in Montreal: "Monotremes oviparous, ovum meroblastic." The words meant that monotremes lay eggs, and the eggs have large yolks, like birds' eggs.

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ECHIDNAS
Tachyglossidae

Class: Mammalia
Order: Monotremata
Family: Tachyglossidae
Number of species: 2 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Echidnas (ih-KID-nahz), also called spiny anteaters, are solidly built, short-legged, shuffling mammals that can grow fairly large, up to 14 pounds (6.5 kilograms) for the short-beaked (or short-nosed) echidna and up to 20 pounds (9 kilograms) for the long-beaked (or long-nosed). Head and body length in an adult short-beaked echidna can reach 21 inches (53 centimeters), the stubby tail adding another 3.5 inches (9 centimeters). Head and body length in adult long-beaked echidnas gets as long as 30.5 inches (77.5 centimeters), and the tail, like that of the short-beaked echidna, is a mere stubby shoot. Male echidnas are larger than females. Although echidnas may look overweight, most of the soft tissue mass that might be mistaken for blubber is muscle, lots of it.

The two species look similar but some differences are obvious, especially the snout, which is made of bone, cartilage, and keratin (what claws and fingernails are made of). The snout is shorter and straight or slightly upturned in the short-beaked echidna, but longer, thinner, and downcurving, like the bill of a nectar-sipping bird, in the long-beaked echidna. An echidna's head is small and the neck is not obvious, so that the head seems to flow directly into the body.

Echidnas have full coats of brown or black hair, with scattered, hollow spines, which are really modified hairs, studding the body on the back and sides. The spines are yellow with black tips in some animals, and up to 2.4 inches (6 centimeters) long. In short-beaked echidnas, the spines are longer than

the fur, so that the spines are noticeable, but the coat of the long-beaked echidna is just the opposite: the fur is long enough to cover most of the spines.

The four legs are short, with powerful muscles and claws, proper for an animal that frequently digs in the soil and tears open logs and termite mounds. The hind feet point backwards, and are used to push soil away and out when the animal is burrowing.

GEOGRAPHIC RANGE

The short-beaked echidna lives throughout Australia, Tasmania, and the lowlands of New Guinea. The long-beaked echidna lives only in the New Guinea highlands.

HABITAT

The short-beaked echidna lives wherever its main food sources, ants and termites, are abundant enough to keep it fed, allowing the species to occupy nearly all habitat types in Australia and New Guinea, from tropical rainforest and grassland to desert. The long-beaked echidna is confined to alpine meadows up to 12,000 feet (3,660 meters) above sea level, and to humid mountain forests in the New Guinea highlands.

DIET

The short-beaked echidna feeds mainly on ants and termites, but varies its menu with beetles, and grubs, and the like. The animal forages (searches for food) usually by day, or in early morning and evening during very hot weather. It digs up soil, and tears open rotten logs and termite mounds to get at its food. The diet of a long-beaked echidna is almost entirely earthworms, but it varies its diet with insects. The long-beaked echidna feeds at night, poking around in the soil and the blanket of fallen leaves and other litter on the forest floor, sniffing for worms and insects.

BEHAVIOR AND REPRODUCTION

Echidnas are monotremes, their only living relative being the platypus, and the three species together are the only living, egg-laying mammals. The mother echidna bears a single, small egg with a leathery shell that she tucks into a temporary pouch, where the offspring will hatch and nurse itself on milk excreted through pores (but no nipples) in the mother's skin within the pouch.

THE ANTEATER SYNDROME

Besides echidnas, several kinds of unrelated mammals that eat mostly ants and termites have evolved in several parts of the world. The others are the anteaters of Central and South America, the aardvark of Africa, the pangolins of Africa and Asia, and the numbat of Australia. Mammals that feast mainly on ants and termites need to be born with certain natural, built-in tools for the job, and all these creatures have them: long, sticky, whiplike tongues that can shoot out of narrow, elongated, tube-shaped snouts; powerful, curved, hooklike claws and heavily muscled limbs for tearing apart termite castles or digging up ant colonies; and powerfully muscled bodies. These animals either have no teeth at all or lose them before they mature (echidnas, New World anteaters, pangolins), lose most of their teeth but keep a few (aardvarks), or seem to be slowly losing their teeth over evolutionary time (numbats).

These ant-eating animals have keen senses of scent and hearing, poor eyesight, and walk clumsily because their long, curved claws slow their gait. They are not diverse. There is only one species of numbat and one of aardvark, two of echidnas, four of New World anteaters, and seven of pangolins. Individual animals of these species lead solitary lives, socialize only to mate, and females nearly always bear and raise one young at a time.

If threatened, an echidna has several options for defense. It can run, climb a tree, or swim. Echidnas do these things quite well. It can wedge itself into a small cranny between rocks, anchoring itself with its paws and spines. If in the open, the echidna can dig itself a hole well within a minute, burying itself, leaving some of the spines on its back poking above the soil as a final barrier.

ECHIDNAS AND PEOPLE

Echidnas are not as well known as the platypus, but they fascinate naturalists and zoologists for the same reasons: they lay eggs, have a combination of reptilian and mammalian characteristics, and remind us of a time when reptiles were evolving into mammals.

CONSERVATION STATUS

The short-beaked echidna is still plentiful in Australia, and has no special conservation status listing at present. The

long-beaked echidna of New Guinea, on the other hand, is faring poorly. Its forest habitat is being cleared for logging, mining, and agriculture, and people hunt the echidna for food with packs of trained dogs. Because of these threats, the long-beaked echidna is listed as Endangered.



SPECIES ACCOUNT

SHORT-BEAKED ECHIDNA
Tachyglossus aculeatus

Physical characteristics: The short-beaked echidna is a compact, heavily muscled, short-legged creature covered with fur and an array of sharp spines. From a distance, it looks and moves something like a porcupine. Up close, it looks less like a porcupine and more like a waddling shrub of grass-like leaves and sharp thorns with a long, probing twig (the snout) at the forward end.

Adult short-beaked echidnas range in head and body length from 14 to 21 inches (35 to 53 centimeters), the stubby tail adding another 3.5 inches (8.9 centimeters). Males weigh about 14 pounds (6 kilograms), while females weigh about 10 pounds (4.5 kilograms).



The short-beaked echidna can use its spines and claws to stay wedged in a small space for protection. If it cannot hide, the echidna can roll into a ball, leaving its spines exposed. (Illustration by Barbara Duperron. Reproduced by permission.)

The pelt (fur) varies in color and thickness throughout the species' range, being darker and thicker as one moves south. In northern Australia, echidna pelts are light brown, while in Tasmania they are black.

Geographic range: Australia, Tasmania, and the lowlands of New Guinea.

Habitat: The short-beaked echidna can live in nearly any habitat where it can count on a steady food supply of ants and termites. This adaptability has allowed the species to occupy nearly all habitat types in Australia and New Guinea, from tropical rainforest and grassland to desert.

Diet: Short-beaked echidnas are ground foragers that feed by wandering across fields and forest floors, sniffing and lightly poking at the soil with their hard snouts, then gouging out dirt with their powerful legs and claws from an area where the animal has detected ants, termites, worms, or other soil-living creatures. Or, an echidna may tear open a rotten log to get at ants, or a termite mound for termites. Once an echidna has exposed the insects or worms, it shoots out its long, ropy, sticky tongue, laps up the insects, then reels in the tongue, loaded along its length with up to twenty insects at a time.

Behavior and reproduction: Short-beaked echidnas have one annual breeding season, July through August. Courtship behavior in echidnas is a sight not soon forgotten, since several males will follow single file in an "echidna train" behind a female for one to six weeks. Sooner or later, the female halts and the males encircle her continuously,

gouging out a circle of dirt around her. The female at last selects one male from the gang and mates with him, after which the two part and go separate ways. Fathers do not help with raising the young.

About twenty-four days after mating, the female lays her egg. When the mother senses that the egg is ready to emerge, she lays on her back and guides it as it slowly rolls down and over her underbelly and into the pouch, which closes to hold and shelter the egg.

A newly hatched echidna is the size of a jellybean. The mother carries the hatchling in her pouch for fifty to fifty-five days. She then removes the youngster and hides it in a burrow or cave, returning every five days to nurse the infant. The youngster is able to move about and forage but continues to nurse until it is six months old, and becomes independent at one year of age.

To protect itself, a short-beaked echidna may wedge itself into small spaces in burrows, rocks, or tree roots, where it can secure itself by using its claws and spines to wedge its body within the space. If caught in the open, the echidna can roll itself into a ball, head and legs tucked underneath and the protective spines pointing outward. It can also burrow and bury itself in the soil within a minute, leaving only its topmost spines visible as a final defense.

Short-beaked echidnas and people: Most people in Australia are either fond of echidnas or indifferent toward them. They are not considered pest animals.

Conservation status: Short-beaked echidnas are protected by law in Australia, and are plentiful there, since they can adapt to a wide range of habitats. Despite their high population, their numbers are declining. Research on short-beaked echidnas is ongoing at Pelican Lagoon Research Center on Kangaroo Island, Australia. ■

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DUCK-BILLED PLATYPUS
Ornithorhynchidae

Class: Mammalia
Order: Monotremata
Family: Ornithorhynchidae
One species: Duck-billed platypus (*Ornithorynchus anatinus*)

family CHAPTER

PHYSICAL CHARACTERISTICS

A platypus, at first glance, resembles an otter with a duck's bill on its face and a beaver's tail in back. An adult platypus, about the size of a house cat, weighs from 3 to 5 pounds (1.5 to 2.5 kilograms), its adult head and body length runs 12 to 18 inches (30 to 45 centimeters), and the tail adds another 4 to 6 inches (10 to 15 centimeters). Males are larger than females.

The snout, despite its duckbill shape, is soft, moist, and rubbery in texture, not hard like a bird's beak. The bill has an upper and lower section, like that of a mammal or bird, and the jaw hinging and motions are like those of mammals. The nostrils are set close together on the top of the upper bill.

The word "platypus" means "flat feet," referring to the animal's webbed, somewhat ducklike feet. The scientific name, *Ornithorhynchus anatinus*, means, in Latin, "bird-snout, resembling a duck." The plural is "platypuses" or just "platypus."

Most of the body is covered with fine, soft fur. The pelt color varies from dark amber to very dark brown on the platypus's back and sides, and from grayish white to yellowish brown on the underbelly. Platypus fur is fine, soft, and dense, with up to 900 hairs per square inch of skin. The fur has two layers, an undercoat with a woolly texture and an overcoat of coarser hair. As the platypus dives, the two fur layers trap a layer of air next to the skin, thus keeping the body dry and helping to insulate it against cold while the platypus swims, often throughout the night, and sometimes in temperatures close to freezing.

The body is somewhat flattened and streamlined. The limbs are short and muscular. As in other monotremes, the limbs of

the platypus are set in a permanent push-up position, the upper limb bones extending out from the sides of the body, horizontal to the ground, the lower limb bones going straight down. Although an excellent swimmer, the platypus is clumsy when trying to walk on land, and seldom does so anyway, except within its tunnels, since it burns up twice as much body energy moving about on land as it does swimming underwater.

All four feet have five claws apiece and are webbed, but the webbing of the front feet extends in a flat flange beyond the toes when the platypus swims. Back on land or in its burrow, the animal folds the extra webbing under its forefeet and walks on its knuckles. The platypus uses the forelimbs and forefeet for swimming and digging, while using the hind feet and claws as combs to keep the fur clean and waterproof.

The eyes are small and the external ears are mere holes in the skull, although the internal structure of the ears is like that of other mammals. There are two long grooves for protecting the eyes and ears, a single groove surrounding both the eye and ear on each side. These grooves are closed underwater, shutting both eyes and ears, when the platypus dives to hunt for food. Out of water, the senses of sight and hearing are sharp.

Both hind limbs of the male bear hollow, pointed, poison spurs mounted on the insides of the ankles, just above the heels. There are venom glands, one in each thigh, called the "crural glands" because they are controlled by the crural nerves, which are major motor nerves of the hindlimbs. The glands secrete venom that is passed through ducts to the sharp spurs, which the platypus can erect like jacknife blades and stab into other animals.

Both sexes have the spurs when they are young. At four months of age, male spurs are protected by a covering of whitish, chalky material that sloughs off completely by the end of the first year of age. Females bear smaller, useless spurs, without venom, that they shed by ten months of age.

The platypus's flat, beaverlike tail is used as a swimming rudder, a shovel, for fat storage, and by the mother for keeping eggs and young warm. The tail can store up to fifty percent of a platypus's total load of body fat. Female platypus use the tail to carry leaves to the nesting chamber, and both sexes use it to sweep loosened soil out of the way when digging. The tail has no fine fur, only coarse, bristly hair on its upper surface to aid in carrying or sweeping.

GEOGRAPHIC RANGE

Platypus are found only in mainland Australia and the southern island of Tasmania. Platypus are distributed along Australia's east coast, to about 500 miles (800 kilometers) inland, from Cooktown, Queensland to Melbourne, Victoria, and into Tasmania.

HABITAT

All platypus live on the edges of freshwater bodies like lakes, ponds, rivers, and streams, in tropical and temperate regions.

DIET

The platypus eats small freshwater animals, which it hunts at night, underwater, with its eyes and ears closed. It finds and catches underwater creatures that are swimming or sunken in the bottom mud by tracking them down with its sensitive bill, which can detect electricity and motion.

Diet is varied, including adult and larval water insects, crayfish (called "yabbies" in Australia), fish, frogs, tadpoles, snails, spiders, freshwater mussels, worms, fish eggs, and unlucky insects that fall into the water from overhanging trees. Occasionally, platypus probe for food at the edge of the water, grubbing under rocks or among roots of plants. A platypus must eat one third to one half of its body weight in food every day.

BEHAVIOR AND REPRODUCTION

Platypus are either solitary, or a male and female may live together, sharing a burrow. Platypus build two types of burrows along the banks of creeks and ponds. One is a "camping burrows," an all-purpose shelter for male and female; the other is the "nesting burrow," built only by the female, and containing a breeding chamber, or room, for birthing and raising the young. Both sorts of burrows keep their entrances at, slightly above, or below water level, the entrance tunnel climbing at an angle a few feet above water level to prevent flooding of the burrow. The openings can be difficult to spot, since platypus prefer to build them as hidden as possible in sturdy, concave banks with reeds and other aquatic plants at the water's edge, and overhanging sod and tree roots.

A burrow's entrance tunnel is barely wide enough to allow the platypus to pass, so that when the animal emerges from water and forces itself through the entrance tunnel, water on the pelt is squeezed and sponged off, and the platypus's fur is dry when it enters the main tunnel. A platypus may have up to a

dozen camping burrows strung along the banks of its territory, providing numerous nearby, safe havens. The animal rotates the burrows for shelter, staying at each a few days, probably to keep down its population of parasites.

A nesting burrow can be as long as 90 feet (30 meters), with two or more branching tunnels that circle about and eventually lead to the central nesting chamber.

Platypus normally hunt and feed at night, but have been seen doing so in the daytime. In the water, a platypus propels itself with powerful strokes of its forelimbs, the extended webbing adding extra push to the motions. It uses the hindlimbs and tail only for steering. As it swims, the platypus swings its head from side to side, allowing a full scan of its surroundings with its sensitive bill. The platypus feeds by snagging swimming creatures with its bill and by rousting them out of stream bottom mud and gravel, shoveling it up with its bill to put buried creatures to flight, then catching them as they try to escape.

Since the platypus must breathe air, it combines underwater hunting with trips to the surface to exhale and inhale. It will usually stay submerged for about a minute at a time, although it can stay submerged for up to five minutes. Platypus blood is especially rich in red cells and hemoglobin, the substance in blood that carries oxygen. The platypus can also ration its blood oxygen supply by reducing its heartbeat from two hundred beats per minute to ten beats per minute.

When not out hunting, a platypus rests in its burrow for up to seventeen hours a day. Platypus are active throughout the year, even in cooler southern Australia and Tasmania, where water temperature drops nearly to the freezing point. Individuals have been known to go into periods of torpor, or sluggishness and reduced activity with a lowering of body temperature, during the coldest months. Such a period, which can last up to six days, is not true hibernation but allows the animal to conserve energy in cold times.

Platypus are for the most part silent. Some naturalists have heard threatened platypus make soft, growling sounds that are only audible at close range. Lifespans for platypus in captivity and in the wild can reach sixteen years.

Platypus mate from August to October. Following an elaborate courtship ritual that includes the male holding on to the female's tail, and the pair swimming in slow circles, the two copulate in the water. Then the female tends to the nesting burrow

SEEING ELECTRICITY AND PRESSURE?

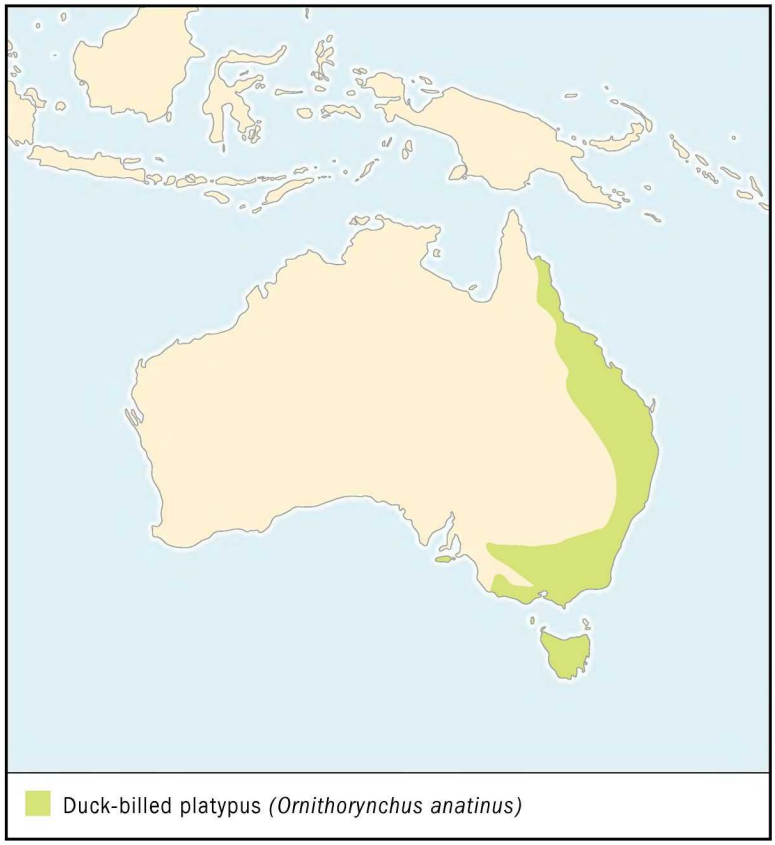
The monotremes, the echidnas and platypus, are the only living mammals that are known to have an ability to sense electricity. The platypus bill is something unique in nature, so sophisticated and advanced that no one can call the platypus "primitive." The skin surface of the bill contains 40,000 tiny electroreceptors, or specialized sensory nerve endings, arranged in rows along the length of the bill. These detect tiny, underwater bursts of electricity from the muscles of swimming creatures that the platypus hunts. The electroreceptors are intermingled with 60,000 mechanoreceptors, nerves ending at the skin in tiny "push rods" that respond to small pressure changes and detect the movements of prey animals underwater and on the bottoms of streams and ponds. Together, the two senses allow the platypus to home in on prey.

In addition to detecting bursts of electricity from prey animals, the electroreceptors in a platypus's bill can probably detect the tiny electric currents made by water flowing over and around rocks and sunken logs, thus producing a three-dimensional map of a river or lake bottom within the platypus brain. In the platypus, the combined abilities of electroreception and mechanoreception are so sensitive and detailed that they have become something like vision, providing a three-dimensional "view" of the platypus's underwater world, and enabling the platypus to pinpoint, in all three dimensions, the exact locations of its prey.

and chamber, carrying wet leaves and moss with her folded tail for lining the chamber, to prevent the eggs from drying out. The female lays one to three eggs in the chamber two to four weeks after mating. A typical egg is slightly oval, about half an inch in diameter (13 millimeters), with a soft, leathery shell like a reptile's.

The mother incubates the eggs by holding them against her belly fur with her tail, maintaining a constant temperature of 90°F (31.5°C). The young hatch in about ten days, each tearing through the eggshell with a temporary egg tooth. The newly hatched, inch-long young are fragile and translucent, blind and furless, and at about the same stage of development as a newly born marsupial young.

The mother, having no nipples, nurses the young with milk that comes directly from her belly skin. In about four months,



the young emerge for the first time from the burrow, each about a foot long and with a full coat of fur.

Predators of platypus, other than humans, include birds of prey such as hawks, eagles, and owls; Murray cod, a freshwater fish; and crocodiles. Carpet pythons, goanna lizards and rakali, or Australian water-rats, prey on young platypus in burrows. Carnivorous mammal species introduced by European settlers, including foxes, dogs, and cats, prey on platypus, although some of these predators are dealt painful ends by the poison spurs of male platypus.

PLATYPUS AND PEOPLE

The platypus, almost as much as the kangaroo, has become a national symbol of Australia and of the odd, weird, and outright bizarre creatures native to that continent and country. The platypus is a symbol, as well, for the unique, the quirky,



The world's first platypus twin puggles (baby platypus) born in captivity are shown together for the first time in 2003. (AFP PHOTO/Torsten BLACKWOOD. Reproduced by permission.)

and the unexpected in nature, which makes the animal and its behavior a subject of curiosity and science education.

Platypus were nearly wiped out by hunting, into the early twentieth century, for their fine, soft, waterproof fur. Nevertheless, humans, out of carelessness and ignorance, continue to make life miserable for the platypus. The animals become entangled in fishing hooks and lines, and in fishing nets; such encounters end in drowning or in the scarring of the bill. Tasmania's platypuses are being impacted by infection from an introduced fungus and by chemical pollutants.

Well-meaning people may try to rescue a platypus that is wandering and seems to be lost, a move that often proves harmful to people and platypus. A wild platypus captured by humans will probably die of shock. The rescuers may end up with days of pain and misery from a platypus sting. Wildlife education in Australia stresses leaving lost animals alone and calling a local office of the Australian Government Department of the Environment and Heritage so that someone can professionally capture and care for a lost platypus.

Recently, platypus have started invading human-made urban waterways in Melbourne, Victoria, while disappearing from some wild areas, for reasons still not understood. The urban platypus most likely have been forced into artificial waterways due to destruction of their habitat by development, and there is enough live platypus food in the waterways to feed a platypus population. The Australian Platypus Conservancy and the Melbourne Water Department together have surveyed and taken counts of the urban platypus populations. They found that platypus in the waterways were as healthy and well-fed as those in the wild, while some individual platypus from the waterways have migrated and re-colonized river banks with improved habitat.

CONSERVATION STATUS

Platypus are considered "common but vulnerable" by the government of Australia. It is plentiful in some areas, but is considered vulnerable due to habitat destruction from dams, irrigation projects, being caught in fish nets and lines, and water pollution.

Platypus are strictly protected by law and harsh penalties in Australia, which is agreeable with most, if not all, Australians, since the animals are not pests and are now national emblems. The Australian government and private groups like the Australian Platypus Conservancy keep close eyes on platypus populations and have proposed relocating some of the urban platypus to suitable natural areas where they have been driven from by development in the past.

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NEW WORLD OPOSSUMS
Didelphimorphia

Class: Mammalia
Order: Didelphimorphia
One family: Didelphidae
Number of species: 61 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

The word "opossum," commonly used to refer to all species within the family Didelphidae, is derived from an Algonquian Indian word for the Virginia opossum, the only living marsupial species north of the U.S.-Mexico border. "Possum," without the first "O," refers to certain Old World marsupials in Australia and New Guinea.

Didelphidae are tiny to medium-sized animals, most tending toward the smaller end of the size spectrum. Males are larger than females. In most species, the tail is about the same length as the combined head-and-body length, or longer, scaly and only lightly furred, and is prehensile (able to grasp) to varying degrees among species. In the smallest species, adult head and body length runs 3.3 to 7.2 inches (8.5 to 18.5 centimeters) and tail length is 3.5 to 10 inches (9 to 25 centimeters). In the largest species, adult head and body length runs 13 to 19.5 inches (32.5 to 50 centimeters) and tail length is 10 to 21 inches (25.5 to 53.5 centimeters). Adult weight in the larger species is usually between 4.5 and 12 pounds (2 and 5.5 kilograms).

The limbs of Didelphidae are short, except for the yapok (or water opossum), whose hind legs are a little longer than the forelegs. All four feet bear five digits and the hallux (HAL-lux; big toe) is opposable. All digits are clawed, except for some species in which the hallux lacks a claw. The muzzle (mouth area) is long and pointed, and the ears are prominent. The canine teeth are long and large.

The fur may be fine and velvety, thick and woolly, or somewhat coarse and stiff. Pelt colors, combinations, and patterns vary widely among genera (JEN-uh-rah) and species. The brown four-eyed opossum and the gray four-eyed opossum owe their common names to a colored spot of fur above each eye. In some species, there are dark brown or black patches around the eyes.

In most Didelphidae species, the back and sides of the body are dark, the underparts lighter. Upperparts may be gray, dark brown or reddish brown, the underparts white or yellowish. The thick-tailed opossum has an elaborate coloration that varies among individuals. The upper body fur may be yellow, yellow-brown, or dark brown, while the underparts are reddish-brown, light brown, or dark brown. The fur may have an unusual purple tinge. The face may show vague markings. The body shape of this species is also unusual, tending toward a long, low-slung, weasel-like form, with short but strong legs.

GEOGRAPHIC RANGE

In a very general sense, the Didelphidae can be said to inhabit both New World continents, from southeastern Canada to southern South America, but the common or Virginia opossum is the only marsupial making its home in the continental U.S. and Canada. All other species of Didelphidae range across Mexico, Central, and South America, from northern Mexico to southern Patagonia in South America, and on some of the Lesser Antilles Islands.

HABITAT

The Virginia opossum inhabits the widest range of habitats of any New World opossum, being found over most of the continental United States and southeastern Canada, in forest, grassland, and desert. The other species variously inhabit tropical and subtropical forests, and a few, like the Patagonian opossum, inhabit temperate grasslands in South America. The dryland mouse opossum prefers desert-like conditions in Central America.

DIET

Diet among Didelphidae is omnivorous, with some variation among species. Food sources include insects, small reptiles, small mammals, especially rodents, birds' eggs, fruits, seeds, snails, freshwater crustaceans, earthworms, and carrion. One species is skilled at subduing scorpions. The yapok, or water

"NEW WORLD" MARSUPIALS?

When you hear or read the word "marsupial," you probably think of kangaroos, koalas, and Australia. Maybe you think of New Guinea, the big tropical island just north of Australia, and its hordes of tree kangaroos and other marsupial types, or the Virginia opossum, the only wild marsupial in North America north of Mexico. South and Central America might not even come to mind, but an extraordinary seventy-five species of marsupial mammals live today on those landmasses, from the deserts of northern Mexico through the forests of Central and South America, and across the grasslands of Patagonia, almost to the southern tip of South America. How did they get there, on the other side of the Pacific Ocean from Australia?

Eighty million years ago, small, early mammals, including marsupials, were flourishing. Today's southern continents were united in a supercontinent called Gondwana, which split from the northern supercontinent, Laurasia, made up of the present-day northern continents, around 160 million years ago. The two giant continents continued to split apart into the continents of the present day. The southern continents of Australia, Antarctica, and South America remained joined into a great landmass that allowed early animals to wander freely back and forth across the landmass. Ninety million years ago, Antarctica separated from South America, isolating South America (which had lost its connection with Laurasia 160 million years ago), and isolating the ancestors of the Australian marsupials and monotremes in what would become the present-day island continent of Australia and its large satellite island, New Guinea. South America, like Australasia (Australia and nearby islands), became a continent-sized refuge for early marsupial types, although these would be sharing the continent with placental mammals. By forty million years ago, marsupials had become extinct in North America, Africa, Asia, and Antarctica but flourished in Australasia and South America, where they continued to evolve and diversify.

opossum, hunts and eats freshwater fish. Some species store fat in the bases of their tails to carry them through the lean months.

BEHAVIOR AND REPRODUCTION

New World opossums are marsupials, mammals that give birth to tiny, only partly developed young that crawl into the mother's pouch, latch their jaws tightly onto a milk nipple, and finish their development. Most mammals are placental, meaning that they

carry their young in the womb for longer periods before birthing them, and these are born in a more completely developed state. "Marsupial" comes from "marsupium," the Latin word for pouch or bag, and names that special feature of marsupials.

Not all species have females with complete, functional pouches. In species without pouches, newborn young just cling with their jaws onto the mother's nipples and grasp her fur, remaining so until weaning, or stopping breastfeeding, and clinging to the mother wherever she goes. Some of the non-pouched opossums have partial pouches that cover only the rows of nipples on either side, and run the length of the underbelly. Females may have from five to as many as twenty-five nipples. In the common large opossum species, a typical female has a functional, snug, fur-lined pouch and thirteen nipples inside, arranged in a circle, with one nipple in the center, although the number of nipples may vary among species and even among individual females within a species.

American opossums may have definite mating seasons in more temperate regions, or may breed anytime of the year in the tropics. Litter sizes generally run between four and nine young. As many as sixteen young, or a record fifty-two for the Virginia opossum, may be born in a single litter. In such large litters, some of the young are likely to die before weaning, depending on the number of nipples the mother has. The gestation period is short, about two weeks, followed by up to ten weeks of pouch life. When leaving the pouch, the young may still nurse and ride on their mother's back for another month before striking off on their own. Individuals reach reproductive age at four months to one year. Lifespans among Didelphidae species are short, only one to five years.

For shelter, some American opossum species build nests of twigs and leaves, or of grasses; others dig their own burrows or use burrows abandoned by other animals, abandoned birds' nests, or shelter in hollow logs and among rocks.

All but a few species are nocturnal (nighttime) foragers, and as far as anyone knows, all are solitary, breaking that rule only during mating times. Outside of the mating season, same-sex individuals of a species, upon meeting, ignore or threaten each other. During the breeding season, a male and female may stay together for several days. Some species are mainly arboreal (spending most of their time in trees), others forage on the ground, and some do both. The Patagonian opossum is an ex-

cellent swimmer in freshwater, where it hunts for fish, even though it is not as specialized as the water opossum.

NEW WORLD OPOSSUMS AND PEOPLE

As a whole, the Didelphidae are no threat or bother to humans. People hunt and eat some species and use their fur for clothing and parts of clothing. The gray short-tailed opossum frequents houses in South America, where it is welcome because it hunts and eats rodents and insects infesting the houses.

Brown four-eyed opossums, gray four-eyed opossums, woolly opossums, and common mouse opossums occasionally raid fruit and corn crops. The southern opossum, and the white-eared opossum sometimes kill poultry.

CONSERVATION STATUS

Out of all the Didelphidae species, the IUCN lists three as Critically Endangered (facing an extremely high risk of extinction), three as Endangered (facing a very high risk of extinction), fifteen as Vulnerable (facing a high risk of extinction), and eighteen as Near Threatened (close to becoming threatened with extinction).



Virginia opossum *(Didelphis virginiana)*

VIRGINIA OPOSSUM
Didelphis virginiana

Physical characteristics: The Virginia opossum is one marsupial that a majority of Americans have surely seen, if only as roadkill. These opossums have low-slung, vaguely rat-shaped bodies that in adults can weigh up to 14 pounds (6.4 kilograms). Males are larger than females. Adult head and body length can reach 20 inches (50 centimeters), and the tail length can reach 18 inches (47 centimeters). The body fur is light to dark grayish, due to a coat of white fur with black tips under a longer coat of pale guard hairs. The head is white and elongated, and studded with long whiskers. In some individuals, the gray coat may extend in a stripe across the crown, tapering to an end between the eyes. The eyes are black and shiny. The long, strong tail is scaly, colored whitish or pinkish, and nearly hairless, much like a rat's, and is prehensile, able to grasp tree branches



Virginia opossums can eat poisonous snakes. They are immune to the venom of these snakes, including copperheads, water moccasins, and rattlesnakes. (Illustration by Jonathan Higgins. Reproduced by permission.)

and carry nesting materials. The ears, nostrils, forepaws, and hindpaws are pinkish and only sparsely furred. Each paw has five digits, and the hallux (HAL-lux; big toe) is opposable, allowing the opossum to grasp branches.

Geographic range: The Virginia opossum is one of the few marsupials, in Australasia or the Americas, that is at home in temperate regions with cold winters. Its range extends as far north as Ontario, Canada, and as far south as Costa Rica in Central America. Virginia opossums are found in North America, from Central America and Mexico in the south, through the United States east of the Rocky Mountains and north into southwestern Ontario. Opossums are also found along the west coast of the United States.

Habitat: Virginia opossums prefer living in forest, farmland, and suburbia with possible denning sites and a water source close at hand, but this adaptable species can survive and thrive almost anywhere, including grassland and near-desert conditions. These opossums are nomadic, seldom staying in one foraging area for more than a year. Individuals may sleep during the day in whatever temporary shelters they find, or build nests, lined with leaves. Refuges include woodpiles, thickets, rock crevices, and in various human-made structures such as under porches and raised houses, and in barns, drainpipes, and sheds.

Diet: The Virginia opossum is truly omnivorous, eating almost anything that can be considered food. A partial list of dietary preferences includes rats, mice, moles, slugs, snails, shrews, worms, beetles, ants, grasshoppers, crickets, frogs, garbage, fruit, corn, berries, and carrion.

An even more unusual source of food is poisonous snakes, to whose venoms the opossums are immune. This includes copperheads, water moccasins, and rattlesnakes.

Behavior and reproduction: Like most opossums, Virginia opossums live and forage, search for food, solitarily. They forage mostly at night, but sometimes during the day. If male individuals meet, they avoid each other or sound off with threat displays, with hissings, growlings, and screechings, often going on to one-on-one combat. Males fight one another ferociously during mating seasons. On the other hand, if a male and female meet during the breeding season, they will mate and then stay together for several days.

Mating seasons vary according to how far north individual opossums live. Virginia opossums begin mating in December in the southern states, in March in the northernmost states and Canada, and in January and February for areas between. In Canada and in the north and central states, females usually bear only one litter per year. Two or even three litters are common in the southern states and further south.

Young are born thirteen days after mating. Litters can range in numbers of up to twenty, with a record of fifty-two, but since the mother has only thirteen nipples, only a maximum of thirteen in a litter can survive. Newborns are scarcely bigger than rice grains. The young spend up to 100 days, or slightly over three months, in the pouch. By seventy-five to eighty-five days, the young are weaned and leave the pouch, but remain with the mother for another two or three months before leaving to live on their own. Until they leave, the mother carries the young on her back. Young males reach sexual maturity at eight months, females at six. The longest recorded lifespan in the wild for the Virginia opossum is three years, although captive individuals have lived as long as ten years.

When threatened by a predator, a Virginia opossum may react in any of several ways. Escape is always the optimal choice, and includes climbing trees and swimming. If escape proves impossible, the opossum may use its variation of the basic mammalian threat response, opening its jaws wide, baring its fifty-five teeth, and hissing at its foe. It may also discharge a foul-smelling, greenish fluid from anal glands. Or, the opossum may use its "drooling" display, building up its saliva content, drooling from its mouth and blowing froth and bubbles from its nostrils, in hopes of convincing a predator that the opossum is seriously diseased and therefore dangerous to eat.

The opossum's final defensive recourse is either fighting back or performing its most famous behavior, "playing possum." The animal

collapses, the eyes glaze, the jaws open, the tongue lolls, the teeth are partly bared, and the stinky anal fluid release adds the final carrion touch. The deathlike state is a form of catatonia, in which the animal lies limp, does not react to touch or prodding, and cannot be roused by any method. The muscles become limp, basic functions slow. Predators of opossums, among them coyotes, dogs, bobcats, and birds of prey, will reject the seemingly dead opossum and leave it untouched. From one minute to six hours after the predator has left the scene, the opossum rouses itself and moves off.

Throughout its range in Canada and in parts of the United States that have long, cold winters, Virginia opossums feed to build up extra body fat in the fall in preparation for the lean winter months. The species doesn't hibernate, but in especially cold weather, individuals may stay quietly in their shelters for a few days. Otherwise, they're outside and hiking across the snow to forage.

Virginia opossums and people: Virginia opossums sometimes help themselves to human garbage, but cause far less mess and destruction than do raccoons. Virginia opossums, like most mammals, can carry and transmit rabies. Virginia opossums have been, and still are, hunted for food and for their pelts.

Their ability to eat almost anything organic puts Virginia opossums in the front ranks of living nature's cleaning crews. They eat pest insects like cockroaches, garden pests like snails and slugs, pest mammals like roof rats and mice, and they eat all varieties of carrion.

Conservation status: Virginia opossums have adapted to humans successfully, are in no danger of extinction, and have even extended their ranges in some areas. ■

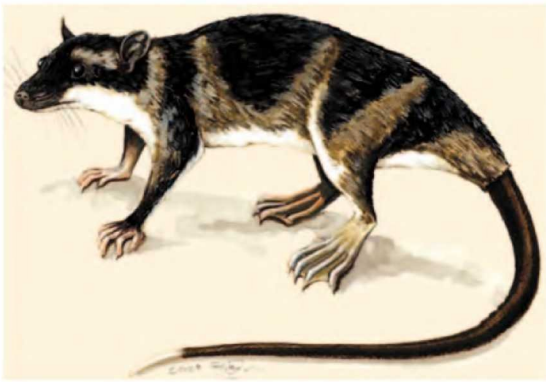


Water opossum *(Chironectes minimus)*

WATER OPOSSUM
Chironectes minimus

Physical characteristics: Unlike most of the New World opossums, the yapok, or water opossum, is specialized for an aquatic lifestyle. It is the only living aquatic marsupial species. In general terms, the yapok can be thought of as a sort of marsupial otter. The name "yapok" is derived from the Oyapock River in northern South America.

Adult head and body length runs 10.5 to 16 inches (27 to 40 centimeters); tail length, 12 to 17 inches (31 to 43 centimeters); and adult body weight, 1.3 to 1.7 pounds (0.6 to 0.8 kilograms). The animal is covered with short, dense, water-repellent fur, unique among the Didelphidae. The sides and upper body are black, with three pairs of



The water opossum is the only marsupial that lives in the water. It has water-repellent fur and webbed hind feet. (Illustration by Jonathan Higgins. Reproduced by permission.)

prominent, grayish bands that run vertically from the light gray underbelly almost to the spine. The head is blunter and wider than is common among Didelphidae species. The upper part of the head, including the eye area, is black. A dark gay bar runs the length of the snout from the nostrils to the crown. The lower part of the head is grayish. A prominent white stripe runs from above each eye to the ear. The eyes are large and black. The prominent, nearly furless ears are oval in shape. Conspicuous tufts of long, white or gray whiskers are mounted on each side of the head near the nostrils and over the eyes.

The hindfeet are webbed and the yapok uses them as its main propulsion organs when swimming. The hallux (first toe), usually shorter than the other toes in mammals, is elongated in the yapok, making the foot shape symmetrical and thus able to push more efficiently against the water. The forefeet are not webbed, and have elongated, furless fingers with reduced claws, which are furnished with a well-developed tactile sense.

Among the yapok's many peculiarities is that both females and males carry well-developed pouches that open toward the rear. The female uses a muscle to close her pouch when carrying young, which can survive without oxygen for several-minute intervals. The male uses his pouch to hold and protect the scrotum, drawing it up and into the pouch when he swims.

Geographic range: Yapoks are found in Central and South America, from southern Mexico and Belize through all of Central America, and into Colombia, Venezuela, the Guianas, Ecuador, Peru, Paraguay, Brazil, and northern Argentina.

Habitat: Yapoks live along streams, rivers, and lakes in tropical and subtropical rainforests of Central and South America, from sea level to 6,000 feet (1,830 meters) or more above sea level.

Diet: The yapok eats crayfish, shrimp, fish, and some water plants.

Behavior and reproduction: Females are polyestrous, meaning that they come into heat and become receptive to mating more than once a year. A breeding pair stays together for several days, the male following and circling the female until actual mating. A typical litter contains one to five young.

Yapok young have the fastest rate of development among all the Didelphidae species. After about forty days in the pouch, the young

have grown body fur, pigmentation and the various markings, and opened their eyes. At about fifty days, the young begin to let go of the nipples and leave the pouch, but continue to suckle and stay with the mother, sometimes riding on her back.

Individual water opossums are solitary and hostile toward others of their species, except during mating times. An individual hunts and forages in freshwater streams, between rest periods, throughout the night. During the day, the animal rests in a temporary ground nest that it constructs from leaves and grass in a shady area. Close by is a more permanent underground burrow, which the yapok excavates in the stream bank, with its entrance a few inches above the water line. The entrance tunnel is about 2 feet (0.6 meters) long, and leads to a den lined with leaves or grasses. Individuals use their prehensile tails to carry nesting materials.

A yapok fishes and forages underwater, propelling itself with alternate strokes of its powerful hind legs and webbed feet. The animal shuts its eyes and ears and depends partly on its whiskers to detect motion, while its fingers, acutely sensitive to touch, are used to contact, check the texture of, and grasp prey.

The longest known lifespan for a captive yapok is three years.

Water opossums and people: Water opossums, confined to forests and riversides by their specialized lifestyles, are no threat or bother to humanity. Humans hunt them for their waterproof pelts, to be made into garments and accessories.

Conservation status: The yapok is listed as Near Threatened, not currently threatened, by the IUCN. ■

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SHREW OPOSSUMS
Paucituberculata

Class: Mammalia
Order: Paucituberculata
One family: Caenolestidae
Number of species: 5 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

The New World marsupial order Paucituberculata contains only one surviving family, the Caenolestidae, or shrew opossums (the true shrews, family Soricidae, are not marsupial but placental mammals). Shrew opossums are mouse-sized marsupial mammals with dense, dark gray or brown fur. Also called mouse opossums and rat opossums, their appearance is more suggestive of shrews. Shrew opossums have long, conical, pointed snouts and tiny, beady eyes. There are three genera (JEN-uh-rah; plural of genus, JEE-nus) and five species: the living members of order Paucituberculata and family Caenolestidae are relicts, little-changed survivors of a once far more diverse assemblage of genera and species. Information about them is spotty, since the animals are nocturnal and secretive, and live for the most part in remote, difficult terrain.

Head and body length across species runs from 3.5 to 5.5 inches (9 to 14 centimeters), and tail length is 3.5 to 5.5 inches (9 to 14 centimeters), the tail length being about the same as the head and body. Males are larger than females, males weighing from 1 to 1.5 ounces (25 to 41 grams), females from 0.5 to 1 ounce (16.5 to 25.5 grams). A shrew opossum has five digits on each foot, the two small outer toes of the forefeet with blunt nails, the remaining three equipped with curved, sharp, strong claws. The hind feet have strong, curved claws on all toes except the so-called great toe, which is small and carries a small nail.

The fur of shrew opossums is thick and soft, covering the entire body and less dense on the tail. The coat has a disorderly

look because different areas of the coat have different textures. The fur may be dark on the dorsal (upper) parts of the body, with lighter-colored under parts, or dark all over the body. Dark colors vary from gray-brown, black-brown, to near-black. The ears are shaped much like those of typical mice, and large enough to protrude well above the thick fur. Hearing is acute, as is the tactile (touch) sense of the long whiskers.

The upper lips bear small flaps of skin on both sides, a feature found only in the Caenolestidae. The Chilean opossum has these and similar flaps on its lower lips. Their function is, so far, unknown. They may be barriers to prevent blood, pieces of flesh, and dirt from collecting on the sides of the jaws. The tail is about as long as the combined head and body. The tail fur, sparser than on the body, is the same color as the upper pelt, but may include a white tip in some individuals. The tail is not prehensile, meaning it is not able to curl around and grasp objects. The tail of the Chilean shrew opossum swells up with stored fat for the southern winter months. Females do not have pouches and have four nipples, except for females of the Chilean shrew opossum, which have seven nipples, the seventh located on the midline of the underbelly.

The rostrum, or the front part of the skull including the jaws, is long and tapering. Each of the lower incisors has only one cusp, or protruding bump on its crown, unlike most mammal teeth, hence the order name, Paucituberculata, meaning, in Latin, "few bumps," since this feature is found in all species, living and extinct, in the order.

GEOGRAPHIC RANGE

The gray-bellied shrew opossum, the blackish shrew opossum, and the silky shrew opossum are found in isolated, separated populations in the mountains of the Western Andes, from Colombia and Venezuela in the north and southwards through Ecuador, Peru, and Argentina. The Incan shrew opossum inhabits southern Peru, while the Chilean shrew opossum lives along the south-central coast of Chile and on the close offshore Chilean island of Chiloé, plus another population in Argentina.

HABITAT

The gray-bellied shrew opossum, the blackish shrew opossum, the silky shrew opossum, and the Incan shrew opossum live in dense vegetation in cool, rainy mountain forests and

DYNASTY IN EXILE

Like the few poor refugees of a downfallen, once mighty civilization, the five living shrew opossum species, lurking in the undergrowth of temperate forests in South America, are but a pale afterglow of their former splendor. From seventeen to twenty-four million years ago, the order Paucituberculata included four other families besides Caenolestidae, while the caenolestids were the most abundant marsupials in terms of species during that era. The extinct Paucituberculata species had teeth specialized in unique ways, and lived in both temperate and tropical biomes throughout most of the South American continent.

The extinct families of Paucituberculata are Paleothentidae, Abderitidae, Polydolopidae, and Argyrolagidae. Species of Paleothentinae had developed an enlarged forward lower molar with a shearing crest. Abderitinae species took that molar further and equipped it with a forward-facing, sharp, high, serrated blade. The species of Polydolopidae carried a number of enlarged, forward-directed lower incisors and a pair of large shearing teeth of uncertain origin. The Polydolopidae were small marsupials, the largest no bigger than a rabbit, that behaved and were equipped much like rodents. The rodent-like Argyrolagidae resembled small kangaroos, with strong, two-toed hind feet and a long, well-muscled tail. They moved about by hopping and leaping, much like kangaroos. Family Paleothentidae evolved an impressive nine genera and nineteen species.

meadows, from 4,500 to 12,000 feet (1,500 to 4,000 meters) above sea level. The Chilean shrew opossum inhabits rainy lowland temperate rainforest along the Chilean coast from sea level to 2,270 feet (1,135 meters), preferring dense forest with mossy trees and logs, and soaking wet forest floors.

DIET

Shrew opossums forage nocturnally, at night, on the ground, and are carnivorous (meat-eaters) with some herbivory (plant-eating). They eat insects, earthworms, small vertebrates, fruits, other plant food, and fungi, in forest floor growth and in alpine meadows, traveling among feeding areas by means of trails through ground vegetation that they maintain by constant use. A shrew opossum uses its lower canines to stab and skewer prey, then uses its sharp premolars to slice the prey into pieces.

BEHAVIOR AND REPRODUCTION

Little is known about the particulars of breeding among shrew opossum species. Field researchers have found lactating (producing milk for young) females of the Chilean shrew opossum in February, March, May, October, November, and December, suggesting a breeding season from December through May, and no breeding from June through September, the coldest months in the Southern Hemisphere. Breeding season for the silky shrew opossum, which lives in a less stressful climate, is thought to begin in July.

Since shrew opossums are marsupials, the unborn young remain in the females' uterus (YOO-ter-us; womb) only a few days, then are born in an incomplete state, to be suckled by the mother until they complete development. Suckling shrew opossums cling to their mother as she moves about. Litters probably number up to four individuals.

If alarmed, a shrew opossum will hop forward repeatedly on all fours, a mode of locomotion unique to the Caenolestidae. Shrew opossums have also been observed climbing trees, though not foraging in trees. The animals rest during the day in hollow logs and burrows. Despite their fattened tails, Chilean shrew opossums have been observed running across packed snow in midwinter.

SHREW OPOSSUMS AND PEOPLE

Tiny, secretive, and living in remote regions, shrew opossums have very little interaction with humanity and pose no threats.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists the Chilean shrew opossum as Vulnerable (facing a high risk of extinction), due to deforestation (removing trees) from logging.



Silky shrew opossum *(Caenolestes fuliginosus)*

SILKY SHREW OPOSSUM
Caenolestes fuliginosus

SPECIES ACCOUNT

Physical characteristics: The silky shrew opossum is probably the best known of the shrew opossum species. Its head and body length ranges from 3.7 to 5.3 inches (9.3 to 13.5 centimeters), the tail 3.7 to 5 inches (9.3 to 12.7 centimeters). The fur on the dorsal (back) body is soft and thick, and colored a dark brown gradually giving way to lighter brown on the lower body and underbelly.

Geographic range: The silky shrew opossum inhabits the western Andes of northern and western Colombia, extreme western Venezuela, and Ecuador.



Silky shrew opossums look for food on the ground at night. During the day, the animals stay in hollow logs and burrows. (Illustration by Brian Cressman. Reproduced by permission.)

Habitat: This shrew opossum is nocturnal and terrestrial, preferring cool, wet areas with heavy vegetation. The species is found in alpine scrub forests and meadow zones of the Andes, at altitudes from 4,500 to 12,000 feet (1,500 to 4,000 meters).

Diet: Silky shrew opossums eat mostly caterpillars, centipedes, and spiders, varied with fruit.

Behavior and reproduction: The breeding season is believed to be July, because animals caught in August were suckling (nursing, or feeding breast milk) their young.

Silky shrew opossums run by bounding, front feet and rear feet working as units and alternating. If threatened, an individual will open its jaws wide and hiss. The tail is not prehensile (able to grab or hold things), but the animal will use it as a sort of third leg when sitting upright.

Silky shrew opossums and people: There is little to no interaction between silky shrew opossums and humans.

Conservation status: The silky shrew opossum has no special conservation status. ■

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MONITO DEL MONTE
Microbiotheria

Class: Mammalia
Order: Microbiotheria
One family: Microbiotheriidae
One species: Monito del monte (*Dromiciops gliroides*)

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

The common name monito del monte is Spanish for "little monkey of the mountain." The "monkey" aspect of the common name derives from the animal's nearly furless, somewhat monkey-like hands and feet. Another local common name for the species is colocolo. The scientific name of this species has recently been changed to *Dromiciops gliroides*, and the species may be referred to as *Dromiciops australis* even in recent writing.

As with the other living New World marsupial orders, the single living species of Microbiotheria is a remnant with a more diverse past. The fossil record has revealed an extinct genus, *Microbiotherium,* with six known species, that thrived during the Oligocene and Miocene Epochs (thirty-four million years ago to five million years ago, for a period of thirty-nine million years). Today, *D. gliroides* represents an order with only a single living species.

An adult monito del monte's size is between a rat's and a squirrel's. The head-and-body length runs 3.3 to 5 inches (8.3 to 13 centimeters). The tail length is about the same, running 3.5 to 5 inches (9 to 13.2 centimeters), The adult body weight runs about a half ounce to just over one ounce (16.7 to 31.4 grams). The animal's coat of fur is fine, short and thick. The upper body pelt is brown, with several light gray patches or spots on the shoulders and rump. The face fur is gray, the large eyes encircled with prominent black rings. The belly fur is pale tan.

The tail is completely furred, except for a furless area, about an inch long (2.5 to 3 centimeters), on the underside, at the

MONITOS AND MISTLETOES

The thousand-or-so species of mistletoe are distributed over most of the world, including the moist temperate forests of southern South America. Mistletoes are hemiparasites, meaning partly parasitic. Although they have green leaves for photosynthesis, they live on tree branches and trunks, anchoring themselves and tapping into the wood to steal nutrients and water from the host tree. In most species of mistletoe, the seeds are spread by birds, which eat the seeds and defecate (DEF-uh-kate) them later while roosting. If they void the seeds while roosting on a tree branch, the seeds, covered with a gluey substance called viscin (VIS-in), are likely to stick to the branch and grow up to be mistletoes.

In an exception to the habit of birds being the main vectors, or transporters, for mistletoe species, the monito del monte feeds and disperses seeds of the mistletoe species *Tristerix corymbosus*. In fact, the little marsupial, as far as anyone knows, is the only disperser of the seeds of this mistletoe species. This was discovered by Guillermo Amico and Marcelo Aizen of the National University of Comahue, Argentina. During field studies, they came across numerous strings of mistletoe seeds sticking to the trunks of host trees. They were seeds of *T. corymbosus*, the fruits of which are green when ripe. Normally, green color in fruits indicates that they are not yet edible, so that fruit-eating birds will pass them up. The large number of *T. corymbosus* strings glued to tree trunks was also unusual, since birds defecate mistletoe species' seeds while roosting on tree branches. Only some of the seeds end up on branches and grow, and birds have no special ability to aim for tree trunks.

On the other hand, some mammal species consume ripe green fruit. That known fact and the sight of lots of mistletoe seeds on tree trunks indicated an arboreal, or tree-living, mammal as the seed-eater and disperser. Further searching and observing revealed that mammal to be the monito del monte. The species gorges on the mistletoe fruit. The animals peel the rinds off the fruit with their front paws, swallow the innards whole, seeds and all. Soon after a meal of mistletoefruits, the marsupial defecates almost all the seeds, undamaged by the animal's digestive system, in and on its foraging territory, which includes tree trunks and branches.

tip. The one-third of the tail closest to the body has the same sort of dense, woolly fur as the body, while the rest of the tail has straight, dark brown fur. The female's well-developed pouch is comfortably lined with light brown fur and has four nipples. The ears are moderately furred.



Young monitos del monte first live in their mother's pouch, then in the nest, and finally ride on her back while she looks for food. (Illustration by Michelle Meneghini. Reproduced by permission.)

As in many small marsupials, the snout is conical, cone-shaped, and tapering, but shorter than is usual among marsupials.

GEOGRAPHIC RANGE

The monito del monte has a limited range in South America, in southern Chile, overlapping into Argentina, from Concepción, Chile, southward to and including the Chilean island of Chiloé, and inland to the Andes and just over the border into Argentina.

HABITAT

Monitos del monte live in dense, cool, temperate rainforests, in the lowlands and the Andes mountains, from sea level to 6,000 feet (1,850 meters) above sea level. They most often live in thickets of Chilean bamboo (*Chusquea* species), especially *Chusquea valdiviensis*, the most common ground plant in these forests.

The forest type where the monito del monte makes its home is as unique as the animal itself. Called Valdivian temperate forest, it is located in a limited range in southern South America between the Andes and the Pacific Ocean, most of it in Chile with some extending into Argentina. The Valdivian forest biome is isolated from the rest of the world by deserts, mountains, and oceans. The forest is a treasure house of ancient plants and animals, some of which date back, little changed, from the time when the southern continents were all attached together, forming the ancient supercontinent of Gondwana. The Valdivian forests have been in their present isolated condition for thirty million years. A full 90 percent of the seven hundred flowering plant species there are endemic, meaning they are found no where else in the world. One third of the woody plants (trees, shrubs, woody vines) have living relatives in Australia, New Zealand, New Caledonia (an island northeast of Australia), and Tasmania, all linking to an ancient common landmass. The monito del monte is a living fossil whose relationship with other marsupials shows the same sort of geographic split as do the Valdivian plants.



DIET

The monito del monte is mostly insectivorous, meaning that it forages for and eats insect larvae (LAR-vee) and pupae (PYOO-pee). They also eat some plant material. They do most of their foraging at night, in the trees and on the ground. In the Southern Hemisphere in autumn, the animals gorge, doubling their body weights in a week, most of the extra weight being fat packed into the base of the tail.

BEHAVIOR AND REPRODUCTION

Colocolos are solitary, nocturnal foragers, both in trees and on the ground. They build and shelter in globe-shaped nests of sticks and water-repelling *Chusquea* bamboo leaves, lined with moss and grass, in protected areas, and often concealed by a final overlay of gray moss. The nests are about 8 inches (20 centimeters) in diameter. Nest locations may be rock clefts, hollows of trees, or in dense ground shrubbery. The nests are

snug and comfortable, but in the coldest months, monitos del monte hibernate, living off fat reserves in the base and first third of the tail.

Since monitos del monte are marsupials, birth and nurturing of the young follow the standard marsupial model: the young are born at an incomplete stage of embryonic development, crawl from the birth canal over the mother's belly fur to the pouch, and there latch onto nipples and remain so, nourished by milk, until they complete their development.

Colocolos mate in the Southern Hemisphere spring and early summer—October through December. A female has a single litter of one to four young annually. Litters of five young have been seen, but since the mother has only four nipples, the fifth cannot survive. On leaving the pouch, the young first reside in the nest, then ride on the mother's back, clinging to her fur as she forages, before beginning to forage on their own. The offspring live solitary lives but continue to associate, off and on, with the mother. The young of both sexes reach sexual maturity in two years. Males remain with females only during the breeding season. The maximum lifespan of this species is probably three to four years.

Colocolos hibernate, intermittently, in their nests, during the cool and cold months, depending on temperature and food availability. Torpor, the low state of body activity in hibernation, is triggered by absence of food over time or by outside temperature. A torpor bout, or period of lowered body functions, may last a few hours to several days (five days is the longest known bout period). Hibernating colocolos rouse themselves spontaneously, probably cued by a temperature increase in their surroundings or a signal from some internal clock. These periods of hibernation, along with the stored tail fat, enable the colocolo to conserve body energy while waiting out periods of low food availability and cold.

MONITOS DEL MONTE AND PEOPLE

There is little interaction between these small, secretive animals and humans. In the Lake Region of Chile, a superstition holds that seeing a monito del monte in the home brings bad luck, and that the only cure is burning down the house. One the other hand, the animal's consumption of insects serves as a local control on insect populations.

Scientific value of the monito del monte is immense, because of its ancient origins and relationships.

CONSERVATION STATUS

Monitos del monte are listed as Vulnerable, facing a high risk of extinction in the wild, on the Red List of the World Conservation Union (IUCN). The main problem facing the species is ongoing deforestation.

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AUSTRALASIAN CARNIVOROUS MARSUPIALS

Dasyuromorphia

Class: Mammalia

Order: Dasyuromorphia

Number of families: 3 families

order

CHAPTER

PHYSICAL CHARACTERISTICS

Most familiar mammals such as cats, dogs, and horses are called eutherian (yoo-THEER-ee-an) mammals. These mammals have a placenta, an organ that grows in the mother's uterus (womb) and lets the mother and developing offspring share food and oxygen. Marsupials do not have a developed placenta. Because of this, they give birth to young that are physically immature and undeveloped. The young are not able to survive on their own. Instead, they are carried around for several months in their mother's pouch, or they are attached to the mother's teats, or nipples, outside the pouch, and carried until they have grown and matured enough to fend for themselves. The Australasian (living in Australia and nearby islands) carnivorous marsupials are made up of three families of marsupial mammals with a total of about seventy-one species.

Australasian carnivorous marsupials vary widely in weight, from less than one ounce (28 grams) to more that 65 pounds (30 kilograms). The combined length of their head and body ranges from less than 2 inches (5 centimeters) to 51 inches (130 centimeters). The largest Australasian carnivorous marsupial, the Tasmanian wolf, became extinct in the early 1900s. The largest living member of the Dasyuromorphia order is the Tasmanian devil.

Australasian carnivorous marsupials are all four-footed, with four toes on each of the two front feet and either four or five toes on each of the two back feet. On each back foot is a toe called a hallux (HAL-lux) that does not have a claw. Species that

phylum
class
subclass
order
monotypic order
suborder
family

live mainly in trees tend to have wider feet than ground-dwelling species and use their hallux to help them grip branches. The tails of Australasian carnivorous marsupials vary in length. Some species have tails nearly as long as their bodies. All of these animals have pointed snouts and a combination of sharp pointed teeth and grinding teeth to help them eat meat.

The fur of carnivorous marsupials ranges from grayish or reddish brown to sand colored, depending on the habitat in which they live. A few have black fur, and some species have underbellies that differ slightly in color from the rest of their fur. The fur on the bodies and heads is usually short, but the fur on the tail can be either very short or very bushy. Some of the animals in this order have distinct markings, such as the numbat's stripes, but most do not.

GEOGRAPHIC RANGE

Animals in this order live in Australia, Tasmania, and New Guinea, and also inhabit some of the nearby Pacific islands.

HABITAT

Australasian carnivorous marsupials live in many different habitats, from the tropical rainforest to the desert. Each species has adaptations that allow it to live in its own particular environment. For example, the numbat has claws that are good for scratching at the dirt and digging out termites in the forest where it lives. The spotted-tail quoll has special ridges on the bottoms of its paws and sharp claws that help it climb large trees.

Many of the Australasian carnivorous marsupials live in habitats where it can become very hot or very cold. Different species have different ways of protecting themselves from these extreme temperatures. Some species such as the numbat dig burrows underground that they line with dead leaves and other plant parts for insulation. Other species are able to reduce their body temperatures on purpose. This is called torpor, and it reduces the amount of energy an animal needs to live when it gets too cold or is exposed to other environmental stresses, such as too little food.

DIET

Australasian carnivorous marsupials eat meat and insects. What each species eats depends on its size, habitat, and what kind of adaptations it has for hunting. Smaller species usually

eat insects, and larger species eat other animals, although they sometimes eat insects as well. Many of the larger Australasian carnivorous marsupials can chew and eat whole animals, including the bones and the skin. The numbat lives in the forest and eats termites that it digs out from underground with its sharp claws or finds under the dead branches it pushes away with its pointed snout. The Tasmanian devil eats many different kinds of meat, and has been reported to eat animals as large as wallabies.

BEHAVIOR AND REPRODUCTION

Most Australasian carnivorous marsupials are nocturnal, meaning that they are only active at night. Some species, however, have shown occasional periods of daytime activity, and a few species such as the numbat are usually active only during the day.

Australasian carnivorous marsupials spend most of their time in the search for food. Each species has different ways of finding prey, from digging for termites, to climbing trees and raiding the nests of possums during the night, to feeding on the bodies of animals that are already dead.

Most Australasian carnivorous marsupials have relatively short life spans. Females usually mate with more than one male, and in many species, offspring born in the same litter have different fathers. Some species in this order only mate once during their lifetime. They usually die soon after reproducing, having used all their energy in a sudden burst of activity required to mate successfully. Antechinus (ant-uh-KINE-us), which are broad-footed marsupial mice, mate in this way. The female lives long enough to raise her young until they can live on their own, but the male often dies before his offspring are mature.

Australasian carnivorous marsupials, like all marsupials, have very short pregnancies, some lasting only days. They give birth to immature young that are usually blind and hairless, and always are unable to survive on their own. In most cases, the young make their way into the mother's pouch, which contains milk teats, and are carried with her wherever she goes. Some species have young that crawl to external teats, or nipples, of the mother. They cling there and are carried wherever the mother goes, protected only by the hairs on her underbelly. Many do not survive to maturity.

The amount of time the young spend growing outside of the mother's womb, or uterus, depends on the species. It can be as

WHAT'S IN A NAME?

When European settlers first came to Australia, they discovered many animals that they did not have back home. When naming the new animals, they chose names based on their experiences with how these new animals looked and sounded. One new animal had large, sharp, white teeth, and ears that turned red when it got angry. It also made horrible screeching noises in the night. The new settlers named this animal the Tasmanian devil.

short as a few weeks or as long as many months. In most species, once the young have grown enough to fend for themselves, they spend a short amount of time in the mother's nest or den, wandering further each day to find food, until at last they leave the nest for good.

AUSTRALASIAN CARNIVOROUS MARSUPIALS AND PEOPLE

Farmers consider many Australasian carnivorous marsupials pests because they prey on livestock such as sheep and chickens. Some animals have been collected for zoos, but none of the animals in this order have been significantly hunted for their fur. In times past, some may have been hunted for food by aboriginal peoples.

CONSERVATION STATUS

Many Australasian carnivorous marsupials have not been studied by scientists. There are no good estimates of how many are left in the wild and how things such as deforestation (clearing the land of trees) are affecting them. One family in this order, Tasmanian wolves, has already gone extinct. The last time a Tasmanian wolf was confirmed to exist in the wild was in 1930. The last remaining animal was in captivity in a zoo and died shortly thereafter in 1936.

Many Australasian carnivorous marsupials such as the southern dibbler and the sandhill dunnart are considered to be Endangered, or facing a very high risk of becoming extinct in the wild. Many others are considered Vulnerable, which means they face a high risk of extinction in the wild.

There are many reasons that Australasian carnivorous marsupials are facing the threat of extinction. The cutting down of forest areas to clear land for agriculture affects many species, as does the changing pattern of fires set to clear grassland areas. Many species are Vulnerable or Endangered in Australia and surrounding areas because of the introduction of the red fox, which is not native to the region. In areas where the red fox is found, populations of Australasian carnivorous mammals have substantially decreased.

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MARSUPIAL MICE AND CATS, TASMANIAN DEVIL

Dasyuridae

Class: Mammalia
Order: Dasyuormorphia
Family: Dasyuridae
Number of species: 69 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Members of the family Dasyuridae include marsupial mice and cats and the Tasmanian devil. Marsupials are animals that do not have a very well developed placenta. A placenta is an organ that grows in the mother's uterus (womb) that allows the developing offspring to share the mother's food and oxygen. Because of this, pregnancy in marsupials is short and the young are born undeveloped and unable to fend for themselves. After birth, the young move to the mother's pouch and attach to her milk teats (nipples) until they have finished developing enough to live on their own.

None of the members of the family Dasyuridae are very large. This order includes some of the world's smallest marsupials, members of the genus (JEE-nus) *Planigale*, some of which are less than 4 inches (10 centimeters) long and weigh less than 0.2 ounces (5 grams). Other members of this family vary in size up to the Tasmanian devil, which is the largest species. The Tasmanian devil can be up to 25 inches (62 centimeters) long and weigh up to 29 pounds (13 kilograms).

Marsupial mice and cats, as well as the Tasmanian devil, have four legs. They have four toes on each of their two front feet and either four or five toes on their two back feet. When they have five toes on their back feet, the fifth toe is a hallux (HAL-lux). A hallux is a toe that does not have a claw. The species in this family usually have pointed snouts and long tails.

The fur of animals in this family is mostly gray or brownish, and sometimes is black. Fur color often depends on the habitat in which the species lives, and the kind of fur that best camouflages

them helps them avoid predators, animals that hunt them for food. Some of the species have other markings. The northern quoll has white spots on its otherwise brown body. The teeth of members of this family vary depending on the preferred diet, but most have some sharp teeth for slicing and biting and other wider, flatter teeth for grinding. This combination of teeth is helpful for catching and eating other animals and insects.

GEOGRAPHIC RANGE

Members of Dasyuridae live in Australia, New Guinea, and Tasmania, and can also be found on some small islands in that area of the Pacific.

HABITAT

Members of the family Dasyuridae live all over Australia, Tasmania, and New Guinea, and occupy all types of habitats. Some species live in trees, but most species are ground dwelling; some species prefer open grassland, and others prefer forests. Animals that have different habitats have different ways of finding or making dens and different ways of finding food.

DIET

What the members of this family eat depends on their size. The species that have smaller bodies, such as the marsupial mice, usually eat insects and sometimes catch and eat small animals such as lizards. These smaller animals will eat large animals only if they are already dead, in which case they will feed from the carcass. Larger species in this family eat mainly other vertebrates, or animals that have backbones, such as wallabies and birds. Species that eat mainly vertebrates will occasionally eat some insects and other invertebrates, animals without backbones, as well. Some species will even supplement their diet with food that does not come from other animals, such as flowers and fruit. All species in this family are scavengers when they get the chance. They will eat animals that are already dead, if they are available. Members of this family are usually nocturnal and hunt and are active mainly at night.



TAZ

Tasmanian devils have a reputation around the world for being vicious destroyers of property thanks to a Warner Brothers cartoon character named Taz. Taz, a Tasmanian devil, spins like a tornado destroying everything in his path. He stands on his hind legs and has teeth that can crush through anything. Although Tasmanian devils do have sharp teeth and very strong jaw muscles, they do not stand on their back legs alone. Tasmanian devils can be vicious when they feel threatened, but do not spin and certainly cannot destroy entire forests!

BEHAVIOR AND REPRODUCTION

Like all marsupials, species in this family give birth to young that are often blind and hairless, and are not able to survive on their own. This means that pregnancy for these species is usually very short. When the young are born, they either move into the mother's pouch or to her underbelly where they attach themselves to her teats. When attached in this way, the developing young travel with their mother for weeks or months as they continue to grow and develop. Once the young are able to survive on their own, they are weaned from their mother and detach from her nipples. After this, there is usually a period during which the young stay close to home and hunt away from their mother for increasingly long periods before going off on their own. The males of these species usually travel farther from the mother's nest to find territories of their own than the females do.

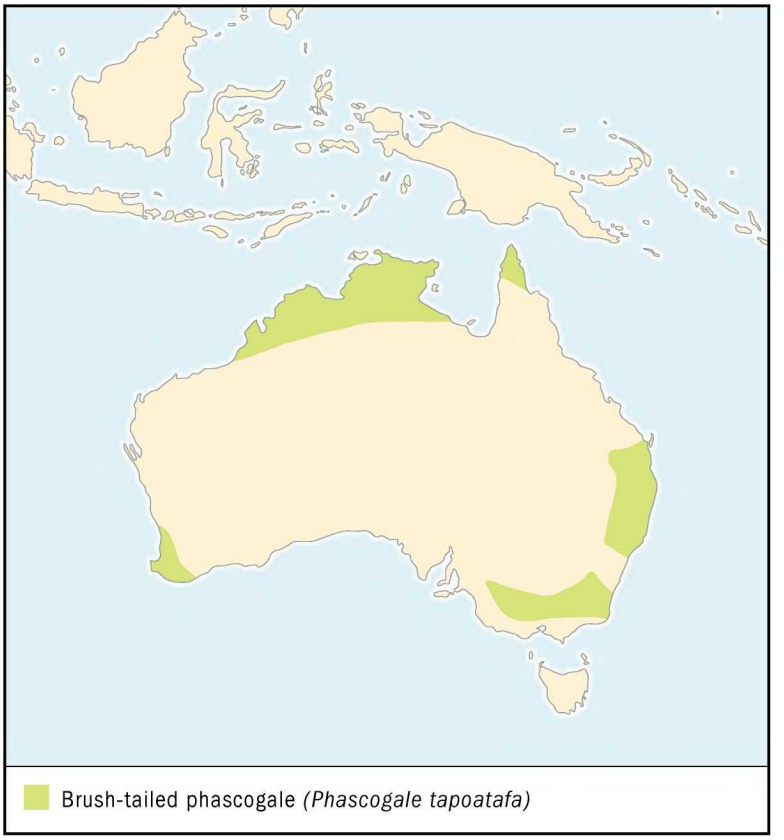
Some species in this family mate only one time before they die. The males of these species often die soon after mating, although the females live long enough to raise their young and sometimes to have a second litter. Scientists think that the reason that males of some species only mate once and then die is because it takes so much energy for the males to mate, especially in years when there is not much food available. Scientists think that these animals use up so much energy mating that they no longer have enough energy to stay healthy.

MARSUPIAL MICE, CATS, TASMANIAN DEVIL, AND PEOPLE

Members of this family usually do not have much direct interaction with people. Some species, however, have been thought to kill livestock and because of this have been hunted by farmers.

CONSERVATION STATUS

No species in this family are known to be extinct, but many, such as the Kangaroo Island dunnart, are Endangered. Animals that are considered Endangered face a very high risk of becoming extinct in the wild. Many other members of this family are Vulnerable, facing a high risk of extinction in the wild. There are some species in this family that scientists do not yet have enough information about to know if they are endangered or not.



BRUSH-TAILED PHASCOGALE
Phascogale tapoatafa

Physical characteristics: The brush-tailed phascogale has gray colored fur on its back and white or creamy fur on the underside of its body. Its brush tail is black with long, 2-inch (5.5-centimeter) hairs. Its body is 5.8 to 10.3 inches (14.8 to 26.1 centimeters).

Geographic range: Brush-tailed phascogales live in coastal areas of Australia.

Habitat: These animals live in dry eucalyptus forests and woodlands with an open understory—not a lot of smaller plants growing under the tallest trees—in temperate and tropical areas of Australia.



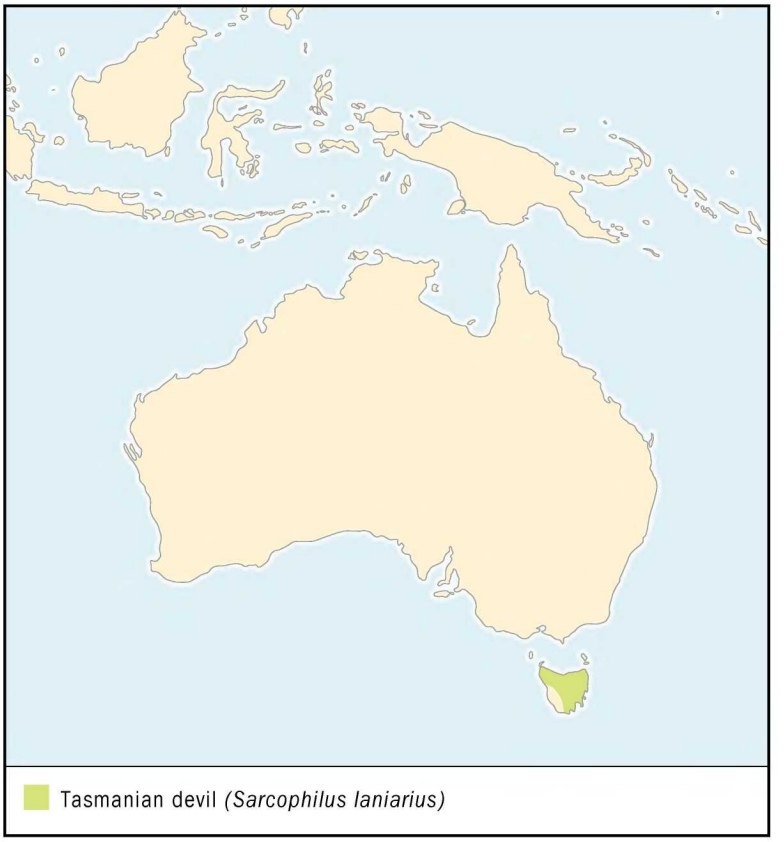
Brush-tailed phascogales prefer Australia's eucalyptus forests for foraging and nesting sites. (Michael Morcombe/Bruce Coleman Inc. Reproduced by permission.)

Diet: Brush-tailed phascogales feed on nectar (sweet liquid produced by plant flowers), large insects, spiders, and small vertebrates, animals with a backbone. They tear the bark off of trees to look for food.

Behavior and reproduction: This animal spends much of its time up in trees, and is nocturnal, or active at night. Brush-tailed phascogales make their nests in tree holes or forks, and also mate there. Females give birth to about eight young, who are attached to her nipples, feeding, for about forty days. After that, they stay in the nest until they're five months old.

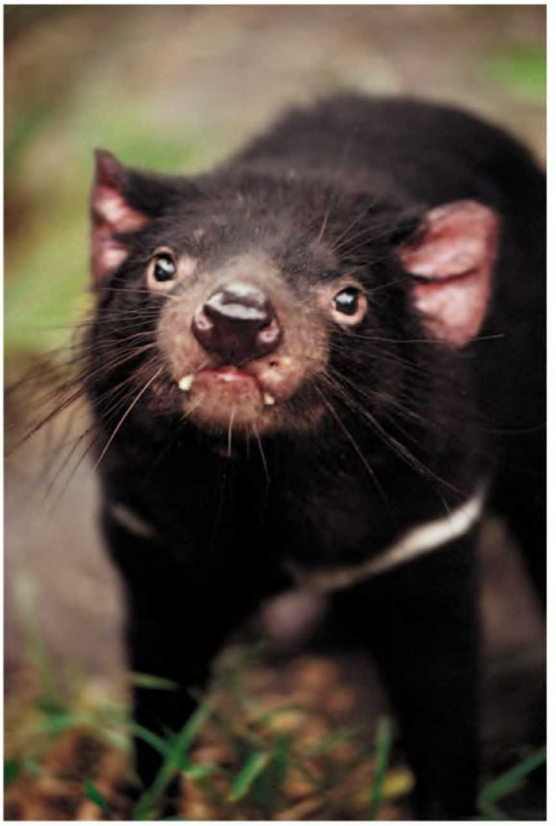
Brush-tailed phascogales and people: These animals occasionally eat poultry raised by humans, but they also eat mice and insects, which humans may appreciate.

Conservation status: The brush-tailed phascogale is not currently threatened. ■



TASMANIAN DEVIL
Sarcophilus laniarius

Physical characteristics: The Tasmanian devil is a four-footed marsupial with four toes on its two front feet as well as four on its back feet. It does not have a hallux. It has black fur with some white markings, usually on the chest, shoulder, and rump. The Tasmanian devil has a pointed snout that is pinkish at the tip. Its sharp, pointed teeth are good for cutting and tearing meat. It also has flat grinding teeth for crushing the bones of the animals it eats. The ears of the Tasmanian devil are short and pointed and turn red when the animal is angry. Males of this species usually have a head and body length between 20 and 25 inches (50 to 62 centimeters) and weigh between 17 and 29 pounds (8 to 13 kilograms). Females usually have a head



The Tasmanian devil's sharp, pointed teeth are good for cutting and tearing meat. Its flat grinding teeth can crush the bones of the animals it eats. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

and body length between 21 and 22.5 inches (53 to 57 centimeters) and weigh between 10 and 20 pounds (4.5 to 9 kilograms).

Geographic range: Tasmanian devils live on Tasmania, a large island off the southeastern Australian coast.

Habitat: The Tasmanian devil lives in the forest. It makes dens using leaves and plant material, although it sometimes sleeps in hollow logs or in the dens of other animals.

Diet: The Tasmanian devil mainly eats the meat of vertebrate animals. It will even eat poisonous snakes, and also occasionally invertebrates or plants. It is mainly a scavenger, and likes to eat animals that have already been killed by other causes. A scientist who studied the Tasmanian devil found that its favorite foods were wallabies, wombats, sheep, and rabbits. Most of these animals were not hunted by the Tasmanian devil itself, but eaten after other animals, cars, or natural causes killed them. The Tasmanian devil makes use of all the parts of animals that it kills or finds, eating even the bones and fur.

Behavior and reproduction: The Tasmanian devil is nocturnal, meaning that it hunts and is active mainly at night. When Tasmanian devils feel threatened or are fighting, they can be very loud. They begin by growling softly, but become increasingly louder and can even make horrible screeching noises. Most mating occurs in February or March. Females are pregnant for about one month and then give birth to young that move into the mother's pouch and attach to her nipples. Female Tasmanian devils have four nipples, which means that four is the most young that can be supported while they develop. Tasmanian devils normally have two or four babies at a time.

Tasmanian devils and people: Most contact between humans and the Tasmanian devil has occurred because the Tasmanian devil may eat animals that farmers keep as livestock. The Tasmanian devil will eat chickens if the coops are not well protected, and also sheep and lambs. Farmers sometimes kill Tasmanian devils to keep them away from their livestock.

Conservation status: The Tasmanian devil used to live all over Australia, but now lives only in Tasmania. Scientists believe that this species disappeared from the Australian mainland because it had to compete with the dingo, a wild dog that is introduced, not a native species. There is no information on how many Tasmanian devils are left in the wild in Tasmania, but it is likely that they are being affected by the clearing of land for agriculture. ■

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NUMBAT

Myrmecobiidae

Class: Mammalia

Order: Dasyuromorphia

Family: Myrmecobiidae

One species: Numbat (*Myrmecobius fasciatus*)

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Numbats, sometimes called banded anteaters, are small marsupial mammals that live in the southwestern region of Western Australia. Considered to be one of the most beautiful and distinctively marked marsupials, numbats are the only species of the Myrmecobiidae family.

Numbats are small, four-legged animals that are a little larger than rats. Weighing about 1 pound (0.45 kilograms), they range in total length from 12 to 19 inches (30 to 47 centimeters). Their tails can be 5 to 8 inches (13 to 20 centimeters) long. Their front feet have five toes and their back feet have four toes. All of the toes have strong claws to help them dig quickly for termites, their preferred food. They also have an extraordinarily long tongue that they use to gather the termites from underground and from holes in rotting trees. Unlike other marsupials, the female numbat does not have a pouch to carry her young, but she does have four nipples on her underside. The young cling to the nipples on her belly while they develop.

The numbat has coarse, short fur that varies in color from grayish brown to reddish brown. The numbat is distinctively marked with a series of five to seven white stripes that run across its rump and lower back. A black band bordered by two white bands runs on each side of the head from the snout through the eye and to the base of the ear. Their underside has paler fur and the fur on their tail is long.

GEOGRAPHIC RANGE

In the late eighteenth and early nineteenth century, when Europeans began to settle in Australia, numbats occupied a much larger area than they do today. At that time, numbats lived in the southern half of central and western Australia. They lived as far east as New South Wales and as far north as the Northern Territory. Today, numbats inhabit nine wild and two free-range areas across the southern region of Western Australia.

HABITAT

Numbats once lived in a variety of habitats from open forests to grasslands. Today they prefer areas with plenty of ground-level cover in order to protect them from the weather and predators such as hawks and red foxes. Numbats also use hollow logs and thickets to protect themselves from predators, animals that hunt them for food.

DIET

Numbats mainly eat termites—their pointed snouts allow them to sniff out the insects underground. They then use their sharp claws to dig small holes and retrieve the termites from underground tunnels using their long, slender tongues. The numbat's tongue can extend as much as 4 inches (10 centimeters) from its mouth. Saliva on the tongue makes the termites stick to it, so that the numbat can quickly pull its tongue back into its mouth with the termites attached. The numbat's salivary glands are large to provide enough saliva for this kind of eating. Another way that numbats find termites is by turning over fallen branches and sticks using their snout and front paws. A numbat that was studied in captivity ate between 10,000 and 20,000 termites per day. In the course of eating termites, ants and other insects sometimes also are consumed. Numbats do not chew their food, even though they have more teeth (between forty-eight and fifty-two of them) than any other marsupial.

BEHAVIOR AND REPRODUCTION

The numbat is a solitary animal and is the only Australian mammal that is active only during the day (diurnal). During

THE DANGER OF INTRODUCING A FOREIGN SPECIES

Whenever an new animal is introduced into an environment, there can be unexpected consequences. The red fox was introduced when Europeans arrived in Australia. For numbats and several other Australian species, the introduction of this animal was disastrous. Numbats had not evolved ways to protect themselves against this new, non-native predator. As a result, foxes killed thousands of numbats and numbat populations substantially decreased. Only by starting programs to lessen the number of red foxes could the numbats be saved.

most of the year, numbats are active from mid-morning until late afternoon, when the temperatures are warmest. However, during the hottest part of the year they avoid activity around noon and prefer to forage in the early morning and late afternoon.

When numbats reproduce, they do not form pairs, so the female is left to raise her young alone. After only a fourteen-day pregnancy, the female gives birth to an average of four young, which she continues to carry without a pouch. Marsupial mammals like the numbat do not form a placenta when their young are in their mother's womb. Instead, they are born underdeveloped and spend time developing outside attached to their mother's milk teats. Unlike other marsupials, the numbat does not have a pouch. When the young are born, they are hairless and their eyes are still sealed shut. They crawl toward their mother's nipples, which are on her belly, and attach themselves there. They remain on the mother's belly and are carried with her for six to seven months while they grow hair and continue to develop. The young then spend several more months in the



mother's nest. While in the nest, their eyes open and they begin to explore. By early the following year, numbat young venture out on their own.

NUMBATS AND PEOPLE

The numbat was known to central Australian aboriginal (native) people as "walpurti." At one time they were hunted for food. Aboriginal people would track individual numbats to their burrows and then dig them up. Today they have no known economic value, although scientists and ecotourists are interested in observing them. As many as two hundred numbats have been collected as museum specimens.

CONSERVATION STATUS

Numbats are a conservation success story. By 1985, so many numbats had disappeared that only two numbat populations remained. At that time they were considered Endangered and

likely to become extinct. An effort to increase numbat populations was undertaken that involved the poison baiting of red foxes, a major predator of the numbat. Numbat populations were also moved into other habitats, and numbats that had been raised in captivity were introduced into the wild. These programs have been successful, because there are now nine wild numbat populations and two that live on fenced reserves. In 1994, numbats were upgraded from Endangered to a conservation status of Vulnerable. Although they are still at risk, they are unlikely to become extinct in the immediate future.

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family CHAPTER

TASMANIAN WOLF
Thylacinidae

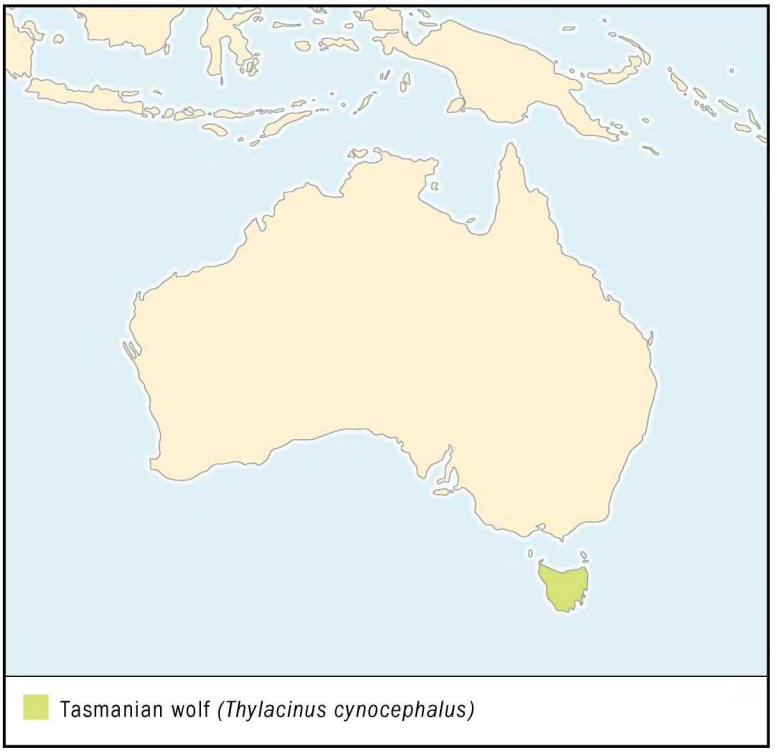
Class: Mammalia
Order: Dasyuromorphia
Family: Thylacinidae
One species: Tasmanian wolf (*Thylacinidae cynocephalus*)

PHYSICAL CHARACTERISTICS

Although Tasmanian wolves, sometimes called Tasmanian tigers, are extinct, or no longer living today, scientists have learned much about them from fossils and earlier written records. These wolves looked like dogs, and they walked on all four legs, although their legs were shorter than most dogs. They had a long narrow snout, ears that stood up, and a straight tail. Tasmanian wolves had short sandy-brown hair with a distinctive set of stripes that ran across their back. The stripes were dark brown and ran from the shoulders to the base of the tail.

Female Tasmanian wolves were smaller than males, with some males growing to twice the weight of females. While females may have averaged 33 pounds (15 kilograms), males could grow to be more than 60 pounds (27 kilograms). Tasmanian wolves had sharp teeth with four incisors in the top of their mouth and three in the bottom. This allowed them to tear their preferred food, meat.

Like all native Australian and Tasmanian mammals, Tasmanian wolves were marsupials. They lacked a placenta, an organ that grows in the mother's uterus and lets the mother and developing baby share food and oxygen. Because of this, they gave birth to young that were physically immature and unable to survive on their own. After a short pregnancy, the young were carried for several months in a pouch that opened under the mother's tail and faced backward. The young attached to milk teats, or nipples, in the pouch and fed until they grew large enough to survive on their own.



GEOGRAPHIC RANGE

When Tasmanian wolves were still alive, they were thought to have lived on the entire island of Tasmania. By the 1800s, Tasmanian wolves were rare in the southwest and western regions of the island, except in coastal areas. Scientists have learned this by reading the diaries of early settlers and examining the bounty payment records of people who lived during that time. Early settlers in Tasmania thought of Tasmanian wolves as pests to be eliminated, and bounty money was paid to hunters who killed them.

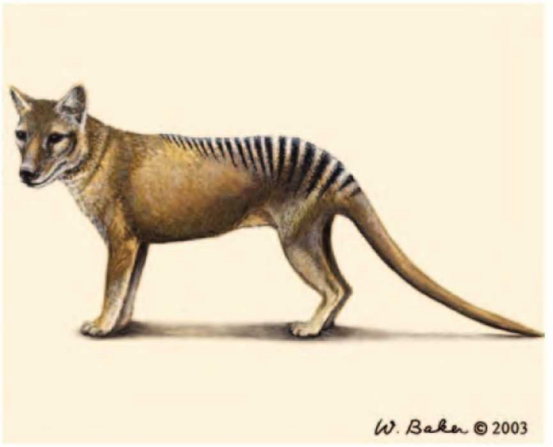
HABITAT

Tasmanian wolves lived in a great variety of habitats, although most often they were found in open areas. These included grassy woodlands, open forests, and coastal regions. They avoided dense forests and wetlands and liked to live in areas that Tasmanian devils, another animal in this order, live in today. The Tasmanian wolves hid in rock outcroppings and dense vegetation during the day and probably built dens there, but they would hunt at night in open grasslands.

DIET

Since Tasmanian wolves are no longer living today, no one knows for sure what they ate. When they were alive, people were more interested in classifying them and studying how they were related to other animals than in learning about how they lived or what they ate. Scientists can make some guesses about their diet, however, by comparing Tasmanian wolves to animals that live today.

Tasmanian wolves were carnivores, or meat eaters. It is believed that they ate many different kinds of animals including birds, small mammals, and even some larger mammals such as wombats, bandicoots, possums, and kangaroos, although it is likely that these larger animals were eaten less often. By looking at the size of their leg bones, scientists believe that Tasmanian wolves did not run very fast, and captured their prey by sneaking up on it or ambushing it rather than running it down.



Most of what is known about Tasmanian wolves comes from what people wrote about them before they became extinct in the 1930s. Scientists can study related animals to try to figure out what they might have eaten and how they lived. (Illustration by Wendy Baker. Reproduced by permission.)

BEHAVIOR AND REPRODUCTION

Not much is known about the behavior and reproduction of Tasmanian wolves. These animals were bred in captivity only once, although females with live young in their pouches were caught and kept in zoos. Scientists think that reproduction was timed so that young Tasmanian wolves left their mothers during the warmer months, as this was when food was more available, giving the young a better chance of survival. They believe that pregnancy lasted only one month. The poorly developed young then moved into the mother's pouch where they nursed until they were developed enough to survive on their own and eat solid food. Beyond this, little is known about their reproductive systems, how long the young would stay in their mother's pouch, or even how many young were in an average litter.

TASMANIAN WOLVES AND PEOPLE

People have had unfriendly relationships with Tasmanian wolves. Native peoples on the island of Tasmania and in Australia killed and ate Tasmanian wolves for food. It is thought that although many groups did use the Tasmanian wolves for food, some would build special shelters to worship the head and skin of the animal afterwards.

FARMING AND WILD ANIMALS

When people begin to farm in areas that were once wild, they often interact with new animals. Farmers who raise sheep, cattle, or other livestock find that wild animals will feed on their flocks. This was probably true of the Tasmanian wolves, although most scientists believe that wild dogs were responsible for killing more sheep and cattle than Tasmanian wolves. Even so, farmers hunted Tasmanian wolves and hired bounty hunters to help them. This drove the Tasmanian wolves to extinction, despite the fact that they may not have been responsible for all the farmers' losses.

Once European settlers and farmers came to the region, hunting of the wolves increased dramatically. Sheep farmers were losing sheep and assumed that the Tasmanian wolves were responsible. It is likely that the wolves did kill some sheep, but wild dogs probably killed more sheep that the wolves. Even so, farmers and bounty hunters continued to hunt the Tasmanian wolves. By the early 1900s, most were gone, and by 1912 bounty hunting of Tasmanian wolves was halted. This was not early enough to save them from extinction. The last time a Tasmanian wolf was confirmed to exist in the wild was in 1930. Despite the official protection that began on July 14, 1936, the last Tasmanian wolf died that September.

CONSERVATION STATUS

Tasmanian wolves are extinct. They were killed off mostly by farmers and bounty hunters during the 1800s. Tasmanian wolves were thought of as pests and killers of livestock, much the way the coyote was thought of during the settlement of the American West.

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BANDICOOTS AND BILBIES
Peramelemorphia

Class: Mammalia
Order: Peramelemorphia
Number of families: 2 families

order
CHAPTER

phylum
class
subclass
● **order**
monotypic order
suborder
family

PHYSICAL CHARACTERISTICS

Peramelemorphia is an order of small ground-dwelling marsupials known as bandicoots and bilbies. All species in this order live either in Australia, New Guinea, or a few nearby Indonesian islands. Although some of the species in this order have been classified differently in the past, current genetic evidence has led scientists to divide this order into two families, the Peramelidae and the Peroryctidae. The Peramelidae include the true bandicoots of Australia and the bilbies. The Peroryctidae are made up of the spiny bandicoots of the New Guinea rainforest.

Bandicoots and bilbies look like a cross between a rabbit and a rat. They range in size from 6.5 to 23 inches (17 to 60 centimeters), excluding tail length, and weigh from 0.3 to 10.5 pounds (0.1 to 4.8 kilograms). Their tails are usually short in proportion to their bodies.

Bandicoots and bilbies have small pointed snouts and ears that are usually short and rounded. One exception is the greater bilby which has long rabbit-like ears. Most species have thin, rat-like tails, and their fur is usually solid earth tone colors. The fur of the rainforest bandicoots is harsh and spiny.

The front legs of most species in this order are adapted for digging. The front feet have strong claws on toes two, three, and four. Toes one and five are either absent or very small and clawless. The hind limbs are strong and muscular, allowing these animals to leap and hop like a rabbit. However, they are also able to run at a fast gallop. On the hind legs, the bones of the second and third toe are fused, joined into one, but still

have separate claws. This pattern of fused toes suggests that these animals may have evolved from the Diprotodonta family.

Bandicoots and bilbies are omnivores, meaning they eat both plants and animals. Members of this order have teeth that are adapted to this diet. Their tooth pattern suggests that they may have evolved from the Dasyuromorphia order (Australasian carnivorous marsupials). Because of the conflicting physical evidence, scientists remain unsure exactly which other marsupial families are their closest relatives.

GEOGRAPHIC RANGE

Species in this order are found only in limited parts of Australia, New Guinea, and the Indonesian island of Seram. In the past, these animals were abundant. They were found in about 70 percent of Australia, throughout New Guinea, and on several other Indonesian islands. Since the beginning of the twentieth century, their range has been drastically reduced by human activities.

HABITAT

The two families in this order live in different habitats. Peramelidae, or true bandicoots and bilbies, live in dry, desert areas, dry grassland, shrubby grassland, open forest, and suburban gardens. Peroryctidae, or spiny bandicoots, live in the tropical rainforests of New Guinea. Several species live in isolated areas at elevations up to 13,000 feet (4,000 meters).

DIET

Bandicoots and bilbies are omnivores, eating both plants and animals, and insects such as ants and termites usually make up most of their diet. They also eat earthworms, insect larvae, insects such as centipedes, and plant parts, such as seeds, bulbs, and fallen fruit. Occasionally larger species eat lizards and mice. They are opportunistic feeders, tending to eat whatever food is available.

Bandicoots and bilbies find food by smell and hearing. Their eyesight is poor. When they locate food underground, they dig cone-shaped holes up to 5 inches (13 centimeters) deep and remove the food with their long tongues. Because so much of their food is dug out of the ground, they also accidentally eat a lot of dirt. Studies have found that between 20 and 90 percent of their waste is earth that was swallowed with the food,

then passed through their digestive system. Some species that live in desert areas do not need to drink water. They can get all the moisture they need from their food.

BEHAVIOR AND REPRODUCTION

Most species in this order are nocturnal, active only at night. The exception is the southern brown bandicoot, which is active mainly during the day. All members of this order live alone, coming together only for a short time to mate. Females will mate with more than one male. Many species mate year round. Both males and females are territorial. Males have larger territories than females. Some species mark their territory with scent from a special gland. Males become aggressive when another male enters their territory. Males kept together in captivity will fight.

Most familiar mammals such as dogs, rabbits, and horses, are called eutherian (yoo-THEER-ee-an) mammals. These mammals have a placenta, an organ that grows into the mother's uterus (womb) and lets the mother and developing offspring share food and oxygen until the organs of the developing young mature. Marsupial mammals do not have this type of developed placenta. Most marsupials have what is called a yolk-sac placenta, where there is no sharing of the mother's food and oxygen.

Bandicoots and bilbies are different from other marsupials, because they have a second placenta in addition to the yolk-sac placenta. This placenta resembles the placenta in eutherian mammals, but does not function as well, because it does not attach as closely to the wall of the mother's uterus. As a result, members of the order Peramelemorphia have very short pregnancies, and, like other marsupials, the young are physically immature and undeveloped when they are born. At birth they crawl to their mother's backward-opening pouch where they attach to the mother's teats, or nipples. They are carried inside the pouch until they are mature enough to survive independently.

BANDICOOTS, BILBIES, AND PEOPLE

Aboriginal (native) people hunted bandicoots and bilbies for meat and fur, however these animals were abundant, and hunting did not cause a major decrease in their populations. The coming of European colonists to Australia and New Guinea began the decline of many species of bandicoots and bilbies. Europeans changed the ecology of Australia. They introduced non-native species such as the red fox and the domestic cat,

both of which prey on bandicoots and bilbies. They also introduced rabbits that compete with them for food. In addition, Europeans introduced cattle and sheep ranching to Australia. This reduced the habitat suitable for many species of bandicoots and bilbies. Finally, native people regularly burned the grassland, and the plants that grew after the burn provide a good habitat for bandicoots and bilbies. This practice changed after large scale livestock ranching began, creating less diverse habitats that did not support these native species well.



YOU DIRTY BANDICOOT

Bandicoots reminded European settlers in Australia of rats. They had a very low opinion of the animal. Today in Australia the word "bandicoot" when applied to a person is considered a mild term of abuse and disrespect.

The number of bandicoots and bilbies has decreased dramatically since the beginning of the twentieth century. Three species have gone extinct. Conservation organizations are tying to provide safe habitat for these animals by fencing preserves and controlling predators, animals that hunt them for food. However, people living in suburban areas still tend to think of bandicoots and bilbies as pests, because they dig up lawns and gardens when hunting for food.

CONSERVATION STATUS

Since the coming of European colonists in 1770, three species have gone extinct: the pig-footed bandicoot, the desert bandicoot, and the lesser bilby. The number of animals in four other species has dropped to dangerously low levels and they are considered Endangered, facing a very high risk of extinction in the wild, or Vulnerable, facing a high risk of extinction in the wild. So little is known about most of the species in the Peroryctidae family that their conservation status cannot be accurately evaluated.

Since the 1980s captive breeding and conservation programs have succeeded in increasing the number of bilbies. The Australian Bilby Appreciation Society has developed public relations programs to increase awareness of the need to protect these animals. They have also raised money for a fenced preserve, because bilbies cannot thrive in the wild without predator control. Other species have been the focus of less conservation awareness and continue to decline.

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family CHAPTER

BANDICOOTS AND BILBIES
Peramelidae

Class: Mammalia
Order: Peramelemorphia
Family: Peramelidae
Number of species: 10 species

PHYSICAL CHARACTERISTICS

Peramelidae are Australian bandicoots and bilbies. This family is sometimes referred to as the true bandicoots to distinguish it from the Peroryctidae, or rainforest bandicoots of New Guinea. True bandicoots are small marsupials with long, pointed snouts. They range in size from 6.5 inches (17 centimeters) and 5 ounces (140 grams), or about the size of a mouse, to 23 inches (60 centimeters) and 10.5 pounds (4.8 kilograms), or about the size of a cat.

Bandicoots live and feed on the ground. They have claws to dig for food, and in the case of bilbies, digging burrows. Their front feet have five toes. The middle three toes have strong claws. Toes one and five are either small or absent. On the hind feet, the bones of the second and third toes are joined, but each toe has a separate claw. Bandicoots look something like a cross between a rat and a rabbit. Their hind legs are longer than their front legs and are strong and well developed for hopping and leaping. They are also able to gallop.

Most bandicoots have short rounded ears and a thin, short tail. However, the extinct pig-footed bandicoot had both long ears and a long tail, and the bilby's ears are very large. All bandicoots have good hearing and a good sense of smell, but poor eyesight. They are nocturnal, or active at night, when their sense of smell and hearing are important in helping them locate food.

True bandicoots live mainly in dry areas. Their fur ranges from dark brown to gray and they are normally darker on their back than on their belly, allowing them to blend into the deserts

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

and dry grasslands where they live. Most bandicoots are solid colored, although a few, such as the eastern barred bandicoot, are striped. The fur of true bandicoots is soft when compared to the harsh, spiky fur of the rainforest bandicoots.

GEOGRAPHIC RANGE

Before the arrival of European colonists in 1770, bandicoots and bilbies were found in about 70 percent of Australia and on several nearby islands. Today they are found in many fewer places in Australia and the island of Tasmania. The bilby, especially, can be found only in isolated pockets mainly on protected park land or in captive breeding areas.

HABITAT

Bandicoots and bilbies prefer dry areas. Before European colonization, up to five species could be found in the Australian inland deserts. Today only one species lives there. Other species live in dry grasslands and open forests. Three species have adapted to human activity and live in suburban neighborhoods and parks.

DIET

True bandicoots are omnivores. They eat both plants and animals. Included in their diet are ants, termites, insect larvae (LAR-vee), earthworms, spiders, centipedes, bulbs, seeds, and bird eggs. Larger species will occasionally eat lizards and mice. Although bandicoots eat a variety of food, each colony seems to prefer one or two particular foods, probably because these are more easily available. Bandicoots dig for food with their strong claws. They make holes up to 5 inches (13 centimeters) deep and scoop out the food with their long tongues. Some species that live in desert areas do not need to drink water. They can get all the moisture they need from their food.

BEHAVIOR AND REPRODUCTION

True bandicoots are nocturnal. The exception is the southern brown bandicoot, which is active mainly during the day. Bandicoots are solitary animals, living alone and coming together only to mate.

Bandicoots are territorial animals. The males defend larger territories than the females. They challenge any other male that comes into this area, and will fight if the intruder does not leave. Although females spend all night feeding, males spend

part of the night patrolling their territories and marking them with scent to scare off other males.

Female bandicoots can reproduce at about four months of age. A female may mate with several different males. Pregnancy is one of the shortest of all animals—from twelve days to a few weeks.

Like all marsupials, bandicoots do not have a well-developed placenta. A placenta is an organ that grows in the mother's uterus (YOO-ter-us; womb) that allows the developing offspring share the mother's food and oxygen. Most marsupials have what is called a yolk-sac placenta, where there is no sharing of the mother's food and oxygen. Bandicoots and bilbies are different from other marsupials, because they have a second placenta in addition to the yolk-sac placenta. This placenta resembles the placenta in eutherian (yoo-THEER-ee-an) mammals, such as dogs, rabbits, and humans, but does not function as well, because it does not attach as closely to the wall of the mother's uterus.

Young bandicoots, called joeys, are born hairless, blind, and poorly developed. They are about 0.4 inches (1 centimeter) long. They use their front legs to pull themselves into their mother's pouch. There they attach to her teats, or nipples, where they remain for at least several weeks until they are able to survive on their own. After that they may remain in the nest and be fed by the mother for another week or two before becoming completely independent. Rarely do bandicoots have more than four young in a litter, and one or two offspring are more common. The death rate of newborn bandicoots is high. Those that live to adulthood have a lifespan of two to three years. Predators of the bandicoot include red foxes, dingoes (wild dogs), and feral cats (domestic cats that have been turned loose and become wild). Rabbits are their main competitors for food.

BANDICOOTS, BILBIES, AND PEOPLE

Australian aboriginal (native) people considered the bandicoot one of the creators of life. According to their legends, Karora, a giant bandicoot, awoke from under the earth and gave birth to humans out of his armpit. Aborginal people also hunted bandicoots for food.

European colonists thought bandicoots looked like rats and tended to treat them as pests. Many were killed when colonists tried to rid Australia of rabbits that were introduced and soon overran the country, because they had no natural predators.

THE EASTER BILBY

Starting in the 1990s, the Foundation for Rabbit-Free Australia and the Save the Bilby Fund began a public relations campaign to replace the Easter rabbit with the Easter bilby. The fund teamed up with candy makers to make chocolate bilbies for children's Easter baskets. Part of the sales price of each candy bilby went to bilby conservation and restoration programs. By 2004, several hundred thousand dollars had been raised through candy bilby sales.

Legal protection of bandicoots did not occur until the middle of the twentieth century, after several species were already extinct. Today conservation groups are trying to save bandicoots and bilbies, but many suburban residents still consider them pests, because they dig up gardens when hunting for food. They also carry ticks, lice, and fleas.

CONSERVATION STATUS

Three species of bandicoot are extinct: the pig-footed bandicoot, the desert bandicoot, and the lesser bilby. All the extinct species lived in the dry inland area of Australia. The western barred bandicoot is considered Endangered, facing a very high risk of extinction. Four other species are considered Vulnerable, facing a high risk of extinction. Captive breeding projects have been started to save the greater bilby and the western barred bandicoot. These projects have had some success, but it is unlikely that populations of bandicoots in the wild will increase without control of their predators (animals that hunt them for food).



EASTERN BARRED BANDICOOT
Perameles gunnii

Physical characteristics: The eastern barred bandicoot, also called the barred bandicoot, the Tasmanian barred bandicoot, the striped bandicoot, or Gunn's bandicoot, measures 10.5 to 14 inches (27 to 35 centimeters) not including the tail and weighs 26.5 to 35 ounces (0.75 to 1 kilogram). It has grayish brown fur with pale bars on its hindquarters. It has large ears, a thin, pointed snout, and its tail is relatively short.

Geographic range: Eastern barred bandicoots are found in the Australian state of Victoria and on the island of Tasmania. At one time it was also found in the state of South Australia, but it is now extinct there.



Eastern barred bandicoots have the shortest pregnancy of any mammal—just twelve days. (Illustration by Gillian Harris. Reproduced by permission.)

Habitat: This species lives in grasslands, open grassy woodlands, and suburban yards and parks.

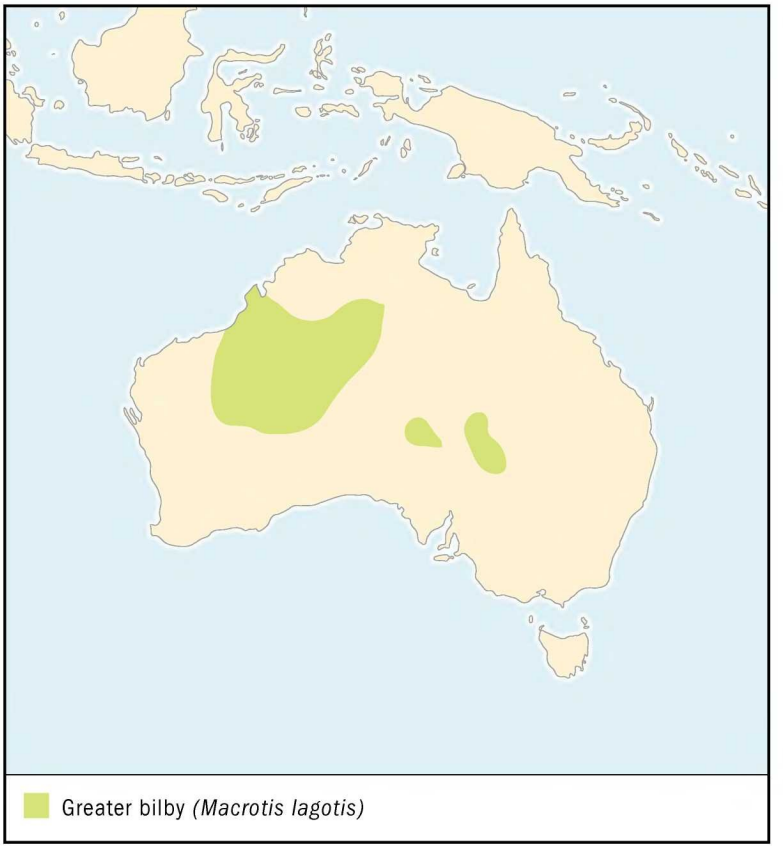
Diet: Eastern barred bandicoots eat mainly insects, insect larvae, earthworms, bulbs, seeds, and fallen fruit.

Behavior and reproduction: Eastern barred bandicoots have the shortest pregnancy of any mammal—around twelve days. The young, usually only two or three, are carried in the mother's pouch another fifty-five days and become completely independent about three weeks later. This species becomes fully mature and capable of reproducing at about four months of age and has a lifespan of two to three years.

Eastern barred bandicoots and people: Aboriginal peoples hunted the eastern barred bandicoot for food. Suburban residents find it a pest because it digs up lawns when hunting for food.

Conservation status: As of 2003, the eastern barred bandicoot was considered Vulnerable to extinction. At one point it was considered Critically Endangered. In 1991, only 109 animals were known to exist on mainland Australia.

Serious conservation efforts are underway in Victoria. These include habitat protection, predator control, community education, captive breeding, and reintroduction of captive-bred bandicoots to the wild. By 1993, the population had grown to over seven hundred animals. The main threats to this species are predators such as the red fox and cats, and being hit and killed by automobiles.



Greater bilby *(Macrotis lagotis)*

GREATER BILBY
Macrotis lagotis

Physical characteristics: The greater bilby, also called the rabbit-eared bandicoot, is a small bilby about the size of a rabbit. It measures 9 to 10 inches (23 to 26 centimeters). Males weigh from 2 to 5.5 pounds (1 to 2.5 kilograms). Females are smaller, weighing from 1.8 to 2.5 pounds (0.8 to 1.1 kilograms). Bilbies have soft, silky blue-gray fur on their back and white bellies. They have a long, thin snout and a long black tail with a white tip. The lesser bilby, a relative of the greater bilby, became extinct in 1931, so the greater bilby is usually referred to simply as the bilby.

Geographic range: Bilbies are found in the Northern Territory, Western Australia, and Queensland, but their populations are isolated from each other.

Habitat: Bilbies prefer hot, dry grassland, and will occasionally live in dry, shrubby, open woodlands.

Diet: Bilbies feed at night. They are omnivores, and like other bandicoots eat insects, insect larvae, earthworms, bulbs, and seeds.

Behavior and reproduction: Bilbies are the only bandicoots that dig burrows. They are excellent diggers, and these burrows can be up to 6 feet (2 meters) deep. They stay in the burrows during the day for protection against the heat.

Like all bandicoots, bilbies live alone, coming together only to mate. They mate throughout the year and give birth only fourteen days after mating. The young are then carried in the mother's pouch for eighty days. After they leave the pouch, they live in the burrow with their mother who feeds them for another two weeks.

Greater bilbies and people: Bilbies were very common until the beginning of the twentieth century and were an important source of food for native peoples. However, their numbers rapidly decreased with the introduction of non-native predators such as the red fox and the cat. Today, the bilby has become a symbol of Australia's efforts to save its native species.

Conservation status: As of 2003, the bilby was considered Vulnerable to extinction. Their numbers decreased because of non-native predators, competition for food by rabbits, and changes in habitat brought about by livestock ranching and farming. The bilby has been the focus of an intensive public awareness and recovery program. The Save the Bilby Appeal was begun in 1999 and has been quite successful. Sales of chocolate Easter bilbies have helped to finance captive breeding programs and reintroduction of bilbies to the wild. Most recently, the Save the Bilby Appeal has started a campaign to fence a large area where bilbies released into the wild will be protected from predators. ■

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SPINY BANDICOOTS
Peroryctidae

Class: Mammalia
Order: Peramelemorphia
Family: Peroryctidae
Number of species: 11 species

family
CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Peroryctidae are spiny bandicoots. They look like a cross between a rabbit and a rat. In many ways they are similar to the bandicoots in the Peramelidae family. Spiny bandicoots range in size from about 6.5 to 22 inches (17.5 to 56 centimeters), not including the tail. They vary in weight from 14 ounces to 10 pounds (0.4 to 4.7 kilograms). The giant bandicoot of southeastern New Guinea is the largest species. The mouse bandicoot is the smallest.

Spiny bandicoots have rough, spiky fur that is usually blackish or brown on the back and white or tan on the belly. Most species are a solid color, but the striped bandicoot has darker stripes on its rump and around its eyes. Like the true bandicoots, spiny bandicoots have claws that are adapted to digging for food. Their front feet have five toes. The middle three toes have strong claws. Toes one and five are either small or absent. On the hind feet, the bones of the second and third toes are joined, but each toe has a separate claw. The hind legs are longer than the front legs and are strong and well developed for hopping and leaping. They are also able to move with a running gait.

Spiny bandicoots differ from true bandicoots mainly in the shape of their skulls, the habitats they prefer, and the roughness of their fur. Recent studies show that they also are genetically different from true bandicoots.

GEOGRAPHIC RANGE

Spiny bandicoots live mainly on the island of New Guinea and a few small neighboring islands. One species is found in

Australia only on the northernmost tip of Queensland, the part of Australia closest to New Guinea.

HABITAT

Spiny bandicoots prefer damp, humid habitats. They live in tropical rainforests and mountain rainforests at elevations from zero to 14,800 feet (zero to 4,500 meters). Species living in the same area tend to live at different elevations.

DIET

Like all bandicoots, spiny bandicoots are omnivores, meaning they eat both animals and plants. Most of their diet consists of insects, insect larvae, earthworms, spiders, centipedes, bulbs, seeds, and fallen fruit. Spiny bandicoots appear to eat more vegetable material, especially fruit, than true bandicoots. This may be because fruit is more available in the damp habitats they prefer than in the dry habitats preferred by true bandicoots. They either lick their food off the ground or dig for it with their strong claws. They can dig holes up to 5 inches (13 centimeters) deep and scoop out the food with their long tongues.

BEHAVIOR AND REPRODUCTION

Spiny bandicoots are nocturnal, feeding during the night and resting during the day in nests of leaves, hollow logs, or shallow burrows. They live alone, coming together only briefly to mate. They are territorial animals, protecting an area against other members of their species and becoming aggressive if their area is invaded.

Little is known about spiny bandicoots. They are difficult to observe, because they live in remote or mountainous areas and are active only at night. Bandicoots are marsupial mammals. Most marsupials have what is called a yolk-sac placenta. A placenta is an organ that grows in the mother's uterus (womb). In eutherian (yoo-THEER-ee-an) mammals, such as dogs, cows, and humans, the placenta allows the developing offspring share the mother's food and oxygen. In animals with a yolk-sac placenta, there is no sharing of the mother's food and oxygen.



THE TINIEST BANDICOOT

The mouse bandicoot measures only 6 inches (15 centimeters) long. It is extremely difficult to observe, and was not discovered until 1932. It lives in moss forests at altitudes of 6,300 to 8,200 feet (1,900 to 2,500 meters), and is active only at night. By 1977 only four specimens of this species had been collected for study.

Bandicoots differ from other marsupials, because they have a second placenta in addition to the yolk-sac placenta. This placenta resembles the placenta of eutherian mammals, but does not function as well, because it does not attach as closely to the wall of the mother's uterus. As a result, spiny bandicoots have short pregnancies, and the young are born nearly helpless. They drag themselves into their mother's pouch where they attach to her teats, or nipples and are carried until they have matured. Spiny bandicoots normally have only one or two young at a time, but little is known about how long they are carried in their mother's pouch, when they become old enough to reproduce, or how long they live in the wild.

SPINY BANDICOOTS AND PEOPLE

In New Guinea, spiny bandicoots are hunted and are an important food source for native peoples. Otherwise, these animals are of interest mainly to scientists and conservationists.

CONSERVATION STATUS

Very little is known about the size of spiny bandicoot populations in the wild. In fact, so little is know about them that they are not given a conservation rating, although they probably are under pressure from human activities such as logging.



Rufous spiny bandicoot *(Echymipera rufescens)*

RUFOUS SPINY BANDICOOT
Echymipera rufescens

SPECIES ACCOUNT

Physical characteristics: Rufous spiny bandicoots have a total head and body length of about 12 to 16 inches (30 to 41 centimeters) and weigh between 1.1 and 4.4 pounds (0.5 to 2.0 kilograms). The short black tail is almost hairless. The fur on their back is coarse, spiky, and reddish brown. The fur on their belly is white. The rufous spiny bandicoot sometimes is called the long-nosed echymipera, the spiny bandicoot, or the rufescent bandicoot.

Geographic range: The rufous spiny bandicoot is the only member of the Peroryctidae family that lives in Australia. There it lives only



Rufous spiny bandicoots' favorite food is insects. They dig insects out of the ground with their claws and lap them up with long, thin tongues. (Illustration by Gillian Harris. Reproduced by permission.)

on the Cape York Peninsula of Queensland. This animal also lives in western and southeastern New Guinea and the neighboring islands of Kei and Aru.

Habitat: Rufous spiny bandicoots prefer lowland tropical rainforests below an elevation of 3,900 feet (1,200 meters). They occasionally are can be found in open costal woodlands or disturbed grasslands.

Diet: Rufous spiny bandicoots are omnivores, meaning they can eat both plants and animals, but their preferred food is insects. They feed on the ground, digging out insects with their claws and lapping them up with long, thin tongues.

Behavior and reproduction: This bandicoot lives and feeds on the ground and is strictly nocturnal. It digs shallow burrows to rest in during the day. Rufous spiny bandicoots live alone and appear to be territorial.

Very little is known about this animal's reproductive cycle. Some scientists believe that this species breeds year round in New Guinea and seasonally in Australia, but not enough animals have been studied to form firm conclusions. Litters usually consist of from one to three young that are carried in the mother's pouch until they mature.

Rufous spiny bandicoots and people: Native peoples of New Guinea hunt these bandicoots for food.

Conservation status: The rufous spiny bandicoot appears to be common to abundant within its very limited range, especially in Australia. However, the small number of places in which this species is found has become cause for concern among conservationists. ■

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MARSUPIAL MOLES
Notoryctemorphia

Class: Mammalia
Order: Notoryctemorphia
One family: Notoryctidae
Number of species: 2 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

Marsupial moles, also called blind sand burrowers, are unusual and rarely seen animals found in Australia. Marsupial moles are about 4 to 6 inches (10 to 15 centimeters) long and weigh only 1 to 2.5 ounces (40 to 70 grams). They have fine golden fur, and are shaped like flattened cylinders.

The body of the marsupial mole shows many adaptations that allow it to live almost its entire life underground. These moles have five toes on each foot. On the front feet, toes three and four are enlarged and have triangular, spade-like claws that are used for digging. The animals have no functional eyes. Only a dark spot marks where the remains of an eye can be found under the skin. In addition, marsupial moles have no external ears, although they do have ear openings under the fur, and it is believed that they can hear. Five of the animal's seven neck vertebrae, neck bones, are fused, or joined together, probably to strengthen the head so that it can push through sand.

A horny shield somewhat like a thick fingernail protects the nose. The nose openings or nostrils are small slits, probably to prevent them from filling with sand as the animal digs. Female marsupial moles also have a backward-opening pouch in which they carry their young. Again, this is probably an adaptation so that the pouch does not fill with sand as they move forward. The tail is short, less than 1 inch (2.5 centimeters), hairless, and covered with a leathery skin and ends in a hard, horny knob.

Genetic studies show that marsupial moles are not closely related to any other Australian marsupial. In 1987 a fossil

marsupial mole was found at Riversleigh, an area that was known to be a rainforest habitat millions of years ago. Scientists think that this fossil mole used its broad claws to burrow through leaves and moss on the forest floor. When the climate changed and Australia became drier, these claws allow it to adapt to living in sand.

GEOGRAPHIC RANGE

Marsupial moles live in the deserts of Western Australia, South Australia, the Northern Territory and southwestern corner of Queensland.

HABITAT

These moles live in sandy desert regions and seem to prefer sand plains near seasonal rivers or sand ridges where spinifex grass grows.

DIET

Marsupial moles hunt and feed underground, digging their food out of the sand. They are insectivores, eating mainly ants, termites, and insect larvae (LAR-vee). They have also been known to eat seeds and small lizards. Marsupial moles kept in captivity and fed on the surface take their food underground to eat it.

BEHAVIOR AND REPRODUCTION

Marsupial moles are active under the ground both day and night. They "swim" or burrow through sand rapidly. They normally tunnel about 4 to 8 inches (10 to 20 centimeters) under the surface. However, they occasionally dig down to depths of more than 8 feet (2.5 meters). When moving through sand, the mole uses its wide front claws to shovel soil backward under its belly. Then the hind feet push together to propel the body forward. These moles do not leave the burrows. The sand fills in the area behind them as they move.

Marsupial moles seem to appear on the surface more often after a heavy rain, although some scientists question if they actually appear more often or if their tracks are simply more noticeable in damp sand. On the surface, they move slowly with a shuffling side-to-side gait and drag their tail, leaving a distinctive pattern of parallel lines. They move only short distances before re-entering the sand. The speed with which they dig allows them to avoid most predators, animals that hunt them for food.

BRRR—IT'S COLD

Marsupial moles are used to living where it is hot. They begin to shiver when the temperature drops to 59°F (15°C) and die of hypothermia, a condition where core body temperature decreases, soon afterwards. Most marsupial moles kept in captivity have died because people did not understand that they need to be kept at temperatures of 73 to 81°F (23 to 27°C) to survive.

Almost nothing is known about marsupial mole reproduction. Females have two teats, nipples, in a backward-opening pouch.

MARSUPIAL MOLES AND PEOPLE

Aboriginal (native) people call the southern species of marsupial mole Arra-jarra-ja or Kakarratul and the northern species Itjari-itjari. These people probably ate moles when they could catch them, but because of the difficulty in hunting them, they were not a major food source. Today marsupial moles are of interest to scientists and the public mainly because of their rarity and interesting adaptations to life underground.

CONSERVATION STATUS

Although the distribution and population size of marsupial moles is not known, both species, the northern marsupial mole and the southern marsupial mole, are considered Endangered, facing a very high risk of extinction in the wild in the near future. Marsupial moles receive legal protection from the Australian government. In an effort to learn more about the marsupial mole population, the University of Western Australia supports a program for the public to report sightings of these animals.



SOUTHERN MARSUPIAL MOLE
Notoryctes typhlops

SPECIES ACCOUNT

Physical characteristics: The southern marsupial mole, sometimes called the greater marsupial mole or just the marsupial mole, has a total head and body length of 3.5 to 7 inches (9 to 18 centimeters) and a 1-inch (2-centimeter) tail. It weighs about 1.2 to 2.5 ounces (35 to 70 grams).

Southern marsupial moles have short legs, spade-like claws on the front feet, and flat nose shields. They also lack eyes and external ears.

Geographic range: Southern marsupial moles are found in Western Australia, the southern Northern Territory, and northwestern South Australia. The northern part of its range may overlap with the range of the northern marsupial mole.

Habitat: Southern marsupial moles live underground in sandy plains and sand ridges.

Diet: This species eats mostly insects and insect larvae.

Behavior and reproduction: Marsupial moles "swim" rapidly through sand, living most of their lives underground. They appear to live alone. Almost nothing is known about their reproductive pattern.

Southern marsupial moles and people: Southern marsupial moles have little practical value to humans, but they are a symbol of the rare and unusual animals of Australia. Their bodies are an excellent example of adaptation to their environment.

Conservation status: These moles have been listed as Endangered, facing a very high risk of extinction, even though little is known about their abundance. It appears, however, as if their numbers are declining. One reason may be compacting of the soil they live in by vehicles or livestock. ■

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KOALA, WOMBATS, POSSUMS, WALLABIES, AND KANGAROOS

Diprotodontia

Class: Mammalia

Order: Diprotodontia

Number of families: 10 families

order

CHAPTER

PHYSICAL CHARACTERISTICS

Diprotodonts are an order of about 131 species of marsupial mammals that live in Australia, New Guinea, and parts of Indonesia. The order also contains a family of giant diprotodonts that are now extinct. Within this order are some of Australia's best known marsupials, including the kangaroos, koalas, and wombats, as well as some of the least known species such as cuscus and potoroos.

Diprotodonts have evolved to fill almost every terrestrial (land) ecological niche, and as a result, they have evolved special physical features that allow them to live most efficiently in their chosen environment. For example, some tree-dwelling (arboreal) gliding possums have evolved a skin membrane that stretches from wrist to ankle and acts as a parasail, allowing them to stay away from predators, animals that hunt them for food, and conserve energy by "flying" from tree to tree. Wombats have evolved strong claws and short, stocky bodies well suited for digging. Kangaroos have strong hind limbs that allow them to race across open grassland at speeds up to 35 miles (55 kilometers) per hour and to leap distances of up to 30 feet (9 meters). Possums and cuscus have evolved tails that can curve around and grasp a branch (prehensile tails).

As a result of this diversification, the species in this order look very different from one another. However they all share at least two physical characteristics that include them as diprotodonts. All members of this order have two large incisor

phylum
class
subclass
order
monotypic order
suborder
family

teeth on the lower jaw. Incisors are front teeth that are modified for cutting. These teeth are also noticeable in more familiar rodents such as beavers and rabbits. Most members of this order also have three pairs of incisors on the upper jaw, and a few species have a second small pair on the lower jaw as well. In addition, members of this order have no canine teeth. Canine teeth are sharp, pointed teeth used for tearing food, and are located between the incisors in the front and the molars (grinding teeth) in the back. Diprotodontia have an empty space where canine teeth usually are located. This pattern of teeth has evolved because most members of this order are herbivores, or plant eaters. They need sharp front teeth to clip off the tough grasses and other plants that make up most of their diet, and they need molars to grind the plants, but they do not need canines to tear their food apart the way carnivores (meat-eaters) do. A few species in this order now eat insects, invertebrates, or flower nectar, but their tooth pattern suggests that at one time during their evolution, they also ate plants.

Besides sharing a common pattern of teeth, all diprotodonts have a condition in their hind limbs called syndactyly (sin-DACK-tuh-lee). Syndactyly means "fused toes." In members of this order, bones of the second and third toe on the hind feet have grown together into a single bone as far down as the claw. However, this fused bone has two separate claws—this twin claw is used for grooming. In many species in this order, the fourth hind toe is enlarged, and the fifth toe is either very small or absent.

On the front limbs of many species, the first two fingers oppose the other three. This means that these fingers, like the thumb on a human hand, can reach across and touch the tip of the other three fingers (unlike, for example, a dog paw or human foot where none of the toes can bend to touch each other). This adaptation is found mainly in species that live in trees, as it helps them grasp branches and climb.

Diprotodonts are marsupials, and like all marsupials they give birth to very poorly developed young after a short pregnancy. The young then attach to teats (nipples) in the mother's pouch and are carried for weeks or months until they mature enough to live independently. All diprotodonts have forward-opening pouches (like the kangaroo) except for wombats and koalas. Wombats are burrowing animals. A backward opening pouch is an advantage when digging, because it will not fill up with dirt. The backward opening pouch of the koala, which

lives in trees, may be left over from a time when its ancestors lived on the ground and dug like the wombat.

Diprotodonts have soft fur, and many species have been hunted for their skins. Most species are earth tone colors, grays and browns, but some have quite eye-catching coloration, such as the yellow-footed rock wallaby, whose patches of red, yellow, and white contrast with its gray fur. Diprotodonts range in size from the red kangaroo, which weighs up to 187 pounds (85 kilograms) to the little pygmy possum, which weighs only about a quarter of an ounce (7 grams). In the past, the fossil record shows that there were much larger diprotodonts living in Australia. These animals became extinct about 50,000 years ago when humans first appeared in Australia.

GEOGRAPHIC RANGE

Diprotodonts are native only in Australia, New Guinea, and a few islands of Indonesia. The brush-tailed possum was introduced to New Zealand, where it is considered a pest.

HABITAT

Diprotodontia have evolved to take advantage of almost every terrestrial habitat. This expansion into different habitats is called radiation. Kangaroos graze on grasslands, cuscus and tree kangaroos live in tropical rainforest trees. Some pygmy possums live in the mountains where it snows six months out of the year. Despite the variety of habitats where members of this order can be found, some individual species live in very restricted areas, because they have evolved to use a very specific set of resources.

DIET

For the most part, diprotodonts are herbivores. Those species that do not eat leaves, fruits, and roots now, probably had ancestors that did. Many species have developed extra large or extra long digestive tracts that allow them to eat leaves and grass with low nutritional value. In addition, they have evolved behaviors that reduce their need for energy. For example, koalas sleep about twenty hours per day to conserve energy.

Some species, such as the mountain pygmy possum, feed heavily on insects. Others species eat insects, worms, and even occasionally a lizard, in addition to a mainly vegetarian diet. The honey possum has developed a long snout that allows it to feed exclusively on plant pollen and nectar.

BEHAVIOR AND REPRODUCTION

Diprotodonts are mainly active at twilight and night. The only species that is active exclusively during the day is the musky rat-kangaroo, although some diprotodonts that live in the forest tend to be active during both day and night. The mountain pygmy possum is the only diprotodont, and in fact the only marsupial, to hibernate or become inactive in cold months.

Many diprotodonts live alone, coming together only to mate, but there are exceptions. Kangaroos tend to associate in loose groups, called mobs, but there is no definite leader and no cooperation among members as there is in a structured group like a wolf pack. Common wombats visit each other's burrows and are not aggressive toward each other, but they do not live together in social groups. Likewise, koalas live near each other, but have their own personal space. On the other hand, hairy-nosed wombats may live in large groups of up to fifty animals, sharing a series of interconnected burrows. Small possums, such as the honey possum and feather-tailed possum, may huddle together for warmth, but larger species of possum live alone. Diprotodonts can be very noisy. They use barking, sneezing, hissing, grunting, gurgling, and growling to mark their territories and communicate their moods to other members of their own species.

In terms of reproduction, diprotodonts, like all marsupials, have short (two weeks to one month) pregnancies. At birth, the newborn is tiny (in some species, as small as a jelly bean). The young are carried in the mother's pouch for weeks or months until they can survive in the outside world. Many species continue to nurse their young after they leave the pouch. Wombats and possums carry their young on their back after they outgrow the pouch. In many species the young may remain with the mother outside the pouch for up to several months before becoming completely independent.

DIPROTODONTS AND PEOPLE

Two members of this order, the kangaroo and the koala, and are national symbols of Australia, and are used heavily in tourist promotions. Kangaroos have been hunted since the first humans arrived in Australia. Today there is a market for kangaroo meat, both for use in pet food and for humans, and leather

made of kangaroo skins. The common brush-tail possum has adapted to suburban environments, and is considered a nuisance. Introduced into New Zealand in 1840, the brush-tailed possum is an invasive alien (introduced, non-native species) that damages native plants and animal habitats. Many farmers also see the wombat as a pest, since its burrows allow rabbits (invasive aliens in Australia) to cross under fences intended to keep them out of grasslands. Kangaroos, however, have benefited from the colonization of Australia by Europeans. Europeans cleared the land for grazing livestock. This increased the amount of grassland habitat favorable to kangaroos and allowed their populations to increase.



MODERN DISCOVERIES

One might think that with our ability to go to every corner of the planet, all the marsupials in Australia and New Guinea would have been discovered. Imagine scientists' surprise and excitement in the 1980s when two new species of diprotodonts were discovered in Australia. Then, in the 1990s, four new diprotodonts were found in New Guinea. It is possible that in the twenty-first century, other adventurous scientists will find still more new species from this order.

CONSERVATION STATUS

The arrival of Europeans and the animals they introduced (rabbits, red foxes, cats, sheep, cattle) significantly changed the habitats of some diprotodonts and put others in direct competition with these introduced animals for food. Hunting, clearing the land for farming, changing patterns of burning grassland, and economic development have put pressure on these animals, often forcing them into marginal habitats, reducing their range or fragmenting them into isolated populations.

About 25 percent of the species in this order are considered threatened or potentially in danger of extinction. Six species have gone extinct in recent years. However, three other species thought to be extinct have been found to be still alive, although considered Critically Endangered, facing an extremely high risk of extinction. The northern hairy-nosed wombat is also Critically Endangered, with possibly fewer than 100 individuals left in the wild. Its cousin, the southern hairy-nosed wombat, is Endangered, facing a very high risk of extinction, because of its limited range. On the other hand, the koala, once threatened with extinction in 1920, has been the target of successful conservation (though in some areas, koalas are dying or being relocated because of overcrowding).

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KOALA

Phascolarctidae

Class: Mammalia

Order: Diprotodontia

Family: Phascolarctidae

One species: Koala (*Phascolarctos cinereus*)

family CHAPTER

PHYSICAL CHARACTERISTICS

Koalas are known worldwide as one of the symbols of Australia. Their gray and white fur, broad head, small eyes, large furry ears, and round belly make them appear cuddly like a teddy bear.

Koalas range in size from 24 to 33 inches (60 to 85 centimeters) and in weight from 8.8 to 33 pounds (4 to 15 kilograms). This is an unusually large size range. Koalas living in the northern (warmer) part of their range are on average 45 percent smaller than those in the southern (colder) areas. In addition, males can be up to 50 percent larger than females.

Koalas are arboreal, meaning they live in trees. They have strong arms and legs with five toes that end in sharp curved claws to help them climb. The first two toes on the front legs are opposable. This means that these toes, like the thumb on a human hand, can reach across and touch the tip of the other three toes (unlike, for example, a dog paw or human foot, where none of the toes can bend to touch each other). This adaptation helps koalas to grasp branches and climb. The first toe of the hind food is short, broad, and clawless. It is also helpful in gripping branches. As in all members of the order Diprotodontia, the bones of the second and third toes of the hind foot are fused. This condition is called syndactyly (sin-DACK-tuh-lee). The single fused bone, however, has two separate claws. This twin claw is used in grooming.

Koalas do not build nests or live in dens. Their fur protects them from the weather. As a result, the fur of animals living in the colder regions of the range is thicker than that of animals living where it is warmer. In the past, many koalas were killed

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

KOALA BEARS?

Because of their teddy bear look, koalas are sometimes called koala bears. They are not, of course bears. They are not even closely related to bears. In fact, their closest living relative is the wombat, a stocky, burrowing marsupial.

for their fur. Males have a gland on their chest that produces scent used for marking trees to warn off other males and establish their own individual territory. Females have a backward-opening pouch in which they carry their young. Koalas also have a tiny brain. It is only 0.2 percent of their body weight.

GEOGRAPHIC RANGE

Koalas are found in isolated patches along the eastern coast of Australia from Queensland to Victoria.

HABITAT

Koalas eat only eucalyptus (yoo-kah-LIP-tus) leaves. Therefore, they are limited to areas where eucalypts grow. This can range from wet tropical forests to dry open woodlands.

DIET

Koalas have strong food preferences. They eat the leaves of about 30 of the 650 species of eucalyptus trees that grow in Australia. Eucalyptus leaves are not an ideal food. They are low in nutrients, hard to digest, and contain toxins (poisons).

In order to digest these leaves, koalas have evolved certain adaptations. They avoid the most poisonous species of eucalypts, and their liver is capable of detoxifying, or making harmless, some of the harmful chemicals in the leaves. They have strong grinding teeth (molars and pre-molars) that grind the tough leaves into a paste. Finally, they have an enormously long cecum (SEE-kum) in which the leaves are digested. The cecum is part of the digestive system. It is a type of sac located where the large and small intestine meet. In the koala, the cecum can be more than 75 inches (2 meters) long. The cecum contains bacteria that help break down the eucalyptus leaves. Koalas get most of the water they need from their diet. However, when fresh water is available, they will drink.

BEHAVIOR AND REPRODUCTION

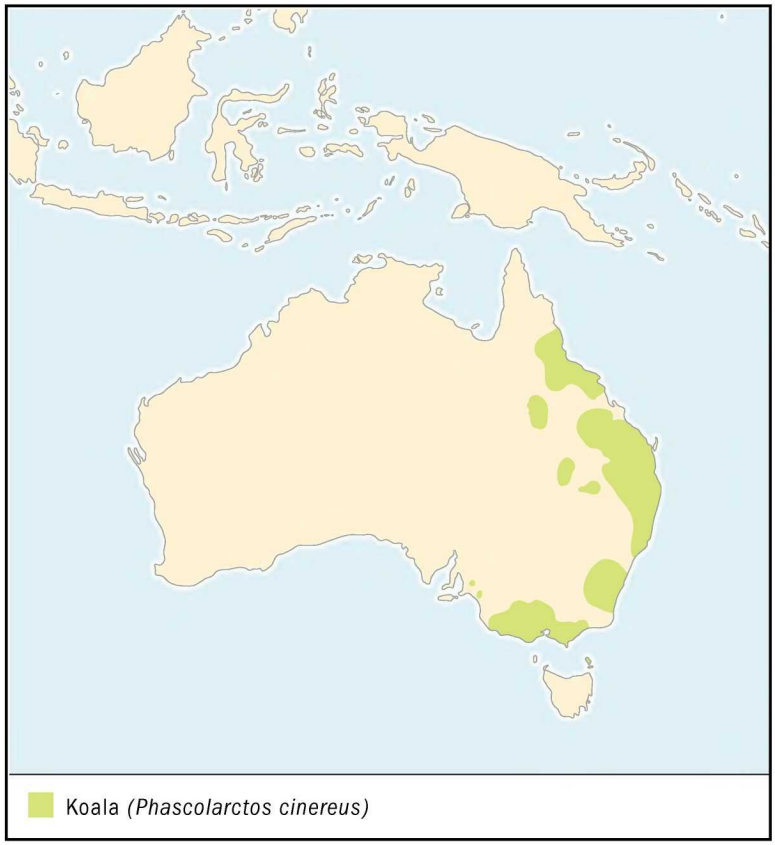
One reason that koalas can exist on low-nutrient food is that they have developed a lifestyle that allows them to conserve



Koalas come out of their mother's pouch when they're about six months old, and cling to her belly or back until they are one year old. (© Kenneth W. Fink/Photo Researchers, Inc. Reproduced by permission.)

energy. They sleep for up to twenty hours each day, and also spend part of the time that they are awake resting. They are nocturnal animals, feeding mainly at night.

Koalas live alone. Males use the scent gland on their chest to mark certain trees as their own territory. They will fight with other male koalas that come into their home trees. The male's home territory often overlaps with that of several females.



The size of the territory depends on how plentiful the food supply is.

Koalas mate during the cool season in Australia. A dominant male will mate with as many females as he can find. Once mating is complete, the animals go their separate ways, and the male has nothing to do with raising the offspring. Koalas are capable of mating when they are two years old, but generally do not begin to reproduce until they are four or five. Their lifespan is about ten years in the wild, and almost double that in captivity.

A single baby is born after a thirty-five–day pregnancy. The baby is tiny, measuring less than an inch (2 centimeters) and weighing less than 0.02 ounces (0.5 grams). The newborn crawls to its mother's pouch where it stays for five to seven months. When it is about half a year old, it comes out of the pouch and clings to its mother's belly or back. During this time, it still nurses, but it also eats vegetable material that has passed through the mother's digestive system. Scientists believe that

in this way the bacteria in the cecum that is needed to digest eucalpytus leaves is passed on from mother to child. The young koala stays with its mother until it is about a year old. By age two it begins looking for its own territory.

KOALAS AND PEOPLE

Aboriginal peoples of Australia hunted koalas for food, as did Europeans when they arrived in Australia. Today koalas are symbols of Australia recognized throughout the world. Their image attracts many tourists, and their image can be found on all types of souvenirs. Very few koalas are sent to zoos outside Australia because of the difficulty in keeping them supplied with fresh eucalyptus leaves.

CONSERVATION STATUS

By the end of the 1920s millions of kolas had been hunted for their fur, and these animals had become extinct in parts of their original range. Intense conservation programs, including protecting habitat, breeding programs, and relocation of some animals, has resulted in a substantial increase in the koala population. There are even some areas where overcrowding is occurring today, leaving the koalas vulnerable to disease and starvation. Today, although there are plenty of koalas, conservationists are concerned about their loss of habitat. The areas in which koalas live are some of the most rapidly developing places in Australia. The Australian Koala Foundation has been a leader in mapping koala habitat and lobbying for its protection.

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The Australian Koala Foundation. G. P. O. 2659, Brisbane, Queensland 4001 Australia. Phone: 61 (07) 3229 7233. Fax: 61 (07) 3221 0337. E-mail: akf@savethekoala.com Web site: http://www.savethekoala.com/.

WOMBATS
Vombatidae

Class: Mammalia
Order: Diprotodontia
Family: Vombatidae
Number of species: 3 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Wombats are stout, stocky burrowing marsupials with powerful forearms and sharp claws for digging. A marsupial is a mammal that does not have a well-developed placenta and gives birth to immature and underdeveloped young, which it then continues to nurture, often in a pouch, until the young are able to fend for themselves. Wombats are about 3.3 feet (1 meter) long and weigh from about 55 to 88 pounds (25 to 40 kilograms). Their fur varies from gray to brown.

All three species of wombat look similar. They have large heads, small ears and eyes, and short, strong necks. They have front teeth, incisors, that continue to grow throughout their life and must be worn down by the food they eat. The main physical difference among the three species is the presence or absence of hair on their nose. Male and female wombats look similar. The female has a backward-opening pouch in which she carries her young. In the past, fossils show that there were as many as nine species of wombat, including one that weighed 440 pounds (200 kilograms). Today the closest living relative of the wombat is the koala.

GEOGRAPHIC RANGE

Wombats live in southeastern Australia. The common wombat is fairly widespread and can be found in parts of New South Wales, Victoria, South Australia, and Tasmania. The northern hairy-nosed wombat lives only in one place in Queensland, and the southern hairy-nosed wombat lives in a small area along the south central coast of Australia.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

THE WOMBAT BOY

In 1960 Peter "PJ" Nicholson was a fifteen year old student at Timbertops, a rural Australian boarding school. PJ became fascinated with wombats. For a year, he sneaked out at night and crawled down wombat burrows. He was patient, visiting often and letting the wombats become comfortable with him. Eventually he traveled 70 feet (21 meters) inside the tunnels to the wombat nests. The measurements and maps that he made of the tunnels were published, and his information is still used by scientists. PJ Nicholson later earned a degree in economics, although he never lost his interest in wildlife.

HABITAT

Wombats live under the ground in open grassland, open woodlands, and dry, shrubby, forested areas. They prefer areas where the ground is soft enough to dig extensive burrows.

DIET

Wombats are herbivores, and eat only plants. They mainly eat native grasses, but will also eat roots, bark, and moss. They graze above ground at night and may travel up to 1.8 miles (3 kilometers) each night looking for food. Because the food they eat is high in fiber and hard to digest, it is held in their digestive system for up to seventy hours in order to break down the fiber and release the nutrients.

BEHAVIOR AND REPRODUCTION

Wombats are nocturnal, active at night. During the day they rest in their burrows, which can be 100 feet (30 meters) long and 6 to 7 feet (1.8 to 2.1 meters) deep. The burrows usually have several entrances and side branches and are large enough for a small adult to fit into them. The southern hairy-nosed wombat builds particularly complex tunnel systems that it may share with other wombats.

Even when they share tunnels, wombats feed alone and are territorial about their feeding grounds. They mark their personal areas with scent and droppings, and act aggressively toward other wombats that move into their territory. Usually, male animals must leave their birth area to find a new territory, but it is the female wombats that are driven out of their birth area and are forced to find new feeding grounds when they mature.

Wombats, like all marsupial mammals, have short pregnancies and give birth to a single tiny, underdeveloped newborn. Pregnancy lasts only about twenty-two days. After birth, the young crawl to the mother's pouch and remain there attached to a teat, nipple, for six to nine months. After leaving the pouch, the young wombat stays with the mother for another year,

gradually nursing less and eating more plant material, until it is finally weaned, not nursing, and independent. Wombats become capable of reproducing when they are two years old. They live more than five years in the wild and have lived up to seventeen years in captivity.

WOMBATS AND PEOPLE

Although wombats have no commercial value, they are considered a symbol of Australia. There are active foster care programs for raising orphaned wombats. However, farmers sometimes see wombats as pests, because their tunnels allow rabbits to pass under rabbit fences and destroy crops. For this reason they are sometimes shot.

CONSERVATION STATUS

Development in Australia has reduced and fragmented wombat habitat. In addition, dogs, dingoes (wild dogs), and automobiles are the other main threats to wombats. The northern hairy-nosed wombat is Critically Endangered, facing an extremely high risk of extinction in the wild. It lives in only one place, the Epping National Forest in Queensland, where it is off-limits to visitors. As few as 100 individuals may remain in the wild. The other two wombat species are not threatened.



SPECIES ACCOUNT

COMMON WOMBAT
Vombatus ursinus

Physical characteristics: Common wombats have stocky bodies that ranges from 35 to 45 inches (90 to 115 centimeters) and short, stumpy tails only about 1 inch (2.5 centimeters) long. They can weigh anywhere from 48.5 to 86 pounds (22 to 39 kilograms). Their short, coarse fur is black, brown, or gray, and they are distinguished from the hairy-nosed wombats by their bare muzzles.

Geographic range: Common wombats are found in southeastern Australia, Tasmania, and Flinders Island.

Habitat: Common wombats prefer open forests and woodlands with well-drained soil that is easy to dig.

Diet: These animals are herbivores and eat mainly native grasses and roots.

Behavior and reproduction: Common wombats live alone and are active at night. They do not often share their burrows with other wombats. They have a home range that usually contains several burrows.

The young can be born at any time of the year. They remain in their mother's pouch for about six months, and continue to stay with the mother outside the pouch for about another twelve months. Males do not help raise their offspring.

Common wombats and people: In some areas, this wombat is considered a pest by farmers and is shot or poisoned.

Conservation status: These animals are not threatened, even though their habitat has been reduced by development. In many parts of their range, this animal is common. ■



Common wombats are active at night and rest in their burrows during the day. Their burrows can be 100 feet (30 meters) long and 6 to 7 feet (1.8 to 2.1 meters) under the ground. (Norman Owen Tomalin/Bruce Coleman Inc. Reproduced by permission.)

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POSSUMS AND CUSCUSES
Phalangeridae

Class: Mammalia
Order: Diprotodontia
Family: Phalangeridae
Number of species: 26 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The Phalangeridae family, or phalangers (fah-LAN-jerz), are made up of five groups of species. Three of these groups are cuscuses and two are possums. Phalangers are small- to medium-sized marsupial mammals. Like all marsupial mammals, the females give birth to tiny, underdeveloped young that finish their development in their mother's pouch.

Possums and cuscuses range in size from 24 to 47 inches (60 to 120 centimeters) long, including the tail, and weigh from 2 to 22 pounds (1 to 10 kilograms). The smallest member of this family is the small Sulawesi cuscus, and the largest is the Sulawesi bear cuscus. Both live in Indonesia.

Members of this family have soft, dense fur that hides small ears. Most species are a solid brown or gray, but the Woodlark cuscus and the black spotted cuscus are spectacularly patterned. Many other species have a dark stripe that runs down the top of their back.

All cuscuses and possums are good climbers. Their feet are adapted to life in the trees. Their hind feet have five toes. The first toe (called the hallux, HAL-lux) has no claw, and is opposed to the other four. This means that this toe, like the thumb on a human hand, can reach across and touch the tip of the other toes (unlike, for example, a dog paw or human foot, where none of the toes can bend to touch each other). The first two toes on the front feet are also opposable. This adaptation makes it easier to grip branches when climbing. Possums and cuscuses also have a prehensile, or flexible grasping, tail that they can

wrap around branches to help steady themselves. Usually the tail has no fur on it to improve its grip.

GEOGRAPHIC RANGE

Phalangers are found in New Guinea, Australia, Tasmania, the Indonesian island of Sulawesi, and a few other small islands. The common brush-tailed possum was introduced in New Zealand over a century ago and has become an alien (non-native) pest species.

HABITAT

Possums and cuscuses spend their lives in trees. Most live in rainforests. However, the common brush-tailed possum has adapted to life in developed areas. It is often found in suburban gardens and city parks. Sometimes it becomes a pest when it makes its home in buildings by finding openings in the roofline and nesting between the house ceiling and the roof.



ENDANGERED STAMPS

The common spotted cuscus was selected to be one of twelve endangered species featured on a 2001 United Nations 34 cent stamp. Every year since 1993, the United Nations has released a new series of stamps in an effort to bring attention to endangered species and to CITES (the Convention on International Trade in Endangered Species), an agreement among nations to help preserve species by controlling their exportation and importation (http://www.cites.org).

DIET

Possums and cuscuses are herbivores, eating almost exclusively plants. Some eat mainly leaves, while others eat mainly fruit. The common brush-tailed possum eats a wider variety of foods than most members of this family, adapting its diet to what is abundant in any given area.

BEHAVIOR AND REPRODUCTION

Most members of this family are nocturnal, or active at night, but the black-spotted cuscus and the Sulawesi bear cuscus feed during the day. All species are arboreal (tree-dwelling) except for the ground cuscus—but even though this animal lives in burrows underground, it is a good climber, and climbs trees to feed on fruit.

Little is known about the social behavior of members of this family. Most species appear to live alone, although a few may form pairs. Males are aggressive toward each other when their home range overlaps. Females usually produce two litters consisting of one offspring each year. Like all marsupials, the young

are tiny, undeveloped creatures that finish maturing while attached to a teat, or nipple, in the mother's forward-facing pouch. After five to eight months, the young leave the pouch and are carried on their mother's back for a few more weeks or months.

POSSUMS, CUSCUSES, AND PEOPLE

Cuscuses are hunted for meat and sometimes fur in New Guinea. Some species, such as the common spotted cuscus, are also sold as pets. Cuscuses play a role in religious beliefs in some parts of Indonesia, and in these areas, they are not eaten. The common brush-tailed possum is considered a pest in many areas. The Telefomin cuscus was not discovered until the late 1980s, and so it is of special interest to scientists.

CONSERVATION STATUS

Two species in this family are considered Endangered and at risk of going extinct in the wild. These are the black-spotted cuscus and the Telefomin cuscus. The population of black-spotted cuscuses is declining because of habitat loss and continued hunting. Little is known about the Telefomin cuscus. Two other species are considered Vulnerable, facing a high risk of extinction, and half a dozen others are of concern to conservationists, but too little is known about them to make an accurate population evaluation.



Ground cuscus *(Phalanger gymnotis)*

GROUND CUSCUS
Phalanger gymnotis

Physical characteristics: The ground cuscus has fur that is light to dark gray with a stripe down its back.

Geographic range: This cuscus is found in New Guinea and the Aru Islands.

Habitat: This animal lives in the rainforest from sea level to 8,900 feet (2,700 meters).

Diet: The ground cuscus eats mostly fruit, but will also eat leaves and sometimes insects and small vertebrates (animals with a backbone).

Behavior and reproduction: This is the only cuscus that sleeps in underground burrows and moves along the rainforest floor. Its

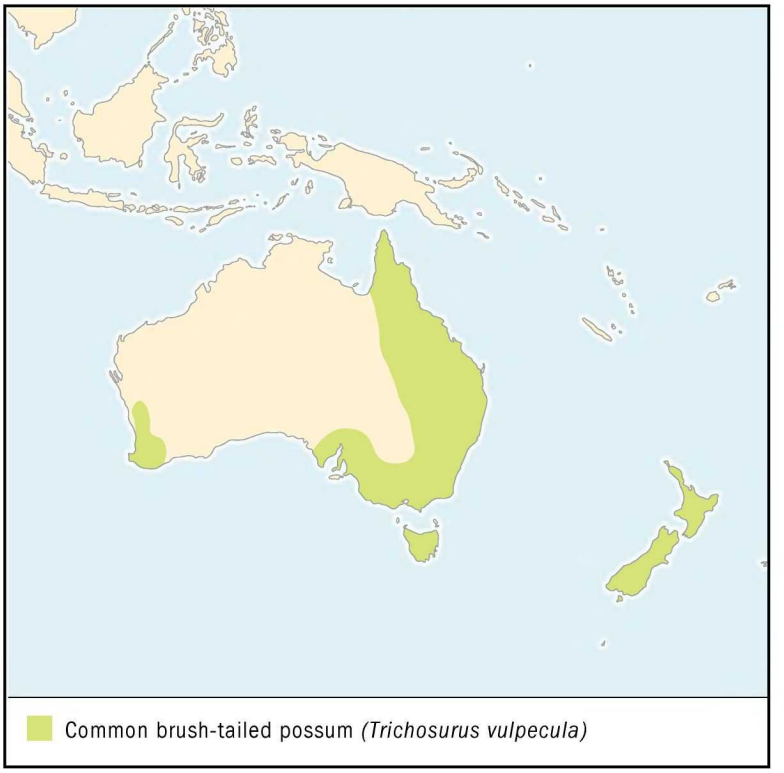


The ground cuscus is the only cuscus that commonly lives in a burrow in the ground. (Illustration by Bruce Worden. Reproduced by permission.)

burrows are usually under trees, along streams, or in caves. The ground cuscus is active at night and searches for food on the ground and in trees. The young leave their mother's pouch five to seven months after birth.

Ground cuscuses and people: These cuscuses are hunted throughout New Guinea, and are important figures in local folklore in some areas.

Conservation status: The ground cuscus is common in many parts of New Guinea, and is probably not threatened. ■



COMMON BRUSH-TAILED POSSUM
Trichosurus vulpecula

Physical characteristics: The common brush-tailed possum varies widely in size and color. Its fur can be black, gray, reddish, or brown. In the colder parts of its range, individuals tend to be larger and furrier than those who live in warmer regions. Unlike some members of this family, the common brush-tailed has a patch of bushy fur on its tail.

Geographic range: Brush-tailed possums live in eastern and southwestern Australia and in New Zealand.

Habitat: The brush-tailed possum is adaptable, living in cool, damp forests and dry regions with few trees. It has adjusted successfully to life in city parks and the suburbs.

Diet: Common brush-tailed possums are herbivores, eating leaves, buds, flowers, and fruits, garden plants, herbs, and grasses.

Its natural habitat is the forest, but common brush-tailed possums have adapted to live in city parks and suburbs. (Jen and Des Bartlett/Bruce Coleman Inc. Reproduced by permission.)



Behavior and reproduction: Common brush-tailed possums are active at night and normally live alone. However, if there are many possums and few places to shelter, they may share their sleeping space with another possum. Male common brush-tailed possums try to avoid conflict with other males, although they can be aggressive in defending their home range. They are known for their loud grunts, growls, and screeches that are used to warn away other males during breeding season. Females usually have one offspring each year, born after an eighteen-day pregnancy. The young then live in the mother's pouch for about seven months.

Common brush-tailed possums and people: This animal probably has more contact with people than any other Australian marsupial because it has adapted so well to cities and suburban areas. It is trapped for its fur and is considered a pest in some farming areas and in New Zealand, where it was introduced about 150 years ago.

Conservation status: The common brush-tailed possum is common within its range and is not threatened with extinction. ■

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MUSKY RAT-KANGAROO
Hypsiprymnodontidae

Class: Mammalia
Order: Diprotodontia
Family: Hypsiprymnodontidae
One species: Musky rat-kangaroo (*Hypsiprymnodon moschatus*)

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The musky rat-kangaroo is a small, four legged, marsupial mammal. It is different from most familiar mammals such as cats, dogs, and horses, which are known as placental or eutherian (yoo-THEER-ee-an) mammals. Eutherian mammals have a placenta, an organ that grows in the mother's uterus (womb) and lets the mother and developing offspring share food and oxygen. Marsupials do not have a well-developed placenta. Consequently, they give birth to young that are physically underdeveloped. These young are hairless, blind, and have immature organ systems. They are unable to survive on their own. Instead, after birth they are carried around for several months in their mother's pouch, where they are attached to the mothers teats, or nipples. They are carried and fed this way until they have grown and matured enough to fend for themselves.

Musky rat-kangaroos are fairly small. Their bodies are generally between 6 and 11 inches (15 to 30 centimeters), and they have a total length from nose to tip of the tail of about 11 to 17 inches (30 to 43 centimeters). Musky rat-kangaroos have short brown or reddish fur that is very soft on their backs, while fur on the underside of their belly is slightly paler. Some musky rat-kangaroos have distinctive white markings on their throats that continue in a white line down to their chest.

Musky rat-kangaroos have small heads that are narrow and taper into a pointed snout. Their ears are small and rounded, and their tails are long, thin, and hairless, except for the area where the tail joins the body. The musky rat-kangaroo has four

paws with five toes on each of its back feet and four on its front feet. Like other kangaroos, the middle toes have a fused (grown together) bone but separate claws. However, all other living kangaroos have only four toes on their back feet. The fifth toe of the musky rat-kangaroo does not have a claw. It is thought that this extra toe is used to help it climb.

Female musky rat-kangaroos have four nipples inside a forward-opening pouch where the young are carried after birth. Female and male musky rat-kangaroos are about the same size, although females usually weigh a little less than males. The average weight of a musky rat-kangaroo is between 11 and 24 ounces (337 to 680 grams).



SAVING FOOD FOR LATER

Fruits from the rainforest are one of the most important parts of the musky rat-kangaroo's diet. However, these fruits are not easy to find during some parts of the year. The musky rat-kangaroo solves this problem by hiding food when there is an abundance of it, then finding it later when food is scarce. This hiding and finding is called scatterhoarding. Scatterhoarding helps ensure that the musky rat-kangaroo will not go hungry, even when food is scarce.

GEOGRAPHIC RANGE

The musky rat-kangaroo lives only in a small area of Australian rainforest in northeastern Queensland.

HABITAT

Musky rat-kangaroos live on the rainforest floor. They usually prefer places where there are many plants that provide good cover for them. They often live near water, such as streams and lakes, because that is where the vegetation is more dense.

DIET

Musky rat-kangaroos are omnivores, meaning they eat both plants and animals. They eat small invertebrates such as insects and worms, as well as fruits, nuts, and roots. Musky rat-kangaroos find food by digging with their front paws in the ground and in the dead leaves and other plant material that cover the rainforest floor. When the musky rat-kangaroo eats, it often uses its front paws to hold the food and sits upright on its hind legs.

BEHAVIOR AND REPRODUCTION

Musky rat-kangaroos are diurnal, which means that they are active during the day. They are the only species in this order that is completely active during the day. At night musky



Musky rat-kangaroos are active during the day and sleep in their nests at night. Most other marsupials are active at night. (Dave Watts/Naturepl.com. Reproduced by permission.)

rat-kangaroos sleep in nests. They also may return to their nests to keep cool during the hottest part of the day. To build their nests musky rat-kangaroos use their tails to pick up leaves and other items. They can curl their tails around what they want to hold and carry it back to their nests. This kind of flexible grasping tail is called a prehensile tail. They take the nest materials to clumps of vines or where two tree roots come together and make their nests there.

Instead of hopping on its two hind legs the way many other rat-kangaroos do, the musky rat-kangaroo moves by using all four legs. Consequently, its front and hind legs are more similar in size than in most other rat-kangaroos. Musky rat-kangaroos have been seen climbing trees, but little is known about why they do this.

Musky rat-kangaroos are thought to live and hunt for food primarily alone, although one scientist reported having seen up to three musky rat-kangaroos feeding in the same place. In the wild, they do not appear to be territorial, meaning that they do not defend an area that they consider to be theirs. When musky rat-kangaroos are kept in captivity, male/female relationships must be taken into consideration. Only one male can be kept in a cage at a time, but two females can be kept together. It is also possible for one male to share a space with more than one female. Little research has been done on how musky rat-kangaroos interact with each other.

Musky rat-kangaroos usually mate between February and July. They normally have two offspring at a time, although they sometimes have three. Like all marsupials, the young are born tiny, blind, hairless, and very immature. The young are not able to fend for themselves and must crawl over their mother's fur and into her pouch. In her pouch they attach themselves to a nipple and spend the next twenty-one weeks in the pouch as they grow and develop. After the young leave the pouch they usually spend time in the nest for another few weeks before they begin to leave the nest and follow their mother.

During the period of time in which a young musky rat-kangaroo follows its mother around the outside of the nest, it is known as a "young-at-foot" (sometimes also called a "young-at-heel"). It is not allowed to return to the pouch, although it



is still allowed to suckle (nurse). The young continue to grow and mature, eventually leaving their mothers to go off on their own.

MUSKY RAT-KANGAROOS AND PEOPLE

The musky rat-kangaroo does not have any known particular significance to humans, except to the scientists who study them.

CONSERVATION STATUS

The musky rat-kangaroo not considered threatened in the wild. However, it is of concern to conservationists, because it lives only in a very small area of the rainforest in northeastern Queensland. Its habitat is disappearing because of clear cutting for agriculture. Because the musky rat-kangaroo lives in only one location, any severe loss of its habitat could be devastating to its population.

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family CHAPTER

RAT-KANGAROOS
Potoroidae

Class: Mammalia
Order: Diprotodontia
Family: Potoroidae
Number of species: 8 species

PHYSICAL CHARACTERISTICS

Rat-kangaroos are four-legged marsupial mammals that are smaller than most cats. Marsupial mammals are different from most familiar mammals such as cats, dogs, and horses, which are eutherian (yoo-THEER-ee-an) mammals, meaning they use a placenta in reproduction. A placenta is an organ that grows in the mother's uterus and lets the mother and developing baby share food and oxygen. Marsupial mammals do not use a well-developed placenta. Because of this, they give birth to tiny young that are not physically mature enough to survive on their own. Instead, the young are carried for several months after birth in their mother's pouch, or they are attached to the mother's teats, or nipples, on her underbelly. While they are carried this way, they continue to grow until they have matured enough to fend for themselves.

Rat-kangaroos usually have a head and body length that ranges from about 6 to 16 inches (15 to 42 centimeters). The tails of rat-kangaroos can be nearly as long as their bodies, and range in length from about 5 to 15 inches (12 to 39 centimeters). Rat-kangaroos range in weight from about 0.8 to 8 pounds (0.4 to 3.5 kilograms). Male and female rat-kangaroos are usually about the same size.

Rat-kangaroos have heads that are long and are usually tapered, with small ears that are either round or slightly pointed. Like all kangaroos, their hind legs are longer and stronger than their front legs. This is because rat-kangaroos use their hind legs to move by hopping. Rat-kangaroos have four toes on each

HOW DID THEY GET SUCH BIG FEET?

Rat-kangaroos have back feet that are longer and stronger than their front feet. Scientists think that the ancestors of kangaroos used to jump up quickly and surprise predators. Animals with bigger back feet had an advantage at hopping higher and faster, which might have helped them to survive. Animals with bigger back feet had a better chance of surviving and having offspring, over many generations the genes for big feet got passed on, and the back feet got bigger and bigger, until they are the large back feet that kangaroos have today.

of their back feet, but the second and third toes actually grow together although the claws remain separate. Each of the front feet has five toes, each with a claw. Their second, third, and fourth toes on their front paws are longer than their other front toes, and these longer claws help them dig for food.

The fur of the rat-kangaroo ranges in color from dark brown to gray or light brown. The fur is lighter on the underbelly than on the rest of the body. These animals can use their tails, which usually have fur on them, to curl around objects and hold onto them. This type of tail that can be used to grasp is called a prehensile tail. Female rat-kangaroos have a pouch containing four nipples.

GEOGRAPHIC RANGE

Rat-kangaroos live on the coasts of Australia, especially the southern and eastern coasts. They also live in Tasmania and on a few nearby islands.

HABITAT

Rat-kangaroos live mainly in forests where there are many eucalyptus trees. Some types of rat kangaroos, like the burrowing bettong, live in other habitats, such as sandy areas that have dunes.

DIET

Rat kangaroos are primarily herbivores, meaning that they eat mostly plants rather than animals. They mainly eat the parts of fungi that grow underground. To find this food underground, rat-kangaroos use their well-developed sense of smell to help them know where to dig. They dig using the long, sharp claws on their front paws. Some rat-kangaroos also eat small invertebrates, such as insects. Some also eat grass or fruits.

BEHAVIOR AND REPRODUCTION

Rat-kangaroos are nocturnal, which means they are awake and do most of their foraging (searching) for food at night. Most of the daylight hours are spent sleeping, most often in a nest. They build nests out of grass, leaves, and other plant

material. Many species get the plant material to their nests by curling their prehensile tail around it and holding it against their rump to keep it steady as they carry it to their nest.

Female rat-kangaroos give birth to one baby at a time. The baby is born after around three weeks of pregnancy. When it is born, it is blind, hairless, and not able to live on its own. The newborn crawls into the mother's pouch and attaches it to one of the mother's nipples where it remains until it is mature enough to survive outside the pouch. Once the young animal leaves the pouch, it becomes a "young-at-foot." During this stage, it follows its mother around and still suckles, nurses, but it is not allowed to get back in the mother's pouch. After another period of development, the young rat-kangaroo goes off on its own. Rat-kangaroos do not usually live in groups after the young mature.

On the night that the female gives birth, she mates again. The egg that is fertilized during that mating stops developing until just before the young that is in the mother's pouch is almost old enough to leave the pouch. The same night that the young leaves the pouch, the mother gives birth to a new baby that then crawls into the pouch that just recently been vacated. After this new baby is born, the mother will mate again. This cycle continues, which means that there are often four generations of rat-kangaroos together: a mother, a young-at-foot, a young in the pouch, and a developing baby that has not yet been born.



RAT-KANGAROOS AND FUNGI: HELPING EACH OTHER

Rat-kangaroos eat the parts of fungi that grow underground and contain the spores. Spores are the reproductive part of the fungi, similar to a tiny seed. Rat-kangaroos eat the fungi for energy. When the fungi are digested, the spores become activated and ready to grow. The spores leave the rat-kangaroo's body in its waste and are ready to grow into new fungi. In this way, the spores are spread to new areas. This type of relationship between two species where both gain something and neither is harmed is called mutualism.

RAT-KANGAROOS AND PEOPLE

Rat-kangaroos are not known to have any particular significance to people.

CONSERVATION STATUS

Many species of rat-kangaroo have been threatened by the clearing of land for agriculture, by fires, and by the introduction of predators that are not native to Australia. Some species of rat-kangaroo have already gone extinct. The desert rat-kangaroo has

not been seen since 1935. It is thought that the broad-faced potoroo has been extinct since around 1875. Many other species of rat-kangaroos, such as the long-faced potoroo, are Endangered, facing a very high risk of extinction. Conservation efforts to protect rat-kangaroos include controlling the number of introduced predators, establishing breeding colonies, and creating protected zones.



NORTHERN BETTONG
Bettongia tropica

SPECIES ACCOUNT

Physical characteristics: Northern bettongs are about the size of a rabbit, except that their tails are nearly as long as its head and body combined. The length of the head and body is usually about 15 inches (38 centimeters) and the length of the tail is usually about 14 inches (36 centimeters). Northern bettongs weigh about 3 pounds (1.4 kilograms). The back legs are much larger and stronger than the front legs. The head tapers to a pointed snout, and they have small, slightly pointed ears. The fur on the belly is much lighter in color than the rest of the fur. Female northern bettongs have four nipples and a forward-opening pouch.

Geographic range: The northern bettong lives on the northeast coast of Australia.



Northern bettongs eat mainly truffles, a type of fungus that grows underground. They use their well-developed sense of smell to find the fungus, and then dig for it using their sharp claws. (Illustration by Bruce Worden. Reproduced by permission.)

Habitat: Northern bettongs usually live in areas of forest that are open and have grass on the forest floor. These areas are often found along the edge of tropical rainforests.

Diet: Northern bettongs, like many rat-kangaroos, eat mainly truffles, a type of fungus that grows underground. It also eats cockatoo grass.

Behavior and reproduction: The young of the northern bettong are born after twenty-one days and are immature, like the young of all marsupials. The young then move into the pouch where they remain for 106 days (about three and a half months) before they are mature enough to live outside the pouch.

Northern bettongs and people: Northern bettongs do not have any known significance to humans, except to the scientists who study them.

Conservation status: Northern bettongs are Endangered, which means that they face a high risk of going extinct in the wild. The main reasons it is endangered are loss of habitat due to clearing of land for agriculture and the destruction of habitat through fires. The red fox, which is not native to Australia, may also prey on the northern bettong, leading to reduced numbers. Conservation measures are being taken through the maintenance of two captive breeding populations of northern bettongs. ■

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family CHAPTER

WALLABIES AND KANGAROOS
Macropodidae

Class: Mammalia
Order: Diprotodontia
Family: Macropodidae
Number of species: 62 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Kangaroos and wallabies are marsupial mammals, meaning that they do not produce a well-developed placenta like many familiar mammals. A placenta is an organ that grows inside the mother's uterus (womb) during pregnancy and allows the developing baby to share the mother's food and oxygen. Marsupial mammals are born underdeveloped and they finish developing inside their mother's pouch.

Kangaroos and wallabies are some of the best known Australian marsupials. They have four legs, although their front legs are much smaller and weaker than their large back legs. They usually have long tails and large ears that are either pointed or rounded. They have a head and body length that varies in size from 11 to 91 inches (28 to 231 centimeters), and a tail that ranges in length from 6 to 43 inches (15 to 109 centimeters). They weigh between 3 and 187 pounds (1 to 85 kilograms). In some species the males are much larger than the females. Kangaroos and wallabies have fur that ranges in color from reddish orange to black.

Kangaroos and wallabies have very long, large, strong back feet that allow them to hop at speeds of up to 35 miles per hour (55 kilometers per hour). They have four toes on each of their front and back feet, and the second and third toes on their back feet are fused (attached) together. All of their toes have strong claws.

GEOGRAPHIC RANGE

Kangaroos and wallabies live all over Australia, as well as in parts of New Guinea and some surrounding islands. They have been introduced into Hawaii, New Zealand, Great Britain, and Germany.

HABITAT

Kangaroos and wallabies live in many different habitats. Some live in the tropical rainforest while others live in the grasslands or woodlands. There is almost no area of Australia where at least one species of kangaroo or wallaby does not live.

DIET

Most kangaroos and wallabies are herbivores, which means that they eat only plants. They eat mostly leaves and grass, although some also eat fruit, seeds, and fungi. Some of the smaller species are omnivores, animals that eat both animals and plants. These species eat insects and other invertebrates.

BEHAVIOR AND REPRODUCTION

Kangaroos and wallabies portray a very diverse set of behaviors. Larger species tend to be diurnal, or mostly active during the day. Smaller species tend to be nocturnal, or mostly active at night. Smaller species are often solitary, while larger species often live or feed in groups of up to fifty animals called mobs. A few species are thought to be territorial. They live alone and defend their home area.

When male kangaroos or wallabies fight, they often do so by supporting themselves on their back legs, or even sometimes just their tail for short periods, and attack each other with the strong claws on their front paws. Sometimes they use their strong hind legs to kick out when they are lying on their sides. Females sometimes do this if males try to mate with them and they are not interested.

Like all marsupials, kangaroos and wallabies give birth to young that are not fully developed. These tiny newborns are blind, hairless, and cannot survive on their own. When they are born, they crawl into their mother's pouch where they attach to one of her nipples. This nipple usually swells, keeping the young in place while the mother moves. In some species the mother will let the young out of the pouch for short periods when it gets older. After the young matures, the mother will no longer let it return to the pouch. In some species it becomes what is called a "young-at-foot." During the young-at-foot period, the young kangaroo or wallaby stays with the mother and often suckles, but no longer re-enters the pouch. In some species there is no young-at-foot period.

Kangaroos and wallabies usually give birth to one baby at a time. In some species the female gives birth the same day

MEETING THE CHANGING NEEDS OF BABIES

When kangaroo newborns climb into their mother's pouches, they attach themselves to one of her nipples. From this nipple they get the milk that provides the nourishment they need to survive and grow. But the nutritional needs of a newborn are not the same as the nutritional needs of a young animal almost ready to leave the pouch. To make sure their young get the nutrients they need, female kangaroos have milk that changes in content as the young matures. When the young-at-foot and a young in the pouch are both suckling, the two different nipples actually produce two different types of milk, suited to the needs of the two different young.

another young leaves her pouch and becomes a young-at-foot. These species often mate the same day that they give birth, but the fertilized egg stops developing until the pouch-young is nearly old enough to leave the pouch. When the pouch-young is ready to leave, the next baby moves to the pouch.

WALLABIES, KANGAROOS, AND PEOPLE

Many species of kangaroos and wallabies have been hunted for their meat and their skins both by aboriginal (native) Australians and by European settlers. These animals are also important in the Aboriginal culture, where they often play important roles in traditional dreamtime stories. Some sheep ranchers consider kangaroos and wallabies to be a nuisances, because they eat the grass and other plants that the farmers want for livestock grazing.

CONSERVATION STATUS

Four species in this family have already gone extinct. Many others are Endangered, which means that they face a very high risk of extinction in the wild. Others are considered Vulnerable, which means that they face a high risk of extinction in the wild. Some actions are being taken to help particular species, including protecting their habitats and breeding them in captivity, so they may be later reintroduced into the wild.



SPECIES ACCOUNTS

EASTERN GRAY KANGAROO
Macropus giganteus

Physical characteristics: Eastern gray kangaroos have a head and body length that ranges from 38 to 91 inches (97 to 231 centimeters). Their tails range in length from 18 to 43 inches (46 to 109 centimeters). They weigh from 8 to 146 pounds (4 to 66 kilograms). Eastern gray kangaroos have the characteristic body shape of all kangaroos with strong hind legs and large back feet. They have grayish brown fur that is paler on their bellies. Unlike other kangaroos, they have hairy snouts.

Geographic range: The eastern gray kangaroo lives in eastern Australia and in eastern Tasmania.



Eastern gray kangaroos may gather in large social groups, called "mobs." (© Bill Bachman/ Photo Researchers, Inc. Reproduced by permission.)

Habitat: The eastern gray kangaroo lives mainly in grassy woodlands, open grasslands, and forest.

Diet: The eastern gray kangaroo eats mainly grasses.

Behavior and reproduction: The eastern gray kangaroo is diurnal. It usually grazes during the early morning and late afternoon when temperatures are lower. Pregnancy usually lasts for thirty-six days, and the young stay in the pouch for 320 days.

Eastern gray kangaroos and people: It is thought that native Australians probably hunted the eastern gray kangaroo for food. Today, it is illegally hunted for skins and meat.

Conservation status: The eastern gray kangaroo is considered Near Threatened. This classification means that this kangaroo is not currently threatened, but could become threatened. This kangaroo has been affected by illegal hunting for its skins and meat, as well as the destruction of its habitat for agriculture. ■



RED KANGAROO
Macropus rufus

Physical characteristics: Red kangaroos have fur that is reddish brown to blue-gray on most of their body, while their fur is white underneath. Red kangaroos have a head and body length that varies from 29 to 55 inches (74 to 140 centimeters). Their tail length is 25 to 39 inches (64 to 100 centimeters). Their weight varies between 37 and 187 pounds (17 to 85 kilograms). These are the largest kangaroos living today.

Geographic range: Most of Australia, except the coastal regions.



The male red kangaroo (on the right) has a rich red color, while the female red kangaroo (on the left) is smaller and less colorful. The males are called "boomers" and the females "blue flyers." (© Wayne Lawler/Photo Researchers, Inc. Reproduced by permission.)

Habitat: Red kangaroos live in grasslands, open woodlands, and open forests.

Diet: Red kangaroos are herbivores. They eat grass and the leaves of shrubs and other plants.

Behavior and reproduction: Red kangaroos are pregnant for 33 days before giving birth. The young live in the pouch for 235 days.

Red kangaroos and people: Red kangaroos are hunted for their skins and meat in some places in Australia. The red kangaroo also has important cultural significance for native Australians, in whose traditional dreamtime stories they often play large parts.

Conservation status: Red kangaroos are not considered threatened. They have benefited from clearing of land for livestock grazing and are one of the few native Australian animals to have increased their population since the coming of European settlers. ■



BRUSH-TAILED ROCK WALLABY
Petrogale penicillata

Physical characteristics: Brush-tailed rock wallabies have fur that is black-brown on their front section and red-brown on their rump. On their underside the fur is paler. They have a tail that is furry and dark colored, characteristics that have contributed to their name. These wallabies have distinctive markings on their heads consisting of a white stripe on their cheeks and a black stripe on their heads. Their head and body length ranges from 20 to 23 inches (51 to 58 centimeters). Their tails range in length from 20 to 28 inches (51 to 71 centimeters). Their weight ranges from 11 to 24 pounds (5 to 11 kilograms).



Brush-tailed rock-wallabies are native to Australia, but have been introduced into Hawaii and New Zealand, where populations of the animals now live. (Illustration by Marguette Dongvillo. Reproduced by permission.)

Geographic range: Brush-tailed rock wallabies live in eastern Australia. They have also been introduced successfully to Hawaii and New Zealand, where self-sustaining colonies now exist.

Habitat: Brush-tailed rock wallabies live in rocky areas in a variety of habitats such as rainforest and woodlands.

Diet: Brush-tailed rock wallabies mainly eat grass, but they also sometimes will eat herbs and fruits.

Behavior and reproduction: Brush-tailed rock wallabies are mostly nocturnal. They sleep in deep cracks in rocks and caves. Females are pregnant for thirty-one days before giving birth. Young live in the pouch for almost seven months before leaving.

Brush-tailed rock wallabies and people: Although brush-tailed rock wallabies have no current economic significance to humans, they were hunted in large numbers for their furs in the late nineteenth and early twentieth centuries.

Conservation status: The brush-tailed rock wallaby is considered Vulnerable, meaning that it faces a high risk of extinction. The main threats to these wallabies are destruction of their habitat from the grazing of livestock and predation from species of animals that are not native to Australian such as red foxes and dingoes (wild dogs). ■



BRIDLED NAIL-TAILED WALLABY
Onychogalea fraenata

Physical characteristics: Bridled nail-tailed wallabies have gray fur with paler gray fur on their bellies. They have a distinctive white stripe on both sides of their body extending from neck to forearms. On the end of the tail is a horny spur, probably inspiring their name. Bridled nail-tailed wallabies range in head and body length from 18 to 28 inches (46 to 71 centimeters), with a tail length that ranges from 15 to 21 inches (38 to 53 centimeters). They have a weight that ranges from 9 to 18 pounds (4 to 8 kilograms).

Geographic range: Currently bridled nail-tailed wallabies have significant populations only in a few places including one location in central Queensland, two places in eastern Australia where they have been reintroduced, two sanctuaries, and a zoo.

Habitat: Bridled nail-tailed wallabies live in areas of woodlands dominated by acacia trees and shrublands.

Diet: Bridled nail-tailed wallabies are herbivores. They eat soft-leaved grasses and other vegetation.

Behavior and reproduction: Bridled nail-tailed wallabies are nocturnal. They use dense vegetation as shelter during the day. Females are pregnant for twenty-three to sixty-two days before giving birth. The young live in the pouch for 119 to 126 days.

Bridled nail-tailed wallabies and people: There is no known significant relationship between the bridled nail-tailed wallabies and people, although scientists think that they have been hunted for their meat and skins.

Conservation status: Bridled nail-tailed wallabies are considered Endangered. This means that they are facing a very high risk of extinction in the wild. Scientists think that the main threats to these wallabies are probably clearing of their habitat for agriculture, and predation by species that are not native to Australia, such as the red fox. ■



Bridled nail-tailed wallabies are active at night and stay sheltered in thick vegetation during the day. (© Mitch Reardon/Photo Researchers, Inc. Reproduced by permission.)



BENNETT'S TREE KANGAROO
Dendrolagus bennettianus

Physical characteristics: Bennett's tree kangaroos have dark brown fur on most of their bodies although the fur on the top of their head and shoulders is reddish brown. Their foreheads and snouts are gray. Bennett's tree kangaroos have head and body lengths that range from 27 to 30 inches (69 to 76 centimeters). Their tails range in length from 29 to 33 inches (74 to 84 centimeters). They weigh between 18 and 30 pounds (8 to 14 kilograms).

Geographic range: Bennett's tree kangaroos live on the eastern part of Cape York, which is a peninsula in the far northeast of Australia.

Habitat: Bennett's tree kangaroos live in tropical rainforests.

Diet: Bennett's tree kangaroos eat mainly leaves, although they sometimes also eat fruit.

Behavior and reproduction: Male Bennett's tree kangaroos live alone. They are territorial, which means that they defend their living area against other males of their species, although their home range may overlap with that of several different females. The young remain in the pouch for about 270 days and are young-at-foot for up to two years.

Bennett's tree kangaroo and people: Bennett's tree kangaroos were hunted by native Australians.

Conservation status: Bennett's tree kangaroo is considered Near Threatened. This means that while these kangaroos are not in serious danger yet, they may soon become threatened. ■



Young Bennett's tree kangaroos are in their mother's pouch for seven months, and may stay with their mothers until they're two years old. (Illustration by Marguette Dongvillo. Reproduced by permission.)

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family CHAPTER

PYGMY POSSUMS
Burramyidae

Class: Mammalia
Order: Diprotodontia
Family: Burramyidae
Number of species: 5 species

PHYSICAL CHARACTERISTICS

Pygmy possums, like most animals native to Australia and New Guinea, are marsupial mammals. This type of mammal, unlike familiar eutherian (yoo-THEER-ee-an) mammals such as dogs, cats, or humans, does not have a well-developed placenta. A placenta is an organ that grows in the mother's uterus (womb) during pregnancy in order to share food and oxygen with the developing young. Since marsupial mammals like pygmy possums do not have a well-developed placenta, their young are born hairless, blind, and underdeveloped and must complete development inside their mother's pouch.

Pygmy possums look much like common mice. They are small, between 2 and 4 inches (5 to 10 centimeters) long, and they weigh between 0.2 and 1.4 ounces (7 to 40 grams). They are covered with soft fur that is brown on their backs and lighter underneath.

GEOGRAPHIC RANGE

Pygmy possums live in central New Guinea, Tasmania, and southeastern and southwestern Australia.

HABITAT

Most pygmy possums live in wet forest areas with evergreen or eucalyptus (yoo-kah-LIP-tus) trees. One species, the mountain pygmy possum, lives in the tropical mountain rainforest of New Guinea above 4,900 feet (1,500 meters).

DIET

Different species of pygmy possums have different diets, ranging from plant pollen and nectar to insects to small lizards.

SEX SEGREGATION

Mountain pygmy possums have a social structure unlike any other members of this family. Groups of up to ten related females (mothers, daughters, grandmothers) share a home range high on the mountain. The males live together lower down the mountain and visit the females only to breed. Unlike many species, the males are not aggressive to each other and do not seem to mind this separation of the sexes.

The long-tailed pygmy possum eats mainly insects, but will also feed on flowers. The eastern pygmy possum eats mainly pollen and nectar. The mountain pygmy possum eats seeds, fruit, insects, and other small animals. All species of pygmy possum are eaten by owls, feral (wild) cats, snakes, and carnivorous (meat-eating) marsupial mammals.

BEHAVIOR AND REPRODUCTION

Pygmy possums are nocturnal, which means that they sleep during the day and are active at night, although a few species may come out on cloudy days. All but one species live in trees and are good climbers, using their prehensile (grasping) tail to help them climb. These tree-dwelling pygmy possums build nests inside tree hollows using leaves and other plant material. As many as five possums live in a shared nest.

The female pygmy possum has four teats, or nipples. This is the maximum number of young that she can raise, although the usual number is one to three young, once or twice a year. She raises the young without any help from the male. After birth, she carries the young in her pouch until they reach an appropriate size, around 0.2 ounces (7 grams). They then spend time in the nest until they reach about 0.35 ounces (10 grams), after which they become independent. Although not much is known about how long some species live, female mountain pygmy possums live about eleven years, while males live only four, an unusually large difference in lifespan.

The mountain pygmy possum lives in mountain meadows and rock fields. It is very different from other pygmy possums. It lives at high elevations between 4,265 and 7,300 feet (1,300 and 2,230 meters), where there is snow on the ground at least three months out of the year. It shares a nest with other possums of the same sex, and stores up fat to survive the winter. One individual was found in autumn that weighed almost three times its normal weight. In the winter, the mountain pygmy possum can reduce its heart rate, energy use, and body temperature and remain inactive for up to twenty days at a time.

PYGMY POSSUMS AND PEOPLE

Pygmy possums are not known to have any significance to humans except to those interested in scientific study. Species that feed on plant nectar and pollen may be responsible for helping to extend the range of these plants.

CONSERVATION STATUS

The mountain pygmy possum is considered Endangered because of the very limited area (only two places in Victoria, Australia) in which it lives. Disturbances to its habitat are considered the most important threat. A natural threat is the annual change in rainfall. The amount of rain affects the size of the Bogong moth population—this in turn affects the amount of food that is available for the mountain pygmy possum, which gorges on Bogong moths almost exclusively during the summer months.



Eastern pygmy possum *(Cercartetus nanus)*

SPECIES ACCOUNT

EASTERN PYGMY POSSUM
Cercartetus nanus

Physical characteristics: Eastern pygmy possums grow to a length of between 7 and 8 inches (18 to 20 centimeters). They have brown fur, except on their belly, which has gray fur. The base of their tail is thick because of stored fat in that area. Eastern pygmy possums also have long tongues with bristles on the tip like a brush.

Geographic range: This species lives in Tasmania and in eastern and southeastern regions of Australia.

Habitat: Eastern pygmy possums live in open forests, shrubby woodlands, and rainforests.

Diet: These possums are omnivorous. They eat nectar and pollen as well as insects. More insects are eaten by individuals that live in wet areas where plants bloom less continuously.

Behavior and reproduction: Eastern pygmy possums are solitary animals. They build nests out of leaves and bark inside of tree-hollows. The female is mature at about five months of age. She gives birth to one to three young twice each year. The young are born after a month-long pregnancy. They remain in the pouch for about forty-two days, and stay in the nest another three weeks before becoming independent at the age of about two months.

Eastern pygmy possums and people: Eastern pygmy possums hold no known significance to humans beyond scientific interest.

Conservation status: This species is not considered to be threatened. ■

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RINGTAIL AND GREATER GLIDING POSSUMS

Pseudocheiridae

Class: Mammalia
Order: Diprotodontia
Family: Pseudocheiridae
Number of species: 16 species

family

CHAPTER

PHYSICAL CHARACTERISTICS

Ringtail and greater gliding possums are marsupial mammals. They range in length from 13 to 37 inches (32 to 95 centimeters) and weigh between 4 ounces and 79 pounds (115 grams to 22.5 kilograms). In this family there are two distinct types of possums. The greater gliding possums have a membrane, or thin layer of skin, between their front legs and their back legs. They spread their arms and legs when they leap from tree to tree and the membrane acts like a parasail or parachute and allows them to glide. The other group, known as the ringtail possums, is much different. They do not have this membrane, and their legs are short and stocky. The greater gliding possums can be up to 37 inches (95 centimeters) long, including their long tail, and weigh up to 42 ounces (1,200 grams).

Ringtail possums are furry and can be light gray, cream, orange, or dark brown in color. One species, the green ringtail, even looks green because of a combination of yellow, black and white fur. Ringtail possums have short round ears and a tail that is bare near the end.

Because they are marsupial mammals, ringtail and greater gliding possums are different from most familiar mammals such as cats, horses and humans. These familiar mammals are all eutherian (yoo-THEER-ee-an) mammals, which means they have

a well-developed placenta. A placenta is an organ that grows in the mother's uterus, womb, and lets the mother and developing baby share food and oxygen. Marsupial mammals do not have this type of placenta. Because of this, they give birth to young that are not physically developed enough to be able to survive on their own. Instead, the young are carried around either in a pouch or attached to the mother's teats, or nipples, on her underbelly until they have completed their development.

GEOGRAPHIC RANGE

Ringtail and greater gliding possums live along the eastern coast of Australia from its northern-most tip near New Guinea to its southern-most tip near Tasmania. They can also be found in the more mountainous areas of New Guinea, as well as Tasmania, and the southwestern tip of Australia.

HABITAT

Most of the species that live in New Guinea, live in mountain forests. In Australia there are a number of different species that occupy a variety of different habitats. One species known as the rock possum lives on the rocky ground. Most other ringtails are arboreal, meaning they live in trees. Some of these tree-dwelling possums live in Australia's rainforests while others live in more dry and less dense forests.

DIET

Ringtail and greater gliding possums are herbivores, which means that they eat plants. Most of their diet is made up of leaves, especially eucalyptus (yoo-kah-LIP-tus) leaves. Some species also eat fruits and flowers. These animals have teeth that are specially suited to grinding up leaves. They also all have a large cecum (SEE-kum), which is a pouch in the digestive system. In order to get enough nutritional value from the leaves they eat—eucalyptus leaves, especially, have low nutritional value—the leaves must be broken down. In the cecum, these animals have special bacteria that break down the leaves, so that they can be used by the animal.

BEHAVIOR AND REPRODUCTION

Ringtail and greater gliding possums are nocturnal, which means that they are active at night and sleep during the day. Almost all species live in trees. Social organization and interaction

DIGESTIVE RECYCLING

Greater gliding and ringtail possums eat plants like eucalyptus leaves that are tough, difficult to digest, and do not contain a lot of nutrients or calories. To get enough energy out of these leaves, they pass them through their digestive system once. Chunks of undigested leaf are eliminated when they defecate, have a bowel movement, then they eat their waste and digest it again so that more nutrients can be removed.

are important to most species in this family. Some live in bonded pairs and raise their young together. Most of the rainforest species live alone, but some of the other species spend time in groups and share sleeping spots. These possums use vocal calls to communicate with each other and with their young. None of them are territorial or protect a particular area.

Ringtail and greater gliding possums give birth to one or two young once a year. The young are born underdeveloped and crawl into their mother's pouch to continue to grow and mature. After 90 to 120 days in the mother's pouch, they leave and are carried on her back for another three months. After ten months the young become independent.

RINGTAIL AND GREATER GLIDING POSSUMS AND PEOPLE

Most ringtail and greater gliding possums do not have a significant impact on people, except for the scientists who study them. In New Guinea, some larger species are hunted for food. Some species living near people's homes have been known to eat flowers from gardens.

CONSERVATION STATUS

Populations of ringtail and greater gliding possums vary in how threatened they are by extinction. Some species, like the lemuroid ringtail possum, are widespread and have large populations. They are not considered threatened. Other species are threatened by the shrinking size of their habitat. The d'Albertis's ringtail possum and the golden ringtail are among this group. No species in this family is currently considered endangered, and they are not protected under law on the island of New Guinea.



GREATER GLIDER
Petauroides volans

Physical characteristics: The greater glider is one of the largest of the gliding possums, with lengths that range between 35 and 41 inches (90 and 105 centimeters). They weigh between 2 and 3.8 pounds (0.9 and 1.7 kilograms). Their fur is dark brown on most of the body except the underside, which is white. They have a long bushy tail that allows them to turn in mid-air and a gliding membrane that runs from their elbows to their ankles and acts as a parasail.

Geographic range: Greater gliders are found in eastern Australia.

Habitat: Greater gliders live in the both dry and wet forests, but not rainforests.



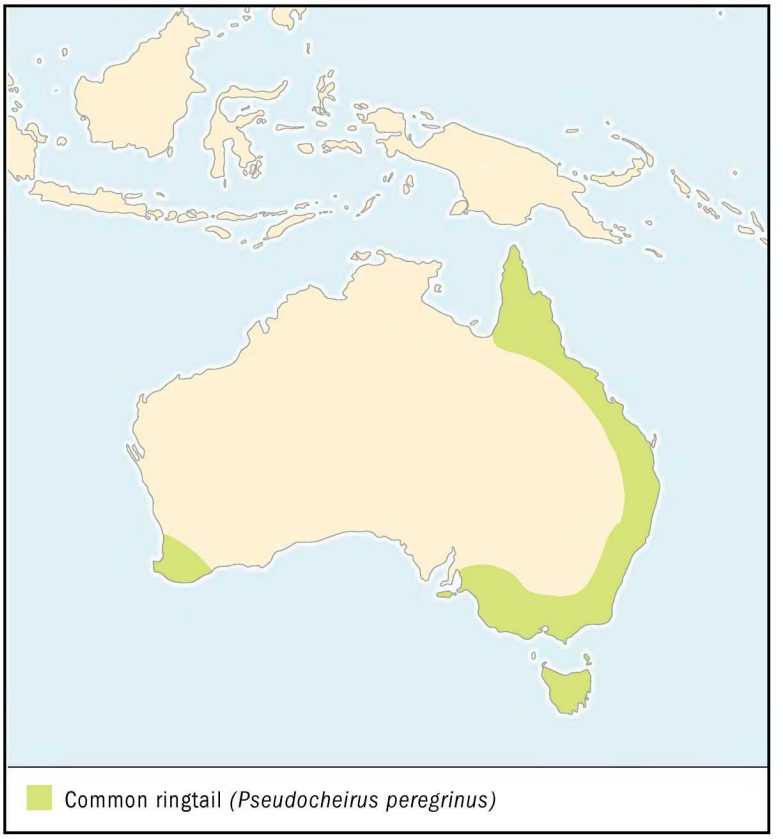
The greater glider is one of the largest gliding possums. This possum feeds in the trees at night. (© B. G. Thomson/Photo Researchers, Inc. Reproduced by permission..)

Diet: Greater gliders are herbivores. Their primary food is the leaves of trees and some parts of other plants.

Behavior and reproduction: Greater gliders are able to glide for distances up to 330 feet (100 meters) and even make 90 degree turns while in the air by using their tail like a rudder. The female gives birth to one young each year between March and June. The young stay in their mother's pouch for 120 days, after which they ride on their mother's back for three more months.

Greater gliders and people: Greater gliders have no known importance for people.

Conservation status: Greater gliders are classified as Vulnerable, facing a high risk of extinction in the wild. ■



Common ringtail *(Pseudocheirus peregrinus)*

COMMON RINGTAIL
Pseudocheirus peregrinus

Physical characteristics: Common ringtails range in length from 24 to 28 inches (60 to 70 centimeters) and weigh between 1.5 and 2.4 pounds (0.7 and 1.1 kilograms). Ringtails have gray-brown fur with lighter fur on the belly. Their tail is long, thin, and pale on the end.

Geographic range: Common ringtails can be found along the eastern coast of Australia from the northern-most tip, down to the southern tip near Tasmania. They are also found throughout Tasmania and the Bass Straight islands.

Habitat: Common ringtails live among any type of vegetation with dense underbrush. This can mean a wide variety of locations, from rainforests to Australian coastal wasteland.



Common ringtails may build their large nests next to one or more other common ringtails. (E. R. Degginger/Bruce Coleman Inc. Reproduced by permission.)

Diet: Common ringtails are herbivores meaning that they eat mainly leaves, fruits, and flowers.

Behavior and reproduction: Common ringtails are nocturnal. Common ringtails build large nests, often next to each other or in groups. Females give birth to two young at a time between April and November. After birth the young live in their mother's pouch for three months. Males take part in the care of the young after they leave the pouch. Once young are six months old, they leave their parents.

Common ringtail and people: Common ringtails in the areas around where people live have been known to eat flowers and other decorative plants in gardens.

Conservation status: Common ringtails are not threatened. ■

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family CHAPTER

GLIDING AND STRIPED POSSUMS

Petauridae

Class: Mammalia
Order: Diprotodontia
Family: Petauridae
Number of species: 12 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Gliding and striped possums are arboreal, which means that they live in trees. They are also nocturnal, meaning they are active at night and sleep during the day, often in hollow trees. Members of this family are medium-sized. They measure between 12 and 31 inches (32 to 78 centimeters) long and weigh between 3 and 25 ounces (95 to 720 grams).

As the name of this family suggests, there are two major types of Petauridae. These two types are organized into groups called subfamilies. One subfamily is called Petaurinae, and the other is called Dactylopsilinae. The Petaurinae subfamily is the group known as the gliding possums. The Dactylopsilinae are the striped possums. Although they are closely related, these two subfamilies look quite different from each other.

Gliding possums are gray, brown, or cream colored. They have a membrane (a thin layer of skin) between their front and rear legs that stretches from their wrist to their ankle. When they leap from branch to branch, they spread this membrane out like a bed sheet in order to glide. Gliding possums also have a bushy tail that is used for steering while in the air. The end of their tail is prehensile, which means that it can be used for grasping branches.

Striped possums are black with two white stripes that run along their back like a skunk. Also like a skunk, these animals have a strong and unpleasant odor that is produced by several glands or organs that secrete chemicals from the body. Striped possums have five toes on their front paws. The fourth toe is much longer

than the rest. They use this to tap tree trunks to find hollow spaces where insects might be hiding. Once they find the insects, they use this toe to dig them out. They also have very strong front teeth that help them to puncture the bark of trees.

GEOGRAPHIC RANGE

Striped possums live in New Guinea. One species is also found in the rainforest on the northern tip of Australia that is closest to New Guinea. Gliding possums also live in New Guinea and Australia, but are found in a much wider area. They live both on the northern and eastern coast of Australia and on the island of Tasmania.

HABITAT

Gliding and striped possums live in many different types of forests, from dense rainforests to open forests where trees are spread far apart.

DIET

Gliding possums are omnivorous meaning they eat both plants and animals. They feed mostly on sap from trees, as well as nectar and blossoms. Some species of gliding possums are able to bite into tree bark in order to get the sap. Others feed off sap that leaks from wounds in trees made by other species.

Striped possums are insectivorous, meaning that they mainly eat insects. They use their long fourth finger to tap trees and rotting logs to find the hollow spots where insect larvae (LAR-vee; young developing insects) are living. They then use their strong front teeth to dig into the tree and their fourth finger to pull out the larvae.

BEHAVIOR AND REPRODUCTION

Striped possums live alone and do not form social groups. They are believed to be territorial. This means that they stay in a particular area and defend it against other members of their species. Gliding possums are more social and live in family groups and share their nests. These groups are made up of variable numbers of adult males and females. Within these groups, both males and females develop a system of ranking known as a hierarchy (HI-uh-raar-key). Females will aggressively bother other females that are below them in this hierarchy, sometimes causing the death of their babies. Males that are high in this system tend to care for the young when the females are away. Gliding possums are also

territorial, because they protect their area from other gliding possums that are not in their group.

Gliding and striped possums are marsupial mammals, which means that they do not have a well-developed placenta. The placenta is an organ that allows the mother to share food and oxygen with developing offspring in her uterus (womb) during pregnancy. As a result, marsupials like these possums are born underdeveloped and need to continue to grow in their mother's pouch for some time after birth before they can survive in the outside world.

All female members of this family have a pouch with two teats (nipples). Two young are born at a time. After the young are born, they crawl to the pouch and attach themselves to one of their mother's teats. After many days, the young emerge from the pouch and live in a nest. During this time, they may be carried around on their mother's back. Information about reproduction is not known for all species, but it is known that for the sugar glider, pregnancy lasts only sixteen days. However, the young remain in the pouch for another sixty days after birth. The young then live in the nest until they are about four months old. In this species the males that live in the group help to care for the young.



ODOR AND TERRITORY

Animals produce odors for many different reasons. In some cases an animal uses odor as protection to ward off potential predators. They also use odor to attract potential mates. In other situations, animals use odors to let other animals know that a particular area is their territory. Gliding and striped possums use odors to mark territory for different reasons. While striped possums are most likely telling other striped possums to stay out of their area, gliding possums use odor to identify members of their group.

GLIDING AND STRIPED POSSUMS AND PEOPLE

The sugar glider is becoming popular as an exotic pet. It is not clear whether these animals make appropriate pets and some countries have placed a ban on importing them from New Guinea. Beyond this species, there is no significant relationship between humans and the members of this family other than scientific study.

CONSERVATION STATUS

Three species in this family are Endangered, facing a very high risk of extinction in the wild: Tate's triok, the mahogany glider, and Leadbeater's possum. Other species, such as the yellow-bellied glider and the squirrel glider are considered Vulnerable, facing a high risk of extinction in the wild. Conservation efforts are underway to identify and protect key habitats of a number of these animals.



SPECIES ACCOUNT

SUGAR GLIDER
Petaurus breviceps

Physical characteristics: Sugar gliders are part of the gliding group (Petaurinae) of this family. They have a membrane that extends from the fifth toe of their back legs to the first finger on their front legs. They spread their arms and legs to make a sail out of the membrane when leaping between branches. Sugar gliders are fairly small measuring between 12 and 15 inches (32 to 42 centimeters) long and weighing between 3.5 to 5.5 ounces (95 to 160 grams). They have two black stripes along the sides of the face, and one black stripe that runs along their back. The rest of their fur is blue-gray, except for on the belly, which has lighter fur.



Sugar gliders are social, and live in family groups. (© Alan and Sandy Carey/Photo Researchers, Inc. Reproduced by permission.)

Geographic range: Sugar gliders live in New Guinea, Tasmania, and in the northern and eastern parts of Australia.

Habitat: Sugar gliders are frequently found living in acacia and eucalyptus trees.

Diet: The sugar glider is an omnivore. It eats tree sap, pollen, insect larvae, and insect-like animals such as spiders.

Behavior and reproduction: Sugar gliders are nocturnal. Using strong legs to launch themselves, they are able to glide up to 230 feet (70 meters). Sugar gliders, like many gliding possums, are social and they live in family groups that are territorial.

Sugar gliders give birth to one or two offspring twice a year. Their pregnancy lasts sixteen days. Pouch stay for the young is about two months, with another two months are spent in the nest. Their lifespan is about fourteen years.

Sugar gliders and people: Despite controversy, sugar gliders are becoming popular as household pets, both in Asia and the United States.

Conservation status: This species is not threatened. There is no serious danger that they will become extinct in the foreseeable future. ■

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HONEY POSSUM
Tarsipedidae

Class: Mammalia
Order: Diprotodontia
Family: Tarsipedidae
One species: Honey possum (*Tarsipes rostratus*)

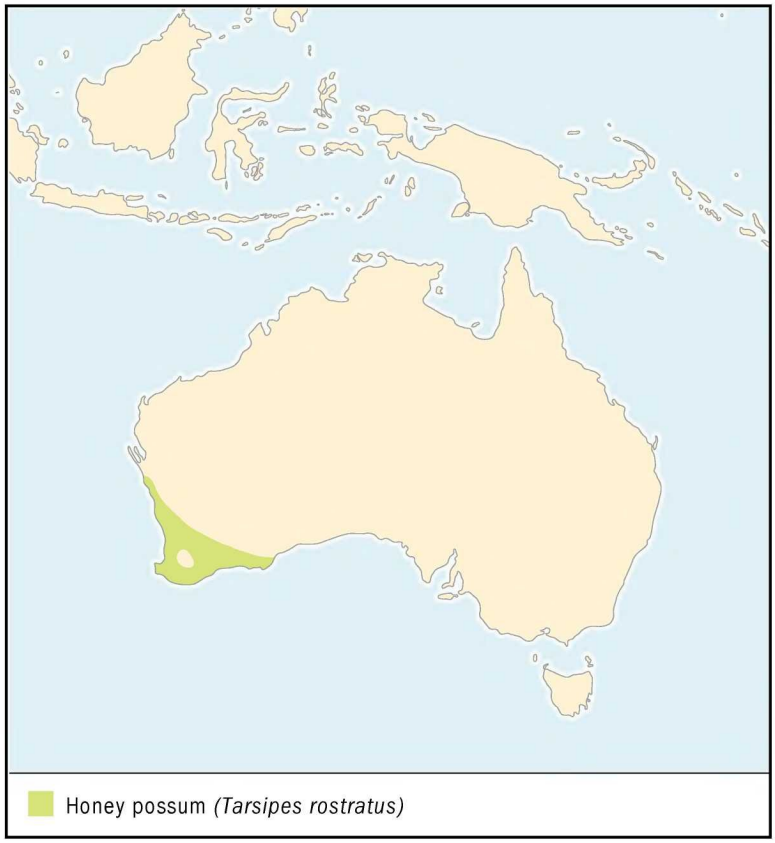
family CHAPTER

PHYSICAL CHARACTERISTICS

Honey possums are very small and highly specialized marsupial mammals. Despite their name, honey possums do not actually make or eat honey—instead, they have unique physical features that help them to feed primarily on the pollen and nectar from flowers. They are very small and have long tongues to pull the nectar or pollen out from inside a flower. Their heads are long and tapered, and they are covered in coarse, short hair. Except for three black stripes down the middle of their back, their coloring is a grayish brown.

Male honey possums weigh only 0.24 to 0.38 ounces (7 to 8 grams). Female possums weigh slightly more, between 0.28 and 0.56 ounces (8 to 16 grams). From the tip of their nose to the end of their body (excluding the tail) they are only between 2.6 and 3.5 inches (6.5 to 9 centimeters) long.

Honey possums have long tails, as long or longer than their bodies. They use this tail to help them climb along branches between flowers. The tip of the tail is prehensile, meaning that the honey possum can use it to grasp objects. It is almost hairless, which also helps to improve its grip. Honey possums are often seen hanging upside down by their tails. They also have very long tongues, which they can extend beyond their mouth even further than the length of their head. This helps them to retrieve their food from flowers. Their paws have four toes. The bones of the middle two toes on the back paws are fused (attached) but have separate claws that are used for grooming. Other toes are clawless.



GEOGRAPHIC RANGE

Honey possums live in a very small region in the southwestern tip of Australia.

HABITAT

The honey possum lives on uninhabited sandy beaches where the kinds of flowers that they feed on bloom almost all year round.

DIET

Even though they are called honey possums, these animals do not eat honey. They feed upon the nectar and pollen from the flowers of plants such as myrtles (MER-tuhlz), proteas (PRO-tee-ahz), and banksias (BANK-see-ahz) that grow on the coast of southwestern Australia. Their teeth, which are stubby and short, are not used to chew or bite. In order to get the pollen and nectar, honey possums use their long tongue and tapered head to poke into the flowers. The end of their tongue

is like a brush, and they use it to pull the food into their mouth. In order to maintain themselves, honey possums must consume large amounts of their sugary food and spend most of their time searching for flowers.



Honey possums feed on the nectar from flowers, like this Banksia *flower. (© Jiri Lochman/Lochman Transparencies. Reproduced by permission.)*

BEHAVIOR AND REPRODUCTION

Because they require a large amount of energy to keep warm, honey possums spend most of their time in search of food. They are nocturnal, which means they are most active at night, and sleep during the day. Honey possums live alone and sleep in holes of trees or nests that birds have abandoned. While the flowers from which they eat pollen or nectar bloom most of the year, sometimes there is a scarcity of food. During this time, honey possums often gather in large groups and curl up together. They become inactive, as if they are hibernating. Their heart rate slows and their body temperature drops in order to conserve energy. When more food is available, the honey possums become active again.

To get from flower to flower, honey possums run quickly along the sandy ground and climb very skillfully up branches in order to reach the blossoms. They use their long tails to grasp branches in case they lose their balance. Often they hang upside down in order to reach a flower. Once they have reached the flower, they use their front toes to pull it apart and then push their snout inside. Their long tongues can extend far into the flower and scrape out the pollen inside.

Honey possums are marsupial mammals, which means that they do not have a well-developed placenta. The placenta is an organ that allows the mother to share food and oxygen with developing offspring in her uterus (womb) during pregnancy. As a result, their young are born underdeveloped and need to continue to grow in their mother's pouch for some time after birth before they can survive in the outside world.

Honey possums live only for a year or two, but they reproduce almost continuously. After only six months, both male and female honey possums are able to produce offspring. After about a two-month pregnancy, the mother gives birth. The

EVOLVING ALIKE

Even though monkeys and honey possums are not related, and they are so different in size, they share many characteristics. For example, honey possums have long tails, which they use for grabbing and balancing on branches like monkeys. Both monkeys and honey possums have toes that are good for grasping and climbing. When two animals are not related by evolution but develop similar characteristics, scientists call this "convergent evolution." Since both monkeys and honey possums needed to be able to climb efficiently, they have evolved similar features to help them.

newborns then spend another two months inside her pouch attached to one of her four nipples. At birth, the young weigh only 0.00002 ounces (0.0005 grams), and they are the smallest of all known mammals. Inside the pouch they grow to 0.09 ounces (2.5 grams). Their eyes open, and they grow hair.

The mother usually mates shortly after the litter (a group of young born at the same time) is born and enters her pouch. Because of this, she is able to give birth to another litter as the first litter is leaving her pouch. After a litter leaves the pouch, they spend a week or two following their mother around and even riding on her back. They are then ready to leave and begin looking for food on their own. A female will usually give birth to two litters, or eight young, but she will not often live long enough to give birth to a third litter.

HONEY POSSUMS AND PEOPLE

Honey possums have little direct relation to humans, although they do help to spread flowers along the coast because of their pollen diet. Despite their nocturnal lifestyle, which makes them hard to find, honey possums are also popular with ecotourists. Ecotourists are people who want to observe nature without disturbing it.

CONSERVATION STATUS

In 1992, much of the habitat and food supply of the honey possum was disappearing because humans were developing their habitat with little regard to this small animal. Today, with increased awareness, the number of honey possums has rebounded and they are not considered threatened.

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FEATHER-TAILED POSSUMS
Acrobatidae

Class: Mammalia
Order: Diprotodontia
Family: Acrobatidae
Number of species: 2 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The family Acrobatidae is made up of two species: the pygmy glider and the feather-tailed possum. Although they are very different in many ways, these two species have similarities that make them part of the same family.

The pygmy glider is the smaller of the two species. Their heads and bodies are usually between 2.5 and 3 inches (6.5 to 8 centimeters). They have tails that are also between 2.5 and 3 inches (6.5 to 8 centimeters) in length. The pygmy glider weighs less than 0.5 ounces (14 grams). Feather-tailed possums are larger, with a head and body length that ranges from 4 to 5 inches (10 to 13 centimeters). Their tail is longer than their body, with a length of between 5 and 6 inches (12 to 15 centimeters). They weigh between 1 and 2 ounces (30 to 60 grams).

Pygmy gliders and feather-tailed possums both have tails that are long and have long straight hairs sticking off both sides of their tail. These hairs make the tail look like a feather, which is how they got their name. Both species have large eyes and round ears. They both also have gray fur. The feather-tailed possum has black and white stripes on its face. The pygmy glider does not have these stripes and has a white belly.

Both species of this family have sharp claws that help them grip trees. They also have six pads on their feet to help them grip. The pygmy glider has a thin membrane, or piece of skin, that goes from its front legs to its back legs. This membrane allows it to glide. The feather-tailed possum does not glide and does not have this membrane.

Both species are marsupial mammals. This makes them different from most familiar mammals such as cats, dogs, and horses. These familiar mammals are all eutherian (yoo-THEER-ee-an) mammals, which means they have a well-developed placenta. A placenta is an organ that grows in the mother's uterus, womb, and lets the mother and developing baby share food and oxygen. Marsupial mammals do not have this type of placenta. Because of this, they give birth to young that are not physically developed enough to be able to survive on their own. Instead, the young are carried around either in a pouch or attached to the mother's teats, or nipples, on her underside until they have developed more fully and can survive on their own.



WHAT MAKES A FAMILY?

Pygmy gliders and feather-tailed possums are in the same family, but they are different in many ways. Pygmy gliders have a special membrane that allows them to glide, while feather-tailed possums do not. Scientists look at many different clues to decide what species are similar enough to belong in the same family. These possums have ears that are very complex and unique to these two species. This is the kind of information scientists used to decide that these two species belonged in the same family, even though they may not look very similar.

GEOGRAPHIC RANGE

The pygmy glider lives in eastern Australia. The feather-tailed possum lives in New Guinea.

HABITAT

Both species in this family live in trees. Feather-tailed possums live in tropical rainforests and woodland areas. They are also sometimes found in suburban gardens. Pygmy gliders prefer forests that contain many eucalyptus (yoo-kah-LIP-tus) trees. They also live in other woodland areas.

DIET

Pygmy gliders and feather-tailed possums eat insects, fruit, flowers, and nectar.

BEHAVIOR AND REPRODUCTION

Both the pygmy glider and the feather-tailed possum are nocturnal, which means they are active mainly at night. They have flexible prehensile tails that allow them to grab hold of branches. Feather-tailed possums usually live alone or in pairs, but pygmy gliders often live in groups and make nests out of dry leaves in branches or hollows in trees.

Feather-tailed possums have one or two offspring at a time, while pygmy gliders usually have three or four offspring. They both give birth to young that are underdeveloped and spend time in the pouch while they grow and mature. After they leave the pouch, the young spend time in the nest before being weaned, no longer dependent on their mother's milk, and are ready to fend for themselves.

FEATHER-TAILED POSSUMS AND PEOPLE

Feather-tailed possums do not have any known significance to humans except to the scientists who study them.

CONSERVATION STATUS

Neither species of feather-tailed possum is considered threatened. They do not face a high risk of extinction in the wild in the near future.



Pygmy glider *(Acrobates pygmaeus)*

PYGMY GLIDER
Acrobates pygmaeus

SPECIES ACCOUNT

Physical characteristics: The pygmy glider is the smallest marsupial that is able to glide. They weigh less than 0.5 ounces (14 grams). Their head and body measure between 2.5 and 3 inches (6.5 to 8 centimeters) in length. Their tail is also usually about 2.5 to 3 inches (6.5 to 8 centimeters) long. Females have pouches that contain four nipples.

Pygmy gliders have fur that is soft and gray. Around their large eyes are circles of black fur. Their belly is white. The pygmy glider's tail is about as long as its body and has long stiff hairs on each side of it. A membrane with fur on it is attached to either side of the pygmy glider's body from its front feet to its back feet.

Geographic range: Pygmy gliders are found in eastern Australia.

Habitat: Pygmy gliders live in forest areas where there are many eucalyptus trees. They also live in woodland areas.

Diet: Pygmy gliders eat mainly insects. They also eat nectar from flowers.

Behavior and reproduction: Pygmy gliders are nocturnal. They live in trees and rarely spend any time on the forest floor, where they would be vulnerable to predators. Pygmy gliders are very social animals. They build nests out of leaves in branches and holes in trees. Many pygmy gliders live together in one nest. When it gets cold, they often huddle together to share warmth. When it gets especially cold or there is not enough food, pygmy gliders can go into torpor. Torpor is when the animal purposely lowers its body temperature and heart rate temporarily to conserve energy, similar to hibernation.

Pygmy gliders glide by jumping and then spreading their hands and feet so that their special membrane becomes stretched out. This membrane acts like a parachute so that the pygmy glider glides instead of falling. The feather-like tail is used to help control the glide. This way they are able to glide distances of up to 65 feet (20 meters) or more at a time. Because they live in trees and almost never go down to ground level, gliding is an important way for this species to move from tree to tree.

Pygmy gliders usually have three or four offspring at a time. The mother gives birth to young that are not able to fend for themselves.

The young crawl into her pouch where they continue to grow. Once the young have fur and are a little older, they sometimes ride around on their mother's back. After about sixty days, they leave the pouch and stay in the nest alone. They stay in the nest for another thirty-five or forty days. At this time the young are weaned, although they might not leave the nest. The day that the babies are born, the mother mates and gets pregnant again. The new fetuses stop developing until just before the young have been weaned. This means that the mother gives birth again just a day or two after the last set of young has stopped nursing.

Pygmy gliders and people: Pygmy gliders are not known to have special significance to people except to the scientists who study them.

Conservation status: Pygmy gliders are not considered threatened. They are not at risk of extinction in the wild in the foreseeable future. ■

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SLOTHS, ANTEATERS, AND ARMADILLOS

Xenarthra

Class: Mammalia

Order: Xenarthra

Number of families: 4 families

order CHAPTER

phylum
class
subclass
● **order**
monotypic order
suborder
family

PHYSICAL CHARACTERISTICS

The order Xenarthra consists of sloths, anteaters, armadillos, and the extinct glyptodonts. The glyptodont, which became extinct 10,000 years ago, belonged to the armadillo family. It was 10 feet (3 meters) long. Modern-day xenarthrans (ZEN-arth-ranz) range from the pink fairy armadillo, which is 6 inches (15 centimeters) long, to the giant anteater, which is up to 7 feet (2.1 meters) long.

Sloths move slowly and spend most of their lives upside down in trees. They hold onto branches and trunks with their long limbs. Sloths have small heads, slim bodies, and tiny tails. Their hair is long and rough. Fur is mainly gray or brown, with green coloring in the outer hair. The green color is caused by algae (AL-jee), which are tiny water plants. Sloths aren't bothered by algae growing in their fur. They lick the algae when hungry, and the color helps sloths blend in with trees. This camouflage (KAM-uh-flaj) protects sloths from predators, animals that hunt them for food.

Two-toed tree sloths are up to 3 feet (0.9 meters) long and weigh 18 pounds (8 kilograms). There is a claw, approximately 3 inches (7.5 centimeters) long, on each of two digits (toes) of the sloth's front feet. Three-toed tree sloths are about 2 feet (0.6 meters) long and weigh 11 pounds (5 kilograms). They have three digits with claws on the front feet.

In the anteater family, two species have tiny heads and long snouts. The giant anteater and tamandua (tuh-MAN-duh-wah) use their tube-shaped snouts to dig into ant nests, and lick up

ants with their tongues. The giant anteater weighs up to 88 pounds (39 kilograms) and its tongue is 2 feet (0.6 meters) long. The anteater's long, coarse fur is black, white, gray, and brown. Because its claws are long, the anteater walks on the side of its feet.

Tamandua is the scientific and common name of the lesser anteater. Length ranges from 3 to 5 feet (0.9 to 1.5 meters), and weight ranges from 8 to 13 pounds (3.5 to 6 kilograms). The northern tamandua is brown with black fur on its back. Southern tamandua fur color ranges from blonde to brown.

Tamandua and the silky anteater have prehensile tails that they use to hold objects or hang onto trees. The silky anteater is up to 20 inches (50 centimeters) long and weighs 17 ounces (480 grams) and up. Its fur is soft, and colors range from gray to yellow. In comparison to its size, the silky anteater's mouth is larger than that of other anteaters.

Armadillos' size ranges from the tiny fairy armadillo to the giant armadillo, which is 4.9 feet (1.5 meters) long and weighs 66 pounds (30 kilograms). Armadillos have long tails, and their bodies are covered by shells, "armor" formed out of bony plates. Hair grows between the plates, and the number of these bands varies by species. Shell color includes brown, white, and yellow. Body color is usually gray or brown. However, the pink fairy armadillo has a pink shell and white body. The armadillo shell covers most of its body.

GEOGRAPHIC RANGE

Xenarthrans originated in the New World and live primarily in Central and South America. Sloths, anteaters, and armadillos live in Bolivia, Brazil, Colombia, Costa Rica, French Guiana, Guyana, Nicaragua, Panama, Peru, Suriname, and Venezuela. Sloths are also found in Ecuador and Honduras. Anteaters range in Belize, Guatemala, El Salvador, Honduras, Suriname, Paraguay, and Uruguay. Sloths and armadillos live in Mexico, and the nine-banded armadillo is the only xenarthran living in the United States.

HABITAT

Sloths live in trees in the rainforest, an area where there is much rain throughout the year. This rain leads to the growth of many trees and plants. Anteaters live in rainforests or in the savanna, an area of grassland with few trees. Giant anteaters

live on the ground, and pygmy anteaters live in trees. Tamanduas live in trees or on the ground.

Armadillos live in the rainforest, grasslands, desert, and in deciduous forests where leaves fall off trees during a certain season. Most armadillos burrow, using their claws to dig holes or tunnels that serve as their homes.

DIET

Sloths are primarily herbivores, eating mostly leaves and twigs. Anteaters are insectivores, feeding mainly on insects. Armadillos are omnivores; their diet includes plants, insects, and other animals.

Sloths sleep most of the day and spend about seven hours eating. They develop a taste for the leaves that their mothers eat. This is because the mother sloth carries the cub with her. The young sloth feeds itself by reaching for leaves in the trees where its mother eats. The sloth diet includes leaves, flowers, buds, and twigs. Two-toed sloths may also eat bird eggs and insects.

The anteater's name describes its diet. A giant anteater must consume about 30,000 ants each day. The tamandua eats about 9,000 a day, and the silky anteater can eat 5,000 ants in a day. Giant anteaters and tamandua also consume termites. If tamandua can't locate ants and termites, they feed on bees, honey, and small fruit. The pygmy anteater eats beetles and fruit.

Armadillos eat plants and dig into the ground to find insects and worms to eat. They also eat small animals like snakes and frogs. Diet is based on habitat.

BEHAVIOR AND REPRODUCTION

Xenarthrans are usually solitary. However, armadillos sometimes travel in pairs or small groups. Sloths, anteaters, and armadillos are thought to be polygynous (puh-LIH-juh-nus), meaning males mate with more than one female. After mating, the males leave, and the females raise the young.

A female sloth bears one young that she carries with her for up to a year. A female anteater usually gives birth to one cub. Very rarely, twins are born. The cub stays on the mother's back for six to nine months. Females of most armadillo species bear a litter of one to three young. However, some species bear up to twelve cubs.

When the armadillo is faced by predators, it bends its head down to protect its flesh from attack. The three-banded armadillo

rolls itself into a hard-shelled ball. Sloths and anteaters use claws as protection. Predators of xenarthrans include jaguars, lions, and humans.

SLOTHS, ANTEATERS, ARMADILLOS, AND PEOPLE

Humans have various relationships with sloths, anteaters, and armadillos. People hunt xenarthrans for food, and they make pets of some species. Sometimes people keep anteaters at home to help get rid of ants. People kill some sloths for their fur pelts. Tamandua is hunted for the tendon, a cord-like tissue that attaches muscle to bone, in its tail. The tendon is used to make rope.

In addition, medical researchers are studying armadillos. They are the only mammals besides humans that contract leprosy, a skin disease. Research on armadillos helps to develop treatment of this condition in people.



AN UNUSUAL ORDER

Sloths, anteaters, and armadillos were once thought to belong to the order Edentata, a word that means "toothless." Some xenarthrans have teeth, and they all have skeletons that are different from other mammals. "Xenarthra" is a combination of Greek words meaning "strange joints." In xenarthrans, three pairs of joints connect some vertebrae (backbone segments) in the backbone. In addition, xenarthrans don't have separate pelvic bones. Pelvic bones are unconnected in the hips of most mammals.

CONSERVATION STATUS

The three-toed sloth, giant armadillo, and pink fairy armadillo are considered Endangered, according to the World Conservation Union (IUCN). These mammals face a very high risk of extinction. Considered Vulnerable, facing a high risk of extinction, by the IUCN are the giant anteater and several species of armadillos in South America. Risk to these xenarthrans is caused mainly by loss of habitat as the rainforest is cleared of trees. Farming and hunting also threaten these populations.

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family CHAPTER

WEST INDIAN SLOTHS AND TWO-TOED TREE SLOTHS

Megalonychidae

Class: Mammalia
Order: Xenarthra
Family: Megalonychidae
Number of species: 2 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The family Megalonychidae consists of one living genus (JEE-nus), *Choloepus*, the two-toed tree sloths. A genus is a group of animals within a family that have some similar characteristics. Megalonychidae also includes eleven or more extinct genera (JEN-uh-rah; the plural of genus). Since the last of the West Indian sloths is dead, scientists have learned about them by studying fossils. From skeletons found in Haiti, researchers determined that the lesser Haitian ground sloth weighed about 50 pounds (23 kilograms) and was as large as a medium-sized dog. It lived on the ground, and probably also spent time in trees.

The lesser Haitian sloth, like the living *Choloepus* species, had long limbs, long claws, and a broad body. While tree sloths have tiny tails or none at all, this extinct sloth had a long tail that touched the ground. The ground sloth could balance with its tail and then stand on two feet to reach into trees.

Within *Choloepus* are two living species, Hoffmann's two-toed sloth and Linné's two-toed sloth (also called the southern two-toed sloth). Both use their limbs to hang upside down in trees. Front limbs are slightly longer than back limbs.

Two-toed sloths have small heads and shaggy fur ranging in color from brown to gray. There is a green tint to sloth fur. The color comes from algae (AL-jee), tiny water plants growing in the sloth's hair. The algae, along with the sloth's natural fur color, camouflage (KAM-uh-flaj) the tree-dweller and keep it hidden from predators, animals that hunt it for food. When hungry, sloths may lick the algae on their fur.

The head and body length of two-toed tree sloths ranges from 2 to 3 feet (60 to 90 centimeters). They weigh from 9 to 18 pounds (4 to 8 kilograms). Sloths have eighteen teeth and 3-inch (7.5-centimeter) claws on each digit of their feet. There are two digits, or toes, on the front feet and three on the back feet. Sloths use their hook-shaped claws to hang from trees and to move.

Sloths may have as many as eight neck vertebrae, or bone segments. Other mammals, including humans, have seven. Two-toed sloths can turn their heads 180 degrees (a half-circle), which gives the sloths a very broad view of their surroundings.

GEOGRAPHIC RANGE

The extinct West Indian sloths lived in the West Indies, in island countries including Haiti. Living two-toed sloth species reside in Bolivia, Brazil, Colombia, Costa Rica, Ecuador, French Guiana, Guyana, Honduras, Nicaragua, Panama, Peru, Suriname, and Venezuela.

HABITAT

The earliest West Indian sloths were arboreal, living in trees. Later species lived both on the ground and in trees. Most two-toed sloths live in trees in the rainforest, an area where there is much rain throughout the year. Sloths also range in cloud forests, forests in high altitude areas that are kept moist by the clouds at that height.

DIET

West Indian sloths probably ate leaves. Two-toed sloths are herbivores, eating mostly leaves and twigs. They also eat fruit. Since sloths move from tree to tree, their diet is as varied as the trees they live in.

BEHAVIOR AND REPRODUCTION

Two-toed sloths are also known as *unau*. Their English name, sloth, means laziness. Sloths' diet of leaves produces little energy, so the animals move slowly to preserve that energy. The lack of energy also results in a low body temperature that ranges from 75° to 95°F (24° to 33°C). This wide range is the most varied of any mammal.

The two-toed tree sloths are solitary and remain alone unless breeding or raising their young. After mating, the male leaves. The female gives birth to one young after about eleven

months. Gestation, the time a mother carries the baby inside her, may vary by species. A female Linné's two-toed sloth in captivity gave birth five months after mating. Mothers of both species keep the offspring with them for almost a year.

Two-toed sloths spend most of their lives upside down. They eat, mate, and sleep in that position. The low-energy animals may sleep fifteen hours or more a day. These sloths are nocturnal, and are most active at night. During that time, they eat and move from one tree to another. Sloths usually change locations by climbing on tree branches and vines. If this is not possible, the sloth will climb down and move to another tree.



SLOW BUT NOT LAZY

Sloth is often understood to mean laziness, an undesirable trait. The word "sloth" is a version of the word "slow," which better describes sloths. Their limbs can't support their bodies, so sloths drag themselves on the ground at the rate of 45 feet (13.7 meters) per minute. In trees, sloths move no more than 125 feet (38 meters) per day.

TWO-TOED TREE SLOTHS AND PEOPLE

From the earliest times, people probably hunted ground sloths for food and used their fur pelts to make clothing. Scientists study West Indian sloth fossils to learn how these animals evolved and changed over thousands of years. Two-toed sloths were occasionally hunted for their meat.

CONSERVATION STATUS

West Indian sloths became extinct two thousand years ago, after people came to the area where they lived. Two-toed sloths lose habitat as forest land is used for lumbering and farms. There is not sufficient information available to determine whether sloths are at risk of extinction, according to the World Conservation Union (IUCN).



Hoffmann's two-toed sloth *(Choloepus hoffmanni)*

SPECIES ACCOUNT

HOFFMAN'S TWO-TOED SLOTH
Choloepus hoffmanni

Physical characteristics: Hoffmann's two-toed sloths are about 2 feet (60 centimeters) long and weigh up to 18 pounds (8 kilograms). They have coarse fur that is tan colored or grayish brown. Hair color is lighter on the face. Algae adds a green color to the shaggy fur.

Geographic range: Hoffman's two-toed sloths live in Bolivia, Brazil, Columbia, Costa Rica, Ecuador, Honduras, Nicaragua, Panama, Peru, and Venezuela.

Habitat: Hoffmann's sloths live in the tree canopies, near the top of trees in rainforests and cloud forests. They often stay in liana

(lee-AN-uh) tangles, twisted vines that provide shelter. The tangle also serves as an alarm. If a predator is approaching, the leaves move and the sloth is alerted about a possible attack.

Diet: Hoffmann's sloths eat leaves, shoots, flowers, and fruit.

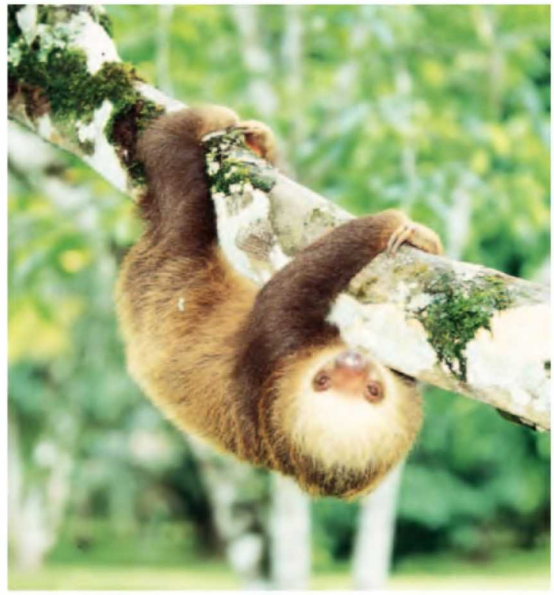
Behavior and reproduction: Two-toed sloths are nocturnal, and do not become active until about an hour after the sun sets. Like other sloths, Hoffmann's sloth is solitary. However, a group of sloths may live in one tree. These groups are formed of only female sloths. Males stay on their own unless they are breeding.

After mating, the female sloth gives birth to one offspring in about eleven and a half months. Newborn sloths weigh from 12 to 16 ounces (340 to 454 grams). The mother carries the young sloth on her stomach. Since the offspring eats the same leaves as its mother, the young sloth develops a taste for those leaves. At the age of five months, the young sloth may feed on its own. However, it remains close to its mother for about a year.

Young and adult sloths use their claws and teeth as defenses against predators like harpy eagles, jaguars, and ocelots.

Hoffman's two-toed sloths and people: Sloths are known to heal quickly, so studying them could help scientists understand how to help people heal more quickly.

Conservation status: There is not enough information to determine whether Hoffmann's sloth faces a threat of extinction, according to IUCN. ■



Hoffmann's two-toed sloth spends its time in the tree canopy, near the top of the trees in rainforests and cloud forests. (Tom Brakefield/Bruce Coleman Inc. Reproduced by permission.)

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THREE-TOED TREE SLOTHS
Bradypodidae

Class: Mammalia
Order: Xenarthra
Family: Bradypodidae
Number of species: 4 species

family CHAPTER

PHYSICAL CHARACTERISTICS

The three-toed tree sloth family consists of four species, groups within the family that share similar characteristics. All species have eighteen peg-like teeth, slim bodies, long limbs, and tiny tails. Front limbs are longer than their back limbs.

Sloths' fur ranges in color from gray to brown. The brown-throated three-toed sloth has brown fur in its throat area and may also have white or red fur. The pale-throated sloth has dark fur on its back and lighter colored fur on its front. The maned sloth has long, black hair on its back and neck. The monk sloth has a tan face.

All species of sloths may have green in their fur. This is caused by algae (AL-jee), tiny water plants growing in sloths' hair. Algae are a food source, and sloths lick their fur when hungry. Sloths live in trees, and the green and brown in their fur helps them blend in with the trees and hide from predators, animals that hunt them for food.

The head and body length of three-toed tree sloths ranges from 15.8 to 30.3 inches (40 to 77 centimeters). Tail length ranges from 1.9 to 3.5 inches (4.7 to 9 centimeters). They weigh from 5.1 to 12.1 pounds (2.3 to 5.5 kilograms). The monk sloth is about 20 percent smaller than other sloth species.

Three-toed tree sloths have three long, hooked claws on the digits (toes) of each foot. Sloths use the claws measuring from 3.2 to 3.9 inches (8 to 10 centimeters) to hang upside down from tree branches. Sloths can see a great distance because sloths can turn their heads 270°. They can turn so far because sloths

FOURTH SLOTH SPECIES FOUND ON ISLAND

The identification of a new three-toed tree sloth species in 2001 was a living lesson in evolution. The monk sloth is also known as the pygmy sloth because it is 20 percent smaller than the three other *Bradypus* species. The new species lives only on Escudo de Veraguas Island, part of the Boca del Toro islands located off the east coast of Panama. Monk sloths live in red mangrove trees and are thought to be polygynous.

have eight or nine neck vertebrae (bone segments)—most mammals, including humans, have seven vertebrae.

GEOGRAPHIC RANGE

Three-toed tree sloths live in Central and South America. Species are found in Mexico, Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, Nicaragua, Panama, Paraguay, Suriname, Venezuela, French Guiana, and Guyana. Monk sloths live only on Escudo de Veraguas Island off the coast of Panama.

HABITAT

Three-toed sloths live primarily in forests. They are located in rainforests, where heavy rain throughout the year produces abundant growth. Some species also live in dry forests and coniferous forests where leaves are green year-round. In addition, sloths have been found living in trees in parks and pastures.

DIET

Three-toed sloths are herbivores and eat the leaves and shoots of trees. Sloths move slowly because their diet of leaves produces little energy. To make up for the lack of energy, sloths have a low body temperature of 86° to 90°F (30° to 34°C).

BEHAVIOR AND REPRODUCTION

Three-toed sloths live upside down. They sleep, mate, and give birth in that position. Sloths are solitary. They are also polygynous (puh-LIH-juh-nus), meaning that males mate with more than one female. Sloths breed at any time during the year. The male leaves after mating, and the female bears usually one young within five to six months. She carries this offspring with her for up to a year. During this time, the young sloth develops a taste for the leaves on which its mother feeds.

Three-toed sloths are active during the day and night. During the day, they position themselves in trees so that the sun warms them. They sleep as much as eighteen hours each day.

Sloths use their claws as hooks to move through trees. They move slowly and travel at most 125 feet (38 meters) in a day. Their on-ground speed is 15 yards (13.7 meters) per minute. In the water, three-toed sloths swim well. Sloths also use their claws as a defense against predators like hawks, harpy eagles, boa constrictors, and anacondas, a type of snake.

THREE-TOED TREE SLOTHS AND PEOPLE

Three-toed sloths can be important to medical research because they heal quickly and do not get infections easily. Scientists are interested to know why this is.

CONSERVATION STATUS

The maned sloth is ranked as Endangered by the World Conservation Union (IUCN). This species faces threats of becoming extinct in the future because habitat is lost as trees are cut down in forests. Hunting also reduces the population.



Brown-throated three-toed sloth *(Bradypus variegatus)*

SPECIES ACCOUNT

BROWN-THROATED THREE-TOED SLOTH
Bradypus variegatus

Physical characteristics: The brown-throated three-toed sloth is named for the brown fur around its throat. Chest fur is also brown, and adult males have a patch of yellow or orange fur on their backs between their shoulder blades. On this patch are thin stripes of black fur. These tree sloths have dark fur "masks" around their eyes and the area where fur covers their ears.

Other fur color varies, depending on where the sloths live and mate. Just as human parents pass along traits like eye color to their children, sloth offspring inherit the coloring of their parents. Brown-throated sloths may have grayish brown or reddish brown hair. While

some have patches of white hair in their fur, other sloths are almost completely white.

These sloths range in length from 1.5 to 2 feet (45 to 60 centimeters) and weigh from 7 to 11 pounds (3 to 5 kilograms). They have tiny tails and three digits with claws on each of their four feet.

Geographic range: Brown-throated tree sloths live in Mexico, throughout Central America, and in parts of South America. They are found in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, Nicaragua, Panama, and Paraguay.

Habitat: Brown-throated sloths adapt to a variety of habitats. They live in rainforests, evergreen forests, parks, and pastures. They may spend up to three days in a tree before moving to another tree.

Diet: Since people frequently saw brown-throated sloths in *Cecropia* (sih-KROPE-ee-uh) trees, it was thought that sloths only fed on these trees. However, the tree-toed sloths eat leaves and twigs from up to thirty different species of trees. Since the sloth learns feeding habits from its mother, it prefers to eat from the same type of tree that its mother does.



The algae growing on the brown throated three-toed sloth's fur helps to keep it hidden in the trees. (Michael P. L. Fogden/ Bruce Coleman Inc. Reproduced by permission.)

Behavior and reproduction: Three-toed sloths are also known as *ai* by the Guarani people of South America. The name comes from the noise made when sloths are in trouble—they make a whistling sound and hiss.

Brown-throated sloths are solitary except while they're breeding. Once they mate, the male leaves. The female gives birth in five to six months. The female typically has one young. However, there have been a few cases of twin births. At birth, a sloth weighs from 0.4 to 0.6 pounds (0.2 to 0.25 kilograms).

The mother sloth carries her baby on her stomach. The offspring nurses for about six weeks. After that, it feeds itself by reaching up for food in the trees where its mother lives. The young sloth also learns its range, the area where it will travel to live and feed. By the age of six months, the sloth keeps one foot on its mother while reaching for food. After about nine months, the mother leaves her offspring to live on its own.

Brown-throated three-toed sloths and people: Sloths are of interest to medical researchers because they heal quickly. The brown-throated sloths have also been hunted as food.

Conservation status: Brown-throated sloths are not threatened. ■

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family CHAPTER

ANTEATERS

Myrmecophagidae

Class: Mammalia
Order: Xenarthra
Family: Myrmecophagidae
Number of species: 4 species

PHYSICAL CHARACTERISTICS

The anteater has a long snout, the part of the face that includes the nose, mouth, and jaw. While the anteater is toothless, it has a long tongue that it uses to catch the ants that make up the major part of its diet. The anteater uses its snout and claws to reach into ant nests. Long hair on the anteater's body is a protection against bites from the ants that they hunt and eat.

The anteater family includes three genera (JEN-uh-rah) and four species. A genus (JEE-nus), the singular of genera, is a group of animals with similar characteristics. Size is the primary difference in each anteater genus, and that difference is represented in the animals' common names.

From head to tail, the giant anteater measures a total of 110 inches (280 centimeters), and weighs from 48 to 88 pounds (22 to 39 kilograms).

Next in size are the tamanduas (tuh-MAN-duh-wahz), which are also known as the "lesser anteaters." Tamandua translates to "ant catcher" in Portuguese. The northern tamandua is brown with black fur on its back, and the southern tamandua's fur color ranges from blond to brown.

The silky anteater is also called the pygmy anteater. The maximum head-to-tail length is 21 inches (52 centimeters). Weight ranges from 6 to 13 ounces (175 to 357 grams).

The silky anteater and tamandua have prehensile tails that they use to grab and hold onto objects like trees. Both species have soft, silky hair in contrast to the coarse (rough) fur of the giant anteater.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

DECIDING WHERE TO EAT

Giant anteaters use their sense of smell to find underground ant nests or termite mounds that can be up to 12 feet (4 meters) above ground. After using their claws to break into the mounds, anteaters use their long tongues to scoop up the insects. They can flick their tongues 150 times a minute into nests.

GEOGRAPHIC RANGE

Anteaters live in Central and South America, in Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, French Guiana, Guatemala, Guyana, Honduras, Nicaragua, Panama, Peru, Suriname, and Venezuela.

HABITAT

Silky anteaters live in trees in rainforests, areas where abundant rainfall produces heavy growth. They also inhabit grassland, areas where there are few trees. Giant anteaters live on the ground and are found mainly on grassland. They also live in wetlands, where the land is flat and wet. They live in moist forests and may live near rainforests. Tamandua live in trees or on the ground. They are found in rainforests, grassland, and dry forests.

DIET

A giant anteater eats about 30,000 ants each day. The tamandua eat about 9,000 in a day, and the silky anteater can eat 5,000 in one day. The giant anteater and tamandua also consume termites.

BEHAVIOR AND REPRODUCTION

All anteaters are believed to be solitary, only meeting up to breed. They are thought to be polygynous (puh-LIH-juh-nus), meaning males mate with more than one female. After giant anteaters mate, the male leaves, but the male silky anteater helps to feed its young while it's in the nest. The gestation period, the amount of time before the female gives birth, is 120 to 150 days for silky anteaters and tamandua. The giant anteater gives birth after about 190 days.

Female anteaters usually give birth to one young. The female's claws are so sharp that she cannot touch her cub. It climbs onto her back and lives there for six to nine months.

Silky anteaters are nocturnal, meaning that they are active at night. The other anteaters are active at night and during the day.

Anteaters use their claws to protect themselves against predators including hawks, mountain lions, and people.

ANTEATERS AND PEOPLE

People sometimes keep anteaters to eliminate ants and termites from their homes, as well as keeping them as pets. In addition, people kill giant anteaters and eat their meat. People kill tamandua to make rope out of the tendon, a cord-like tissue that attaches muscle to bone, in the tail.

CONSERVATION STATUS

Giant anteaters are Vulnerable, facing a high risk of extinction in the wild, according to the World Conservation Union (IUCN). Threats to giant anteaters' survival include the loss of habitat, and lack of food as trees are cut down and insect nests are destroyed. Habitat loss could threaten other anteaters in the future.

SPECIES ACCOUNTS



SILKY ANTEATER
Cyclopes didactylus

Physical characteristics: The hair of silky anteaters is soft like silk. Their fur is gray or gold with a brown stripe on the back. Silky anteaters are 12 to 21 inches (32 to 52 centimeters) long. They have pink noses, tube-shaped muzzles, and long tongues.

These animals are also called two-toed anteaters because the anteaters have two toes on each of their front feet. Each toe has a long, curved claw. There is a smaller claw on each of the four toes on the back feet.

Tail length ranges from 6 to 12 inches (16 to 30 centimeters). Anteaters use their prehensile tails to hold on as they move through trees.



Young silky anteaters stay on their mother's back for six to nine months. (Wolfgang Bayer/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Silky anteaters live in Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Peru, Ecuador, Bolivia, and Trinidad and Tobago.

Habitat: Silky anteaters spend most of their lives in trees, in rainforests where deciduous trees undergo seasonal changes. The anteaters live mainly in kapok (KAY-pock) trees, where pods (dry seed vessels) are fluffy and gold and silver. The anteaters resemble the pods in appearance, helping the animals to hide from predators.

Diet: Silky anteaters eat ants off of leaves and from the insides of tree nests.

Behavior and reproduction: Silky anteaters are nocturnal. After they mate, the female gives birth to one young in 120 to 150 days. She keeps the cub in a nest made of leaves in a hole in a tree trunk. Both parents raise the cub, feeding it and carrying it on their backs.

Silky anteaters are hunted by birds like the harpy eagle and hawk eagle. While anteaters strike out with their claws at predators, their best defense is their appearance, since they blend in with kapok pods.

Silky anteaters and people: Silky anteaters are sometimes hunted by people as a source of meat.

Conservation status: The silky anteater is not a threatened animal. ■



GIANT ANTEATER
Myrmecophaga tridactyla

Physical characteristics: Giant anteaters range in length from 5 feet, 7 inches to 9.1 feet (174 to 280 centimeters). That length includes tails, which are from 25 to 35 inches (64 to 90 centimeters) long. Tail fur is about 16 inches (40.6 centimeters) long.

The anteater's long fur is gray with bands of black and white. The animals have tiny heads, and small eyes and ears. Although their vision is poor, their sense of smell is forty times stronger than that of humans. Giant anteaters have long tube-shaped snouts that they use



Giant anteaters' worm-like tongues are up to 2 feet (0.6 meters) long. They use them to reach into underground ant nests. (Illustration by Joseph E. Trumpey. Reproduced by permission.)

to reach into underground ant nests. Their tongues look like worms and can extend 2 feet (0.6 meters) into nests.

Anteaters' claws are 4 to 6 inches (10 to 15 centimeters) long. Although useful for digging for food, the claws are so long that anteaters have to walk on the side of their feet.

Geographic range: Giant anteaters live in Belize, Guatemala, El Salvador, Nicaragua, Honduras, Costa Rica, Panama, Paraguay, Uruguay, Colombia, Venezuela, Guyana, Suriname, French Guiana, Argentina, Brazil, Ecuador, Peru, and Bolivia.

Habitat: The giant anteater lives on the ground in nearly treeless grasslands and in forests. They also range in wetland swamps.

Diet: Giant anteaters eat ants and termites. They lick wet plants to get water.

Behavior and reproduction: Giant anteaters are usually active during the day. However, they become nocturnal when people are around. They do not climb trees, but are talented swimmers.

Anteaters are solitary unless breeding or raising young. After mating, the male leaves and the female gives birth after 190 days to one cub. Very rarely, twins are born. The cub rides on the mother's back for up to nine months.

Anteaters use their claws to fight predators like jaguars.

Giant anteaters and people: People hunt giant anteaters and kill them for their meat and skin. Giant anteaters may be trapped to keep as pets.

Conservation status: Giant anteaters are Vulnerable, facing a high risk of extinction in the wild. Threats to their survival include loss of habitat as land is developed, in addition, to being hunted and killed by people. ■

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family CHAPTER

ARMADILLOS
Dasypodidae

Class: Mammalia
Order: Xenarthra
Family: Dasypodidae
Number of species: 20 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The smallest armadillo is the pink fairy armadillo, which is 5 to 6 inches (12.7 to 15.2 centimeters) long and weighs 4.2 ounces (120 grams). The largest family member is the giant armadillo, which is 4.9 feet (1.5 meters) long and weighs 66 pounds (30 kilograms).

"Armadillo" is Spanish for "little armored one." The armadillo's protective armor is the turtle-like shell, or carapace, made up of round, bony plates. Between the hard plates on the armadillo are bands of softer skin. Hair grows between the plates. Shell colors include brown, gray, and yellow. Body color is usually gray or brown. Hair is usually white and pale yellow. The pink fairy armadillo has a pink shell and white hair.

Armadillos have bony plates on their backs. Some have plates on their heads, and plates cover some armadillos' tails. The shell protects the armadillo from predators, animals that hunt and kill armadillos for food.

The arrangement of plates and bands in the Dasypodidae family varies within subgroups called genera (JEN-uh-rah) and species. The family is divided into eight genera. A genus (JEE-nus), the singular of genera, is a group that shares similar characteristics. For example, members of the genus *Tolypeutes* are three-banded armadillos.

Armadillos have tiny eyes and poor eyesight. Some species have short snouts, or noses, while others have long, tube-shaped snouts. Armadillos have long tails and short limbs. They

ARMADILLOS ENJOY WATER

People in Texas have seen nine-banded armadillos playing in shallow water. However, armadillos can do more than splash and take mud baths. Armadillos can swim across a body of water or walk underneath water. Armadillos swim by taking in air to inflate their stomachs. Then they float while paddling with their paws. In addition, armadillos can sink and remain on the ground below water for six to ten minutes.

use claws on their limbs to dig for food and to burrow, digging a hole or tunnel for sleeping or hiding from predators.

GEOGRAPHIC RANGE

The nine-banded armadillo is the only armadillo living in the United States. Armadillos live in the South American countries of Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, and Venezuela. Some armadillo species range in Mexico and the Central American countries of Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

HABITAT

Armadillos live in the desert, grassland areas with few trees, and various types of forests, including rainforests, coniferous forests, and deciduous forests. In all habitats, armadillos sleep in burrows, holes, or tunnels they make by burrowing.

DIET

Armadillos eat beetles, ants, termites, and worms. They sometimes eat snakes, frogs, and plants. Their diet is based on what is available in their habitat.

BEHAVIOR AND REPRODUCTION

Armadillos are usually crepuscular (kri-PUS-kyuh-lur), active at dawn and dusk, and nocturnal, active at night. Some species are active during the day, and many species look for food during the day when the weather is colder.

Armadillos are solitary, staying alone until they mate. Armadillos are thought to be polygamous (puh-LIH-gah-mus), having more than one mating partner. After mating, the male leaves, and the female raises the young. Females bear from two to twelve pups, depending on the species.

Predators that hunt armadillos include jaguars, wolves, wild dogs, and alligators. As a defense, the armadillo burrows and

curls up so that little of its soft flesh is exposed. The three-banded armadillo can roll itself into a ball.

ARMADILLOS AND PEOPLE

People have found various uses for armadillos. They have eaten their meat and made purses and baskets out of their shells. Some people keep armadillos as pets.

While sometimes resented for the burrows they dig, armadillos eat insects that cause damage. In addition, doctors study nine-banded armadillos because they are the only mammals besides humans that contract leprosy (LEH-pruh-see), a skin disease. Research of armadillos could help treat people diagnosed with leprosy.

CONSERVATION STATUS

The giant armadillo and pink fairy armadillo are Endangered, facing a very high risk of extinction, or dying out, according to the World Conservation Union (IUCN). The main threat is habitat loss as trees are cut down. The use of land for farming reduces fairy armadillo habitat and development has cut into the amount of giant armadillo habitat. Furthermore, domestic dogs kill small armadillos, and people hunt giant armadillos for their meat.

Four other armadillo species are Vulnerable, facing a high risk of extinction in the wild.



SPECIES ACCOUNTS

NINE-BANDED ARMADILLO
Dasypus novemcinctus

Physical characteristics: Although named nine-banded armadillos, these brown and gray mammals have from seven to eleven bands on their backs. Nine-banded armadillos are about 25.4 inches (64.6 centimeters) long and weigh up to 15 pounds (6.8 kilograms). Tails measure 9.5 to 14.6 inches (24 to 37 centimeters) in length. They have protective armor on their tails and heads, and have visible ears and small eyes. Nine-banded armadillos have strong claws, a powerful sense of hearing, and poor vision.



The nine-banded armadillo is the only armadillo that lives in the United States. (Jeff Foott/Bruce Coleman Inc. Reproduced by permission.)

Also known as common long-nosed armadillos, nine-banded armadillos use their long noses to smell ants and other prey hunted for food.

Geographic range: Nine-banded armadillos live in the United States, Mexico, Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, French Guiana, Grenada, Guatemala, Guyana, Honduras, Nicaragua, Panama, Paraguay, and Peru.

Habitat: Nine-banded armadillos live in coniferous forests, and also range in grassland areas like prairies, where there are fewer trees.

Diet: These armadillos eat ants, beetles, other insects, snails, and worms. They also eat larvae (LAR-vee), the early, often worm-like forms of insects, such as a caterpillar that later changes into a butterfly. They sometimes eat fruit.

Behavior and reproduction: Nine-banded armadillos are crepuscular and nocturnal, but may also be active in the daytime during the winter. They are solitary unless breeding.

The female can give birth only once a year. She usually mates with one male, but males may mate with other females. After the male fertilizes the female's egg, it takes four months or longer before the egg is implanted (attached) in the uterus. After implantation, the female gives birth in about two months to four young.

When frightened, armadillos can jump 3 to 4 feet (0.9 to 1.2 meters) in the air. This action can scare predators like dogs, coyotes, wildcats, and bears. Cars are a threat to armadillos; a vehicle may pass over an armadillo without hurting it, but if the motion startles the armadillo, it may jump, hit the underside of the car, and die.

Nine-banded armadillos and people: The nine-banded armadillo became the Texas state mascot in 1981. In the 1930s, people ate armadillos during the Great Depression, a time of high unemployment. People called armadillos "Hoover hogs" and "Texas turkeys." The first name referred to President Herbert Hoover, who people blamed for the Depression. Some people still eat armadillo—barbecuing the meat or cooking armadillo chili. Texans began holding armadillo races during the 1970s. Researchers also study the armadillo to develop treatments for leprosy.

Conservation status: Nine-banded armadillos are not threatened. ■



PINK FAIRY ARMADILLO
Chlamyphorus truncatus

Physical characteristics: Pink fairy armadillos are approximately 5.9 inches (15 centimeters) long and weigh 4.2 ounces (120 grams). The armadillo has a pink shell and thick, white fur on its sides. The shell is attached to the backbone and covers the top of the armadillo's head. The shell extends on the back but doesn't cover the armadillo's rear.

Pink fairy armadillos have small eyes and ears, and pointed noses. They cannot move their tail up and down, so the tail drags on the ground.



Pink fairy armadillos live in the central grasslands of Argentina. They dig their burrows near ant nests. (© N. Smythe/Photo Researchers, Inc. Reproduced by permission.)

Geographic range: Pink fairy armadillos are found in Argentina.

Habitat: Pink fairy armadillos live in central Argentina in grassland and sandy plains where thorn bushes and cacti (KACK-tie, or KACK-tee; plural of cactus) grow. The armadillos often dig burrows in dry soil near ant nests. When rain wets the ground where they live, armadillos move to another place.

Diet: Pink fairy armadillos eat ants most of the time. Their diet also includes snails, worms, roots, and other plant material. The armadillos sometimes eat carrion, the flesh of dead animals.

Behavior and reproduction: Pink fairy armadillos are nocturnal and are strong diggers. They eat at night and spend the day in their burrows. The armadillos are solitary until they mate. They are thought to be polygamous. The female gives birth to one young. The pup's shell does not become completely hard until it is fully grown.

Pink fairy armadillos and people: There is no known relationship between pink fairy armadillos and people.

Conservation status: Pink fairy armadillos are Endangered, facing a very high risk of extinction in the wild, and the major threat to their survival is agriculture. Habitat is lost as land is plowed for farming. Another threat comes from domestic dogs that kill the tiny armadillos. ■

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INSECTIVORES

Insectivora

Class: Mammalia

Order: Insectivora

Number of families: 7 families; 1 is extinct

order

CHAPTER

PHYSICAL CHARACTERISTICS

Insectivora is the third largest order of mammals after the rodents and bats. Most of the insectivores are smaller than a child's hand, and shrews are some of the smallest mammals known. A few, however, reach a foot long (30 centimeters) or more. The largest insectivore is the moonrat, which stretches 24 inches (60 centimeters) long from the tip of its snout to the end of its tail.

A typical insectivore is covered with smooth fur, although some, like the hedgehogs, have spines. They usually have five clawed fingers or toes at the end of each of its four, short legs, but the tenrecs and golden moles have only four claws. Their skulls are small, long, and flat, however the furry coat may make the head appear larger. They also have tiny, often unnoticeable ears and eyes. Insectivores have an excellent sense of smell that is assisted by their snouts, which may be long and flexible, or short and stout. Many insectivores have rows of stiff sensory hairs, called vibrissae (vuh-BRIS-ee), on their snouts, tails, ears, and sometimes feet. Beyond this general description, these animals vary widely.

GEOGRAPHIC RANGE

Insectivores occur worldwide except Antarctica, Australia, and northern South America.

HABITAT

Insectivores live primarily on land, typically at ground level or beneath it. A few species, like the Asiatic water shrews, are

phylum
class
subclass
order
monotypic order
suborder
family

aquatic. Insectivores can survive in a wide range of habitats from tropical rainforests to temperate marshes, from thick forests to open fields, and from sea-level deserts to mountainsides up to 14,760 feet (4,500 meters). Some fossorial, underground, species, like the star-nosed mole, prefer to burrow in the wet soil around freshwater marshes and occasionally venture into somewhat salty, brackish, waters, while others, like the eastern mole, use enlarged, shovel-like forefeet to tunnel through the drier soils of forests and fields. The gymnures prefer hiding places among tree roots or fallen branches, sometimes even inside termite mounds. Shrews, which comprise almost three-quarters of all species in the order, spend much of their time in shallow depressions that they dig beneath some form of shelter, including rocks, logs, and fallen leaves.

DIET

As the name of the order implies, most of these animals primarily eat insects, although many will also eat other invertebrates, animals without a backbone. In addition to insects, many will also eat leaves, tender shoots, seeds, fruits, and other plant materials. Some, like hedgehogs and tenrecs, prefer to dine on invertebrates other than insects, such as snails, clams, and worms, or on vertebrate animals, animals with a backbone, like small snakes or lizards, fish, frogs, and bird eggs.

Many insectivores require a lot of energy, so they must eat frequently. Some, like the long-tailed shrew, spend almost every waking moment eating in order to meet their energy needs.

BEHAVIOR AND REPRODUCTION

These active little mammals prefer to remain out of sight, whether that is underground in tunnels, beneath leaf litter or brush piles, under rocks, or in some species, in the water. Typically nocturnal, active at night, although a few are active during the day. Insectivores have poor eyesight and they must rely on other senses. Sensory hairs, which are located on various parts of their bodies, heighten their sense of touch and make them extremely sensitive to their surroundings. Their hearing is also good, and the animals communicate with others of their own species and with other animals through a variety of squeaks, hisses, whistles, and buzzes. Insectivores have a keen sense of smell, which is important in locating and identifying prey, picking up the scent markings that border the territories of other insectivores, and in

finding mates during the reproductive season. The moles and desmans have sensory receptors called Elmer's organs on their snouts, to identify and possibly to locate food items.

Insectivores' best defense against predators, animals that hunt them for food, is to remain hidden, so that predators are more likely to overlook them. Some, however, use other defense tactics. Hedgehogs, for example, can erect their spines to present an intimidating barrier to attacker. Some shrews and solenodons actually produce venom that they transfer with their bites in order to capture prey. Many species, especially shrews, will also attack members of their own species—not for food, but to protect territory. When placed in a confined space, shrews will typically charge one another, sometimes locking together and inflicting tearing bites until one dies.

Insectivores are typically active all year long, even in climates where temperatures in the winter drop below freezing. In colder areas of North America, for example, shrews are sometimes seen scurrying across the snow. A few, like some hedgehogs and tenrecs, hibernate, a dormant state where the animal does not eat or pass wastes, or go into a hibernation-like state when temperatures dip too low or when food becomes scarce.

For many insectivores, details about their reproductive behavior and their early development are unavailable. In general, however, individual insectivores remain alone all year, except during the breeding season. Even then, males and females come together for a very short time, and the male leaves the female well before she has her offspring. Depending on the species, an insectivore may mate once a year with many offspring, as the tenrecs do, or several times a year with fewer offspring per litter, which is common in many moles. Often the young of several nearby females will have the same father. The young of all species are born fully developed, with some becoming independent of their mothers within a few weeks, while others rely on their mother for food and protection for several months. In an unusual display of mother-and-child interplay, the mother in a few shrew species will lead the family in a caravan, with one youngster gripping the tip of her tail with its teeth. A second youngster does the same to the first youngster and on down the line, until the entire three to seven member family is all linked together in a row.

Most insectivores live only about a year, but a few, like the solenodons, may live several years in the wild.

ARE THEY ALL INSECTIVORES?

Scientists are beginning to rethink exactly which animals should be placed in the order Insectivora. Many scientists believe that two of the families traditionally placed under the Insectivora should fall under a separate order known as Afrotheria. Under this arrangement, the tenrecs and golden moles would be classified in Afrotheria with such animals as elephants and aardvarks. While this controversy continues, field biologists are still finding new species, especially in the tropics of Africa where the small, hidden shrews are particularly difficult to find.

INSECTIVORES AND PEOPLE

For the most part, people rarely see insectivores and are not affected by them. A few, like the eastern mole, make above-ground mounds when they tunnel, which are visible and may present a source of frustration to people who want to maintain a perfect lawn. The majority of insectivores are small and inactive during the day, which makes them poor pets. Hedgehogs, however, are larger, easy to keep, and have become quite popular in homes around the world.

CONSERVATION STATUS

Dozens of insectivores around the world are threatened, according to the World Conservation Union (IUCN). Thirty-six are listed as Critically Endangered, facing an extremely high risk of extinction in the wild. Forty-five are Endangered, facing a very high risk of extinction in the wild, and eighty-eight are Vulnerable, facing a high risk of extinction in the wild. In the United States, only the Buena Vista Lake ornate shrew is listed as Endangered by the U.S. Fish and Wildlife Service.

Habitat destruction has proven to be the biggest danger to these species. As humans clear forests, farm more land, and use toxic chemicals to control plants and animals, populations of these small animals can be destroyed.

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European Hedgehog Research Group (EHRG). Phone: +47 370 36 509. Fax: +47 370 35 050. E-mail: bsjohans@stud.hia.no Web site: http://www.ngo.grida.no/ngo/hedgehog/.

GYMNURES AND HEDGEHOGS
Erinaceidae

Class: Mammalia
Order: Insectivora
Family: Erinaceidae
Number of species: 21 species

family
CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Gymnures and hedgehogs are generally small, pointy-snouted animals covered with fur, or in the case of hedgehogs, with spines. Each of their four, short legs ends in a flat, walking foot with five toes. In a few African hedgehogs, the big toe is small or nearly nonexistent (not there).

Overall, this group ranges from 4 to 18 inches (10 to 46 centimeters) in body length plus tails from 0.4 to 12 inches (1 to 30 centimeters), and weighs from 0.5 ounces to 4.4 pounds (15 to 2,000 grams). Most members of this group have bodies about 4 to 6 inches (10 to 15 centimeters) long, and short, sometimes barely noticeable tails. A few, however, have longer tails and larger bodies. For example, the Madagascar hedgehog has a grasping tail that can be more than two times the length of its body. The Malayan moonrat is the largest member of this family. With a body that can reach 16 to 18 inches (41 to 46 centimeters) long and a tail that stretches up to 8 to 12 inches (20 to 30 centimeters) long, this animal can measure more than 2 feet (0.6 meters) long from snout to tail tip and weigh up to 4.4 pounds (2 kilograms).

GEOGRAPHIC RANGE

Gymnures and hedgehogs are found in parts of Africa, Eurasia, central Asia, and southeast Asia. New Zealand is also home to a healthy population introduced by humans. Hedgehogs tend toward the cooler climates, while gymnures and moonrats demand tropical and subtropical areas.

HABITAT

Members of this family thrive in a number of varying habitats on land, usually living and feeding at ground level and, in some species, in burrows. A few, like the moonrat, may take an occasional swim in the water. Gymnures prefer humid forests, while hedgehogs can live in a dry and rocky desert, a busy city park, or a mountainside meadow. In fact, hedgehogs can survive almost anywhere they can find food during their nighttime hunts and sheltered hideaways for their daytime slumber.

DIET

The diet of hedgehogs and gymnures can include a variety of things, but they mostly eat insects, spiders, worms and other invertebrates, animals without backbones. If they are big enough to kill a reptile, amphibian, or a small mammal, they will do so once in a while. Sometimes they will also eat fungi or fruit. In addition, hedgehogs often prey on birds' eggs. They spend most of their active hours either looking for food or eating it.

BEHAVIOR AND REPRODUCTION

Most members of this family are nocturnal, active only at night. Some species, like the lesser gymnure, may venture out in the daytime if they become hungry enough, but they usually spend their days resting in a sheltered spot. In the winter, many cold-climate species have the ability to slow their body processes, and essentially enter a deep sleep known as hibernation until the weather warms. The European hedgehog sometimes hibernates for six or seven months, surviving on body fat it stored when it was active earlier in the year. Warm-climate species do not have to contend with bitter winters, but they do sometimes face extended dry periods, or droughts, when food can become scarce. During droughts, many will enter a deep sleep, called estivation (est-ih-VAY-shun), which is similar to hibernation.

Adult gymnures and hedgehogs typically live alone. They protect a territory by marking its edges with often-powerful scents and by threatening other adults to stay away with raspy hisses. If a predator approaches, hedgehogs take on a defensive posture by rolling into a ball and standing their spines on end—turning themselves into living pin cushions. Gymnures have no spines for protection and instead try to stay out of sight of predators as often as possible, hiding beneath piles of branches or leaves, among tree roots, or sometimes in burrows dug by other animals.

AN ODD HEDGEHOG BEHAVIOR

A particularly odd behavior among the hedgehogs—and one that is still not fully understood—is called "self-anointing." It happens when a hedgehog comes across a powerful odor. The animal stops what it is doing, and begins licking and sometimes even chewing the source of the odor until it starts to foam at the mouth. Next, it smears the foam over its body spines with small backward jerks of its head and flicks of its tongue. Although many people have seen hedgehogs perform this ritual, scientists still are not sure exactly why animals do it.

Adult gymnures and hedgehogs give up their solitary existence during mating periods, and the females welcome males with the same types of hisses they used earlier in the year to scare them away from their territories. Because of their spines, hedgehog mating can be tricky. To accomplish it, the female smoothes down her spines, so the male can approach without being hurt. After mating, the male leaves and returns to his solitary life. Females, on the other hand, must care for the two to five, blind and helpless babies now living in the nest. The young stay with the mother for five to seven weeks until they are ready to survive on their own.

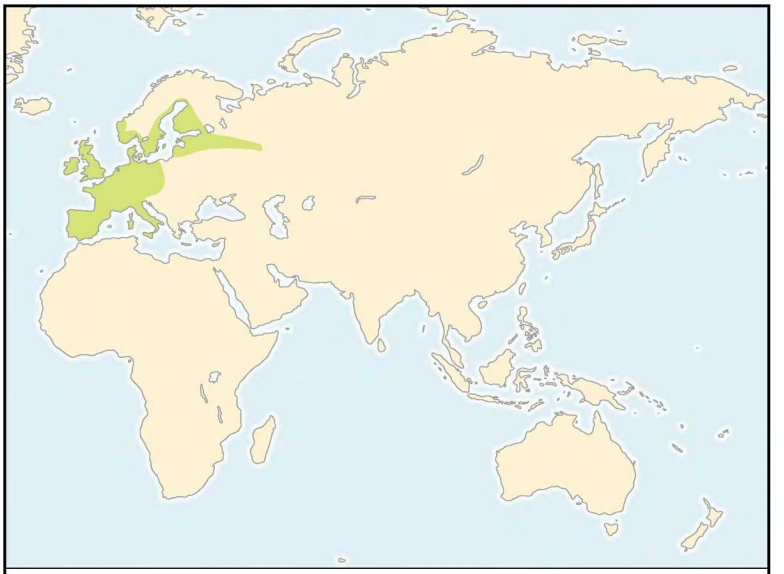
GYMNURES, HEDGEHOGS, AND PEOPLE

The most intense relationships between people and this family surround the hedgehogs. Gardeners often consider a hedgehog in the yard a helpful addition that will suppress insect and spider numbers. On the other hand, poultry farmers dislike hedgehogs, which are quite fond of eggs and will occasionally eat a chick.

Superstitions in some cultures view a hedgehog as a good omen, and some folk remedies call for the use of blood or some other part of a hedgehog. Historically, hedgehogs have also been killed for their meat, and for their spines to use to comb newly cut sheep wool.

CONSERVATION STATUS

Seven species of this family are at some risk, according to the World Conservation Union (IUCN). The dwarf gymnure is Critically Endangered, facing an extremely high risk of extinction in the wild. In addition, three species are Endangered, facing a very high risk of extinction in the wild, and two species are Vulnerable, facing a high risk of extinction in the wild. In addition, one is considered Near Threatened, not currently threatened, but may become so. Many of these species live in small areas, and human activities like logging and new farms are destroying their limited habitats.



Western European hedgehog *(Erinaceus europaeus)*

WESTERN EUROPEAN HEDGEHOG
Erinaceus europaeus

Physical characteristics: Western European hedgehogs are round- to oval-shaped and mostly brown. Their most recognizable feature is the layer of light-yellow and brown spines on their backs. They have small, but noticeable rounded ears, fairly long snouts, and dark, beady eyes. Their body ranges from 9 to 11 inches (23 to 28 centimeters) long with short tails of 0.5 to 1.2 inches (1.5 to 3 centimeters) long. The adult weight can vary from 14 to 42 ounces (400 to 1,200 grams).

Geographic range: Western European hedgehogs are found in Western and central Europe from Scandinavia, northern European Russia, Britain and Ireland to Italy and the Mediterranean islands. A population introduced by humans in New Zealand is also thriving.

Habitat: People most frequently see western European hedgehogs in farmlands, parks and gardens, but the animals are also quite common in forests and meadows where they are less likely to encounter humans.

Diet: Active at night, these hedgehogs primarily eat insects, worms, spiders and other invertebrates, but they will also prey on eggs and



The western European hedgehog eats mainly insects, spiders, and worms, which makes it a welcome visitor in most yards. (© Hans Reinhard/OKAPIA/ Photo Researchers, Inc. Reproduced by permission.)

fruit. In captivity or when otherwise fed by humans, they will eat just about anything from dog food to bread.

Behavior and reproduction: They do not set up territories like some other insectivores, but adults still live alone. Those in cooler climates survive the winter by hibernating for four to seven months. Mating occurs from spring to summer, and females usually have four to six babies, although they sometimes have as few as two or as many as ten at a time. The babies are blind, naked, and helpless, and remain in the mother's nest for no more than six weeks, then they are pushed out to face the world on their own.

Western European hedgehogs and people: Hedgehogs are becoming increasingly popular as pets. Most human contact with the animals, however, comes from positive encounters in the yard. Homeowners generally welcome the hedgehogs, which have a taste for insects and spiders that homeowners view as pests.

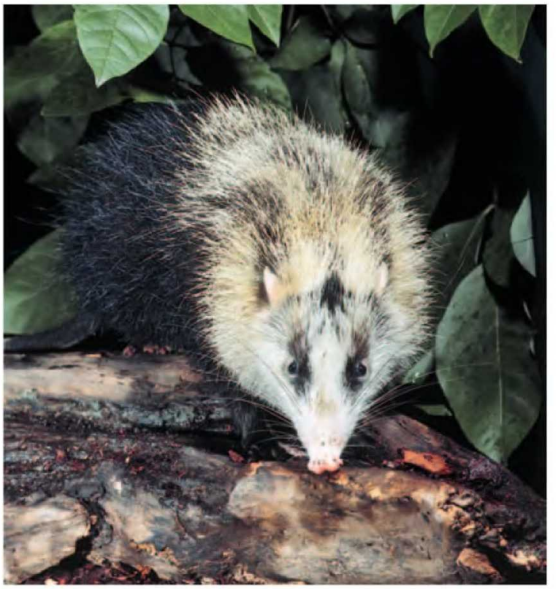
Conservation status: Western European hedgehogs are not threatened. ■



Malayan moonrat *(Echinosorex gymnura)*

MALAYAN MOONRAT
Echinosorex gymnura

Physical characteristics: Malayan moonrats have long and narrow bodies, coarse hair, pointy snouts and long, almost naked tails giving them an appearance that resembles a Virginia opossum. They have mostly black fur toward the back and white fur toward the head, although they may have quite large, black patches on the head. Sometimes they are completely white. Malayan moonrats range from 10 to 18 inches (26 to 46 centimeters) in body length, plus a 6.5- to 12-inch (16.5- to 30-centimeter) tail. Adult weight varies from about 1 to 3 pounds (0.45 to 1.4 kilograms), but can sometimes reach 4.4 pounds (2 kilograms). Males are generally a bit smaller than females.



Malayan moonrats search at night for worms, insects, crabs, and other invertebrates found in moist areas. (© N. Smythe/Photo Researchers, Inc. Reproduced by permission.)

Geographic range: Malayan moonrats are found on the Malay Peninsula, Sumatra, and Borneo.

Habitat: Moist forests, mangrove swamps, and wet farmlands are the typical habitats of Malayan moonrats. Scientists believe the animals spend at least part of their time in the water.

Diet: An animal of the night, Malayan moonrats eat worms, insects, crabs, and other invertebrates found in moist areas. They will also eat fruit, and occasionally frogs or fish.

Behavior and reproduction: When they are not looking for food at night, Malayan moonrats rest in hiding places among tree roots, inside hollow logs, or in other tight spaces. Adults live alone. They release strong odors to mark the edges of their territories and warn other moonrats to stay away with threatening hisses. They also release odors to ward off predators. When they are preparing to have young, they will make nests mostly from leaves. Females usually have two babies at a time, either once or twice a year. Scientists know little more about moonrat adults or young.

Malayan moonrats and people: Generally speaking, Malayan moonrats leave people alone, and people leave them alone.

Conservation status: Malayan moonrats are not threatened. ■

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GOLDEN MOLES
Chrysochloridae

Class: Mammalia
Order: Insectivora
Family: Chrysochloridae
Number of species: 21 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Generally, a golden mole looks like little more than a round to oblong lump of fur with a tiny, naked nose poking out at one end. Adults range from 2.7 to 9 inches (7 to 23.5 centimeters) long, and 0.5 to 17.6 ounces (16 to 500 grams). The fur is generally brown to gray, but it shines golden, bronze, and even purple and blue when the light hits it just right. Their small ears and tails are typically buried under their silky, thick fur, and their eyes are covered with skin beneath the fur. They have four short legs, the front two of which often have enlarged claws they use for digging. Their back legs are more slender than their powerful forelimbs and their back feet have webbing between the toes—a big help when kicking away the soil they've just dug. One species, the yellow golden mole, can tunnel through the soil so quickly and efficiently that it is sometimes called a "sand swimmer." Many of the other species, like the Grant's desert golden mole, also almost appear to be swimming when they travel through the loose sand in dunes.

GEOGRAPHIC RANGE

The southern half of Africa.

HABITAT

Golden moles typically live much of their lives underground in shallow burrows they dig themselves. The burrows are often visible above ground as slight ridges in the soil. Many golden moles prefer loose soil that is easily moved by their

hollow claws. Some species, such as the rough-haired golden mole, make tunnels to connect chambers within mounds of soil.

DIET

Because their eyes are buried beneath the skin, golden moles are blind and they must rely on other senses, like touch and smell, to get around and to find prey. Food items include ants, termites, beetles, earthworms, and other invertebrates (animals without backbones) that they hunt at night. Sometimes, they will feel above-ground vibrations, then burst out of their shallow tunnels to grab an insect on a blade of grass or a lizard moving along the ground. De Winton's golden mole is noted for its ability to kill a lizard with its enlarged front claws. The typical golden mole will alternate between periods of activity and rest throughout the night, spending a considerably greater amount of time resting. Most remain active only at night, but a few, like Sclater's golden moles, stay busy digging through the soil and looking for food both day and night.

When golden moles are confronted with a span of extreme temperatures, lengthy dry periods, and/or a lack of prey, golden moles can become inactive for a few days—a state called torpor—to conserve their energy until conditions become more favorable.

BEHAVIOR AND REPRODUCTION

Like most other insectivores, golden moles live alone as adults. During the spring breeding season, males and females will come together, but only briefly. Although much of their behavior is still unknown, some mating rituals have been observed in which the male nods its head, stomps its feet, and chases the female. The two also communicate through scents that ooze out of body glands, and by making chirping and squeaking noises at one another. Females give birth to their young in a grassy nest built within a tunnel that may be several feet (a few meters) below ground. Each brood commonly has one or two, sometimes three young. The mother recognizes her offspring by their scent. She raises them only until they are able to survive on their own, and then she kicks them out and lives alone again until the next mating season.



NOT ALWAYS LONERS

Although adult golden moles are typically described as loners that live a solitary life all year, except for mating season, the adults of one species are a little more friendly to one another. Among the species known as large golden moles, several adults may share a single burrow system in the winter months. This species, which is Endangered, lives in South Africa.

GOLDEN MOLES AND PEOPLE

Golden moles are sometimes seen as beneficial, and other times as pests. Because they eat insects that may be destructive to vegetation, many people welcome their presence. At the same time, farmers, gardeners and homeowners may prefer that the moles and their noticeable burrows stay out of the crops and the lawn. In some cases, people kill and skin the moles for their shiny fur.

CONSERVATION STATUS

Eleven species of golden mole are at some risk, according to the World Conservation Union (IUCN). The Red List describes four as Critically Endangered, facing an extremely high risk of extinction, dying out; one as Endangered, facing a very high risk of extinction; and six as Vulnerable, facing a high risk of extinction. These golden moles exist in limited areas and those areas are becoming ever smaller through habitat destruction due to human activities, like farming, mining, and lumbering.



Grant's desert golden mole *(Eremitalpa granti)*

GRANT'S DESERT GOLDEN MOLE
Eremitalpa granti

SPECIES ACCOUNT

Physical characteristics: One of the smallest golden moles, this species reaches only about 3.0 to 3.3 inches (7.6 to 8.8 centimeters) in body length and weighs 0.5 to 1.0 ounces (15 to 32 grams). On its back, it has long, shiny, light-gray fur that is sometimes tinged with yellow. Its underside fur is lighter and yellowish. Grant's desert golden mole has three long claws on each forelimb, although they aren't as hefty as the claws in some other golden mole species.

Geographic range: South Africa and the Namib Desert in extreme southwestern Africa.

Habitat: Coastal sand dunes, typically areas with some dune grass, are its preferred habitat.



Grant's desert golden mole prefers to live in coastal sand dunes, where it searches for food at night and spends the days in shallow burrows. (Illustration by Jacqueline Mahannah. Reproduced by permission.)

Diet: Its diet consists of various invertebrates, such as spiders, termites, beetles, and ants, that it hunts at night. When the opportunity presents itself, these moles will also eat kill and eat lizards, some of which may be as long as the mole.

Behavior and reproduction: Active at night, it will venture above ground in search of prey, sometimes covering as much as 3.6 miles (5.8 kilometers) in a single twenty-four-hour period. It spends its days in shallow burrows. Interestingly, this species doesn't maintain a constant body temperature during the day. Instead, its body becomes cooler or warmer with the temperature of the sand around it. In breeding season, the females will crawl into deeper tunnels that may lie 6 feet (1.8 meters) or more beneath the surface, where it gives birth to and raises typically one or two offspring. As soon as the youngsters are old enough to survive alone, the mother forces them out of her nest. Although details about behavior are lacking, scientists believe that males may mate with more than one female, and therefore father numerous young with different females. Outside of breeding season, adult moles live alone and have little contact with other adults.

Grant's desert golden moles and people: Since this is a desert species that lives in sand dunes away from most people, it has little impact on humans.

Conservation status: The IUCN lists the Grant's golden mole as Vulnerable. Dune removal and diamond mining are destroying the

habitat within the limited range of this animal, but efforts are under way to create a national park, which will protect at least part of the mole's range. ■

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TENRECS
Tenrecidae

Class: Mammalia
Order: Insectivora
Family: Tenrecidae
Number of species: 27 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Rat- or shrew-like in general appearance, tenrecs vary greatly in body size, tail length, and color. One of the most consistent features is the long, pointy snout that is typically adorned with long whiskers. The smallest tenrecs have head and body lengths of just 2 inches (5.5 centimeters) and weights of 0.14 ounces (4 grams), while the largest can reach 14 inches (35.7 centimeters) and weigh up to 44 pounds (2 kilograms). Tails vary from tiny, unnoticeable stubs to long and very obvious structures stretching up to three times the length of the body. Some species have soft yellow to brown fur, and a few have vivid black-and-white or yellow-and-black fur patterns. Adults in several species have sharp spines that are quite effective in thwarting attacks by would-be predators. Some youngsters, like the common tenrec, have blunt spines that produce a sound when rubbed together.

GEOGRAPHIC RANGE

Tenrecs live in Madagascar and western central Africa. Introduced to Comoros, Mascarenes, and Seychelles, which are islands in the Indian Ocean.

HABITAT

Most species live in humid forests or in grasslands. A few species can survive well in marshy areas, drier forests, or agricultural fields. Aquatic tenrecs and otter shrews spend much of their time in or near freshwater streams.

DIET

The tenrec diet varies considerably among species. For the most part, the land-living tenrecs eat insects, worms, and other invertebrates (animals without backbones). A few will also devour baby mice and other small vertebrates (animals with backbones), and some will even munch on dead animals they come across. The tenrecs that live in marshes, near streams, or in the water dine on other water-loving creatures, like aquatic insects, frogs, fishes, mollusks, and crabs.



TOGETHERNESS AMONG TENRECS

Usually, less than a handful of different mammals from the same group live together within a small area. With tenrecs, it is different. In one small, forested area in Madagascar, sixteen different species of tenrecs share the same space. This type of high diversity among one type of animal is extremely rare, and may, in fact, represent the greatest concentration of such similar animals found anywhere in the world.

BEHAVIOR AND REPRODUCTION

Scientists have few details about many species of tenrecs, partly because the animals are relatively small and are typically only active at night. They rest during the daytime, often in tunnels that they construct. Some, like the Ruwenzori otter shrew, sleep on beds of grass in the tunnels. During their daily rest, several species are known to enter a state of deep sleep, called torpor, which allows them to conserve their energy. One species, known as the large-eared tenrec, is particularly tuned in to the outdoor temperature, and its internal body temperature quite closely matches the outdoor temperature. When weather becomes cool, its body temperature takes a similar dip, and the animal may enter torpor. In long, dry periods, some species take an extended deep sleep, called estivation (est-ih-VAY-shun), during which the heart rate and body temperature fall and the animal needs to burn far less energy to stay alive. Estivation may last days or even weeks. Tenrecs that estivate for longer periods will frequently plug the openings of their burrows in preparation for the extended sleep.

Adults likely spend most of their lives alone, coming together only for mating. Sometime, males will remain with the female while she's pregnant, a span that typically lasts about two months. A few reports suggest that some male-female pairs may remain together during other times of the year, too. Overall, scientists know little about mating rituals in most species, but they have observed some behaviors. In the hedgehog tenrec, for example, the females give off an odor during mating season that causes a milky substance to flow from glands near the eyes

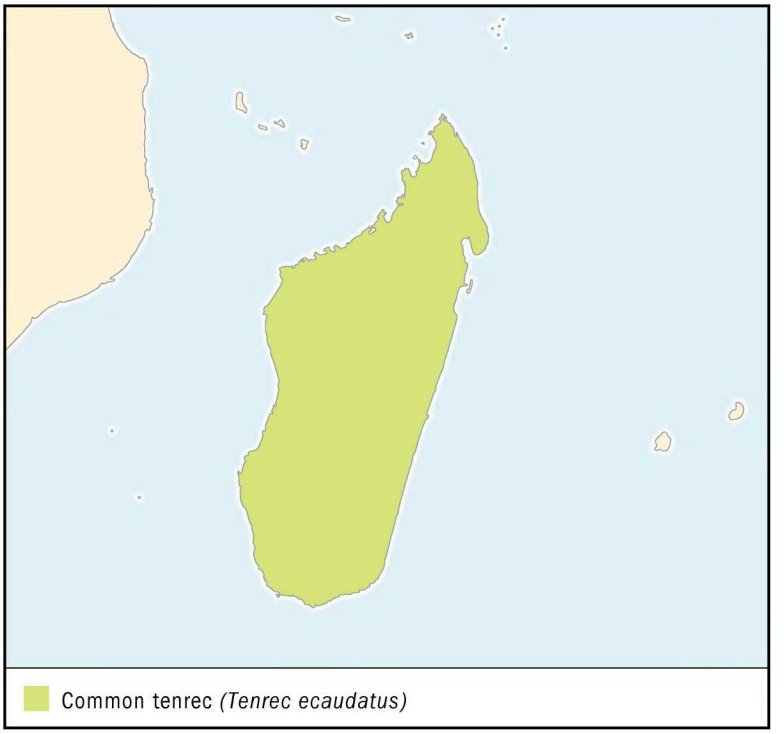
of males. Each year, females have one litter of one to thirty-two babies, depending on the species. The young, most of which are born blind and naked, apparently stay with the mother for at least four or five weeks, and possibly more.

TENRECS AND PEOPLE

Of all the tenrecs, the most popular is perhaps the greater hedgehog tenrec, which has become quite a popular pet. In Madagascar, which has a thriving tenrec community, humans have traditionally viewed the animals as a source of prime meat, and enthusiastically hunted them. Humans also hunt the giant otter shrew for its pelt.

CONSERVATION STATUS

Ten species are at risk, according to the Red List of the World Conservation Union (IUCN). One, the tree shrew tenrec, is listed as Critically Endangered, facing an extremely high risk of extinction, or dying out; six are Endangered, facing a very high risk of extinction; and three are listed as Vulnerable, facing a high risk of extinction. Many of these species exist in small areas and are threatened by human activities that are changing their habitat. For example, the aquatic tenrec is an Endangered species that is found in only a few spots in Madagascar. It needs clean rivers to survive, but agriculture and deforestation are either eliminating the rivers or allowing silt to muddy up the waters.



COMMON TENREC
Tenrec ecaudatus

Physical characteristics: A grayish brown to reddish brown animal with long, coarse hairs and a lighter-colored belly. It has small, beady eyes, small ears, a long and pointed snout with lengthy whiskers, a short and unnoticeable tail, and front legs that are a bit longer than the hind legs. Youngsters have streaked fur and two rows of blunt spines down their backs, but the stripes disappear when they get older, and the spines are covered with longer fur. Adults weigh about 42 to 70 ounces (1.2 to 2 kilograms), and are about 10.5 to 15.3 inches (26 to 39 centimeters) from nose to rump.

Geographic range: Common tenrecs live in Madagascar. Introduced populations also live on the islands of Comoros, Mascarenes, and Seychelles in the Indian Ocean.

Habitat: Common tenrecs usually live in forested areas with a nearby water source such as a river or paddy field.



Common tenrec adults live alone for most of the year, but males and females come together in the spring to mate. (Illustration by Gillian Harris. Reproduced by permission.)

Diet: Insects, earthworms, and other invertebrates are their primary food, but they will also eat small vertebrate animals, fruit, and plant roots on occasion.

Behavior and reproduction: Adults live alone for most of the year, spending days sleeping in the burrows they make, and nights on the prowl for food. In the dry winter months, food can become quite scarce, triggering the tenrecs to enter a state of deep sleep, called estivation, for up to several months. They mate in the spring, and females give birth to a single litter of twelve to thirty-two babies in the summer, which falls in December and January for these creatures of the Southern Hemisphere. The mother nurses her young for almost a month, then takes them out with her to search for insects and other food items. By the time they are two to two-and-a-half-months old, the youngsters leave the mother to live on their own.

Common tenrecs and people: Humans in Madagascar hunt this species for meat, which is considered a delicacy.

Conservation status: The common tenrec is not considered to be threatened. ■



YELLOW-STREAKED TENREC
Hemicentetes semispinosus

Physical characteristics: A small, black tenrec with a mane of longer golden-yellow to whitish hairs as well as yellow to whitish stripes down the center and on either side of its face. It has a lighter-colored belly, and its back sports scattered, long, yellowish spines. This species has small eyes, black ears, and a long, pink snout, but no noticeable tail. The yellow-streaked tenrec is about 6 to 7.5 inches (15 to 19 centimeters) long, and weighs 3 to 7 ounces (90 to 220 grams).

Geographic range: Madagascar.



Yellow-streaked tenrecs may live alone (like most other tenrecs), or they may share their burrows with up to twenty-four family members. (© H. Uible/Photo Researchers, Inc. Reproduced by permission.)

Habitat: This is a burrowing species that lives in humid forests, as well as shrubby areas, frequently near a water source.

Diet: The yellow-streaked tenrec prefers earthworms but will also eat other invertebrates.

Behavior and reproduction: Unlike most other tenrecs, which are loners much of the year, yellow-streaked tenrecs can either live alone or share their burrows with up to two dozen members of their families, including parents, grandparents, cousins, and siblings. Females may have more than one litter per year, usually with five to eight babies at a time. The babies quickly mature, becoming old enough to mate at just five weeks old. Yellow-streaked tenrecs survive the dry winter months by estivating in their burrows.

This tenrec's spines come in two types: barbed and stridulating (STRIH-juh-late-ing). A barbed spine is sharp with tiny barbs, or hook-like structures, at the end. These spines detach easily from the animal. When a predator is foolish enough to nip at this tenrec, it gets a mouthful of spines that fall off the tenrec and stick in the predator. Stridulating spines aren't barbed, and don't fall off the tenrec's body so easily, but they do have their own unusual characteristic: they produce a sound when rubbed against one another.

Yellow-streaked tenrecs and people: This species has little contact with humans. Humans do not consider them pets, pests, or a source of meat.

Conservation status: The yellow-streaked tenrec is not considered to be threatened. ■

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SOLENODONS
Solenodontidae

Class: Mammalia
Order: Insectivora
Family: Solenodontidae
Number of species: 2 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The two living species in this family are the Cuban solenodon (suh-LEN-uh-dun), which is also known as the almiqui (ahl-mee-KEE), and the Hispaniolan solenodon, which is sometimes called the Haitian solenodon. Both have extremely long snouts that extend beyond the end of their lower jaw. Their four relatively tall legs, clawed feet, and long tails are nearly hairless. Most are brown on the back, or sometimes black in the Cuban solenodon, and have lighter-colored fur on their undersides. Cuban solenodons have longer, coarser, back hair, giving it a shaggier appearance. They are also slightly smaller than Hispaniolan solenodons. Overall, adult solenodons range from about 10 to 15 inches (25 to 38 centimeters) in length, and their tail adds another 6 to 10 inches (15 to 25 centimeters). Adults weigh 1.3 to 2.4 pounds (0.6 to 1.1 kilograms).

Both species have glands under their front teeth that produce poison. When they bite into a prey animal, the poison flows from the glands down grooves in their teeth and into the prey.

GEOGRAPHIC RANGE

Solenodons live in Haiti, Dominican Republic, and Cuba. In the past they were also found in Puerto Rico.

HABITAT

Solenodons occupy tropical forests on the sides of mountains, and also can be found in plantations and other flat, brushy areas.

DIET

Solenodons spend most of their nighttime hours above ground, poking their long snouts into the dirt and any other little opening they can find to search for insects, spiders, earthworms, and other invertebrates, animals without backbones. They will also claw apart old, rotten logs where many of their prey live.



A FIGHT FOR MILK

Like other mammals, solenodon mothers nurse their babies with milk delivered through their nipples. A mother may have up to three babies in each litter, but she has only two nipples. All three of her young cannot feed at once. As a result, one of the three babies typically gets less of the nourishing milk than the other two, becomes weaker and weaker, and eventually dies.

BEHAVIOR AND REPRODUCTION

Like most other insectivores, solenodons rest during the day and become active at night. They usually spend their days in small groups within burrows or shallow hollows in the ground, but may also rest in small hiding places. They spread out at night to look for food alone, and will attack fellow solenodons that get too close, often inflicting nasty bites. If a predator approaches, the solenodon has the option of charging and biting, or running off. Unless it is startled or has nowhere to flee, it will usually choose running over fighting.

Solenodons make a number of noises, including shrieks, grunts, and clicks. Some scientists believe the clicks may help them find prey. Just as bats make high-pitched noises and listen as the noises bounce off objects and back to them, solenodons may listen for the bounced clicks to detect objects, like prey, in their surroundings. This ability to "see" objects with reflected sound waves is called echolocation (eck-oh-loh-KAY-shun).

Males and females can breed at any time of year, and females usually have two litters (young born at the same time) every year. A mother may have one, two, or three babies at a time. Mothers nurse their young with two nipples located toward the rear of the animal, which are farther back than on a typical mammal. The babies continue nursing for about seventy-five days, but often stay with their mother until well after the next litter is born.

SOLENODONS AND PEOPLE

Solenodons and people usually do not see one another, unless the solenodon makes its home in a plantation or

garden. Homeowners and farmers sometimes view them as pests because they occasionally damage crops while rooting around in the dirt for insects and other prey that live near plants.

CONSERVATION STATUS

According to the World Conservation Union (IUCN) both species are Endangered, facing a very high risk of extinction in the wild. The U.S. Fish and Wildlife Service also list these two species as Endangered. The causes for their decline include hunting by dogs and cats, and the removal of the forests where the solenodons live. The IUCN lists a third species, Marcano's solenodon, as extinct.



Hispaniolan solenodon *(Solenodon paradoxus)*

HISPANIOLAN SOLENODON
Solenodon paradoxus

SPECIES ACCOUNT

Physical characteristics: This large insectivore's long tail, long snout, and rather lengthy legs are nearly naked. From the tip of the snout to the end of the tail, an adult can reach 22 inches (56 centimeters) long. Adults range from 11 to 12 inches (28 to 32.5 centimeters) in body length with tails of 7 to 10 inches (17.5 to 25.5 centimeters), and weigh 1.3 to 2.4 pounds (0.6 to 1.1 kilograms). Color varies somewhat, but individuals usually have a brownish coat on the back and a lighter-colored underside. The forelimbs are stronger and have larger paws than the hind limbs. All four paws have five toes.

Geographic range: Dominican Republic and Haiti.

Habitat: Hispaniolan solenodons typically live in forests, but sometimes make their homes in plantations or gardens.



The Hispaniolan solenodon is considered Endangered. Dogs and cats prey on the animal, and humans have cleared many of the forests where it lives. (© N. Smythe/photo Researchers, Inc. Reproduced by permission.)

Diet: The Hispaniolan solenodon's diet includes insects and other invertebrates, small reptiles, some fruit and vegetables, and possibly an occasional young chicken.

Behavior and reproduction: During the day, Hispaniolan solenodons rest in various hiding places, including hollow trees or logs, tight places in caves or slender cracks in rocks, or in the burrows they make. Several solenodons may rest together in a burrow. When they become active at night, they scout around on the surface looking for food. Adults are loners during this period, even fighting with one another.

Males and females produce an oily, greenish fluid, which tells members of the opposite sex that they are ready to mate. Females can have one or two litters each year, and may have them in any season. Each litter typically has one to three babies, which the mother feeds from two nipples located near the mother's rump. The young can latch onto the nipples and remain attached even if the mother decides to go for a walk. The young simply drag along the ground underneath her. The babies stop nursing after about two-and-a-half months, but may stay with the family for several months, even after the mother has another litter.

Hispaniolan solenodons and people: Other than an occasional run-in in a farm field or garden, solenodons and humans rarely see one another.

Conservation status: Both the IUCN and the U.S. Fish and Wildlife Service list this species as Endangered. Threats come in the form of dogs and cats that prey on the animal, and the human destruction of the forests where it lives. ■

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SHREWS
Soricidae

Class: Mammalia
Order: Insectivora
Family: Soricidae
Number of species: 333 species

family
CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Sometimes confused with mice, the typical shrew has a long, pointy snout with sensitive whiskers, a long and thin tail, tiny eyes that are sometimes hidden under their fur, noticeable ears, and fairly short legs with five clawed toes on each foot. Most have short, brown or gray fur, and many of them have red-tinged teeth. The vast majority of shrews are no bigger than a house mouse, but a few species, like the water shrews, can top 5 inches (12.5 centimeters) in head and body length. Overall, shrews range from 1.4 to 5.3 inches (3.6 to 13.5 centimeters) in head and body length and 0.06 to 1.5 ounces (2 to 40 grams) in body weight. Tails are typically from half the length to the same length as the head and body measurement. The smallest shrew, and indeed one of the tiniest living mammals, is Savi's pygmy shrew with a body that is just 1.4 to 2.1 inches (3.6 to 5.3 centimeters) long. The tail is about half that size. The tiny shrew weighs 0.4 to 0.1 ounces (1.2 to 2.7 grams).

GEOGRAPHIC RANGE

Shrews can be found nearly worldwide, including North America, Central America, northern South America, Africa, Europe, and Asia.

HABITAT

This is a very wide-ranging family, but most species tend to prefer areas with at least some moisture. Many scuttle along the damp earth under leaf litter, but a few will climb trees in

search of food. The aquatic species naturally seek out water sources that may range from bogs and swamps to streams and rivers. A few species survive well in the desert.

DIET

Shrews are not picky eaters. While insects and other invertebrates (animals without backbones) make up the bulk of their diet, they will also eat fruit and seeds, as well as small mammals, lizards, frogs, and even other shrews if food is scarce. They burn energy very quickly, so many shrews spend just about every waking moment either eating or looking for their next meal. Many species eat at least their body weight, and sometimes up to four times that amount in food every day.



SCARED TO DEATH

Shrews are very active little animals, dashing from place to place with noses almost always twitching. A typical heart rate for a shrew is in the hundreds, five or more times higher than a human heart rate, and can nearly double if the animal is frightened. In fact, a shrew can actually die of fright if it is startled by a loud noise, like a clap of thunder.

BEHAVIOR AND REPRODUCTION

Most shrews are active at night and rest during the day. A few, however, like the long-tailed shrew, stay awake for much of the day trying to feed their hefty appetites. When they can't find enough food, some species may spend a few hours in an inactive state called torpor that decreases their energy needs. Unlike most other mammals, some shrews actually produce venom to immobilize their prey, and then either kill the prey immediately or save it for a later meal. European water shrews, for instance, have a deep groove in the lower front tooth to help direct the venom from a duct at the base of the tooth into the prey.

Shrews are well-known for being aggressive toward members of their own species and sometimes other species. By making and marking small territories with scents, they typically avoid one another and thus sidestep fights. However, when two shrews, like the short-tailed shrews of North America, encounter one another in a confined space, they will commonly attack quickly and continuously, often until one dies. Despite their reputation as fighters, a few species tolerate other shrews quite well. Adult small-eared shrews will even share a nest.

Most shrews spend their whole lives on land, usually running from place to place. A few species are good swimmers. These aquatic shrews typically have stiff, fringed hairs on their

feet that serve to enlarge the surface area of their feet and help them paddle through the water. The elegant water shrew has actual webbing on its feet to aid in swimming.

Shrews generally breed two or more times a year, giving off specific odors or making characteristic movements, such as tail-wagging in house musk shrews, to announce that they are ready to give up fighting long enough to mate. Females may mate with several males during each breeding period, so the offspring in one female's litter may have several different fathers. Many species build nests. The short-tailed shrew, for example, makes a small nest of leaves and grass in a hidden spot, often under a rock or inside a tunnel. Pregnancies last only three to four weeks for most species, and the babies are small and quite helpless. The number of offspring varies, but three to seven is a common litter (young born at the same time) size for shrews. Babies grow very rapidly and are ready to face the world on their own at just three to four weeks old. Before they do so, however, some species of the group, known as white-toothed shrews because they lack the reddish tinge seen in other shrews, take part in an odd behavior. The mother leads them around in a row, with each shrew using its teeth to grasp the hair on the rump of the one in front of it. This line-up of shrews is called a caravan, or chain behavior. Scientists now believe that families of some red-toothed shrews may use this peculiar but effective method of travel, as well.

As noted, shrews develop quickly and they begin having young of their own before they reach their first birthday. Shrews rarely live much past fourteen to eighteen months of age.

SHREWS AND PEOPLE

Since they are small, usually active only at night, and like to hide, shrews avoid human attention most of the time. They do, however, play an important role for farmers and gardeners, who have fewer destructive insects in the crops, thanks to the shrews' appetites. Shrews have cultural significance, as well. For example, Shakespeare's *The Taming of the Shrew* is a classic tale, and people in Taiwan consider a shrew to be a symbol of good luck. On very rare occasions, shrews have bitten people. If the shrew is venomous, this can be quite painful.

CONSERVATION STATUS

According to the Red List of the World Conservation Union (IUCN), twenty-eight species are Critically Endangered, facing an extremely high risk of extinction; twenty-eight are Endangered, facing a very high risk of extinction; fifty-five are Vulnerable, facing a high risk of extinction; and four are Near Threatened, not currently threatened, but could become so. In other words, more than one-third of all shrew species are at some risk. The U.S. Fish and Wildlife Service names one species, the Buena Vista Lake ornate shrew, as Endangered. Many of the at-risk shrews live in limited areas and have very small known populations. This combination puts them in danger, because a single natural disaster, like a flood or one human disruption of their habitat, such as a mining operation, could destroy the entire population.



AMERICAN LEAST SHREW
Cryptotis parva

Physical characteristics: Just 2.2 to 3.1 inches (5.5 to 7.8 cm) in head to body length, this small shrew has a brownish gray back and whitish belly, a long snout, red-tinged teeth, and a tail that is no more than a third of the length of its head and body. It weighs from 0.1 to 0.3 ounces (4 to 8 grams). Its eyes are small and its ears are unnoticeable.

Geographic range: United States, extreme southeastern Canada, Mexico, and much of Central American to Panama.

Habitat: American least shrews are common in open, grassy fields, sometimes near a stream, but may also live in damp forests. This species spends much of its time in shallow tunnels it either makes itself or borrows from other animals.

Diet: Active day and night, year-round, they spend most of their time running about in search of food, which can include caterpillars, worms and other invertebrates (animals without backbones), small frogs and lizards, or bits of already-dead animals they find.



Most shrews prefer to live alone, but two dozen or more adult American least shrews may share a burrow, where they click at one another to communicate. (Illustration by Emily Damstra. Reproduced by permission.)

Behavior and reproduction: Least shrews are skittish animals that are mainly active at night, although they will also warily venture about during the day. Their brownish gray coloration, small size, and tendency to hide among grasses or underground helps them avoid their numerous predators, animals that hunt them for food, which include owls, skunks, snakes, and a variety of other animals. They make a variety of sounds, some of which may be used to help them find their next meal. Just as bats make high-pitched noises and listen as the noises bounce off objects and back to them, American least shrews may make clicking noises, and then listen for the bounced clicks to detect objects, like prey, in their surroundings. This ability to "see" objects with reflected sound waves is called echolocation (eck-oh-loh-KAY-shun).

Unlike most other shrews that like to live alone, several to sometimes even more than two dozen adult American least shrews may share a burrow, where they click at one another to communicate. They mate all year long in warmer areas of their range, but limit mating to spring, summer, and fall in cooler areas. The female has her young after a pregnancy of about three weeks in grassy and/or leafy nests built in the burrow. The litter size is usually three to seven, but may be as small as one or as large as nine. The babies stay with the mother for almost three weeks.

American least shrews and people: This shrew usually remains out of sight, but it can assist gardeners and farmers by eating crop-destroying insects.

Conservation status: Neither the IUCN nor the U.S. Fish and Wildlife Service lists them as endangered, but some states consider them to be threatened. Connecticut, for example, lists American least shrews as endangered because their habitat is rapidly disappearing. ■



American water shrew *(Sorex palustris)*

AMERICAN WATER SHREW
Sorex palustris

Physical characteristics: The American water shrew ranges from 2.5 to 3.2 inches (6.3 to 8.1 centimeters) in head and body length with a similar-sized tail, and weighs 0.3 to 0.6 ounces (8 to 18 grams). They have dark brownish gray backs and whitish bellies, a likewise two-toned tail, red-tinged front teeth, and hind feet that are larger than the forefeet. Like many other water-loving shrews, they have stiff, fringed hairs on their feet that aid in swimming.

Geographic range: United States and Canada.

Habitat: Usually found in or near water, these shrews prefer damp, forested areas with many places on land where they can hide, such as

fallen logs, a thick understory, and/or rock piles. They readily take to the water, where they can make good use of their specially designed feet and swim underwater or run across the water surface like some water insects do.

Diet: Active mainly at night, they eat caterpillars, grubs, worms, and an occasional fish. Unlike many shrews that have to eat their body weight in food every day, this species can survive on just a tenth of its body weight or less in food per day. Compared to humans, however, that is still a considerable amount.



The American water shrew has stiff, fringed hairs on its feet that aid in swimming underwater or running across the surface of the water. (Illustration by Emily Damstra. Reproduced by permission.)

Behavior and reproduction: A variety of land animals find the American water shrew to be a tasty treat, but the shrews are quite adept at escaping into the water. Unfortunately, they must also be wary of several fish species, including trout, which also eat shrews. The shrews float well, so they must paddle with their hindfeet furiously to stay underwater. This species also makes chirping noises that may be used to find food through echolocation. Adults keep to themselves most of the time and will fight other adults that come too close. Mating occurs in the spring and summer. Pregnancies last about three weeks, and mothers retreat to tunnel nests to have their young. She may have two or three litters each year with three to ten babies at a time. Although the babies are helpless when they are born, they grow quickly and leave their mothers in about a month. The young can start their own families a few months later. Those that survive to adulthood usually only live to be about eighteen months old.

American water shrews and people: Other than a fleeting glimpse, people rarely have any contact with this shrew.

Conservation status: American water shrews are not considered threatened. ■

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MOLES, SHREW MOLES, AND DESMANS

Talpidae

Class: Mammalia
Order: Insectivora
Family: Talpidae
Number of species: 42 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Moles are small, short-legged, smooth-furred animals with tiny, sometimes hidden eyes, and long, nearly naked snouts. Many land-living moles have large, wide, shovel-like front feet adapted for digging through the soil. Some moles, including the desmans, are swimmers and have slender, webbed forefeet. Shrew moles, which live on land but dig little, if at all, have feet that are neither shovel-like nor webbed. Overall, adult moles range from about 2.4 to 17.0 inches (6 to 43 centimeters) in body length and another 0.6 to 8.3 inches (1.5 to 21.5 centimeters) in tail length. They weigh from 0.4 ounces (12 grams) in the smallest species to 7.8 ounces (220 grams) in the largest.

GEOGRAPHIC RANGE

Moles, shrew moles, and desmans are found in the United States, Canada, Mexico, and much of Europe and Asia.

HABITAT

About three-quarters of the species in this family live much of their lives underground. A few live above ground on land, and others spend a good deal of their time in or near the water. Those that prefer the water usually make their homes near fresh water, but a few will also enter brackish water, water that is somewhat salty.

DIET

The primary diet among the moles is insects, earthworms, centipedes, and other invertebrates, animals without backbones,

IS IT A SHREW OR A MOLE?

At first glance, an observer might think that the smallest mole in North America is actually a shrew. Its size of just 3.5 to 5.2 inches (8.9 to 13.2 centimeters) is similar to shrews, and it does not have the large front feet that are common in many moles. Most of its activity occurs above ground, where it runs beneath the leaf litter in a manner similar to shrews. Land-living moles, on the other hand, are mainly tunneling animals. Even its name can be confusing. This small animal is called the American shrew-mole.

but many will also eat roots and other parts of plants. Water-living species may also include frogs and fish in their diet.

BEHAVIOR AND REPRODUCTION

Most moles have long and narrow snouts that they are able to wiggle and bend. The snout tip has tiny Elmer's organs that the mole uses to sense its environment and to find prey. Desmans that spend a good amount of time underwater use their snouts for several purposes. In one common behavior, a desman will stick just its snout tip out of the water to sniff the air for prey as well as predators, animals that hunt them for food. They will also dig through the water bottom with their snouts looking for food.

Some moles are active mainly at night, but others move around both day and night. The land-living, digging species are capable of making tunnels quickly for such a small animal. The eastern mole, which is less than 12 inches (30 centimeters) long from the tip of its nose to the end of its tail, can tunnel up to 15 feet (4.6 meters) in a single hour, and more than 100 feet (30 meters) in a day. Their tunnels are often visible from above ground, and look like long, sometimes-branching strings of broken ground. These are called mole runs. A molehill is a circular mound of dirt that is created when the mole pops above ground from the tunnel. Both the land-living and the water-loving species also dig deeper chambers for breeding and to escape the winter cold. Moles usually spend their lives alone, although some are more social. Reports suggest that Russian desmans may share their dens on occasion.

After mating one or two months earlier, most moles have one set, or litter, of about three to five babies in early to midsummer. A few species have one or more additional litters later in the year. The young are helpless and naked at birth, but after approximately four to six weeks, they are ready to leave the mother. The young can have babies of their own within a year.

MOLES, SHREW MOLES, DESMANS, AND PEOPLE

The land-living, tunneling moles have the greatest contact with humans. Their tunneling activity is beneficial in that it

loosens the soil and actually helps plants to grow, but their plant-eating habits and the visible mole runs frequently make them an unwelcome guest in yards, gardens, and farm fields. At one time, people also hunted moles for their silky fur, which was used for collars and cuffs on women's clothing. People even hunted some species, like the Russian desman, for their scent, which was used in perfumes.

CONSERVATION STATUS

According to the World Conservation Union (IUCN), two species are Critically Endangered, facing an extremely high risk of extinction in the wild. Five species are Endangered, facing a very high risk of extinction in the wild, and three are Vulnerable, facing a high risk of extinction in the wild. That means that nearly one quarter of all mole species are at some risk. The U.S. Fish and Wildlife Service lists no species as endangered. Many of the at-risk moles have small populations and/or live in habitats that are disappearing due to human activity. In addition, some species are facing threats from hunting or from introduced species that are invading their habitat. The Vulnerable Russian desman, for example, is now competing for food and shelter with the introduced muskrat and coypu (KOY-poo).



SPECIES ACCOUNTS

EASTERN MOLE
Scalopus aquaticus

Physical characteristics: Eastern moles are shiny grayish, occasionally black, moles with very large, clawed, shovel-like front feet that are well-suited for digging. A typical adult, which has a short tail, may be 5.9 to 7.9 inches (15 to 20 centimeters) long and weigh 3.2 to 5.0 ounces (90 to 143 grams).

Geographic range: Eastern moles are found in the eastern United States, far southern Canada, and far northern Mexico.

Habitat: Eastern moles live much of their lives underground in good soils in forests or grasslands.

Diet: Eastern moles eat mostly grubs and earthworms, but also centipedes and slugs. If they come across a root or seed during their tunneling, they will also eat those.



Eastern moles spend much of their time alone, making shallow tunnels in search of food. (E. R. Degginger/Bruce Coleman Inc. Reproduced by permission.)

Behavior and reproduction: Eastern moles spend much of their time alone, making shallow tunnels in search of food. They also make deeper, living chambers. Their below-ground life protects them from most predators, although dogs, cats and other large digging mammals will sometimes root out a mole. Rarely, when a mole pops out of its tunnel, a nearby owl or snake will attack it. Moles mate once a year in early spring—a bit earlier in warmer areas and later in cooler climates—and build a nest in an underground chamber. About a month and a half afterward, the mother gives birth to a litter of three to five young. They stay with her for four to five weeks, and are ready to become parents themselves by the following spring.

Eastern moles and people: Most people are familiar with eastern moles from their mole runs, which are visible above the ground and often considered unsightly. Moles will also eat some crop roots, so they are sometimes considered pests. Homeowners, gardeners, and farmers frequently try various methods to rid their yards and fields of the moles.

Conservation status: Eastern moles are not threatened. ■



STAR-NOSED MOLE
Condylura cristata

Physical characteristics: This dark-brown mole is best-known for the collection of twenty-two short and pink, fleshy tentacles on the tip of its snout. They have wide, clawed hands, and a tail that is almost as long as their body. Adults range from 6.1 to 8.1 inches (15.5 to 20.5 centimeters) and weigh 1.1 to 3.0 ounces (30 to 85 grams).

Geographic range: Star-nosed moles are found in the eastern United States and eastern Canada.

Habitat: Star-nosed moles prefer wet meadows and forests near water. Occasionally waterside homeowners may find evidence of one in a moist lawn area.



The star-nosed mole is best-known for the collection of twenty-two short and pink, fleshy tentacles on the tip of its snout. The tentacles act like feelers and help the animal to find its food and to make its way through the dark tunnels it digs. (© Rod Plank/Photo Researchers, Inc. Reproduced by perission.)

Diet: Star-nosed moles like grubs, earthworms, and other invertebrates, and will occasionally eat a small fish.

Behavior and reproduction: A star-nosed mole's always-wiggling tentacles act like feelers and help the animal to find its food and to make its way through the dark tunnels it digs. Active all year, and both day and night, this mole not only hunts for food inside its tunnels but above ground and in the water. Predators vary depending on the mole's location. When they are in the water, fish pose a threat. On land, meat-eating birds, snakes, and mammals may attack and kill moles. Other moles make long and winding mole runs, but the usual outward sign of the star-nosed mole is its molehills, which are small mounds of dirt at the entrances and exits for their tunnels. Although they are usually loners, two or more individuals may spend the winter together in shared, below-ground chambers. They do not hibernate, and even in the cold of winter, may leave their tunnels to dig through the snow. Females have one litter of two to seven babies each year. The young leave the nest in about a month, and begin having their own families by the following year.

Star-nosed moles and people: People rarely see star-nosed moles or recognize evidence of them, so interactions between these moles and humans are rare.

Conservation status: Star-nosed moles are not threatened. ■

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TREE SHREWS
Scandentia

Class: Mammalia
Order: Scandentia
One family: Tupaiidae
Number of species: 19 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

In physical appearance, tree shrews resemble a squirrel with a long snout, nose. The scientific family name is from the Malay word *tupai,* which means squirrel. Animals in this family are commonly referred to as tree shrews, ever since they were first mistaken for shrews when they were first spotted in 1780. Shrews are small, insect eating mammals with pointy snouts.

Tree shrews are relatively small, with the head and body length ranging from about 5 to 9.5 inches (13 to 24 centimeters). These animals have a long tail, which is covered with long thick hair in all the species except the pen-tailed tree shrew. The tails of pen-tailed tree shrews are hairless except for a whitish feather-shaped arrangement of hairs near the end. In general, tree shrews have small ears similar to those of a squirrel, and their ears are covered with fur. An exception is the ears of the pen-tailed tree shrews, which are bare and larger than all the other species.

Fur colors of tree shrews range from gray to dark brown on the upper side of their body, and white, yellow-brown, or dark brown on their belly. Their fur is generally soft and thick. Some species have light shoulder stripes and others have facial markings. Their legs are short, with claws on their fingers and toes.

GEOGRAPHIC RANGE

Tree shrews are found in south and Southeast Asia, ranging from India and southwest China eastward through Malaysia, Indonesia, and the Philippines. Out of the nineteen tree shrew species, ten live on the island of Borneo.

HABITAT

Tree shrews live in shrub and forested areas, which are often mountainous. Many of the tree shrews are arboreal, meaning that they live in trees. Some species spend the majority of their time on the ground.

DIET

Tree shrews primarily eat a combination of insects and fruits. They also will occasionally feed on plant material, along with other small animals, including fish and mice. Different tree shrew species have their own feeding method, one species may collect black ants at night while another species digs up earthworms.

BEHAVIOR AND REPRODUCTION

In general, tree shrews are active during the day. The pen-tailed tree shrew is nocturnal, meaning that it is active at night. Researchers do not know a lot about the behavior of tree shrews. One reason is that they are difficult to observe because they are highly active animals that move quickly and constantly.

All tree shrews have the ability to climb trees. They use their sharp claws to dig into the trees and branches as they climb. Many species are arboreal, while others find their food and spend a great deal of time on the ground. Tree shrews commonly use the same paths along the ground or on branches to reach their favorite feeding or resting areas.

They have well-developed senses of vision, hearing, and smell. These animals typically catch food with their snout, and use their hands only when they cannot reach their food. They may grab hold of flying insects with their hands. They eat in a style similar to squirrels, hunching on their hind legs while holding the food in their arms and eating it.

Most species nest in holes in tree trunks or branches. These animals make a nest of dried leaves, twigs, and soft wood. Tree shrews are territorial, meaning they protect their own territory. They release droplets of urine and scent to mark their territory. Tree shrews have specialized glands, located on their chest and belly, which produce the chemical scent. Many of the scents are distinct to a particular animal. They deposit their scent in areas where other animals may smell it to let them know that the area is occupied.

Tree shrews live in monogamous (muh-NAH-guh-mus) pairs, meaning they have one mate. Gestation, or pregnancy,

lasts between forty-three and fifty-six days. Females give birth to small litters (young born at the same time) of poorly developed, hairless offspring. The typical litter size ranges from one to three offspring. Baby tree shrews are often born in pairs.

In many of the species studied, researchers found an unusual mothering strategy unlike other mammals. Mother tree shrews visit their babies only once every two days for about two minutes each visit. When the mother visits her young in the nest, she immediately allows the babies to nurse, which they do quickly. Babies take in large amounts of milk and lie back with a bloated stomach. With no mother in the nest, the babies snuggle with each other to keep warm. The babies also groom each other, a task traditionally done by the mother.

Field studies have found that tree shrews breed when fruiting peaks occur in the forest.

A CASE OF MISTAKEN IDENTITY

For years, scientists debated about who was the tree shrews' closest relative. In the 1920s, a scientist proposed that tree shrews were related to primates based on studies of primate and shrew skulls. Many accepted these findings and said the tree shrew belonged in the primate order. Other researchers said it was more similar to animals in the insectivore order, because of its resemblance to animals such as the shrew. In 1984, researchers decided the tree shrew was unique enough to have its own order.

TREE SHREWS AND PEOPLE

With their close relationship to primates, and a well-developed sense of vision and hearing, tree shrews are being used by researchers as animal models for human diseases. An animal model is an animal studied that mimics human biological or psychological disease. Research studies have included hepatitis (hep-uh-TIE-tuhs), a disease of the liver, vision disorders, and psychosocial stress.

CONSERVATION STATUS

The majority of tree shrew species are common, however several are Endangered or Threatened. Long-footed tree shrews and Nicobar tree shrews are Endangered, facing a very high risk of extinction in the wild. Bornean smooth-tailed tree shrews, golden-bellied tree shrews, Palawan tree shrews, and Mindanao tree shrews are Vulnerable, facing a high risk of extinction in the wild. Mindanao tree shrews are listed as Near Threatened, not currently threatened, but could become so.



SPECIES ACCOUNT

COMMON TREE SHREW
Tupaia glis

Physical characteristics: Common tree shrews have a head and body length of about 7.5 inches (19.5 centimeters). They have a long, pointed snout. Their fur is darker on the upper side of their body than on their bellies. Upper side fur can be dark brown, pale brown, blackish gray or it can appear almost black. Their undersides are whitish, orange or rusty red, or a light or dark brown. Common tree shrews that live in northern areas with less rainfall are typically lighter than those in southern areas with greater rainfall.

They often have a pale stripe along their shoulder. Similar to a squirrel, common tree shrews have a long, bushy tail. It can be about as long as the length of the head and body. These animals have relatively small ears, with their lower lobe smaller than the upper one.



Common tree shrews typically live alone or with their mate. This pair is grooming each other. (R. Williams/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Common tree shrews are found in Thailand, the Malayan Peninsula, and in Sumatra, Java, and surrounding islands.

Habitat: Common tree shrews live in evergreen tropical rainforests.

Diet: Common tree shrews eat a varied diet that they collect primarily from the ground. Their food includes insects, particularly ants, as well as spiders, seeds, buds, leaves, and fruit. They can also eat lizards.

Behavior and reproduction: Active during the day, common tree shrews are extremely energetic. They spend a great deal of their time on the ground, yet they can also easily climb trees. They typically live alone or with a mate. Field studies in Malaysia have shown that breeding may occur at any time of year. Gestation periods last roughly forty-six to fifty days, and families produce one to three offspring. The newborn young are hairless, with closed eyes. The young are

ready to leave the nest about thirty-three days after birth. The young are reared in a nest separated from that of the mother and are suckled every other day.

Common tree shrews and people: There is no known connection between common tree shrews and people.

Conservation status: Common tree shrews are not considered threatened. ■

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COLUGOS
Dermoptera

Class: Mammalia
Order: Dermoptera
One family: Cynocephalidae
Number of species: 2 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

Colugos are commonly referred to as flying lemurs, even though they do not technically fly and they are not lemurs, primate mammals found in Madagascar. Colugos are about the size of a cat, approximately 20 inches (75 centimeters) long. They weigh about 3 pounds (1.35 kilograms).

Their ability to glide—not fly—is due to their most distinctive feature, after which they are named. The order they belong to, Dermoptera, means "skin wings" in Greek, referring to the flap of skin that extends between the front and hind limbs. This thin layer of skin or membrane is called a patagium (pah-TAY-jee-um). The patagium stretches from the side of the neck to the tips of its fingers, toes, and tail. When the front and hind legs are spread out, the patagium allows the colugo to glide like a kite. The patagium also acts as a parachute, catching air inside of it as it jumps. This parachute effect prevents colugos from losing too much height as they move between trees.

Colugos resemble lemurs, with long noses and wide bulging eyes. The shape of their head and snout is similar to a greyhound dog. They have small round ears and sharp claws.

The fur of male colugos is generally brown to red-brown and in females the fur is grayish brown. Malayan colugos have white spots on their fur, but Philippine colugos do not. The underside of the animal is a lighter orange-yellow, orange, or brownish red color.

PREY FOR AN EAGLE

The national bird of the Philippines has a taste for colugos. The Philippine eagle is one of the world's rarest birds with only about 200 live birds. At one time it was thought this bird's favorite food was a monkey. But a report in one area of the Philippines found that 90 percent of the eagle's diet consists of colugos. The eagle can swoop down and catch the colugo in the air while it leaps from tree to tree.

GEOGRAPHIC RANGE

The Philippine colugo is found only in the Philippines, and the Malayan colugo is found in Borneo, Peninsular Malaysia, Thailand, Indochina, and some of the Indonesian islands.

HABITAT

Colugos live in the rainforest. They are often found in coconut, banana, and rubber plantations. Their habitat must contain many trees with few branches low on the trunk.

DIET

Colugos are herbivores, animals that eat plants. They feed on leaves, buds, flowers, and occasionally fruits. They get their water from food and also by licking wet leaves.

BEHAVIOR AND REPRODUCTION

Relatively little is known about colugos. They are arboreal, meaning they spend most of their time in trees and bushes. They are solitary animals that move from tree to tree by climbing and gliding. These animals are nocturnal, active at night. They spend the day resting inside tree holes or on branches or tree trunks. They rest either with their head up and all four claws clinging to a branch, or they hang upside down with their two rear claws holding onto the branch. In coconut trees, they curl up in a ball among the leaves.

Colugos usually emerge before dusk and climb to the top of trees. They move awkwardly up trees because of their patagium, bringing both their front limbs together and then both back limbs.

In the evening they move to a feeding area, gliding distances up to 230 feet (70 meters) in one leap. Colugos have been known to glide as far as 450 feet (135 meters) in a single glide. Colugos may land near the bottom of trees, and then climb back up trees slowly before they take off on another glide.

Each colugo tends to have a certain feeding area, which the animal returns to every night. When eating, colugos use their front feet to pull a bunch of leaves towards them, and then use their tongues and teeth to pluck off the leaves.

Little is known about the mating of colugos. Females give birth to one or two young following a gestation, or pregnancy, period of sixty days. The offspring is born in an undeveloped state, almost like a marsupial, an animal that carries its young in a pouch. Young are carried on their mother's belly until they are weaned at about six months old. Females can fold the patagium near the tail to form a pouch for their young. When ready to forage, or look for food, females may carry their young with them. Young colugos cry out with duck-like sounds. Young colugos reach maturity when they are about two or three years old.

COLUGOS AND PEOPLE

Deforestation, clearing trees, of the rainforest by people has caused the loss of colugo habitat and thus, a decrease in their population. Some people also hunt colugos for their fur to make caps, and for food. Plantation growers, especially banana, coconut, and rubber growers, may consider these animals pests because they eat the reproductive flowers and fruits of the trees.

CONSERVATION STATUS

The Philippine colugo is considered Vulnerable, facing a high risk of extinction in the wild.



SPECIES ACCOUNT

MALAYAN COLUGO
Cynocephalus variegatus

Physical characteristics: Malayan colugos are also called Malayan flying lemurs. They resemble lemurs with their dog-like shaped heads. Malayan colugos have large eyes, long limbs, and sharp claws. Their fur is gray or brown with white spots along the back. Their head and body length is about 15 inches (38 centimeters), and they weigh approximately 3.3 pounds (1.5 kilograms). The fur of male colugos is generally brown to red-brown with white spots, and in females it is grayish brown with white spots. The underside of the animal is a lighter orange-yellow to orange color.

Geographic range: Malayan colugos are found in Southeast Asia, including Malaysia, Thailand, Indonesia, Borneo, and some nearby islands.

Habitat: Malayan colugos live in tropical forests and woodlands.



Malayan colugo babies stay on the female's belly, enclosed in the patagium, folded into a pouch, for about six months. (Peter Ward/Bruce Coleman Inc. Reproduced by permission.)

Diet: Malayan colugos are herbivores, eating leaves, buds, pods, flowers, and fruit.

Behavior and reproduction: Malayan colugos are independent and solitary animals. They are nocturnal, resting during the day in tree hollows, against trees, or while clinging to branches. Individual animals have their own feeding area, or even tree, and follow a pattern of returning to the same area every evening.

Malayan colugos generally have one offspring per birthing period. Gestation period is about sixty days. When the offspring is born it is poorly developed, like a marsupial. It stays on the female's belly, enclosed in the patagium, folded into a pouch, until it is weaned at about six months.

Malayan colugos and people: Destruction of the rainforest for timber and agriculture has caused the loss of habitat for Malayan colugos. They are also hunted for their fur and meat.

Conservation status: Malayan colugos are not listed as a threatened species. ■

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BATS
Chiroptera

Class: Mammalia
Order: Chiroptera
Number of families: 18 families

order

CHAPTER

PHYSICAL CHARACTERISTICS

Bats are the second largest group of mammals after rodents. Almost one out of every four mammalian species on the planet is a bat species. Living bats are categorized into two main groups, each with its own distinct features. The Megachiroptera (mega-keer-OP-ter-ah), or "large bats" group includes one family. The Microchiroptera (micro-keer-OP-ter-ah), or "small bats" group includes all the rest of the bats.

Bats are the only mammals that can fly. Chiroptera comes from the Greek roots *cheiro* (hand) and *ptera* (wing), named for the similarity of a bat wing to a hand. Bat wings are long arms, hands and extra-long finger bones that are covered with a double layer of thin skin called a membrane. The membrane is thin enough that light can shine through it. The membrane contains blood vessels, nerves, and muscles.

In some bats, a membrane extends between the legs and encloses the tail. Some bats have tails that extend past the membrane and others have no tails. In most bats, the thumbs are free from the membrane. These thumbs have claws and are often used for climbing up trees or other structures.

Bat membranes are tough and flexible, allowing bats to move their wings much like people move their fingers. Changing the shape of their wings allows bats to turn and maneuver quickly. Some bats can hover in the air while others glide. When it is cold, the bats fold their wings around themselves. When it is warm, bats flap their wings to cool themselves.

Bats range widely in size, yet the majority of bats weigh less than 1 ounce (25 grams). The largest bat is the Malayan flying

fox, which can have a wingspan of 6 feet (1.8 meters) and weigh 3.3 pounds (1.5 kilograms). The smallest bats are the Kitti's hog-nosed bats, also called bumblebee bats, of Thailand, with a wingspan of 6 inches (15 centimeters) and a weight of about 0.07 ounces (2 grams), less than a penny.

Like other mammals, bats are warm-blooded and fur covers their body. Megachiroptera are characterized by large eyes, small ears, and dog-like snouts. Most Microchiroptera species are characterized by wide, extended ears and odd shaped noses. Bats have weak legs and do not walk long distances. Their feet are small with sharp claws on each toe. Bats use their claws to hold the weight of their body when they hang upside down, which is their normal resting position.

GEOGRAPHIC RANGE

Bats live on every continent on Earth except Antarctica and some remote islands. Most bats live in the tropics and species are most numerous around the equator.

HABITAT

Bats need a roost, a place to settle or rest, and a place to find food. The type of roost a bat chooses depends upon the type of bat. Bats can roost in hollow trees, cracks in trees, and under bridges. Many bats depend on caves in the cool winter months to survive, and others roost in caves all year long. Some bat species find their roosting site in abandoned mines. The dome shaped ceilings can hide and protect the bats from predators, the animals that hunt them.

A few species of bats make their roost from large leaves, such as palm and banana leaves. These small bats chew across the leaves so that the sides droop down in the form of a tent. Other bats can roost in flowers and animal dens.

Bats often return to the same site at the same time each year. In warm weather, big brown bats commonly roost in buildings and then shift to caves and abandoned mines during the colder months. The Pallas's mastiff bats are found roosting in buildings, hollow trees, rock crevices, caves, and bridges.

DIET

While the most famous bats are the vampire bats, known for eating blood, the majority of bats eat only insects. Microchiroptera are generally carnivores, meat-eaters, that feed on

insects, such as moths, flying beetles, and mosquitoes. Bats can capture insects while flying by catching them in their mouths or scooping them into their tails or wing membranes. Some bats pick the insects off leaves or the ground. One gray bat may eat up to 3,000 insects in one night.

Some bats feed on larger prey, animals hunted or caught for food, such as fish, frogs, birds, mice and other bats. A fish-eating bat will swoop down and grab fish with its claws. A bat that eats mice will swoop down, wrap the prey in its wings, bite it and then whisk it away to eat it.

The three species of vampire bats are the only bats that feed on blood, sucking up the blood of cattle, sheep, or other relatively large animals. The bats use their razor-sharp teeth to pierce the animal's skin, often while the animal is sleeping. The bats then lap up about 2 tablespoons (30 milliliters) for their meal.

Most megachiropteran species are herbivores, plant-eaters, eating fruit, seeds, leaves, nectar, and pollen. Whatever it eats, bats eat only the parts of their prey that they want to ingest. When a bat catches an insect, it will generally bite off and drop its wings and legs. When eating another bat or bird it will not ingest its wings. An Old World fruit bat will chew its fruit thoroughly, swallow the juices then spit out the remaining pulp.

Bats drink by flying close to the water and taking up the water while flying. With the exception of three species of nectar-feeding bats that live along the Mexican border of Arizona and Texas, bats in the United States and Canada eat insects.

BEHAVIOR AND REPRODUCTION

Bats as a group are crepuscular (kri-PUS-kyuh-lur), meaning they are active at dawn and dusk, or nocturnal, meaning they are active at night. When they are roosting, bats generally hang upside down by their claws. This allows them to simply let go of whatever they are hanging onto and start flying.

With their large ears and small eyes, microchiropteran bats depend upon a complex sound technique called echolocation (eck-oh-loh-KAY-shun) to help them find prey and move. While flying, these bats send out high-frequency sounds that bounce off of other objects. The bat listens for the bounced sound, and then determines the location, size, distance, and speed of the object—all within a split second. In most bats, the echolocation is at such a high pitch that it is beyond the human hearing range,

though humans can hear the sounds of some bats. Researchers are still working to understand exactly how echolocation works. Megachiroptera generally depend upon their eyes to navigate, but some of these bats also use echolocation.

Like all mammals, bats are warm-blooded, meaning they maintain their body temperature. Bats roost in warm places during the cool months to conserve the energy it takes to keep warm. Unlike other mammals, bats can allow their body temperature to drop to the ambient temperature, or surrounding temperature, when they are not active. As their temperature drops, metabolism slows down.

During the winter, some bats will drop their body temperatures for months at a time and go into hibernation, meaning they go into a resting state in a safe place, typically without eating or passing wastes. A bat's body temperature can drop to as low as 35.6°F (2°C). These bats survive the winter by living off their storages of fat and making occasional food trips during warmer weather.

Other bat species follow an annual migration pattern, traveling to warmer climates in the cool months and cooler climates in the warm months.

Bats are generally social animals and gather together in roosts. Bats can roost in colonies of several hundred to tens of millions. The number of bats in a roost depends upon the type of bat. Pipistrelle maternity, or motherhood, roosts usually contain between fifty and two hundred bats. Brown long-eared bats usually live in colonies of twenty-five up to fifty bats. Mexican free-tailed bats are one of the more social bat species and found in huge populations throughout their range. In Bracken Cave, Texas, the population of Mexican free-tailed bats was estimated at twenty million bats!

Like all mammals, female bats give birth to live young and feed their newborns milk. Females often roost in large colonies, with many females giving birth in the same area. Bats usually give birth to only one young per year. During their first weeks of life newborn bats cling to their mothers while in flight. Only the mother cares for the young, and there is no lasting relationship between the mother and father.

Bats grow quickly; the young are often flying at four weeks. Young microchiropterans become independent at approximately six to eight weeks, megachiropterans at about four

months old. At the age of two years bats are sexually mature. Bats live about twenty-five years, far longer than most mammals of a comparable size.

BATS AND PEOPLE

Popular folklore and myths have led to many people having a negative reaction to bats. Because most people do not typically see or interact with bats, many misunderstandings about these creatures remain. The Eastern European tale of a vampire, a corpse that came back to life and sucked blood from the neck of its human victim, dates back to the Middle Ages. After Bram Stoker's *Dracula* was published in 1897, the misconception of bats as dangerous and mysterious became more popular. Although there are only three species of vampire bats, all living in South and Central America, all bats still have a reputation for sucking blood.

Bats also have a reputation for carrying rabies, a viral disease that affects the nervous system and can be spread through bite of an affected animal. Yet less than one half of one percent of bats carries the rabies virus. And bats are rarely aggressive, usually attacking only if they are frightened.

Not all people consider bats a bad omen or scary. In China, bats are considered good luck symbols. Fabrics and dishes are often decorated with bat-shapes for good luck. Native Americans considered the bat a protector.

Bats are beneficial to people in many indirect and direct ways. They are one of the few predators of night-flying insects, some of which are pests to crops and people. People have long used the nitrogen-rich bat droppings, called guano (GWAN-oh), as a fertilizer.

Bats also play an important role in plant pollination, the transfer of pollen, the reproductive spores, for fertilization. When nectar-eating bats move from flower the flower to eat, the bats pick up pollen on their fur and disperse it as they move. Bats are the most important pollinators among mammals in the rainforest. They pollinate many plants that humans eat, including bananas, figs, mangos, and peaches. Bats also are integral for seed dispersal, having led to the continued survival of



A WHOLE LOT OF BATS

Bracken Cave in Texas is home to the world's largest bat colony. Each year, some twenty million Mexican free-tailed bats gather at this cave near San Antonio to give birth and rear their young. And each night they emerge to forage for food. The twenty million bats can eat more than two hundred tons of insects in a single summer night!

FINDING DINNER

Bats have an amazing ability to find food. Fishing bats have echolocation so sophisticated that they can detect a minnow's fin as fine as a human hair, which sticks up above a pond's surface only 0.08 inches (2 millimeters); that's about the thickness of about twenty human hairs. African heart-nosed bats can hear the footsteps of a beetle walking on sand from a distance of more than six feet. And when the Central American fringe-lipped bat hears the mating calls of mud-puddle frogs, it switches to the frogs' lower frequency so that it can detect its exact location.

over 1,000 species of trees. The fruit bat disperses seeds away from the parent tree by either swallowing them and leaving the seeds in their droppings, or carrying off the fruit to eat.

CONSERVATION STATUS

Bat populations are in decline in the United States and throughout the world. In the United States, out of forty-five bat species, six are federally endangered, facing an extremely high risk of extinction, dying out, or threatened, close to facing the risk of extinction. Twenty species are categorized as being of special concern by the U.S. Fish and Wildlife Service.

The World Conservation Union (IUCN) includes 521 bats on its Red List of Threatened Species. Twenty-nine are Critically Endangered, facing an extremely high risk of extinction; thirty-seven are Endangered, facing a very high risk of extinction; 173 are Vulnerable, facing a high risk of extinction. The rest on the list are not currently threatened, but could become so, or there is not enough information about the bats to know how threatened they are.

With few natural predators, the primary reason for declining bat populations is directly and indirectly related to humans. Pesticides on plants have reduced insect populations, the food supply for many bats. Occasionally, people hunt bats for food, but far more harmful to bats is the destruction of their natural areas and living spaces. Deforestation, the clearing of trees for agriculture or people, decreases their food supply and habitats.

People have also killed colonies of bats out of fear or ignorance. In Central America, where vampire bats can be a problem for livestock, locals find bat caves and blow them up, killing entire colonies whether they are colonies of vampire bats or not. In the United States, destroying bat habitats such as mines have killed them and any that remain are left without protection.

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OLD WORLD FRUIT BATS
Pteropodidae

Class: Mammalia
Order: Chiroptera
Family: Pteropodidae
Number of species: About 170 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Bats are broken into two categories: the Microchiroptera (micro-keer-OP-ter-ah) and the Megachiroptera (mega-keer-OP-ter-ah). The vast majority of bats fall under the microchiropterans, which are in general smaller than the megachiropterans. Pteropodidae is the only family in the megachiropteran category. Pteropodids are commonly referred to as Old World fruit bats. The Old World refers to southern Europe, Asia, and Africa, while New World refers to North and South America.

Old World fruit bats have a wide range in size. Pygmy fruit bats are one of the smallest Old World fruit bats, with a head and body length of 2.4 to 2.8 inches (6 to 7 centimeters), smaller than many microchiropterans. Gigantic flying foxes are 15.7 inches (40 centimeters) long and can have a wingspan of 59 inches (150 centimeters).

In general, Old World fruit bats have large eyes that face forward. These bats have claws on the first finger, their thumb, and most also have claws on their second finger. Their faces are typically doglike, with simple and relatively small ears. Their wings are typically broad and mostly furless. The tail is usually short or absent. With so many different species, fur color varies greatly. Most species of the Old World fruit bat are reddish brown, gray, or black. The underside of the bat is usually a pale color, such as a white or yellow.

Teeth are shaped to bite through fruit skin and crush the soft fruit matter. The front incisors, chisel-shaped teeth at the front of the mouth, are small and all have canines, four pointed

teeth. Teeth at the sides and back tend to be flat and wide. In some species, especially those that eat nectar, the tongue is long and can stick out far beyond the end of the mouth.

GEOGRAPHIC RANGE

Old World fruit bats can be found in tropical and subtropical regions of Africa, through southern and central Asia to Australia, including the Philippines, a number of islands of the Indian and Pacific Oceans, in Pakistan, and across India.

HABITAT

Old World fruit bats live in a variety of habitats. Many fruit bats live in humid forests in tropical and subtropical areas. Species of flying foxes live in tropical coastal areas.

DIET

As their name suggests, Old World fruit bats eat fruit along with nectar. Some species eat primarily nectar and pollen, powdery grains that contain the male reproductive cells of seed plants. Other bats also add leaves and flower parts to their diet.

BEHAVIOR AND REPRODUCTION

Like all bats, Old World fruit bats are crepuscular (kri-PUS-kyuh-lur), active at dawn and dusk, or nocturnal, active at night. During the day they roost, settle or rest, by hanging from their feet. They may hang with their wings wrapped around their bodies. If it is hot, they may use their wings to fan themselves. Many of the species roost in extremely large groups, called camps. A bat camp may contain anywhere from ten individual bats to over one million. The larger species often roost in large groups, whereas the smaller species tend to be more solitary. Most roost in trees; others roost in caves, deserted mines, or buildings.

When fruit is not available fruit bats will travel to another area. The larger species are slow and powerful fliers. Some of these bats will fly as far as 30 miles (15 kilometers) to reach a new feeding area. Island bats may fly over to a neighboring island.

Old World fruit bats differ from other families of bats in that most use smell and sight, rather than echolocation (eck-oh-loh-KAY-shun), to navigate and find their food. Echolocation is the technique of emitting sounds than detecting the location of objects from the echoes. Rousette bats are the only Old World fruit bats that use echolocation.

DEADLY DELICACY?

The diet of flying fox bats may have helped solve a medical mystery. Researchers have been trying to understand why the Chamorro people of Guam developed neurological, brain, disorders at 50 to 100 times the rates elsewhere. A 2003 study linked this disease to the popular delicacy of the flying fox bat. These bats eat cycad (SYE-kad) seeds, which come from palm-like cycad plants common on Guam and surrounding Pacific islands. Cycad seeds contain chemicals that are poisonous to the human nervous system. Researchers continue to investigate the connection.

After these bats find their food they typically take it to away to a nearby tree. Smaller species are able to eat while hovering. Large Old World fruit bats, such as many of the flying fox species, may have to land or grab hold of a branch in order to eat the fruits. These bats hang upside down by one foot and use the other foot to hold the food. They bite off chunks of the food, swallow the juice, and spit out the pulp and seeds. Occasionally they also eat the pulp.

Within camps of flying foxes, one male fruit bat usually lives with up to eight female bats. This arrangement is called a harem (HARE-um). Females will produce one young per year. In other species the females may mate with two or more males while the males will mate with as many females as possible. At least one species is considered monogamous (muh-NAH-guh-mus), having one mate. Gestation, or pregnancy, is between four and six months.

OLD WORLD FRUIT BATS AND PEOPLE

Because Old World fruit bats spit out seeds as they eat, they are important for spreading seeds for many plant species that people eat, and use for medicine and materials. Fruits that depend on bats for pollination, the transfer of pollen, or seed dispersal include bananas, peaches, dates, avocadoes, mangoes, and cashews. The species that thrive on nectar are also important pollinators. As these bats lap up nectar with their tongues, pollen sticks to their fur and is then rubbed or dropped when the bat visits its next flower. These bats are an important disperser of many rainforest species, which the planet and people depend upon.

Deforestation, clearing the forest, has caused a decline in the population of many Old World fruit bat species as they lose their habitats and food supply. Forests also protect bats from natural storms, such as cyclones. People consider many of these bats pests, as they can destroy crops, and may try to eliminate them. Other people hunt and eat some of the Old World fruit bats, especially the larger ones. People such as the Chamorro of Guam consider flying foxes a delicacy.

CONSERVATION STATUS

Many of the Old World fruit bat species are facing a serious decline in population, extinction (dying out), and the threat of extinction. Eight species are listed as extinct by the World Conservation Union (IUCN). Thirteen species are listed as Critically Endangered, facing an extremely high risk of extinction in the wild; six species are listed as Endangered, facing a very high risk of extinction; and thirty-six species are listed as Vulnerable, facing a high risk of extinction in the wild.



SPECIES ACCOUNTS

MARIANAS FRUIT BAT
Pteropus mariannus

Physical characteristics: Marianas fruit bats are one of the many species commonly called flying foxes. They are medium-sized bats with a body length of 7.5 to 9.9 inches (19 to 25 centimeters). The males are slightly larger than the females. The abdomen and wings are dark brown to black with silver hairs mixed throughout the fur. Around the neck and sides of the neck are yellow to bright gold on most animals. In some bats, this area is pale gold or pale brown. The color of the head varies from brown to dark brown.

Geographic range: The Marianas fruit bats are found in the Mariana Islands, located in the western Pacific Ocean, 1,500 miles

(2,400 kilometers) southeast of Japan. They are also found in Guam, Okinawa, and the Ryuku Islands.

Habitat: Marianas fruit bats live in tropical and subtropical areas. They typically live near a body of water.

Diet: These bats feed primarily on fruit, but they do eat other parts of plant materials, such as the flowers and leaves. Favored foods include the fruits of breadfruit, papaya, and figs, along with the flowers of kapok (KAY-pock), coconut, and gaogao.

Behavior and reproduction: Little is known about the nightly movements and behavior of Marianas fruit bats. Many of these bats live in large colonies that can reach 800 individuals. A smaller portion of these bats roost in smaller colonies of ten to twelve; all-male colonies of ten to fifteen; and some roost independently. During the day these bats primarily sleep. Bats gradually leave the colonies for several hours after sunset to forage, search for food. These bats move from island to island but overall, they do not move about much.

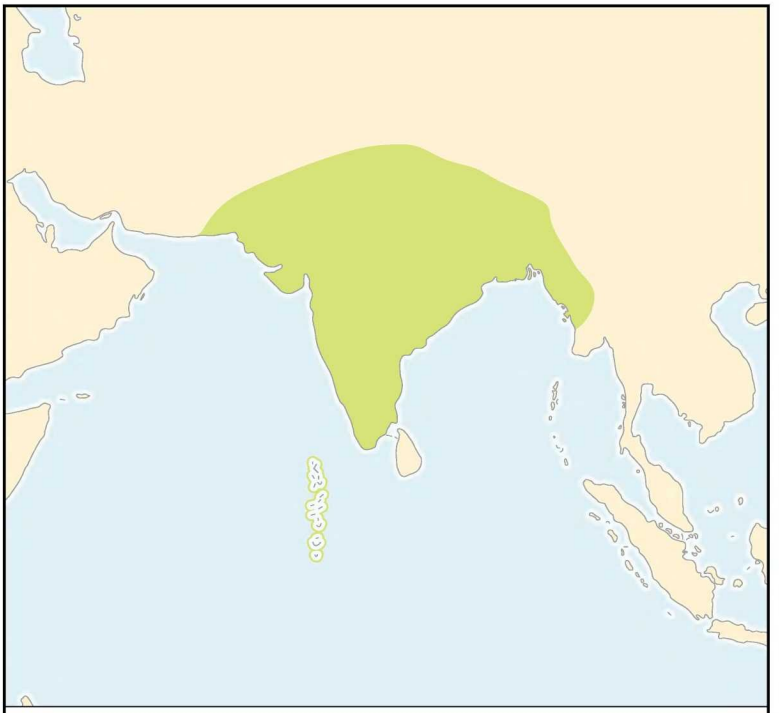
Within larger colonies, some males form harems of several females. The males will defend the females in its group.



The Marianas fruit bat may live in colonies of up to 800 bats. Bats leave the colonies after sunset to search for food. (Illustration by Marguette Dongvillo. Reproduced by permission.)

Marianas fruit bats and people: Marianas fruit bats are hunted for food and, occasionally, their fur. This is one reason these bats have declined in population. These bats are a delicacy to the native Chamorro culture and are illegally hunted. Habitat destruction is another reason for the decline in population. The introduced species, a species brought from another part of the world, the brown tree snake in Guam has been a major predator on these young fruit bats.

Conservation status: Marianas fruit bats are listed as Endangered by the IUCN. In the Commonwealth of the Northern Mariana Islands (CNMI), the Marianas fruit bat is locally listed as an endangered species due to the decline in population. Under local law it is illegal to hunt the fruit bat anywhere in the CNMI. ■



Indian flying fox *(Pteropus giganteus)*

INDIAN FLYING FOX
Pteropus giganteus

Physical characteristics: Named for its physical similarity to a fox, the Indian flying fox has reddish brown fur and the shape of its head is similar to a fox. These bats are one of the largest of all bats and have a wingspan of more than 4 feet (1.2 meters). Its head and body length ranges from 8 to 12 inches (20 to 30 centimeters). These bats have prominent claws that they use to move through trees and branches.

Geographic range: Indian flying foxes are found throughout Bangladesh, Myanmar, India, Pakistan, and Sri Lanka.

Habitat: The Indian flying fox lives in tropical forests and swamps, where there is a large body of water nearby.

Diet: Indian flying foxes feed almost exclusively on a variety of fruit. They chew the fruit to obtain the juice. Very soft fruits such as bananas

are swallowed, but usually the bat spits out the fruit pulp and seeds once it has extracted all the juice. The Indian flying fox also feeds on the juice and pollen of various tree flowers.

Behavior and reproduction: During the day Indian flying foxes roost in large camps in trees. These sites are out in the open. Camps may contain several hundred to several thousand flying foxes. Colony size changes with the seasons, becoming smaller during the summer and increasing during the rainy season. These bats typically keep the same roost sites for many years, and the trees become stripped of bark and leaves over time. During the day the bats are noisy and active. At night they can fly great distances to forage for food.



Indian flying foxes fly long distances at night in search of food. (© Stephen Dalton/Photo Researchers, Inc. Reproduced by permission.)

Within the roost there is often a pecking order within the male population. The more dominant males, those that are larger and stronger, take the best roosting sites.

Indian flying foxes breed from July to October. When ready to give birth, the females will gather in upper branches of their roosting trees. Females have one offspring after a gestation period of 140 to 150 days. The baby will cling to its mother for about two months until it is almost full size.

Indian flying foxes and people: While it once fed mainly on wild fruit, the bat now increasingly feeds on cultivated crops of fruit trees, which has caused many people to consider these bats pests. Farmers have used various methods to get rid of these bats. These foxes are also hunted in parts of Pakistan for its fat, which is used for medicine. People have also cleared the trees from many of the islands where these bats live, causing the population to decline.

Conservation status: The Indian flying fox is not considered threatened by the IUCN. In Pakistan, this species is specifically exempted from protection under wildlife regulation. ■



EGYPTIAN ROUSETTE
Rousettus aegyptiacus

Physical characteristics: Rousettes are relatively small compared to other Old World fruit bats. The head and body are approximately 4.5 to 5 inches long (11.4 to 12.7). These bats have a simple, dog-like face and ears, large eyes, and a very short tail that sticks out. The tail is about 0.4 to 0.9 inches (1 to 2.2 centimeters) long. The fur of these bats is brown, and often tinged with gray.

Geographic range: Egyptian rousettes are found in southern, western, and eastern Africa, Egypt, the Middle East, and Cyprus.



Egyptian rousettes are usually found roosting in caves. (© Clive Druett/Papilio/Corbis. Reproduced by permission.)

Habitat: Egyptian rousettes roost in humid areas, such as dark caves and abandoned buildings. Most are found roosting in caves. In Cyprus, some colonies may move to open sites in March.

Diet: Rousettes feed on many kinds of soft fruits, the juice of hard fruits, and certain leaves. Figs and dates form its main diet in dry regions.

Behavior and reproduction: Egyptian rousettes roost primarily in caves. They also roost in buildings, ancient ruins, trees, and rock crevices. They can form colonies of up to several thousand individuals. In South Africa, camps had an estimated 7,000 to 9,000 bats. In Pakistan, these bats appear to form small roosting colonies of about twenty to forty individuals. The bats use smell to help them locate their food.

While Egyptian rousettes appear to have good vision, these bats also use echolocation. Scientists think they use echolocation to help them navigate in caves and at night. As opposed to the echolocation calls of many other bats, humans can hear the echolocation calls of rousettes. They make a clicking sound with their tongue.

Some populations breed two times during the year. Females have one offspring per year and gestation is about four to six months. In Egypt, a field study found they breed year round.

Egyptian rousettes and people: Fruit farmers are the most important threat to populations. In Turkey and Israel, rousette caves have been fumigated, filled with smoke or fumes in order to kill pests, or the caves have been closed off by walls.

Conservation status: Egyptian rousettes are not listed as threatened by the IUCN. ■



DWARF EPAULETTED FRUIT BAT
Micropteropus pusillus

Physical characteristics: Dwarf epauletted fruit bats are relatively small. Their head and body length is approximately 2.6 to 3.7 inches (6.7 to 9.5 centimeters). Males are larger than females. While the tail length varies among individual bats, it is never long, ranging from not having a tail to 0.2 inches (0.4 centimeters). Fur is typically a light brown with a paler color on the underside. The hair is moderately long, thick, and soft. At the base of the ear are small whitish tufts of hair and males have pouches in their shoulder with tufts of white hair.

Geographic range: Dwarf epauletted fruit bats are found in western, southwestern, and central Africa.



Dwarf epauletted fruit bats live in open woodlands and on the edges of forests and feed on small fruits, nectar, and pollen. (Illustration by Brian Cressman. Reproduced by permission.)

Habitat: These bats live in open woodlands and on the edges of forests. Dwarf epauletted bats have also been found between the leaves of dense bushes, usually close to the ground.

Diet: Dwarf epauletted bats feed on small fruits, nectar, and pollen. When eating the fruits, these bats place their mouths around the ripe fruit and slowly suck its juices. They then drop the uneaten fruit pulp when they are finished.

Behavior and reproduction: Little is known about the dwarf epauletted bat's behavior and mating behavior. Dwarf epauletted bats are independent, typically roosting alone, with one other bat, or in small groups of up to ten. These bats move about frequently and do not have a regular roosting spots or feeding areas. These bats may eat two and a half times their body weight in a single night. It digests quickly and disperses, spreads, large quantities of seeds as it flies between feeding sites.

These bats are polygamous (puh-LIH-guh-mus), having more than one mate. There are two breeding seasons. Studies in the Ivory Coast indicate that births peaks from about March to May and from September to November. The gestation period is five to six months. Young females can mate at six months and give birth at twelve months.

Dwarf epauletted fruit bats and people: There is no known relationship between dwarf epauletted bats and people.

Conservation status: Dwarf epauletted bats are not listed as threatened. ■



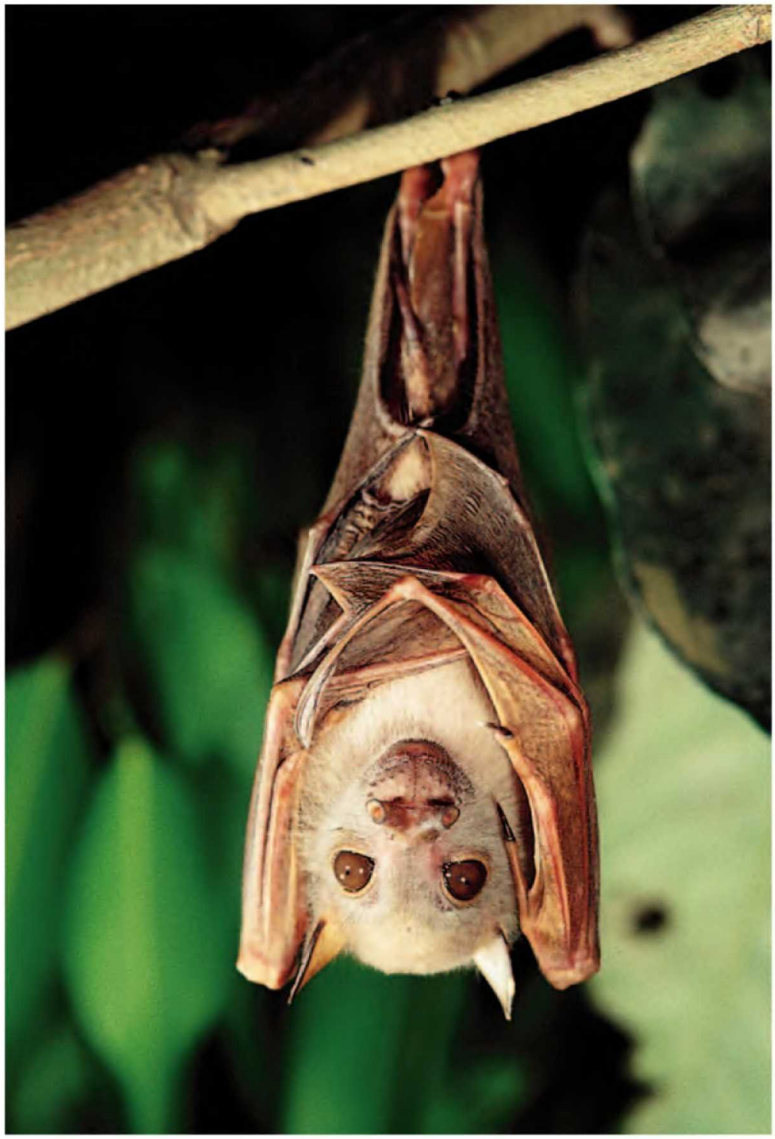
Queensland tube-nosed bat *(Nyctimene robinsoni)*

QUEENSLAND TUBE-NOSED BAT
Nyctimene robinsoni

Physical characteristics: Queensland tube-nosed bats are also called eastern tube-nosed bats. These bats have nostrils shaped like tubes that jut out about 1 inch (2.5 centimeters). Researchers do not yet understand the purpose of these tubes. Their head and body length is 3 to 5.1 inches (7.5 to 13 centimeters) with a tail length of 0.8 to 1 inch (2 to 2.5 centimeters). These bats have light brown fur with a dark stripe down the back. Their wings are brown with yellowish spots.

Geographic range: Queensland tube-nosed bats are found in eastern Australia.

Female Queensland tube-nosed bats typically have one offspring per year. A baby is shown here, hanging on a branch. (© B. G. Thomson/Photo Researchers, Inc. Reproduced by permission.)



Habitat: These bats live in tropical rainforests and subtropical rainforests.

Diet: These bats feed on fruit.

Behavior and reproduction: Queensland tube-nosed bats roost on branches of trees that have thick vegetation. They are solitary and do not appear to roost in groups. The bats often fly very close to the ground as they search for food. Queensland tube-nosed bats are polygamous with one breeding season. Females generally

have one offspring per year. Gestation is approximately four to five months.

Queensland tube-nosed bats and people: By clearing these bats' natural habitats, people have caused the population of this bat to decline.

Conservation status: Queensland tube-nosed bats are not listed as threatened by IUCN. They are listed as vulnerable in Australia's New South Wales Threatened Species Conservation Act. ■

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MOUSE-TAILED BATS
Rhinopomatidae

Class: Mammalia
Order: Chiroptera
Family: Rhinopomatidae
Number of species: 4 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Also known as long-tailed bats, the bats in this family have a tail almost as long as their head and body. This slender, long tail is unique among all the bats. These bats are small to medium-sized, about 2 to 3.5 inches (5 to 9 centimeters), not including the tail. Their backs are generally gray-brown to dark brown, and they may be lighter on their underside.

The ears of mouse-tailed bats are rather large and connected by a band of skin across the forehead. The ears extend past the nose when they are laid forward. Their snouts have a small, rounded noseleaf, a horseshoe-shaped flap of skin around the nose.

GEOGRAPHIC RANGE

Mouse-tailed bats are generally found in Africa and Asia, across the Sahara, from western Africa through the Middle East to India and Thailand.

HABITAT

Mouse-tailed bats are usually found in arid, extremely dry, regions. This can range from deserts to extremely dry woodland. They roost, rest or settle, in caves, rock clefts, wells, pyramids, and buildings.

DIET

Mouse-tailed bats eat insects, including flying ants, termites, beetles, and moths.

As the months turn cooler the bat begins store fat, especially in the abdominal, stomach, region. These fat deposits can equal the bat's normal body weight. During the winter months when insects are in short supply some species of mouse-tailed bats go into a type of deep sleep called torpor, and they absorb the fat deposits. During this period the bat is able to survive for several weeks without food and water. In some areas, some species migrate between summer and winter roosts.



TUNING TO BATS

Bats are difficult to study because they fly and are only active at night. Radio tagging, the marking of bats with a radio transmitter, is one technology that researchers are using to study bats. Transmitters are typically 5 percent of the bat's body weight and can be glued to the bat's back or put on a collar. Results from these studies show that long-tailed bats are highly selective in choosing nest sites and sites are usually used for only one day.

BEHAVIOR AND REPRODUCTION

When mouse-tailed bats roost they often hang by the thumbs as well as the feet. They emerge from their roosts at dark and begin their search for food. The small mouse-tailed bat has an unusual flight in that it rises and falls, much like some small birds. This species travels by a series of glides, some of great length, and occasionally it flutters, about 20 to 30 feet (6 to 9 meters) above the ground.

Like all bats, mouse-tailed bats are nocturnal, active at night. They use echolocation (eck-oh-loh-KAY-shun) to pinpoint, identify, and capture their prey, the animals they hunt for food. In echolocation, the bats call out a high-frequency sound in the ultrasonic ranges, which is above the sounds humans can hear. These sound waves bounce off of objects and echoes or bounces back to the bat. The bat can then determines the location, size, distance, and speed of the object.

Mouse-tailed bats generally hunt in the open air high above ground. With small prey distributed throughout a large space, the bats must cover a large search area to find an insect. Mouse-tailed bats can travel up to 12 miles (20 kilometers) from their roost sites in a single night.

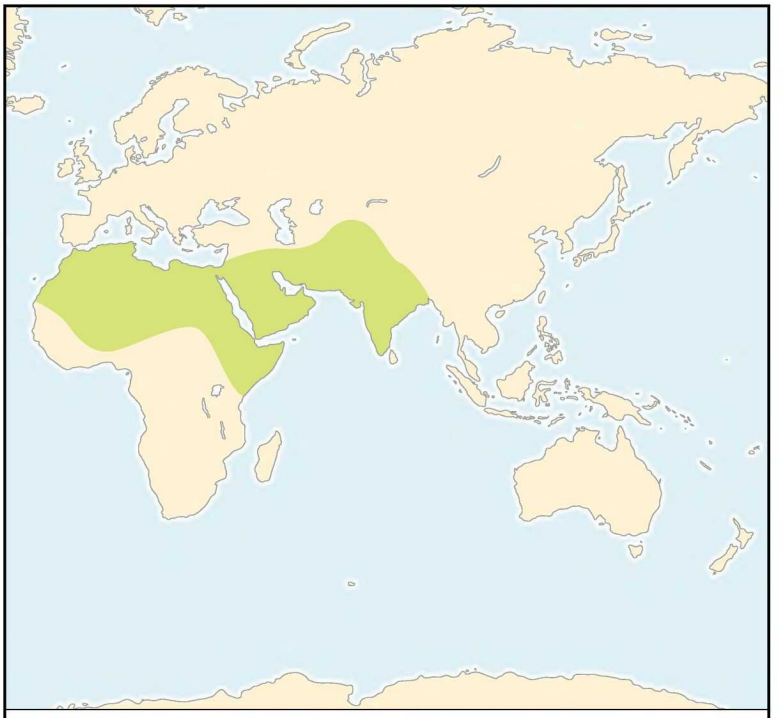
Female bats give birth to one young annually. The young are fully grown and weaned in about six weeks. Reproduction periods of these bats depends upon where they live and their species.

MOUSE-TAILED BATS AND PEOPLE

Mouse-tailed bats are indirectly helpful to humans because they eat many insects that humans consider pests.

CONSERVATION STATUS

One species, MacInnes' mouse-tailed bat, is categorized as Vulnerable, facing a high risk of extinction in the wild due to the destruction the bat's natural habitat. The other three species are not listed as threatened with extinction.



Hardwicke's lesser mouse-tailed bat *(Rhinopoma hardwickei)*

HARDWICKE'S LESSER MOUSE-TAILED BAT *Rhinopoma hardwickei*

SPECIES ACCOUNT

Physical characteristics: Hardwicke's lesser mouse-tailed bats are also called long-tailed bats, referring to their long, thin mouse-like tail. The tail can be as long to the length of the head and body combined.

These bats are relatively smaller than other species in the family. They have a body length of about 2.5 inches (5.5 centimeters), and their forearms range in length from 2 to 2.5 inches (5.2 to 6.4 centimeters). They weigh about 0.4 to 0.5 ounces (11 to 14 grams).

The fur of lesser mouse-tailed bats is soft. It is generally a gray-brown color on the upper side of and a paler color of the same shade on its underside. These bats appear to be furless on their faces and backsides. These bats feature large ears that are connected by a band of skin across the forehead. The snout has a small, rounded noseleaf. Directly above the nostrils are slits that they can open and close.



Hardwicke's lesser mouse-tailed bats live in dry regions. To help them survive, they can close valves in their nostrils to keep from breathing in dust, and they can control their kidneys to reduce water loss. (© Merlin D. Tuttle, Bat Conservation International. Reproduced by permission.)

Geographic range: Lesser mouse-tailed bats extend from northern Africa to southern Asia. They are found in Morocco, Senegal, Egypt, Israel, Syria, Jordan, Lebanon, Saudi Arabia, Yemen, Afghanistan, India, Socotra Island, and Pakistan.

Habitat: Lesser mouse-tailed bats typically live in extremely dry or arid regions, They are found in mostly treeless areas ranging from deserts to grasslands and dry woodland.

Diet: Lesser mouse-tailed bats feed on flying insects, such as moths and beetles. These bats build up a large fat reserve in their lower abdomen and can go without feeding for two months.

Behavior and reproduction: Lesser mouse-tailed bats have unique adaptations, changes in body structures and functions, for life in dry regions. They can close valves in the nostrils to keep from breathing in dust. They can also control their kidneys to reduce water loss. In extremely hot weather these bats move into a shelter.

Lesser mouse-tailed bats find their food using echolocation. Studies have found that when several of these bats forage for food together, each uses an echolocation call of a different sound frequency.

Lesser mouse-tailed bats roost in caves, rock clefts, wells, pyramids, palaces, and houses. They gather in both large and small colonies. Colonies can number in the thousands, or range from one to ten individuals. They often hang by their thumbs as well as feet. Studies have found that roosting sites are generally used for only one day, and then they will select another site.

Studies indicate that lesser mouse-tailed bats are polygamous (puh-LIH-guh-mus), having more than one mate. Female lesser mouse-tailed bats produce one offspring annually. They gestate, are pregnant, for a period of 90 to 100 days. In a field study of lesser mouse-tailed bats, birth occurred over ten days in mid-December. The young began flying at five to six weeks.

Lesser mouse-tailed bats and people: Lesser mouse-tailed bats eat insects that many humans consider pests. There are indications that these bats may be declining in population, due to human activities. Reasons for the population decline include clearing these bats' forest habitats, disturbing their roosting sites, and introducing animals into an area that are predators of these bats, animals that hunt them for food.

Conservation status: Lesser mouse-tailed bats are not currently in danger of extinction. There is some evidence that long-tailed bats are now rare or absent at many sites where formerly they were common. ■

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SAC-WINGED BATS, SHEATH-TAILED BATS, AND GHOST BATS

Emballonuridae

Class: Mammalia
Order: Chiroptera
Family: Emballonuridae
Number of species: 47 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Emballonurids (bats in the family Emballonuridae) are small to medium in size. Their head and body length is about 1.4 to 6.3 inches (36 to 160 millimeters). They can weigh from 0.1 to 3.5 ounces (3 to 100 grams), about the weight of a first-class letter. These bats have thirty to thirty-four teeth.

For the most part, emballonurids are brown or gray in color, but this family also includes the whitish ghost bats in the genus *Diclidurus,* and bats with a pair of white stripes down their back in the genus *Saccopteryx.* Emballonurids have a smooth face and lips with relatively large eyes. Their ears are usually round and cup-shaped, often joined by a band of skin across the forehead. The ears have a tragus (TRAY-gus), a flap that projects from the inner ear. Researchers theorize the tragus plays some role in echolocation (eck-oh-loh-KAY-shun), the process of sending out high-pitched sounds and identifying objects by interpreting the sound when it bounces back.

Some emballonurids are also known as sheath-tailed bats because of their tail. They have a short tail that juts out from the membrane (double layer of thin skin) between their legs, and when their legs are stretched out their tail appears to be sheathed in the membrane. Another name for some emballonurids is sac-winged bats, referring to the glandular sacs in their wing membranes. Glandular sacs produce and release substances for use in the body. In this case they contain a liquid with a strong odor. In the sac-winged bats these sacs are more pronounced in males. The position and size of these sacs differs depending upon the species.

GEOGRAPHIC RANGE

Emballonurids live in the tropical and subtropical regions of the world, including Mexico, Argentina, Madagascar, and Southeast Asia.

HABITAT

Emballonuridae bats generally live in humid rainforests. These bats tend to roost, rest or settle, in areas that are relatively light compared to what other bat families prefer. Their roosts include the entry areas to caves and other structures, the outside of buildings, hollow trees, and leaves.

DIET

Emballonurids eat primarily insects, although they have been seen eating fruit. They generally eat insects while flying, yet some species are known to look for their food along the ground. These bats start foraging, searching for food, relatively early in the day compared to other bats. Some of these bats such as the ghost bats, capture their meals while flying high in the open air. Other bats, such as the proboscis bat, hunt insects above or close to water surfaces.

BEHAVIOR AND REPRODUCTION

By pulling their hind legs together or apart during flight, the emballonurids can shorten or lengthen their membrane. This gives these bats tremendous control as they steer, maneuver, and turn in flight. Like all bats, they are nocturnal, resting during the day and becoming active at night. During bad weather, some species forage in the afternoon.

Some emballonurids roost in large groups, others gather in smaller groups of about ten to forty, and a few are loners. Colonies of African sheath-tailed bats include up to 50,000 bats, each of which returns to a precise place in a roosting cave along the Kenyan coast. Daytime roosts for the sac-winged bat can reach up to sixty individuals. Proboscis bat females roost apart from the males when the young are born. Different shelters are used by adult male and female gray sac-winged bats during the summer; most of the other forms seem to remain together throughout the year.

Some emballonurids, such as the greater sac-winged bat, live in year-round stable harems (HARE-um; group of females associated with one male), with one to eight females in an area

THE FIRST FOSSILS

Emballonurids were first recorded in Europe thirty-eight to fifty-four million years ago.

that is patrolled by a male. Male sac-winged bats in the genus *Saccopteryx* defend their harems with energetic flight maneuvers. Researchers have found that harem males father an average of 30 percent of the offspring within their harem. The majority of offspring is fathered by other harem males or by males from outside the colony.

Some of these bats perform elaborate mating rituals. The social calls they emit are audible to humans. For species in which the males have sacs in the front wing membrane containing a liquid with a strong scent, the males fan the odor towards the females while hovering around them. Each afternoon, male *Saccopteryx* bats store a cocktail of perfume in their wing sacs that consists of urine, saliva and other bodily secretions.

There is a variety of different mating customs among the different species of emballonurids. Most of these bats are polygamous (puh-LIH-guh-mus), meaning that males mate with more than one female during the mating season. Yet the chestnut sac-winged bat, and possibly other species, are monogamous (muh-NAH-guh-mus), meaning a male and female mate and pair only with each other.

Emballonurids generally give birth to a single offspring each year. An exception is the small proboscis bat that reproduces twice a year. Most emballonurid females give birth to their offspring at the beginning of the rainy season.

EMBALLONURIDS AND PEOPLE

Because emballonurids prefer roosting in open areas, these bats are among the more common bats for people to spot. They can be seen in trees, on buildings, and at the edges of caves. The social calls they emit are also within human hearing range. Some emballonurids are declining due to human destruction of their natural habitat.

CONSERVATION STATUS

There are several emballonurid species that are endangered or threatened with becoming endangered. The IUCN lists two species as Critically Endangered, facing an extremely high risk of extinction in the wild; two species as Endangered, facing a very high risk of extinction in the wild; and ten species as Vulnerable, facing a high risk of extinction in the wild.



Greater sac-winged bat *(Saccopteryx bilineata)*

SPECIES ACCOUNTS

GREATER SAC-WINGED BAT
Saccopteryx bilineata

Physical characteristics: Greater sac-winged bats are relatively small, with a body length of 1.8 to 2.2 inches (47 to 56 millimeters). These bats are also called greater white-lined bats, referring to the two white lines that run down their bodies. Their fur is typically dark brown, while the underside is typically gray. These bats have dark wings, long noses, and the females are slightly larger than the males.

Geographic range: Greater sac-winged bats live in Central and South America; from south Mexico to southeast Brazil.



The greater sac-winged bat is also called the greater white-lined bat, because of the two white lines that run down the back. (Illustration by Barbara Duperron. Reproduced by permission.)

Habitat: Greater sac-winged bats live in lowland evergreen or semi-deciduous forests. They roost in relatively open areas, such as hollow trees and occasionally in buildings.

Diet: Greater sac-winged bats feed on insects.

Behavior and reproduction: Greater sac-winged bats are among the most common bats seen in the rainforest because they often roost on the outer parts of large trees. They use echolocation to locate their prey and then catch the insects while flying. Echolocation is a process by which the bats emit a variety of sounds and use the echoes from the sounds to identify objects around them. These bats are unusual in that males sing songs to females during the day in their colonies. These bats have been found roosting in relatively large colonies of sixty individuals. Within those colonies there can be smaller groupings of one to nine females. As seasons change, colonies move between different areas to forage for food.

Females give birth to a single offspring each year, typically at the beginning of the rainy season in July or August. It is thought these bats are polygamous, meaning that they have more than one mate during the mating season.

Greater sac-winged bats and people: There is no known significant relationship between greater sac-winged bats and people.

Conservation status: Greater sac-winged bats are not listed as threatened. ■



Greater dog-faced bat *(Peropteryx kappleri)*

GREATER DOG-FACED BAT
Peropteryx kappleri

Physical characteristics: Greater dog-faced bats are also referred to as greater dog-like bats. These bats are relatively small, with a head and body length of 2.5 to 2.9 inches (63 to 75 millimeters). Their fur is typically dark or reddish brown and their underside is paler in color. Tufts of hair cover the head. The ears are separated at the base and are usually, along with the wings, black in coloration. Males are generally slightly larger than females.

Geographic range: Greater dog-faced bats live in southern Mexico to Peru and southern Brazil.



Greater dog-faced bats roost in small, shallow caves, holes in trees, and under fallen logs. (Illustration by Barbara Duperron. Reproduced by permission.)

Habitat: Greater dog-faced bats have been found in forests, swamps, and savanna (grassland). They roost in small, shallow caves, holes in trees, and under fallen logs where light can enter. A study in Costa Rica found these bats roost about 39 inches (1 meter) from the ground.

Diet: Greater dog-faced bats eat insects.

Behavior and reproduction: Greater dog-faced bats have been found in Costa Rica to roost in colonies of one to six individuals. Usually there were several adults of each sex in the group. One unique behavior is that males sit on top of females. This implies that the male bat is protecting or guarding the female and that the females and males could be monogamous. At the beginning of the rainy season females give birth to a single offspring.

Greater dog-faced bats and people: There is no known significant relationship between greater dog-faced bats and people.

Conservation status: Greater dog-winged bats are not listed as threatened. ■

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KITTI'S HOG-NOSED BAT
Craseonycteridae

Class: Mammalia
Order: Chiroptera
Family: Craseonycteridae
One species: Kitti's hog-nosed bat (*Craseonycteris thonglongyai*)

family
CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The only species in the Craseonycteridae family is Kitti's hog-nosed bat or simply, hog-nosed bat. They are also called bumblebee bats, because they are about the size of a bumblebee. This species was unidentified until 1974.

Kitti's hog-nosed bat is considered the word's smallest mammal. The head and body combined measure only 1.1 to 1.3 inches (29 to 34 millimeters), and they weigh about 0.7 to 0.9 ounces (2.0 to 2.6 grams), which is about the weight of a dime. These bats have a wingspan of about 6 inches (15 centimeters), which is smaller than some butterflies.

The name hog-nosed refers to the bat's facial appearance. Their muzzle is pig-like, with two wide, crescent-shaped nostrils. Their ears are relatively large with rounded tips. They extend beyond the snout when the bat is lying forward. Their eyes are relatively small and partially hidden by fur. Hog-nosed bats have long and broad wings with pointed tips. Fur on the back may be a brown to reddish brown and its belly is typically paler. These bats have twenty-eight teeth.

Kitti's hog-nosed bats have long, slender feet and a short thumb with a well-developed claw. They do not have an external tail. Males have a glandular swelling at the base of the throat. The bumblebee bat also has a web of skin between its hind legs, which is thought to help with flying and catching insects.

GEOGRAPHIC RANGE

Kitti's hog-nosed bats were once found only in Thailand. Most of these bat populations were located in Sai Yok Na-

tional Park. In 2001 a second population of bumblebee bats was found in a cave in Myanmar.



Kitti's hog-nosed bat is also called the bumblebee bat, because of its very small size (© Merlin D. Tuttle, Bat Conservation International. Reproduced by permission.)

HABITAT

Bumblebee bats have been found deep inside small, remote limestone caves, caves formed by water dissolving calcium carbonate rock. Hog-nosed bats appear to prefer caves with multiple chambers and domed roofs located near rivers or areas with water.

DIET

Kitti's hog-nosed bats feed on insects, including spiders, beetles, small flies, wasps, and bark lice. They hunt their prey (animals they eat) through echolocation (eck-oh-loh-KAY-shun), a technique in which the bats emit high-pitched sounds that bounce off objects. The bats then detect the objects around them by listening to the sounds' echoes. These sounds are too high pitched for humans to hear.

BEHAVIOR AND REPRODUCTION

Hog-nosed bats are crepuscular (kri-PUS-kyuh-lur), meaning that they are active at dawn and dusk. These bats are most active in the evening. A few minutes after the sun sets they leave the cave and fly in a circular pattern above the cave entrance for about one minute before flying away. They then separate into small groups and head off to a foraging area, a place to search for food, which is usually relatively close, within 820 feet (250 meters) of the cave.

Hog-nosed bats eat for about thirty minutes then return to the cave for the night. They are active again during the hours before sunrise. In the early morning they feed and then return to the cave.

The bats roost (settle or rest) together in caves in small numbers of up to fifteen individuals. While they roost together, the bats appear to be independent. They roost alone instead of clustered together with others.

From the shape of their wings and stomach content it appears that they can hover to catch their prey. It is unclear exactly how the hog-nosed bat captures its food. It could snatch small insects



off surrounding leaves, twigs, or other surfaces. It could hunt near the ground. Other observations conclude that these bats may catch insects on their wings while flying.

Little is known about the hog-nosed bat's mating habits. The species is thought to be polygamous (puh-LIH-guh-mus), meaning that they have more than one mate during the mating season. There is evidence to show that the bats have their young during the beginning of the summer's rainy season.

KITTI'S HOG-NOSED BATS AND PEOPLE

People have caused the population of hog nosed bats to decline by disturbing their habitats and food supplies. Much of the areas around the bats' caves have been cleared for agriculture. Recreation and tourism are also reasons for the disruption of the bat's habitat and the resulting decline in population.

CONSERVATION STATUS

Kitti's hog-nosed bats are listed as Endangered, facing a very high risk of extinction, dying out, by the IUCN; they are one of the rarest bats in the world.



HOLY BAT DISCOVERY!

The discovery of the tiny bumblebee bats set a new record for the smallest bat in the world. The Kitti of Kitti's hog-nosed bats refers to Kitti Thonglongya, who collected the bat in Thailand in 1968. Thonglongya went on to collect and discover other new bat species, such as the extremely rare Salim Ali's fruit bat.

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SLIT-FACED BATS
Nycteridae

Class: Mammalia
Order: Chiroptera
Family: Nycteridae
Number of species: 14 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Slit-faced bats are small to medium in size. Head and body length is 1.6 to 3.7 inches (4 to 9.3 centimeters), and adults weigh 0.2 to 1.2 ounces (6 to 36 grams). Also called hollow-faced bats, the feature that gives slit-faced bats their name is a deep groove that runs from their nostrils to a pit in the middle of their forehead. The dent is hidden by fur, which makes it hard to see.

Species of slit-faced bats have large, oval ears and their wings are broad. Slit-faced bats range in color from orange, brown, and red to gray. These bats also have a distinctive feature among mammals at the end of their tail. The long tail, completely enclosed within a membrane, ends in a T-shaped tip.

GEOGRAPHIC RANGE

Slit-faced bats are found throughout most of Africa, Southeast Asia, and Madagascar. Most species are found in Africa.

HABITAT

Some species of slit-faced bats live in woodland savanna or dry country, and others live in rainforests in Africa or in Southeast Asia.

DIET

A slit-faced bat's diet depends upon the species. Most species of these bats feed primarily on a variety of arthropods (animals that have jointed bodies and limbs), such as moths, butterflies, beetles, crickets, centipedes, scorpions, and spiders. Some bats,

the larger slit-faced bats, will also eat small vertebrates (animals with a backbone), such as frogs, birds, fish, other bats, and mice.

BEHAVIOR AND REPRODUCTION

Like all bats, these bats are nocturnal, meaning they are active at night. Slit-faced bats also use echolocation (eck-oh-loh-KAY-shun), the detection of an object by means of reflected sound. It is not known how much they depend upon echolocation to catch their prey (animals hunted for food). The echolocation calls of these bats are low in intensity, or energy, and brief. Usually the calls last only a millisecond or less.

As well as echolocation, it appears that these bats depend upon sound to find food. Their large ears are apparently used to listen for the low-frequency sounds of prey-generated movements, such as the sound of an insect scuffling along the ground or calls the insects may make. Slit-faced bats sometimes catch their prey in the air, but primarily snatch their prey from a surface, such as a leaf or branch.

The broad wings of slit-faced bats enable them to fly slowly and hover, then pluck insects off ground or vegetation surfaces. When bats, such as the large slit-faced bat, catch and kill larger prey such as small vertebrates, they carry them off to their feeding perch. These bats can hunt either lying in wait on their perches or from slow, continuous flight low to the ground. When they eat insects, they typically drop their wings and legs.

Like all bats, slit-faced bats are active in the night hours and they roost (settle or rest) during the day hours. Most species shelter alone, in pairs, or in small family groups or colonies (group of animals of the same type living together). Roosting sites for slit-faced bats are diverse, and may include hollow trees, dense foliage, rocky outcrops, caves, buildings, ruins, abandoned wells, and porcupine and aardvark burrows.

Slit-faced bats have one offspring per year, typically at the beginning of the rainy season. Female large slit-faced bats leave their young behind in the roost when they set out at night to hunt. They return several times throughout the night to feed their young.

SLIT-FACED BATS AND PEOPLE

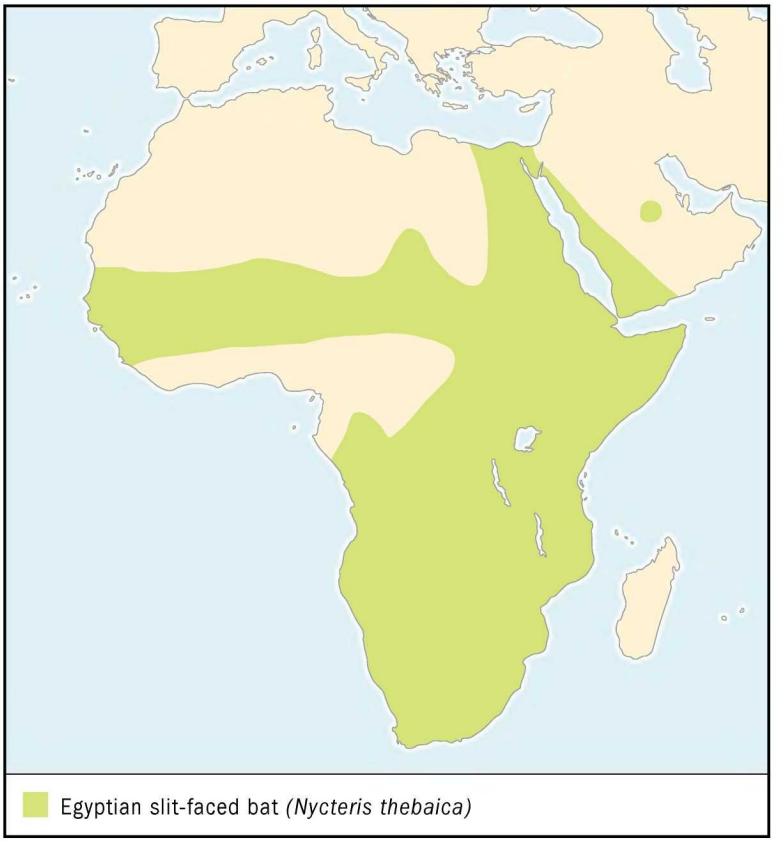
There is no known special relationship between slit-faced bats and people.

From the Greeks

The name *Nycteris* comes from the Greek word *nykteros,* meaning nocturnal.

CONSERVATION STATUS

The IUCN lists the Javan slit-faced bat and the Ja slit-faced bat as Vulnerable, facing a high risk of extinction in the wild. Three other species are listed as Near Threatened, not currently threatened, but may become so.



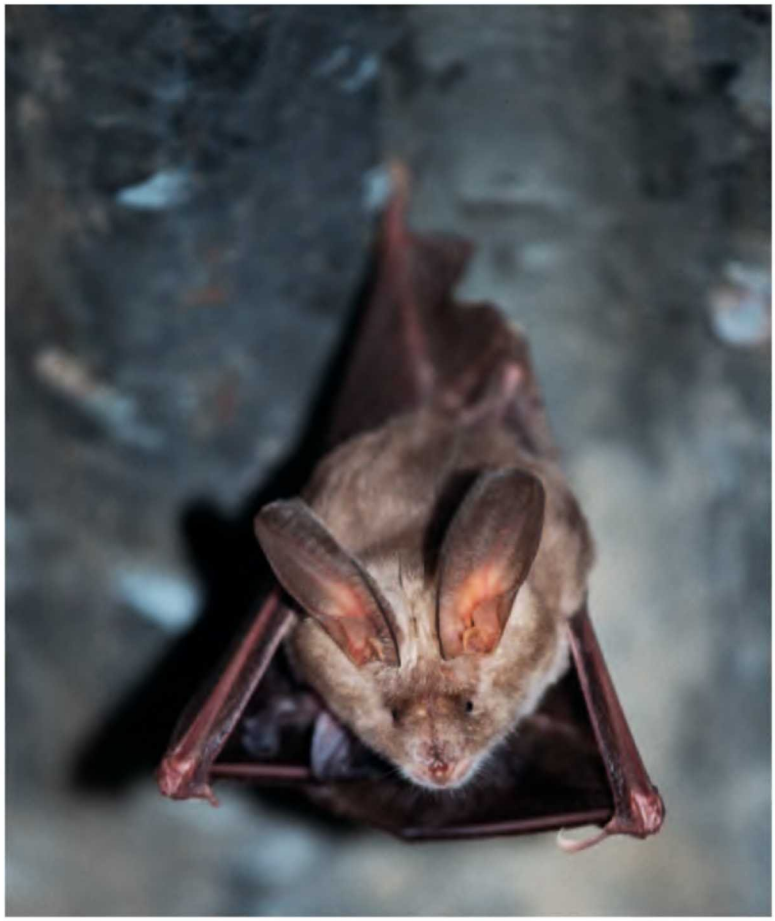
EGYPTIAN SLIT-FACED BAT
Nycteris thebaica

SPECIES ACCOUNT

Physical characteristics: A distinctive feature of the Egyptian slit-faced bat is its long ears. The bat has long, fine fur that is gray to red. Its underparts are lighter in color. These bats are also called common slit-faced bats. They are medium-size bats, with an adult weighing about 0.2 to 0.4 ounces (7 to 12 grams)—about the weight of five pennies.

Geographic range: Egyptian slit-faced bats are found in Africa.

Habitat: These bats live in the open savanna woodlands of sub-Saharan Africa, in the dry or arid (extremely dry) areas of Africa. These bats can live in a wide range of habitats, with roosts including caves, under mines, buildings, and tree hollows.



When the female Egyptian slit-faced bat leaves the roost at night to hunt, she takes her young with her and then sets them in another area while she hunts. (Brock Fenton. Reproduced by permission.)

Diet: Egyptian slit-faced bats typically diet on arthropods, such as spiders, crickets, and scorpions, as well as insects, such as moths and beetles.

Behavior and reproduction: When foraging for food, Egyptian slit-faced bats pick their prey off the ground and vegetation surfaces, such as leaves or branches, as well as while flying. They can fly slowly and maneuver well, which allows them to hunt close to the ground and in dense vegetation.

These bats use echolocation and simply listening to detect their prey. Their large ears enable the bats to pick up sounds like the scuffling of some insects or the beating of wings. The purpose of the bird-like chirps they make while searching for their prey at night is unknown.

The roosts of Egyptian-slit faced bats include caves, areas under roads, mines, hollow trees, and roofs. They can be seen hanging from

veranda (a structure like a porch) rooftops in temporary night roosts as they rest from their foraging. Observations have spotted colonies ranging in size from several and several hundred individuals.

Females produce a single offspring each year after gestating (being pregnant) for about 150 days. When the female leaves the roost at night to hunt, she takes her young with her and then sets them in another area while she hunts. Both sexes reach reproductive maturity at about their second year of life.

Egyptian-slit faced bats and people: There is no known significant relationship with people.

Conservation status: The IUCN does not consider Egyptian slit-faced bats to be threatened. ■

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FALSE VAMPIRE BATS
Megadermatidae

Class: Mammalia
Order: Chiroptera
Family: Megadermatidae
Number of species: 5 species

family
CHAPTER

PHYSICAL CHARACTERISTICS

False vampire bats are medium-sized to large bats with a head and body length of 2.6 to 5.5 inches (6.5 to 14.0 centimeters). Their wingspans can reach 3 feet (1 meter). The Australian false vampire bat, also called the Australian ghost bat, is among the largest of the microchiropteran (my-kro-keer-OP-ter-an) bats. Microchiroptera is one of the two suborders of bats and includes most of the bats in the world.

False vampire bats have large ears joined by a band of skin across the forehead and noseleafs, which are fleshy protrusions from the nose. The heart-nosed bats have a leaf-like nose that is heart-shaped.

Megadermatids (meg-ah-der-MAT-ids; bats in the family Megadermatide) have a tail that is either short or absent. These bats typically have relatively short and broad wings.

Their fur tends to be long and gray in color, although the yellow-winged bats have bright yellow or orange wings and ears, with bluish fur. False vampire bats have twenty-six or twenty-eight teeth. The flesh-eating, or carnivorous, megadermatids, such as the Australian false vampire bats, have sharp and strong canine teeth for tearing flesh and crushing bones.

GEOGRAPHIC RANGE

Megadermatids are found in Africa, Asia, east India, Philippines, and Australia.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

HABITAT

Megadermatids live in open, dry habitats in Australia, and in open woodlands. They also live in the very dry or arid areas of Africa and India. Typical habitats for heart-nosed bats include dry lowlands, coastal strip habitats, and sometimes river valleys.

DIET

Many of the megadermatid species are also known as false vampire bats because people mistakenly believed that they eat blood. Megadermatids eat insects or small vertebrates (animals with backbones), and none of them feed only on blood. The carnivorous species, such as the Australian false vampire bats, eat small vertebrates that include fish, frogs, lizards, birds, mice, or other bats. The Asian false vampire bats have a diverse diet, feeding on everything from insects, spiders, fish, birds, and frogs, to rodents and even occasionally smaller bats. False vampire bats are among the top predators (hunters) of the forest, hunting mainly birds, other bats, and rodents.

Yellow-winged bats eat insects on the ground or while flying. They feed on large and small insects, including moths and butterflies, grasshoppers, beetles, flies, and mosquitoes.

BEHAVIOR AND REPRODUCTION

Megadermatids make echolocation (eck-oh-loh-KAY-shun) calls through the nose. Echolocation is a technique of sending out sounds and then using the reflection or echoes of the sound to detect objects. In bats these sounds are too high-pitched for humans to hear. Megadermatids use their large noseleaf to focus the sound outwards.

Megadermatids roost (settle or rest) in caves, rock crevices, buildings, and trees. Roosting habits vary from solitary to colonial. The Asian false vampire bats roost in caves, buildings, and hollow trees in small groups, although one particularly large colony of nearly 2,000 was reported in India. Eating a wide range of foods from insects to birds, these bats maneuver (mah-NOO-ver) well as they snatch their food.

False vampire bats commonly kill the prey (animals hunted for food) by biting the head and crushing the skull. False vampires share their prey with other members of the family group, consisting of a pair of adults and their non-breeding young. The Australian false vampire bat drops on small mammals from above,

and envelops them with its wings before biting the head and neck. They carry their prey to a high point or back to the roost.

Heart-nosed bats hang upside down on a low perch while they scan the area for their meals. This bat eats beetles, centipedes, scorpions, and small bats. From its perch, typically 10 to 16 feet (3 to 5 meters) above ground, this bat twists its body 180°, using its eyes and ears to search for prey. When it spots a meal, the bat swoops down and snatches the prey, carrying it back to its perch. There, the bat removes the legs and wings before eating the body.

Some megadermatids, such as the yellow-winged bats, appear to be monogamous (muh-NAH-guh-mus), meaning that the male and female pair up, which is unusual in bats and mammals. Heart-nosed bats mate in monogamous pairs for the breeding season. They make an effort to keep the same mate during the following breeding seasons. Mated pairs have a breeding site that the male defends. Prior to foraging for their food in the evening, the male of the heart-nosed and false vampire bats sing from perches.

Megadermatids give birth to a single offspring during each breeding period. In yellow-winged bats, following a gestation (pregnancy) of about three months, most births of the single offspring occur in April. False vampire bats also have a gestation period of about three months, and give birth at the beginning of the rainy season. Sometimes, an older member of the family may remain to sit with the young while the adults hunt.

KEEPING WARM

Ghost bats cannot stand getting cold. Studies suggest that these bats need to keep their body temperatures between 95 and 102.2°F (35 to 39°C). When surrounding temperatures are higher or lower, these bats need to need to increase or decrease their metabolic rate to keep warm or stay cool. They move between a number of caves, depending upon the weather, which means they need multiple cave sites where they can roost. Females especially need to keep warm while they are pregnant.

MEGADERMATIDS AND PEOPLE

People are destroying the natural habitat of megadermatids, causing many of these species' populations to decrease.

CONSERVATION STATUS

The IUCN lists the heart-nosed bat as being Near Threatened, not currently threatened, but may become so; and the Australian false vampire bat as Vulnerable, facing a high risk of extinction in the wild.

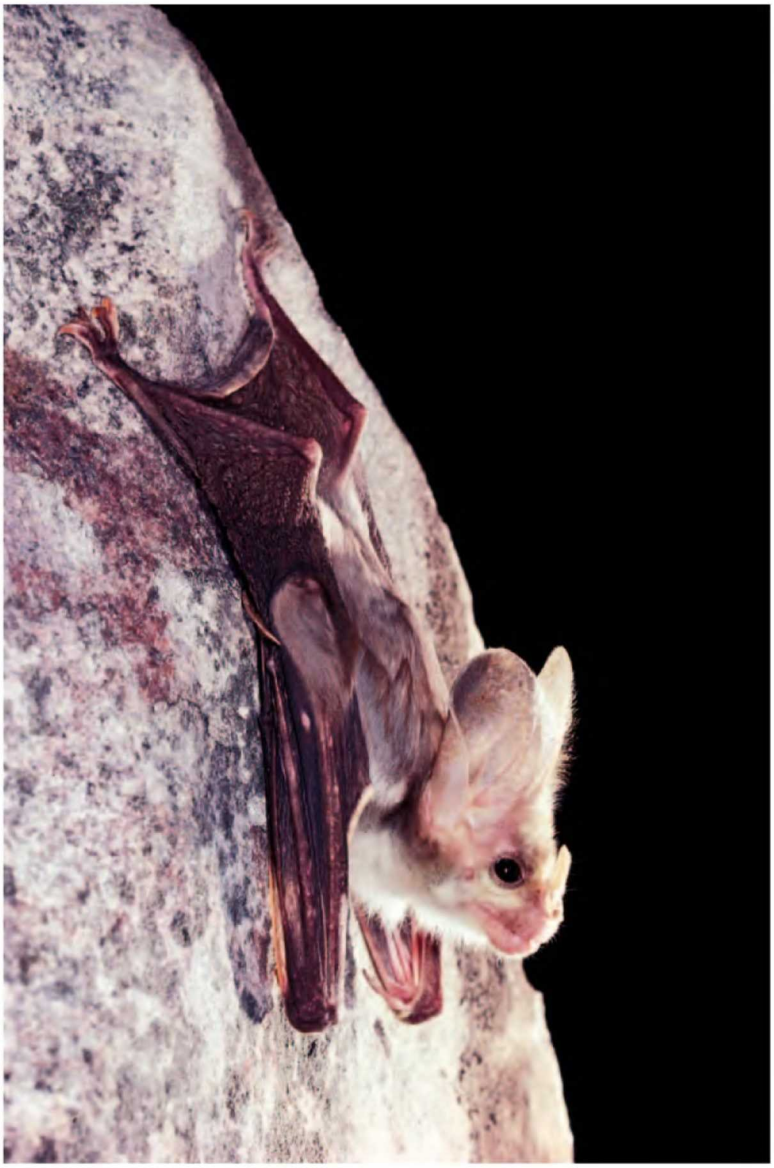


SPECIES ACCOUNT

AUSTRALIAN FALSE VAMPIRE BAT
Macroderma gigas

Physical characteristics: Australian false vampire bats are among the largest of the bats. They have forearms that range from 3.7 to 4.6 inches (9.6 to 11.8 centimeters) long, and weigh 2.6 to 5 ounces (74 to 144 grams). Their head and body length is 3.9 to 5.1 inches (10 to 13 centimeters). Females are smaller than males.

These bats are also called ghost bats, because their fur is light brown to gray to almost white. In some areas, ghost bats have an ashy gray back and white underparts. These bats have wide ears that meet above the head and are fused. They have large eyes relative to their heads, along with prominent noseleafs.



Australian false vampire bats typically roost in caves and abandoned mines. (© B. G. Thomson/Photo Researchers, Inc. Reproduced by permission.)

Geographic range: Australian false vampire bats are found in northern Australia, mainly north Queensland, along the north central coast, and in the northwest.

Habitat: Australian false vampire bats live in both arid regions and rainforest areas, such as north Queensland. They typically roost in caves and abandoned mines.

Diet: The Australian false vampire bat is Australia's only carnivorous bat. These bats eat large insects, such as cockroaches, and vertebrates, such as reptiles, frogs, birds, small mammals, and other bat species.

Behavior and reproduction: Australian false vampire bats commonly hang from a branch and wait for their prey to pass on the ground below. The bats then drop down, envelop the prey with their wings and kill it by biting its head and neck. They also catch prey while in flight. Australian false vampire bats eat large amounts of food and consume much of their prey, including its flesh, bones, teeth, fur, small feathers, and the exoskeletons of insects.

Australian false vampire bats move to the warmer northern Australia area when the weather becomes cooler, and then back to the cooler southern areas when the weather becomes warm. These bats do use echolocation, yet they appear to capture their prey with their extremely sensitive hearing and vision. Their echolocation calls are less than one millisecond long. Australian false vampire bats roost alone or in small groups. During the breeding season, for the most part, females gather in colonies, while males gather into their own colonies. Yet some studies have found that some males are always present with the females. There are typically fewer than 100 bats in a group.

Australian false vampire bats generally mate in April or May and gestate for about three months. The females bear a single offspring. Mothers stay with their young and also fly with them to forage (search) for food during the first several weeks of life. Both sexes reach reproductive maturity at about their second year of life.

Austalian false vampire bats and people: Australian Aborigines, the early inhabitants of Australia, have a spiritual connection to the Austalian false vampire bats. Mining operations are destroying their roosting sites, causing a decline in their population. These bats are also extremely sensitive to any disturbance. People that enter a ghost-bat cave colony may cause the group to become nervous and leave.

Conservation status: Australian false vampire bats have declined in population because people have destroyed their habitats. They are categorized as Vulnerable by the IUCN. ■

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HORSESHOE BATS
Rhinolophidae

Class: Mammalia
Order: Chiroptera
Family: Rhinolophidae
Number of species: 69 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The name "horseshoe" bats comes from the distinctive shape of their nose. Many species of bats have fleshy folds of skin around their nostrils called a noseleaf. In the horseshoe bats, the lower part of its noseleaf is shaped like a horseshoe or a U-shape. This lower section covers the bat's upper lip. The upper part of the noseleaf, above the nostril, is pointed. In some species, such as Hildebrandt's horseshoe bat, the noseleaf is hairy.

Horseshoe bat species range widely in size, from small to moderate. The smaller species of these bats can have a head and body length of 1.4 inches (3.5 centimeters) and the larger species can measure 4.3 inches (11 centimeters). They weigh from 0.15 ounces (4.3 grams; less than the weight of two pennies) to 13.8 ounces (35 grams).

The fur on horseshoe bats can be a variety of colors, including gray-brown and reddish brown fur. Other bats can have gray, black, dark brown, yellow, or bright orange-red fur. Their fur is long and soft. These bats have large ears that are typically pointy and can move independently of one another. Their eyes are relatively small. The wings are broad with rounded ends.

GEOGRAPHIC RANGE

Horseshoe bats are found in temperate (areas with moderate temperatures) and tropical regions of the Old World, meaning the part of the world made up of Australia, Africa, Asia, and Europe. These bats are found in southern Europe, Africa, and southern Asia to northern and eastern Australia, including many

Pacific islands. They do not live in the arid (extremely dry) ranges of Africa. In many areas, these bats have extremely small ranges.

HABITAT

Horseshoe bats live in a wide variety of areas, such as forests, savannas, open areas, and occasionally in deserts. Horseshoe bats can live in areas that are cooler than many other bats can survive. They also have a wide variety of places in which they roost, meaning rest or settle. Primary roosting sites include caves and hollow trees. Other roosting sites include buildings, houses, mines, holes, and tunnels. Some of these bats roost in open areas. Research indicates that the roosting sites for these bats may be important factors in determining where they decide to live.

DIET

Horseshoe bats eat insects and spiders.

BEHAVIOR AND REPRODUCTION

Like all bats, horseshoe bats are nocturnal, meaning they are active at night. They begin foraging for their food later in the evening than most other bats, typically hunting about 20 feet (6 meters) above the ground. Horseshoe bats have a fluttering or hovering flight. These bats will catch prey (animals hunted for food) both in flight and on surfaces, such as leaves or branches. Some species also sit on some type of perch, such as a branch, and snatch insects as they fly past. When foraging, or searching, for food on surfaces, called gleaning, these bats find prey on branches, leaves, rocks, and the ground. The bats will eat the insect in flight if they are small enough. If the prey is a large insect, they may take their prey back to a roost or a feeding perch. They can catch the insect in their wings and store it in their cheek.

To locate their prey, horseshoe bats use echolocation (eck-oh-loh-KAY-shun), a technique in which they send out sounds and listen to the sounds that bounce back to locate objects. Horseshoe bats echolocate through their noses, as opposed to most bats, which send out echolocation calls through their mouths. Using echolocation, horseshoe bats can detect the flutter of insects' wings.

Most species gather together to roost, from small colonies of about twenty individuals, to large colonies of up to 2,000 individuals. One species in particular, the woolly horseshoe bat, roosts in pairs. These bats hang freely when they roost, not huddling next to one another to keep warm as do many other bats. When roosting, these bats wrap their wings around themselves, enclosing their entire body.

SPECIES RECOVERY

With a population that has dwindled down to an estimated 5,000 individuals, the greater horseshoes are one of England's most rare bats. Concerned about extinction, the country has taken steps to help this species once again flourish. In 1998 the English Nature Greater Horseshoe Bat Project was launched with the prime goal to increase the species population by 25 percent by the year 2010. With awareness, education, and specially designated roosting sites, the number of recorded births in 2003 had reached record levels (228). Warmer winters and a reduction in the use of chemicals and pesticides in farming also contributed to population growth.

Species that live in northern areas may hibernate (deep sleep in which an animal conserves energy) during the winter. Other species go into torpor every day. Torpor is a period of inactivity in which an animal's heart rate slows down to conserve energy. At least one species is migratory, meaning they travel to warmer areas when the weather becomes cool. Many species that hibernate can awaken easily and change their hibernating sites occasionally, sometimes flying almost a mile (1,500 meters) or more to a new place.

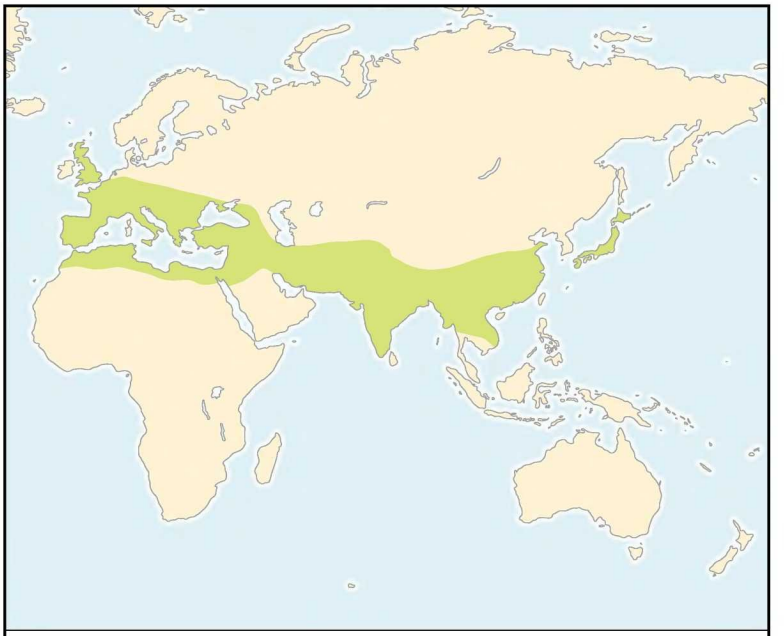
In some species, including ones that hibernate, females mate during the fall, but fertilization does not occur until the spring. In other species, mating and fertilization occur in the spring. For bats that live in tropical areas, females give birth during the warm summer months. In some species, males and females live together all year, while females form separate colonies in other species. Gestation (pregnancy) ranges from seven weeks to slightly over five months. Bats typically have one offspring per season, and the babies are independent at six to eight weeks of age.

HORSESHOE BATS AND PEOPLE

People have caused the decline in many species of horseshoe bats by destroying their habitat. Altering or disturbing these bats' habitat can indirectly reduce their prey. The use of insecticides, a chemical used to kill or control insects, has also reduced the population of the bats' prey.

CONSERVATION STATUS

Most species of horseshoe bats are in danger of a decline in population or have already experienced population loss. Researchers know little about some species of these bats and so their conservation status is not known. Out of the species listed in the IUCN Red List, thiry-eight species, there is one species listed as Critically Endangered, facing an extremely high risk of extinction, dying out, in the wild; and two as Endangered, facing a very high risk of extinction in the wild. There are also species that are not considered endangered globally but are in danger of extinction in specific areas, such as the greater horseshoe bat, which is regarded as endangered in Europe.



GREATER HORSESHOE BAT
Rhinolophus ferrumequinum

Physical characteristics: The greater horseshoe bats are among the largest species of its family. The length of their head and body combined ranges from 2.2 to 3.1 inches (5.6 to 7.9 centimeters), and its wingspan is from 13.8 to 15.6 inches (35 to 40 centimeters). These bats have large, pointed ears, small eyes, and a flattened face, with a distinct horseshoe-shaped fleshy disc nose. Fur is fine and silky, typically light brown to grayish, with a reddish color. The wings and ears are light gray. Offspring are born gray and turn reddish brown as they grow.

Geographic range: Greater horseshoe bats are found in southern Europe, Great Britain, India, and southern Asia to southern China and Japan. In the United Kingdom they are primarily found only in southwest England and south Wales.

Habitat: These bats live in forest, as well as open land, such as pastures. They roost in caves, mine tunnels, and large buildings.



Greater horseshoe bats can catch their prey, such as this moth, while they are flying. (© Stephen Dalton/Photo Researchers, Inc. Reproduced by permission.)

Diet: Greater horseshoe bats eat small- to medium-sized insects, including beetles, moths, and flies.

Behavior and reproduction: With their broad wings, greater horseshoe bats fly slowly. These bats can feed by flying low to the ground and catching prey in flight. They also can wait for their prey on a perch, snatching the insect as it passes. They take large prey to a regular feeding perch.

Greater horseshoe bats emerge from their roosts about half an hour before sunset. Between warmer months, May to August, they typically return to their roost after about an hour and remain there until they emerge for a second round of foraging at about dawn. From late August until May they may remain at their roost all night.

Greater horseshoe bats hibernate. They may start hibernating near the entrance of caves, then move to sites deeper within the cave as the weather becomes cooler. The moistness of the caves prevents the bats from losing too much water from their bodies.

Greater horseshoe bats breed in autumn, from September to October, and give birth from June to July (where they've been studied in Europe). Females give birth to one young, after a gestation

period of about seventy-five days. The mother hangs upside down while giving birth and the infant is born into her overlapped wings. They can live for up to thirty years.

Greater horseshoe bats and people: People have caused the decline of the greater horseshoe bats by disturbing or destroying their roosts and prey (with pesticide use). In Great Britain, it is estimated that the greater horseshoe bat population has decreased by 90 percent since 1900.

Conservation status: The IUCN Red List classifies the greater horseshoe bat as Near Threatened, meaning it is not yet threatened, but could become so, around the world. But in some areas, such as Europe, this species is considered endangered by national or regional conservation groups. ■



Cape horseshoe bat *(Rhinolophus capensis)*

CAPE HORSESHOE BAT
Rhinolophus capensis

Physical characteristics: The cape horseshoe bat is small to medium in size, with a head and body length of about 2.4 inches (6.2 centimeters). Its fur on the upper side and wings are dark brown, the back is lighter brown and the underside is brown to cream in color. It has the distinctive horseshoe ring around the nose, with a large, wavy triangular leaf extending from the horseshoe up between the eyes.

Geographic range: Cape horseshoe bats are found along the coastline of southern Africa.

Habitat: Cape horseshoe bats live along the coast. They are found in coastal and sea caves.

Diet: Cape horseshoe bats eat mainly beetles.

Behavior and reproduction: These bats catch their prey while flying slowly and low to the ground. They also can hunt from perches, waiting for prey to pass. When roosting, they usually hang individually, rather than in dense clusters.

They mate in spring, August through September, and young are born from November to December.

Cape horseshoe bats and people: There is no known, significant relationship between these bats and people.

Conservation status: The IUCN lists the cape horseshoe bat as Vulnerable. ■



Cape horseshoe bats live along the coast of southern Africa, in coastal and sea caves. (Illustration by Emily Damstra. Reproduced by permission.)

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OLD WORLD LEAF-NOSED BATS
Hipposideridae

Class: Mammalia
Order: Chiroptera
Family: Hipposideridae
Number of species: 66 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Also called roundleaf bats, Old World leaf-nosed bats vary greatly in size. They have a combined head and body length that ranges from 1.1 to 4.3 inches (2.8 to 11 centimeters). One species, Commerson's leaf-nosed bat, is one of the largest insect-eating bats of all the microchiroptera (my-kro-keer-OP-ter-ah; one of two bat categories that includes most of the bats in the world), with a wingspan of about 2 feet (0.6 meters). These bats are closely related to and share many of the features of horseshoe bats. They have a fleshy fold of skin around their nostrils called a noseleaf, which is leaf-like in appearance. The lower part of the noseleaf is shaped like a horseshoe or U-shape, with leaf-like flaps of skin above that protrude outwards.

The ears of these bats vary in size. They do not have a tragus (TRAY-gus), a flap of skin in front of the ear opening, which is common in many bats. These bats have only two bones in each toe. Their tail length ranges from nothing to approximately 2.4 inches (6 centimeters). Fur color ranges widely among the species, from reddish and yellowish to brown and cream. In several species, males and females have different fur colors, as well as different body and noseleaf sizes.

GEOGRAPHIC RANGE

Old World leaf-nosed bats are found in tropical (hot and humid weather) and subtropical areas of the Old World, meaning the part of the world made up of Australia, Africa, Asia, and Europe. They are found in Africa and southern Asia, east to the Philippine Islands, the Solomon Islands, and Australia.

TO GROUP OR NOT TO GROUP

The first accounts of Old World leaf-nosed bats came in 1831, and the family's classification still remains uncertain. Some scientists consider Old World leaf-nosed bats a subfamily of horseshoe bats. Other researchers maintain that both groups are distinct families, as they are in this reference.

HABITAT

These bats live in a range of habitats that include deserts and rainforests. They roost (settle or rest) in caves, underground openings, buildings, and hollow trees. One species, the fulvous (FUL-vus) leaf-nosed bat, has been found in burrows of a large porcupine in Africa.

DIET

Old World leaf-nosed bats eat insects, although little is known about the specific insects that make up their diet.

BEHAVIOR AND REPRODUCTION

There is little information on the behavior and reproduction habits of many Old World leaf-nosed bat species. Most roost in groups that range widely in size: from about twelve to groups of hundreds, to approximately 5,000. Some species appear to roost singly. The primary roosting sites of these bats are caves and tunnels, yet many roost in tree hollows and buildings.

Old World leaf-nosed bats are nocturnal, or active at night, as are all bats. When they emerge from their roosts at night, they use echolocation (eck-oh-loh-KAY-shun) to forage, search, for food. Echolocation is the process of detecting objects by sending out sounds and listening to the sounds that bounce back from the objects. Old World leaf-nosed bats fly with their mouth closed and send out sounds through their nose, as opposed to most bats that use their mouths. These bats can send out sound in one frequency and listen to the sounds bounced back on another frequency.

Observations show they catch their prey in flight. Many hunt close to the ground, such as the Old World leaf-nosed bat of the Congo.

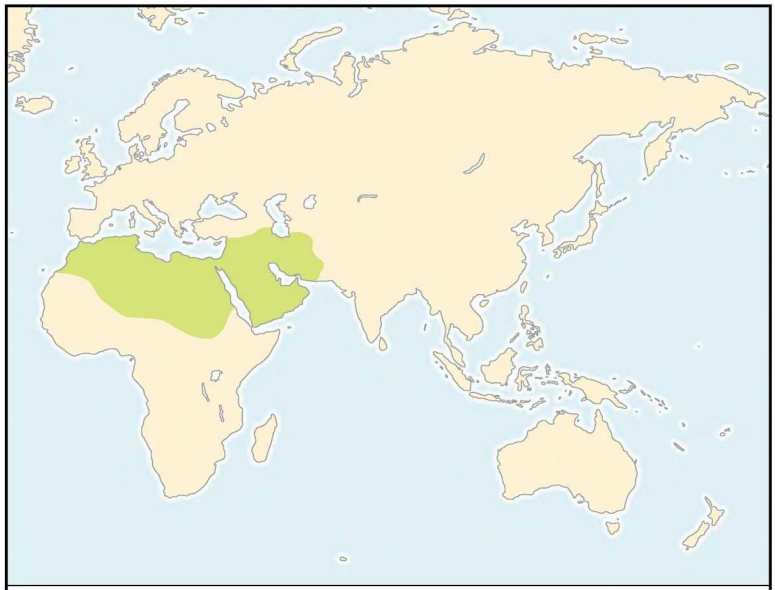
These bats mate during the fall and females do not become fertilized until the following year. Females generally give birth to a single offspring each year. When the offspring become independent and sexually mature depends upon the species and where they live.

OLD WORLD LEAF-NOSED BATS AND PEOPLE

These bats eat many insects that are considered pests to people. Some species have been harmed by humans destroying their habitat.

CONSERVATION STATUS

Some of the species in this family are common and others are rare and vulnerable to threats. Since little is known about many species in this family, the vulnerability of these bats is not fully understood. Out of the species that the IUCN lists, two are classified as Critically Endangered, facing an extremely high risk of extinction, dying out, in the wild; fifteen as Vulnerable facing a high risk of extinction, and twenty-three as Near Threatened, not currently threatened, but could become so.



SPECIES ACCOUNT

TRIDENT LEAF-NOSED BAT
Asellia tridens

Physical characteristics: These bats have a feature on their nose that resembles a trident, which is a spear with three prongs. The noseleaf is made up of the horseshoe-shaped lower part, the triangle-shaped central part, and three spear-like projections. The nostrils are located in the front, and there is a frontal sac behind the noseleaf. The ears are large and nearly hairless. Fur color ranges and includes grayish, pale yellow, and orange-brown. Some trident leaf-nosed bats in Egypt have medium- to dark tan-colored fur. These bats have large ears and pale faces.

Geographic range: These bats are found in Morocco, Algeria, Egypt, Libya, Sudan, the Arabian Peninsula, and Pakistan.

Habitat: These bats live in arid (extremely dry) environments. They have often been observed roosting in caves and artificial structures, such as tunnels and old temples. Species have also been spotted roosting in underground tunnels and under the iron roof of a shed in Iraq

in June, when the temperature inside the shed was an estimated 100.4°F (38°C).

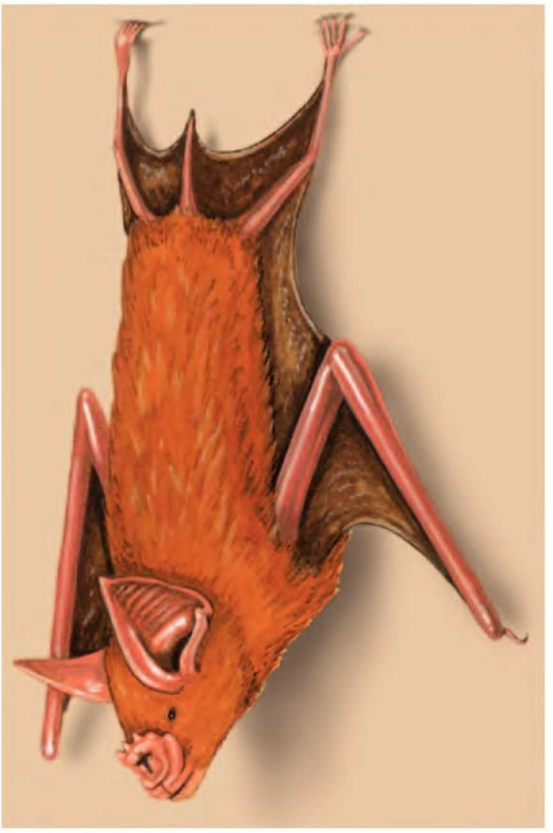
Diet: Trident leaf-nosed bats eat beetles, bees, ants, and wasps.

Behavior and reproduction: Trident leaf nosed bats catch their prey (animals hunted for food) primarily while they are flying. They also may snatch up prey from the ground and other surfaces. These bats forage in vegetated areas and can travel far across desert areas for food.

Roosts of several hundred individuals have been observed. One researcher in 1980 discovered a roost of about 5,000 individuals. When exiting and entering roosts, these bats have been observed flying in small groups and low to the ground. In Iraq, these bats travel to cellars and tombs when they hibernate, from mid-September to mid-November. They then return to their summer roosts in April.

Trident leaf-nosed bats and people: By destroying their local habitats, there is some evidence that humans have caused a decrease in the bats' population.

Conservation status: The trident leaf-nosed bat is not considered to be threatened. ■



Trident leaf-nosed bats live in very dry areas, and may travel far across the desert in search of food. (Illustration by Joseph E. Trumpey. Reproduced by permission.)

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family CHAPTER

AMERICAN LEAF-NOSED BATS
Phyllostomidae

Class: Mammalia
Order: Chiroptera
Family: Phyllostomidae
Number of species: 151 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

American leaf-nosed bats, also called New World leaf-nosed bats, are made up of diverse species. They range from small to large, with a combined head and body length of 1.6 to 5.3 inches (4 to 13.5 centimeters). This family includes the largest species of bat in the Western Hemisphere, the spectral vampire bat. These bats have a wingspan of about 3 feet (1 meter).

Some species have visible tails that are as long as 2.2 inches (5.5 centimeters), and others have no tail. These bats have noseleafs, meaning fleshy protrusions on the nose. Some of these species have noseleafs that are almost as long as the head, such as the sword-nosed bat. In most species, the noseleaf is a relatively simple structure shaped like a spear. Many species have bumps, warts, and other protrusions on the head near the noseleaf or on the chin.

The size and shape of these bats' heads vary widely and reflect their diverse feeding habits. Fruit-eating bats, for example, may have a medium-sized noseleaf, flat faces, and wide teeth to crush fruit. Bats in this family that lap up nectar (sweet liquid produced by plants) have a small noseleaf, long tongue, and small teeth. Species in this family that eat meat are generally large and have sharp teeth.

Fur color of American leaf-nosed bats is generally brown or gray, with the exception of one species, the white bat. Some species have color patterns that include stripes on the head or back, or white tufts of fur on the shoulders.

BLOOD-SUCKING STORIES

Long before Bram Stoker's *Dracula* was published in 1897, there were stories about vampires. In many human cultures, vampires are people who return from the dead to feed on the blood of living people. When Spanish explorers spotted vampire bats when they came to Central and South America in the 1500s, they noticed how their feeding off the blood of other animals was similar to the vampires of their own legends. A few hundred years later European explorers traveling in the New World discovered these bats and brought them back to Europe. The bats were given the common name vampire bats, after the vampire myths. Stoker, who lived in England, was one of the people fascinated with the stories of vampire bats and incorporated them into his story. With the popularity of the novel, bats in general soon became associated with the blood-sucking vampires and this stigma continues in modern day.

GEOGRAPHIC RANGE

These bats are also called New World leaf-nosed bats because of where they are found. The New World is made up of North America, Central America, and South America. American leaf-nosed bats are found in the southwestern United States south to northern Argentina, the West Indies, and central Chile.

HABITAT

Most American leaf-nosed bats live in the forest. They can live in forests that range from the dry to the tropical (hot and humid). Some species live in deserts. Many species roost (settle or rest) in caves or the hollows of trees. Other roosts include hollow logs, under tree roots, mines, tree foliage, and houses. Some species form tents out of leaves, settling under the tent for protection and rest.

DIET

American leaf-nosed bats eat a broad range of foods and groups in the family are generally categorized by diet. Most species eat animals, with the smaller species eating insects and other arthropods (a group of invertebrates that have a segmented body and jointed limbs) and the larger species feeding on frogs, lizards, birds, and other bats. Other species eat nectar and fruit. Some bats frequently eat insects and fruit. Just three species feed on blood.

BEHAVIOR AND REPRODUCTION

American leaf-nosed bats typically form colonies (groups), yet the numbers in the groups vary widely both within and among species. Sizes of groups range from pairs to colonies made up of several hundred thousand individuals.

All species of American leaf-nosed bats use echolocation (eck-oh-loh-KAY-shun) to detect objects and catch their prey (animals hunted for food). Echolocation is when an animal

emits (sends out) high-pitched sounds that bounce off an object and return to the animal, which can then tell where the object is. These bats emit echolocation calls through their nose rather than their mouth.

Mating and reproduction vary widely among the species. Spectral vampire bats mate monogamously (muh-NAH-guh-mus-lee), meaning a male and female mate only with one another. The most common mating system is harem polygynous (HARE-um puh-LIJ-uh-nus), meaning one male mates with multiple females. Females in this family have one offspring either once or twice a year.

AMERICAN LEAF-NOSED BATS AND PEOPLE

Many of these bats are important pollinators for plants, meaning they disperse pollen, the fine grains that contain the male reproductive cells of seed plants. These bats help forests' and plants' continued survival. Through deforestation and destroying these bats' natural habitat, people have caused the decline in many of these bats' populations. Much of the negative myths and superstitions about bats come from the three species in this family that feed on blood. These vampire bats are considered pests to many farmers and feared for the spread of rabies.

BATTY FOLKLORE

Ancient artwork and hieroglyphics (high-ruh-GLI-fix; a writing system that uses pictures instead of letters) have shown that many cultures in the New World had stories about bats in this family. Representations of bats show these bats have a characteristic noseleaf. Many show bat traits added to a human figure. In New World myth and art, the underworld, the world of the dead, was one of the most important themes. Bat imagery was common because bats share several themes in the underworld, such as they are active in the dark, and they roost in caves, which were considered openings to the underworld. Vampire bats specifically were also part of folklore for the Mayans, who revered a vampire bat god. "Camazotz," the death bat, killed dying men on their way to the center of the Earth. Hieroglyphics and graphic drawings of the vampire bat are found throughout the Maya ruins in southern Mexico, Guatemala, and Honduras.

CONSERVATION STATUS

Out of the seventy-one listed species, the 2003 IUCN Red List categorizes four species as Endangered (facing a very high risk of extinction, or dying out, in the wild) and twenty-five species as Vulnerable (facing a high risk of extinction in the wild).



SPECIES ACCOUNTS

CALIFORNIA LEAF-NOSED BAT
Macrotus californicus

Physical characteristics: California leaf-nosed bats are small to medium sized, with a head and body length combined of 2.1 to 2.5 inches (5.3 to 6.4 centimeters). They have a visible tail that ranges from 1.4 to 1.6 inches (3.5 to 4.1 centimeters). These bats have a large noseleaf, large ears, and broad wings. Their fur is brown or gray. The underside is lighter, typically a brown or tan color.

Geographic range: California leaf-nosed bats are one of only a few species of this family found in the United States. These bats are found in southern California and Arizona, as well as northwestern Mexico. There is also a record of the bat being found in Texas.

Habitat: California leaf-nosed bats live in arid (extremely dry) habitats. They roost in caves, mines, and abandoned buildings. They

often roost in well-lit areas. They select mines and caves that stay warm in the winter months due to the heat from the Earth.

Diet: These bats eat insects, such as crickets, moths, beetles, and a variety of other arthropods.

Behavior and reproduction: California leaf-nosed bats gather in colonies of hundreds to thousands. Smaller groups have also been found.

To locate prey, California leaf-nosed bats use both echolocation and the sounds made by the prey. They also can use vision to find prey, and when they do, they stop producing echolocation calls. They capture their prey both while flying and from gleaning, picking the prey off surfaces such as vegetation and the ground. After they catch it, they take the prey to a roost to eat. They only eat certain parts of the prey, dropping legs, wings, and other parts of the insect on the ground.

These bats mate in August, September, and October. Males attract females by flapping their wings and vocal sounds. Females form maternity colonies, and the female has one offspring the following spring.

California leaf-nosed bats and people: The disturbance of these bats' natural habitats through mining has caused a decrease in these bats' population.

Conservation status: The California leaf-nosed bat is listed as Vulnerable. ■



California leaf-nosed bats live in extremely dry places, and feed on insects and other arthropods. (© Merlin D. Tuttle/ Bat Conservation International/ Photo Researchers, Inc. Reproduced by permission.)



VAMPIRE BAT
Desmodus rotundus

Physical characteristics: Vampire bats have a combined head and body length of about 2.7 to 3.7 inches (6.8 to 9.3 centimeters). One of these bats' striking features is their pointed front teeth. These bats have dark grayish brown fur, which is lighter on the underside. Ears are pointy and there is no visible tail. The thumb is clawed. Females are generally larger than males.

Geographic range: Vampire bats are found in northern Mexico to central Chile, Argentina, Uruguay, and Trinidad.



Vampire bats do feed on animal blood—usually livestock, such as pigs or cows. (M. W. Larson/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Vampire bats live in warm climates, in both tropical and subtropical (nearly tropical, with warm temperatures and little rainfall) areas. They are commonly found where there is plenty of livestock. These bats are found roosting in caves, mines, tree hollows, and occasionally abandoned buildings.

Diet: Vampire bats feed on blood. These bats need about 2 tablespoons (29.6 milliliters) of blood each day; this is about 60 percent of the bat's body weight. Bats need to feed nightly.

Behavior and reproduction: Vampire bats are social animals; they roost in colonies that can range from twenty to 100 individuals. Much larger colonies of thousands have also been found.

Vampire bats approach their intended food source stealthily. They can walk, run, and hop along the ground, using their strong hind limbs and thumbs. At night, when vampire bats emerge to hunt for food, their victims are often sleeping. The bat will land beside the sleeping animal and then climb up until it finds a feeding spot. With its sharp front incisor teeth, the bat pierces the animal's skin and laps up blood from the wound. Vampire bats have chemicals in their saliva that stops blood from clotting. The bite rarely wakes a sleeping victim.

These bats occasionally will share the blood with other bats from its colony. After one female grooms another, the female being groomed may regurgitate (re-GER-jih-tate; throw up) part of her blood meal for the grooming female. It is also common to see females regurgitate food for their offspring.

Vampire bats mate year round. Females typically give birth to one offspring in April to May, or October to November. The offspring remain with their mothers for several months after they are weaned. They often share blood from the same wounds with their mothers.

Vampire bats and people: The fact that these bats feed on blood, combined with mythological stories about vampires, has caused many people to fear all bats. While the fears are largely myths, vampire bats can transmit rabies to humans and animals. These bats have caused tens of millions of dollars of damage to livestock farmers by transmitting rabies. They are considered pests in many livestock areas where they live. Also, researchers are investigating the anti-clotting properties of these bats' saliva to help with people who have strokes, in which a blood clot in the bloodstream cuts off blood supply to a part of the brain.

Conservation status: In areas with lots of livestock, vampire bats flourish. These are not considered threatened animals. ■



Pallas's long-tongued bat *(Glossophaga soricina)*

PALLAS'S LONG-TONGUED BAT
Glossophaga soricina

Physical characteristics: Pallas's long-tongued bat is named for its most distinctive feature: its long tongue. It is a relatively small bat, with a head and body length combined of 1.8 to 2.3 inches (4.5 to 5.9 centimeters). Its visible tail is short, only about a quarter of an inch (0.6 centimeters). Fur color is dark brown to reddish brown, and the underside is paler. These bats have a long, narrow snout, small eyes, and short, rounded ears.

Geographic range: Pallas's long-tongued bats are found in northern Mexico, Paraguay, northern Argentina, Trinidad, Grenada, and Jamaica.



Pallas's long-tongued bats are important to their ecosystems because they disperse seeds and pollinate flowers, such as this banana flower. (© Merlin D. Tuttle/Bat Conservation International/Photo Researchers, Inc. Reproduced by permission.)

Habitat: These bats live in lowland habitats. They are more commonly found in dry forests than in wet forests. Bats roost in a variety of sites, including caves, hollows in trees, mines, and abandoned houses.

Diet: Pallas's long-tongued bats feed on nectar, pollen, and insects. When those foods are scarce, they will eat fruit as well.

Behavior and reproduction: Pallas's long-tongued bats often share their roosting sites with other species. They are social animals, forming colonies of several hundred individuals to a few thousand. Smaller colonies have also been found. The bats use their long, narrow tongues to lap nectar from plants. Individuals forage for food independently.

Females give birth to a single offspring twice each year. Females form maternity colonies. The seasons of birth vary depending upon where the bats live. In Costa Rica, births occur in December to February, then in April to June.

Pallas's long-tongued bat and people: Pallas's long-tongued bats are important to the ecosystem because of their role in dispersing seeds as well as pollinating night-blooming cacti (KACK-tie or KACK-tee; plural of cactus) and many other species of plants.

Conservation status: These bats are not threatened. ■



WHITE BAT
Ectophylla alba

Physical characteristics: These bats are relatively small, with a combined head and body length of 1.6 to 1.9 inches (4 to 4.7 centimeters). They are named for the color of their fur. The hair over their entire body is white to a light gray tinge. A ring of dark gray hair surrounds the eyes. Ears and noseleaf are yellow.

Geographic range: White bats are found from eastern Honduras to western Panama.

Habitat: White bats live in moist or wet tropical forests. They roost in makeshift tents about 6.5 feet (2 meters) above the ground.

Diet: White bats eat figs and other fruits.



White bats roost in a "tent" they made from a heliconia leaf in the rainforest of Costa Rica. (© Michael & Patricia Fogden/Corbis. Reproduced by permission.)

Behavior and reproduction: White bats modify leaves of plants in the relatively low-growing plants of forests to make roosts. These bats chew the large leaves, nipping the center so that the two sides of the leaf fold downward to form a "tent," under which the bats gather. The bats have been found roosting singly and in groups of two, four, and six.

White bat females apparently bear only a single young. In Costa Rica, females give birth in April. The males were observed sharing a tent with females until the young were born.

White bats and people: There is no known connection between white bats and people.

Conservation status: The IUCN Red List categorizes the white bat as Near Threatened, or close to becoming threatened. ■

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MOUSTACHED BATS
Mormoopidae

Class: Mammalia
Order: Chiroptera
Family: Mormoopidae
Number of species: 8 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Moustached bats are named for their moustache-like distinctive feature. Above their upper lip, they have tufts of stiff hair. Their lips are large, with flaps and folds of skin on the bottom. When their mouth is open it appears to form a funnel. There are three common names for species in this family: moustached bats, ghost-faced bats, and naked-backed bats.

These bats are relatively small to medium size. The size of these bats' forearms range in length from approximately 1.4 inches (3.6 centimeters) to 2.6 inches (6.6 centimeters).

Moustached bats have a small bump on their nose and their eyes are relatively small. All bats in this family have a tail. Ears vary in size and shape but always have a tragus (TRAY-gus), meaning a flap of skin at the bottom of the external ear. In some species, the wings connect to the body at a point high along the middle of the back, making the surface of the back appear naked. These bats are commonly referred to as naked-backed bats. Ghost-faced bats can be easily identified by the folds of skin that reach from ear to ear, across the chin.

The fur of moustached bats can be gray, bright orange, brown, or reddish brown. Within species, individuals can vary widely in color. The fur color of some species in this family may change in different seasons. Fur in this family is short, fine, and thick.

GEOGRAPHIC RANGE

Moustached bats are found from the southern United States, including Arizona and southern Texas, through to Mexico,

Central America, and South America to Brazil, and much of the West Indies.

HABITAT

These bats generally live in tropical (hot and humid) habitats below 10,000 feet (3,000 meters). They live in the rainforest, forest, and in open areas. They generally roost in caves, mines, tunnels, and the hollows of trees. Some of these bats have been found in houses.

DIET

Moustached bats feed on a wide range of insects, including flies, beetles, moths, and mosquitoes.

BEHAVIOR AND REPRODUCTION

Moustached bats generally roost together in large colonies. Observations of the Parnell's moustached bats have found approximately 5,000 individuals roosting together.

Moustached bats, like all bats, are nocturnal, meaning they are active at night. At night they emerge to forage for food by using echolocation, the detection of an object by listening to reflected sounds that are called out. They catch their prey (animals hunted for food) while flying. In forested habitats, these bats often search for prey, animals they hunt for food, along trails and roads and fly low, within 3.3 feet (1 meter) of the ground. The wings of these bats are associated with the ability to maneuver, fly rapidly, and remain in the air for long periods of time.

At the beginning of the rainy season, females give birth to a single young each year. Gestation (pregnancy) lasts approximately sixty days.

MOUSTACHED BATS AND PEOPLE

These bats can eat large numbers of nocturnal insects, including many that are harmful to crops and ones that are considered pests, such as mosquitoes. Humans are causing the loss of population among some species of these bats by destroying their habitat.



NEW FAMILY: NEW NAME

Mormoopidae have a complex history of how they became their own family. These bats were first described in the early 1800s. For most of the twentieth century, this group was usually considered a subfamily of the Phyllostomidae, and given the name Chilonycterinae. (Some authorities continue to classify the mormoopids as only a subfamily of Phyllostomidae.) Mormoopidae became accepted as a distinct family and in 1972 was given its own name and family.

CONSERVATION STATUS

The IUCN lists two species as Near Threatened, meaning they are not currently threatened, but could become so. MacLeay's moustached bat is listed as Vulnerable, meaning it faces a high risk of extinction.



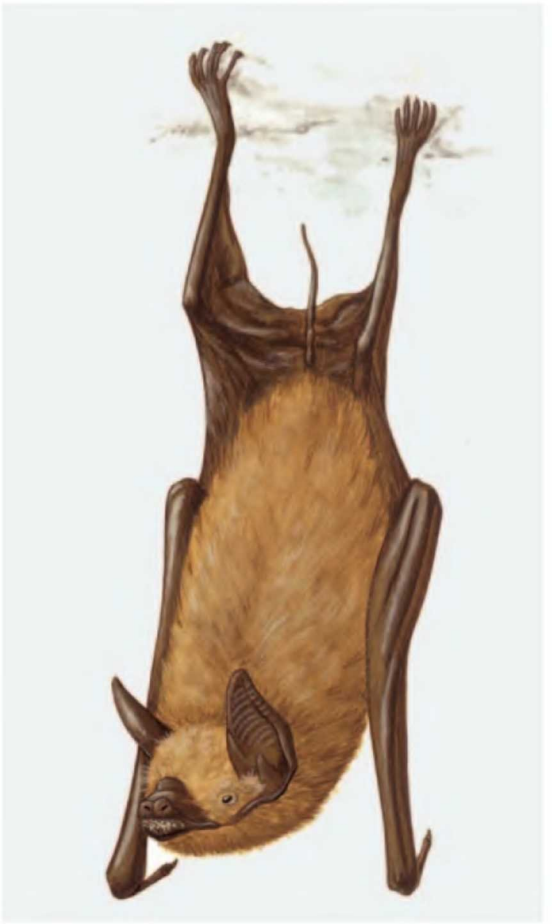
Parnell's moustached bat *(Pteronotus parnellii)*

PARNELL'S MOUSTACHED BAT
Pteronotus parnellii

SPECIES ACCOUNT

Physical characteristics: Like other bats in this family, Parnell's moustached bat has distinctive stiff hairs around its mouth. The fur color is medium to dark brown. These bats are relatively small with forearms ranging from 2.2 to 2.5 inches (5.5 to 6.3 centimeters). They have wingspan of about 13.4 to 13.8 inches (34 to 35 centimeters).

Geographic range: These bats are found throughout the Greater Antilles, Central America, southern Mexico, northern South America



Parnell's moustached bats roost in mines and caves, generally in large chambers and passageways far from the cave entrance. (Illustration by Barbara Duperron. Reproduced by permission.)

east of the Andes, northern Colombia, Venezuela, Brazil, Peru, and the Guianas.

Habitat: Parnell's moustached bats roost in mines and caves, generally in large chambers and passageways far from the cave entrance. These bats live in habitats ranging from arid to humid, tropical forests.

Diet: Parnell's moustached bats eat insects, primarily beetles and moths.

Behavior and reproduction: Parnell's moustached bats are extremely active. They are most active in the early evening. Observations of these bats in Mexico saw them emerging from their roost shortly after sunset. Some of the bats returned within one and a half hours, but most appeared to remain away from the roost for five to seven hours. The total number of bats in the cavern system was estimated at 400,000 to 800,000 individuals. It was estimated that these bats consumed between 4,190 and 8,380 pounds (1,900 to 3,805 kilograms) of insects each night.

These bats have a body temperature that varies with the environment, called heterothermic (het-ur-oh-THER-mic). When they are feeding, their body temperature remains high. When at rest, their body temperature and heart rate lower, thus conserving energy. When their heart rate slows down to conserve energy, the bats are going into torpor. Protected in their roost, Parnell's moustached bats can go into torpor from several hours to several months. If they go into a long-term torpor during the winter months it is considered hibernation.

These bats catch their prey while flying and can detect insects through dense vegetation. They are the only species of New World (North America, Central America, and South America) bat to have developed specialized echolocation calls. Structures within the ears of these bats work with the nerve cells to allow the bat to hear narrow and specific frequencies. This distinctive call enables the bat to sense the speed things move at, and thus relate its hearing to moving objects.

The only time males and females roost together during the year is when they are mating. Females have one offspring a year after a

gestation period of approximately fifty days. Babies have no fur. Most of these bats usually give birth at the start of the rainy season, even though some may mate several months earlier.

Parnell's moustached bats and people: The relatively large bats of this species consume large numbers of insects, many of which are considered pests to humans, such as mosquitoes. One bat is capable of consuming over 1,000 insects per night. Occasional reports have connected these bats with rabies, a viral disease that affects the nervous system and can be deadly. Rabies is usually transmitted by the bite of an infected animal.

Conservation status: The IUCN does not list these bats as threatened. ■

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BULLDOG BATS
Noctilionidae

Class: Mammalia
Order: Chiroptera
Family: Noctilionidae
Number of species: 2 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Bulldog bats' lips are similar in appearance to a bulldog's. The lips are thick and the upper one hangs over the bottom lip, forming pouches. Their upper lip is split in the middle. The nose, which sticks out slightly over the lip, is long and thick. The ears are pointed and relatively large. Both species have long legs, and large feet with well-developed claws. The bats have long, narrow wings. They also have a visible tail. Bulldog bats have a strong odor, often described as fishy.

Bulldog bats are relatively large bats, having a combined head and body length that ranges from approximately 2.2 to 5.2 inches (5.7 to 13.2 centimeters). Males are larger than females.

Bulldog bat fur is typically short and slightly curly. Fur colors range from bright orange to orange-brown and gray-brown. There can be a pale stripe running down their backs. The undersides of these bats are lighter in color. At one point researchers thought that male bulldog bats were different in color than females. Males were said to be bright yellow, brown, and orange, and females a brown or gray color. Research has shown that fur color may vary among the species as a whole, and is not necessarily distinct between the sexes.

GEOGRAPHIC RANGE

Bulldog bats are found in Mexico, Central America, and South America as far south as Argentina. The greater bulldog bat also lives on islands in the West Indies.

HABITAT

Bulldog bats are found living near water and in other moist habitats. Greater bulldog bats generally roost, settle or rest, in dark caves, often located on the seashore, and the hollows of trees. Lesser bulldog bats roost in hollow trees, and in buildings.

DIET

Both species of bulldog bats eat insects, but greater bulldog bats feed primarily on fish, along with frogs and crustaceans, freshwater and saltwater animals with no backbone, such as shrimp. The greater bulldog bat is one of only a handful of bats known to eat fish. Lesser bulldog bats feed primarily on insects.



FLYING WITH BIRDS

Look closely at a group of pelicans during the day and you might spot a few greater bulldog bats, or fisherman bats, in their midst. While these bats generally feed at dusk and during the night, observers have also seen them in the late afternoon flying alongside pelicans over water. Pelicans are large aquatic birds that eat fish. The bats probably catch small fish disturbed by the pelicans.

BEHAVIOR AND REPRODUCTION

Like all bats, bulldog bats rest during the day. While bulldog bats may sometimes leave their roost in the late afternoon, they are most likely to begin foraging for food at dusk, sunset. Both species catch their prey, animals hunted for food, using echolocation (eck-oh-loh-KAY-shun), the technique of detecting objects from calling out sounds and listening to the echo reflected from the object. These bats use echolocation to detect prey in flight, on the surface of the water, or directly below the water's surface.

After bulldog bats catch their prey they either eat the insect in flight or tuck away the partially-chewed food in their cheeks. These bats have pouches in their cheeks that can stretch to hold extra food. By storing the food, bulldog bats do not have to return to their roost after each catch. Mother and father bulldog bats can store food in their cheeks to bring to their young.

Bulldog bats are found living in colonies or groups of about thirty individuals up to several hundred. One kind of colony has young male bats. Another type of colony is made up of males, females, and their young. When they begin foraging for food, groups of up to fifteen leave their colony at the same time.

Female bulldog bats generally give birth to one offspring once a year. In general, bulldog bats mate in November and

December, and then give birth in April through June. Births have also been recorded in the fall. The newborns can fly and become independent after one month. Both the male and female look after the baby, an unusual behavior for bats.

BULLDOG BATS AND PEOPLE

Bulldog bats eat insects that many people may consider pests. Water pollutants and habitat destruction are likely to harm the population of bulldog bats.

CONSERVATION STATUS

Bulldog bat species are not listed as threatened.



Greater bulldog bat *(Noctilio leporinus)*

GREATER BULLDOG BAT
Noctilio leporinus

SPECIES ACCOUNT

Physical characteristics: The greater bulldog bat, also called the fishing bat, is a relatively large bat. These bats have a wingspan of almost three feet (1 meter), and a combined head and body length ranging from 4.6 to 5 inches (11.9 to 12.7 centimeters) Males are larger than females. Their feet and claws are much larger than the lesser bulldog bats, and their claws are very sharp. The fur is short and repels water.

Geographic range: Greater bulldog bats are found in parts of Central and South America, and throughout many islands on the Caribbean.



Greater bulldog bats use echolocation to find ripples (produced by swimming fish) on the water's surface. They drag their claws through the ripples and grab the fish with their claws. (© Stephen Dalton/Photo Researchers, Inc. Reproduced by permission.)

Habitat: Greater bulldog bats live in lowland and moist habitats that are near a water source, including the seashore, lakes, river basins, and ponds.

Diet: Greater bulldog bats eat primarily fish. They also eat crab and insects, including winged ants, crickets, and scarab beetles.

Behavior and reproduction: Greater bulldog bats typically roost in caves near a water source and in tree hollows. They roost in colonies of up to several hundred individuals bats. Each colony may have a distinctive odor. They emerge at dusk to forage for food in groups of five to fifteen.

Greater bulldog bats use echolocation to detect the ripples along the water's surface, which indicates a fish swimming. Groups of these bats zigzag low over the water and send out chirpy echolocation calls. The bats can track fish movement by predicting their speed and direction. Then they drag their sharp claws through the ripples and snatch the fish with their large, sharp claws. Once out of the water, the fish is carried to a perch, where the bat eats it. Greater bulldog bats may also

capture insects and crustaceans on the surface of the water. Prey is either eaten in flight, stored in its cheeks, or carried to a roost to be eaten.

These bats have powerful wings. If they drop into the water while they are foraging they can use their wings like paddles. Once they have gained enough speed in the water the bat lifts itself up into flight.

Female greater bulldog bats generally have a single offspring each year. The breeding season may vary regionally. In the Northern Hemisphere, mating typically begin in November and the young are born in May and June.

Greater bulldog bats and people: The health of a population of greater bulldog bats may act as an indication of water pollution.

Conservation status: Greater bulldog bats are not listed as threatened. ■

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family CHAPTER

NEW ZEALAND SHORT-TAILED BATS

Mystacinidae

Class: Mammalia
Order: Chiroptera
Family: Mystacinidae
Number of species: 2 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

New Zealand short-tailed bats are small to medium-sized bats. Their head and body length ranges from 2.3 to 3.5 inches (5.8 to 8.9 centimeters). They can weigh from 0.4 to 1.2 ounces (11 to 35 grams). As their name suggests, these bats have a short tail. The nose or snout of New Zealand short-tailed bats is relatively long and it sticks out over the lips.

These bats have unique wing membranes, the thin pieces of skin that form their wings. The parts of the wing membranes that run along the body are thick and leathery. When not flying, these bats can fold their wings beneath this thick membrane part.

Fur color on these bats is typically brown-gray or brown-black, with the tips of the hairs being white to grayish. This gives the bat a frosted look. The fur is velvety, short, and thick. New Zealand short-tail bats have relatively large ears. These bats have thick bodies with short, strong legs. The claws on their feet are pointy and sharp. The thumbs have a large claw with a talon, a sharp hooked claw, at the end and each of the toe claws also has a talon.

GEOGRAPHIC RANGE

New Zealand short-tailed bats are found on New Zealand and some of its offshore islands. New Zealand is made up of two large and many smaller islands in the southwest Pacific Ocean, east of Australia.

HABITAT

New Zealand short-tailed bats are found in moist forests, where they roost, settle or rest. These bats also forage, search, for food along low-growing shrubbery and the coastline. The greater short-tailed bat was once found on two islands but it was last sighted in 1967 and is considered extinct.

DIET

New Zealand short-tailed bats eat a broad range of foods. They are omnivores, meaning they eat both plants and animals, which is unusual in bats. Their diet includes flying and resting arthropods, animals without a backbone with jointed legs and segmented bodies, fruit, nectar, and pollen. The bat has a relationship with a rare and parasitic plant, called woodrose, or pua reinga. The flower produces nectar on the forest floor. As the bats move around eating the nectar they pollinate the plants. New Zealand short-tailed bats are the woodrose's only pollinator. Researchers have also observed New Zealand short-tailed bats sometimes feeding on birds and carrion, animals that have already been killed.

BEHAVIOR AND REPRODUCTION

New Zealand short-tailed bats are active on the ground more than any other species of bat. Like all other bats, they are nocturnal, meaning they are active at night. Several hours after dusk, they begin foraging for food by running along the ground, up trees, and along tree branches.

These bats typically roost in the hollow trees of forests. They have also been found roosting in caves, houses, and in burrows, holes that they dig in the ground. Observations have shown that these bats roost in large groups of 100 to 500 individuals during the day. They also may roost in far smaller groups, and sometimes singly. When the weather becomes cooler, the bats go into a state of inactivity called torpor, but they will come out of their roosts on warmer winter nights to forage, or search, for food.

To find food, New Zealand short-tailed bats use echolocation (eck-oh-loh-KAY-shun), a technique in which the bats detect objects by sending out high-pitched calls and then listening to the reflected sound. They also find prey, animals hunted for food, by listening for movements and using their sense of smell. They commonly hunt prey on the forest floor, often forming

burrows or holes under leaf litter in the ground to forage for food. When they tuck their wings away, these bats use the front arms like front legs, which helps them move along the ground.

Female New Zealand short-tailed bats give birth to one offspring once a year. The timing of mating and births appears to vary according to their location. Limited observations of the greater New Zealand short-tailed bat suggest that a single young may be born from spring to autumn.

NEW ZEALAND SHORT-TAILED BATS AND PEOPLE

People have caused a population decline in the New Zealand short-tailed bats, primarily through introducing predators, animals that hunt the bats for food, and destroying the bats' natural habitat. In stories the Maori (MAH-oo-ree), the original settlers of New Zealand, associate bats with a mythical, night-flying bird that foreshadows death or disaster.



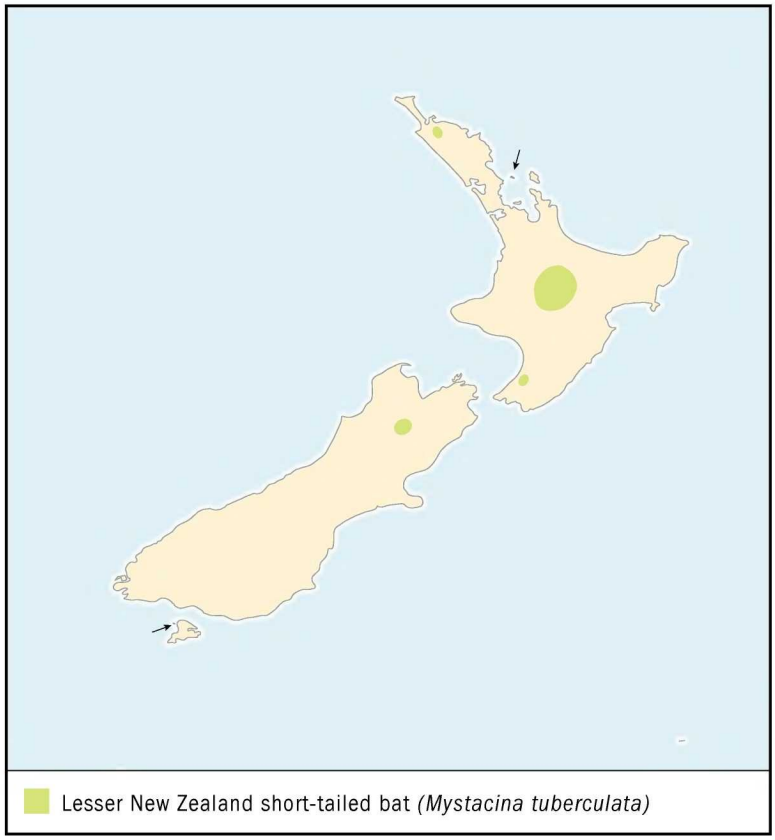
RAT TROUBLE

Before humans arrived on New Zealand there were no predators of bats and they were free to roam on the ground. When the Maori, the first settlers of New Zealand, arrived they brought Polynesian rats with them. Polynesian rats were predators of New Zealand bats and they quickly spread. By the early 1800s, when European settlers arrived in New Zealand, the greater short-tailed bat had been devastated. It was extinct over 98 percent of its habitat and only survived on two small rat-free islands. The lesser short-tailed bat was not affected as badly.

The lesser short-tailed bats play an important role in the continued life of plants in New Zealand. As they feed on nectar and other plant material, they move from plant to plant and spread pollen, the fine grains that contain the male reproductive cells of seed plants. They are the only pollinators of the woodrose, an endangered and unique flower. These bats also are predators on insects that people may consider pests.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists the lesser New Zealand short-tailed bat as Vulnerable, facing a high risk of extinction, and greater New Zealand short-tailed bat as Extinct, no longer existing. The lesser New Zealand short-tailed bat is known to be present on several islands. Populations have declined to about ten populations that may contain only a few thousand individuals.



SPECIES ACCOUNT

LESSER NEW ZEALAND SHORT-TAILED BAT
Mystacina tuberculata

Physical characteristics: Lesser New Zealand short-tailed bats are a relatively small species of bat. The length of their body and head together ranges from 2.3 to 2.6 inches (5.8 to 6.6 centimeters). The wingspan of these bats is 11 to 11.4 inches (28 to 29 centimeters). There are three subspecies of the lesser New Zealand short-tailed bat, and all vary in size. The bats that live in the south are larger than those that live in the north.

Also called a northern short-tailed bat and the New Zealand long-eared bat, these bats have fur that is short, thick, and velvet-like. Their fur is typically brown-gray or dark brown in color. The hairs have white on the tips, which gives these bats a frosted appearance. These



The lesser New Zealand short-tailed bat is the only pollinator of the woodrose, an endangered and unique flower in New Zealand. (Illustration by Barbara Duperron. Reproduced by permission.)

bats have large, simple ears. The thumbs and each of the toe claws have a talon at the end.

Geographic range: Lesser New Zealand short-tailed bats live on New Zealand and some of its offshore islands. Fossil evidence suggests that these bats once lived on all the islands of New Zealand. In recent years, populations of these bats decreased to only an estimated ten locations on several islands.

Habitat: Lesser New Zealand short-tailed bats are found primarily in the moist, native forests of New Zealand. They often roost in the hollows of trees but have also been found roosting in houses, caves, and burrows. They have been observed foraging for food and flying along coastlines and in grassy areas with low shrubbery.

Diet: Lesser New Zealand short-tailed bats have a wide range of food options. They eat both flying and non-flying arthropods, nectar, pollen, fruit, and other plant materials. Observations have also spotted these bats eating both young and adult birds, along with the meat of animals that are already dead.

Behavior and reproduction: Unlike most bats, the lesser New Zealand short-tailed bat spends much of its time scurrying about on the ground, up trees, and along branches. Their ability to fold their wings up prevents them from injury as they move about. When they fold up their wings the bats can walk on their hind legs and use their front arms. These bats still fly but it is not known how much they use flight.

These bats roost in large groups of 100 to 150 individuals or more, and also to roost in small groups. They emerge several hours after dark to search for food. These bats chew out cavities, holes, and tunnels to use as roosts.

Researchers are still working to understand these bats' mating and reproduction. The bats have a breeding season in which males and females separate. At dark, males travel to the hollows in trees where they call out a high-pitched call or song. Females visit and mate with the males each evening, before they begin foraging for food. Females give birth to one offspring each year. In the northern populations the young are born in the summer, January and December; in the southern populations they are born later, April to May. Newborn bats are furless and born with their eyes open. They are able to fly in four to six weeks, and reach adult size at eight to twelve weeks.

Lesser New Zealand short-tailed bats and people: Because Lesser New Zealand short-tailed bats eat pollen, nectar, and other plant materials, they play a significant role in the continued survival of many plant species. People have had a significant impact in the decline of the population by introducing bat predators, such as Polynesian rats. The introduction of other species has also indirectly harmed the bat population. The Australian brush-tailed possum was introduced to start a fur industry, and one method of killing the possum is with cyanide poison that often contains added fruit smells to lure the animal. Since the lesser short-tailed bat spends a great deal of time on the forest floor, this poison can attract the bats. It is unknown how many bats have been killed by this method. People have also caused the decline of these bats by clearing the forests where these bats live.

Conservation status: Lesser New Zealand short-tailed bats are protected by law and listed by the Department of Conservation of New Zealand as a species of highest conservation priority. The New Zealand Red Data Books lists this species as Vulnerable to Endangered, facing a very high risk of extinction in the wild in the near future. The IUCN lists the lesser short-tailed bat as Vulnerable. ■

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FUNNEL-EARED BATS
Natalidae

Class: Mammalia
Order: Chiroptera
Family: Natalidae
Number of species: 5 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Funnel-eared bats get their name from the shape of their ears, which are large and formed like a funnel. They are small and slim with relatively long legs that can be longer than the head and body combined. Combined the head and body is approximately 2 inches (5 centimeters) long. Their wings are long and slender with a slender tail that is completely enclosed in a tail membrane. They also have small eyes.

Adult males have a large structure typically in the center of the forehead called the natalid (NAT-ah-lid) organ. The function of this is uncertain.

The fur of these bats is soft and long with color ranging from gray, yellowish, reddish, to deep chestnut. One species, the Mexican funnel-eared bat, has two color phases, or types: one in which fur is light, tan to pinkish light brown, and the other in which fur is darker, a yellowish or reddish brown. The belly is paler in both phases.

GEOGRAPHIC RANGE

The five species of funnel-eared bats are found in several areas. One species is found in northern Mexico, eastern Brazil, and specific Caribbean islands. Another species occurs in northern South America and nearby islands. The other three species are found on islands in the Caribbean.

HABITAT

These bats live in lowland forests that are dry and deciduous, forests where the trees lose their leaves at the end of the

growing season. In general, they are found below 984 feet (300 meters). In Venezuela, these bats were found in habitats from sea level to about 8,200 feet (2,500 meters). Typically, these bats roost, rest or settle, in the darkest areas of caves and mine tunnels. They also have been found roosting in tree hollows.



WHAT A BABYFACE

The genus (JEE-nus) name *Natalus* comes from the Latin word *natus* meaning to be born. (*Natus* is also the root word for nature.) These bats were given this name because they are small and look like newborns even as adults.

DIET

These bats feed on small insects.

BEHAVIOR AND REPRODUCTION

Funnel-eared bats form colonies, groups, of up to 300 individuals. Some observations have also found fewer than a dozen individuals. These bats often roost with other families of bats. Northern populations may travel to warmer areas in the winter. Some species of bats have been observed hanging singly, alone.

Since they are nocturnal, active at night, funnel-eared bats leave their roost about half an hour after sunset to forage, search, for food. They use echolocation (eck-oh-loh-KAY-shun) to locate their prey, animals hunted for food. Echolocation is the detection of objects by emitting, sending out, sounds and listening to the returning sounds that bounce off objects. These bats flutter their wings rapidly while flying, like a moth, and can maneuver (mah-NOO-ver) easily. This allows them to enter and exit dense plant growth.

Females bear a single offspring late in the dry season, when they establish separate maternity colonies. Little is known about the mating behavior of these bats, but findings show that males mate with more than one female during the season.

FUNNEL-EARED BATS AND PEOPLE

Bacteria that cause fevers in humans have been isolated in one species of funnel-eared bat, the Trinidadian funnel-eared bat. Many bats, such as this one, have bacteria or other organisms associated with their droppings, waste, that can lead to diseases in people.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists Gervais's funnel-eared bat as Near Threatened (not currently threatened, but could become so in the future), and the Bahaman funnel-eared bat as Vulnerable, facing a high risk of extinction in the wild.



Funnel-eared bat *(Natalus stramineus)*

SPECIES ACCOUNT

FUNNEL-EARED BAT
Natalus stramineus

Physical characteristics: Funnel-eared bats, also called Mexican funnel-eared bats, have the funnel-shaped ears that are characteristic of the family. They have long, slender hind legs. They have black, stiff hairs above the upper lip, appearing like a moustache, and white hairs below the lower lip. The natalid organ is shaped like a bell and covers the muzzle, the snout.

Fur color occurs in both a light and a dark phase. The light phase is generally a light to medium tan and the dark phase is a reddish brown. The belly is paler in both phases, and of a similar color.

Geographic range: Funnel-eared bats are found in northern Mexico to eastern Brazil, Cuba, Jamaica, Lesser Antilles, and Tres Marias islands off western Mexico.

Habitat: Funnel-eared bats generally live in deciduous forests. They may also live in moister forest areas.

Diet: Funnel-eared bats feed on insects.

Behavior and reproduction: These bats were found roosting in large colonies with thousands of individuals in Venezuela. At high altitudes, some colonies may go into torpor, a dormant state, during the cooler months.

In general, bats of this species roost in the darkest areas of caves and mines. Females form maternity roosts during the breeding season. Gestation, pregnancy, lasts approximately ten months. Offspring are born weighing more than 50 percent of the mother's weight.



Funnel-eared bats roost in the darkest areas of caves and mines. (© Merlin D. Tuttle, Bat Conservation International. Reproduced by permission.)

Funnel-eared bats and people: There is no known special significance between funnel-eared bats and people.

Conservation status: Funnel-eared bats are not considered threatened by the IUCN. ■

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SMOKY BATS
Furipteridae

Class: Mammalia
Order: Chiroptera
Family: Furipteridae
Number of species: 2 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Smoky bats are also commonly called thumbless bats. While they do have a thumb, it is small, enclosed in the edge of the wing, and can appear invisible. Other bats, on the other hand, use their thumbs to grip surfaces while crawling, and to hang right side up while giving birth. Smoky bats are among the smallest of bats, having a head and body length combined of 1.4 to 2.6 inches (3.5 to 5.8 centimeters). Their forearms are about 1.2 to 1.6 inches (3 to 4 centimeters) long. Females are slightly larger than males.

These bats appear delicate, with broad wings that are relatively long. The snout is pig-like in appearance, being short and turned up at the tip. Set close together, the nostrils are oval or triangular. Ears resemble funnel-eared bats. They are separate, large, and funnel-shaped, reaching almost to the jaw line. These bats have tiny eyes that are hidden by fur and their large ears. They also have long legs and short feet, with claws on the end of their feet. The tail is relatively long, but it does not reach past the edge of the tail membrane (layer of thin skin).

The fur is generally coarse. The smoky bat has triangular, wart-like fleshy projections around its mouth and lips.

GEOGRAPHIC RANGE

The two species of the family are found in different areas. The thumbless bat is found west of the Andes, from central coastal Ecuador south to northern Chile. The smoky bat is found in Costa Rica, lowland Brazil, Peru and Trinidad.

BAT RELATIVES

There are no known fossils in this family. In general, bats do not fossilize well because of their small, delicate skeletons. Scientists consider the smoky bats to be most closely related to Central and South American disk-winged bats and funnel-eared bats.

HABITAT

Furipterids (members of the family Furipteridae) live in diverse habitats. The thumbless bat has been found living in lowland rainforests to the arid (extremely dry) deserts of South America to cultivated land. The smoky bat appears to have a narrower range of habitats, found primarily in lowland, moist forests. Many of these bats live in isolated populations. They are found primarily in caves, tree hollows, and human-made structures.

DIET

Bats in this family feed on insects, primarily moths and butterflies.

BEHAVIOR AND REPRODUCTION

Little is known about the species of bats in this family. Because they are small, agile flyers in isolated populations, smoky bats are difficult to catch and study. It is known that these bats roost in colonies (groups) between 100 and 300 individuals.

Like all bats, the smoky bats become active at night (nocturnal). The long and broad shape of their wings allows them to fly slowly and with great agility to forage, search, for moths and butterflies. This also gives them the ability to forage for prey (animals eaten for food) in dense forest undergrowth.

SMOKY BATS AND PEOPLE

People have caused the decline of the species in this family due to harming their natural habitats.

CONSERVATION STATUS

The World Conservation Union (IUCN) Red List categorizes the thumbless bat species as Vulnerable, meaning it is facing a high risk of extinction in the wild. The smoky bat is not considered threatened.



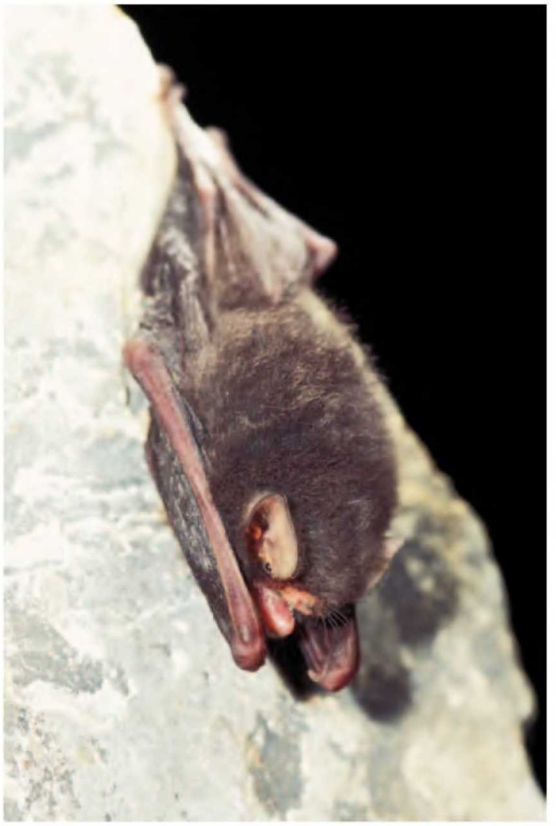
Smoky bat *(Furipterus horrens)*

SMOKY BAT
Furipterus horrens

SPECIES ACCOUNT

Physical characteristics: The smoky bat is the smaller of the two species in this family. Head and body length is approximately 1.3 to 1.6 inches (3.3 to 4 centimeters), and their forearms can range from 1.2 to 1.6 inches (3 to 4 centimeters). These bats weigh about 0.1 ounces (3 grams)—only slightly more than the weight of a penny. Females are larger than males by about 10 to 15 percent.

These bats have dense fur. Fur on the head is long and thick. Fur color ranges from brownish gray, dark gray, to a slate blue. Color on the belly is paler. The fur on these bats' head is long and thick. It covers the head and reaches to the snout, almost concealing the



The smoky bat has a reduced thumb that is enclosed in the wing membrane. (Photograph by Maarten Vonhof. Reproduced by permission.)

mouth. Ears are dark and stiff, and the snout is black.

Geographic range: These bats are found from Costa Rica to southern Brazil, including Venezuela and Colombia. They are also found on Trinidad but they have not been found on any other Caribbean island.

Habitat: These bats live primarily in humid rainforests of Costa Rica south to Brazil. They often live near streams. They have also been found in evergreen forests and clear areas. They have been found in caves, hollows in trees, and beneath rotting logs.

Diet: Smoky bats eat small moths.

Behavior and reproduction: These bats fly slowly and flutter similar to the way moths fly. These bats wait for complete darkness before they leave their roost to begin foraging. They search for prey beneath the forest canopy, at heights ranging from 3.2 to 16.4 feet (1 to 5 meters).

Colony size varies but it appears these bats do group together in relatively large numbers. One colony observed contained fifty-nine individuals. Another found colony contained approximately 250 individuals divided into groups of four to thirty roosting in holes in the walls. In another cave there were 150 bats roosting separately from one other.

Discovered colonies primarily include males, females, and young. Observations have also found there are all-male colonies, suggesting that females may have separate sites to raise their young.

Smoky bats and people: There is no known connection between smoky bats and people.

Conservation status: These bats are not considered threatened. ■

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DISK-WINGED BATS
Thyropteridae

Class: Mammalia
Order: Chiroptera
Family: Thyropteridae
Number of species: 2 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

These bats are about the size of a person's thumb, having a head and body length that ranges from 1.2 to 2.3 inches (3 to 5.7 centimeters). They weigh from 0.10 to 0.17 ounces (3 to 5 grams), about the same weight as one to two pennies.

These bats are also called New World sucker-footed bats, named after the suction cup-like feature found on their feet. These bats have circular suction cup disks with short stalks on the soles of the feet and the bottom of their thumbs. The disks on the thumb are larger than those on the feet. They also have a well-developed claw on their thumb.

Bats in this family have small eyes. There is a small wart-like projection above the nostrils, and there is no noseleaf (leaf-shaped fleshy protrusion). The tail juts out freely past the membrane (thin layer of skin), so it is visible. The ears are large and shaped like a funnel. The muzzle is long and slender. Nostrils are circular and set relatively far apart.

Species in this family have long, fluffy hair. Fur color ranges from a medium reddish brown to slightly darker. The undersides of these bats are white or brown. The ears can be either black or yellow.

GEOGRAPHIC RANGE

These bats are found in Central and South America, east of the Andes, including southern Nicaragua to the Guianas and Peru, and southern Mexico to Bolivia and southern Brazil, and Trinidad.

HABITAT

Disk-winged bats live in the moist parts of forests. They are common in many areas, and in Costa Rica there are up to four colonies (groups) for every 2.5 acres (1 hectare). They generally roost (rest or settle) in a curled leaf of some plant, such as the heliconia plant or the banana tree, before the leaf opens.

DIET

Disk-winged bats eat insects.

BEHAVIOR AND REPRODUCTION

Disk-winged bats use only their suction-like disks to grip and stick to the smooth surfaces of the curled-up leaves in which they roost. They do not use their feet or claws to touch the surface of the leaves.

These bats can support their entire weight with the suction of a single disk. Sweat glands keep the disks' undersurfaces moist, which helps provide the vacuum seal for sticking to the surface. Beneath each disk is a muscle that controls the vacuum. This muscle can create the seal and, when the bat wants to come unstuck, the muscle also undoes the seal. These bats will also lick their disks to help with the suction. Studies have found that these bats have lost the ability to roost on rough surfaces, such as trees and rocks.

Generally only one or two disk-winged bats roost in the same leaf, yet observers have found as many as eight individuals in one leaf. Roosting inside curled leaves protects them from the weather and predators. Leaves open within days, and groups must change roosts often.

Like all bats, these bats are nocturnal, meaning that they are active at night. When more than one bat roosts in a leaf, these bats spread out evenly, one above the other. In Costa Rica, a study reported that group sizes ranged from one to nine, and averaged six bats. Generally, the same group moves together from one old leaf to a new roosting site. Bats in this family



SUCKER COUSINS?

One of the puzzling features of the disk-winged bats is their relationship to the Old World sucker-footed bat. Both families of bats feature suction-like disks that allow them to grip onto vertical, smooth surfaces. Yet the Old World sucker-footed bat is found primarily in the rainforests of Madagascar, far away from where New World disk-winged bats are found. The Old World bat also has suction cups on its thumbs and roosts in young, rolled leaves, but their suction cups are thought to be the result of an evolutionary convergence with the suction cups of the New World bats. This means that both groups of bats evolved the suction cups separately, not as a result of their relationship to one another. Unfortunately, there is no fossil record for the New World disk-winged bats.

have been found roosting with bats in another family, the proboscis bat.

Unlike most other bats, individuals in this family typically hang with their head upward. Disk-winged bats use echolocation (eck-oh-loh-KAY-shun) to find prey (animals hunted for food) and detect objects. Echolocation is a process for locating objects by emitting, sending out, sounds, which are reflected back to the bat by objects in the sound's path.

Females roost together in hollow logs to give birth. Males in this family are thought to be polygynous (puh-LIJ-uh-nus), meaning they mate with more than one female during the mating season.

DISK-WINGED BATS AND PEOPLE

People have caused the decline in this family's population due to disturbing and destroying their natural habitat. Because they feed on insects, these bats eat many insects that people may consider pests.

CONSERVATION STATUS

Although these bats are common in some areas, the IUCN lists *Thyroptera lavali* as Vulnerable. In 1999, findings observed that *Thyroptera lavali* was restricted to a small area in extreme northeastern Peru.



Spix's disk-winged bat *(Thyroptera tricolor)*

SPIX'S DISK-WINGED BAT
Thyroptera tricolor

SPECIES ACCOUNT

Physical characteristics: Fur color of Spix's disk-winged bats ranges from dark brown to reddish brown. Their undersides are a cream or yellow, and their ears are blackish. The sides of their bodies are an intermediate color, which is why they were given the name tricolor, which means to have three colors. These bats weight about 0.14 ounces (4 grams). They have a head and body length combined of 1 to 1.5 inches (2.7 to 3.8 centimeters). Females are slightly larger than males.

Geographic range: Spix's disk-winged bats are found in tropical forests from Veracruz, Mexico to southeast Brazil.



Spix's disk-winged bat roosts with its head upright. Most other bats, besides disk-winged bats, hang upside down. (Brock Fenton. Reproduced by permission.)

Habitat: Spix's disk-winged bats have been found in rainforests, swamps, and clearings. They have generally been found living below 2,625 feet (800 meters) and have not been recorded living above 4,265 feet (1,300 meters).

Diet: Spix's disk-winged bats feed on insects, such as small beetles and flies. Spix's bats eat about 20 percent of its weight each night.

Behavior and reproduction: This species roosts in young, partly uncurled leaves. They are found roosting in leaves of heliconia plants, recognizable by their large leaves. Roosts contain about six individual bats, composed of one or more adult males, several females and several juveniles of both sexes. Female Spix's bats have been observed taking their offspring for the evening flight in search of food.

These bats are polygynous, meaning that the bats mate with more than one female at a time. These bats breed twice annually. Gestation (pregnancy) lasts about two months. For the first month of life offspring either remain in the roosts or cling to their mothers when they go out to feed, even though young can weigh up to 46 percent of the mother's weight. Offspring can generally fly after one month.

Spix's disk-winged bats and people: Aside from eating insects some people consider pests, these bats have no known significant relationship with people.

Conservation status: These bats are not considered threatened. ■

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OLD WORLD SUCKER-FOOTED BAT

Myzopodidae

Class: Mammalia
Order: Chiroptera
Family: Myzopodidae
One species: Old World sucker-footed bat (*Myzopoda aurita*)

family CHAPTER

PHYSICAL CHARACTERISTICS

Also known as the Madagascar sucker-footed bat, the sucker-footed bat family has only one known species. Bats in this family are small to medium in size, having a head and body length combined of 2.3 inches (5.7 centimeters), and a tail length of approximately 1.9 inches (4.8 centimeters). The tail extends beyond the tail membrane (layer of thin skin). The bat weighs about 0.3 ounces (8 grams).

Old World sucker-footed bat is named after the suction-like pads or disks on their wrists and ankles. These pads are horseshoe shaped. They are attached directly to the feet and ankles, without a stalk as in the disk-winged bats.

Old World sucker-footed bats have large ears, which are about 1.2 to 1.4 inches (3 to 3.5 centimeters) long. The ears do not have a tragus (TRAY-gus), which is a small flap of flesh in front of the opening of the ear. The upper lip extends beyond the lower lip. Their thumbs are small and have a vestigial (ves-TIJ-ee-al; not fully developed) claw.

These bats are occasionally called golden bats because of their fur color. Their moderately thick fur is brown to golden brown in color with some reddish shades.

GEOGRAPHIC RANGE

This species has been found only in Madagascar. It has been observed primarily from areas that stretch the full length of the east coast, and one area on the west coast. There are fewer than twenty localities where this bat has been recorded.

FAMILY MATTERS

The relationship between the Old World sucker-footed bat and the New World disk-winged bats has long interested researchers given that both families feature suction-like disks. The Old World sucker-footed bat, now only found in Madagascar, is thought to have lived in East Africa at one time. The suction cups appear to have evolved independently of those found on disk-winged bats. Sucker-footed bats were discovered in 1878 and classified as a distinct family in 1904. They were considered closely related to the disk-winged bats, and grouped together under one superfamily. Yet recent findings have put this relationship in question. The sucker-footed bat may have evolved at a much earlier date than the disk-winged bats, and may not be able to be grouped with any other bat family.

HABITAT

Old World sucker-footed bats are found primarily in the rainforests along eastern Madagascar.

DIET

An examination of one bat's droppings found that moths were its main food source. It is not known what other prey (animals eaten for food) or other foods the bats may eat.

BEHAVIOR AND REPRODUCTION

Little is known about the behavior and mating habits of these bats. Their suction disks allow them to cling onto smooth surfaces, yet they do not appear to hold the bat's body as tightly to a vertical surface as those of the disk-winged bats. The bats probably use the pads to hold on to the smooth, hard stems and leaves of palms and other smooth surfaces.

They have been found roosting (resting or settling) in the unrolled leaf of a traveler's palm. One bat was discovered over a small stream, another in a vanilla plantation, and one in a sparsely forested area over a path close to a stream. These bats have also been recorded flying over urban areas. They probably roost in a variety of palm species and other similar types of plants.

Like all bats, Old World sucker-footed bats are nocturnal, meaning that they are active at night. One bat was caught in a net about one hour after sunset.

Old World sucker-footed bats can maneuver (mah-NOO-ver) well in flight. They have been observed spending long periods of time hovering over freshly dug and planted paddy fields, as well as within forest clearings. It is assumed they were feeding in these areas.

These bats use echolocation (eck-oh-loh-KAY-shun) to capture their prey. Echolocation is the process for locating objects

by emitting, or sending out, sounds, which are reflected back to the bat by objects in the sound's path. Old World sucker-footed bats emit relatively long echolocation calls with complex frequency modulated (FM) calls.

No information is available about this species' mating and breeding habits.

OLD WORLD SUCKER-FOOTED BATS AND PEOPLE

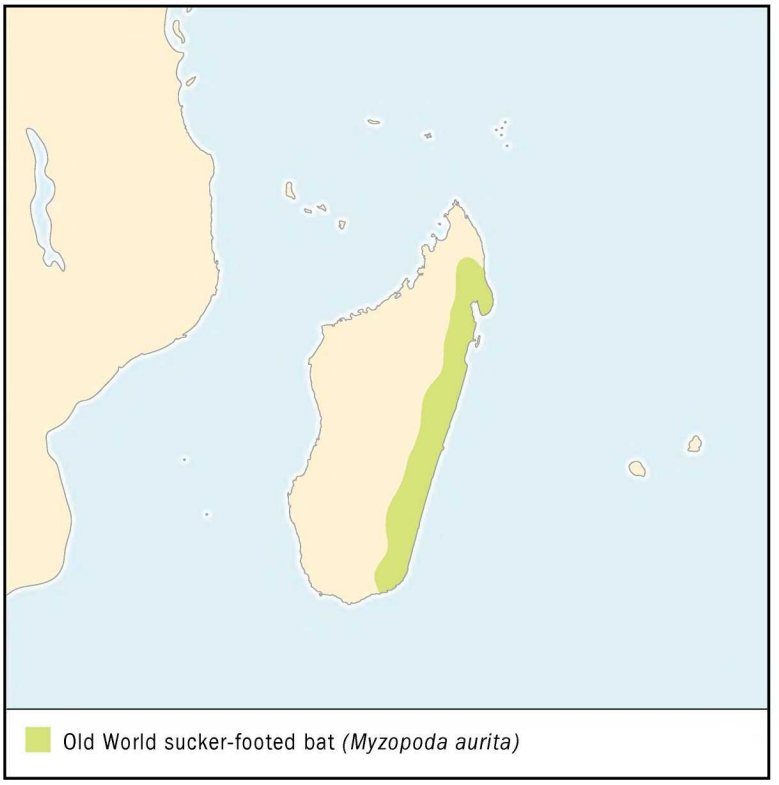
These bats are considered extremely rare and the IUCN defines the loss of forest due to human interference as the most likely threat to this species.



*Old World sucker-footed bat (*Myzopoda aurita*). (Illustration by Jonathan Higgins. Reproduced by permission.)*

CONSERVATION STATUS

Old-World sucker footed bats are considered one of the world's rarest species. The IUCN Red List categorizes these bats



as Vulnerable, meaning they are facing a high risk of extinction in the wild.

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family CHAPTER

FREE-TAILED BATS AND MASTIFF BATS

Molossidae

Class: Mammalia
Order: Chiroptera
Family: Molossidae
Number of species: 90 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Molossids (mol-LOSS-ids; members of the family Molossidae) range widely in size from small to moderately large bats. They have a forearm length of approximately 1.1 to 3.4 inches (2.7 to 8.5 centimeters), and weigh from 0.2 to 3.8 ounces (5 to 167 grams). Free-tailed bats are named for their thick tail that extends far beyond the tail membrane (thin layer of skin). The mastiff bats are named after their facial resemblance to the mastiff dog.

Some species of molossids have a distinctive wrinkled upper lip, while others have a smooth upper lip. Muzzles of all these bats are generally short and wide and often have wide, fleshy lips that may have folds or creases. Many have a distinctive pad over their noses. The upper surface of this pad often has small horn-like projections. Ears of free-tailed bats are relatively short and thick, often joined across the forehead and point directly forward. The eyes of these bats are relatively small, while the lips are large. All species have long and narrow wings that are thick and, along with the tail, are covered in a leathery membrane. Molossids also have short, strong legs and broad feet. On the outer toes of each foot are curved bristles that the bat uses for grooming its fur.

Molossids generally have short, velvety fur. One group of bats in this family is called the hairless bats because their hair is so short that the animal appears to be naked. Some species have a crest of hairs on the top of the head that stands upright. Fur color may be gray, tan, black, or brown. Many species have

two color phases, or types, a reddish one and brownish or blackish color phase.

GEOGRAPHIC RANGE

Molossids are found throughout the world's warmer areas. They are primarily found in South America and Africa, as well as from southern Europe and southern Asia through Malaysia, and east to the Fiji Islands. They are also found in the central and southern part of the United States, south through the West Indies, Mexico, and Central America to the southern half of South America. Except for one other family of bats, the Vespertilionidae, molossids are found in the widest geographic area.

HABITAT

With molossids spread out all over the world, they are found living in a wide range of habitats. They are commonly found in both natural and urban areas. These bats are most plentiful in arid (extremely dry) and semi-arid conditions. They prefer to live in temperatures that are at least 110°F (43°C). These bats roost (rest or settle) in sites such as caves, tunnels, buildings, hollow trees, foliage, decayed logs, and holes in the ground. They also shelter under bark, rocks, and iron rooftops.

DIET

Molissids eat a variety of insects, such as moths and ones with hard shells, such as beetles and stinkbugs.

BEHAVIOR AND REPRODUCTION

Molossids are generally strong flyers that can fly quickly for long periods of time. Like all bats, these bats are nocturnal, meaning they are active at night. These bats fly all night, whereas other bats typically fly a short time during the night. They can fly six or seven hours without stopping.

Molossids catch their prey using echolocation (eck-oh-loh-KAY-shun), a technique where the bat detects objects by receiving the reflection of sounds it produces. They fly with their mouths open and send out echolocation calls. They forage, search for food, in groups and head towards large swarms of insects. They also look for food around streetlights, which attract insects, such as moths. They generally catch their prey while they are flying.

THAT'S A LOT OF GUANO

A colony with thousands or millions of bats will produce a lot of guano, and people have been putting these droppings to use for a long time. Before people began to sell guano as fertilizer, the Confederate Army was using guano during the Civil War (1861–1865), as a source of gunpowder. It is thought that this guano was collected from the Brazilian free-tailed bat. In the late 1800s came the discovery of the millions of bats in Carlsbad Caverns, New Mexico, and their associated guano, which was valuable. In the early 1900s mining operations started in the caves, using mining cars to transport guano to the cave entrance. Most of the guano was shipped to southern California to help the developing citrus industry. In about twenty years of operation, over 100,000 tons of guano was taken from Carlsbad Cavern. Six companies attempted to make a profit in this venture, but all failed due largely to high transportation costs. Bat droppings in Carlsbad Caverns over the past 17,000 years have formed guano deposits covering several thousand square feet to a depth of almost 50 feet (15 meters)!

Because they live in warm areas, molossids do not need to hibernate (become inactive in the cooler months to conserve energy). Some of these bats travel to even warmer areas in the winter.

Molossids have a range of roosting habits, from solitary to social, living in large colonies (groups) of millions of individuals. Between those two extremes, sizes of colonies range from hundreds to thousands of individuals. Most of these bats do form colonies in the size of a few tens to several hundred individuals. Molossids generally return to their roosting sites every year. Their colonies generally give off a strong, musky odor.

Little is known about the mating habits of most molossids. Most species are considered polygynous (puh-LIJ-uh-nus), meaning the male mates with more than one female during the mating season. Females of most species appear to produce one offspring per year. Two young are born on rare occasions, and the black mastiff bat in Trinidad possibly has two litters per year. During pregnancy, females generally form maternity colonies that are separate from the males. In these colonies, females relocate and nurse their young independently.

MOLOSSIDS AND PEOPLE

Like many insect-eating bats, molossids eat many insects that humans consider to be pests. The one hundred million Mexican free-tailed bats that live in Texas in the summer eat an estimated 1,000 tons (907 metric tons) of insects each night, many of which destroy crops. In California and other areas, farmers build bats houses to attract these bats so they will eat the pests. People also collect the bat droppings (guano; GWAH-no) of molossid bats that live in large colonies, using the guano as a fertilizer as it is rich in nitrogen. Some species of these bats have also been associated with spreading disease, such as rabies. Rabies is a viral infection that attacks the nervous system and can be deadly.

People have caused the decrease in population of molossids by destroying and disturbing their natural habitat. These bats have also been harmed through eating insects that have come into contact with pesticides, chemicals designed to control pests.

CONSERVATION STATUS

The survival of many of these species is under threat. The IUCN lists Gallagher's free-tailed bat, Niangara free-tailed bat, and Wroughton free-tailed bat, as Critically Endangered, meaning they face an extremely high risk of extinction in the wild. The Incan little mastiff bat is listed as Endangered, meaning it faces a very high risk of extinction in the wild. Fifteen other species are listed as Vulnerable, meaning they face a high risk of extinction in the wild.



Naked bat *(Cheiromeles torquatus)*

NAKED BAT
Cheiromeles torquatus

Physical characteristics: Naked bats are the largest molossids, with a head and body length ranging from 4.5 to 5.8 inches (11.5 to 14.5 centimeters). They weigh from 3.2 to 5.7 ounces (96 to 170 grams). Also called naked bulldog bats, these bats are almost completely hairless. They have scattered short hairs and bits of longer hair around a scent gland on their neck. This haired gland produces a strong, foul odor.

These bats have loose, dark gray, brown, or black skin. A naked bat has bristles on its toes, which it uses for cleaning and grooming. Another distinguishing characteristic of the bat is the pocket of skin along its sides. These flaps of skin form a wing pouch that the bat



The naked bat is the largest bat in its family. They are called "naked" bats because they have very little hair on their bodies. (© Simon D. Pollard/Photo Researchers, Inc. Reproduced by permission.)

folds its wings into when it rests. Ears are separate and their lips are smooth. Big toes have a flat nail instead of the typical claw.

Geographic range: Naked bats are found in Southeast Asia, including Malaysia, Borneo, Java, Sumatra, the Philippines, and surrounding islands.

Habitat: These bats live in tropical forests and several live on islands. They roost in caves, rock crevices, tree hollows, and holes in the ground.

Diet: Naked bats feed on insects, primarily termites and winged ants.

Behavior and reproduction: Naked bats are strong, fast fliers. They fly high above the forest canopy (the tops of trees) or above clearings to forage, or search, for food. When they fold their wings into their pouch, these bats can move about relatively easily on all four limbs.

This species of bat roosts in large colonies. Nearly a thousand individuals were observed in a hollow tree, and a colony of about 20,000 was observed in a cave in Borneo.

There are usually two offspring. The young are most likely left in the roost when the parents leave to forage for food in the evening.

Naked bats and people: In certain areas, most of the forest habitat of the naked bat has been destroyed by development, logging, and cultivation. People have hunted these bats for food and killed them because they mistakenly believed these bats were harming their crops.

Conservation status: The IUCN Red List categorizes these bats as Near Threatened, not currently threatened, but could become so. In specific areas, this species has significantly declined, and is protected by law. ■



Brazilian free-tailed bat *(Tadarida brasiliensis)*

BRAZILIAN FREE-TAILED BAT
Tadarida brasiliensis

Physical characteristics: Also called the Mexican free-tailed bat, Brazilian free-tailed bats are small to medium in size, with a total head and body length of approximately 3.8 inches (9.5 centimeters).

Geographic range: Brazilian free-tailed bats are found in the southern half of the United States, as well as Mexico, Central America, South America to southern Chile and Argentina, and much of the Lesser and Greater Antilles.

Habitat: Brazilian free-tailed bats are primarily found in arid and semi-arid habitats. They are also found in urban areas, moist forests, and grassland areas. These bats roost in caves, mine tunnels, tree hollows, and under bridges. They also are frequently found in and around buildings.

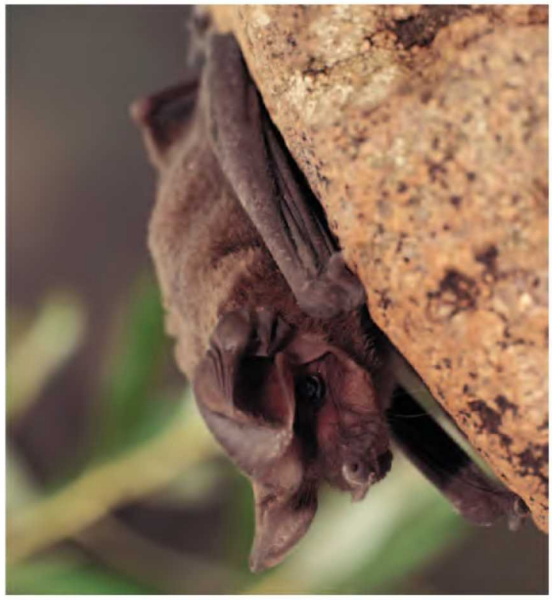
Diet: These bats feed on a range of insects, including moths, beetles, weevils, mosquitoes, flying ants, and leafhoppers.

Behavior and reproduction: Brazilian free-tailed bats are best known for their immense roosting colonies. While roosts of several dozen have been found, these bats also roost in colonies that reach the millions. A colony that lives in Bracken Cave, Texas, makes up the largest colony of mammals in the world, with an estimated twenty million individuals in this summertime maternity colony. They fly high above the ground when foraging for prey, except when sweeping over a body of water to drink.

Mating among these bats is considered promiscuous (prah-MISS-kyoo-us), meaning males and females mate with more than one other bat. Females bear a single offspring once a year in May to July. In maternity roosts where millions of bats are packed tightly together, mothers are able to identify and nurse their own young.

Brazilian free-tailed bats and people: Many of the insects these bats eat are considered pests by humans. These bats are also known carriers of rabies.

Conservation status: Many of the large colonies have declined dramatically in numbers. The IUCN lists Brazilian free-tailed bats as Near Threatened. ■



Brazilian free-tailed bats may roost in colonies of millions of bats. These are some of the largest colonies of mammals in the world. (John Hoffman/Bruce Coleman Inc. Reproduced by permission.)

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family CHAPTER

VESPERTILIONID BATS
Vespertilionidae

Class: Mammalia
Order: Chiroptera
Family: Vespertilionidae
Number of species: About 267 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Although this group of bats is large and contains many different-looking species, they do share several characteristics. Compared to many other bats that have what might be described as bizarre noses with flaps and other fleshy decorations, the vespertilionid (ves-per-TILL-ee-on-id) bats have plain faces. They are even known as the "plain-faced bats." Some species have noses shaped like tubes, however, with nostrils at the end of the tube.

The "webbed tail," known as a patagium (pah-TAY-jee-um), is actually a membrane or a thin bit of skin that stretches between the hind legs and aids the bat in flight. In these bats, the patagium is hairless. Their ears are noticeable and sometimes quite large, and they also have tails at the middle of the patagium that can be as long as the body. All have an obvious outgrowth, called a tragus (TRAY-gus), arising from the bottom of the ear. Most of them have small eyes. Overall body length ranges from about 1.4 to 5.5 inches (3.5 to 14 centimeters) and weight from 0.01 to 1.6 ounces (2.5 to 45 grams).

GEOGRAPHIC RANGE

Vespertilionid bats live in temperate to tropical climates worldwide. They are absent from far northern North American and Eurasia, as well as Antarctica.

HABITAT

The habitat varies in this large group of animals. Many of them spend the day resting in caves, or in tight little places,

like cracks in a house or a barn, underneath bark or in the hollow of a tree. Some even rest during the day, a behavior called roosting, inside curled leaves or in other sheltered spots within vegetation. At night, when they become active, the bats are often seen flying above open spaces, or over or near wetlands, rivers and streams, and lakes and ponds. During winter months, the bats typically hibernate. In colder climates, the bats overwinter in caves or other places with relatively stable temperatures. In warmer climates, they may simply choose a spot beneath a loose piece of bark or in the hollow of a tree.

DIET

The diet for most of the vespertilionid bats consists of insects, and many species eat their body weight in insects each night. A few species eat other things, including spiders, scorpions, fish, and lizards.

BEHAVIOR AND REPRODUCTION

Like other bats, the vespertilionid bats use sound waves to find their way through their habitat and to find food. They make high-pitched sounds, ones that we cannot hear, and then listen as the waves bounce off of objects and return to them as echoes. Using this method of "seeing" with sound, they can fly quickly between tree limbs and around objects, while also finding and identifying prey insects. It is common for a vespertilionid bat to notice a moth or other flying insect while both the bat and insect are in flight, then swoop in and capture the insect in midair. Using echolocation (eck-oh-loh-KAY-shun), they can also spot insects on plants and pick them off of leaves. Echolocation is particularly useful in these animals that rest during the day and look for food in the dark of night. A few species become active around sunset, sometimes even a little earlier, but most wait until the skies darken before they leave their roost and begin looking for food. Because they are such excellent and swift fliers, the vespertilionid bats avoid most predators. Occasionally an owl is able to catch one at night, but their biggest threat of predation (hunting by animals that eat them for food) comes from larger land animals that stumble upon a roost while the bats are resting.

Bats have a fairly set schedule with certain activities occurring during specific seasons. Mating occurs in the fall in most species. Some bats don't engage in any courtship rituals, but for the most

part, scientists know little about these behaviors in most bats. In the fall, bats that live in cooler climates begin to disappear, probably to start migrating to warmer climates for the winter. Cool- and warm-climate bats typically participate in hibernation, although some warm-weather bats remain active all year. Some vespertilionid bats hibernate alone, and others hibernate together in large groups, often numbering a hundred or more. If the temperature rises sufficiently in the winter, the bats may awaken and fly about in search of food. When spring arrives, males typically strike out on their own, but females usually form colonies in roosts, which may be in caves or other hideaways, and share the duties associated with raising young, which are born in late spring to early summer. (A few warm-weather species may be able to have young at other times of the year.) Most mothers have one or two young, called pups, a year. A few species may have up to four pups at a time. The pups begin flying in about a month and then start hunting for insects on their own. Some remain with the colony for their first year, but others leave earlier.



BIRDS AREN'T THE ONLY ANIMALS TO MIGRATE

When people hear about a fall migration, they usually think of birds that fly south for the winter. Other animals, including bats, migrate, too. Some bats may fly several hundred miles (kilometers) to escape the winter cold. The noctule, a medium-sized bat from Europe and Asia, makes migrations of 400 miles (670 kilometers) or more each year—quite a feat for an animal that is only about 3 inches (7.6 centimeters) long in body length and weighs about an ounce (28 grams).

Bat behavior is a field with many unanswered questions. Although scientists know a good deal about the behavior of a few species, they know little about most of the vespertilionid bats.

VESPERTILIONID BATS AND PEOPLE

Humans frequently don't recognize the benefits of bats. Vespertilionid bats eat many insects, including mosquitoes, crop-damaging beetles, and other pest species. Just five bats can eat 15,000 or more insects in a single night. Besides their benefit in keeping insect populations in check, bats have become a part of the folklore of many cultures. Much of the folklore, including that portrayed in horror books and movies, describes bats as evil creatures bent on sucking blood. Vespertilionid bats engage in no such activity, and rarely even fly close to a human.

CONSERVATION STATUS

The Red List of the World Conservation Union (IUCN) contains two Extinct, died out, species; seven Critically Endangered,

facing an extremely high risk of extinction in the wild; twenty Endangered, facing a very high risk of extinction in the wild; fifty-two Vulnerable, facing a high risk of extinction; and seventy-three Near Threatened, not currently threatened, but could become so. Those categories total 154 bats, more than half of all vespertilionid species. The U.S. Fish and Wildlife Service lists thirteen vespertilionid bats as endangered. For many of the species, habitat destruction and pesticide use are major reasons for their declines. Both organized and grassroots efforts are now under way to protect many bat populations. These include the preservation of roosting and hibernation sites.



PALLID BAT
Antrozous pallidus

Physical characteristics: Unlike many of the dark-furred, small-eyed vespertilionid bats, the pallid bat is yellowish with larger eyes. It also has large ears. Adult size ranges from 3.6 to 5.5 inches (9.2 to 14 centimeters) in body length and 0.5 to 1 ounce (13 to 29 grams) in weight. Its tail is a little more than a third of its body length.

Geographic range: The pallid bat lives in western North America from southern Canada to northern Mexico, also western Cuba.

Habitat: Their daytime roosts are in cracks and crevices of rocky outcroppings and in caves, usually near a water source. At night, they



The pallid bat eats insects, scorpions, and other invertebrates, and possibly small lizards and mammals, such as mice. (© Merlin D. Tuttle/Bat Conservation International/Photo Researchers, Inc. Reproduced by permission.)

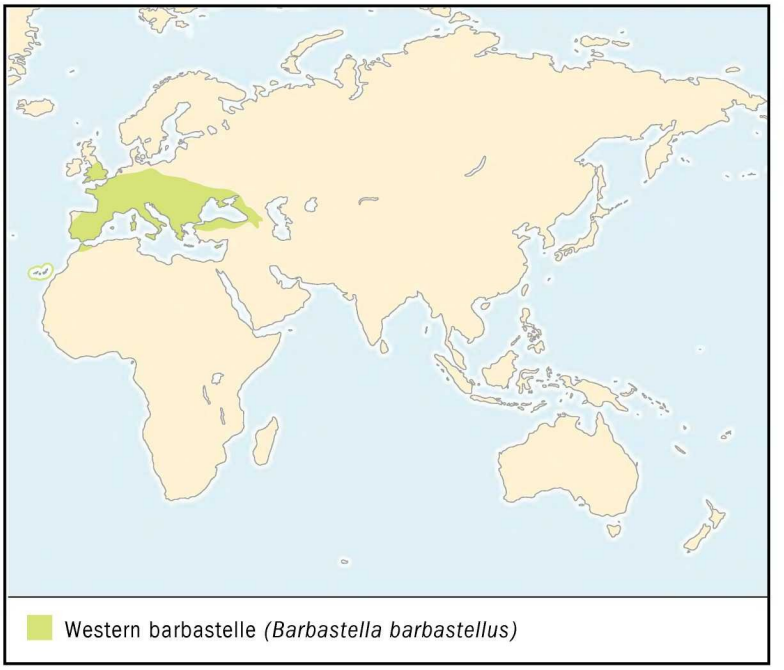
typically roost nearby in tree hollows, under bridges, or in some other hiding place.

Diet: These bats eat insects, scorpions, and other invertebrates (animals without backbones); possibly small lizards and mammals, such as mice.

Behavior and reproduction: They leave their daytime roosts after sunset, then begin looking for insects by flying between about 1 and 7 feet (30 centimeters to 2.1 meters) above the ground. They mate in fall to early winter, and females give birth to one or two pups in late spring to early summer. The young stay with their mothers in maternity roosts, and begin flying about a month and a half later.

Pallid bats and people: This species visits plants, probably in search of insects. In so doing, it picks up and delivers pollen, which helps fertilize plants.

Conservation status: The pallid bat is not threatened. ■



WESTERN BARBASTELLE
Barbastella barbastellus

Physical characteristics: This large-eared bat ranges from 1.8 to 2.4 inches (4.5 to 6.0 centimeters) in body length with a tail nearly as long, and 0.2 to 0.4 ounces (6 to 12 grams) in weight. Its back fur is black with white tips, and its belly fur is lighter.

Geographic range: The western barbastelle lives in central and northern Europe.

Habitat: These bats prefer upland forests, usually near water.

Diet: This species eats mainly flying insects, which they catch in midair. They will also swoop down to plants and pluck insects from their leaves.

Behavior and reproduction: This bat becomes active before sunset when it emerges from its daytime roosts in trees, caves, and other secluded spots. It is more solitary than many other vespertilionid bats,



The western barbastelle lives in central and northern Europe, preferring upland forests, usually near water. (Illustration by Emily Damstra. Reproduced by permission.)

with many individuals spending the summer alone. Females will sometimes form small maternity colonies. Hibernation begins in late fall. Many questions remain about this rather rare bat's behavior.

Western barbastelles and people: Like other insect-eating bats, the western barbastelle rids its habitat of many insects that humans might consider pests.

Conservation status: The IUCN Red List lists this bat as Vulnerable. ■



LITTLE BROWN BAT
Myotis lucifugus

Physical characteristics: Similar in appearance to the big brown bat, this species is a bit smaller. Its body length averages 3.1 to 3.7 inches (20 to 27 centimeters) with a tail a little less than half that size. It weighs 0.2 to 0.5 ounces (6 to 14 grams). The little brown bat is light to dark brown above with a lighter belly.

Geographic range: This bat lives in Canada, the United States, and Mexico.

Habitat: When they aren't flying in search of food, they do their summertime resting in tree hollows, underneath bark, or in barns, attics, and other such structures. During winter, they typically hibernate in caves.

Diet: Their diet consists mainly of flying insects.

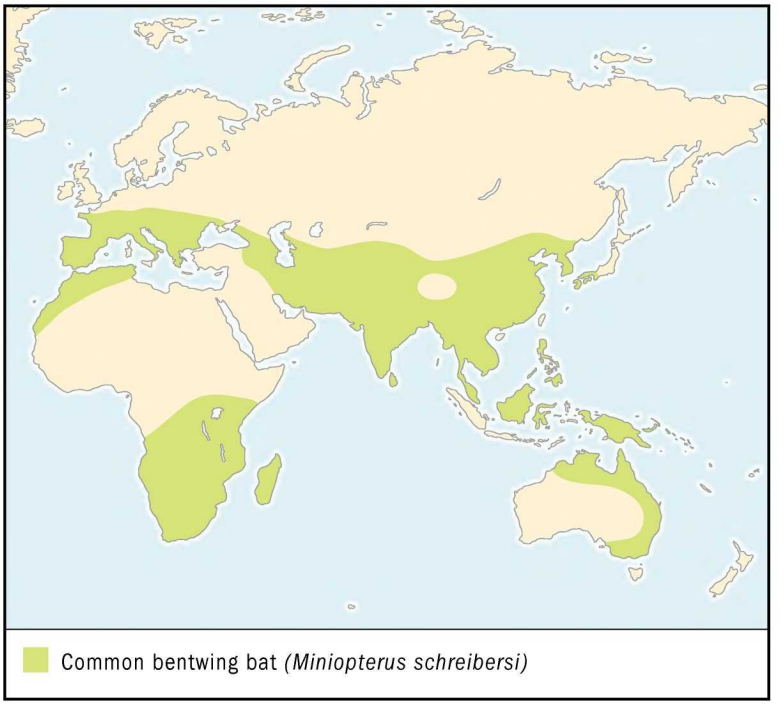


Little brown bats fly in search of food, mainly flying insects. (© Joe McDonald/Corbis. Reproduced by permission.)

Behavior and reproduction: They mate in the late summer to early fall. The females typically have just one pup in late spring or during the first half of summer. The young grow quickly, but don't mate until at least the following year.

Little brown bats and people: Like many other insect-eating bats, the little brown bat helps to control pest insect populations.

Conservation status: This bat is not threatened. ■



COMMON BENTWING BAT
Miniopterus schreibersi

Physical characteristics: Unlike other vespertilionid bats, bentwing bats have a long third finger that they can bend beneath their wing when they aren't flying. The common bentwing bat has a thick gray, yellow, or brown fur coat. It ranges from 2.0 to 3.1 inches (5.1 to 7.8 centimeters) in body length and weighs 0.3 to 0.6 ounces (8 to 16 grams). Its tail is about as long as its body.

Geographic range: This bat lives in Madagascar, southern and northwestern Africa, southern Europe, southern Asia, eastern and northern Australia, and New Guinea.

Habitat: They tend to prefer woodlands and fields that are near caves or other roosting sites.

Diet: Adult bats will eat up to a third of their body weight in flying insects every night.



Owls may sometimes catch common bentwing bats while they are flying for insects. (Brock Fenton. Reproduced by permission.)

Behavior and reproduction: They mate in the fall, and females typically give birth to one pup each summer. The females form large maternity roosts where they raise their young together. A roost can contain several thousand pups. The pups are old enough to mate and have their own families in about a year. Predators for common bentwing bats include owls that may occasionally catch the bats in the air, as well as snakes and cats that may find a roost.

Common bentwing bats and people: Like most other bats, the insect diet of this species helps to keep pests in check.

Conservation status: The IUCN Red List considers this species Near Threatened, likely due to predation and disturbance to maternal roosts. ■

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PRIMATES

Primates

Class: Mammalia

Order: Primates

Number of families: 14 families

order

CHAPTER

PHYSICAL CHARACTERISTICS

There are many different types of primates. Some are very small—the smallest primate is the pygmy mouse lemur, which weighs only one ounce (30 grams). Others are very large—the largest primate is an adult male gorilla. A full-grown male gorilla can weigh 375 pounds (170 kilograms) or more, and be as tall as 6 feet (1.8 meters). Primates include the lemurs, lorises and bushbabies, tarsiers, New World monkeys, Old World monkeys, apes, and humans.

Because there are so many different types of primates, appearance varies quite a bit. Body hair may be long, as in the orangutan or the golden lion tamarin. Other primates have short fur all over the body, such as the chimpanzee or pygmy marmoset. There are many quite colorful primates. The male mandrill of Central Africa has bright red and blue on his face and red, blue, and violet coloration on his rump. The Japanese macaque is medium brown with a red face. The golden langur of China has flame orange fur with a bright blue face.

But even though primates may be quite different in size and color, they do have many things in common. Primates tend to have longer arms and legs in relation to body size than other mammals. Their hands and feet are shaped so that they can hold on to objects very well. On a primate's foot, the big toe is set far apart from the other four digits, or toes. This allows an especially strong wraparound grasp on branches. Every primate has this special grasping action of its feet except humans. The ventral or bottom surface of both hands and feet have special pads that help

phylum
class
subclass
order
monotypic order
suborder
family

primates grip. This is another way that enables primates to achieve a better hold on tree limbs. Also, primates usually have rounded skulls with a large brain for their body size. Their eyes are set forward in the face for stereoscopic vision, which allows them to see things around them in three-dimensions (or "3-D"), rather than two-dimensions, like a page in a book.

GEOGRAPHIC RANGE

Primates are found in Africa, Asia, and South and Central America. The largest number of primates live in Africa, including the pottos, bushbabies, guenons, mangabeys, colobus monkeys, chimpanzees, gorillas, and baboons. Tarsiers, macaques, lorises, and most of the leaf monkeys live in Asia. Lemurs and aye-ayes are found only on the island of Madagascar. The New World monkeys, such as the marmosets, tamarins, and squirrel monkeys, live in South and Central America.

HABITAT

Primates live in a variety of habitats, including evergreen tropical rainforests with rain throughout the year, dry scrub forests, dry areas that have forests along river banks, coastal scrublands, bamboo stands, and dry deciduous forests where trees lose their leaves each year. For example, the mandrills and chimpanzees can be found in rainforests, and the ring-tailed lemurs live in dry woodlands. Rainforests are evergreen forests with a short dry season and high rainfall. Woodlands are areas with a lot of trees and shrubs.

DIET

Primates eat a wide variety of foods. All primates may eat insects, leaves, nuts, seeds, plant gums or fluids, and fruits. But each primate may have a food preference. The indri prefers young plants and leaves, fruit, and seeds. The aye-aye eats fruit and insect larvae (LAR-vee), or young. The blue monkey eats fruits, leaves, and slow-moving insects, as well as occasional birds and small animals.

BEHAVIOR AND REPRODUCTION

Most primates are arboreal, living in trees. Some are active during the day, such as the black lemurs and chimpanzees. Others are active only at night, such as the owl monkeys and lesser bushbabies. A few primates live primarily on the ground,

such as mandrill baboons and gorillas, even though they may sleep in trees for protection.

A few primates live alone most of the time, such as the orangutan and the potto. However, most primates are quite social, living together in small or large groups. Verreaux's sifaka lives in groups of about six animals. The moustached monkey lives in groups of up to thirty-five animals. The savanna baboon may have 200 animals in its group. Depending on species, the groups have different numbers of males and females. The indri has equal numbers of males and females. The guenons, or forest monkeys, have one male to each group of adult females. This is sometimes called a harem (HARE-um) group. The gray-cheeked mangabey groups have two adult females to one adult male.

Primate females give birth to live young. Compared to other animal species of the same size, they have long pregnancies. Bushbabies are pregnant four to five months, and may have one to three babies each time. Baboons are pregnant for six months, and usually have one baby each time. Gorillas are pregnant for eight and a half months and have one baby each time. Babies are usually born covered with fur, and with their eyes and ears open.

Dedicated care by one or both parents is usual for primates. Babies nurse for a long time. There is a lot of physical contact between the infant and the mother—this is often because the infants travel with the mother, clinging to her fur. In some primate species, such as the cotton-top tamarin and Goeldi's monkey, they travel with the father too. They may ride clinging to a parent's front, belly, or back.

Primates often interact with each other in social ways. Grooming, or cleaning, each other is one example. Depending on species, grooming may be done with the teeth, with hands, or with a finger, or grooming claw, which has a long nail specialized for grooming. Primates also interact with sound communication. Each sound is a form of communication.



SOUNDING OFF

Primates make a wide variety of vocalizations, or sounds. The dourocouli (or night monkeys) of South America grunt. Howler monkeys sound their loud howl from the trees at dawn, during territorial arguments, and when they hear loud noises. Long-haired spider monkeys squeak, grunt, hoot, wail, moan, and scream. The sifakas get their name from the clear "si-fak!" call that they make. Male mandrills both grunt and make high-pitched crowing sounds. The Bornean orangutan male makes a booming sound that can be heard a half mile away. Tamarin monkeys and marmosets make a bird-like twittering sound. Marmosets can make ultrasonic sounds that humans can't hear.

THE ORGAN GRINDER'S MONKEY

In the early 1900s, the 6-pound (2.7-kilogram), brown, pale-fronted capuchin monkey would hold out its hand for money when its organ grinder owner played music in the streets of New York and Boston. The capuchin is a very intelligent primate. It has a large brain relative to its small size, and excellent eye-to-hand coordination, enabling it to accurately pick up the tiniest items. It would grab fruit and coins from passers-by on the street.

PRIMATES AND PEOPLE

People hunt some non-human primate species for meat, unproven medicinal uses of their body parts, or capture them for pets. Zoos collect primates as exhibit animals. Some primates, such as the baboon, rhesus monkey, and the common marmoset, are used in laboratory biomedical research. Current breeding programs have slowed the practice of taking these animals from the wild. A few primates, in close contact with human living areas, have become crop pests, such as the macaques who raid fruit trees that humans grow.

If not threatened, primates seldom bother human beings. However, some may harbor viruses that can be transmitted to human beings, such as Ebola, a usually fatal disease.

CONSERVATION STATUS

About one-third of all primate species are threatened. Of these, 120 species are Critically Endangered, facing an extremely high risk of extinction in the wild; Endangered, facing a very high risk of extinction; or Vulnerable, facing a high risk of extinction. Critically Endangered species include the Sumatran orangutan, one species of snub-nosed monkey, three lion tamarin species, and two gentle lemur species. Most of the problems for these tree-dwelling animals come from deforestation, or tree destruction and removal. Hunting in some areas is also a problem, as are brush fires. Tourism, while increasing local awareness, also means increased development to house and feed tourists. There are captive breeding programs and protected national parks, but as habitat loss continues, extinction of several species is predicted.

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LORISES AND POTTOS
Lorisidae

Class: Mammalia
Order: Primates
Family: Lorisidae
Number of species: 9 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Lorises and pottos have short heads covered with hair. Snouts, or nose areas, are small. Their C-shaped ears are close to the scalp, and they have large, round, dark eyes. Arms and legs are long and about equal length. All ten fingers and ten toes have a claw, but the claw is longest on the second toe. This is called a grooming claw, and lorises and pottos use it to comb through and clean their fur. The index finger is quite small compared to the rest of the fingers, and their thumbs and big toes are located far from the other four fingers and toes. When these animals wrap their hands or feet around a tree branch, their grasping hold is very strong, allowing them to hold onto a branch for a long time.

Lorises and pottos are very small animals. The tiniest loris is the gray slender loris. It is only 8.5 inches (21.5 centimeters) long from head to the start of its tail. It weighs only 9 ounces (255 grams). The potto is the largest member of the Lorisidae. Tail length varies in the lorises and the pottos. Some, such as the slender loris, have no tail. Others may have a tail length of up to 2.5 inches (6.5 cm). Their color varies; pottos and lorises can be cream colored, pale brown, grayish brown, reddish brown, orange-brown, or dark brown. Some have mixed fur colors. Some lorises have contrasting markings or striped areas. The color contrast may be especially visible when it forms a ringed area around the large eyes, as it does in the pygmy slow loris.

GEOGRAPHIC RANGE

The slow lorises live throughout tropical rainforests in Southeast Asia. The slender lorises are found in the tropical

forests of India and Sri Lanka. Pottos occur only in the tropical and subtropical forests of West and Central Africa.

HABITAT

Lorises and pottos live only in thickly forested areas. Most often, they live in the trees of tropical rainforests, forests where the trees are evergreen and there is a lot of rain.

DIET

Lorises are omnivores, eating both plants and very small animals. They are nocturnal, feeding at night. They locate food with their keen sense of smell. Diet includes insects, lizards, fruits, leaves, birds' eggs, and gum, the liquid from plants. Each species, or type, of Lorisidae, may have a food preference. When feeding, they hang by their feet from a branch.

BEHAVIOR AND REPRODUCTION

Lorisids (species in the family Lorisidae) are usually solitary animals, each having a specific range for its food searches. However, the home range (place where an animal feeds and lives) of males may overlap that of females. During the day, lorisids may sleep on a tree branch, in a hollow tree trunk, or in the fork of a tree. They typically sleep while curled up, with head and arms tucked between their thighs. While they see well in daylight and dark, they search for food at night. The animals move very slowly and carefully. Sometimes they don't even disturb tree leaves as they pass through. This careful behavior helps them to avoid predators, animals that hunt them for food. While moving through tree branches, they tend to drag their bottoms to mark their trail with urine. If a lorisid hears even the slightest sound that might mean a predator is nearby, it just stops and hangs on to a branch. With strong arms and legs, it can stay that way for hours, until it feels it can safely move again.

Lorisids may have more than one mate. Pregnancy is from about four to six months, depending on the species. Lorisids usually have just one baby at a time. Babies weigh from 1 to 2 ounces (28.4 to 56.7 grams). After a baby is born, it hangs on



LORISID COMMUNICATION

When Asian lorisids want to communicate with each other, they make specific noises, or vocalizations. Sounds vary by species, and include panting, hissing, growling, soft and loud whistles, rapid clicking, and chirping. The clicking sound made by infants when separated from their mother is a series of short, sharp, rapid clicks called a "zic" call.

POTTOS DEFEAT AN ENEMY

If a potto senses a predator, or enemy, it holds onto a branch and stays very still. Because its arms and legs are so strong, it can stay in this non-moving position for several hours, until the predator gives up and goes away.

If it must fight, the potto first turns its thickened neck hump, or shield, toward the attacker, while keeping its hands and feet tightly clamped on a branch. It then makes a series of sideways movements. It tries to hit the enemy with its hump. If the potto is successful, the enemy falls to the ground below.

to the front fur of its mother's body for a few weeks. Sometimes, as she searches for food at night, the mother may place her infant on a small branch. The infant holds onto the branch until the mother returns. At night, while the mother sleeps, the baby holds onto her belly. As the infant grows, it begins to travel on its mother's back. Then it follows her. As the mother looks for food, she also is teaching her young how to look for, and recognize, suitable food. Young lorisids stay with their mother until they are about a year old, then go off on their own.

LORISES, POTTOS, AND PEOPLE

Large zoos may have special exhibits of lorisids and pottos. In their native homes, in some areas, they are trapped and kept as pets. Occasionally the larger species are used as food.

CONSERVATION STATUS

While no Lorisidae are considered Endangered, two are Vulnerable (facing a high risk of extinction, or dying out, in the wild) due to habitat loss. Two are Near Threatened (not currently threatened with extinction), and four species are fairly common.



Pygmy slow loris *(Nycticebus pygmaeus)*

PYGMY SLOW LORIS
Nycticebus pygmaeus

Physical characteristics: This small loris is only 10 inches long (25.5 cm). It has no tail. Weight is just 11 ounces (310 grams), with males and females about the same size. The pygmy loris is colorful. It has bright orange-brown fur on its upper back and a light orange-gray area on its upper chest. Its face is gray, with a dark orange-brown eye mask, and a white stripe between its eyes.

Geographic range: The pygmy slow loris is found in China, Laos, and Vietnam.

Habitat: Pygmy slow lorises thrive in evergreen tropical rainforests.

Diet: Pygmy slow lorises eat fruit, insects, and gums (plant juices). Some scientists believe this species prefers to eat gum, because in captivity they have been seen making holes in tree wood to get plant sap.

Behavior and reproduction: Pygmy slow lorises usually travel and feed alone. Each has a preferred territory where it lives. During the

Young pygmy slow lorises stay with their mother until they are about a year old, then go off on their own. (Rod Williams/ Naturepl.com. Reproduced by permission.)

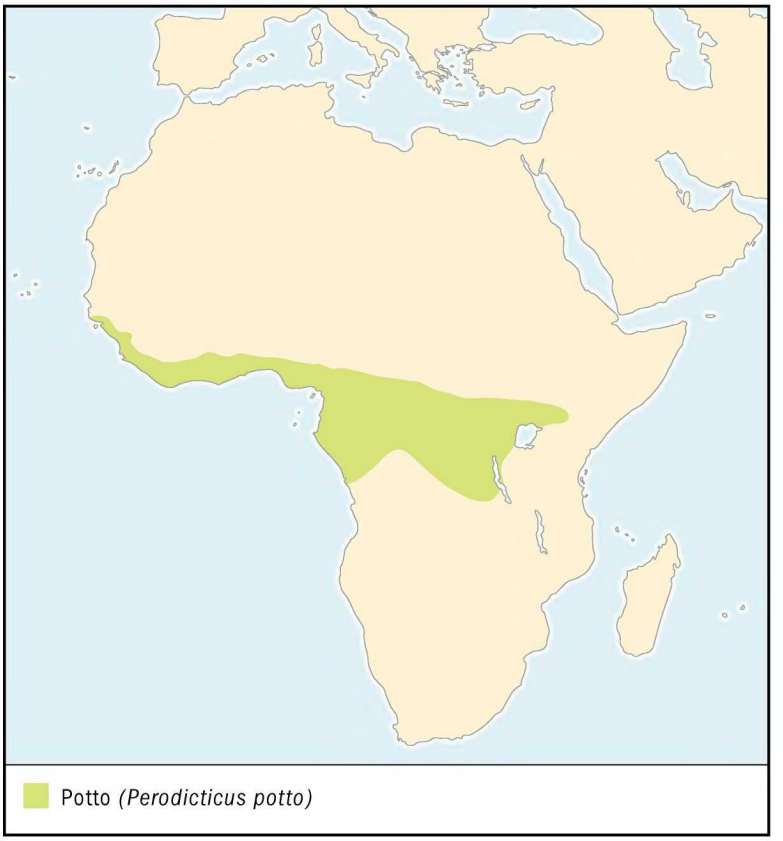


day, the pygmy slow loris sleeps holding on to branches in the midst of thick leaves and branches. At night, they use their strong arms and legs to move slowly and carefully, hand-over-hand, through trees. Like other lorisids, they mark their trails with urine.

Their mating system is not currently known. Females are pregnant for 192 days, a little more than six months. They may have one offspring (baby), or twins. Babies stay with the mother for a few weeks, hanging on to her belly. As the infant grows, it clings to its mother's back while she travels. Then it follows her. Young pygmy lorises stay with their mother until they are about a year old, then go off on their own.

Pygmy slow lorises and people: Because they move around mostly at night, and are quite small, few people see them. However, some pygmy slow lorises are kept as pets in their native areas. Large zoos may include them in special exhibits.

Conservation status: The pygmy slow loris is listed as Vulnerable due to habitat loss from deforestation. ■



POTTO
Perodicticus potto

Physical characteristics: Pottos have dark fur on the top of their body, and light brown fur underneath. They have a body length of 15 inches (38.1 centimeters) with a 2.5-inch tail (6.5 centimeters). A grown potto weighs only about 2.75 pounds (1.25 kilograms). Its dark eyes are large and round.

As protection from predators, a potto's upper back has a humped area of thickened skin on top of long vertebral spines. This thickened area, often called a shield, is covered by fur and contains long tactile, or feeler, hairs. These tactile hairs help detect a possible predator attack, and the shield can be turned toward the predator to help protect the potto from the attack.



The potto's upper back has a humped area of thickened skin on top of long vertebral spines. This thickened area, often called a shield, can be turned toward an attacking predator for protection. (Rod Williams/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Pottos are found in Africa, including Nigeria, Sierra Leone, Ghana, Cameroon, Equatorial Guinea, Gabon, Congo, Democratic Republic of the Congo, Uganda, and Kenya.

Diet: Pottos eat mostly fruit, but they also eat insects and gums (plant juices). They find insects by smell. They will eat insects that other animals might avoid, such as ants, hairy caterpillars, slugs, and stinky beetles.

Behavior and reproduction: Pottos usually live alone. They move about at night in the trees, traveling quite slowly hand over hand. They mark their trails with urine. During the day, pottos sleep in thickly leaved branches.

Female pottos usually have one infant after being pregnant for about 163 days. A potto baby weighs just 2 ounces (56.7 grams). It has a thin layer of fine fur. It eyes are open. From the first day, the infant holds on to the mother's front and travels with her until it becomes more independent. It will leave its mother at about one year old.

Pottos and people: Potto habits of moving slowly and carefully at night, high in the trees, make them difficult to study.

Conservation status: Pottos are listed as Vulnerable. The major problem is habitat, or living site, destruction due to deforestation, cutting down trees. ■

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BUSHBABIES
Galagidae

Class: Mammalia
Order: Primates
Family: Galagidae
Number of species: 20 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The largest bushbaby is the brown greater bushbaby. An adult male weighs 3.1 pounds (1.4 kilograms). Body length is 12.5 inches (31.5 centimeters) with a 16.5-inch (41-centimeter) tail. The smallest bushbaby is the mouse-size Demidoff's bushbaby. An adult male weighs 2.5 ounces (65 grams). Its body is 5 inches (13 centimeters) long, with a 7-inch (18-centimeter) tail. Females are somewhat smaller than males.

Bushbabies are usually gray, reddish, or brown with lighter underparts, having gray or dark eye patches. Their fur is thick and soft, and larger bushbabies have quite long bushy tails that help them balance. All bushbabies have rounded heads, short pointed faces with forward-facing eyes, and a pointed snout, or nose area. They can rotate their head in a full circle. Their ears individually bend backward or wrinkle forward, enabling them to better locate sounds. Bushbabies have a special reflective, or mirror-like layer at the back of their retina, or light-receiving, part of the eye. This lets them see in extremely dim light. It also makes their eyes shine in the dark, like a cat's eye.

Bushbabies have larger hindlegs, or back legs, than forelimbs, or front legs. Very strong hindlegs and very long anklebones enable most species to move extremely quickly and accurately. A bushbaby's hands and feet have five long slim fingers, or digits, on each forelimb and five long, slim toes on each hindlimb. Their fingertips have round flat pads of thickened skin that help them grip firmly onto branches. All digits have nails, except the second digit of the hind foot, which has a long curved claw

for grooming or cleaning. For grooming, bushbabies also use their lower incisors, or front teeth, and pointed canine teeth as a toothcomb. Underneath the tongue is a false-tongue, which is used to clean the toothcomb.

GEOGRAPHIC RANGE

Bushbabies are found in many parts of Africa, from sea level to 6,000 feet (1,800 meters).

HABITAT

Bushbabies live in many areas, from dry, thorny scrub to evergreen tropical rainforests.

DIET

Depending on the species, bushbabies usually eat fruit, gum or plant fluids, and insects. They can find insects by sound alone and snatch them from the air as they fly past.



SOUNDING OFF

The common name bushbaby comes from their loud wailing territorial sound, which sounds somewhat like a human baby crying. Bushbabies make a variety of different sounds, as well. The Senegal bushbaby makes a high-pitched scream when upset, has an alarm call which includes grunting, clucking, whistling, wailing, and sneezing, as well as grunts when it is ready to fight. Infants call to their mothers with a "tsic" sound, and mothers reply with a cooing or soft hooting sound.

BEHAVIOR AND REPRODUCTION

Bushbabies are nocturnal, searching for food at night. They usually remain in trees, but occasionally travel on the ground. Most leap from branch to branch. Some can leap long distances from one branch to another. Others hop on their strong hind legs between branch supports. Some can hang onto vertical supports, such as tree trunks. While most move quickly, the thick-tailed bushbaby sometimes moves very slowly and quietly.

Bushbabies usually sleep in social groups of eight to twenty members. During the day, they rest in hollow trees, tree forks, or old bird nests. Some make sleeping nests from leaves. In a few species, a mated pair and their young may sleep together. In other groups, the adult male does not sleep in the group-sleeping nest. He keeps in contact with females when they are outside the sleeping nest.

Bushbabies forage, or search for food, by themselves. Males have larger territories, or feeding areas, than females. These often overlap those of several female groups. Scent, sounds, and facial expressions all play a role in bushbaby communication.

An adult male bushbaby may mate with several females. Twice a year, one to three infants are born. The young are fully furred with their eyes open at birth. Bushbaby young spend a week or longer in a hidden tree nest. The mother may leave them there while searching for food, or she may travel, carrying her young in her mouth. When she eats, these babies are placed to cling onto branches. Later, bushbaby young may ride on their mother's back as she searches for food. A baby is weaned, or stops feeding on breastmilk, at about two months of age. It becomes independent at about four months of age. Females may remain in their birth area or travel to new areas.

BUSHBABIES AND PEOPLE

Bushbabies are often captured by local people as pets. The larger species may be used as food or killed for their fur. Bushbabies may also be taken for zoo exhibits. Bushbabies can be carriers for the yellow fever virus. Mosquitoes feeding on them can transmit the disease to humans.

CONSERVATION STATUS

Most species are common in Africa. However one species is Endangered, facing a very high risk of extinction, and six are Near Threatened, not threatened, but could become so, due to habitat, or living area, destruction.



Senegal bushbaby *(Galago senegalensis)*

SENEGAL BUSHBABY
Galago senegalensis

Physical characteristics: The Senegal bushbaby is also known as a lesser galago or lesser bushbaby. It is gray with yellowish highlights. It has soft, thick fur. Its large eyes are surrounded by thick dark eye-rings. It has very large, moveable ears. A bushbaby can rotate its head in a circle, like an owl. The Senegal bushbaby is 6.5 inches long (16.5 centimeters) with a 10.5-inch (26-centimeter) tail. Adult males weigh 11 ounces (315 grams), with adult females being slightly smaller.

Geographic range: Senegal bushbabies are found in sub-Saharan Africa, from Senegal to Kenya.

Habitat: Senegal bushbabies live in dry forests, thorny scrublands, and grasslands with some trees.



Senegal bushbabies move around at night, usually staying up in the trees and moving from branch to branch. (© Gallo Images/Corbis. Reproduced by permission.)

Diet: Senegal bushbabies usually feed on the gum, or liquid, from acacia (uh-KAY-shah) trees and insects.

Behavior and reproduction: Senegal bushbabies are nocturnal, moving about at night. They usually stay in trees, hanging vertically, or up and down, on tree trunks. They move by making long leaps from branch to branch, up to 10 to 13 feet (about 4 meters). They also can kangaroo-hop on the ground.

A Senegal bushbaby adult male may mate with several females. Females give birth twice a year and are pregnant for about four months. The pregnant mother prepares a leafy birthing nest. Babies weigh about 0.42 ounces (12 grams) at birth. Mothers nurse babies for about three months. For the first few weeks, the infants cling to the mother's fur as she travels. Young males leave their parents at about ten months of age, but females may stay longer. They are ready to have a litter by twelve months of age.

Senegal bushbabies and people: Senegal bushbabies play a small part in the lives of local people.

Conservation status: Senegal bushbabies are not currently endangered, but may become threatened by habitat loss due to land clearing for farming purposes. ■



Northern greater bushbaby *(Otolemur garnettii)*

NORTHERN GREATER BUSHBABY
Otolemur garnettii

Physical characteristics: The northern greater bushbaby, also known as Garnett's bushbaby, Garnett's galago, small-eared galago, or greater bushbaby, has reddish to grayish brown fur. It lacks facial markings and has very large, light-sensitive eyes. At night, the pupil opens into a complete circle to allow for better vision in the dark. Adult males weigh 1.75 pounds (795 grams) with females slightly smaller. Body length, including the head, is 10.5 inches (26.5 centimeters), and they have a 14.5-inch (36.5-centimeter) long bushy tail.

Geographic range: Northern greater bushbabies are found in northeastern Africa.



The northern greater bushbaby eats fruit and insects. (© Tom & Pat Leeson/Photo Researchers, Inc. Reproduced by permission.)

Habitat: Northern greater bushbabies live in coastal and highland forests.

Diet: The northern greater bushbaby usually feeds on fruits and insects.

Behavior and reproduction: The northern greater bushbaby adult male may mate with several females. Adult females give birth to one or two infants at a time. They are pregnant for eighteen weeks. Until two weeks of age, the babies stay in a leafy nest. They then cling to the mother's fur as she travels searching for food.

The northern greater bushbaby runs and walks on all four limbs along tree branches, following regular pathways. Occasionally it searches for food on the ground, where it may hop like a kangaroo, or jump-run, hopping first on hind legs, then on forelegs. It hides during the day to avoid predators, such as large snakes.

Northern greater bushbaby males and females often share feeding territories as well as nests. However they usually feed alone at night. Adult males will tolerate younger or lesser males within their feeding range. During the day, these bushbabies return to tree hollows or vine tangles to sleep as a group.

Northern greater bushbabies and people: Northern greater bushbabies have no known interaction with people.

Conservation status: These bushbabies are rather common and not immediately threatened. ■

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DWARF LEMURS AND MOUSE LEMURS

Cheirogaleidae

Class: Mammalia
Order: Primates
Family: Cheirogaleidae
Number of species: 17 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ family

PHYSICAL CHARACTERISTICS

Dwarf lemurs and mouse lemurs are the smallest lemurs. The pygmy mouse lemur weighs just one ounce (30 grams). The largest of these lemurs is the fork-crowned lemur, weighing 16.5 ounces (460 grams), or about a pound. The head and body length of dwarf and mouse lemurs ranges from 4.9 to 10.8 inches (12.5 to 27.4 centimeters), depending on species. Tail length is about as long as total body length.

Dwarf and mouse lemurs have large ears and large, mirror-like eyes set close together. They have excellent night vision. Depending on where they live, these lemurs may have grayish hair or reddish brown hair. Their underbody hair is much lighter, sometimes whitish or yellowish brown. Body hair is soft, thick, and woolly.

GEOGRAPHIC RANGE

Dwarf and mouse lemurs live in Madagascar, an island off the southeast coast of Africa.

HABITAT

Dwarf and mouse lemurs live in a variety of forested habitats, including evergreen rainforest, deciduous forest where trees lose their leaves each year, and semiarid forest, which doesn't get rain part of the year. Mouse lemurs are also found in patches of scrub vegetation where there are small bushes, and in people's gardens in settled areas.

DIET

Dwarf and mouse lemurs usually eat fruit and insects, but some species prefer other foods too. Coquerel's mouse lemur licks the sweet body liquids that are the waste matter produced by some planthopper insects. Fork-crowned lemurs primarily feed on plant gums, or sticky plant liquids. Many of the dwarf and mouse lemurs slow down in the dry season when plants and insects are not as readily available. They survive on stored body fat in their tail until the plentiful rainy season starts, when they become active again.

BEHAVIOR AND REPRODUCTION

Dwarf and mouse lemurs are nocturnal, or active at night. They search for food by themselves, usually in the smaller branches of trees and shrubs.

Dwarf and mouse lemurs are quite social. They have group nests, which they share during the day. The nests can be within tree hollows or tree branches. Five of the little fat-tailed dwarf lemurs may share a tree hole. Mouse lemur nests may have two to nine residents. These nests may have female dwellers, with the males nesting alone or in pairs, or both male and female dwellers. Dwarf lemurs have male-only or female-only nests. Communication is with scent and a variety of calls. Calls include those for keeping contact, mating, alarm, and distress.

Mouse and dwarf lemurs usually travel along branches on all four legs, leaping at times. They can use their tail for balance. Some species can take long leaps from one branch to another. A gray mouse lemur may also move on the ground with froglike hops. Each species, or type, of dwarf or mouse lemur marks its trail with scent while traveling. These markings, deposited by scent or smell glands, or from urine, give information about the traveler's age, sex, and whether it is ready for mating.

After mating, mouse and dwarf lemur females have a two- to three-month pregnancy, depending on species. They may have one to three infants each birth. Births usually take place

MATING COMPETITION

Female mouse lemurs are all ready to mate at one time. Male mouse lemurs can defend only one female at a time. So it's very difficult to keep a group of females all to themselves for mating. Rather than do a lot of fighting, dominant males have a way to put other males out of action. The urine of stronger male mouse lemurs contains chemicals producing a smell that makes weaker males sterile, or unable to reproduce. In addition, these weaker males can't even make the special trills, or calls, used to attract females for mating.

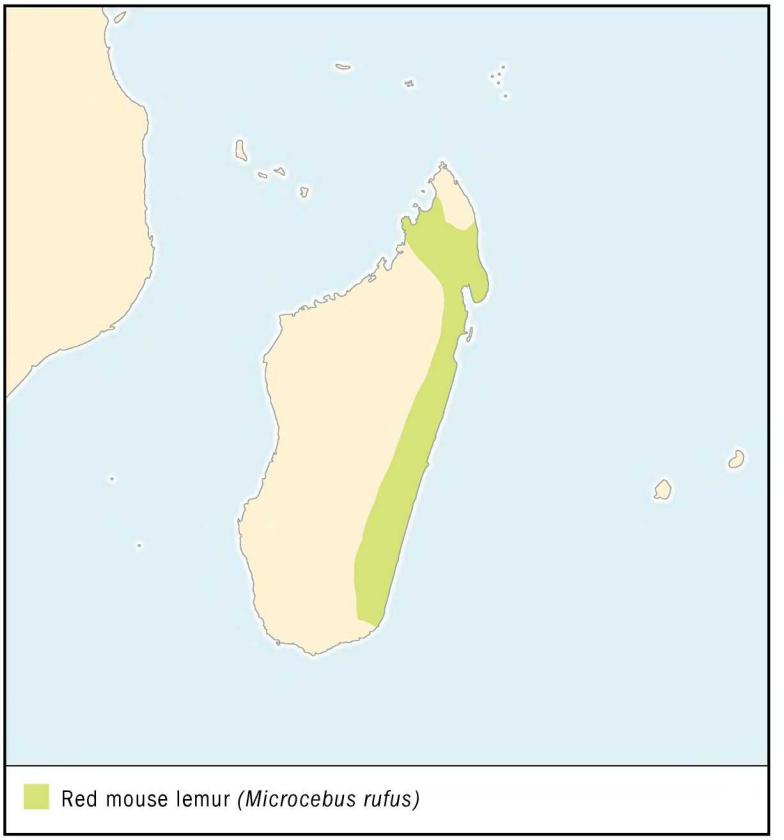
during the rainy season, when food is plentiful. The smaller mouse lemur infants weigh about 0.175 ounces (5 grams) each. The larger Coquerel's mouse lemur infants can have a birth weight of 0.42 ounces (12 grams) each. Mouse and dwarf lemur infants are raised in a nest made of twigs and leaves.

DWARF AND MOUSE LEMURS AND PEOPLE

Dwarf and mouse lemurs are not often hunted for food because of their small size.

CONSERVATION STATUS

Dwarf, red, and gray mouse lemurs are still fairly common. However, they and other small lemur species are at risk due to destruction of their forest habitats, or dwelling places, by human logging, farming, and cattle and goat grazing. It is estimated that only 10 percent of Madagascar's forests remain. The World Conservation Union (IUCN) lists three species as Endangered, facing a very high risk of extinction; one as Vulnerable, facing a high risk of extinction; and one as Near Threatened, not currently threatened, but could become so.



RED MOUSE LEMUR
Microcebus rufus

SPECIES ACCOUNT

Physical characteristics: The red mouse lemur, also called the russet mouse lemur and the brown mouse lemur, is reddish brown on its back and light gray or whitish underneath. It has a whitish stripe between its large round eyes. Its moveable ears are rounded, thin, and hairless. Red mouse lemurs are among the smallest primates. An adult is 5 inches long (12.5 centimeters) with a 5.6-inch tail (14 centimeters). A full-grown red mouse lemur weighs 1.5 ounces (43 grams). Females are about the same size as males.

Geographic range: Red mouse lemurs are found in eastern Madagascar.



A red mouse lemur marks its territory. These markings give information about the mouse lemur's age, sex, and whether it is ready for mating. (Photograph by Harald Schütz. Reproduced by permission.)

Habitat: Red mouse lemurs live in coastal rainforests.

Diet: The red mouse lemur eats a lot of fruit, preferring fruit from plants in the mistletoe family. It also eats insects, spiders, flowers, and gum, or plant juices, and occasionally small frogs and lizards. These lemurs have been seen eating millipedes and scarab beetles as big as they are.

Behavior and reproduction: The red mouse lemur lives in trees and travels through all forests heights. It makes round, leafy nests in hollow trees or among branches. It sleeps during the day, and is nocturnal, active and feeding at night. Each red mouse lemur searches for food by itself. From July to September, fat is stored in its tail. A tail with stored fat may increase this mouse lemur's weight by 1.6 to 2.6 ounces (50 to 80 grams). Then, during the harsh dry season, June to September, it slows down considerably for short periods, becoming almost motionless, utilizing its stored fat as food.

From two to nine male and female red mouse lemurs usually share a sleeping nest. Males may also nest by themselves or in pairs. Home ranges vary with food availability. Males usually have a larger home range than females.

The red mouse lemur has several ways of moving. It runs along branches on all four limbs, like a squirrel. It also may leap as far as 9.8 feet (3 meters) from one tree branch to another, landing on all four limbs. Its long tail helps with balance.

The mating season of the red mouse lemur is from September to October. The female is pregnant about two months, and gives birth to one to three infants. A newborn weighs about 0.18 ounces (5 grams). The infants stay in their nest for three weeks, with the mother leaving only briefly to seek food and water. Weaning, or taking the young off breastmilk, occurs in February when there is the greatest amount of food available.

Red mouse lemurs and people: These lemurs are not considered important by local people.

Conservation status: The red mouse lemur is common in some areas, but could become threatened due to losing habitat through logging and grazing by cattle and goats. ■

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LEMURS

Lemuridae

Class: Mammalia

Order: Primates

Family: Lemuridae

Number of species: 9 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Lemur males and females are about the same size. Lemurs weigh 4.4 to 10 pounds (2 to 4.5 kilograms), depending on species, with the mongoose lemur being the smallest. Adult head and body length is 11 to 22 inches (28 to 56 centimeters). Thickly furred lemur tails are from 11 to 22.5 inches (28 to 65 centimeters) long.

For jumping ease, lemurs have strong hind or back limbs which are longer than their forelimbs, or front legs. For better branch hold, thumbs and big toes are set at an angle to the other digits, or fingers and small toes. The palms of the hands and soles of the feet are deeply ridged, or creased, adding to strong branch grip. A clawlike grooming nail is present on the second toe of each hind foot. It is used to clean their fur.

Lemurs have foxlike heads with long muzzles, or nose areas. Large, round, owl-like eyes can be bright red, orange, yellow, or blue. Ears are medium size. Special comb-shaped front teeth are used for grooming in addition to the grooming nail. Lemurs lick their noses to keep them clean and damp. This helps with odor sensing.

Lemurs can be brown, gray, black, and reddish, often with mixed colors. For example, the ruffed lemur is black and white, and the red ruffed lemur is flame-red with a black face and a white neck patch. Lemur fur is thick and soft. Males and females may look alike, or quite different, depending on the species.

GEOGRAPHIC RANGE

Lemurs are found in Madagascar and the Comoros Islands.

HABITAT

Lemurs live in tropical forests, or warm damp forested areas, plus subtropical areas located near tropical areas. These include dry scrub, dry tropical deciduous forests where leaves fall off during winter months, and occasionally grassy areas.

DIET

Lemurs eat plant foods, including flowers, plant juices, fruits, leaves, seeds, and seedpods. Occasionally some feed on insects, small vertebrates such as lizards, and bird's eggs. Bamboo lemurs prefer young bamboo shoots and leaves.



STINK FIGHTS

When ringtailed lemur mating occurs in April, males begin fighting over females. These fights involve lots of loud noises, and "stink fights." The wrists of male ringtailed lemur have scent or stink glands. Males pull their long tail between their wrists, picking up the smell. Males then stand face-to-face, shaking their stinky tail in the direction of their enemy. As yet, no one is sure how a winner is declared.

BEHAVIOR AND REPRODUCTION

All lemurs are arboreal, living in trees. Some species also spend time on the ground. When in trees, lemurs walk and run on all fours. They also leap between trees. Their tail helps in balancing and steering during these leaps.

Lemurs are social, living in groups of two to twenty members, depending on species. Large groups break up into smaller groups to look for food, then rejoin at night. Within each group, lemurs groom each other. This is a very important lemur activity, reinforcing group bonding.

Most lemurs search for food during the day, although some species, like the mongoose lemur, may feed in the day or evening. They are territorial, each group claiming a certain feeding area. When groups meet at territory boundaries, or edges, they get quite upset. Alarm calls and branch shaking are used to get another group to move away. Besides different alarm calls, there are sounds for greeting, meeting other lemurs, and threat calls.

Females often supervise lemur groups. A dominant, or stronger, female in each group leads males and other females in searching for food and shelter. Females have first food choices, with males waiting their turn. Females also choose

their mating partners. Females are ready to have young at two to three years old.

After mating, females are pregnant about four months. They usually give birth when the monsoon, or rainy season, starts. There are usually one or two infants each birth, although the ruffed lemur may have up to six infants.

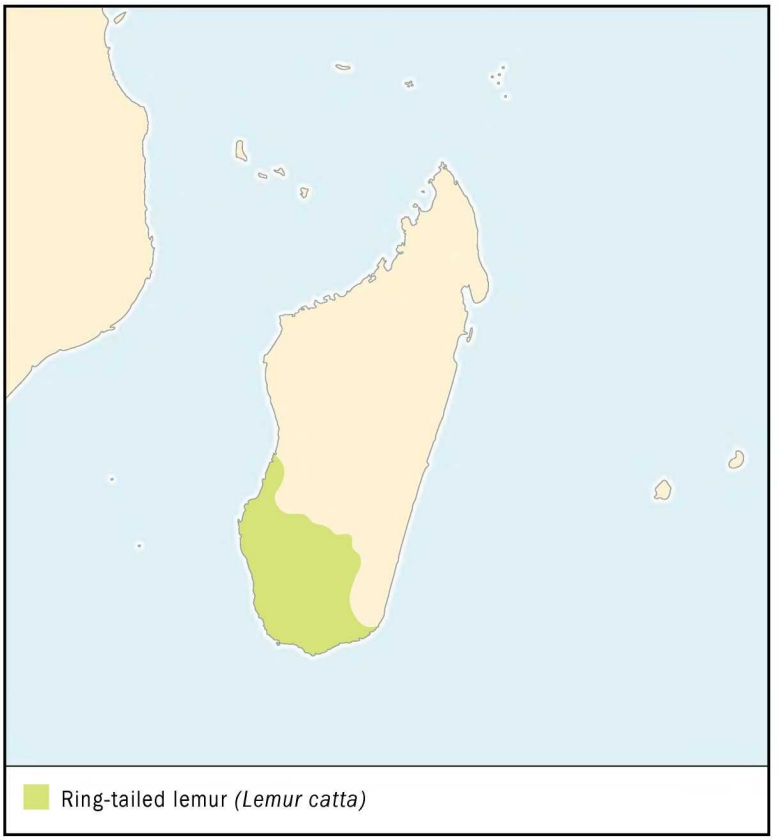
At first, a newborn lemur rides under its mother's body, clinging onto her fur. At a month old, it begins riding on its mother's back. Shortly after, the young lemur starts wandering on its own. It is weaned, or taken off breastmilk, by five months.

LEMURS AND PEOPLE

People hunt and trap lemurs for food. Some lemurs are kept as pets. Others are shipped overseas for the illegal pet trade. Sometimes lemurs are killed if they're blamed for feeding on food crops. However, ecotourism (travelers coming from abroad to see local wildlife) is helping lemurs to survive. Ecotourism brings in a lot of money, so it is hoped that local people will benefit and aid world efforts to keep lemurs from becoming extinct, dying out.

CONSERVATION STATUS

Madagascar is the only place where lemurs are found. Animal grazing, farming, tree cutting for fuel and brush fires decrease habitat, or living areas. Since only 10 to 15 percent of Madagascar's forests remain, all lemur species are threatened or could become threatened. Two species are Critically Endangered, facing an extremely high risk of extinction in the wild; one species is Endangered, facing a very high risk of extinction; and five species are Vulnerable, facing high risk of extinction.



SPECIES ACCOUNTS

RINGTAILED LEMUR
Lemur catta

Physical characteristics: Ringtailed lemurs are about the size of a cat. Males and females look alike. Adult weight is 6.5 to 7.75 pounds (3 to 3.5 kilograms). Head and body length is 15 to 18 inches long (39 to 46 centimeters). These lemurs are gray with white undersides. Black eye-rings in a white fox-like face surround bright orange eyes. They have a very long, black-and-white ringed tail, which is held straight up in the air as they walk.

Ringtailed lemurs have scent glands on their inner wrists and armpits. These glands give off a stinky substance, or liquid. Ringtailed lemurs use this to mark their feeding areas.



The female ringtailed lemur gives birth to one or two young. The mother carries them around for a few months. (John Giustina/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Ringtailed lemurs are found in Madagascar.

Habitat: Ringtailed lemurs live in dry brush forests and dense forests near riversides. There is a separate ringtailed lemur population living on rocky areas and cliffs within in a national Madagascar park.

Diet: Ringtailed lemurs eat flowers, leaves, some tree sap, and fruit. Tamarind tree seedpods are a favorite food.

Behavior and reproduction: Ringtailed lemurs live in groups of fifteen to twenty-five members. There are males and females in each group. The strongest female leads each group. Female ringtailed lemurs have first food choice, and may slap males on the nose and take food from them.

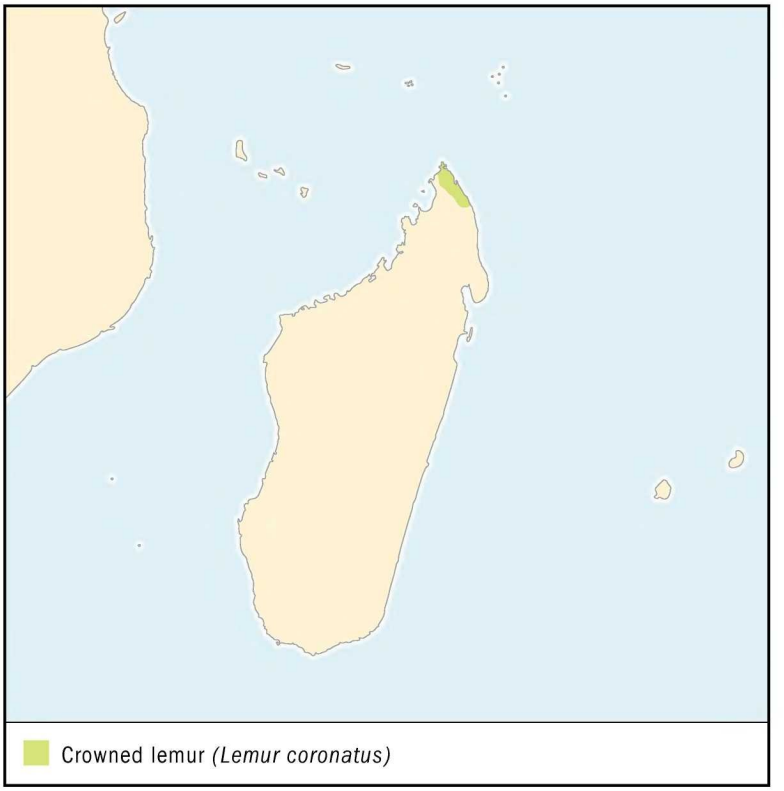
Ringtailed lemurs are diurnal, searching for food during the day. They spend half their food-seeking time on the ground, walking on all four limbs. Powerful hind legs permit easy leaps into nearby trees.

When ringtailed lemurs meet, they tap noses. At night, groups go to sleep under big trees. Before falling asleep, there is often a shrill group whoop-like call. Group members huddle together for warmth, sometimes making a purring sound. In the morning, before food searching, ringtailed lemurs sit upright on the ground. The sunlight warms them up. Ringtailed lemurs also like to sunbathe during the day.

Mating occurs in April. The female gives birth to one or two young. At first they are carried everywhere by the mother. By three months old, while still carried about, they are playing with other young ringtailed lemurs. Youngsters are weaned, or stop nursing, by six months old. Females in ringtailed lemur groups often have "aunt behavior." They help take care of infants and watch over the young when they play.

Ringtailed lemurs and people: Ringtailed lemurs are hunted for food and sold in the illegal pet trade. However, they are increasingly important in ecotourism.

Conservation status: The ringtailed lemur is considered Vulnerable due to hunting, fires, and tree removal for farm land, all of which destroy lemur habitat. ■



CROWNED LEMUR
Lemur coronatus

Physical characteristics: The crowned lemur has a contrasting color, or "crown," on the top of its head. Males have brownish fur with orange fur encircling a whitish face. Their crown is a black fur patch between the ears. Females have short, gray-brown body hair with a red-orange patch on their crown. Both males and females have round orange eyes.

Adult crowned lemurs weigh 4.5 pounds (2 kilograms). Head plus body length is 13.4 inches (34 centimeters) long, with a 17.7-inch (45-centimeter) tail. They have scent glands on various parts of their body.

Geographic range: Crowned lemurs are found in Madagascar.



Crowned lemur males (on the left) and females (on the right) live together in social sleeping groups. (Photograph by Harald Schütz. Reproduced by permission.)

Habitat: Crowned lemurs live in dry to moist forests.

Diet: Crowned lemurs prefer fruit, but also eat flowers, flower pollen, and leaves.

Behavior and reproduction: Crowned lemurs live in groups of about six members. Within a group, communication is by various vocalizations, or sounds, as well as bonding through mutual grooming, or fur cleaning. Crowned lemurs are mainly diurnal, feeding in the daytime, with an afternoon rest. However they may feed for a few hours at night. They search for food at all tree levels, as well as on the ground.

Crowned lemur males and females live together in social sleeping groups. Females are in charge, with the strongest one leading the entire group. Mating takes place at twenty months old. One to two offspring are born each time.

Crowned lemurs and people: Poachers, or illegal hunters, kill crowned lemurs for food, and local people may kill them if lemurs take food from their farms.

Conservation status: Crowned lemurs are considered Vulnerable due to poaching, brush fires, farming, and logging. ■

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AVAHIS, SIFAKAS, AND INDRIS
Indriidae

Class: Mammalia
Order: Primates
Family: Indriidae
Number of species: 8 to 10 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

This family (also spelled Indridae) includes the indris (IN-dreez), sifakas (suh-FAH-kuhz), and the avahis (ah-VAH-heez) or woolly lemurs. Head and body length is 10.4 to 20.5 inches (26.4 to 52 centimeters). Weight ranges from 2.2 to 16.1 pounds (1 to 7.3 kilograms). The sifakas and avahis have rather long tails, while the indris have just a stump.

Indriids (members of the Indriidae family) fur color varies. Avahis can be whitish, brownish, or reddish. Indris are black and white. Sifakas are mostly black or dark brown. Fur can be woolly or silky. Contrasting fur colors occur on their backs, eyebrows, top of head, and head ruffs (a fringe of long hairs around the neck). Eye colors include golden brown, orange, and yellow. Indriid eyes are reflective, like mirrors, increasing their ability to see in dim light.

Indriids' hind limbs are longer than forelimbs. There are five fingers on each of two forefeet and five toes on each of two hind feet. All toes have nails except the second digit, or toe. This digit has a grooming (or cleaning) claw. Indriids also have a dental toothcomb, or special front teeth, used for fur cleaning.

GEOGRAPHIC RANGE

Indriids are found in Madagascar.

HABITAT

Indriids live in a wide range of environments, including original forests, disturbed forest fragments, and desert areas with spiny plants.

DIET

Indriids feed on fruit, leaves, bark, and flowers.

BEHAVIOR AND REPRODUCTION

Groups of avahis and indris have two to six members, usually an adult male and female and their young offspring. Sifakas have groups of up to ten members. Females are dominant, or in charge, in both the sifakas and indris. Little is known about avahis.

Indris and sifakas mate at three to five years old. Little is known about avahis, or woolly lemurs, although they usually have one offspring each time.

Sifakis and indris are diurnal, or active during the day. Avahis are nocturnal, or active at night.

All indriids are vertical clingers, able to climb up and down trees. They can leap long distances between trees. Indris usually stay in trees, while sifakas occasionally travel on the ground.

Scent marking and facial expressions are important means of communication for all the indriids. Vocalizations, or sounds, are also important. Among other sounds, avahis make shrill whistles, sifakas bark, honk, and making sneezing noises, and indris can sound somewhat like a loud clarinet.

ONCE UPON A TIME: SLOTH LEMURS AND BABOON LEMURS

The family Indriidae has lost over half of its species in the last 1,000 years. Lost species include the sloth lemurs and the baboon lemurs. Sloth and baboon lemurs were large. Sloth lemurs might have weighed up to 441 pounds (200 kilograms). They climbed slowly and hung from tree branches. Baboon lemurs weighed up to 49 pounds (22 kilograms). They probably traveled on the ground and within trees. Sloth and baboon lemurs became extinct, not one exists anymore, anyplace, primarily due to forest destruction and human hunting.

INDRIIDS AND PEOPLE

Sifakas and indris are protected in some areas by taboos, or forbidden deeds. Due to their human-like hands and faces, they may be thought of as ancestor spirits, and so should not be harmed.

CONSERVATION STATUS

Six indriids are considered threatened due to loss of habitat occurring from deforestation (tree removal), fire, poaching, and encroaching human populations. The golden-crowned sifaka is considered Critically Endangered, or at an extremely high risk of extinction, dying out.



MILNE-EDWARDS'S SIFAKA
Propithecus edwardsi

Physical characteristics: The Milne-Edwards's sifaka is black or dark brown with a large whitish patch on its lower back. Its fur is long and soft, and its face is hairless and black. Front legs are short, and hind limbs large and strong. Eye color may be orange. Males and females look alike. Adult weight is 12.3 pounds (5.6 kilograms). Head and body length is 18.9 inches (48 centimeters), with a long tail used for balancing. Sifaka males and females have scent glands for marking territory.

Geographic range: These sifakas live on the southeastern coast of Madagascar.

Habitat: Milne-Edwards's sifaka is found in moist, humid mountain rainforests.

Diet: Milne-Edwards's sifaka eats fruits, fruit seeds, leaves, and flowers.

Behavior and reproduction: The Milne-Edwards's sifaka is diurnal, or active during daylight hours. It travels by leaping and clinging onto trees. It usually feeds within large trees, but may food search on the ground. On the ground, sifakas hop on their hind legs in an upright position, holding arms above their heads for balance. At night they sleep with a social group high in the trees. Sleeping locations can change each night to avoid predators.

Social groups have up to ten members. These groups may be all male, all female, or mixed. Females are dominant, leading their group and demanding first choice of food. However, males defend the group against large raptors, such as hawks and eagles.

Sifakas are mature at four to five years old. Females may mate with several males. One infant is born every two years. Newborns weigh 4.4 ounces (125 grams). They cling to the mother's underside for their first month, then ride on her back for the next four months. Infant mortality, or death rate, is high.

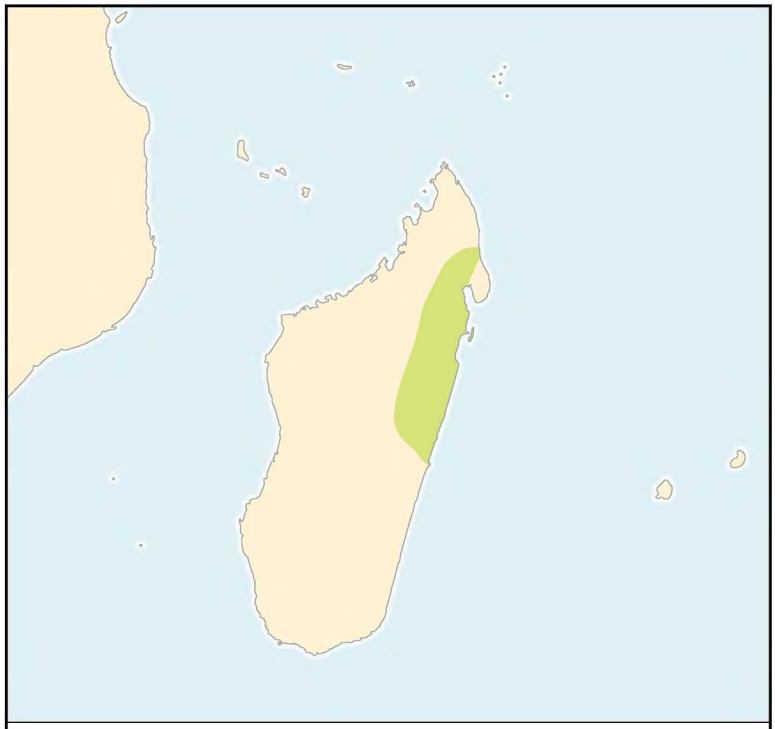
Milne-Edwards's sifakas have several vocalizations, or sounds. The loud alarm barking sound warning about bird predators may last up to fifteen minutes. A short, quick "zusss" call warns of ground predators, or enemies. Quiet "moos" tell of a group's current location. Lost sifakas give a long, warbling whistle to announce where they are.



Milne-Edwards's sifakas sleep high in the trees at night. When they're on the ground, they hop in an upright position, holding their arms over their heads for balance. (Illustration by Gillian Harris. Reproduced by permission.)

Milne-Edwards's sifakas and people: In some areas, it is forbidden by local custom to hunt sifakas because they resemble humans.

Conservation status: Though not listed as Threatened, Milne-Edwards's sifakas may become threatened due to hunting, logging, firewood use, land clearing to provide pasture for livestock, and slash-and-burn agriculture. It has so far been impossible to keep and breed this sifaka in captivity. ■



Indri *(Indri indri)*

INDRI
Indri indri

Physical characteristics: The indris are the largest living prosimians (or "before apes"). They weigh 13.2 to 16.5 pounds (6 to 7.5 kilograms). Head and body length is about 23.6 inches (60 centimeters). The tail is stubby.

An indri is mostly black with white areas. A black hairless face has large tufted ears and a pointed nose area. Large eyes are yellow. Body hair is long and silky. Feet have strong big toes, and long hands have strong thumbs, creating a very powerful tree branch grasp. A special throat sac enables indris to make loud sounds.

Geographic range: Indris are found in northeastern Madagascar.



Baby indris cling to their mother's underside for four months, and then begin riding on her back. (Photograph by Harald Schütz. Reproduced by permission.)

Habitat: Indris live in humid moist forests from sea level to 6,000 feet (1,830 meters).

Diet: Indris eat leaves, flowers, and fruits. When these foods are hard to find, the indri uses its tooth comb to scrape tree bark and dead wood as food.

Behavior and reproduction: Indris are diurnal, moving about only in the daytime. They live in social groups of two to six members, usually a male and female pair and their young. Female indris are dominant, or in charge. However, males are responsible for defending group feeding territory, which they mark with scent glands.

Indris are arboreal, living in trees. They leap between tree trunks. Leaps can be as long as 33 feet (10 meters). Indris seldom move on the ground; when they do, they walk upright, moving forward by hopping and holding their somewhat short arms above their body. At night, before going to sleep, indris have a group grooming session.

Indris begin mating at seven to nine years old. There are two to three years between births. Only one offspring is born each time. Tiny babies cling to the mother's underside until four months of age, then begin riding on her back. Leaping practice begins at this time. By eight months of age, young move about by themselves, although they stay with the parents for about two years.

Indris sound like a clarinet, a musical instrument, early in the morning. These calls can be heard up to 2 miles (3 kilometers) away. The indris are very territorial, making shrill cries warning other groups to stay away. There are also loud howling or singing sessions by group members. These howling songs can last up to four minutes. Other sounds made by indris include hooting and barking to warn of nearby predators, and grunts and wheezes when frightened.

Indris and people: In many areas there are local taboos against people harming indris, however hunting does occur.

Conservation status: Indris are considered Endangered, facing a very high risk of extinction, due to logging, hunting, and slash-and-burn agriculture (cutting down trees and burning remnants to clear land for farming). ■

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SPORTIVE LEMURS
Lepilemuridae

Class: Mammalia
Order: Primates
Family: Lepilemuridae
Number of species: 7 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Sportive lemurs, also called weasel lemurs, have a head and body length of 9.8 to 13.8 inches (25.0 to 35.0 centimeters). Tail length is 9.8 to 12 inches (25 to 30.5 centimeters). The tail may be shorter or longer than the body, depending on species. Body weight is 1.1 to 2.2 pounds (0.5 to 1 kilograms).

Sportive lemurs have short, pointed heads with large round ears. They have binocular vision, they're are able to see with both eyes at the same time. In the mouth, lower front teeth are joined and tilted forward. This dental-comb is a grooming, or fur-cleaning aid. Sportive fur is woolly and dense. All sportive lemurs have very long, strong hind limbs. They are much longer than the forelimbs, or front legs.

GEOGRAPHIC RANGE

Sportive lemurs live only on the island of Madagascar, which is off the east coast of Africa.

BIOMES

Evergreen forests, where the trees stay green all year, and hot, dry forests.

HABITAT

Most sportive lemurs live in forested areas, ranging from evergreen rainforests to hot dry forests.

DIET

Sportive lemurs feed mostly on leaves. Sportive lemurs may also eat flowers, bark, and fruit. They are different from other lemurs in being able to feed on difficult-to-digest food, such as cactus-like leaves. When these partially digested leaves are eliminated as waste, in order not to waste any nutrition remaining, the sportive lemurs will eat this waste. Basically, they digest everything twice. This process is called cecotrophy (SEE-cuh-troh-fee), and is present in other animals, but not in other lemurs.



ONCE THERE WERE MORE

The koala lemur doesn't exist anymore—it is extinct. It weighed 88 to 176 pounds (40 to 80 kilograms) and had a quite large head and a short body, with front legs longer than the hind legs. All legs were somewhat curved, and hands and feet were quite long. The koala lemur would hold onto tree trunks, moving upward with short hops. When humans came to Madagascar, koala lemurs and their living areas were destroyed. They disappeared entirely by the 1500s.

BEHAVIOR AND REPRODUCTION

Sportive lemurs are nocturnal, moving about at night. They often gather in groups between the hours of twilight and darkness before moving on to their separate feeding territories, or areas. During the day, they sleep curled up in a ball within a hollow tree, in thick leafy areas, or among vines. They may use the same nesting area for several years. In the afternoon, they tend to stick their heads out of their hiding place, either watching their surroundings or napping.

Sportive lemurs have powerful, long, hind legs. They move by leaping from tree trunk to tree trunk, then clinging onto the tree trunk. Sportive lemurs may leap as far as 13 feet (4 meters) at a time. Large pads on their hands and feet help with holding on to tree trunks. They are also able to run on all four limbs, or hop on their two hind limbs. They can do this on tree branches or on the ground.

Male sportive lemurs often live alone. A mother and her children stay together. A male's territory includes that of several females. Males, and sometimes females, defend their territories from other sportive lemurs of the same sex by vocalizations, or sounds, body actions, chasing, or, if that doesn't succeed, fighting.

Mating occurs at about eighteen months. Males will visit several females for mating purposes. Females are pregnant for four and a half months. One infant is born each year. Mothers may

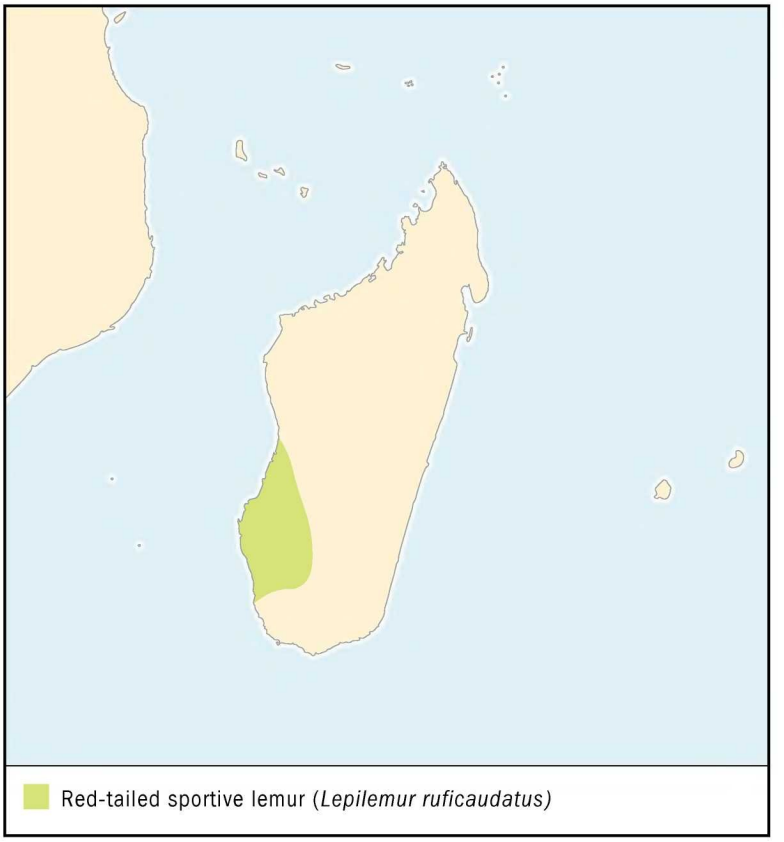
carry their young in their mouth as they leap from tree to tree, or leave them clinging onto branches while the mother hunts for food. At about one month the young start seeking food on their own. The young remain with the mother for about a year, until the next baby is born.

SPORTIVE LEMURS AND PEOPLE

Sportive lemurs are hunted for food.

CONSERVATION STATUS

All seven species of sportive lemur are listed by the World Conservation Union (IUCN) due to loss of forest habitat, or living spaces. This is due to slash-and-burn agriculture, where forests are burned to clear land for people's homes and farms. Cattle and goat overgrazing also destroys habitat. Two species are Vulnerable, facing a high risk of extinction, and five are Near Threatened, not currently threatened, but could become so.



RED-TAILED SPORTIVE LEMUR
Lepilemur ruficaudatus

Physical characteristics: Red-tailed sportive lemurs, also called lesser weasel lemurs, measure about 11 inches (28.0 centimeters) long, including head and body. Their tail is 9.8 to 10.2 inches (25 to 26 centimeters), slightly shorter than body length. Weight is about 1.3 to 2.0 pounds (0.6 to 0.9 kilograms). Eyes are yellow. Upper fur is light gray-brown, with front fur reddish brown. Undersides are whitish.

Geographic range: Red-tailed sportive lemurs are found in southwestern Madagascar.

Habitat: Red-tailed sportive lemurs live in dry forests.



Red-tailed sportive lemurs may make their nests in holes in trees. (Photograph by Harald Schütz. Reproduced by permission.)

Diet: Red-tailed sportive lemurs usually eat leaves, but they also eat fruit. Because tough leaves are difficult to fully digest, these lemurs re-digest some of their waste matter, so they can obtain all the nutrition from their food.

Behavior and reproduction: Mating occurs about eighteen months of age. Male red-tailed sportive lemurs mate with several females during the mating season. Females are pregnant about four and a half months, giving birth to one baby per year. The young stay with their mother and follow her about until they are about one year old.

Red-tailed sportive lemurs are arboreal, living in trees. A female and her young live in individual tree hollows and tree nests. Males live alone, having home ranges, or activity areas, that overlap that of several females. During the first few weeks of a red-tailed sportive lemur's life, the mother carries it about in her mouth. Later, an infant clings to her fur. However, when she goes food searching, she often leaves her young clinging to a branch or in a tree hollow.

Red-tailed sportive lemurs are nocturnal, active at night. They are very territorial, protecting their feeding areas. Males make loud crow-like calls to tell other males that an area is already taken. Males, and sometimes females, defend their feeding territory with noise, threatening body movements, chases, and even fighting.

Red-tailed sportive lemurs and people: Red-tailed sportive lemurs are hunted for food.

Conservation status: Red-tailed sportive lemurs are Near Threatened due to habitat destruction by fire and overgrazing of cattle and goats as well as hunting. ■



White-footed sportive lemur *(Lepilemur leucopus)*

WHITE-FOOTED SPORTIVE LEMUR
Lepilemur leucopus

Physical characteristics: The white-footed sportive lemur, also called the white-footed weasel lemur, weighs 1.2 to 1.3 pounds (0.5 to 0.6 kilograms). Body and head length measures about 9.8 inches (25.0 centimeters). Their tail is the same length. This lemur has large ears and whitish circles around large orange eyes. Its upper-body fur is gray-beige with brown shoulders. It has white on its forelegs and hindlegs.

Geographic range: The white-footed sportive lemur lives in southern Madagascar.

Habitat: The white-footed sportive lemur lives in trees, bushes, and grass in deserts with spiny plants and forests near streams and rivers.

Diet: The white-footed sportive lemur prefers to feed on thick, juicy leaves. However these may be rare in the dry areas it lives, so it eats tough, fibrous leaves. Because these leaves are hard to digest completely, it will eat some of its waste matter to extract, or get out, any remaining food value.



White-footed sportive lemurs are arboreal, meaning they spend most of their time in the trees. They move from tree to tree by leaping. (© Nigel J. Dennis/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: The white-footed sportive lemur is arboreal, living in trees. It has very strong, long hind limbs and travels by leaping between trees, then clinging onto tree trunks while climbing.

The basic family group of a white-footed sportive lemur is a mother and her young children. They sleep in tree holes, on branches, or in nests within thick vines. Each female group has its own small feeding territory. Males live alone in tree holes or vine bunches. Each male's feeding territory, or area, overlaps that of several females. During the mating season, a male will mate with more than one female.

White-footed sportive lemurs mate between May and July. Females are pregnant for about four and a half months. Females have one baby at a time. It is very tiny, weighing about 1.8 ounces (50 grams). Babies feed on mother's milk for about four months. When the females go out to search for food, babies are left clinging to a tree branch. Mothers make special noises, which sound like a kiss, to keep in contact with them. The young are mature, or adult, at eighteen months.

White-footed sportive lemurs are nocturnal, or active at night. They are highly territorial, protective of their feeding areas. Males, and sometimes females, threaten intruders with noises and physical displays. Intruders may be chased or even injured.

White-footed sportive lemurs and people: People hunt white-footed sportive lemurs for food.

Conservation status: White-footed sportive lemurs are Near Threatened due to forest fires, overgrazing by livestock, hunting, and poor land use. They are found in two Nature Reserves, a Special Reserve, and the Berenty private reserve. ■

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AYE-AYE
Daubentoniidae

Class: Mammalia
Order: Primates
Family: Daubentoniidae
One species: Aye-aye (*Daubentonia madagascariensis*)

family CHAPTER

PHYSICAL CHARACTERISTICS

An aye-aye (EYE-eye) has long, woolly, black or dark brown hair tipped with white. Its head is rounded with a short face. Large, hairless black ears are 4 inches (10 centimeters) long and 2.8 inches (7 centimeters) wide. Large eyes are golden brown. The aye-aye has white around its nose and above its eyes. Front teeth, or incisors, are quite large. The incisors grow continuously, and keep growing back as they are worn down by the aye-aye gnawing on trees.

The aye-aye is about 16 inches (40 centimeters) long, including head and body. It has a bushy tail, which, at 22 inches (55 centimeters), is longer than its body. An aye-eye weighs about 6 pounds (2.7 kilograms). Males and females are about the same size.

An aye-aye's arms and legs are about the same size, enabling it to move easily on all fours. Especially unique, or different, are the aye-aye's forefeet or hands. Its hands have five long thin fingers, with an extremely long thin bony middle finger. There is a pointed, clawlike nail on every finger and toe, except for the big toes, which have flat nails. The aye-aye uses its hands for feeding or cleaning itself.

Another unusual feature is the aye-aye's two nipples, for nursing or breastfeeding, which are placed on the lower abdomen rather than on the chest. Aye-ayes are the only primates with this body arrangement.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

NOSY MANGABE SPECIAL RESERVE

Aye-ayes were once thought to be extinct in Madagascar. But in 1957, a small group was discovered living on Madagascar's east coast. There were many attempts to protect its habitat there, but the aye-aye population kept growing smaller. Finally, to prevent the aye-ayes total disappearance from the world, two French scientists spent weeks collecting nine protesting aye-ayes. They were released on a nearby uninhabited island called Nosy Mangabe. This island is just 2 square miles (5.2 square kilometers) in size. However it is covered in dense rainforest with many very tall trees. Scientists hoped the aye-ayes would survive there. For many years, scientists weren't sure. Aye-ayes move about only at night, and vegetation is thick, so they are hard to find. However, eventually some nests and aye-ayes were seen. It is hoped that aye-ayes will multiply on this protected island.

GEOGRAPHIC RANGE

Aye-ayes are found in Madagascar.

HABITAT

Aye-ayes live in several habitats, including rainforests where the weather is damp or wet throughout the year, dry forests that get little rain, mangroves or riverbank tree areas, and bamboo thickets or groups.

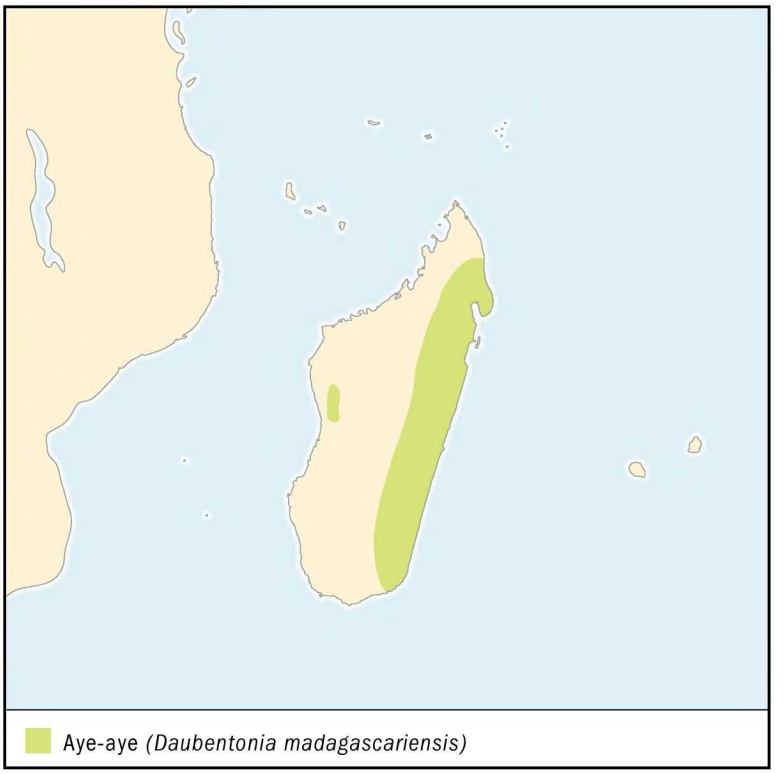
DIET

An aye-aye's diet consists of fruits, fungi, seeds including coconuts, nectar (sweet liquid) from palm tree flowers, and wood-boring beetle larvae (LAR-vee) or young. To get at the soft larvae feeding within trees, the aye-aye walks along tree branches, its nose pressed against the bark. The aye-aye has excellent hearing. It may tap on a branch, listening for hollow spaces created by larval feeding. When a larva is located, the aye-aye gnaws quickly through the wood with its long incisors, or front teeth. Larvae are squashed with the aye-aye's unique long, thin middle finger. Squashed remains are scooped out, bit-by-bit, and licked off the tip of this middle finger. Larvae add protein and fat to the aye-aye's diet.

The aye-aye also uses its strong incisors to tear through the outer surface of hard-shelled nuts. Unripe coconuts are a favorite. The aye-aye chews on them until it makes a hole. Then, it uses its long middle finger to scrape out the thick coconut milk and the softer interior, eating both.

BEHAVIOR AND REPRODUCTION

Aye-ayes are nocturnal, or active at night. Each spends most of the day in an individual nest hidden among thick vines that are within a high fork of a tall tree. Each round nest, about 20 inches (50 centimeters) wide, is constructed of leaves and twigs woven together. Each nest takes about twenty-four hours to build. It has a closed top, a side entrance, and a bottom layer



of shredded leaves. An aye-aye may build up to twenty nests in its home range. Aye-ayes often change their daytime sleeping nest. Many different aye-ayes may individually occupy a nest over a period of time.

Each aye-aye usually lives alone, however young may stay with the mother for quite a while. Little is known about their social behavior. Female home ranges, or feeding areas, are not usually shared. Male home ranges are larger, and may overlap female home ranges. Range boundaries are marked with urine and with a special scent gland. Some scientists believe that aye-ayes may search for food in male-female or male-male pairs.

When moving upward, the aye-aye climbs with a series of rapid leaps, one after another. It also walks on four limbs on the ground, but more slowly.

A female aye-aye is ready to mate at three to four years old. Mating can occur during several months of the year. Several males fight over who will be the one to mate with a female. However, after this mating, the female may mate again with a different male. Pregnancy is about five months. Females only



The aye-aye taps on tree bark to find grubs and insects burrowing within the bark of a tree. (Photograph by Harald Schütz. Reproduced by permission.)

give birth every two to three years. Births can occur at any time of the year. There is only one infant each time. Babies are weaned, or stop nursing, at about seven months old.

When moving about in the trees, aye-ayes are usually quiet. But they can make many different vocalizations, or sounds. These include an "eep" call when meeting another aye-aye, a "hai-hai" alarm call when fighting over food, and a begging "bird call" given by young aye-ayes that want to feed with older animals.

AYE-AYES AND PEOPLE

In many unprotected areas, aye-ayes are destroyed by the local people, either due to superstition, or because of aye-aye crop raiding on coconut plantations—large coconut growing areas. This problem began when their normal feeding areas were destroyed.

CONSERVATION STATUS

Aye-ayes are considered Endangered, facing a very high risk of extinction, or dying out, due to superstition-related killing, loss of habitat due to logging, and use of former tree land for

crop growing. At one time they were considered to be extinct, however some were later found and moved to safer sites. Currently there are aye-ayes in about sixteen reserves, or semi-protected areas, and some other places.

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TARSIERS
Tarsiidae

Class: Mammalia
Order: Primates
Family: Tarsiidae
Number of species: 6 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Tarsiers (TAR-see-urz) weigh 2.8 to 5.8 ounces (80 to 165 grams). Body length is 3 to 6 inches (8 to 15 centimeters), and tail length is 5 to 11 inches (13 to 28 centimeters). They range in color from sandy to grayish brown to reddish brown. The undersides may be yellowish beige, grayish, or bluish gray. Relative to their body size, tarsiers have the largest eyes of all mammals. Their goggle-like eyes cannot move within the sockets, but a flexible neck can rotate the head 180 degrees for a backward look.

The tarsier is named for its powerful, extended tarsals (TAR-sullz), or ankle bones. The tarsals, together with the merging at the ankles of the two lower-leg bones, the tibia and fibula, allow for remarkable leaps. Fingers and toes are enlarged at the tip, with adhesive pads for gripping vertical branches. The tail is nearly naked, except for a tuft of hair on the tip.

GEOGRAPHIC RANGE

Tarsiers are found in the Philippines, Indonesia, and Borneo.

HABITAT

Tarsiers live in a variety of habitats. They occupy mainly secondary forests with enough canopies that provide vertical branches for clinging, usually about 3 to 6 feet (0.9 to 1.8 meters) above the ground. Tarsiers also inhabit shrublands, bamboo thickets, mangroves, grasslands, and plantations. They also live in primary forests with their characteristic dense canopies and thinner lower vegetation.

DIET

Tarsiers are carnivores, feeding mainly on live animals, including cockroaches, beetles, moths, lizards, snakes, and roosting birds. They consume almost every part of their prey, including the feathers, beaks, and feet of birds.



FLYING ACROBAT

When preparing to leap from one tree branch to another, the tarsier rotates its head 180° toward the intended landing spot. Then pushing off from its perch using its powerful hind legs, it leaps backward. The body takes off like an acrobat's, twists around in mid-air, and aligns with the forward direction of the head. The tarsier then lands vertically, grasping the branch with its fingers and toes.

BEHAVIOR AND REPRODUCTION

Tarsiers are arboreal, spending most of their time in trees. They forage alone at night, although some species may be active at dawn or dusk. When catching large insects, the tarsier closes its eyes, opening them only after putting the prey into its mouth. An insect's sharp body parts could do damage to the tarsier's big, exposed eyes. Tarsiers leap and cling to vertical branches. They communicate through high-pitched calls. When they get together to sleep during the day, tarsier pairs may perform duets, or a group may vocalize together as if in greeting.

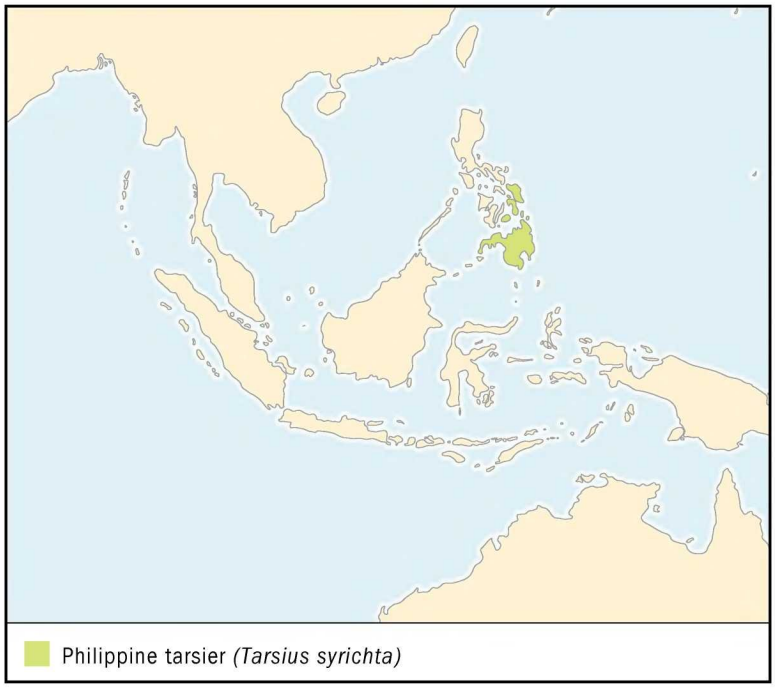
Tarsiers have just one partner, mating year round or seasonally, depending on the species. After a pregnancy of about six months, the mother gives birth to a single, well-developed infant, about one quarter of her weight.

TARSIERS AND PEOPLE

Some people take tarsiers for pets. Some farmers mistakenly believe tarsiers eat crops and may kill the tarsiers. Actually, tarsiers help control some harmful insects, including grasshoppers, caterpillars, and moths.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists the Dian's tarsier as Lower Risk/Conservation Dependent, meaning its survival depends on conservation efforts. The Eastern tarsier is listed as Near Threatened, not currently threatened, but could become so, because of habitat loss and degradation due to human activities. The Philippine tarsier and three other species found in Indonesia are listed as Data Deficient, meaning the species may be well-studied but information about distribution is lacking.



SPECIES ACCOUNTS

PHILIPPINE TARSIER
Tarsius syrichta

Physical characteristics: The Philippine tarsier has soft gray fur, a body length of about 5 inches (13 centimeters), and a tail length that is twice as long (9 inches, or 23 centimeters). It weighs about 4 to 5 ounces (113 to 142 grams). The head is round and the snout is short. The enormous eyes that seem too big for the sockets are immobile. For side and back vision, the tarsier swivels its head, sometimes almost a full circle. The large, thinly textured ears move like giant antennas to track sounds made by crawling insects and other prey. Long fingers and toes have suction pads at the tips for gripping tree branches. All nails are flattened, except for the second and third toes, which are grooming claws used for removing dead skin and parasites from the fur. The nearly naked tail has a sandy coloration, with a tuft of hair at the tip. The inside part of the tail has ridges that help prop the tarsier against a tree trunk or branch, especially while it sleeps.

Geographic range: The Philippine tarsiers are found in the Philippine Islands.

Habitat: Philippine tarsiers inhabit small trees found under the canopy of less mature forests. They also occupy coastal rainforests. They live in tree hollows close to the ground and are also found in thick bushes and bamboo roots.

Diet: Philippine tarsiers prey on live crickets, beetles, termites, lizards, spiders, scorpions, frogs, and birds.

Behavior and reproduction: Philippine tarsiers mostly live in trees and shrubs, moving from branch to branch by leaping and clinging to vertical branches with their padded fingers and toes. The average jump covers about 5 feet (1.4 meters), with the greatest leaps recorded at 20 feet (6 meters). They also sleep while clinging to vertical branches, supported by their tail. Individuals sleep alone in dense vegetation close to the ground. On the forest floor, they hop, holding the long tail straight. They are nocturnal (active at night), preferring to forage alone. They are usually quiet, but call out to one another by squeaking in a high note, trilling, or chirping. Tarsiers scent mark tree branches, using urine and secretions from skin glands found within the lips, on the chest, and in genital areas.



The Philippine tarsier is usually quiet, but calls out to others by squeaking in a high note, trilling, or chirping. (© Tom McHugh/ Photo Researchers, Inc. Reproduced by permission.)

A male Philippine tarsier may form a family group with one or two females and their offspring. Due to a long pregnancy (about six months), the newborn is well developed, having a full coat and open eyes. The mother carries the infant in her mouth while she forages in trees, resting the infant on branches while she feeds. The newborn is able to cling to branches and can jump after a month.

Philippine tarsiers and people: Some Filipinos believe it is bad luck to touch a tarsier. Others take tarsiers for pets. However, tarsiers do not make good pets. They dislike being handled and will inflict serious bites. They do not thrive in zoos, dying soon after captivity.

Conservation status: IUCN lists the Philippine tarsier as Data Deficient, a category that does not refer to a threatened species. This means that the species may be well studied, but information about its population status is lacking. Nevertheless, tarsiers have experienced habitat loss because of the clearing of land for agriculture and timber. ■



WESTERN TARSIER
Tarsius bancanus

Physical characteristics: The western tarsier is yellowish beige or sand-colored. Enormous, goggled eyes take up most of its face. The eyes cannot move within the sockets, so a flexible neck turns the head around almost 180° for a backward look. Large ears are in constant motion as they follow the sounds of possible prey. The fingers and toes are very long and have suction pads at the tips for gripping tree branches. Fingernails and toenails are flattened, except for those on the second and third toes. These two toes have grooming claws, used for cleaning the fur of dead skin and parasites and for scratching. The long, rod-like tail is bare with a small clump of hair at the end. Ridges on the inside part of the tail support the tarsier when it clings to tree trunks or branches.

Geographic range: Western tarsiers are found in Indonesia.

Habitat: Western tarsiers favor secondary forests, with their dense ground vegetation and small trees. They also inhabit primary forests,

characterized by a full-ceiling canopy and trees of different heights. They are found in human settlements and plantations.

Diet: Western tarsiers eat primarily large insects, including beetles, cockroaches, praying mantis, cicadas, butterflies, and grasshoppers. They also feed on birds, bats, and snakes. They even eat poisonous snakes.

Behavior and reproduction: The western tarsier forages for food alone at night and at dawn and dusk, listening for sounds made by insects on the ground and catching them with its hands. It closes its eyes when attacking insects to protect its eyes. During the day, males and females sleep separately, either among vines and tangled vegetation or while clinging to vertical tree trunks or branches. Using urine

and scent gland secretions, tarsiers scent mark tree branches to advertise territory ownership. They are rather quiet, although females vocalize when ready to mate.

Western tarsiers may be monogamous (muh-NAH-guh-mus), having just one partner, or polygynous (puh-LIH-juh-nus), with males having several partners. Births occur throughout the year, although more births occur between February and June at the end of the rainy season. Females give birth to a single infant that weighs about one quarter of its mother's weight. The well-developed infant is born with a full coat and open eyes. It can climb right away after birth.

Western tarsiers and people: The Ibans, the indigenous people of Sarawak, Borneo, who were once head-hunters, considered the western tarsier as an omen animal. They had seen the tarsier rotate its head full circle and thought the tarsier had a loose head. A head-hunter who encountered a tarsier would turn around right away so as not to incur the spirits' spell on him and his people. Today, tarsiers are taken for pets but do not survive in captivity.

Conservation status: The IUCN lists the western tarsier as Data Deficient, a category that does not refer to a threatened species. This means that the species may be well-studied, but there is not enough information about its population status. ■

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family CHAPTER

SQUIRREL MONKEYS AND CAPUCHINS

Cebidae

Class: Mammalia
Order: Primates
Family: Cebidae
Number of species: 12 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Cebids (members of the family Cebidae, including squirrel monkeys and capuchins) have round heads, forward-facing eyes, rounded snouts, and small ears. Squirrel monkeys are the smallest cebids. They have a slim body with a dense, soft fur that is gray to black on the crown of the head. The body may be yellow, golden, or reddish. The shoulders are gray to olive, and the underparts are white to yellow. The forearms, hands, and feet are yellow to golden. The furry tail has a black tip.

Capuchins have a heavy body build. The face is covered with short fur, while the rest of the body has longer fur. Color ranges from black to brown to yellowish beige. The chest and shoulders have patches of white, and the underparts are light-colored. The tail is usually coiled at the tip, earning it the nickname ringtail monkey.

GEOGRAPHIC RANGE

Squirrel monkeys are found in most of South America and in Central America (just Costa Rica and Panama). Capuchins are found in most of South America and Central America and the Caribbean islands of Trinidad and Tobago.

HABITAT

Cebids are found in the spreading forest canopy and in smaller understory trees. Squirrel monkeys also inhabit swamps, while capuchins thrive in dry forests.

DIET

Squirrel monkeys eat predominantly fruits and insects, but also feed on flowers, shoots, buds, leaves, spiders, frogs, bats, and crabs. Capuchins consume mainly fruits, but also eat insects, snails, lizards, small birds, baby squirrels, crabs, and oysters.

BEHAVIOR AND REPRODUCTION

Cebids are arboreal (tree-dwelling) and diurnal (active during the day). They form large groups headed by a dominant male. Capuchin groups have a dominant female that submits only to the dominant male. The dominant male defends his group but does not try to control the members. Squirrel monkey groups, on the other hand, may or may not have dominant females, depending on the species. However, only the dominant male mates with the receptive females. Nevertheless, all cebids, males and females, have several partners. Females have a single infant, which keeps a close relationship to its mother. Fathers do not share in childrearing. Cebids use vocalizations to communicate. They urinate on their hands, then rub them on their fur and feet to scent mark territory. This behavior is called urine washing.

CEBIDS AND PEOPLE

Cebids are popular as pets and zoo exhibit animals. They are used in medical research. They have been used in the space program to test the effects of space travel. Capuchins are trained to help disabled persons, using their human-like hands to perform daily tasks, such as feeding people.

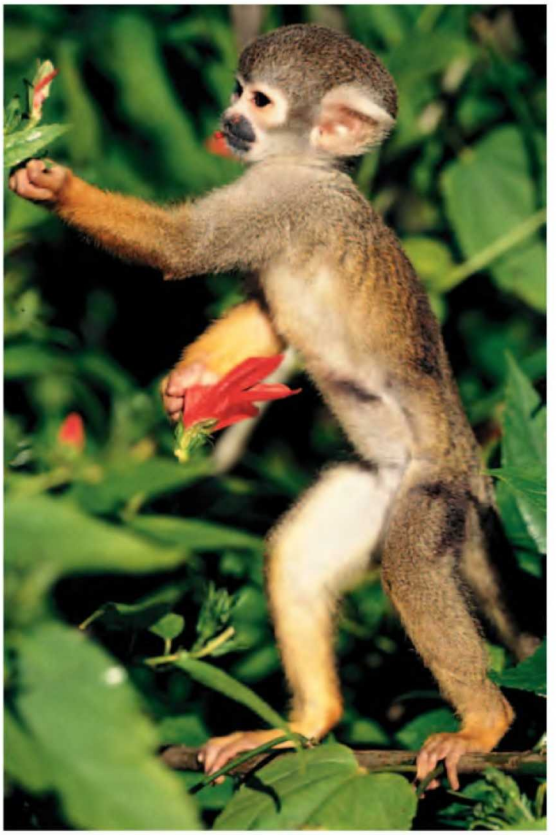
CONSERVATION STATUS

IUCN lists the yellow-breasted capuchin as Critically Endangered, facing an extremely high risk of extinction, because of habitat loss and degradation, and hunting for food. It classifies the red-backed squirrel monkey as Endangered, facing a very high risk of extinction, and the black squirrel monkey and the crested capuchin as Vulnerable, facing a high risk of extinction, due to habitat loss and degradation.



COMMON SQUIRREL MONKEY
Saimiri sciureus

Physical characteristics: Common squirrel monkeys weigh 1.5 to 2.75 pounds (0.6 to 1.2 kilograms), with the males being larger than the females. They measure about 12 inches (30 centimeters), with a tail length of about 16 inches (41 centimeters). The fur is short and dense. The round head is gray to black on top, with a white face mask and a black snout surrounded by black fur. Eyes are large and ears are small. The back is olive-gray, and the underparts are light yellow. The forearms, hands, and feet are yellow-orange. The long tail tipped with black is non-prehensile, or incapable of grasping things such as tree branches.



Common squirrel monkeys feed mainly on soft fruits and insects. (Norman Owen Tomalin/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Common squirrel monkeys are found in Brazil, Colombia, French Guiana, Guyana, Suriname, and Venezuela.

Habitat: Common squirrel monkeys occupy the middle layers of the forest with abundant vines and other vegetation. They also inhabit mangroves and forests along rivers and streams.

Diet: Common squirrel monkeys feed mainly on soft fruits and insects. They also eat frogs, spiders, snails, crabs, and occasionally bats.

Behavior and reproduction: Depending on available habitat, common squirrel monkeys live in groups of twenty to 300. Subgroups of males, mothers with offspring, and juveniles are formed within the main group. They are active during the day, foraging together in small groups. They are mostly arboreal but are sometimes found on the ground. They normally walk on all fours, but can move on their hind legs.

Males and females have several partners. Before the mating season, adult males gain weight on the upper body and in the genital organs in what is known as the "fatted male" condition. They also fight with one another to determine who will mate with the females. One large offspring is born during the rainfall season when food is plentiful. The young stay with the mother for about a year. Males do not share in parenting.

Common squirrel monkeys and people: Common squirrel monkeys are sometimes hunted for food. They are sold as pets and used for medical research.

Conservation status: Common squirrel monkeys are not considered a threatened species. ■



White-throated capuchin *(Cebus capucinus)*

WHITE-THROATED CAPUCHIN
Cebus capucinus

Physical characteristics: White-throated capuchins weigh 5.9 to 8.6 pounds (2.7 to 3.9 kilograms), with males being larger than females. They measure about 18 inches (46 centimeters) with a tail that is just as long. The robust body is fully furred, with white to yellowish coloration on the throat, head, and shoulders. The back, arms, and legs are black. The long, black, hairy tail is semiprehensile, able to wrap around tree branches, but unable to function as a fifth limb for holding objects.



White-throated capuchins are in the trees for all of their activities, including sleeping. (J-C Carton/ Bruce Coleman Inc. Reproduced by permission.)

Geographic range: White-throated capuchins are found in Colombia, Costa Rica, Honduras, Nicaragua, and Panama.

Habitat: White-throated capuchins occupy evergreen forests with full canopies and those with less-developed canopies but dense understory. They also inhabit mangroves and dry deciduous forests.

Diet: White-throated capuchins feed on plants and animals. Fruits are their favorite food, but they also eat shoots, leaves, flowers, buds, berries, and nuts, as well as insects, spiders, crabs, small birds, baby squirrels, and lizards. They eat oysters, using rocks to open the shells.

Behavior and reproduction: White-throated capuchins form groups of ten to twenty individuals, typically with more adult females than males, but ruled by a large, older male. They are arboreal and active during the day. When foraging, they call out to one another, using squeaks, shrieks, and chatters. They groom each other, looking through each other's fur to remove parasites and dirt. Males defend the group's territory, rubbing urine on their fur and feet and distributing that scent among the trees. They have been known to throw branches and fruits at perceived enemies, including humans.

Adults have several partners. Females have single births. The newborn clings to its mother's undersides or across her shoulders. After six weeks, the infant rides on its mother's back. Males do not share in childcare. Young males leave their birthplace as early as age two.

White-throated capuchins and people: White-throated capuchins are the familiar creatures associated with organ-grinders who used to entertain in city streets. They are popular in zoos worldwide. Their intelligence makes them a prime candidate for medical research. Farmers consider them pests for raiding crops.

Conservation status: White-throated capuchins are not considered a threatened species. ■

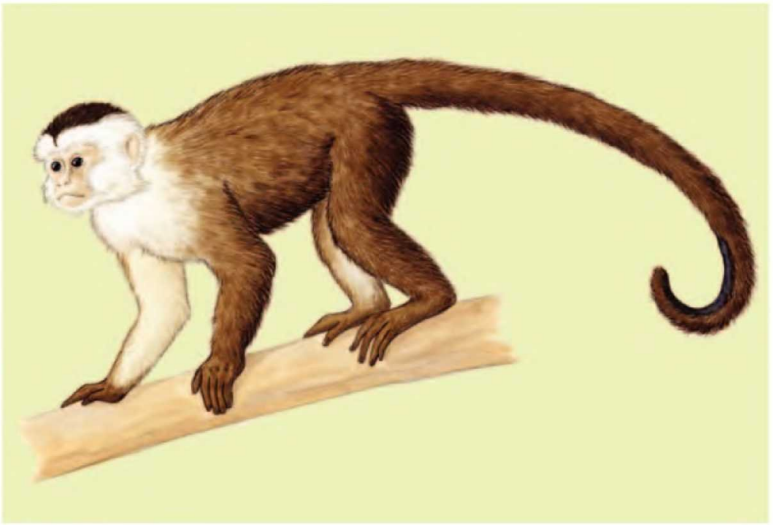


WEEPER CAPUCHIN
Cebus olivaceus

Physical characteristics: Weeper capuchins weigh 5.3 to 6.6 pounds (2.4 to 3 kilograms), males being larger than females. They measure about 20 inches (55 centimeters) with a tail that is just as long. They have an orange-brown body and yellowish shoulders and upper arms. A wedge-shaped, dark brown coloration extends from the forehead to the back of the head. The long, brown tail tipped with black is semiprehensile, so it can wrap around a branch.

Geographic range: Weeper capuchins are found in Brazil, French Guiana, Guyana, Suriname, and Venezuela.

Weeper capuchins live in groups of eight to fifty individuals with a dominant male. Young females stay with the group, but young males leave when they are as young as two years old. (Illustration by Barbara Duperron. Reproduced by permission.)



Habitat: Weeper capuchins inhabit the middle and lower layers of evergreen rainforests. They also live in dry forests, mountain forests, gallery forests (woods along streams and rivers), and shrub woodlands.

Diet: Weeper capuchins eat fruits, buds, shoots, and roots of small trees. They also feed on insects, snails, and birds.

Behavior and reproduction: Weeper capuchins form groups of eight to fifty individuals, ruled by a dominant male. They are arboreal and forage during the day. They take breaks to groom each other's fur, removing parasites and dirt. Capuchins claim territory by urine washing. They soak their hands with urine, which they rub on their fur and feet, leaving the scent throughout their forest routes. They show aggression by shaking branches and bouncing up and down. They have about a dozen vocalizations, one of which is a sad sound that earned them the name "weeper."

All receptive females mate with the dominant male at a given time. Females have single births. The newborn is able to cling to its mother's fur right away. The father does not take care of the young but may find food for the mother. Females stay with the group, but males leave home as early as two years of age.

Weeper capuchins and people: Weeper capuchins are hunted for food in some areas. They are also used in medical research.

Conservation status: Weeper capuchins are not considered a threatened species. ■

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MARMOSETS, TAMARINS, AND GOELDI'S MONKEY

Callitrichidae

Class: Mammalia
Order: Primates
Family: Callitrichidae
Number of species: 41 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Callitrichids (cal-ih-TRICK-ids; members of the family Callitrichidae) are among the smallest primates and include the world's smallest monkey, the pygmy marmoset. They have luxurious, silky fur that ranges from the brightly colored to the more subdued black or brownish black. Some species come in several color combinations. A shock of hair may be worn on top of the head, over the nape and shoulder, or as a beard. All have claws on fingers and toes, except for the big toes. The claws are useful for vertical clinging. Non-prehensile (non-grasping) tails are long, sometimes several inches longer than the body. Most callitrichids have scent glands in different areas of their bodies.

GEOGRAPHIC RANGE

Callitrichids are found in most of South America and in Central America (Panama and Costa Rica).

HABITAT

Callitrichids occupy various habitats, including primary forests with well-developed canopies and secondary forests with dense understories. They live in open woodlands, bamboo thickets, and scrub forests, as well as forests along rivers.

DIET

Fruits, insects, and gum (a sticky substance from tree bark) make up the main diet of all callitrichids. Most also eat nectar (sweet liquid from flowering plants), lizards, tree frogs, baby birds, bird eggs, butterflies, and spiders.

BEHAVIOR AND REPRODUCTION

Callitrichids are very social animals, living in extended family groups made up of a breeding pair, their offspring, and other relatives. They are arboreal (tree-dwelling) and diurnal (active during the day). They perform mutual grooming, or looking through each other's fur to remove parasites and dirt. Only one female breeds in a family, giving birth to twins. Goeldi's monkeys are the exceptions, having single births. The father and other family members share in childrearing, taking turns carrying the infants and sharing food with them. They guard their territories, sending messages through scent marking, loud calls, body language, and facial expressions.



COOPERATIVE PARENTING

In tamarin and marmoset groups, just one female gives birth, producing twins each time. At birth, the twins weigh as much as 25 percent of the mother's weight. Juvenile siblings and other adults help take care of the infants, sharing food after the infants are weaned from milk and guarding them against predators. Family members take turns carrying the twins, especially since there are no places to set the babies down in tree tops.

CALLITRICHIDS AND PEOPLE

Marmosets and tamarins are sold as pets. These animals are commonly used in medical research, especially in the United States.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists the black-faced lion tamarin and the black lion tamarin as Critically Endangered, facing an extremely high risk of extinction, because of habitat loss/degradation from logging and hunting. The pied tamarin is also classified as Critically Endangered due to human expansion into its habitat. Five species are Endangered, facing a very high risk of extinction, because of habitat loss/degradation resulting from deforestation for agriculture: the buffy tufted-ear marmoset, the buffy-headed marmoset, the

golden-headed lion tamarin, the golden lion tamarin, and the cotton-top tamarin. The IUCN classifies two other species as Vulnerable, facing a high risk of extinction, due to habitat loss/degradation from logging and hunting.



Cotton-top tamarin *(Saguinus oedipus)*

COTTON-TOP TAMARIN
Saguinus oedipus

Physical characteristics: The cotton-top tamarin gets its name from the long, white hair that starts as a wedge at its forehead and flows all way to the nape of the neck. Black or brown fur covers the back, and white fur covers the undersides. The black face is framed in grayish fur. The arms and legs are grayish white. The long, brownish black tail helps in keeping balance when jumping and climbing. It has claws for vertical climbing, except for the big toe, which has a flat nail. It weighs about 12.4 to 15.9 ounces (350 to 450 grams) and measures 7.9 to 11 inches (20 to 28 centimeters), plus an additional 12.2 to 16.1 inches (31 to 41 centimeters) for the tail.

Cotton-top tamarins prefer the tropical deciduous forests that are typically found on the edges of rainforests. They live in Colombia. (Gail M. Shumway/Bruce Coleman Inc. Reproduced by permission.)



Geographic range: Cotton-top tamarins are found in Colombia.

Habitat: Cotton-top tamarins are found in rainforests, but prefer the tropical deciduous forests that are typically found on the edges of rainforests. They also inhabit open woodlands and dry forests.

Diet: Cotton-top tamarins eat mainly ripe fruits, insects, and spiders. They also feed on flowers, buds, young leaves, nectar, gum, tree frogs, snails, and lizards.

Behavior and reproduction: Cotton-top tamarins live in groups of three to ten individuals, consisting of a dominant pair, their offspring, and several subordinate males and females. During the day, they travel through the forest as a group foraging for food. They take long breaks for grooming sessions to remove parasites and dirt from each other's fur. Cotton-top tamarins are vocal, making long calls to contact group members or to greet other tamarin species. They scent mark territories and use body language to communicate, such as raising their head fur or nape fur when agitated.

Only the dominant pair breeds, usually having twins. Infants travel with their parents by clinging to their fur. Both parents care for the young, although fathers usually carry the young. The parents are assisted by older siblings and other group members, who also share their food with the young. Young females leave home at about eighteen months of age, while young males stay longer until they are about two years old.

Cotton-top tamarins and people: Cotton-top tamarins are popular as pets. They are used in medical research, especially in the study of colon cancer.

Conservation status: The IUCN lists the cotton-top tamarin as Endangered because of habitat loss and degradation due to deforestation for agriculture and ranching. ■



Goeldi's monkey *(Callimico goeldii)*

GOELDI'S MONKEY
Callimico goeldii

Physical characteristics: Goeldi's monkeys have long, silky, brownish black fur, with a mane of hair covering the neck and shoulders and longer hairs on the rump. They weigh about 1.1 pounds (500 grams) and measure 8 to 9 inches (20 to 23 centimeters), with a tail length of 10 to 12 inches (25 to 30 centimeters). Unlike other callitrichids, they have thirty-six teeth instead of thirty-two, due to an extra molar on both sides of the jaws. The long tail is used for balance in traveling through the trees. They have claws, except for the large toes that have flat nails.



The Goeldi's monkey's diet consists predominantly of fruits and insects. (Norman Owen Tomalin/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Goeldi's monkeys are found in Bolivia, Brazil, Colombia, Ecuador, and Peru.

Habitat: Goeldi's monkeys prefer secondary forests with less-developed canopy and dense bamboo grasses and shrubs. They also inhabit deciduous scrub forests.

Diet: The Goeldi's monkey's diet consists predominantly of fruits and insects. It also eats tree frogs and occasionally forages for grasshoppers, crickets, and cockroaches on the forest floor.

Behavior and reproduction: Goeldi's monkeys live in groups of two to nine individuals, made up of one to three adult males and females. During the day they travel through the forest by vertical clinging and leaping, instead of on their four feet. They communicate through a variety of vocalizations, including trills for warning signals and whistles for long-distance calls.

Each group has two breeding females, who may give birth twice a year. Unlike tamarins and marmosets who give birth to twins, Goeldi's monkeys give birth to a single young. The mother alone takes care of the newborn for almost three weeks, after which the father and other family members share in parenting. The infant is carried on the back. However, when escaping predators, animals that hunt them for food, the monkeys do not take their young with them, but hide them among vegetation. They themselves hide in the lower shrubbery. Infants become independent by the eighth week.

Goeldi's monkeys and people: Goeldi's monkeys are trapped for the pet trade.

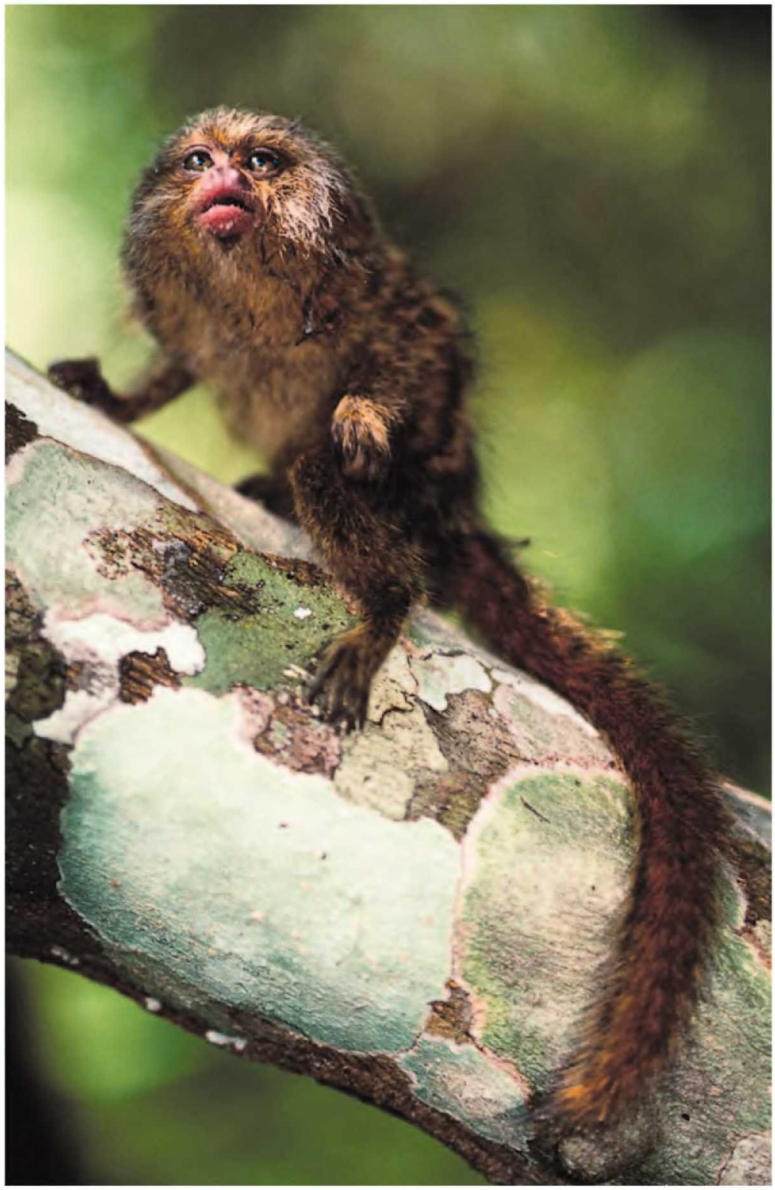
Conservation status: The IUCN lists Goeldi's monkey as Near Threatened, meaning they are not currently threatened, but could become so, due to habitat loss and degradation from human settlements and logging. It is classified as vulnerable in Colombia because of limited populations. ■



PYGMY MARMOSET
Cebuella pygmaea

Physical characteristics: The smallest of the New World primates, the pygmy marmoset weighs about 4.4 ounces (125 grams) and measures about 5 inches (13 centimeters), with another 8 inches (20 centimeters) for the tail. The fine, soft fur is brown and tinged with yellow, resulting in a grizzled look that makes it blend in with the tree branches. The fur is thicker on the head and chest, giving it a larger appearance. The orange or yellow hands and feet have claws, except for the big toes. The non-prehensile tail maintains balance when the marmoset darts through the forest. The lower jaw has chisel-shaped front teeth for gouging holes in tree barks to extract gum.

The pygmy marmoset is the smallest of the New World primates. (© Art Wolfe/The National Audubon Society Collection/Photo Researchers, Inc. Reproduced by permission.)



Geographic range: Pygmy marmosets are found in Bolivia, Brazil, Colombia, Ecuador, and Peru.

Habitat: Pygmy marmosets prefer forests along rivers, as well as flood-plain forests. They also occupy scrub forests.

Diet: Pygmy marmosets consume mainly tree gum, which they collect by excavating holes on tree barks with their sharp lower incisors

and canines. The gum hardens when exposed to air but can be dislodged for a fresh supply. Marmosets also feed on insects, spiders, lizards, and grasshoppers.

Behavior and reproduction: Pygmy marmosets live in groups of two to nine individuals, typically an adult pair and their offspring, which may include up to four generations. Some groups may have more than one male and female, but just one breeding pair. Marmosets breed throughout the year, producing twins. The whole family shares in child care.

Pygmy marmosets are active during the day, traveling on all fours and sometimes clinging and leaping vertically. They communicate through various vocalizations, body postures, and facial expressions. They are territorial, defending their forest sites using scent gland secretions. Defense of their territory involves calls, threat displays, and chasing of intruders.

Pygmy marmosets and people: Pygmy marmosets are sometimes kept as pets.

Conservation status: The pygmy marmoset is not a threatened species. ■

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family CHAPTER

NIGHT MONKEYS
Aotidae

Class: Mammalia
Order: Primates
Family: Aotidae
Number of species: 8 species

PHYSICAL CHARACTERISTICS

Night monkeys, so named because they are the world's only nocturnal (active at night) monkeys, are medium-sized animals weighing about 2 pounds (0.9 kilograms). They measure about 13.5 inches (34 centimeters), with a tail length of about 14.6 inches (37 centimeters). Forward-facing, large eyes dominate the round face. The large size of the eyes makes up for the lack of a reflective eye layer used by many nocturnal mammals for night vision. Night monkeys are also called owl monkeys because of their round, flat face and eyes that resemble those of an owl.

Night monkeys have a thick, woolly fur that ranges in color from gray to brown, with yellow to orange undersides. An orange stripe runs down the back. Large white or gray patches surround the eyes and the mouth. Three dark stripes extend from the top of the nose and on each side of the head. The stripes vary in darkness and width. Very small rounded ears seem almost absent in the thick fur. A sac under the chin can be inflated to make vocalizations louder. The long, bushy tail is non-prehensile, or incapable of grasping. It is used for balance when traveling through the forest on hands and feet and for leaping.

GEOGRAPHIC RANGE

Night monkeys are found in Argentina, Bolivia, Brazil, Colombia, Nicaragua, Panama, Paraguay, and Venezuela.

HABITAT

Night monkeys inhabit evergreen tropical rainforests and deciduous scrub forests. They also occupy forests along rivers.

They prefer dense middle-level canopies and understories with tangled vines that provide cover for sleeping sites. They also like hollows in old trees.

DIET

Night monkeys eat mainly fruits, but also consume leaves, flowers, insects, tree frogs, spiders, bats, birds, and eggs. They forage, search for food, at all levels of the forest, from the canopy down to the forest floor.

BEHAVIOR AND REPRODUCTION

Night monkeys are arboreal and live in family groups consisting of an adult pair and two or three offspring. During the day, the family sleeps in tree hollows or tangled vines. At night they forage for food throughout the forest levels, sometimes descending to the ground. They are especially active on moonlit nights, when they can see better. Night monkeys are adaptable. In Argentina, when the nights get cold at certain times of the year, the animals sleep at night and look for food during the day.

Night monkeys are monogamous (muh-NAH-guh-mus), having just one partner. The female gives birth to one offspring a year. The mother nurses the infant for up to eight months, but only carries the infant during the first week after birth and when nursing. The father provides almost all the child care. He carries the infant when the family travels through the trees. He also plays with the infant and the older offspring and guards them from predators, animals that hunt them for food. If the father dies, the older sibling, not the mother, assumes infant care. The young leave home at about three years of age.

Night monkeys scent mark territories with a behavior called urine washing. They wet their hands with urine, then rub them on their coats and the soles of their feet. The urine scent is transferred to the leaves and branches during their travels. They also communicate using secretions from scent glands on the chest and on the base of the tail. Conflicts between neighbors tend to occur when the moon is bright, perhaps because they can better see aggressive physical signals that include arching the back, erecting the fur, passing wastes, and urinating. The monkeys emit a variety of calls, including shrill cries, squeaks, and loud owl-like hoots that can be made louder by inflating the throat sac. Young males wishing to attract a mate hoot for long periods of time during a full moon.

NIGHT MONKEYS AND PEOPLE

Night monkeys are hunted for their meat and fur by native people. They are sold as pets and used for medical research.

CONSERVATION STATUS

The IUCN lists the Andean night monkey as Vulnerable, facing a high risk of extinction in the wild, because of small populations and habitat destruction from deforestation. The gray-bellied night monkey is also classified as Vulnerable due to hunting by humans and collection for the pet trade and medical research.



Three-striped night monkey *(Aotus trivirgatus)*

SPECIES ACCOUNT

THREE-STRIPED NIGHT MONKEY
Aotus trivirgatus

Physical characteristics: The three-striped night monkey has a woolly, dense fur that varies in coloration from grizzled gray to brown to reddish. Its undersides are orange or yellowish. The ears are small and rounded. Very large eyes are forward-facing and are brown or orange. Large white patches surround the eyes and the mouth, giving the appearance of alertness even when sleeping. Three dark stripes extend from the top of the nose and on each side of the head. The distinctive facial markings may prove helpful for communications among family members, especially on moonless nights. The legs, which are longer than the arms, are used for jumping. An inflatable



Three-striped night monkeys live in family groups, which typically consist of the parents and their infant and juvenile offspring. (© Kevin Schafer/Corbis. Reproduced by permission.)

sac under the chin is used to produce loud vocalizations. The orange, bushy tail, which is tipped in black, is non-prehensile. It is used for maintaining balance when leaping on branches and moving on hands and feet through the different levels of the forest. Males weigh about 1.8 pounds (0.8 kilograms). Females are slightly smaller. The monkeys measure 9.5 to 18.5 inches (24 to 47 centimeters) with a tail length of 8.7 to 16.5 inches (22 to 42 centimeters).

Geographic range: Three-striped night monkeys are found in Brazil, Colombia, and Venezuela.

Habitat: Three-striped night monkeys inhabit different types of forests, including evergreen forests, wet and dry forests, and forests along rivers. They prefer forests with thick, tangled vines and thickets

for cover during sleep or rest. They also thrive near human developments.

Diet: Three-striped night monkeys feed mainly on fruits, supplementing them with insects, tree frogs, nectar, and leaves.

Behavior and reproduction: Three-striped night monkeys live in family groups in forest trees. A typical family consists of the parents and their infant and juvenile offspring. The family forages at night, staying up longer on moonlit nights. They travel through the same areas of the trees, which is especially helpful in finding their way in the dark. They usually move on all fours, but can jump from tree to tree. During the day, they share a sleeping site among tangled vines, dense vegetation, or in a tree hollow.

Mothers give birth to a single infant annually, although they may have twins, but very rarely. Fathers are the principal caregivers, carrying the infant starting from birth. They play with the infant and older offspring, guard them against predators, and also teach them. The infant is given to the mother only during nursing. The mother does not participate in play and gives the infant back to the father immediately after it is fed. The infant is weaned by eight months of age. Older offspring help the father care for the newborn. The young stay with the family for up to three years, leaving peacefully on their own.

Three-striped night monkeys are territorial, advertising their ownership with secretions from scent glands in the chest and the tail base. They also use urine for scent marking. They soak their fur and the soles of their feet with urine, which gets transferred to leaves, branches, and trunks. They are loud creatures, announcing their presence with different types of sounds. They use an owl-like hoot when ready to mate or when separated while foraging in the dark. They whoop and grunt to threaten intruders, and trill when greeting each other. Hostile physical communications include back-arching, fur-raising, defecating, and urinating.

Three-striped night monkeys and people: Three-striped night monkeys are hunted for food by native people. They are also trapped and sold as pets. These monkeys have been found to be carriers of the human malaria parasites. They are especially valued for research in the development of drugs used for treatment and prevention of malaria.

Conservation status: The three-striped night monkey is not a threatened species. ■

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SAKIS, TITIS, AND UAKARIS
Pitheciidae

Class: Mammalia
Order: Primates
Family: Pitheciidae
Number of species: 28 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Pitheciids (PITH-uh-sidz; members of the family Pitheciidae) are small- to medium-sized monkeys, ranging from the smallest, the titis, to the largest, the uakaris. Male bearded sakis and uakaris are about 20 percent larger than the females. Male and female white-faced sakis differ in coloration. The bald uakari is easily recognized by its pinkish to bright red naked face. All pitheciid species have long coats, except for the short-furred bearded saki. The bald uakari alone has a short tail, about a third of its body length. The rest of the species have long, nonprehensile (nongrasping) tails.

GEOGRAPHIC RANGE

Pitheciids are found in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, and Suriname.

HABITAT

Pitheciids inhabit a variety of rainforest habitats. Sakis prefer the middle and lower layers of the canopy, as well as the understory. They are found in savanna forests, mountain forests, swamps, and forests along rivers, but not flooded forests. Uakaris choose forests that get flooded from seasonal rainfall for about six months. Titis occupy coastal forests, living in the understory.

DIET

Sakis and uakaris feed mainly on seeds, especially from tough-skinned fruits, while titis prefer fruit pulps. All species

supplement their diet with flowers, leaves, shoots, and insects.

BEHAVIOR AND REPRODUCTION

Pitheciids differ in the size of their social groups, ranging from small parent-and-offspring groups among titis to the uakari multimale-multifemale groups of up to 100 members. They are mostly arboreal, living in the trees of the forest canopy and understory. Active during the day, these primates take breaks for mutual grooming. Pitheciids are vocal and use body postures to communicate, such as erecting the body hair to show aggression.

All pitheciids give birth to one infant. Some species breed seasonally, while others do not. Saki fathers do not help with child care but do groom infants. Titi fathers are the principal caregivers, even of older offspring. The young are weaned at different ages, with sakis being independent at about age one and titis remaining with the parents until they are two or three years old.



DE-STRESSING

Sakis, uakaris, and titis, like many primates, practice mutual grooming. They take turns looking through each other's fur, carefully removing dirt, dead skin, and parasites. The parasites are usually eaten by the groomer. These primates seem to have found a way not only to de-stress but also to practice hygiene (HIGH-jeen) and reinforce social bonds.

PITHECIIDS AND PEOPLE

Pitheciids are hunted for food and trapped for the pet trade. Sakis are hunted for their long, bushy tails that are made into dusters.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists Barbara Brown's titi and Coimbra's titi as Critically Endangered, facing an extremely high risk of extinction, due to habitat loss or degradation from logging. The bearded saki is classified as Endangered, facing a very high risk of extinction, because of hunting and pet collection, as well as habitat loss from deforestation. Six other species are listed as Vulnerable, facing a high risk of extinction, and two species as Near Threatened, not currently threatened, but could become so, due to several factors, including hunting, capture for the pet trade, and habitat loss from deforestation for timber and agriculture.



SPECIES ACCOUNTS

WHITE-FACED SAKI
Pithecia pithecia

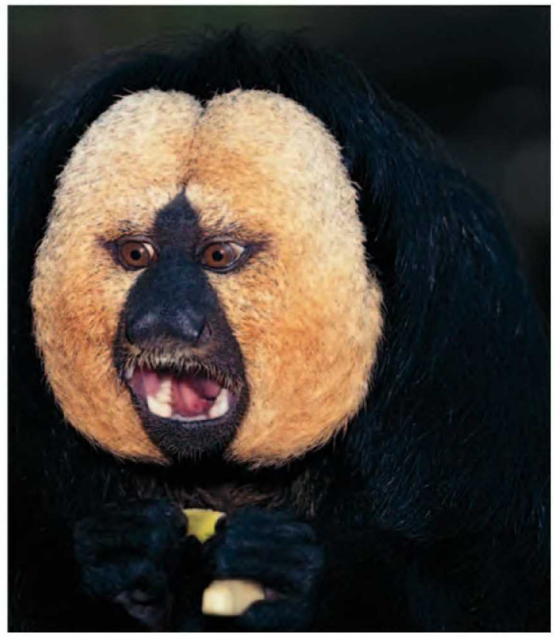
Physical characteristics: The white-faced saki weighs 1.8 to 5.5 pounds (0.8 to 2.5 kilograms). It measures 13.2 to 13.8 inches (33.5 to 35 centimeters), with a tail length of 13.5 to 17.5 inches (34.3 to 44.5 centimeters). The coarse fur is long, thick, and shaggy, making the animal seem larger. The saki is named for its white facial coloration, sometimes tinged with red, which is typical only of males. Females have black or brownish fur, with a pale stripe running down from under the eyes to each side of the face. This marked color difference is unusual in primates. Long nape hair flows forward like a hood. The black nose is very wide, and the nostrils are flat. The long,

bushy tail is non-prehensile, or incapable of grasping. It is used for balance when traveling through the forest.

Geographic range: White-faced sakis are found in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, and Suriname.

Habitat: White-faced sakis inhabit savanna forests where grassland and forest meet, as well as mountain forests. They live in palm swamps and forests along rivers, although they do not like flooded areas. They prefer the middle and lower levels of the forest canopy but will forage at the tangled vegetation below.

Diet: White-faced sakis feed mainly on seeds, fruits, flowers, shoots, and leaves. They occasionally eat birds, termites, and other insects. They sometimes catch mice and bats, which they skin and tear to pieces before eating.



The white-faced saki is named for the white facial coloration of the males. Males show the white coloration at two months old. (Norman Owen Tomalin/Bruce Coleman Inc. Reproduced by permission.)

Behavior and reproduction: White-faced sakis are active during the day, sleeping at night curled up on branches. They are agile climbers, traveling and climbing on all fours. They are known as the flying monkeys because of their ability to jump downward through forest gaps of up to 33 feet (10 meters). Sakis also travel upright on their hind feet. They show aggression by arching their back, erecting their fur, and shaking their body. Sakis communicate using loud calls, chirps, and high-pitched whistling.

Sakis live in small groups of up to five individuals, typically the parents and their young. Larger groups may get together at abundant food sources. Females give birth to a single infant from December to April. All infants are born with female colorations. Males acquire their striking facial coloration at two months. The mother alone rears the young, who leave home at age one.

White-faced sakis and people: White-faced sakis are hunted for food and collected for the pet trade.

Conservation status: The white-faced saki is not considered a threatened species. ■



BALD UAKARI
Cacajao calvus

Physical characteristics: The bald uakari has long, coarse, shaggy hair that varies in coloration from white to red to reddish gold to orange. The bald face is pink to bright red. It is thought that the red face is an indication to a potential mate that the individual is healthy. Malaria is a common disease in the Amazon rainforest, and uakaris afflicted with the disease tend to have paler faces. Sharp incisors, canine teeth, and powerful jaws are especially adapted for piercing and cracking the hard shells of fruits and extracting the seeds, their favorite food. Bald uakaris weigh about 6.6 to 7.7 pounds



It is thought that the red face of a bald uakari is an indication to a potential mate that the individual is healthy. Malaria is a common disease in the Amazon rainforest, and uakaris afflicted with the disease tend to have paler faces. (R. A. Mittermeier/ Bruce Coleman Inc. Reproduced by permission.)

(3 to 3.5 kilograms) and measure about 21.3 to 22.4 inches (54 to 57 centimeters), with a tail length of 5.9 to 6.3 inches (15 to 16 centimeters). It is the only South American monkey with a short tail.

Geographic range: Bald uakaris are found in Brazil, Colombia, and Peru.

Habitat: Bald uakaris prefer flooded rainforests along small rivers. Seasonal rainfall, which can last six or more months, causes water to cover as much as 33 feet (10 meters) of tree trunks, so the uakaris remain in the trees during that time.

Diet: Bald uakaris are seed specialists, preferring the seeds found in unripe fruits and those with hard skins that abound in flooded rainforests. They eat young saplings on the ground when the waters dry up. They also feed on flowers, insects, and snails.

Behavior and reproduction: Bald uakaris generally live in groups of ten to thirty individuals. Large groups consisting of up to 100 individuals form smaller groups when foraging. Uakaris sleep at night in the forest canopy. They travel on four limbs and also leap through the forest, although they are not expert leapers. When feeding, they sometimes suspend themselves in the air using their limbs.

Uakaris have several mating partners. Females have single births every two years, caring for the infants themselves. The mother carries the newborn on her front during the first three or four months, after which she carries it on her back. Infants are weaned by twenty-one months.

Bald uakaris and people: Bald uakaris are hunted for food and collected as pets.

Conservation status: The IUCN lists the bald uakari as Near Threatened due to continued hunting for food and trapping for the pet trade. ■



MASKED TITI
Callicebus personatus

Physical characteristics: The masked titi weighs 0.9 to 3.6 pounds (1 to 1.7 kilograms). It measures 12.2 to 16.5 inches (31 to 42 centimeters), with a tail length of 16.5 to 21.7 inches (41.8 to 55 centimeters). The long, soft, hairy coat is grayish to yellowish or orange. The face, hands, and feet are black. The non-prehensile tail is long and bushy.

Geographic range: Masked titis are found in Brazil.



Masked titis mate for life, and the father provides most of the child care for infants as well as for older offspring. (Illustration by Marguette Dongvillo. Reproduced by permission.)

Habitat: Masked titis prefer coastal forests. They are found in dense understory vegetation up to 33 feet (10 meters) high. They also inhabit banana groves.

Diet: Masked titis feed on unripe fruits, leaves, flowers, and insects.

Behavior and reproduction: Masked titis are active during the day. At dawn, neighboring groups emit loud calls, usually initiated by the mated pair, announcing ownership of a certain territory. Titis defend their territory, chasing away intruders. They move through the forest canopy on all fours. They intertwine their tails when sleeping, resting, or sitting on tree branches.

Titis mate for life, producing a single infant annually. The family group consists of two to seven individuals, typically the parents and offspring of different ages. The father almost exclusively rears the infant, carrying it on his back and giving it to the mother just to nurse. The father is known to move the infant to his underside to protect it from the rain. He also rears the older offspring, grooming them, guarding them from predators, and sharing his food with them. The mother does not share her food with the young. The young leave their home at ages two to three.

Masked titis and people: Masked titis are hunted for food and collected as pets.

Conservation status: The IUCN lists the masked titi as Vulnerable due to hunting and trapping by humans, as well as habitat loss and degradation from logging. ■

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HOWLER MONKEYS AND SPIDER MONKEYS

Atelidae

Class: Mammalia
Order: Primates
Family: Atelidae
Number of species: 22 to 24 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The atelids (members of the Atelidae family) are the largest New World primates. They range in color from yellowish beige to dark red to black. Males and females of some howler species differ in color. Many spider monkeys have light-colored masks around their eyes. Howler and woolly monkeys have stocky bodies and shorter limbs, while spider monkeys and muriquis have slimmer bodies and long tails. All tails are prehensile, capable of grasping tree branches, so that the monkeys usually feed while suspended.

GEOGRAPHIC RANGE

Atelids are found in Mexico, all of Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), and South America (including Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, and Venezuela).

HABITAT

Howler monkeys and muriquis inhabit secondary forests with open canopies. Spider and woolly monkeys prefer full-canopied primary forests, although spider monkeys are also found in semideciduous and secondary forests.

DIET

Howler monkeys prefer leaves, while other atelids favor ripe fruits. All diets are supplemented with flowers, seeds, and insects.

BEHAVIOR AND REPRODUCTION

All atelids are arboreal (tree-dwelling) but occasionally descend to the ground. They are diurnal (active during the day). Some species have grooming sessions and play time. Atelids do not defend territories. They generally move through the forest on all fours with brachiation (brake-ee-AY-shun; swinging below branches using the arms), usually assisted by the tail.

Adults have several mating partners. Females have single births, which occur at different intervals depending on species. The mother alone tends to the infant. Except for howler monkeys, young males remain with the group, while females leave to join other males. Male howler monkeys form their own group and invade another group, killing the young.

A THIRD HAND

All atelids have a prehensile, or grasping, tail. A prehensile tail is muscular and is bare underneath in the last third of the tail. The bare skin has tiny, fingerprint-like ridges that provide a firm grip around branches, just like an extra hand. An animal can wrap its tail around a sturdy branch, freeing up its hands to reach for fruits and new leaves at the end of weaker branches.

ATELIDS AND PEOPLE

Atelids are valued for their meat. Spider monkeys and muriquis are collected as pets because they are typically good-natured.

CONSERVATION STATUS

The IUCN lists eleven species as threatened because of continued hunting and habitat loss and degradation from human activities. The variegated spider monkey, the northern muriqui, and the yellow-tailed woolly monkey are listed as Critically Endangered, facing an extremely high risk of extinction, dying out, in the wild. The Guatemalan black howler monkey, the white-whiskered spider monkey, and the southern muriqui are listed as Endangered, facing a very high risk of extinction. The Colombian woolly monkey is classified as Vulnerable, facing a high risk of extinction, and two other species are listed as Near Threatened, not currently threatened, but could become so.



SPECIES ACCOUNTS

VENEZUELAN RED HOWLER MONKEY
Alouatta seniculus

Physical characteristics: The Venezuelan red howler monkey has thick, dark red to purplish red fur, with bright orange or gold underparts. The prehensile tail is used as a third hand for picking food. The black face is naked, and the wide jaw is covered with a thick beard. An enlarged hyoid (HYE-oid) bone at the root of the tongue gives the throat a swollen appearance. This bone is responsible for producing the loud howls that gave the monkey its name. Together with the enormous jaw, the swollen throat gives the monkey a grim appearance. It weighs 8 to 25 pounds (3.6 to 11 kilograms) and mea-



At dawn and dusk, Venezuelan red howler monkeys perform deafening howls that can be heard for at least 2 miles (3 kilometers). (Norman Owen Tomalin/Bruce Coleman Inc. Reproduced by permission.)

sures 17.5 to 27 inches (44 to 69 centimeters), with another 21 to 31 inches (54 to 79 centimeters) for the tail.

Geographic range: Venezuelan red howler monkeys are found in Venezuela and Brazil.

Habitat: Red howler monkeys prefer the forest canopy and understory. They inhabit secondary forests where the canopy is less developed but the ground vegetation is dense. They are also found in mountain forests, mangroves, and forests by rivers and streams.

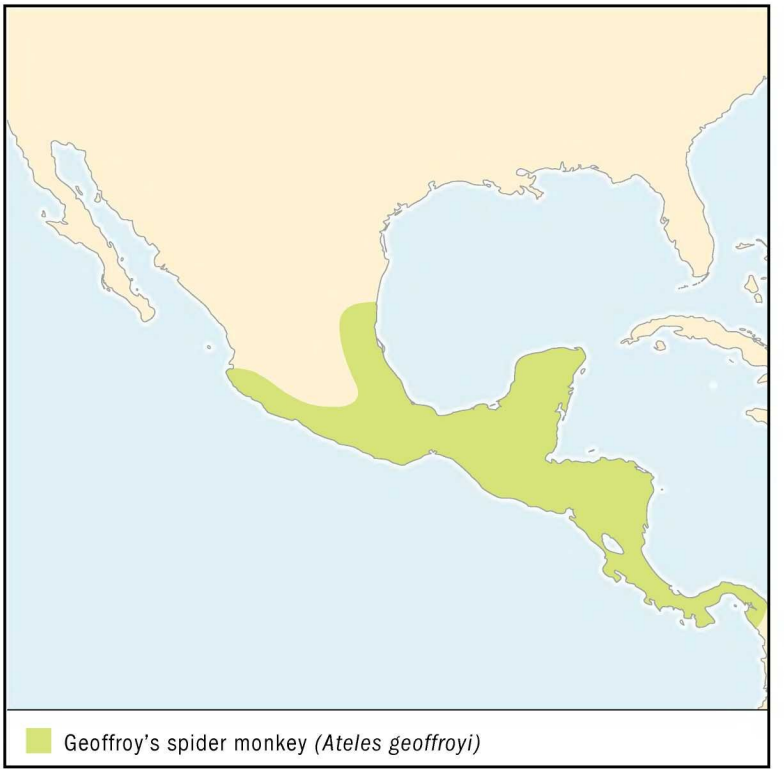
Diet: Leaves make up more than 60 percent of a howler monkey's diet. It prefers the young leaves that are plentiful in the treetops. It also eats fruits, seeds, flowers, and insects.

Behavior and reproduction: Venezuelan red howler monkeys are arboreal and diurnal. Sluggish creatures, these monkeys spend plenty of time resting during the day. At dawn and dusk, they perform deafening howls that can be heard for at least 2 miles (3 kilometers). These calls advertise territory and group size to avoid confrontations with other groups. The monkeys also howl during heavy rainstorms.

Red howlers form groups of three to ten individuals, generally consisting of several unrelated adults. Adults have several mating partners, although the dominant male mates with all the receptive females. Females have single births every eighteen to twenty-four months. Mothers carry infants for about six months, first against the stomach and later on the back. Young howlers leave home by two years of age, although females may stay with the group. Young males leave to form their own all-male groups, which later take over another group, sometimes killing the young.

Venezuelan red howler monkeys and people: Red howler monkeys are hunted for food.

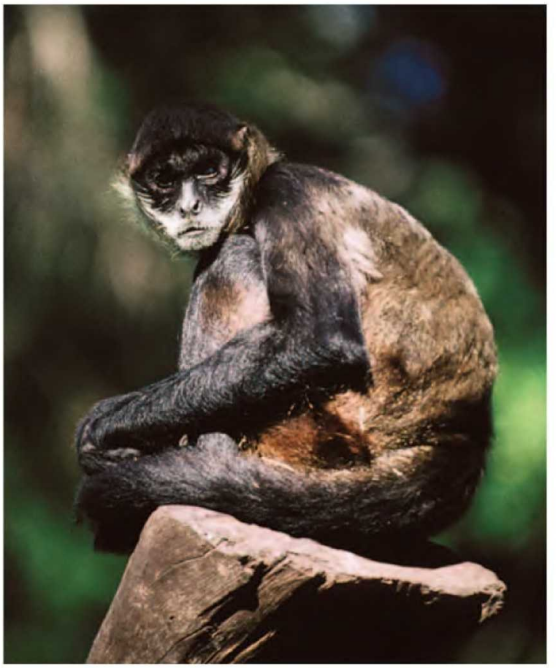
Conservation status: The IUCN does not consider the Venezuelan red howler monkey a threatened species. ■



GEOFFROY'S SPIDER MONKEY
Ateles geoffroyi

Physical characteristics: Geoffroy's spider monkeys have a coarse, shaggy coat that comes in yellow, red, or black, turning lighter on the undersides. The black hands and feet are very long and spidery, giving the monkeys their name. The hands have underdeveloped thumbs. White cheek hair is raised, and the eyes are surrounded by pale skin to form a mask. The prehensile tail, at 25 to 33 inches (63.5 to 84 centimeters), is longer than the head and body length of 12 to 24.8 inches (30.5 to 63 centimeters). The prehensile tail enables the large animal to hang from a sturdy branch to pick fruits at the end of thin branches. The monkey weighs 13 to 20 pounds (6 to 9 kilograms).

Geographic range: Geoffroy's spider monkeys are found in Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.



While they usually travel on all fours, or use their arms to swing from branch to branch, Geoffroy's spider monkeys can also jump down through forest gaps of over 33 feet (10 meters). (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Geoffroy's spider monkeys prefer the top level of the forest canopy, where ripe fruits and young leaves are abundant. They occasionally descend to the middle layers. They inhabit mountain forests and mangroves.

Diet: Spider monkeys eat mainly ripe fruits. They especially prefer those with big seeds. They also feed on young leaves, flowers, buds, insects, insect larvae, and bird eggs.

Behavior and reproduction: Geoffroy's spider monkeys form groups with over forty individuals. When food is scarce, smaller subgroups and lone monkeys split from the main group when feeding. They forage, search for food, mostly in the early morning, resting the remaining part of the day. Spider monkeys are agile climbers, using their tail as an extra limb to move through the trees. They also travel on all fours and brachiate. They can jump down through forest gaps of over 33 feet (10 meters). The monkeys tend to go back to the same sleeping areas at nightfall.

Adults have several partners. Some males and females are dominant over others, but males competing for the same females are seldom aggressive with one another. A female determines which partner she will take. On average, females give birth to a single infant every three years because infants take that long to be independent. This is the longest period of infant dependency known among monkeys. Young females leave home, while young males remain in their birthplace.

Geoffroy's spider monkeys and people: Humans hunt spider monkeys for food.

Conservation status: The IUCN does not list Geoffroy's spider monkey as a threatened species. ■



COLOMBIAN WOOLLY MONKEY
Lagothrix lugens

Physical characteristics: Colombian woolly monkeys range in color from black to blackish brown to lighter gray, with darker undersides, head, limbs, and tail. The fur is short, thick, and soft. The head is large and round, with a flat face and a snub nose. The ears are small. The body is stocky, with a protruding belly and a long, thick, muscular tail. The powerful prehensile tail can hold the large animal while suspended from a branch, as well as function as an additional hand. Woolly monkeys measure 20 to 27 inches (50.8 to 68.6 centimeters), with a tail length of 23.6 to 28.4 inches (60 to 72 centimeters). They weigh about 12 to 24 pounds (5.5 to 10.8 kilograms).



During midday, Colombian woolly monkeys rest, groom each other, and play. They greet each other by kissing on the mouth and embracing. (Illustration by Bruce Worden. Reproduced by permission.)

Geographic range: Colombian woolly monkeys are found in Colombia and Venezuela.

Diet: Colombian woolly monkeys feed mainly on fruits, supplemented with leaves, seeds, and occasional insects.

Behavior and reproduction: Colombian woolly monkeys are arboreal, sharing home ranges with other groups of their own species without hostility. They form groups of ten to forty-five individuals. Some males are dominant over other males, and all males are dominant over females, but they have a friendly relationship. They are diurnal, mostly foraging in the early morning and late afternoon, splitting into smaller subgroups when doing so. During midday, they rest, groom each other, and play. They greet each other by kissing on the mouth and embracing. Woolly monkeys travel through the forest on all fours, with some brachiation. They do not jump up but drop down to a branch by as many as 20 feet (6 meters).

Woolly monkeys have several partners, with dominant males mating with all receptive females. Females have single births every two to three years. An infant can cling to its mother's fur right away, first holding on to her stomach and later on to her back or side. Mothers carry the young for six to eight months, but nursing continues for up to twenty months. Young males remain in their birthplace, while females leave home to join other males.

Colombian woolly monkeys and people: Colombian woolly monkeys are hunted for food and trapped for the pet trade.

Conservation status: The IUCN lists the Colombian woolly monkey as Vulnerable due to habitat loss and degradation from logging and human settlement. ■

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OLD WORLD MONKEYS
Cercopithecidae

Class: Mammalia
Order: Primates
Family: Cercopithecidae
Number of species: 131 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Old World monkeys are divided into the leaf-eating monkeys (including langurs [lang-GURZ] and colobus and proboscis monkeys) and the cheek-pouched monkeys (including macaques [muh-KOCKS] and mandrills). Most have subdued dark colorations with lighter undersides. Some, such as mandrills, have spectacular color combinations. All species have forward-facing eyes and short snouts. The buttocks have two hardened pads for prolonged sitting. Most have long tails. Leaf-eaters have a four-chamber stomach for digesting their main diet of plants. The cheek pouches are used for storing food to be safely eaten in trees.

GEOGRAPHIC RANGE

Leaf monkeys are found in Asia and Southeast Asia, except for the colobus monkeys. Cheek-pouched monkeys are found in Africa, including the Barbary macaque. All other macaques are found in Southeast Asia.

HABITAT

Old World monkeys live in virtually all land habitats, including grasslands, open dry forests, dense evergreen forests, mangroves, swamps, and forests along rivers. Some live near humans.

DIET

Leaf monkeys eat mainly leaves. Cheek-pouched monkeys consume fruits, seeds, insects, and occasionally young leaves.

BEHAVIOR AND REPRODUCTION

Old World monkeys are diurnal (active during the day). Most are arboreal (tree-dwelling), traveling on all fours. They can also leap, using the tail for balance. Some species use some brachiation (brake-ee-AY-shun, a type of locomotion in which an animal swings below branches using its arms. Social groups vary in size. Larger groups may split into subgroups when foraging. They are polygynous (puh-LIH-juh-nus), with males having several partners. Females have single births. Young females leave their birthplace, while young males stay with the group.

OLD WORLD MONKEYS AND PEOPLE

Old World monkeys are hunted for food. Some species are used in medical research.



POT BELLIES

The western red colobus, the proboscis monkey, and the red-shanked douc langur, all considered leaf monkeys, have evolved a four-chamber stomach that brings about a pot-bellied look. The stomach houses bacteria that break down fibrous leaves, the monkeys' main diet. The bacterial action not only releases nutrients from the leaves but also renders harmless the poisons found in some leaves.

CONSERVATION STATUS

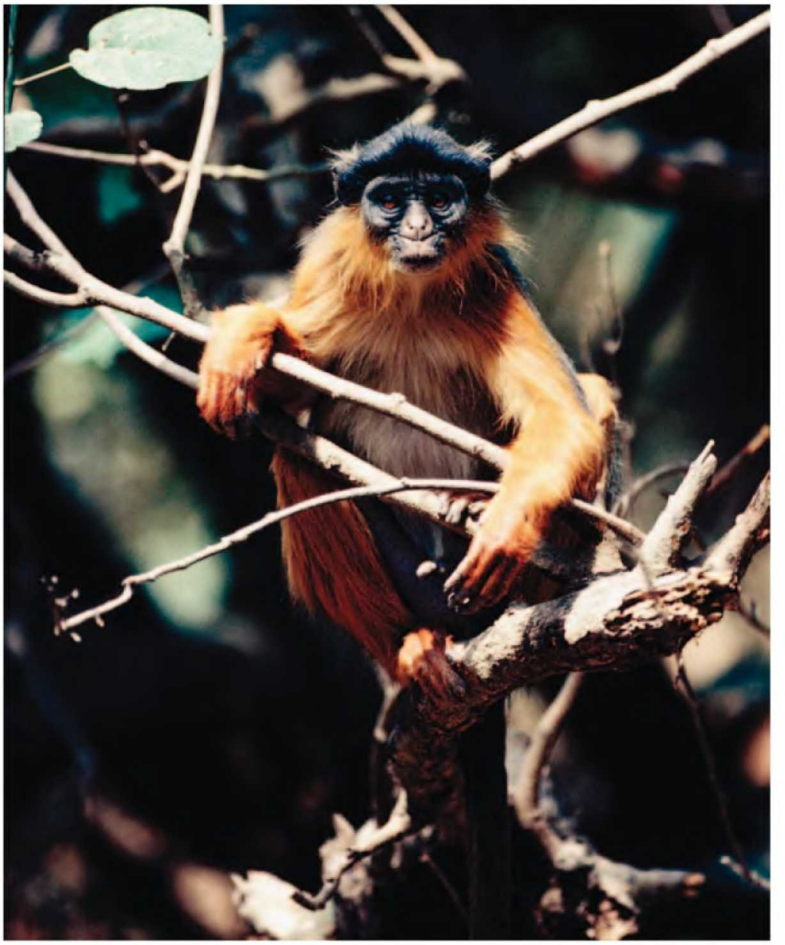
The World Conservation Union (IUCN) lists five species as Critically Endangered, facing an extremely high risk of extinction, due to hunting, as well as habitat loss and degradation from agriculture, logging, and other human activities. These are the eastern red colobus, the Tonkin snub-nosed monkey, the Delacour langur, the white-headed langur, and the Mentawai macaque. Twenty-two species are classified as Endangered, facing a very high risk of extinction in the wild; seventeen are Vulnerable, facing a high risk of extinction in the wild; and twenty are Near Threatened, not currently threatened, but could become so.



WESTERN RED COLOBUS
Piliocolobus badius

Physical characteristics: The western red colobus monkeys are black or dark gray with bright red undersides. The cheeks and the lower parts of the limbs are also bright red. The Greek word *kolobos*, meaning "cut short," describes the missing thumbs, which allow for faster brachiation because thumbs do not get caught in the branches. The long tail maintains balance when leaping. Males measure about 23 inches (57 centimeters), with a tail length of 26.5 inches (66.5 centimeters), and weigh 18.4 pounds (8.36 kilograms). Females are slightly smaller.

Geographic range: The monkeys are found in Cameroon, Ivory Coast, the Democratic Republic of the Congo, Gambia, Ghana, Guinea-Bissau, Liberia, Nigeria, Senegal, and Sierra Leone.



The word "colobus" in the western red colobus's common and scientific names comes from the Greek word kolobos, *meaning "cut short," referring to the monkey's "missing" thumbs. (Ernest A. Janes/Bruce Coleman Inc. Reproduced by permission.)*

Habitat: Red colobus monkeys prefer rainforests that provide young leaves year round. They inhabit primary and secondary forests, forests along rivers and streams, and wooded grasslands.

Diet: Western red colobus monkeys feed mainly on leaves, especially young leaves, but also eat flowers and shoots. They consume only unripe fruits. Ripe fruits contain sugar, which can be broken down by stomach bacteria, causing gas and acid formation that may be fatal.

Behavior and reproduction: Western red colobus monkeys form groups of nineteen to eighty individuals with numerous adult males and females. They do not defend their territory. They are arboreal and diurnal, splitting off into smaller subgroups when foraging. They move through the trees on all fours, with some brachiation. However, they are not agile climbers.

Males have several mating partners. Females give birth to a single infant every two years. The mother alone carries the infant. Young females leave home, transferring from one group to another. Males stay in their birthplace, forming a close association with one another.

Western red colobus monkeys and people: Western red colobus monkeys are hunted for food.

Conservation status: The IUCN lists the western red colobus as Endangered due to hunting for meat, as well as habitat loss and degradation from agriculture, logging, and human settlement. ■



PROBOSCIS MONKEY
Nasalis larvatus

Physical characteristics: The proboscis monkey got its name from its bulbous nose, which in the male is long and drooping. It is thought that females are attracted to the large nose. The naked face is pinkish brown. The head and back are reddish orange, while the shoulders, neck, and cheeks are pale orange. The undersides, legs, and tail are grayish white. The webbed feet are useful for swimming. Males weigh about 45 pounds (20.4 kilograms) and measure about 30 inches (74.5 centimeters), with a tail length of 26.5 inches (66.5 centimeters). Females are about half the male size, weighing 21.6 pounds (9.8 kilograms) and measuring 25 inches (62 centimeters), with a tail length of 23 inches (57.5 centimeters).

Geographic range: Proboscis monkeys are found in Borneo.

Habitat: Proboscis monkeys occupy coastal mangrove forests and forests along rivers.



The proboscis monkey is found in mangrove and lowland forests in Borneo. (© Aaron Ferster/Photo Researchers, Inc. Reproduced by permission.)

Diet: Proboscis monkeys feed mainly on leaves, supplemented with flowers and seeds. They eat unripe fruits but not ripe fruits, which, when processed by stomach bacteria, can cause potentially deadly gas and acid formation.

Behavior and reproduction: A proboscis monkey family consists of an adult male and several females and their offspring. Females give birth to a single infant and are assisted by other females with child-care. Young males are usually expelled upon puberty, traveling alone for a while or joining other bachelors. Proboscis monkeys do not defend their territory, but adult males threaten intruders with loud honks using their nose.

They are arboreal and diurnal, foraging in the early morning, then taking a long rest to digest their food. They may eat again before dark. The monkeys move on all fours and brachiate through the trees. They often jump from the trees into the water, from heights of as much as 53 feet (16 meters). They swim well and can stay underwater to escape a predator. They sleep in trees with branches that extend over water, perhaps as a lookout for their main predator, the clouded leopard.

Proboscis monkeys and people: Proboscis monkeys are hunted for meat.

Conservation status: The IUCN lists the proboscis monkey as Endangered due to hunting, as well as habitat loss and degradation from logging. ■



RED-SHANKED DOUC LANGUR
Pygathrix nemaeus

Physical characteristics: The red-shanked douc langur is a colorful monkey. The back and upper arms are a grizzled gray, turning to a lighter gray on the undersides. Black hair covers the top of the head, and long, white whiskers frame the golden face. The eyelids are pale blue. The lower arms, wrists, and tail are white, and the hands and feet are black. The thighs are black, and the lower legs are maroon. Males weigh about 24.4 pounds (11 kilograms), and females weigh about 18.6 pounds (8.45 kilograms). Males measure 23.5 inches (58.5 centimeters), plus a tail length of 27 inches (68 centimeters). Females are 24 inches (60 centimeters) long, with a tail of the same length.

Geographic range: Red-shanked douc langurs are found in Vietnam and Laos.

Habitat: Douc langurs inhabit primary and secondary forests. They also live in evergreen forests, as well as in monsoon deciduous forests, characterized by heavy rainfall and dry periods during which leaves drop. They also occupy lowland and mountain forests.

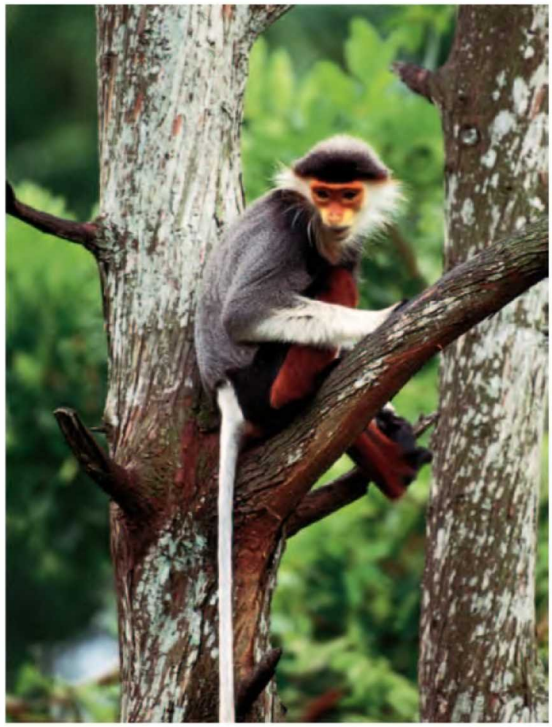
Diet: Red-shanked douc langurs eat leaves, buds, flowers, fruits, and seeds.

Behavior and reproduction: Red-shanked douc langurs form groups of four to fifteen individuals, typically with more females than males. Both sexes have dominant individuals, but males are always dominant over females. The langurs are arboreal and diurnal, moving through the forest canopy on all fours and by leaping from branch to branch, landing on their hind legs. They socialize by grooming, going through each other's fur to remove dirt and parasites. They are vocal, using growls and squeaks to communicate.

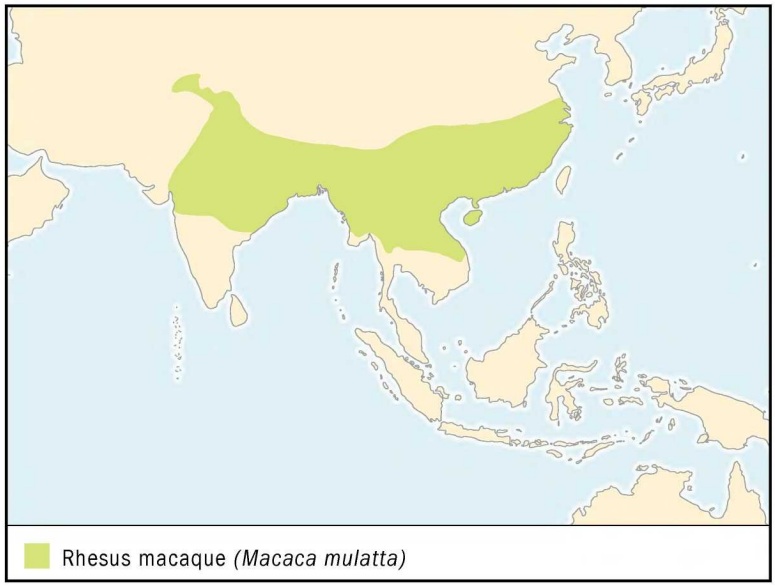
Males have several mating partners. Every two years, females give birth to a single infant who receives plenty of attention and care from other females. Males sometimes tend to the young. Young males and females leave home when they are ready to start their own families.

Red-shanked douc langurs and people: Red-shanked douc langurs are hunted for meat.

Conservation status: The IUCN lists the red-shanked douc langur as Endangered due to habitat loss and degradation from human activities. ■



Red-shanked douc langurs form groups of four to fifteen individuals, and socialize by grooming, going through each other's fur to remove dirt and parasites. (© Art Wolfe, Inc./Photo Researchers, Inc. Reproduced by permission.)



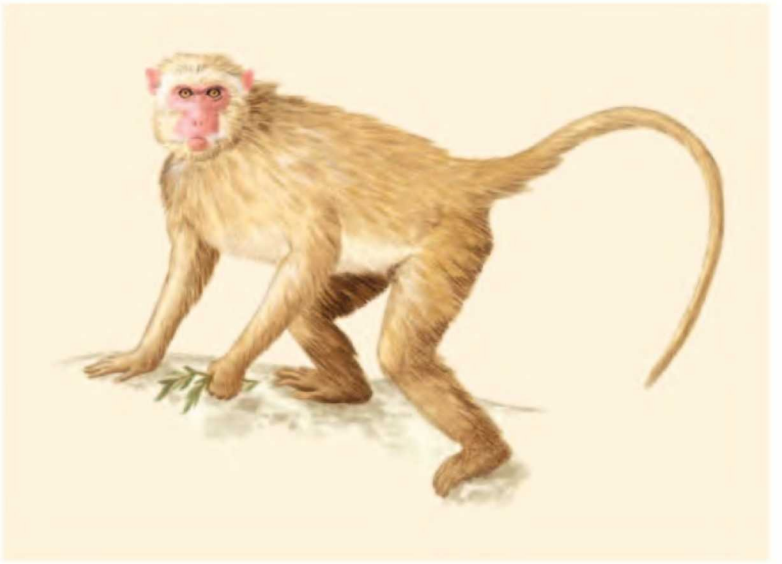
RHESUS MACAQUE
Macaca mulatta

Physical characteristics: Rhesus macaques have long, brown hair with pale brown undersides. The hair at the top of the head is short. Facial skin is pinkish, while the rump is red. Males are slightly bigger than females, weighing about 17 pounds (7.7 kilograms) and measuring 21 inches (53 centimeters), with a tail length of 10 inches (24.5 centimeters). Females are about 11.8 pounds (5.4 kilograms), measuring 18 inches (45 centimeters), with a tail length of 9 inches (22 centimeters).

Geographic range: Rhesus macaques are found in Afghanistan, Pakistan, India, Nepal, Bhutan, Bangladesh, Myanmar, China, Thailand, Laos, and Vietnam.

Habitat: Rhesus macaques are adaptable, able to thrive in mangrove swamps, cedar-oak forests, woodlands, semi-desert scrub forests, forests along rivers, and even human settlements.

Diet: Rhesus macaques eat fruits, seeds, leaves, flowers, grasses, roots, bark, gum, and insects.



The Rh factor in humans is named after the rhesus macaque, which was first discovered to have this substance in its blood. (Illustration by Barbara Duperron. Reproduced by permission.)

Behavior and reproduction: Rhesus macaques live in groups of eight to 180 individuals, although the average size is about twenty, with two to four times as many females as males. There are dominant males and females within a group, with the offspring inheriting the mother's rank. Macaques are arboreal but descend to the ground to forage and to move among human settlements. They prefer to sleep in the trees at night. They communicate through facial expressions, body language, and vocalizations, including barks, squawks, and growls. Adults have several partners. Females give birth to a single infant annually. Females remain with the group, while males may transfer from one group to another.

Rhesus macaques and people: The Rh factor in humans is named after the rhesus macaque, which was discovered to have this substance in its blood. Rhesus macaques are popular zoo animals. Farmers consider them pests for eating crops.

Conservation status: The IUCN lists the rhesus macaque as Near Threatened, meaning it could become threatened, due to hunting and habitat loss and degradation from human activities. ■



MANDRILL
Mandrillus sphinx

Physical characteristics: Mandrills have a grizzled brown coat and gray-white undersides. Males have the most striking coloration of all mammals. The large, bright red nose is enclosed by blue bony bulges. The whiskers are white and the beard is golden. A tuft of hair on top of the head and a mane over the shoulders can be erected for threat displays. The rump has shades of red, blue, and lilac, and is used as a signal when leading the group through the dense forest. Females have almost similar colorations, but are not as striking. They have black faces. The largest of the Old World monkeys, male mandrills weigh about 69.7 pounds (31.6 kilograms), more than twice as heavy as females, who weigh 28.4 pounds (12.9 kilograms). Males measure 27.5 inches (70 centimeters), with a tail length of 3 inches (8 centimeters).

Females measure 22 inches (54.5 centimeter), with a tail length of 3 inches (7.5 centimeters).

Geographic range: Mandrills are found in Cameroon, the Democratic Republic of the Congo, Equatorial Guinea, and Gabon.

Habitat: Mandrills occupy evergreen forests and forests along rivers and coasts.

Diet: Mandrills have a varied diet of fruits, seeds, grains, leaves, bark, mushrooms, tubers, snakes, and insects.

Behavior and reproduction: Although a typical mandrill family consists of a male and several females and their offspring, large groups with as many as 800 members have stayed together year after year, foraging for food, breeding, and fighting. A group having 1,350 individuals had been recorded. However, when not mating, males tend to be loners. Males prefer to forage on the ground, while females and the young climb trees. They may travel as much as 5 miles (8 kilometers) a day while feeding. All sleep in the trees. Mandrills communicate using grunts and crowing sounds. Adults have several partners, and females have single births. Young females stay with the group, but young males leave home, fighting fiercely during mating season, using their large, sharp canines.



Mandrills are the largest of the Old World monkeys. (© C. K. Lorenz/Photo Researchers, Inc. Reproduced by permission.)

Mandrills and people: Mandrills are hunted for meat.

Conservation status: The IUCN lists the mandrill as Vulnerable due to continued hunting, as well as habitat loss and degradation from agriculture, logging, and human settlements. ■

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family CHAPTER

GIBBONS
Hylobatidae

Class: Mammalia
Order: Primates
Family: Hylobatidae
Number of species: 10 to 12 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Gibbons have a thick coat that ranges in color from black to silvery gray to ash blond. They have a slender body and no tail. The bare face is framed in white fur or other markings. The extremely long arms, with hooklike fingers, are used for brachiating (BRAKE-ee-ate-ing), or swinging from branch to branch. Scientists consider gibbons as the only true brachiators, having powerful shoulder joints for reaching overhead and a wrist that can be rotated 180 degrees for switching position without tiring the arms and upper body. Gibbons are the only apes with skin pads on their buttocks that allow them to sleep comfortably sitting up.

GEOGRAPHIC RANGE

Gibbons are found in Southeast Asia, including China, India, Bangladesh, Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, and Indonesia.

HABITAT

Gibbons prefer the upper forest canopy, where fruits are abundant and spreading branches allow for continuous travel. They also thrive in surviving areas of forests that have been logged.

DIET

Ripe fruits are gibbons' main diet. Figs are their favorite. They also feed on leaves, flowers, buds, shoots, bird eggs, young birds, and insects.

SINGING GIBBONS

Gibbons typically begin their day by singing. It is thought that singing serves to advertise territory ownership or readiness to mate. It also reinforces pair bonds and family ties. Songs are loud and long, lasting up to an average of fifteen to thirty minutes. The songs, either solos or duets, follow certain complicated patterns and are specific just to a particular species. Siamangs sing hooting-bark notes made louder by their inflated throat sacs.

BEHAVIOR AND REPRODUCTION

Gibbons are predominantly arboreal (tree-dwelling), defending their territory by chasing intruders and shaking branches. They sing to advertise ownership. Gibbons brachiate by grasping one branch after another or by propelling themselves through the air, loosening their grasp. They walk upright on wide branches or on the ground, arms held overhead to avoid tripping. They are diurnal (active during the day), but go to sleep before dark, sleeping in a sitting position.

The family consists of the parents and one to four juveniles. Females have single births every two or three years. The mother carries the infant around her waist for the first two months. When a juvenile reaches the age of five, the parent of the same sex may start chasing it off. Offspring who refuse to leave home stay in the vicinity of the family, but keep a distance when feeding and sleeping. Most leave home when they become sexually mature, or able to reproduce, at age seven or eight.

GIBBONS AND PEOPLE

Gibbons are popular zoo animals. The Ibans, the native people of Borneo, believe gibbons are human reincarnation, or the reappearance of a loved one's soul in the animal's body. Infants are captured for the pet trade.

CONSERVATION STATUS

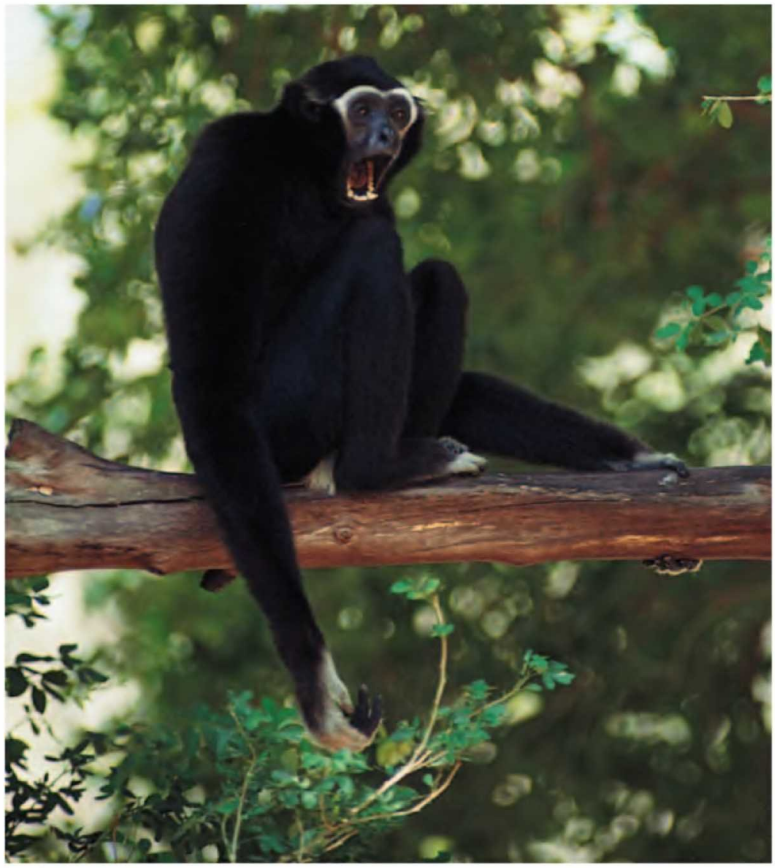
The IUCN lists the Moloch gibbon and the eastern black gibbon as Critically Endangered, facing an extremely high risk of extinction in the wild, due to hunting, as well as habitat loss and degradation from logging and human settlement. The hoolock gibbon and the black crested gibbon are listed as Endangered, facing a very high risk of extinction, due to habitat loss and degradation from human activities. The pileated gibbon, the Kloss gibbon, and the golden-cheeked gibbon are classified as Vulnerable, facing a high risk of extinction, due to habitat loss and degradation from human activities.



Pileated gibbon *(Hylobates pileatus)*

PILEATED GIBBON
Hylobates pileatus

Physical characteristics: Pileated gibbons have dense, woolly fur. Males are black, with a black face framed in white. Hands and feet are white. Females are silvery beige or ash blond, with a black face and chest. The top of females' head is also black. The body is slender and the small head is rounded. Very long arms have hook-like fingers for brachiation. Thick skin pads line the rears for prolonged sitting. Males weigh 17 to 23 pounds (7.7 to 10.4 kilograms), and females about 14 to 19 pounds (6.3 to 8.6 kilograms). The average head and body length is 17.5 to 25 inches (44 to 63.5 centimeters).



A pileated gibbon family consists of an adult pair and up to four offspring. The family searches for food together. (© Terry Whittaker/Photo Researchers, Inc. Reproduced by permission.)

Geographic range: Pileated gibbons are found in Thailand, Cambodia, and Laos.

Habitat: Pileated gibbons prefer primary forests with well-developed canopies. They live in evergreen and semi-evergreen forests. They also occupy monsoon deciduous forests that have periods of heavy rainfall and dry spells, causing leaves to fall.

Diet: Pileated gibbons eat predominantly ripe fruits, supplemented with flowers, leaves, and insects.

Behavior and reproduction: The family consists of an adult pair and up to four offspring. The gibbons are arboreal and diurnal. Upon waking, the mated pair sings a duet, in which the offspring may join. The family forages soon after. Gibbons are territorial, defending their home against outsiders. They mostly travel by brachiating, but sometimes

walk on two feet or leap through wide forest gaps. The family almost never goes down to the forest floor. They sleep before sundown, sitting on tree branches.

Females give birth to an infant every two or three years. The mother is the principal caregiver. The young tend to stay with the parents until they are ready to start their own family at seven or eight years of age. However, the parents may try to expel them when they reach the age of five.

Pileated gibbons and people: Poachers (illegal hunters) kill gibbons for food and capture the young for pets.

Conservation status: The IUCN lists the pileated gibbon as Vulnerable due to habitat loss from logging and human settlement. ■



LAR GIBBON
Hylobates lar

Physical characteristics: Lar gibbons have thick, shaggy fur that is dark brown, beige, or a combination of both. The hands and feet are white. The black naked face is surrounded by a ring of white hair. Extremely long arms end in slender fingers that hook over branches when brachiating. The buttocks have thickened pads, adapted for prolonged sitting while asleep. Males weigh 11 to 16.8 pounds (5 to 7.6 kilograms), and females about 9.7 to 15 pounds (4.4 to 6.8 kilograms). The average head and body length is 16.5 to 23 inches (42 to 58 centimeters).

Geographic range: Lar gibbons are found in China, Indonesia, Malaysia, Myanmar, and Thailand.



Lar gibbon mother with young. The parents might send their young away by age five, but some females stay with the family until age eight. (Gail Shumway/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Lar gibbons prefer the high forest canopy where plentiful fruits are found. They occupy evergreen and semi-evergreen forests. They also inhabit monsoon deciduous forests, characterized by heavy rainfall and dry periods during which leaves fall.

Diet: Lar gibbons feed mainly on fruits, supplemented with flowers, leaves, and insects.

Behavior and reproduction: Lars gibbons are arboreal and diurnal. Brachiation is their chief means of moving through the forest. On the ground and on wider branches, they walk on two feet, holding their long arms over their heads for balance and to avoid tripping over the

arms. They are territorial, chasing neighbors off their home boundaries and advertising ownership by loud singing.

The family consists of the mated pair and their young. However, there have been reports of the adult male or female moving in with the neighbors. Some stay permanently; others eventually return home. Females give birth to one infant every two or three years. When a juvenile reaches the age of five, the parent of the same sex may force it to leave. The young may continue to stay in the vicinity of the family, but keeps a distance when feeding and sleeping. Young females typically leave home by age eight.

Lar gibbons and people: The young are captured for the pet trade, and the mothers are usually killed.

Conservation status: The IUCN lists the lar gibbon as Near Threatened, not threatened, but could become so, due to habitat loss and degradation from agriculture, logging, and capture for the pet trade. ■



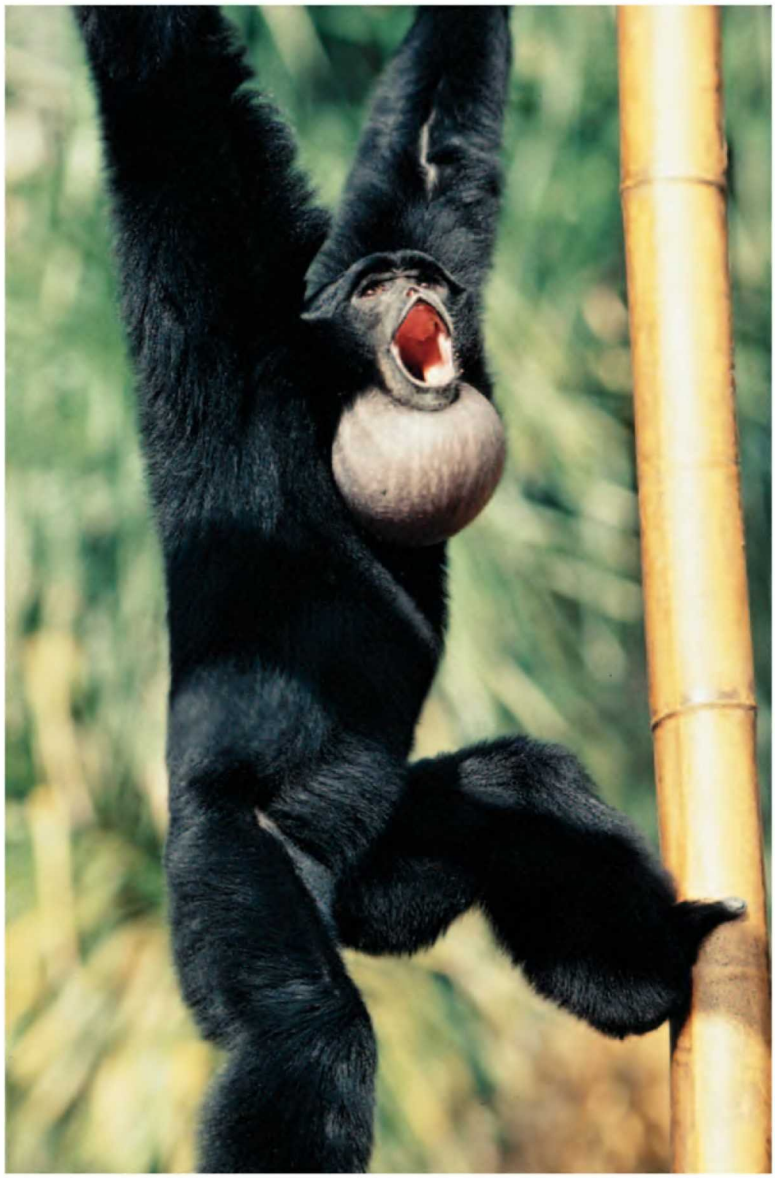
Siamang *(Symphalangus syndactylus)*

SIAMANG
Symphalangus syndactylus

Physical characteristics: Siamangs are the largest gibbons, weighing about 18 to 29 pounds (8 to 13 kilograms), with a head and body length of 29.5 to 35.5 inches (75 to 90 centimeters). Their black fur is long and shaggy, making them look larger. The face is reddish brown. Both sexes have a pinkish throat sac that can be inflated to magnify the siamangs' booming and barking calls. Thick skin pads on the rear provide comfort when sleeping in a sitting position. Hooked fingers at the end of long arms allow for brachiation. The second and third toes are fused by a webbing of skin.

Geographic range: Siamangs are found in Indonesia and Malaysia.

Male and female siamangs have a pinkish throat sac that can be inflated to magnify the siamangs' booming and barking calls. (© R. Van Nostrand/Photo Researchers, Inc. Reproduced by permission.)



Habitat: Siamangs are found in the lower canopy of evergreen forests. They also occupy mountain forests and monsoon deciduous forests, characterized by heavy rainfall and dry periods during which leaves fall.

Diet: Siamangs consume ripe fruits, leaves, flowers, shoots, and insects.

Behavior and reproduction: Siamangs are arboreal and diurnal. Upon waking, they sing harsh barking and booming notes, made

louder by their inflatable throat sacs. Brachiation is the chief mode of locomotion among siamangs, who are capable of gliding over a forest gap of 25 to 32 feet (8 to 10 meters). They walk upright when on the ground or when branches are too wide for grasping.

The family consists of the parents and up to four offspring of different ages. Females have single births every two or three years. The mother carries the infant around her waist for the first two months. The father may help carry the infant when it stops nursing at two years of age. Offspring who reach sexual maturity at ages seven or eight leave the family to form their own.

Siamangs and people: Some local people revere siamangs for their impressive songs. Poachers hunt them to sell the meat for food and body parts for medicinal use.

Conservation status: The IUCN lists the siamang as Near Threatened due to habitat loss and degradation from human activities. ■

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GREAT APES AND HUMANS
Hominidae

Class: Mammalia
Order: Primates
Family: Hominidae
Number of species: 7 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Gorillas, chimpanzees, and bonobos are dark-colored, while orangutans are reddish brown. All have arms that are longer than their legs. Gorilla and orangutan males are twice as big as females. Great apes have forward-facing eyes for three-dimensional (height, width, and depth) viewing. They have powerful fingers and toes for gripping branches. They have no tails.

GEOGRAPHIC RANGE

Orangutans are the only great apes residing in Asia, in the countries of Indonesia and Malaysia. Gorillas and chimpanzees live in most countries of Africa, while bonobos are found only in the Democratic Republic of the Congo.

HABITAT

Great apes generally occupy fully developed forest canopies and dense shorter vegetation. They inhabit grasslands, bamboo forests, swamp forests, and mountain forests.

DIET

The diet of great apes includes fruits, leaves, flowers, seeds, barks, insects, and meat.

BEHAVIOR AND REPRODUCTION

African apes are mostly ground-dwellers, walking on their knuckles and feet. The lighter species climb trees, swinging by their arms from branch to branch in a mode of traveling called brachiation (brake-ee-AY-shun). Orangutans are arboreal

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

A CHOREOGRAPHED DISPLAY

A silverback puts on an impressive threat display to protect his family from an intruder. First he hoots, and then throws vegetation around. Standing erect, he beats his chest with cupped hands. He kicks with one leg and shows his sharp canine teeth. Running on all fours, he rips off more vegetation. Standing up again, he slaps the ground with his hands. Finally, he rushes the intruder, stopping just a few feet away to allow the intruder to leave.

(tree-dwelling). On the rare occasions that they descend to the ground, they walk on their clenched fists. All great apes are diurnal, foraging during the day and sleeping in nests at night. Some take long breaks for grooming sessions.

Great apes are not seasonal breeders. Females have single births, caring for the young for a lengthy period with no help from the fathers. Male gorillas and chimpanzees engage in rivalries and takeovers that result in infanticide (killing of the young). Bonobo females are constantly receptive to mating. Orangutan males may commit forceful mating.

GREAT APES AND PEOPLE

Great apes are hunted by humans for meat and trophies. Some people believe apes' body parts have medicinal or magical powers. When infants are collected for the pet trade, the mothers are often killed.

CONSERVATION STATUS

The IUCN lists the Sumatran orangutan as Critically Endangered, facing an extremely high risk of extinction in the wild, due to hunting, as well as habitat loss and degradation from agriculture and logging. The remaining five great ape species are Endangered, facing a very high risk of extinction, for the same reasons.



BORNEAN ORANGUTAN
Pongo pygmaeus

Physical characteristics: Bornean orangutans have long, shaggy, reddish brown hair. Facial skin color ranges from pink to red to black. Arms, which are longer than the orangutan is tall, are useful for reaching fruits and brachiating. Scooplike hands and feet have powerful grips for grasping branches. Cheek pads in adult males make the face look larger. A throat pouch is inflated to produce loud, long calls to advertise their whereabouts. Males may reach 200 pounds (90.7 kilograms), with a standing height of about 5 feet (1.5 meters). Females are about 100 pounds (45.4 kilograms), standing 3 feet (1 meter) tall.

Geographic range: Bornean orangutans are found in Indonesia and Malaysia.

Habitat: Bornean orangutans prefer mature forests with fruiting trees. They also inhabit mangroves, swamps, mountain forests, and deciduous forests.

Bornean orangutans spend most of their time in the trees, and they feed on fruits there. Males sometimes travel on the ground, and they sleep in nests on the ground. (© B. G. Thomson/Photo Researchers, Inc. Reproduced by permission.)



Diet: Orangutans feed mainly on fruits, supplemented with leaves, flowers, buds, barks, honey, insects, and bird eggs. They use tools, such as sticks, to get honey out of beehives.

Behavior and reproduction: Orangutans are mostly arboreal, although heavy adult males travel on the ground, walking on their clenched fists and feet. They ascend trees to feed. Females and juveniles build sleeping nests in trees, while adult males sleep on ground

nests. Orangutans use big leaves as umbrellas for protection from the hot sun and rain.

Orangutans do not form social groups. Adult males avoid one another, using long calls to warn neighbors to stay away. When encounters are unavoidable, fights may end fatally. Females with offspring congregate briefly at abundant feeding sites. Females ready to breed pursue males, who leave soon after mating. Both sexes may have several partners. Some males force themselves on unwilling females. Females have single births every four to eight years, the longest interval between births of any mammal. Orangutan young also have the longest childhood of all animals. After nursing for about four years, they stay close to their mothers for another three (males) to five (females) years.

Bornean orangutans and people: Orangutans are hunted for meat and infants are sold as pets.

Conservation status: The IUCN lists the Bornean orangutan as Endangered due to hunting for food and capture of young for the pet trade. Habitat is lost to agriculture, logging, and human settlements. ■



WESTERN GORILLA
Gorilla gorilla

Physical characteristics: The western gorilla has short black hair with red or brown coloration on the top of the head. The face is black. The head is elongated, and a brow ridge sits over the eyes. A protruding belly houses a large intestine for processing a plant diet. The arms are very long, and the thick-skinned knuckles are used for walking. Big toes help grasp tree branches. At ages eleven to thirteen, males acquire silver-gray hair on their back, earning the name silverbacks. Males are bigger than females, averaging 352 pounds (160 kilograms) with a standing height of 5 to 6 feet (1.5 to 1.8 meters). Females weigh 150 to 251 pounds (68 to 114 kilograms), standing 5 feet (1.5 meters) tall.



The western gorilla is an herbivore, although young gorillas may eat termites and ants. (© Mark Newman/Photo Researchers, Inc. Reproduced by permission.)

Geographic range: Western gorillas are found in Angola, Cameroon, the Central African Republic, Congo, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, and Nigeria.

Habitat: Western gorillas occupy open canopies and dense understories and forests that have been cultivated or logged. They inhabit swampy clearings, forests along rivers, and full-canopied primary forests.

Diet: Western gorillas prefer fruits but also feed on plants. In swamp forests, they eat water plants. Juveniles also eat termites and ants.

Behavior and reproduction: The gorilla family typically consists of a dominant male (silverback), a younger male, several adult females, and their offspring. The silverback protects the group, settles conflicts, and determines daily activities. The group forages on the ground, climbing trees only for special fruits or leaves. Members communicate using facial expressions, body language, and vocalizations. Females groom the silverback and mothers and infants groom each other, but other adults do not engage in mutual grooming. Gorillas build sleeping nests in trees, although heavier males nest on the ground.

The silverback mates with all receptive females, but adults of both sexes may have several partners. Females have single births every four years, nursing the young for three years. A young female leaves home to join a lone male or another group. She may change groups several times. A young male may inherit his father's position or leave home. When ready to reproduce, he will try to take over a group. If he succeeds, he kills the infants so that the mothers will be receptive to breeding. Scientists have found that males who stay in the neighborhood after leaving home have nonaggressive encounters, because they may be siblings or half-brothers and, therefore, have a familiar relationship.

Western gorillas and people: Western gorillas are popular in zoo exhibits. They are hunted for meat.

Conservation status: The IUCN lists the western gorilla as Endangered due to hunting, as well as habitat loss and degradation from agriculture, logging, and human developments. ■



CHIMPANZEE
Pan troglodytes

Physical characteristics: Chimpanzees have black hair, which may turn gray with age, accompanied by partial balding. The naked face varies from pink to black and has a short, white beard. They have a brow ridge, protruding snout, and large ears. The thumbs function like those of humans for handling objects. The large toes are used for a firm grip when climbing trees. Males weigh 80 to 130 pounds (36.3 to 59 kilograms), and females about 70 to 100 pounds (31.8 to 45.4 kilograms). They stand about 3.8 to 5.5 feet (1 to 1.7 meters) tall.

Geographic range: Chimpanzees are found in many African countries, including Senegal, Guinea, Sierra Leone, Ivory Coast, Ghana,



Young chimpanzees play with one another, as these orphaned chimpanzees are doing. (K. and K. Ammann/Bruce Coleman Inc. Reproduced by permission.)

Nigeria, Cameroon, the Central African Republic, the Democratic Republic of the Congo, Rwanda, Tanzania, Uganda, and Sudan.

Habitat: Chimpanzees occupy mountain forests, open woodlands, and grasslands.

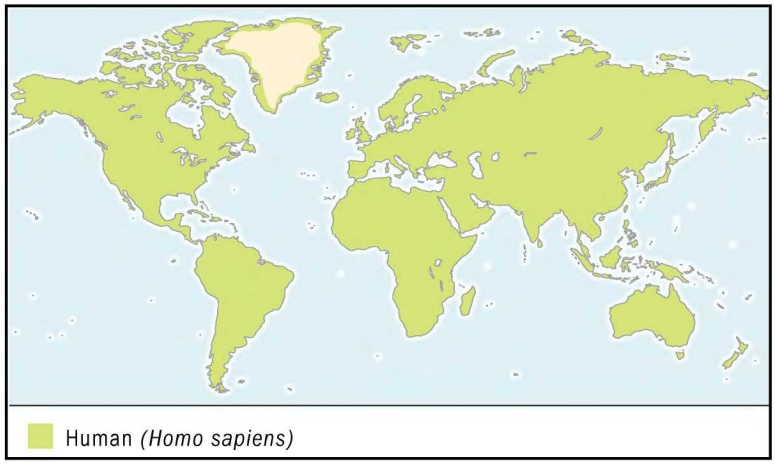
Diet: Chimpanzees are omnivorous, eating both plants and animals. They feed on fruits, nuts, flowers, seeds, and bird eggs. Their favorite prey is the red colobus monkey. They also eat termites, small antelopes, and bush pigs.

Behavior and reproduction: Chimpanzees live in communities of as many as eighty individuals, but may form subgroups of just males, mothers and young, or both sexes of different ages. A dominant male rules a group but may be replaced at any time. Adult males dominate all females. Males defend their territory from outside groups, sometimes killing all the members of the outside group. Chimpanzees sleep in tree nests. They are expert tool users, using rocks to open nuts and sticks to get termites. They communicate through facial expressions and a variety of sounds. Group members groom each other to strengthen social bonds.

Adults have several partners. Females have single births every four or five years. The young nurse for about four years, staying close to their mothers for another four years. Adolescent females may join another group.

Chimpanzees and people: Chimpanzees are popular exhibit animals in zoos and have been used in movies and television shows. They are hunted for food. They are used in medical research and were used in the space program.

Conservation status: The IUCN lists the chimpanzee as Endangered due to hunting for food, as well as habitat loss and degradation for agriculture, logging, and human settlements. ■



HUMAN
Homo sapiens

Physical characteristics: Humans differ in skin color, depending on the amount of the pigment melanin in their skin. The body is hairless, except for the head, armpits, and genital areas. Scientists suggest that early humans had shed their fur to prevent over-heating when chasing their prey, and developed sweat glands on the skin surface to cool the body by perspiring. The subcutaneous fat, or the fatty layer under the skin, preserves body heat when the environment gets cold and serves as an energy source when food is scarce.

Humans possess a distinct trait, bipedalism (bye-PED-ul-ih-zem), or a mode of locomotion on two legs. Strong, muscular legs are adapted for upright walking. The S-shaped curve of the spine keeps an erect human from toppling by distributing the body weight to the lower back and hips. However, the flexible spine, adapted by early humans for running and catching prey, has caused problems to modern humans, especially the weak lower backbone that is not adapted for supporting the heavy head and trunk.

Geographic range: Humans inhabit almost all of Earth's land surfaces. While humans may not be able to live in the very cold regions of Antarctica or in the central Sahara Desert, they are capable of visiting those areas. Modern technology has allowed humans to travel over water, underwater, and through the air. Humans are also able to



A group of young humans—children. (Pat Lanza/Bruce Coleman Inc. Reproduced by permission.)

live in space, such as in the International Space Station, and have landed on the moon.

Habitat: Humans live in all land habitats.

Diet: Humans are omnivorous, feeding on both plant and animal matter.

Behavior and reproduction: Humans differ from other primates by their use of language, a distinct type of communication that can be manipulated to produce an unlimited number of expressions. Humans use symbols and communicate through symbols, such as art. Another human-specific behavior is their reliance on tools and technology. However, humans' most striking characteristic is their mental ability to create ideas.

Although a monogamous (muh-NAH-guh-mus) family, with a mated male and female, typically represents the human social unit, many cultures practice polygyny (puh-LIH-juh-nee; one male with several mates), polyandry (PAH-lee-an-dree; one female with several mates), and polygamy (puh-LIH-guh-mee; both sexes have several mates). Humans are unique in that they do not generally sever ties with relatives when they move. However, humans are capable of aggressive and violent relationships.

Humans have no breeding seasons. While single births are most common, multiple births occasionally occur. Human young develop slowly, needing care and protection from adults. The young learn

social behaviors through imitation. While average life spans can vary around the world, men and women generally live into their sixties and seventies. While males can parent children in old age, females stop reproducing with menopause (generally starting at age fifty), after which they may live many more years.

According to scientists, the human baby, given the big size of its brain, needs about twenty-one months to develop fully in the mother's womb. But, since the female birth canal, through which a baby passes, has evolved to a narrower size to allow for upright locomotion, babies have to be born "prematurely" (after nine months). The brain develops further outside the womb.

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LAND AND MARINE CARNIVORES

Carnivora

Class: Mammalia

Order: Carnivora

Number of families: 12 families

order

CHAPTER

phylum
class
subclass
order
monotypic order
suborder
family

PHYSICAL CHARACTERISTICS

The order Carnivora (kar-NIH-vuh-ruh) refers to a group of mammals whose evolutionary ancestors were carnivores, or meat-eaters. Over several millions of years, these ancestors had adapted to the rise of bigger and more powerful herbivores, their main prey, by developing carnassials (kar-NAH-see-uls), bladelike teeth that slice through flesh. Powerful jaws that move up and down were especially useful for stabbing and holding prey and the incisors for biting off pieces of food.

Although the 264 species in the order Carnivora come from the same ancestors, not all species eat only meat. Therefore, while the carnassials are very pronounced in species that eat large prey (cats, for example), those that are not purely carnivorous have less developed carnassials (bears). Some, like the aardwolf that feeds on termites, and the giant panda that eat mainly bamboo, have no carnassials at all.

Carnivores come in a wide range of sizes. The smallest carnivore, the least weasel, weighs about 1.76 ounces (50 grams). In contrast, the southern elephant seal, the largest carnivore, weighs about 5,300 pounds (2,400 kilograms). Some carnivores are terrestrial (land-dwelling) mammals, including the familiar dogs, cats, bears, raccoons, hyenas, mongooses, and skunks. Land carnivores either walk on the soles and heels of their feet (plantigrade) or on their toes (digitigrade). A combination of strong bones in the feet and bendable wrists allow these mammals to climb, run, jump, and overcome their prey. An undeveloped collarbone allows for increased movements of the arms

when pursuing prey. The long baculum (penis bone) enables prolonged mating and is especially important in species in which mating brings on ovulation (the formation and release of eggs from the ovary). Anal glands release substances used as scent marks for various types of communication.

Other carnivores are marine (sea-dwelling) mammals, including eared seals, true seals, and walruses. Marine mammals, also called pinnipeds (fin-footed mammals), have a torpedo-shaped body that allows for easy movement through water. The thick layer of blubber, or fat under their skin, not only provides insulation but also contributes to streamlining (smoothing out) their bodies.

GEOGRAPHIC RANGE

Carnivores are found throughout the world. Some, however, are not naturally occurring but have been introduced to some areas.

HABITAT

Carnivores are found both on land and sea. Although most terrestrial carnivores live on land, the polar bear spends most of its time on sea ice, while the palm civet is arboreal (a tree-dweller). The sea otter lives exclusively in the water, as opposed to other marine carnivores who forage in the sea and breed on land.

DIET

The term carnivore literally means meat-eater, but not all species in the order Carnivora live on a strict diet of meat. Among the true carnivores are cats. Although lions in the Kalahari Desert have been known to eat melons, they only do so for the moisture content, not for sustenance. Some mustelids (weasels, martens, and otters) are also pure carnivores. The rest of the mustelids (skunks, badgers, and tayras) are omnivores, supplementing their meat diet with fruits, roots, and seeds. The bears are generally omnivores, although most prefer a larger proportion of plant food, including fruits, grasses, and roots. The exceptions in the bear family are the giant panda that lives exclusively on bamboo and the polar bear that consumes mainly ringed seals.

Procyonids (raccoon family) are omnivores, with several food specialists. Ringtails prefer meat, red pandas eat mainly

bamboo leaves, and kinkajous and olingos live off fruits. The civets and genets (viverrids) eat a mixture of animals and fruits, although palm civets are primarily frugivores (fruit-eaters). The mongoose family, while generally favoring insects, also lives on a mixed diet of rodents, worms, reptiles, and plant matter. Canids (dogs) are also omnivores, eating all sizes of mammals, as well as insects, berries, carrion (dead and decaying flesh), and garbage.

The smallest carnivore family consists of three hyena species and the aardwolf. While the aardwolf eats termites almost exclusively, hyenas have a varied diet, ranging from large antelopes and reptiles to wildebeest feces and human garbage. Hyenas are often described as scavengers who feed off the leftover kills of other animals. However, they often hunt their own prey. In fact, lions have been known to scavenge hyena kills.

The marine carnivores eat various marine mammals, including fish, crustaceans (shrimps, crabs, and lobsters), mollusks (clams, mussels, squid, and octopus), and penguins. Some marine carnivores have specialized diets. The crab-eater seal feeds almost exclusively on krill (a small shrimplike animal), while the walrus feeds almost entirely on mollusks.

BEHAVIOR AND REPRODUCTION

Many carnivores are solitary creatures, except for mating pairs and mother-offspring groups. The majority are not antisocial, as they share overlapping territories and congregate at abundant food sources. Some belong to social groups, in which strict rules are observed. For example, carnivores "talk" to one another through scent marking, or the depositing of anal secretions, urine, and feces. They also use a variety of vocalizations. Some use body postures to show dominance or submission.

The typical mating system among carnivores is polygyny (puh-LIH-juh-nee) in which a male has two or more partners. Some, like canids, are monogamous (muh-NAH-guh-mus), with a male and a female mating with just with each other. Pinnipeds usually breed on land. Males arrive on land to stake out a territory. Females arrive later to give birth to the previous year's pup before mating. The father departs for the sea soon after mating, leaving the mother to raise the pup. When the pup is able to survive on its own, mother and pup leave land for the water, going their separate ways.

CARNIVORES AND PEOPLE

The relationship between carnivores and humans is complex. Humans have domesticated the wolf and wild cats and made them house pets. In addition, humans have trained dogs to perform certain tasks. Collies help herd sheep, German shepherds serve as seeing-eye dogs, beagles sniff for drugs at airports, and bloodhounds help locate missing people.

Humans and carnivores have historically had conflicting interests. Thousands of years ago, early humans and carnivores competed for food. Today, carnivores in the wild continue to prey on domesticated animals, even attacking and killing some humans. Humans who feel threatened by carnivores resort to poisoning, trapping, and shooting, leading to the extinction of certain species. Some carnivores are also hunted for their fur, meat, and body parts, resulting in declining populations.

Certain government agencies and private organizations around the world have established programs to try to save the threatened species. Millions of dollars and plenty of human effort have been devoted to the conservation and protection of endangered species.



IT'S ALL IN THE TEETH

The feature that differentiates the order Carnivora from other orders is a set of scissor-like carnassial teeth, specifically the upper last premolar and the lower first molar on both sides of the jaw. These are shearing teeth that slice animal flesh and crush bones. Each carnassial has ridges that grip meat, much like a fork that holds a piece of steak in place, so it does not slide around.

CONSERVATION STATUS

The World Conservation Union (IUCN) promotes the conservation of species, assesses their conservation status worldwide, and publishes an annual list of threatened species. The 2003 IUCN Red List of Threatened Species lists 125 carnivores as threatened. Five are listed as Extinct, no longer living: the Falkland Island wolf, the Caribbean monk seal, the sea mink, the Barbados raccoon, and the Japanese sea lion. The black-footed ferret is classified as Extinct in the Wild. The five Critically Endangered species, facing an extremely high risk of extinction, are the red wolf, the Ethiopian wolf, the Iberian lynx, the Mediterranean monk seal, and the Malabar civet.

The Endangered list of carnivores, facing a very high risk of extinction, consists of thirty-one species, made up of one dog,

one eared seal, one true seal, two bears, four cats, four mongooses, four viverrids, seven mustelids, and seven procyonids. Of these species, three are classified as endangered species in the United States. These are the sea otter, the northern sea lion, and the Hawaiian monk seal.

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DOGS, WOLVES, COYOTES, JACKALS, AND FOXES

Canidae

Class: Mammalia
Order: Carnivora
Family: Canidae
Number of species: 35 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Canids (members of the dog family) have a uniform body color with markings on the head and tail tip. Dogs typically come in black, black and white, brown, or red. The only exception is the African wild dog that has patches of black, white, and yellow. The canid's coat consists of a dense underfur and an overcoat of waterproof guard hairs, which retain a large amount of body heat for survival in very cold climates. Canids range in weight from the fennec fox, at about 3 pounds (1.3 kilograms), to the gray wolf, which can be as heavy as 175 pounds (80 kilograms). They are digitigrade, walking on their toes. This enables them to make quick stops and turns. A keen sense of smell comes from more than 200 million scent cells in the nose (humans have about five million scent cells).

GEOGRAPHIC RANGE

Canids live on every continent except Antarctica.

HABITAT

Most canids favor areas where forests meet open country. Some live in deserts. The Arctic fox and some gray wolves occupy the tundra. The bush dog and raccoon dog prefer thick forests near water. Canids have also adapted to human environments.

DIET

Canids primarily prey on other mammals. Large prey include elk and caribou, and small animals include rodents and rabbits.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

A SUPERB ATHLETE

The red fox is sometimes compared to an athlete, with its stamina and grace. It can hunt day and night, trotting more than 6 miles (10 kilometers) a day and running as fast as 30 miles (48 kilometers) per hour. When attacking prey, the fox uses a lunge-and-pounce move, first crouching very low, then jumping as far as 17 feet (5 meters) over ground to pounce on the surprised prey.

They also eat insects, berries, carrion (dead and decaying flesh), and garbage.

BEHAVIOR AND REPRODUCTION

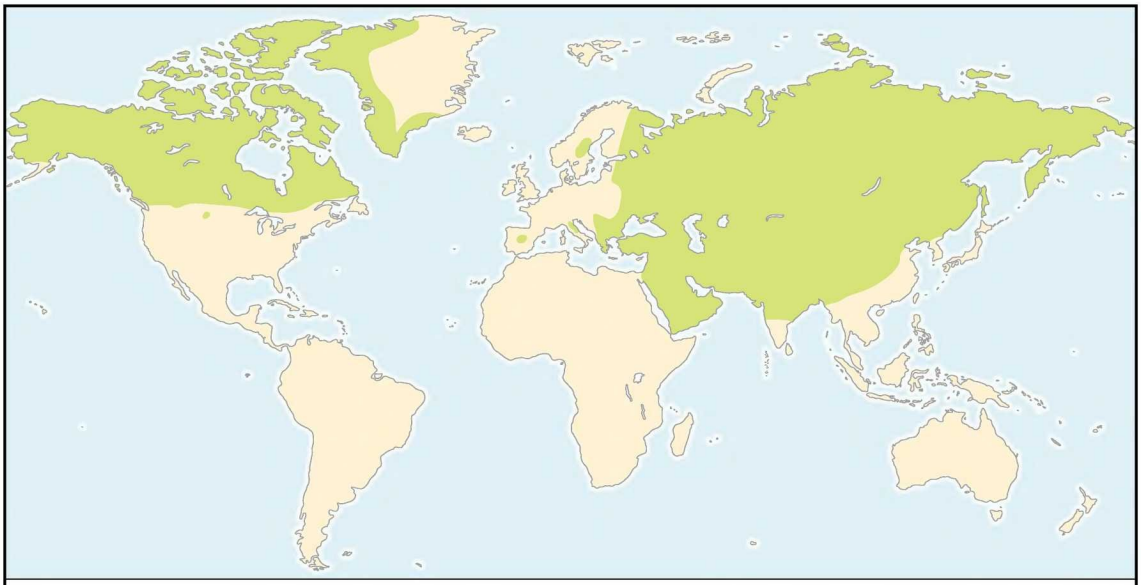
Canids live in packs, or social groups, ruled by a male and his partner. They communicate through vocalization, including barks, growls, and howls. They also use body language, such as erecting the fur, to show dominance. Canids mate for life, with the whole pack parenting the young.

CANIDS AND PEOPLE

Many canids are hunted for their fur. Humans have always felt threatened by certain canids, such as wolves and foxes. Canids sometimes prey on pets and livestock.

CONSERVATION STATUS

The United States lists the red wolf as Endangered, facing a very high risk of extinction in the wild, because of habitat loss due to deforestation and hunting. The IUCN classifies the African hunting wolf and the Ethiopian wolf as Endangered because of habitat loss resulting from human settlement and killing.



GRAY WOLF
Canis lupus

Physical characteristics: The gray wolf, ancestor to the domestic dog, is the largest of the wild dogs. Males weigh up to 175 pounds (80 kilograms). The smoky gray fur is tipped with brown or red hair. The long, bushy tail helps the wolf keep its balance when running, while large, padded paws provide traction (resistance to slipping), especially in snow.

Geographic range: Gray wolves, although sparsely populated, occur in more than fifty countries, including the United States, Canada, Russia, Spain, Portugal, and Italy.

Habitat: Gray wolves live in deciduous forests inhabited by their main prey, herbivores (plant-eaters), such as deer, elk, and moose. They also thrive in the tundra and desert, where they prey on small animals.

Diet: Packs hunt large ungulates, or hoofed animals, such as elk and deer, but lone wolves usually hunt smaller animals, including rabbits,



Gray wolves live in packs of as many as thirty individuals. The pack uses facial expressions, body postures, and vocalizations to communicate. (Tom Brakefield/Bruce Coleman Inc. Reproduced by permission.)

beavers, and mice. Wolves also eat carrion and prey on domestic livestock, insects, fish, and berries. In the Arctic, they eat birds, seals, and caribou. An adult eats an average of 5.5 to 13 pounds (2.5 to 6 kilograms) of food per day. If food is unavailable, it can fast for two or more weeks.

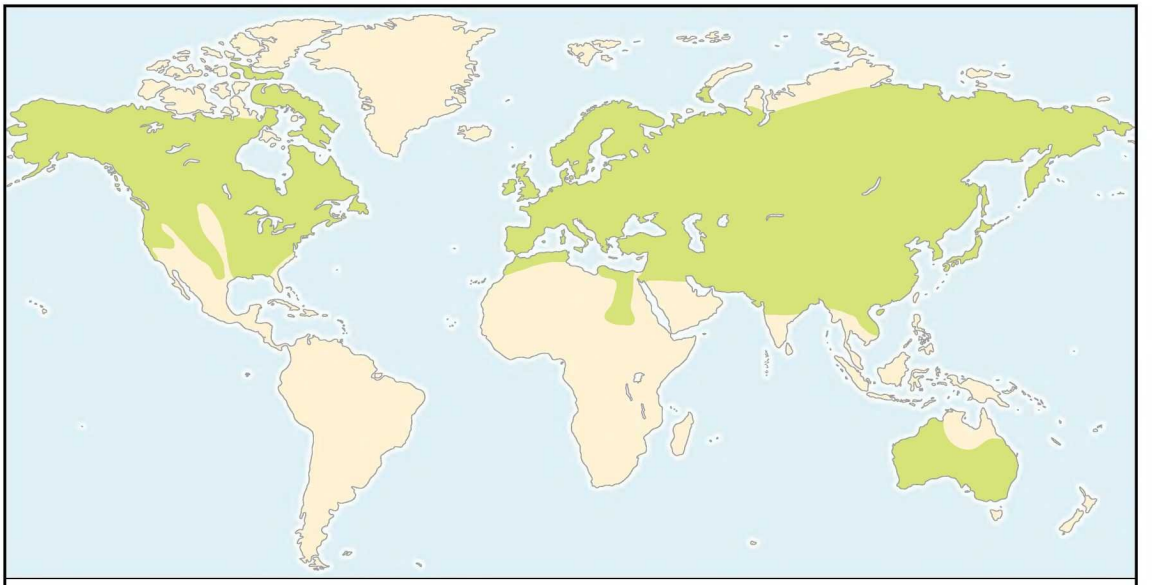
Behavior and reproduction: Gray wolves live in packs of as many as thirty individuals, consisting of parents, offspring, and relatives. The top dogs are the dominant male and female, called the alpha pair. They alone breed and feed first. However, younger and more powerful members may replace the leaders at any time. Sometimes, couples pair off and leave the pack.

The pack uses facial expressions, body postures, and vocalizations to communicate. Members show submission by licking the leader's face or rolling on their back. Howling is used to warn other packs that a certain territory is taken, to announce the start of a hunting expedition, or to summon members to help defend a kill. The pack hunts together, traveling for up to 30 miles (about 48 kilometers) a day.

Gray wolves mate for life, producing six or seven pups a year. Pack members care for the young when the mother goes hunting. Adults feed weaned pups regurgitated (re-GER-jih-tate-ed) food, partly digested food kept in the stomach and brought up to the mouth.

Gray wolves and people: Although humans have always felt threatened by wolves, no attack has ever been reported. In fact, wolves avoid human contact. Some hunters regard wolves as competitors for big game (wild animals hunted for sport).

Conservation status: In 1973, on the brink of extinction from extensive killing, gray wolves were placed under the protection of the newly enacted U.S. Endangered Species Act. They were subsequently reintroduced to the Yellowstone National Park. Some states established programs to protect them. Since then, the gray wolf populations have increased. In 2003, gray wolves (except those in the Southwest) were reclassified as Threatened, or likely to become extinct in the foreseeable future. The IUCN does not list the gray wolf as a threatened species worldwide. ■



Red fox *(Vulpes vulpes)*

RED FOX
Vulpes vulpes

Physical characteristics: The largest of all foxes, the red fox is reddish brown with a white- or black-tipped bushy tail. It weighs 6 to 15 pounds (2.7 to 6.8 kilograms). The snout, backs of the ears, and the lower legs and feet are black. Sensitive, pointed ears can detect prey from 150 feet (45 meters) away. Sensitive whiskers guide the fox in inflicting a killing bite on the prey's body.

Geographic range: The most widely distributed of all canids, the red fox is found in the United States, Canada, Australia, Europe (except Iceland), and Asia.

Habitat: Red foxes prefer a mixture of woodlands and open areas. They thrive in the tundra and desert, where they prey on animals foraging for food at night. They live close to humans in farmlands, the suburbs, and cities, where rabbits, rodents, and garbage pits abound.

Diet: Red foxes prefer rodents but also feed on rabbits, squirrels, insects, earthworms, birds, and carrion. They eat fruits and human



Red foxes are active at dusk, night, and dawn, and do their hunting then. They hunt for animals such as these arctic ground squirrels. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

leftovers. Foxes eat about 1 to 3 pounds (0.5 to 1.5 kilograms) of food a day. When full, they continue to hunt for prey, but unlike wolves who gorge themselves, foxes cache (store in a hidden place) excess food. They bury the food in a hole, occasionally digging it up, then reburying it.

Behavior and reproduction: Red foxes are crepuscular (kri-PUS-kyuh-lur; active at dawn and dusk) and nocturnal (active at night), timing their foraging habits with those of their prey. They live alone, except when breeding. Males and females pair off in late winter or early spring, producing five to thirteen kits. Fathers provide food to the family, and nonbreeding daughters or sisters may share the den and help in child rearing. Red foxes are playful creatures, engaging in games of chasing and mock fighting.

Red foxes and people: Red foxes are prized for their fur and for the sport of fox hunting. However, a love-hate relationship exists between foxes and humans. Some suburbanites treat them as pets, putting out food for them. Others detest them for stealing house pets and livestock.

Conservation status: The red fox is not a threatened species. ■



MANED WOLF
Chrysocyon brachyurus

Physical characteristics: The maned wolf has a long, black mane on its neck down to the middle of its back. The body is golden-red, and the snout and legs are black. The throat, tail tip, and ears have white markings. Very long legs allow for a better view over the tall grasses of its habitat and for high leaps to catch prey and hold it down. It covers great distances, moving the legs of each side of its body together, unlike other canids that move their legs alternately. It weighs 44 to 51 pounds (20 to 23 kilograms) with a shoulder height of 29 to 34 inches (74 to 87 centimeters).

Geographic range: Maned wolves are found in Argentina, Bolivia, Brazil, Paraguay, Peru, and Uruguay.

Habitat: Maned wolves live in grassland that supports small mammals, reptiles, and insects. They also occupy scrub forests, home to a tomato-like fruit that makes up half of their diet.

Diet: A tomato-like fruit, *Solanum lycocarpum*, which comprises 50 percent of the wolf's diet, protects it against giant kidney worm infestation. Although known for preying on domestic chickens, maned wolves prefer rodents, rabbits, and armadillos. Occasionally, they eat birds, lizards, and seasonal fruits, such as guavas and bananas.

Behavior and reproduction: Maned wolves are the most solitary of the canids. Males and females only get together to breed, producing a litter of two to six pups. They normally hunt at night. White markings on the throat, tail tip, and on the large, erect ears serve as visual signals at a distance. They further communicate using harsh barks. Quite territorial, they use urine and feces as boundary markings.



Maned wolves usually live alone. They meet up with other wolves only at breeding time. (Illustration by Wendy Baker. Reproduced by permission.)

Maned wolves and people: The fur of the maned wolf is worn in South America as a good luck charm. Native Brazilians harvest the right eye from live wolves, believed to bring luck with women and gambling.

Conservation status: The maned wolf is listed as Endangered in its native countries due to habitat loss to overgrazing by cattle and deforestation, particularly for soybean farming. The IUCN classifies the maned wolf as Near Threatened. ■

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BEARS

Ursidae

Class: Mammalia

Order: Carnivora

Family: Ursidae

Number of species: 8 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Bears have big heads, round ears, small eyes that face forward, very short tails, and stocky legs. They are plantigrade, walking on the heels and soles of their feet like humans do. Each paw has five curved claws that are not retractable, or cannot be pulled back.

Bears come in many colors, from the familiar black, brown, and white to blonde, cinnamon, and blue-gray. Some have a yellow, orange, or white chest marking in the form of a patch, a letter V or U, or a short horizontal line. Spectacled bears are called "spectacled" because of the light markings around their eyes. Among Malayan sun bears, the smallest species, males are 4 to 5 feet (1.2 to 1.5 meters) long and weigh between 60 and 150 pounds (27 and 70 kilograms). In comparison, male polar bears on average are 8 to 9 feet (2.4 to 2.7 meters) long and weigh 900 to 1,300 pounds (400 to 590 kilograms). Females, or sows, of all species are usually smaller than males, or boars.

GEOGRAPHIC RANGE

Spectacled bears are found in Bolivia, Colombia, Ecuador, Peru, and Venezuela. Brown bears live in the United States, Canada, Europe, and Asia. American black bears inhabit the United States, Mexico, and Canada. Malayan sun bears, sloth bears, and Asiatic black bears thrive in Asia. Giant pandas live in China, while polar bears occupy the Arctic regions.

SURVIVING IN THE ARCTIC

The polar bear has a dense underfur next to its skin and a water-repellent outer fur, called guard hairs. The hairs are clear, hollow tubes that conduct sunlight to the black skin, where heat is absorbed. The clear tubes reflect sunlight, making the outer coat appear white. Blending in with the whiteness of the ice and snow, the polar bear can easily sneak up on its prey. The hollow hairs also keep the bear afloat when swimming. A thick layer of blubber, or fat, further insulates the body from the cold. Compact ears also prevent heat loss. Fur-covered feet serve as snowshoes, while thickly padded soles provide traction against slippage on ice.

HABITAT

Bears live in a variety of habitats. For example, spectacled bears can be found in the dense rainforests of South America, and Malayan sun bears thrive in tropical rainforests in Southeast Asia, while polar bears live on the Arctic tundra.

DIET

Bears are generally omnivores, eating both plants and animals. However, the polar bear is almost entirely carnivorous, eating mainly ringed seals, while the giant panda lives exclusively on bamboo. The sloth bear favors termites and ants. The other species, while preferring plant sources, also eat young animals and fish.

BEHAVIOR AND REPRODUCTION

Bears maintain a solitary lifestyle, living alone, except when mating and rearing their young. When food is plentiful, they share but keep their personal space. Bears are usually crepuscular (active at dawn and dusk). Their excellent memory enables them return to past food sources. They are agile tree climbers and fast runners, reaching speeds of up to 30 miles per hour (48 kilometers per hour). Polar bears and Asiatic black bears are expert swimmers.

Most bears mate during spring or summer, but the fertilized egg undergoes delayed implantation, during which it takes up to six months to attach to the uterus and start developing. As a result, cubs are born tiny, ranging in weight from about 11 ounces (325 grams) in sun bears to 21 ounces (600 grams) in polar and brown bears. Most sows have two cubs, although some have as many as five. Depending on the species, cubs may stay with their mothers for one to more than four years.

BEARS AND PEOPLE

People hunt some bear species for meat and trophies. Some Asian cultures use bear parts to treat diseases. In addition, many zoos house bears as exhibit animals.

CONSERVATION STATUS

The giant panda is considered Endangered, facing a very high risk of extinction, or dying out, in the wild. The spectacled, sloth, and Asiatic black bears are considered Vulnerable, facing a high risk of extinction in the wild. These and other bear species are threatened by declining populations due to losing habitat, as humans clear more land for agriculture, mining, and other activities.

SPECIES ACCOUNTS



AMERICAN BLACK BEAR
Ursus americanus

Physical characteristics: Although most American black bears are black, some are brown, cinnamon, blue-gray, or even white. Siblings (brothers and sisters) may have different colors. Some bears have a white chest marking. They stand about 5 feet (1.5 meters) tall. Males weigh about 250 to 350 pounds (110 to 160 kilograms), almost twice as much as females (150 to 175 pounds, or 70 to 80 kilograms).

Geographic range: American black bears are found in the United States, Mexico, and Canada.

Habitat: American black bears thrive in forested regions, wetlands, and meadows. They range in the frozen tundra (treeless plain) of



American black bear cubs are usually born in the winter and stay with their mothers for up to two years. (Tom Brakefield/Bruce Coleman Inc. Reproduced by permission.)

Alaska and Labrador, Canada. They are also found around campsites and other places where human food and garbage are available.

Diet: American black bears are mostly herbivores, preferring berries, fruits, grasses, and roots. With strong claws, they dig up insects in the ground and pry open honeycombs. In the absence of plant food, they eat fish, young birds, and small mammals. They also feed on carrion (dead and decaying flesh) and campsite leftovers.

Behavior and reproduction: American black bears are active at dawn and dusk, sleeping or resting most of the day and night. They are, however, adaptable, adjusting their schedule to mate or to avoid humans or predators (animals that hunt them for food). Skillful tree climbers, they scale tree trunks with their curved claws to escape predators, such as timber wolves and grizzly bears. Except for mothers and cubs, these bears are loners, although they may feed close together at an abundant food source. From late spring to early summer, adults breed for a few days, then go their separate ways. On average, two cubs are born in mid-winter. They remain with their mothers for up to two years.

American black bears and people: People hunt American black bears for meat and trophies. Poachers, or illegal hunters, kill the animals for body parts believed to have healing powers. The bears very

rarely attack humans, although they may become aggressive in places where human food is found. Some bears damage cornfields and beehives.

Conservation status: American black bears are not in danger of extinction (dying out). ■



GIANT PANDA
Ailuropoda melanoleuca

Physical characteristics: Giant pandas are white, with black fur around the eyes and on the ears, shoulders, chest, and legs. Each front paw has six toes, the last toe functioning as a thumb. Actually an extension of the wrist bone, the oversized thumb helps the panda grasp bamboo stems. Powerful jaws and large molar teeth help grind the tough bamboo.

Giant pandas have bigger heads and shorter legs than other bears. Adults are about 5.5 to 6 feet (1.7 to 1.8 meters) in body length. Males weigh about 175 to 280 pounds (80 to 125 kilograms), and females weigh about 155 to 220 pounds (70 to 100 kilograms).

Geographic range: Pandas are found in southwestern China.

Habitat: Giant pandas live in mountainous bamboo forests.



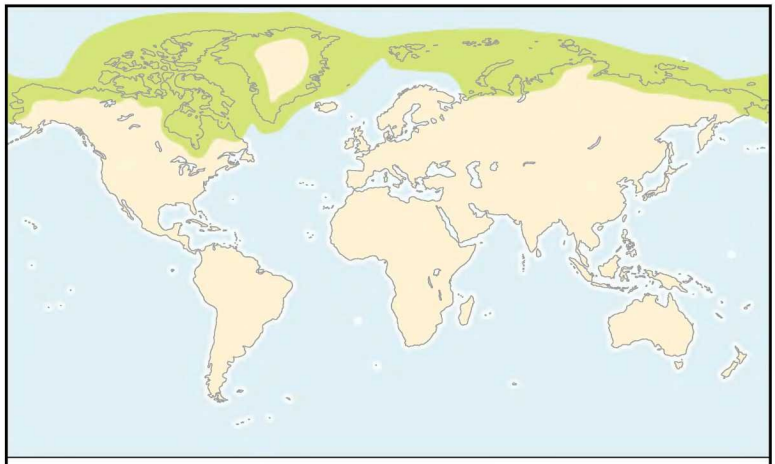
Giant pandas live in bamboo forests in China. They are an important symbol for conservation. (© Keren Su/Corbis. Reproduced by permission.)

Diet: The giant pandas' diet consists almost entirely of bamboo. Occasionally they eat bulbs and small animals, such as bamboo rats and musk deer fawns.

Behavior and reproduction: Although giant pandas mostly live alone, they communicate through different sounds, including squeals, honks, and snorts. They share community scent-marking areas, sending messages through anal-genital secretions rubbed on surfaces. They also use urine to mark tree trunks, with the males doing so on handstands for higher markings. Giant pandas mate during spring. Sows give birth to twins half of the time, but usually only one cub survives when two are born.

Giant pandas and people: Giant pandas are major attractions in zoos around the world. In addition, their endangered status has made them symbols for conservation.

Conservation status: The giant panda is Endangered, driven from its habitat by human activities, such as deforestation, or the clearing of land, for farming. The panda cannot reproduce fast enough to recover its losses. Females mate only in the spring and within just a two-to-three-day period. Only one cub survives, and the mother waits up to three years to mate again. ■



POLAR BEAR
Ursus maritimus

Physical characteristics: Polar bears, the largest land carnivores, have a thick white or yellowish coat, a long body and neck, black nose, and small eyes and ears. The front paws, webbed like a duck's feet, function as paddles for swimming. The long, sharp claws are used for grasping and killing prey. On average, adult males weigh about 900 to 1,300 pounds (400 to 590 kilograms) and stand 8 to 9 feet (2.4 to 2.7 meters). Adult females weigh about 450 to 600 pounds (200 to 270 kilograms) and stand 6 to 7 feet (1.8 to 2.1 meter).

Geographic range: Polar bears live in the icy Arctic Ocean and in the countries that extend into the ocean: United States (Alaska), Canada, Russia, Norway, and Greenland (a territory of Denmark).

Habitat: Polar bears prefer the Arctic pack ice, formed when big pieces of thick ice are frozen together. In summer, when the ice melts, they live on land, staying close to the water.

Diet: Polar bears eat mainly ringed seals and occasionally bearded seals. They also prey on walruses and belugas. In warmer months, they hunt ducks and rabbits, as well as feed on mussels, berries, and kelp, a brown seaweed.



Polar bears give birth to one or two cubs at a time. The cubs stay with their mothers for at least two and a half years. (John Swedberg/Bruce Coleman Inc. Reproduced by permission.)

Behavior and reproduction: Polar bears mostly keep to themselves but do not defend a particular home territory. They gather on shore to share beached whales and walruses. A bear may share its food with another if the latter begs submissively through body language, such as nodding its head. Polar bears are very tidy, washing themselves in the ocean after meals.

Polar bears mate in the spring. In the fall, after stuffing herself with food, the pregnant sow digs a den in deep snow and hibernates while awaiting childbirth. Cubs that are born in winter nurse until spring, with the mother living off the fat storage in her body. Cubs stay with their mothers for at least two and a half years.

Polar bears and people: Once hunted as trophies and for their fur and meat, polar bears are now protected by the laws of the five countries where they live.

Conservation status: Some scientists believe that, within a hundred years, polar bears may become extinct if Earth's temperature continues to rise. Warmer temperatures cause more arctic ice to melt, preventing

the bears from hunting their primary food source, the ringed seals, on the sea ice. ■

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family CHAPTER

RACCOONS AND RELATIVES
Procyonidae

Class: Mammalia
Order: Carnivora
Family: Procyonidae
Number of species: 16 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Procyonids (members of the Procyonidae family) range in size from the ringtail, at 2 pounds (1 kilogram), to the northern raccoon, at 35 pounds (16 kilograms). Most have a rounded head. The erect ears may be rounded or pointed. The snout may be short or long. Except for kinkajous, procyonids have long tails with alternating dark and light rings. In the kinkajou, the ringless tail is prehensile, able to grab on to tree branches. Fur coloration ranges from pale yellowish gray (ringtail) to reddish brown (red panda) to grayish black (white-nosed coati [kuh-WAH-tee]). Most have facial markings. Each paw has five toes with short, recurved claws, or claws that curve back. Procyonids are generally plantigrade, walking on the heels and soles of their feet instead of on their toes.

GEOGRAPHIC RANGE

Except for red pandas, procyonids are found throughout Central America (including Costa Rica and Panama), South America (including Argentina, Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela), the United States, Canada, Mexico, Germany, and Russia. Red pandas live in Asia, including China, India, Nepal, and Tibet.

HABITAT

Some procyonids prefer forested areas close to streams and rivers where they can fish for food. Many inhabit a mixed coniferous-deciduous forest, with rich vegetation and canopies (uppermost forest layers made up of the spreading branches of

DO RACCOONS WASH THEIR FOOD BEFORE EATING IT?

The northern raccoon's species name *lotor* comes from the Latin meaning "washer." This relates to captive raccoons' tendency to dunk their food in water. Some scientists believe that captive raccoons are trying to duplicate their behavior in the wild, where they search for and grasp food underwater using their sensitive forepaws. In captivity, when raccoons dip their food in water, they give the impression of washing the food before eating it.

trees) that provide sleeping and resting sites. Some have established residence in farmlands, cities, and suburban areas.

DIET

Procyonids are omnivorous, consuming both meat and plant food. However, ringtails prefer animal matter (rodents, insects, and birds), while red pandas eat mainly bamboo leaves. Fruits are the favorite food of kinkajous and olingos.

BEHAVIOR AND REPRODUCTION

Procyonids are adept climbers and usually live in trees. Of all the species, the kinkajou rarely leaves the forest canopy. Groups of kinkajous usually feed together in fruit trees. Some species are solitary, while others live in pairs or in family groups. They are nocturnal (active at night), except for the coatis, which are diurnal (active during the day). Some communicate through vocalizations, including chirps, screams, hisses, and barks. Only the red panda is territorial, claiming an area of land for its own and defending it against intruders.

Most procyonids do not mate for life. Breeding occurs commonly in the spring. In warmer climates, breeding may occur throughout the year. Females give birth to one to seven cubs and raise the cubs by themselves.

PROCYONIDS AND PEOPLE

Procyonids are hunted for their meat and fur. Raccoons and coatis are considered pests for attacking chickens and damaging crops. The northern raccoon is a carrier of rabies, an often deadly disease affecting the central nervous system and transmitted through the raccoon's saliva.

CONSERVATION STATUS

The IUCN lists the red panda as Endangered, facing a very high risk of extinction in the wild, due to habitat loss and fragmentation (division of a habitat into small areas, resulting in insufficient food sources and home range) as a result of forest clearing. They are hunted by humans for their fur and preyed on by domestic dogs. Seven other procyonid species are considered Endangered as well.



NORTHERN RACCOON
Procyon lotor

Physical characteristics: The northern raccoon wears a black "bandit" face mask, has a large rounded head, rounded ears, and a pointed snout. The tan underfur topped with gray to black guard hairs gives it a grizzled appearance. The bushy tail has alternating black and white rings. Five long front toes work like human fingers for catching food and putting it into the mouth. The sensitive skin on the toes helps raccoons distinguish the texture of their food. In the suburbs and cities, raccoons use these toes to pry open trash containers. Raccoons are plantigrade, walking on the soles and heels of their feet. Body length is 18 to 25 inches (50 to 65 centimeters), and the tail measures another 8 to 12 inches (20 to 30 centimeters). They weigh 10 to 35 pounds (4 to 16 kilograms).



In cold climates, northern raccoons sleep in their dens for days or even months, living off fat reserves from summer and autumn feedings. They do not truly hibernate, because they get up during warm spells. (Leonard Lee Rue, III/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Northern raccoons are found in the United States, Mexico, Canada, Panama, the Netherlands, Russia, and Germany.

Habitat: Raccoons prefer forested areas, especially those near streams and rivers where they can forage for food. Forests provide nuts, berries, and tree hollows for dens. Highly adaptable, raccoons are equally at home in farmlands, cities, and the suburbs, inhabiting barns and attics.

Diet: Northern raccoons are opportunistic feeders, eating any food that is available. They enjoy fruits, berries, cereal grains, nuts, fish, crayfish, frogs, insects, and bird eggs. They dine on corn in rural areas and have adapted to eating garbage in suburban and urban areas.

Behavior and reproduction: Northern raccoons are solitary, except when mating, raising young, or gathering at human environments, such as garbage pits. They are nocturnal, sometimes spending the day

resting on branches high up in trees. Expert climbers, they can descend a tree headfirst. They are also good swimmers. Although they typically walk leisurely, they can run as fast as 15 miles per hour (24 kilometers per hour).

Raccoons mate in late winter, with males having several partners. In the spring, the female gives birth to a litter of one to seven cubs in a tree hollow or abandoned animal burrow (a hole or a tunnel). The mother sometimes carries a newborn by the nape of the neck, the way cats do with kittens. The male does not participate in parenting. In cold climates, raccoons sleep in their dens for days or even months, living off fat reserves from summer and autumn feedings. However, they do not truly hibernate, getting up during warm spells.

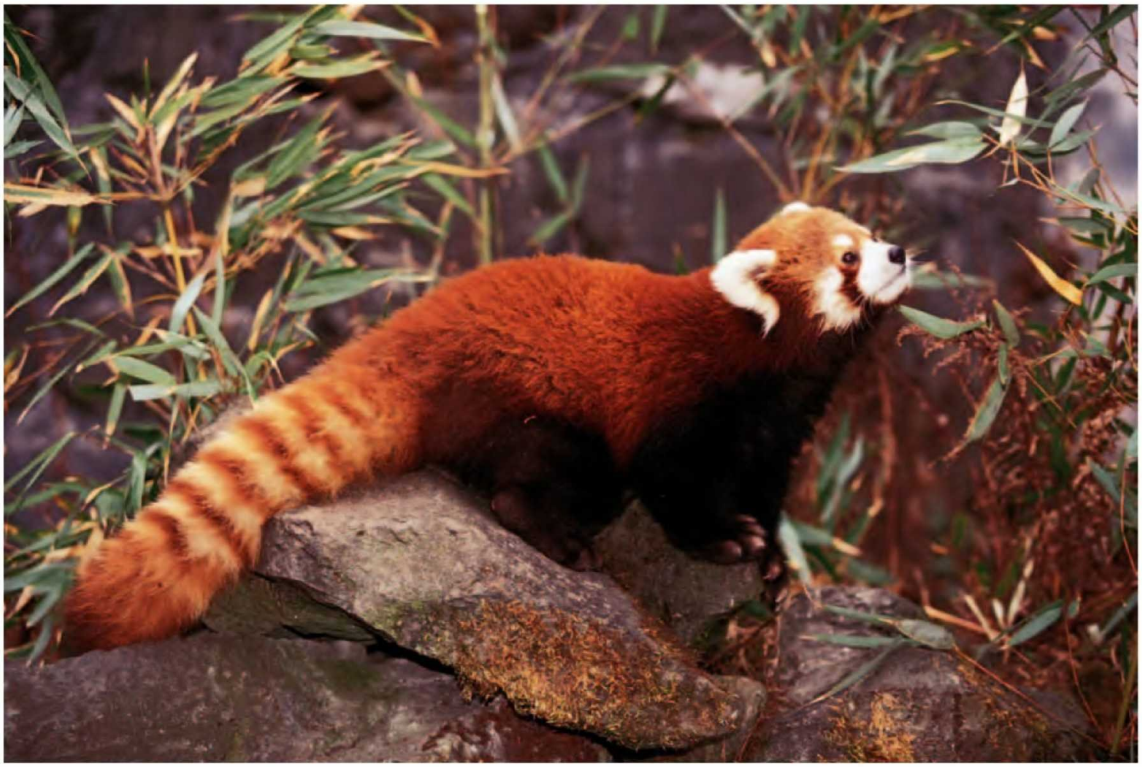
Northern raccoons and people: Raccoons are hunted for their meat. Their fur is made into caps and coats. They are considered pests for raiding cornfields, chicken coops, and garbage bins. They carry the rabies virus, which can be passed on to humans through bites.

Conservation status: The northern raccoon is not a threatened species. ■



RED PANDA
Ailurus fulgens

Physical characteristics: The red panda has a body length of 20 to 24 inches (50 to 60 centimeters) and a tail length of 12 to 20 inches (30 to 50 centimeters). Its light weight of 6.5 to 11 pounds (3 to 5 kilograms) allows for climbing higher, thinner tree branches, with the long, bushy tail helping keep its balance. The tail has alternating reddish brown and tan rings. Reddish brown waterproof guard hairs protect a dense woolly underfur. Brownish black fur covers the back of the ears, belly, throat, and legs. Large pointed ears fringed with white sit atop a round head. White fur covers the cheeks and the areas over the small eyes and around the black nose. Large reddish brown tear marks run from the eyes to the corners of the mouth.



The red panda has to eat lots of leaves to get the nutrition it needs from them—it spends thirteen hours eating up to 2 to 3 pounds (1 to 1.4 kilograms) per day. (© Tim Davis/Photo Researchers, Inc. Reproduced by permission.)

Each front paw has an extended wrist bone, used for grasping bamboo, its main food. Powerful jaw muscles and broad teeth are adapted for chewing the tough bamboo. Although flat-footed, the panda is considered semiplantigrade because the heels of its back feet do not touch the ground. Thick white fur keeps the soles warm in cold weather. The sharp claws can be pulled back like a cat's to keep from getting dull when walking on hard surfaces.

Geographic range: The red panda occurs in Assam, Bhutan, China, India, Myanmar, Nepal, Sikkim, and Tibet.

Diet: The red panda is a folivore, eating almost exclusively the leaves of bamboo. On rare occasions, it eats fruits, berries, acorns, other grasses, as well as bamboo rats, insects, young birds, and bird eggs. It spends up to thirteen hours consuming 2 to 3 pounds (1 to 1.4 kilograms) of leaves. The panda has a carnivore's digestive system that is not adapted for processing plant fiber. Since it gets very little nutrients from the small amount of digested food, it has to eat plenty of leaves.

Behavior and reproduction: Red pandas sleep and rest in tree branches. They are active at night, daybreak, and dusk, mostly foraging for bamboo. Although loners, they communicate through vocalizations and body language. They scent mark territorial boundaries with anal secretions, urine, and feces. Sweat glands between the paw pads secrete fluid that helps pandas find their way around their home range. While territorial, red pandas are not aggressive. They warn each other off by bobbing their heads, raising the forepaws, and hissing.

Pandas pair off to mate, separating soon after. Due to delayed implantation during which the fertilized egg does not attach to the uterus for up to three months, newborns weigh just about 4.4 ounces (about 120 grams). The litter may consist of one to four cubs, but typically just two. To produce enough milk, the mother increases her bamboo intake threefold. The cubs stay with her for about a year or until she is ready to breed again.

Red pandas and people: Red pandas are popular zoo animals. Some Asian cultures make caps from the fur, believed to bring good fortune, especially to newlyweds.

Conservation status: The IUCN lists the red panda as Endangered due to habitat loss and fragmentation resulting from clearing forests for agriculture, timber, and fuel. Poachers (illegal hunters) harvest fur for trade. ■

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WEASELS, BADGERS, SKUNKS, AND OTTERS

Mustelidae

Class: Mammalia
Order: Carnivora
Family: Mustelidae
Number of species: 65 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Mustelids, members of the family Mustelidae, may either have a slim, elongated body and long tail like weasels, mink, martens, and otters, or a stocky body and short tail like badgers and wolverines. Some have webbed feet for swimming. Their fur may be uniform in color, striped, or spotted. They may be white, silver, brown, or black in color. The smallest mustelid, the least weasel, is also the smallest carnivore, weighing about 1.76 ounces (50 grams).

GEOGRAPHIC RANGE

Mustelids are found on all continents except Antarctica. They live in such countries as the United States, Canada, Mexico, Japan, Mongolia, Great Britain, Ireland, Finland, Algeria, and Morocco.

HABITAT

Mustelids inhabit a wide range of habitats. Sea otters live exclusively in the ocean, while river otters forage for food in water but den (make a den, or place to live) on land. Some live in the desert like the honey badgers, and others in tundra marshes, like ermines. Some take over their prey's dens, such as black-footed ferrets. Others, including skunks and badgers live near humans under abandoned buildings, in golf courses, and in parks.

DIET

Mustelids are either true carnivores, such as weasels, martens, and otters, feeding mainly on meat, or omnivores, like skunks, badgers, and tayras, consuming both animals and plants. Their

diet consists of rodents, rabbits, reptiles, birds, insects, fruits, roots, and seeds.

BEHAVIOR AND REPRODUCTION

Mustelids are mostly nocturnal, active at night. Most are solitary, except for otters and European badgers, which form social groups. Some are excellent swimmers and skillful climbers. Musk secreted by anal glands is used to scent mark territory, as a defense mechanism in skunks, or for communication.

Only the giant otter mates with just one partner. Some species experience delayed implantation, during which the fertilized egg waits several months before attaching to the uterus to continue development. Females have a litter of one to twelve offspring, depending on the species. Males do not participate in parenting.



DANCE OF DEATH

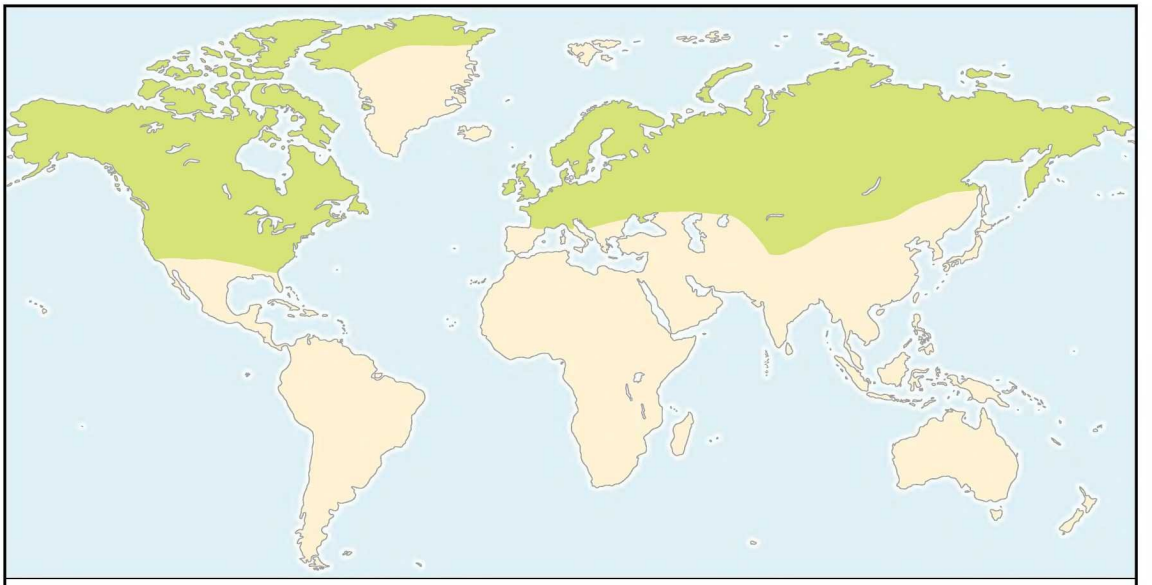
The weasel is known for its dance of death, actually a ploy to catch prey. The weasel stands in full view of a potential audience. It dances, spins, does somersaults, and jumps up and down. Curious onlookers, including rabbits and birds, watch transfixed. Some may draw closer for a better look. The weasel then suddenly stops dancing, rushes the closest spectator, and puts a killing bite on its neck.

MUSTELIDS AND PEOPLE

Mustelids are hunted by humans for their fur. Ferrets are kept as pets, while otters are kept in zoo exhibits. Some are considered pests for spraying musk and for digging up lawns and golf courses. Others carry diseases.

CONSERVATION STATUS

The United States classifies the black-footed ferret as Endangered due to habitat loss to agriculture and the declining population of prairie dogs, its main prey. The IUCN lists the black-footed ferret as Extinct in the Wild, and four otters, two weasels, and one mink as Endangered, facing a very high risk of extinction in the wild.



Ermine *(Mustela erminea)*

SPECIES ACCOUNTS

ERMINE
Mustela erminea

Physical characteristics: Ermines have slender bodies, useful for pursuing prey through narrow passages. They have a triangular head, rounded ears, and a long neck. Long, sensitive whiskers help track prey. The fur changes with the season and acts as a camouflage (KAM-uh-flaj), white in winter to blend in with the snow and brown with yellowish undersides and feet in summer. Their tails measure 2 to 4 inches (3 to 10 centimeters) and have black tips all year-round, which helps distract attention from the predator's body. The body is 6 to 10 inches (15 to 25 centimeters) long. Ermines weigh just 4.4 to 12.3 ounces (125 to 350 grams).

Geographic range: Ermines live in the United States and Canada, Asia (including Japan, India, Mongolia, and Siberia), Europe (including Scandinavia and Ireland), Algeria, and Greenland.

Habitat: Ermines prefer forests, grasslands, and marshy plains that provide cover and prey. They live in tree roots, hollow logs, and



An ermine turns from its brown fur color for summer to its white color for winter. The fur changes with the season and acts as a camouflage, helping the animal blend in with its surroundings. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

burrows, holes or tunnels, inherited from their prey, usually lining their nest with fur from their prey.

Diet: Ermines are carnivorous, eating rodents, rabbits, ground squirrels, birds, and insects. They eat as much as half their body weight in food and store extra food for later use.

Behavior and reproduction: Ermines are loners, except for breeding pairs and mother-offspring groups. They use musk, an anal secretion, to mark territory and as a signal for mating. Ermines also communicate through squeaks, trills, and screeches. They are active throughout the day and night. Expert hunters, they prey on animals several times their size, killing them with a bite at the back of the neck.

Ermines mate in late spring to early summer, but the fertilized egg undergoes delayed implantation, waiting nine to ten months before attaching to the uterus to resume development. Females give birth to one or two litters of four to eight offspring the following spring and raise the young alone. Females become sexually mature, capable of

reproducing, at two months of age, while males attain sexual maturity at one year. It is not unusual for adult males to mate with very young females, sometimes before they are weaned from their mother's milk. This ensures new generations even if males might not be around for mating.

Ermines and people: Some people value ermines for killing rats and mice. Americans used the black-tipped tails as ornaments, while European royalties made ceremonial robes out of the whole fur.

Conservation status: Ermines are not a threatened species. ■



STRIPED SKUNK
Mephitis mephitis

Physical characteristics: Striped skunks have silky black fur. A white stripe starts on top of the head, and separates into two stripes down the sides of the back. Anal glands produce strong-smelling musk that protects against intruders. Sharp forefeet claws are designed for digging. The body is 13 to 18 inches (33 to 45 centimeters) long, and the tail measures 7 to 10 inches (18 to 25 centimeters). They weigh about 4 to 18 pounds (2 to 8 kilograms).

Geographic range: Striped skunks live in the United States, Canada, and Mexico.

Habitat: Striped skunks prefer a mixture of farmland, forest, and grassland, where they den in barns, under wood piles and in underground burrows. They adapt to desert conditions, sleeping in cool

A young striped skunk forages for insects. Rodents and insects make up most of a skunk's diet. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)



dens during the day and foraging at night when their prey are active. They also thrive in the tundra, especially in marshes during the summer thaw. Skunks also live in suburban areas.

Diet: Striped skunks are opportunistic feeders, eating whatever food is available. Their main diet consists of small rodents and insects. They also consume reptiles, frogs, worms, birds, bird eggs, fruits, and seeds.

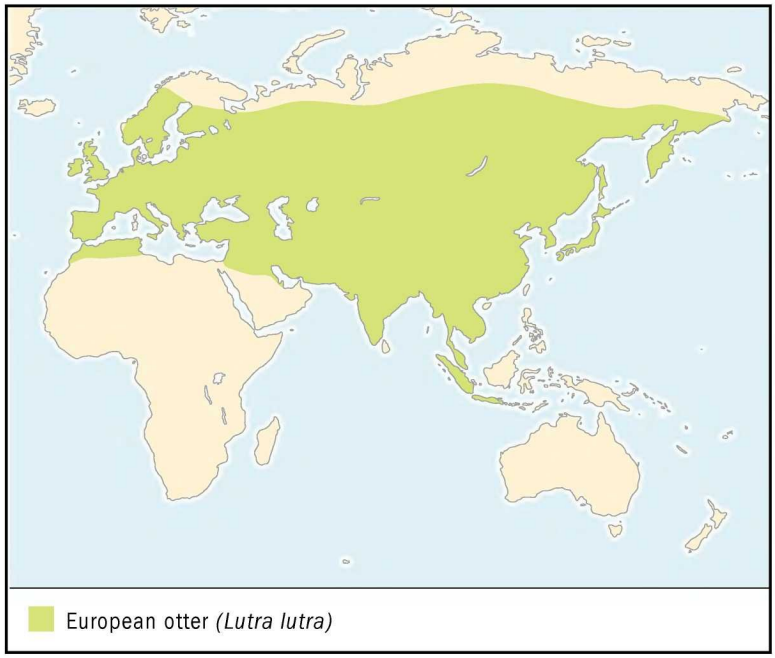
Behavior and reproduction: Striped skunks are active at night. They dig underground dens, use a hollowed tree stump, or share a home with rabbits and raccoons. During severe winters, they become inactive for

several months, living off stored fat in their body. They do not truly hibernate, moving about when the weather warms up. Males are typically solitary but several females may den together. Mating occurs in February and March, with the males having several partners. Litters of four to ten young are born in May and are raised by the females. The young stay with the mother for up to two years.

When threatened, striped skunks give warning by stamping their front feet and growling. If the intruder does not leave, skunks raise their tails and spray a foul-smelling musk. The spray can travel up to 10 feet (3 meters), causing nausea and burning the eyes and nose.

Striped skunks and people: Skunk musk, with its odor removed, is an important perfume ingredient that enables perfume to evaporate slowly and emit fragrance longer. Striped skunks kill rodents and insects that destroy crops but they sometimes assault chickens and damage beehives. In North America, they are carriers of rabies, an often deadly disease affecting the central nervous system and transmitted through the skunk's saliva.

Conservation status: Striped skunks are not threatened. ■



EUROPEAN OTTER
Lutra lutra

Physical characteristics: European otters are river otters with an elongated body and a broad, flat head. When diving, otters close the valves in their ears and nose to keep water out. The fully webbed feet work like paddles, while the flattened, muscled tail acts as a rudder for steering underwater. Sensitive whiskers help them find food, especially in muddy waters. The dark brown fur has two layers: a dense, wooly underfur and coarse, waterproof guard hairs. European otters weigh about 15 to 33 pounds (7 to 15 kilograms). Their body length is 25 to 33 inches (65 to 85 centimeters), and the tail length is 15 to 20 inches (36 to 52 centimeters).

Geographic range: European otters are found in Europe including Great Britain, France, Portugal, Spain, Ireland, Norway, Greece, Scotland, Albania, and Finland, Asia including Japan, Taiwan, Java, Sri Lanka, and Sumatra, and North Africa.

Habitat: European otters are found in freshwater habitats including rivers, streams, lakes, and ponds. They live along seashores where



European otters search for food in the water. When diving, they close valves in their ears and nose to keep water out. (Illustration by Gillian Harris. Reproduced by permission.)

freshwater pools are formed from abundant rainfall. They den on land, inhabiting swamps along rivers and lakes, and on dry land among tree roots and abandoned animal burrows.

Diet: European otters consume fish, frogs, crabs, small rodents, and aquatic birds. They eat small prey in the water, but haul out larger prey to shore. They eat the equivalent of 20 percent of their body weight every day.

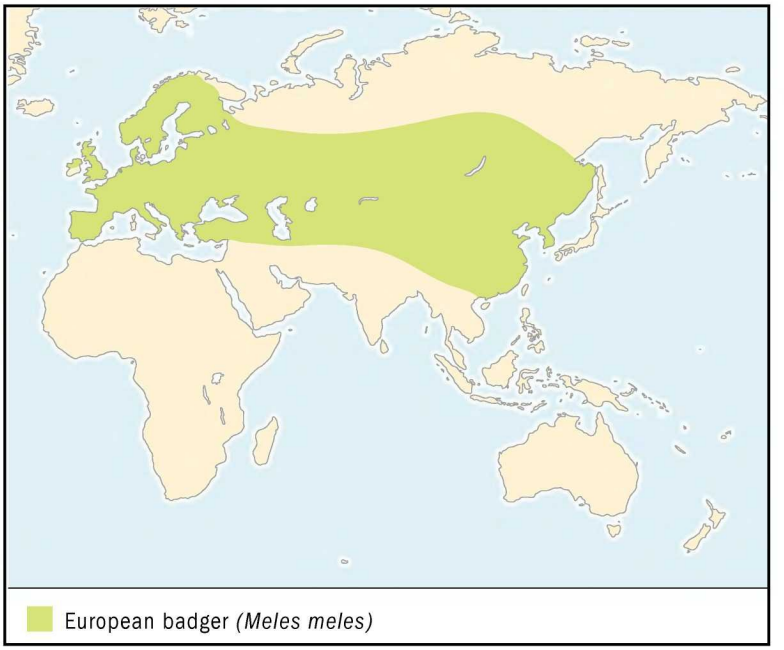
Behavior and reproduction: Although European otters forage for food in water, they den and breed on land, and are active at night. Otters seek freshwater for drinking and for washing sea salt from their guard hairs to keep them waterproof. They scent mark territories with anal secretions and deposit feces on logs and rocks to keep out trespassers. They are playful animals, often seen sliding down mud banks and icy slides. They communicate through chirps, chuckles, and whistles.

Breeding starts in February in water or on land. Males have two or more mating partners. The mother gives birth to two to four kits in April or June. The father leaves after the babies are born, while the young stay with the mother for about a year.

European otters and people: European otters are legally protected in some countries. Commercial fishermen consider them pests for raiding fisheries.

Conservation status: The IUCN lists the European otter as Vulnerable, facing a high risk of extinction in the wild, due to habitat

destruction from dam construction, drainage of wetlands, and conversion of rivers into canals, as well as water pollution from agriculture and industries. Illegal hunting continues in many areas. Accidental trapping in fishermen's nets is also a common occurrence. ■



EUROPEAN BADGER
Meles meles

Physical characteristics: European badgers have broad bodies, short legs, and short tails. They have gray backs, black undersides and legs. The white face has two parallel black stripes that start at the snout, cover the eyes, and extend to the ears. Their loose coat allows the badger to wriggle out of a predator's grasp or to quickly turn around and bite back. Long, strong front claws are designed for digging dirt and wasp nests, beehives, and insect larvae in grass roots. A see-through layer of skin protects the eyes from flying dirt and provides moisture. The back feet work like shovels for pushing out dirt. The badger weighs 22 to 44 pounds (10 to 20 kilograms), with a body length of 24 to 33 inches (60 to 85 centimeters) and a tail length of 6 to 8 inches (15 to 20 centimeters).

Geographic range: European badgers occur in all European countries and a number of Asian countries, including China, Japan, and Iran.

Habitat: European badgers prefer dense forests, but also inhabit open fields, hedgerows, and parks.



European badgers are nocturnal and live together in large underground connected tunnels called "setts." (Hans Reinhard/Bruce Coleman Inc. Reproduced by permission.)

Diet: Earthworms make up about 50 percent of the European badger's diet. They also feed on small rodents, hedgehogs, snails, insects and their larvae, as well as fruits, seeds, mushrooms, and roots.

Behavior and reproduction: European badgers live together in social groups called clans, consisting of twelve to fourteen adults and their cubs. A dominant male and female rule the clan. Badgers are territorial, marking the boundaries of their home range with feces and an anal secretion called musk. They also mark one another with musk for easy identification. Badgers forage for food at night. In winter, they sleep for days but do not truly hibernate.

Badgers mate during most of the year but implantation of the fertilized egg in the uterus can be delayed by about ten months, resulting in almost all cubs being born in February or March, when food is abundant. A litter averages two to three cubs, but may have as many as five. The young stay with their mother until fall.

European badgers and people: European badgers have damaged gardens, lawns, and golf courses. Scientific experiments in Great Britain found that badger are carriers of bovine tuberculosis (bTB), and can transmit the disease to cattle. Government-sponsored killing of badgers in areas where cattle had developed bTB ended because it did not reduce cattle infection. The government continues to monitor the situation.

Conservation status: European badgers are not considered a threatened species. ■

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CIVETS, GENETS, AND LINSANGS

Viverridae

Class: Mammalia
Order: Carnivora
Family: Viverridae
Number of species: 34 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Viverrids (civets, genets, and linsangs) have long, slender bodies and short legs. Some have a uniform coloration, while others are marked with spots, bars, or both. The fur is short. The tail, sometimes longer than the body, is bushy and may be ringed with alternating dark and light colors. The snout is pointed, and the ears are erect. Most have five toes on each paw. Viverrids are the only carnivores with perineal (per-uh-NEE-uhl) glands (perfume glands between the anus and the genital organs) that produce a strong-smelling substance used for defense, territory marking, and sexual communication. These glands are most developed in civets and genets.

GEOGRAPHIC RANGE

Viverrids are found in western Europe (including France, Portugal, and Spain), Southeast Asia (including Thailand, Malaysia, and Indonesia), and most of Africa.

HABITAT

Viverrids occupy tropical deciduous forests that provide canopies (uppermost layer of a forest consisting of spreading branches). They also inhabit tall grasses and thick brush for cover. Some prefer wetlands, while others live near rivers and streams.

DIET

Most viverrids eat rodents, insects, reptiles, frogs, birds, crabs, carrion (dead and decaying flesh), eggs, fruits, and nuts.

Palm civets are predominantly frugivores, eating pulpy fruits and berries.

BEHAVIOR AND REPRODUCTION

Viverrids are generally solitary, although some may live in pairs or small groups. The palm civet and the African linsang are almost exclusively arboreal (tree-dwelling). The otter civet and the aquatic genet live near rivers and streams.

Most viverrids scent mark territories and tree branches with perineal secretions. They also deposit feces on rocks, topping them with perineal secretions to advertise ownership. Some species produce sounds, including hisses, screams, and coughs. Some breed throughout the year. Others breed during certain seasons. Some may give birth two or three times a year. The average litter size is two to three kittens; up to six may be born. Kittens are born with a full coat, although the markings may not be clear. Males do not share in parenting.

VIVERRIDS AND PEOPLE

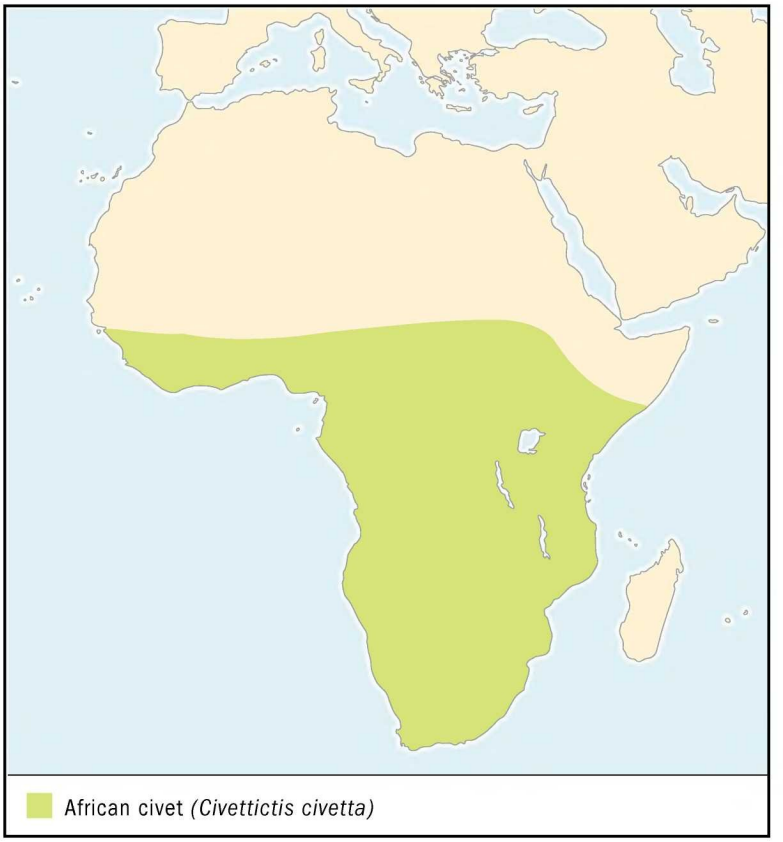
Viverrid meat is consumed by some people. Some species are kept as pets to control rodents. Humans sometimes kill those that attack poultry and lambs. Oil from the civet is valued by perfume makers for enhancing the quality of fragrances.

In 2002, an outbreak of severe acute respiratory syndrome (SARS) in southern China was linked to the consumption of masked palm civet. SARS is an infectious, potentially deadly disease. When the World Health Organization announced the end of the SARS outbreak in July 2003, more than 8,000 cases had been reported in 27 countries, with 774 deaths. In January 2004, when SARS resurfaced in China, authorities ordered the killing of all palm civets raised on farms. Other animals, including the raccoon dog and the Chinese ferret badger, also carry the SARS virus. These are not eaten by humans and have not been destroyed.

CONSERVATION STATUS

The IUCN lists eight species as threatened. The Malabar civet is classified as Critically Endangered, facing an extremely high risk of extinction, due to habitat loss, predation, and hunting by humans. The otter civet and the crested genet are listed as Endangered, facing a very high risk of extinction, because of habitat loss/degradation, predation, and hunting by humans.

Five species are listed as Vulnerable, facing a high risk of extinction, mostly because of habitat loss/destruction and hunting by humans. These are Owston's palm civet, Hose's palm civet, the Malagasy civet, the Sulawesi palm civet, and Jerdon's palm civet.



African civet *(Civettictis civetta)*

AFRICAN CIVET
Civettictis civetta

Physical characteristics: The African civet's fur ranges from silvery gray to creamy yellow with black-brown markings arranged in rows. A black mane of hair from the neck to the tail is erected when the civet gets scared or excited, making the animal seem larger. A black mask covers the eyes, with grayish fur above the eyes all the way to the small, round ears. The snout is black, with white on each side. A white stripe bordered by black stripes runs from the neck down to the front of the shoulders. This distinctive feature may serve to direct harmless, playful bites during mock-fighting or mating. The tail is partly ringed with alternating black and lighter colors, with solid black on the bottom half. Black legs and feet have long, curved claws. The perineal glands produce an oily substance called civet that



African civets are active at night, feeding mainly on fruits, but also eating some rodents, insects, reptiles, and other meat. (Cyril C. Laubscher. Bruce Coleman, Inc. Reproduced by permission.)

is used in the perfume industry. The civet uses this secretion for scent marking its territory. The body length is 27 to 33 inches (67 to 84 centimeters), and the tail is another 13 to 19 inches (34 to 47 centimeters). The largest of the viverrids, the African civet weighs about 22 to 38 pounds (10 to 17 kilograms).

Geographic range: African civets occur in countries south of the Sahara Desert, including Senegal, Somalia, the Democratic Republic of the Congo, Zimbabwe, Mozambique, and the island of Zanzibar.

Habitat: African civets prefer woodlands and areas of tall grasses and dense shrubs for resting and cover. Mothers and young nest in tangled roots and burrows (holes) abandoned by other animals.

Diet: African civets are omnivores, feeding on plants and animals. They eat mainly fruits, supplementing them with rodents, insects, reptiles, frogs, birds, crabs, and carrion. They can eat up to 4 pounds (2 kilograms) of food per feeding, but can fast (go without food) for up to two weeks. They sometimes take poultry and lambs in human environments.

Behavior and reproduction: African civets are solitary, except when mating and raising young. They are nocturnal (active at night), sleeping by day in tangled growths of vegetation or in tall grasses. They defend territories, marking boundaries with perineal secretion. Females use this secretion to advertise readiness to mate. Civets also deposit feces in piles, topped with the secretion, for identification and to claim ownership of a territory. Civets communicate through different sounds, including screams, growls, and coughs.

Mating occurs throughout the year. Females give birth two to three times a year, usually to two to three young. Young civets are quite developed when born, having a full coat with faint markings and able to crawl right away. The mother introduces solid food to her young after about a month and a half. Before this event, the young perform a unique behavior called mouth suckling, in which they drink the mother's saliva by licking her mouth. However, they continue nursing up to fourteen to sixteen weeks of age.

African civets and people: For centuries, the perfume industry has used the perineal secretion from African civets, called civet or civet oil, to make fragrances last longer. Although artificial civet oil has been available since the 1940s, some perfumers prefer the real thing. In Ethiopia, civet continues to be extracted from caged animals. African civets are sometimes considered pests for preying on poultry and lambs.

Conservation status: The African civet is not a threatened species. ■



COMMON GENET
Genetta genetta

Physical characteristics: The common genet has a slender, flexible body that enables it to go through narrow openings to pursue rodents, their main prey. A yellowish or grayish coat is covered with black or brown markings arranged in rows. When threatened or scared, the hair covering the back is erected to give the appearance of a larger size. The long tail has alternating dark and light rings. The snout is pointed, and the ears are rounded. White coloration covers the areas around the eyes and mouth. The sharp claws, used for climbing trees and catching prey, are sharpened on tree barks and kept in a protective sheath when not in use. Secretions from the perineal glands are used to mark territory and as a means of communication. The body length is 17 to 22 inches (43 to 55 centimeters). The tail measures 13 to 16 inches (33 to 51 centimeters). Weight is about 3 to 6 pounds (1.5 to 2.5 kilograms).



Common genets are active during the night and sleep during the day in a hollow tree or a burrow left by another animal. (Photograph by Harald Schütz. Reproduced by permission.)

Geographic range: The common genet is found in France, Portugal, Spain, Arabia, northern Africa (including Algeria, Tunisia, Egypt), and all African countries south of the Sahara Desert.

Habitat: Common genets inhabit forested areas where they have trees for climbing and tree hollows for sleeping and resting. Grasslands provide cover for stalking and ambushing prey. They also live near humans, such as in barns and parks.

Diet: Common genets are omnivores, eating rodents, frogs, reptiles, insects, and fruits. They prey on nesting birds and occasionally take poultry.

Behavior and reproduction: The common genets are equally at home on the ground and in tree branches. They are active at night, sleeping during the day in a tree hollow or a burrow abandoned by another animal. They are solitary, communicating with one another using perineal secretions to mark ground surfaces and tree branches. They make catlike sounds, such as meows and purrs. They also growl and hiss. Genets pair off briefly to mate, mostly in February and March. In summer, the mother gives birth to a litter of one to four

kittens, but normally two to three, nursing them for about two months.

Common genets and people: Genets are sometimes kept as pets to control rodents. They occasionally prey on poultry and game birds.

Conservation status: The common genet is not a threatened species. ■

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MONGOOSES AND FOSSA
Herpestidae

Class: Mammalia
Order: Carnivora
Family: Herpestidae
Number of species: 35 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Mongooses are a family, Herpestidae, of small to medium-sized, mainly carnivorous Old World mammals. Their overall appearance suggests a small, generalized mammalian carnivore. They have long bodies, short but powerful legs, and long, often bushy tails. In some ways, they converge with (resemble) the mustelids (mammal family Mustelidae: weasels, badgers, skunks, otters, wolverines) of the New World.

Family Herpestidae, including species in Madagascar, includes about thirty-five species and seventeen genera (JEN-uh-ruh), although not all taxonomists, or classifiers of animal types, agree as to the exact number of genera and species. The large island of Madagascar, off the southeast coast of Africa, has eight mongoose species arranged in four genera, probably all descended from a single founder species that rafted on floating vegetation from Africa. The Malagasy mongooses are classified in a subfamily of their own, the Galidiinae. All other mongoose species are classified within subfamily Herpestinae.

Adult head-and-body length throughout family Herpestidae runs 9 to 25.5 inches (23 to 65 centimeters), tail length 9 to 20 inches (23 to 51 centimeters), and weight just under 1 pound to 9 pounds (0.4 to 4.0 kilograms). The exception to these measurements is the fossa of Madagascar, the largest of the Herpestidae and the most un-mongoose-like of all mongoose species. A fossa can grow up to 31.5 inches (80 centimeters) head-and-body length, with a tail just as long, and an adult weight of 20 pounds (9.1 kilograms).

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

MONGOOSES AND HORNBILLS GETTING ALONG

The dwarf mongoose has a mutually beneficial relationship with two bird species, the red-billed hornbill and the eastern yellow-billed hornbill. In the scrub country of eastern Kenya, the mongoose and either of the hornbill species forage together, eating the same prey, the hornbills keeping their senses alert for the presence of threat animals, especially birds of prey. The companionship allows the mongooses to forage in peace, while the birds benefit from creatures flushed out by the mongooses. The hornbills sound off with warning calls when a predator approaches, even warning at the sight of predators of mongooses that are not enemies of hornbills.

Fur colors in herpestids are various shades of brown and gray, with lighter, sometimes white, fur on the underside. Some species carry stripes or stipplings on their darker fur. The fur can vary in texture as well, from soft to coarse, short to long. There are five clawed digits on each of the four paws, the claws of the forefeet long, sharp, and curved. Except for the fossa, the claws are not retractable, meaning they cannot pull them back into the paw. The small head and face taper to a pointed muzzle, sometimes with a straight bridge from crown to the end of the snout, or there may be a distinct, sloped forehead where the head and muzzle join. The ears are short and rounded.

Herpestids carry glands for scent-marking in their cheeks and near their anuses. Some species can shoot out a foul-smelling fluid from the anal glands.

GEOGRAPHIC RANGE

Mongooses live in mainland Africa, southern Europe, Madagascar, southern Asia including India, the Malay Peninsula as far as and including Sumatra, Borneo and Java; also the islands of Hainan and Taiwan.

HABITAT

Mongooses live in various types of forest, including humid tropical rainforest, also dry grasslands and near-desert. They shelter in self-made burrows in the ground or in termite mounds, or in natural shelters like hollow logs and spaces within rock piles.

DIET

Mongoose species have generalized, mainly carnivorous diets, helping themselves to insects, crabs, millipedes, earthworms, reptiles, amphibians, mammals, birds, birds' eggs, fruits, and roots. Before eating toads or caterpillars, a mongoose will roll them back and forth on the ground to wipe off skin poisons of toads and irritating hairs of caterpillars. Among mongoose species that

eat bird eggs, a mongoose will break open an individual egg by holding it in its forepaws and pitching it backward between its hindlimbs and into a rock, or by standing up on its hind legs and dropping the egg. Several species eat fruit as supplements to a mainly meat diet. Some species swim in ponds and streams, searching for fish and other aquatic animals.

An individual mongoose baits a snake by skillfully avoiding and dodging the reptile's lunges until it tires and slows down in its actions, enabling the mongoose to dart in and seize the snake behind its head, killing it by biting, then eating the snake at leisure. Mongooses are not immune to the venom, so that a mongoose-on-snake tussle is always dangerous and can end in death for either party.

BEHAVIOR AND REPRODUCTION

Mongooses are energetic, aggressive, and playful. They may hunt and forage alone or in groups. Some species are nocturnal, active at night, others are diurnal, active during the day. Diurnal species often start their days by sunning, outstretched on rocks or the ground near their shelters, and exercising to limber themselves up for a day of foraging.

Mongooses live in colonies of up to fifty individuals. These may live in burrow networks or just build temporary shelters for themselves during migratory foraging.

Some mongoose species breed seasonally, others breed throughout the year, females giving birth two or three times annually. Gestation periods range from forty-two to eighty-four days. There are one to four young per litter. Captive Egyptian mongooses have lived for over twenty years.

MONGOOSES AND PEOPLE

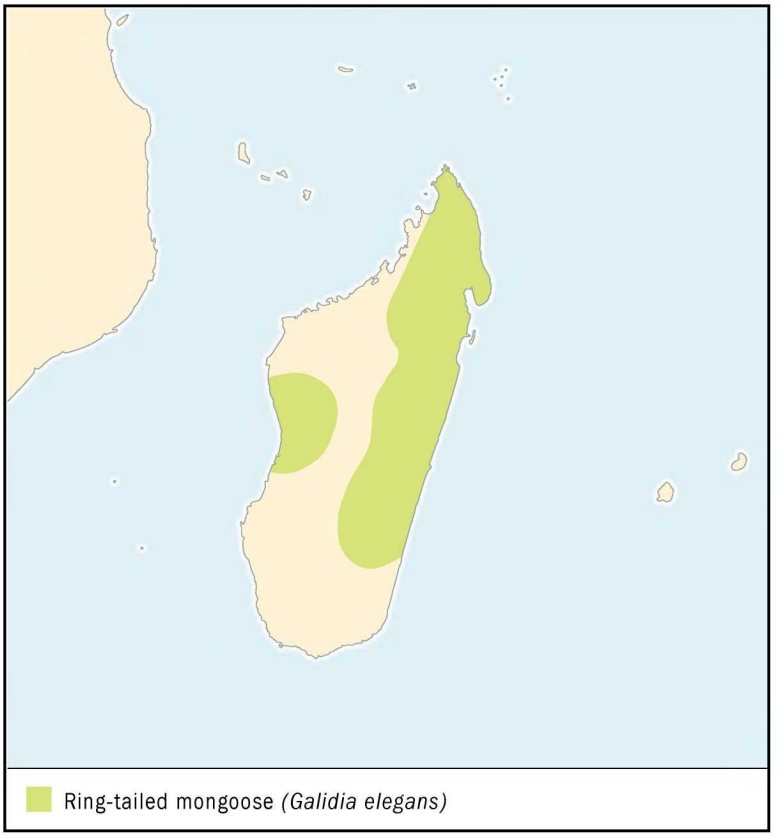
Mongooses and humanity share intertwined histories. The animals have been the source of innumerable folk tales in their native lands, e.g., "Rikki-tikki-tavi," the famous short story by British writer Rudyard Kipling, based on native legends of India. Mongooses have been praised for destroying pests and condemned for preying on non-pests, especially domestic poultry.

From ancient times until the present, mongooses have been introduced by humanity to mainlands and islands over much of the world, in attempts to keep down problem populations of rats and snakes: Italy, Spain, Portugal, Yugoslavia, many of the Caribbean islands, and the islands of Hawaii and Fiji. Since

mongooses are so highly adaptable, they soon outdo the original problem they were introduced to control by becoming pests themselves, preying on harmless and beneficial local bird and mammal species, and raiding poultry. A number of countries that have learned the lesson the hard way and now outlaw the possession or importation of mongooses.

CONSERVATION STATUS

The World Conservation Union (IUCN), includes on its Red List of Threatened Species, four mongoose species considered Vulnerable, facing a high risk of extinction, and five Endangered, facing a very high risk of extinction. Three Vulnerable and three Endangered species are in Madagascar. The main threats to mongoose species are habitat destruction, and, on Madagascar, habitat loss plus competition and predation by introduced predators like dogs and cats. Nevertheless, family Herpestidae, overall, is flourishing.



RING-TAILED MONGOOSE
Galidia elegans

Physical characteristics: In appearance, the ring-tailed mongoose more or less follows the general mongoose body plan, while being a particularly beautiful and striking species, with red-brown to dark brown body fur and a long, bushy tail striped alternately with broad, red-brown and black rings. The underside is very dark to black. The head-and-body length of an adult Malagasy ring-tailed mongoose runs 12.5 to 14 inches (32 to 36 centimeters), tail length, 10.5 to 12.5 inches (27 to 32 centimeters), and body weight of 1.5 to 2.2 pounds (0.7 to 1 kilograms).

Geographic range: This mongoose lives in eastern and western Madagascar.



Ring-tailed mongooses feed on small mammals, birds, birds' eggs, frogs, fish, reptiles, insects, and fruits. (Photograph by Harald Schütz. Reproduced by permission.)

Habitat: The ring-tailed mongoose inhabits humid tropical rainforest along Madagascar's east and northwestern coasts, and drier, seasonal forest along much of the west coast.

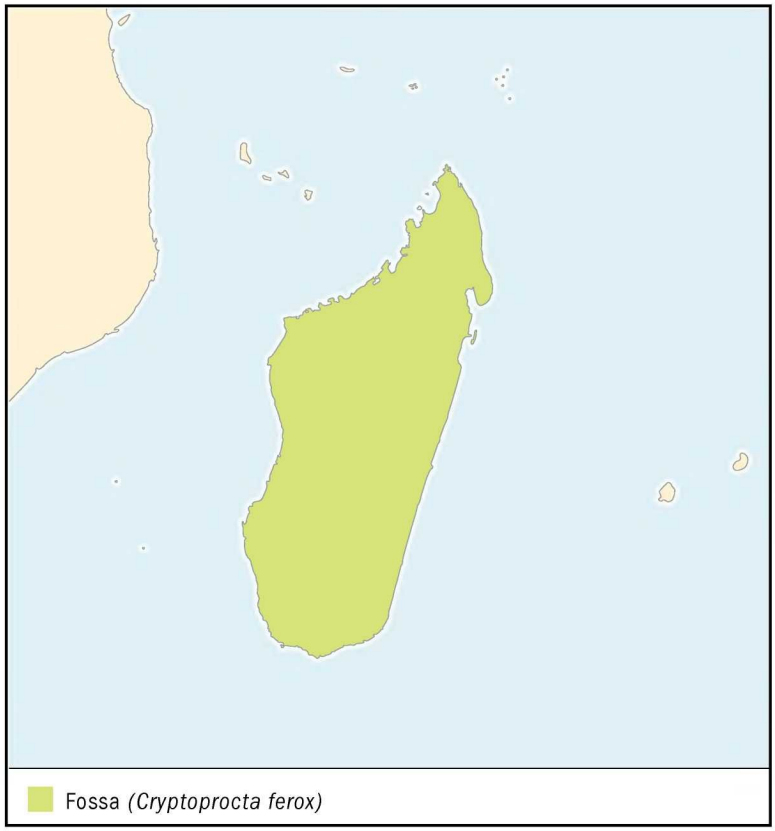
Diet: Ring-tailed mongooses feed on small mammals, birds, birds' eggs, frogs, fish, reptiles, insects, and fruits. They also prey on two small primate species native to Madagascar, the greater dwarf lemur, and the brown mouse lemur.

Behavior and reproduction: Ring-tailed mongooses mate from April to November, and a single young is born from July to February. The gestation period runs seventy-nine to ninety-two days. The young is sexually mature at two years of age. A captive ring-tailed mongoose lived for over thirteen years.

Malagasy ring-tailed mongooses forage and hunt during daylight. They can swim and climb trees easily but do most foraging on the ground. These mongooses forage and hunt in groups of up to five, each group made up of a mated pair and offspring. As they wander, the mongooses mark trees and rocks of their territory with anal scent glands. They shelter in burrows during nights.

The ring-tailed mongoose and people: This animal seems to have little fear of humanity other than natural caution, and will investigate native villages and biological research camps, stealing whatever human garbage or food they can lay hands on. They may add domestic poultry to their diets, resulting in people hunting and harrassing them.

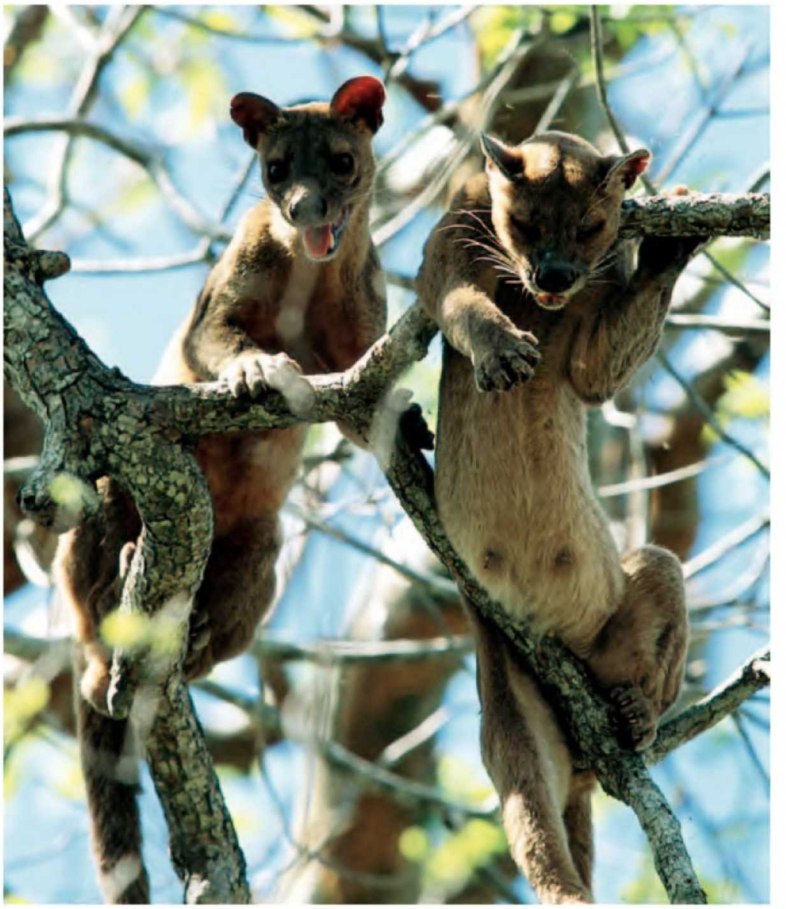
Conservation status: This mongoose is listed as Vulnerable by the IUCN. Some naturalists, after very recent surveys of the species in Madagascar, consider it of little or no conservation concern because of its high numbers and adaptability. ■



FOSSA
Cryptoprocta ferox

Physical characteristics: Its name derived from a native Malagasy word, and pronounced "foosh," this puzzling animal is as worthy of biodiversity poster status as the more famous lemurs of Madagascar.

The fossa is the largest of all mongoose species, with an adult head-and-body length of 24 to 31.5 inches (61 to 80 centimeters), a tail as long as the head and body, and an adult weight of eleven to twenty pounds (5 to 10 kilograms). A fossa looks like a combination of dog, cat, and mongoose, and has retractable claws, like a cat's, something not seen in other mongoose species. If approaching head-on, a fossa gives the impression of a scaled-down puma, but a side view shows the snout to be longer than that of the true cats, but shorter and wider than the norm among mongoose species. The gray-brown nostril pad



Fossas are the largest native predator of Madagascar. (Photograph by Harald Schütz. Reproduced by permission.)

is furless and prominent, like a dog's. The overall appearance and behavior suggests a cat rather than a dog.

The body is long and sleek and the legs are short but powerful, as in a mongoose. The coat color is rich reddish-brown, the undersides lighter but stained with an orange secretion from skin glands. This secretion is more abundant in males than in females. There are five padded digits on each of the four feet. Though its movements are often considered plantigrade, meaning that the entire foot, from the toetips to the back of the heel, touch the ground when walking, fossas have also been seen to walk digitigrade, that is, only on the toetips. The large, prominent eyes are brown and lustrous, and have pupils that can retract to vertical slits, as in cats. The ears are large, prominent, and narrower than in typical mongoose species.

The fossa was originally classified as a direct descendant, little changed, of the ancestor species that gave rise to cats (Felidae) and

dogs (Canidae). That classification arose from both to the appearance of the fossa and to the notion that Madagascar was a natural refuge for primitive mammal species driven to extinction elsewhere by more advanced species. At the same time, the fossa is the living creature closest in form to the dog-cat ancestor. Its classification is still uncertain. Genetic comparison studies strongly support the fossa and the other Malgasy mammal carnivores as being descendants, having changed forms over the ages through adaptive evolution, of a single colonizing species of mongoose. The founder species must have floated from Africa to Madagascar twenty to thirty million years ago. The fossa is the end result of adaptive evolution by which a mongoose, over countless generations, became something like a cat. At the same time, the fossa keeps a number of mongoose-like features. Scientists have found remains of a larger species related to the fossa, since named *Cryptoprocta spelea.*

Geographic range: Fossas live in all of the forested areas of Madagascar.

Habitat: Fossas live in the humid tropical rainforests of Madagascar's east coast and the drier forests along its western coast.

Diet: The fossa is carnivorous and able to deal with nearly all sorts of small to large prey animals on Madagascar, including the larger lemur species, which can be bigger than house cats. Fossas also prey upon snakes, tenrecs (native insectivorous mammals of Madagascar), and rodents, most often introduced rats. Fossas only rarely feed on insects and other invertebrates.

Behavior and reproduction: Fossas hunt at any time of night or day. They can swim and are adept at climbing and jumping among trees while chasing prey. The animals can turn their ankles so that their hindfeet face rearward, a unique adaptation that aids them in keeping a grip on treetrunks. The long tail acts as a balance while the fossa climbs or jumps between trees. Fossas hunt alone, or in family groups made up of a mother and her young.

There is a single annual mating season from October into December. Gestation lasts six to seven weeks. Litters number two to four young. Fossa young are very cute and endearing. They have big ears and eyes, their faces suggest a combination of domestic kitten, puppy, and lion cub, and they stare out at the world with the intent, slightly bewildered stare of young domestic kittens.

Mating is a complex affair, resembling that of cats. A female in heat stations herself in a tree, while several males, following her scent, gather

around the tree, vocalizing and fighting among themselves. Then, one at a time, the males climb the tree and are accepted or rejected by the female. If she accepts a male, she will usually walk farther out on a branch but allow the male to mount her from behind, his forepaws resting on her neck, while he gently grips the female's nape in his jaws. A single mating can last for several hours, and the female will mate with several of the gathered males.

Only the mother raises the young, in a tree hollow or a hollowed-out termite nest. The young of both sexes reach sexual maturity at four years. A most interesting phenomenon among female fossa young is that they pass through a brief pseudo-masculine stage in their second year, during times of becoming less dependent on the mother and reaching sexual maturity. Their genitals come to resemble those of an adult male, they leave ano-genital scent markings on objects, as do adult males (adult females do not, except in mating season), and the female young secrete more of the fur-staining orange fluid than do adult females. Why this occurs is unanswered, and the young females lose the masculine characteristics as they approach sexual maturity.

Fossas have been known to live for twenty years in captivity.

Fossas and people: The fossa has not fared well with humans in Madagascar. Fossas raid chicken coops, leaving resentment behind, and an aura of superstitious fear surrounds them.

Conservation status: The fossa is listed as Endangered by the IUCN. Although widespread throughout Madagascar, the fossa's population density and total population are low, making it especially vulnerable to deforestation, which is ongoing and rampant in Madagascar. ■

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family CHAPTER

AARDWOLF AND HYENAS
Hyaenidae

Class: Mammalia
Order: Carnivora
Family: Hyaenidae
Number of species: 4 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The spotted hyena (hi-EE-nah) is the largest of three species that include the striped and brown hyenas. Hyenas weigh about 57 to 190 pounds (26 to 86 kilograms). The aardwolf (ARD-wolf), included in the Hyaenidae family, weighs about 20 to 30 pounds (9 to 14 kilograms). All hyaenids (members of the Hyaenidae family), except the spotted hyena, have long, shaggy coats. A mane of hair down the back can be erected to make the animals look larger. All have a bushy tail and a sloping back. Anal gland secretions are used for marking territories. Spotted hyena females have genitals resembling those of males.

GEOGRAPHIC RANGE

Hyenas and aardwolves are found in the Middle East (including Turkey, Israel, and Saudi Arabia), Pakistan, India, and in Africa south of the Sahara Desert (except the rainforests of The Democratic Republic of the Congo).

HABITAT

Hyenas and aardwolves occupy grasslands, bush country (wild, uncultivated land), and open woodlands. They dig burrows (holes) underground or live in burrows abandoned by other animals.

DIET

The striped and brown hyenas are mainly scavengers, feeding off the leftover kills of other animals. They also eat hares (relatives of rabbits), rodents, reptiles, vegetables, and fruits. Brown hyenas along the Namib Desert eat South African fur seal pups

PULLING RANK

Among spotted hyenas, rank is passed on by mothers to their female offspring. In the communal den, a dominant female's cub learns from her mother which clan members she can push around. A dominant female will attack a subordinate female, which encourages her offspring to do the same. After repeated aggressive displays by her mother, the cub starts bullying the offspring of subordinate females. The dominant female participates in the bullying.

and other sea organisms. The spotted hyena mostly hunts its own prey, such as gazelles, antelopes, wildebeests, and zebras. Aardwolves feed almost exclusively on termites.

BEHAVIOR AND REPRODUCTION

Spotted and brown hyenas live in groups called clans, dominated by a female. Striped hyenas are solitary, but small family groups may share a den. Females of spotted and brown hyenas stay with the clan for life. Male spotted hyenas are driven from the clan upon puberty, while male brown hyenas may choose to stay with the clan or leave. Hyenas scent mark territories by depositing anal secretions on grass stalks. Aardwolves are solitary, although, like hyenas, they communicate through scent marking. Hyaenids are active at night or at dawn and dusk.

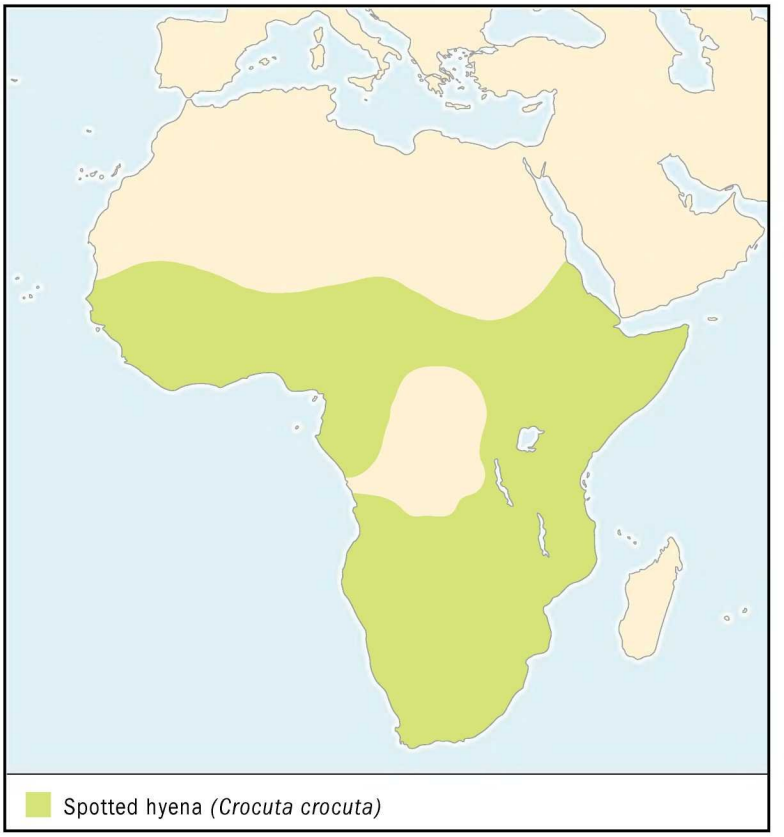
Spotted and striped hyenas breed year round, while brown hyenas are seasonal breeders. Litter size varies, with one to two cubs for the spotted hyena, up to four for the striped hyena, and as many as six for the brown hyena. Brown and striped hyenas wean their young at about one year, while the spotted hyena nurses for up to a year and a half. Aardwolves may be seasonal or nonseasonal breeders, giving birth to two to four cubs, who leave home by age one.

HYAENIDS AND PEOPLE

Some African cultures believe hyenas possess magical powers. Others consider hyenas as pests for preying on domestic livestock. The brown hyena is a popular exhibit animal in zoos. In Africa, garbage is left out for the spotted and striped hyenas to eat. Aardwolves are useful to humans for eating termites.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists the brown and striped hyenas as not currently threatened, but may become threatened because of, among other things, accidental killing from the poison-spraying of pests. The spotted hyena also may become threatened because of killing by humans and habitat loss or degradation as a result of land clearing for agriculture and livestock. The aardwolf is not a threatened species.



SPOTTED HYENA
Crocuta crocuta

Physical characteristics: Spotted hyenas range in color from sandy to brown, with black or dark brown spots. The short, bushy tail is black. The sloping back, caused by front legs that are longer than the hind legs, allows for long-distance pursuit of prey. The massive jaws can crush bones, teeth, hooves, and horns. The neck and back are covered with a short mane of hair that can be raised to make the hyena seem larger.

Females are larger than males. In southern Africa, females weigh up to 190 pounds (85 kilograms) and males up to 135 pounds (60 kilograms). Eastern African hyenas are lighter, with females weighing about 125 pounds (55 kilograms) and males about 110 pounds (49 kilograms). The female's genital organ resembles that of the male



Spotted hyenas hunt animals that are much larger than they are, such as antelopes, zebras, and young giraffes. (Norman O. Tomalin/Bruce Coleman Inc. Reproduced by permission.)

because of overproduction of testosterone, the male hormone responsible for the development of the penis. The female mates and gives birth through her pseudopenis (SUE-doh-pee-nis).

Geographic range: Spotted hyenas are found in Africa in countries such as Chad, Sudan, Angola, Zambia, and Zimbabwe.

Habitat: Spotted hyenas prefer grasslands inhabited by their herbivorous (plant-eating) prey, such as antelopes and wildebeests. They also occupy woodlands and semi-deserts.

Diet: Spotted hyenas mostly hunt rather than scavenge food. They prey on animals several times their size, including gazelles, antelopes, wildebeests, and zebras. They also eat the young of giraffes, hippotamuses, and rhinoceroses, as well as reptiles, domestic livestock, and human garbage. They tear pieces of flesh from prey, killing it in a few minutes. They eat very fast, consuming flesh, skin, teeth, bones, horns, and even hooves. A hyena can eat 33 pounds (15 kilograms) of meat per feeding, throwing up indigestible food as pellets.

Behavior and reproduction: Hyenas live in clans of as many as eighty members, ruled by a dominant female. Daughters inherit their mothers' status. Males are submissive to all females and to the dominant female's offspring. Young males are expelled from their homes between ages two to four. They join other clans, starting at the lowest rank. Sons of dominant females may be allowed to stay longer and are more likely

to become dominant males in the clan they join. Female members occupy the same territory, defending it against intruders, sometimes to the death.

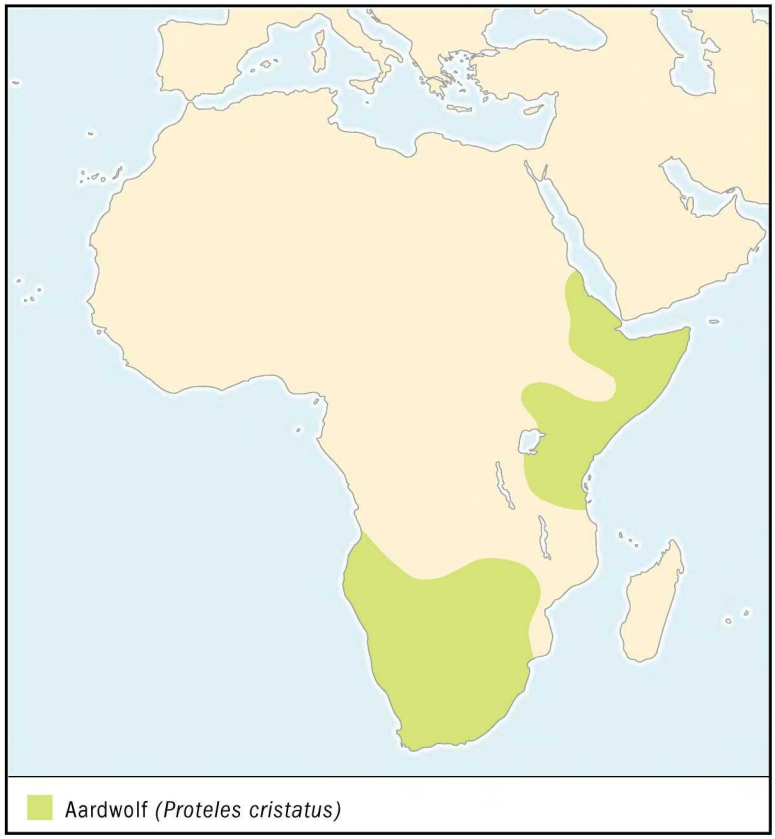
Spotted hyenas are either nocturnal (active at night) or crepuscular (active at dusk and dawn). They hunt alone, although they will join forces to catch large prey. They chase down their prey, running 25 to 31 miles (40 to 50 kilometers) per hour and covering a distance of up to 3 miles (5 kilometers). They target young, old, and sick animals.

The spotted hyena is also called the "laughing hyena" because of its high, cackling laugh. It laughs when it is being chased or attacked or to show submission. Hyenas whoop to call clan members to defend territory or to hunt. Greetings involve sniffing each other's genital areas. They scent-mark territories with anal secretions and feces.

Adults get together only to mate, which may be at any time of the year. A long pregnancy (up to four months) results in well-developed cubs, usually one or two, born with teeth and able to walk. Cubs are kept in a small den inaccessible to adults and predators. When female cubs come out to nurse, they compete for their mother's milk, sometimes resulting in the death of the sibling who cannot nurse. Within the den, cubs may kill littermates during fights for dominance. After two to four weeks, the mother takes her young to a communal den, where cubs of all ages are raised together. Mothers do not nurse each other's young. Cubs learn to recognize clan members and establish social rankings. They are weaned from their mothers' milk at about fourteen to eighteen months. Males do not share in parenting.

Spotted hyenas and people: Some African cultures believe hyenas possess magical powers. Humans kill hyenas for preying on domestic livestock.

Conservation status: The IUCN lists the spotted hyena as Lower Risk/Conservation Dependent (could become threatened) due to killing by humans and habitat loss or degradation as a result of land clearing for agriculture and livestock. ■



AARDWOLF
Proteles cristatus

Physical characteristics: The aardwolf is yellowish white to reddish brown, with several black stripes along the body and legs. A dark mane running from the back of the head down to the tail can be erected to make the aardwolf seem bigger. A sloping back results from hind legs that are longer than the forelegs. The teeth are very small and widely spaced. The spatula-shaped tongue and sticky saliva are adapted for licking up termites. Sharp canine teeth are designed for fighting enemies. Both sexes are about the same size, about 20 pounds (9 kilograms) in southern Africa and up to 30 pounds (14 kilograms) in East Africa.

Geographic range: Aardwolves are found in Africa, including South Africa, Botswana, Zambia, Kenya, and Somalia.

Habitat: Aardwolves prefer grassland, open country, and rocky areas, where they live in burrows they have dug up or taken from aardvarks or springhares.

Diet: Aardwolves feed primarily on two varieties of termites that forage on the ground surface. They can eat about 200,000 termites a night. They also eat other insects, small birds, eggs, mice, and carrion (dead or decaying animal flesh).

Behavior and reproduction: Aardwolves are solitary, feeding at night when their favorite termites emerge. When these termites become inactive in winter, aardwolves switch to another termite species that are active in the late afternoon. When scared or threatened, aardwolves roar and growl. They scent mark territories by depositing anal secretions on grasses. Aardwolves within the same territory erect their back hair until they recognize each other. Mothers and young sniff each other's noses to establish identity. Aardwolves generally mate with just one partner, although a dominant male may mate with the partner of a subordinate male. The litter consists of two to four cubs. Males babysit the young, guarding the den against predators when the mothers feed. The young leave home by one year of age.



Aardwolves can eat 200,000 termites during one night of feeding. (© Terry Whittaker/ Corbis. Reproduced by permission.)

Aardwolves and people: Aardwolves may be hunted as a food source. They sometimes are poisoned when pesticides are sprayed to control locusts in some areas.

Conservation status: Aardwolves are not a threatened species. ■

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CATS

Felidae

Class: Mammalia

Order: Carnivora

Family: Felidae

Number of species: 36 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Cats range in color from pale gray to brown, many with rosettes, spots, and stripes that help them blend in with their natural surroundings. The head is rounded, with a short snout. Ears are rounded or pointed. Sensitive whiskers are useful for night movements and for inflicting the fatal bite on a prey's body. Tiny, rough projections on the tongue are used to scrape meat off bones. Feet are padded for quiet stalking of prey. Claws in most species are retractable, or can be pulled back into a sheath of skin, to keep the nails sharp for climbing trees and clasping prey. The cat's ability to land on its feet from a fall is due to a flexible spine that can turn the body around.

GEOGRAPHIC RANGE

Cats naturally occur in most areas of the world, except Australia, the polar regions, and some oceanic islands.

HABITAT

Cats inhabit all types of habitats with the exception of tundra and polar ice. Most species occupy more than one type of habitat.

DIET

Large cats prey on ungulates (hoofed animals) such as deer, zebras, and wildebeests, but also eat other meat. Small cats eat rabbits, hares, rodents, snakes, frogs, fish, and birds. Many consume carrion (dead and decaying flesh).

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

IS IT REALLY TEAMWORK?

Contrary to popular opinion, lions who hunt together do not necessarily team up to catch a prey animal. If members of the pride see that a lone member might be able to overcome the prey, they simply watch and wait to share the food. Only when the members realize that a large prey cannot be caught unassisted would they risk injury and jump in to help.

BEHAVIOR AND REPRODUCTION

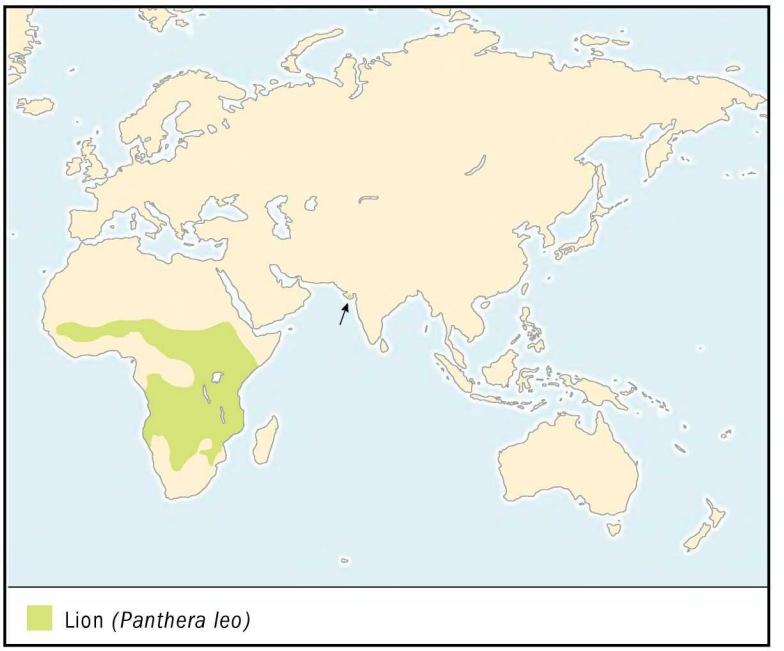
Most cats are solitary, except when mating and raising young. Only lions form social groups. Cats defend territories but avoid physical confrontations through different means of communication. They scrape tree trunks and scent-mark with urine and feces. They use sounds, including roars, meows, purrs, hisses, and growls. They also use body language. Most hunt at night, but may show increased activity at dawn and dusk. Many are excellent climbers, and some are good swimmers. Males and females have several mating partners, producing an average of two to four kittens per litter. The young stay with their mother for up to eighteen months, longer for big cats.

CATS AND PEOPLE

The African wild cat is considered the ancestor of domestic cats. Experts believe ancient Egyptians tamed the cat to catch rodents. Cats are prized for their fur and as trophies. Some are popular exhibit animals in zoos. Large cats prey on humans and livestock.

CONSERVATION STATUS

The United States classifies the Florida panther and the eastern puma as Endangered. The World Conservation Union (IUCN) lists the Iberian lynx as Critically Endangered, facing an extremely high risk of extinction in the wild; four species as Endangered, facing a very high risk of extinction; twelve species as Vulnerable, facing a high risk of extinction; and eight species as Near Threatened, not currently threatened, but could become so.



LION
Panthera leo

Physical characteristics: Lions have a short orange-brown coat tinged with gold. Males have manes, used for gender recognition at distances and protection during fights. A dark clump of fur covers the tail tip. Enormous shoulders and muscular legs are used to tackle large prey. Powerful jaws grasp prey and cut through tough skin. Lions measure 62 to 100 inches (160 to 250 centimeters), and another 24 to 40 inches (60 to 100 centimeters) for the tail. They weigh 270 to 570 pounds (120 to 260 kilograms).

Geographic range: Lions occur in countries south of the Saharan Desert, including Angola, Botswana, Ethiopia, Kenya, and Tanzania. The Asiatic lion lives in western India.

Habitat: Lions prefer a mixture of thick bush, scrub, and grass that afford cover for stalking and ambushing prey. They also live in open woodlands and deserts.



Female lions may give birth to one to six cubs at a time. Mothers help to nurse and raise each other's cubs. (Joe McDonald/Bruce Coleman Inc. Reproduced by permission.)

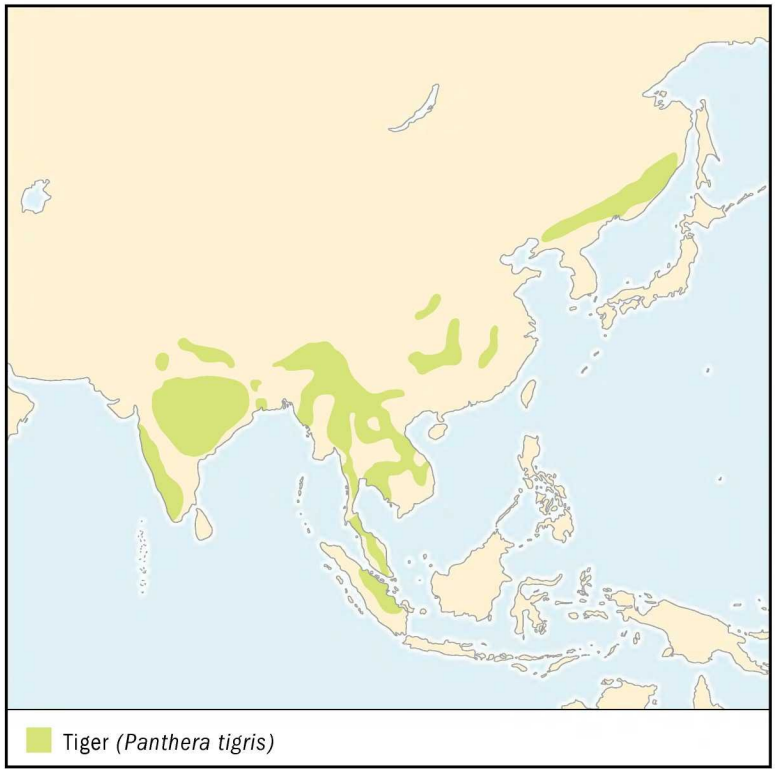
Diet: Lions prey on buffalo, zebra, and wildebeest. They also eat rodents, lizards, birds, and grass. An adult male eats as much as 110 pounds (50 kilograms) per feeding, but may fast (go without food) for several days.

Behavior and reproduction: Lions live in groups called prides, consisting of two to eighteen related females, their cubs, and one to seven unrelated males. Every two or three years, adult male groups called coalitions try to take over prides to mate with the females. If the newcomers win, they attempt to kill the resident cubs in order to produce their own. Mothers band together to defend their young.

Mothers who lose their young become receptive to mating, pairing off with several partners, and giving birth to one to six cubs. Mothers share nursing and cub rearing. Between ages two to four, young males are driven from the pride by dominant males or the new coalition. Females stay with the pride for life, doing most of the hunting at night. Males advertise territorial boundaries through urine markings and group roars.

Lions and people: Many African cultures believe the lion's body parts have magical and healing powers. Lions may be killed as threats to humans and livestock.

Conservation status: The lion is listed as Vulnerable and the Asiatic lion as Critically Endangered due to habitat and prey base (the animals lions hunt for food) loss, as well as killings by humans. ■



TIGER
Panthera tigris

Physical characteristics: The largest of cats, tigers range in color from pale yellow to reddish ochre (brownish yellow). Each tiger has a black stripe pattern that is uniquely its own. In the wild, tigers blend in with the natural background, especially against tall grasses, which break up their body shape. Males have a ruff of hair around the face. Ears are black with a white circle in the middle. The body length is 75 to 150 inches (190 to 310 centimeters). The tail measures 28 to 40 inches (70 to 100 centimeters). Tigers weigh 140 to 670 pounds (65 to 306 kilograms).

Geographic range: Tigers are found in Bangladesh, China, India, Myanmar, Sumatra, and Russia.



Female tigers raise their cubs for about two years. After that, female cubs usually stay near their mother's home range, but male cubs may travel far away to establish their territories. (© Tom Brakefield/Corbis. Reproduced by permission.)

Habitat: Tigers inhabit coniferous and deciduous forests that provide prey and cover. They also inhabit jungle grasslands and mangrove swamps. They need water for drinking and swimming.

Diet: Tigers prey on deer, wild pigs, wild cattle, and occasionally young elephants and rhinoceroses, birds, reptiles, and fish. An adult eats up to 90 pounds (40 kilograms) per feeding. It hides surplus kill to eat later.

Behavior and reproduction: Tigers are solitary, hunting at night. Good swimmers, they will pursue an animal into the water. They roar to advertise ownership of a territory. They further communicate through scratches on trees and scent marks with urine, feces, and anal and cheek secretions.

A male and female pair off briefly, producing an average of two to three cubs. The mother rears the young for about two years. Young females stay close to their mother's home range, but young males may travel far to secure their own territories. When a male takes over another's territory, he kills the cubs because a tigress will not mate while caring for her young.

Tigers and people: Tigers represent either good or bad spirits in some religions. They are illegally hunted for their fur. Body parts are

used by some Asian cultures for medicine. They are killed for attacking humans and livestock.

Conservation status: The tiger is listed as Endangered due to habitat loss, illegal hunting for fur and traditional medicine, and declining prey. ■



Puma *(Puma concolor)*

PUMA
Puma concolor

Physical characteristics: The puma, also known as cougar, panther, or mountain lion, has coloration ranging from silvery gray to reddish brown. Having the longest hind legs of all cats, the puma can jump 18 feet (5.5 meters) up a tree. Pumas measure 41 to 77 inches (105 to 196 centimeters), with another 26 to 31 inches



A puma can take down a large animal by breaking the animal's neck with its powerful jaws. (© Charles Krebs/Corbis. Reproduced by permission.)

(67 to 78 centimeters) for the tail. They weigh about 75 to 264 pounds (34 to 120 kilograms).

Geographic range: Pumas are found in the United States, Canada, Mexico, South America (including Argentina, Bolivia, and Venezuela), and Central America (including Costa Rica, Guatemala, and Panama).

Habitat: Pumas prefer forested areas with cover for hunting and resting. They are adaptable, also occupying mountain areas, swampland, and grassland. They thrive in the desert, getting moisture from the flesh of prey.

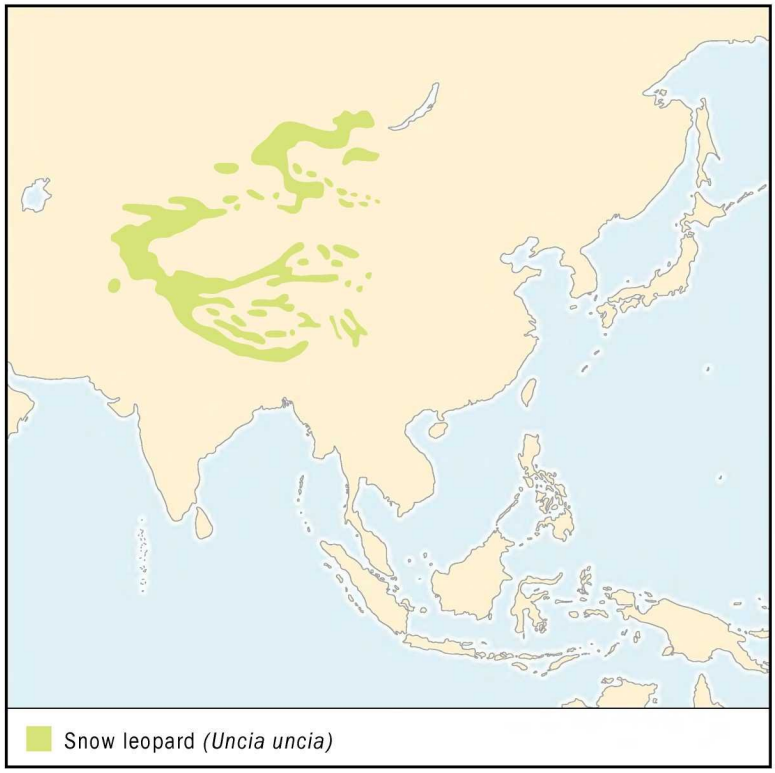
Diet: Pumas feed on deer and other large ungulates, large rodents, rabbits, raccoons, and even bats, grasshoppers, and occasionally domestic livestock. A puma eats 20 to 30 pounds (9.1 to 13.6 kilograms) of meat per feeding, burying extra kill and returning later to feed.

Behavior and reproduction: Pumas are solitary animals, mostly hunting at night. They mark territorial boundaries with urine, feces, and scrapes on tree trunks. Scent marks are also used for mating

signals. Pumas cannot roar but communicate through squeaks, purrs, growls, and hisses. Both sexes have several partners, mating throughout the year. Females give birth every other year to one to six kittens, making the young leave her territory after about two years.

Pumas and people: Human expansion into puma habitat has resulted in close encounters with the animals. Pumas in the suburbs and cities are likely to be killed.

Conservation status: The United States classifies the Florida panther and the eastern puma as Endangered due to habitat loss to forest clearance, prey reduction, and human expansion. The IUCN lists the puma as Near Threatened. ■



SNOW LEOPARD
Uncia uncia

Physical characteristics: Snow leopards are light gray with black-brown rosettes and spots and sides tinged with yellow. This leopard measures 39 to 51 inches (99 to 130 centimeters). The furry tail, nearly as long as the body, acts as a warm wrap during sleep or rest and provides balance during leaps. An enlarged nasal cavity warms cold air entering the body. Long hind legs are adapted for jumping up to 45 feet (14 meters), while wide, furred paws are designed for walking on snow. Snow leopards weigh 77 to 120 pounds (35 to 55 kilograms).

Geographic range: Snow leopards occur in Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia, Tajikistan, and Uzbekistan.



Snow leopards live in high mountain regions, preferring areas near cliffs and ridges. (Cincinnati Zoo. Reproduced by permission.)

Habitat: Snow leopards live in high mountain regions, preferring steep, broken areas near cliffs and ridges. They also inhabit arid or semi-arid shrubland.

Diet: Snow leopards feed mainly on blue sheep and ibex, a wild goat. They also eat small animals, including marmots, hares, and game birds. They may take livestock, including young yaks, sheep, goats, and horses. They occasionally eat plants.

Behavior and reproduction: Snow leopards are generally active at dawn and dusk. They are solitary but communicate by scent marking with urine, feces, and scratches on the ground and tree trunks. They cannot roar but make sounds, including screams, hisses, and mews. Leopards pair off only to mate, averaging two to three cubs. The cubs stay with their mother for about two years.

Snow leopards and people: Snow leopards' bones and body parts have replaced tiger parts in traditional Asian medicine. Illegal hunting for fur continues in some Asian countries. Snow leopards are also killed for preying on domestic livestock.

Conservation status: The IUCN lists the snow leopard as Endangered due to several factors: loss of prey, killing by herders, poaching, and habitat loss and fragmentation due to human activities, especially the raising of livestock. ■



BOBCAT
Lynx rufus

Physical characteristics: Bobcats have a light gray to reddish brown coat covered with black spots and bars. The tip of the "bobbed," or short, tail is black on the upper side. The face is framed in bushy hair. Black ears with a white center have long hairs inside that are very sensitive to sound. A shoulder height of 18 to 23 inches (46 to 58 centimeters), thick fur, and large ears give the appearance of a larger size. Bobcats measure 24 to 42 inches (62 to 106 centimeters) in length, and the tail is another 5 to 8 inches (13 to 20 centimeters). It weighs 13 to 37 pounds (6 to 17 kilograms).

Geographic range: Bobcats are found in the United States, Canada, and Mexico.

Habitat: Bobcats inhabit coniferous forests, mixed coniferous and deciduous forests, swamps, and desert scrub. They prefer thick



Bobcats eat mainly hares and rabbits, but also prey on deer, which they can take when the deer are resting. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

understory (short vegetation under taller trees) for the cover provided by the dappled shade of tall trees.

Diet: Bobcats mainly eat rabbits and hares. They also feed on rodents, large birds, snakes, fruits, and carrion. They prey on deer, which are taken when resting.

Behavior and reproduction: Bobcats are active at all hours, but most active at dawn and dusk. They are good climbers and may rest in trees. They are also excellent swimmers. Bobcats scent mark territorial boundaries with urine and feces. They are solitary, except when mating and raising young. Males have several partners. An average litter consists of two to three kittens, which stay with their mother for nine to ten months. Young females stay close to their mothers' home ranges, while young males may travel far to establish their own territories.

Bobcats and people: In the 1960s and 1970s, bobcat furs were in high demand due to restrictions in the trade of other cat furs. Demand for the furs continues, and research regarding the harvest of bobcat fur continues as well.

Conservation status: The bobcat is not a threatened species. ■

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family CHAPTER

EARED SEALS, FUR SEALS, AND SEA LIONS

Otariidae

Class: Mammalia
Order: Carnivora
Family: Otariidae
Number of species: 15 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Otariids, eared seals, have streamlined, smooth, bodies that allow them to move easily through water. A layer of blubber, or fat, provides insulation. The dog-like head has small external flaps for ears. Long whiskers are sensors for finding food and alerting against predators. Flippers can be turned forward for walking on land. In water, the front flippers function as oars, while the back flippers steer and provide balance. Males are two to four times larger than females.

GEOGRAPHIC RANGE

Otariids haul out on land near the waters they inhabit, including the United States, Canada, Mexico, Argentina, Chile, Ecuador, Peru, Japan, Australia, and New Zealand.

HABITAT

When breeding or molting, shedding fur, otariids gather on rocky coastlines, sandy and gravel beaches, and caves. They also breed in mainland areas in Africa, Argentina, and Peru.

DIET

Otariids feed on krill, a small shrimp-like animal, fish, crustaceans like shrimps, crabs, and lobsters, mollusks such as clams, mussels, squid, and octopuses, and penguins. A small fur seal weighing 110 pounds (50 kilograms) consumes about 4 to 5 pounds (1.8 to 2.3 kilograms) of food per feeding.

ADJUSTABLE EYES

An eared seal's eyes are adapted for seeing in hazy seawater and bright sunlight. Underwater, the pupil, or opening at the front of the eye, expands to let in as much light as possible. In addition, a mirror-like layer behind the eyes reflects light back to the retina, increasing the amount of light entering the eyes. Out of the water, the pupil adjusts to the bright sunlight by narrowing into a tiny pinhole.

BEHAVIOR AND REPRODUCTION

Otariids are active both day and night. Expert divers, they swim to the deepest parts of the ocean floor to forage, find food. They breed annually, except for the Australian sea lion that breeds every seventeen-and-a-half months. Some species migrate far to rookeries, breeding colonies. Females give birth to one pup a year.

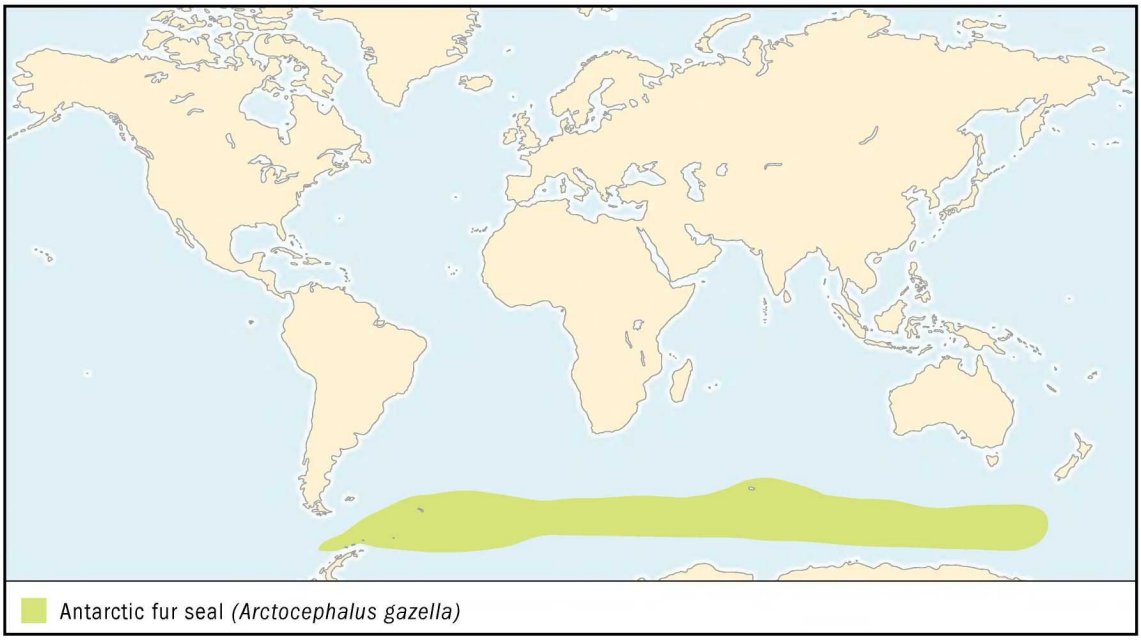
OTARIIDS AND PEOPLE

In the nineteenth century, fur seals were hunted for their fur, meat, and blubber. Today fishermen consider seals as competitors for fish. Seals' body parts may be used as aphrodisiacs, believed to increase sexual desire, or ornaments. Seals may be threatened by pollution caused by humans.

CONSERVATION STATUS

The World Conservation Union (IUCN) and the United States classify the Steller sea lion as Endangered, facing an extremely high risk of extinction in the wild. They are at risk due to extensive commercial fishing of pollock, its major prey fish, human pollution, accidental tangling in commercial fishing gear, and hunting by humans.

The IUCN lists many otariids as Vulnerable, facing a high risk of extinction in the wild. The Galápagos fur seal is vulnerable due to parasites and predators. The Juan Fernández fur seal is threatened by a limited population as a result of inbreeding. Guadalupe fur seals are vulnerable because of excessive harvesting. Northern fur seals are endangered by habitat loss or degradation due to human activities. Hooker's sea lions are at risk due to accidental entanglement in fishing gear and human hunting. Finally the Galápagos sea lion is vulnerable as a result of El Niño events, illegal hunting, and tangling in fishing gear.

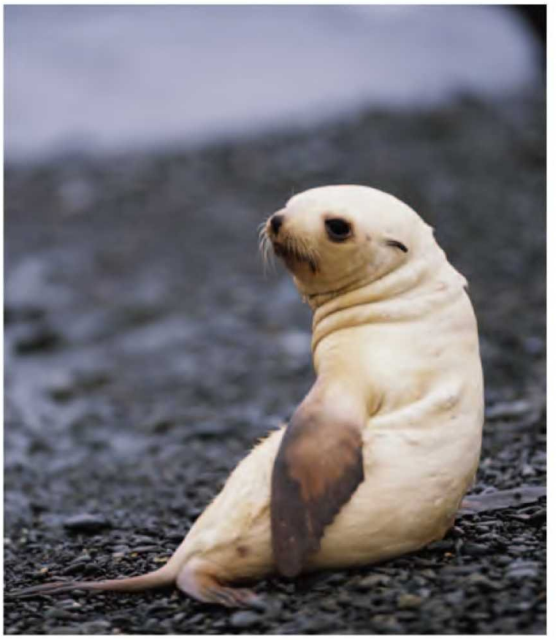


ANTARCTIC FUR SEAL
Arctocephalus gazella

Physical characteristics: Antarctic fur seals have a thick waterproof underfur and an overcoat of long guard hairs. Bulls, adult males, are dark brown or charcoal-gray. A long mane of hair protects bulls when fighting over breeding territories. Bulls measure about 6 feet 7 inches (2 meters) long and weigh up to 440 pounds (200 kilograms). Adult females, cows, are smaller in size, about 4 feet 5 inches (1.4 meters) long and weigh up to 110 pounds (50 kilograms). They are gray, with cream-colored throat and chest.

Geographic range: Antarctic fur seals live in the Southern Ocean surrounding Antarctica. They breed on the islands south of, or close to, the Antarctic polar front. About 95 percent breed on South Georgia in the South Atlantic Ocean.

Habitat: Antarctic fur seals live in the open seas and congregate on land to breed, molt, and rest.



Antarctic fur seal pups stay on land for about four months. Growing seals stay at sea for several years, returning only when they're ready to mate. (© Paul A. Souders/Corbis. Reproduced by permission.)

Diet: Antarctic fur seals are the only otariids that feed mainly on krill. They sometimes consume fish, squid, and birds.

Behavior and reproduction: Antarctic fur seals are solitary, alone, at sea, usually foraging at night. Adult and subadult males congregate on land to molt. Cows may assemble in herds but do not socialize. Growing seals stay at sea for several years, only returning to their birthplaces to mate for the first time.

In late October, bulls arrive at rookeries to claim territories. They quarrel, sometimes biting one another. Males fast, go without food, for as long as two months while protecting their territory. In November, cows arrive, choose a bull's territory, and give birth to a single pup conceived the previous year. A bull has an average of eleven to sixteen cows in his territory. At birth, the pup vocalizes with its mother. After nursing for a week to ten days, the cow mates with the territorial bull. The female then feeds at sea for up to six days. A returning mother calls out to her pup who answers back. After smelling the pup to make sure it is hers, and then nurses for three or more days. The periodic foraging and nursing lasts about four months. In April, all seals leave for the sea, each going its own way.

Antarctic fur seals and people: Once hunted almost to extinction for their fur, meat, and blubber, these seals are currently protected by international agreements and by the islands where they breed.

Conservation status: The Antarctic fur seal is not a threatened species. ■



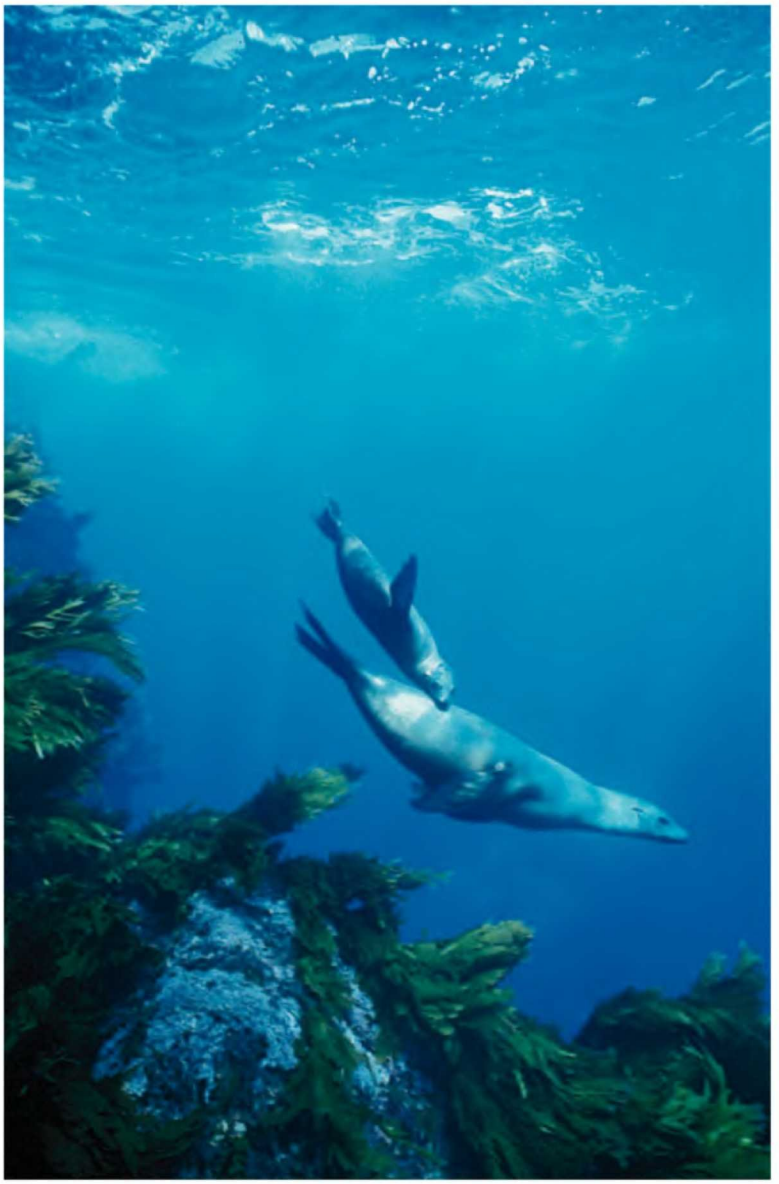
CALIFORNIA SEA LION
Zalophus californianus

Physical characteristics: California sea lions have a torpedo-like body, with flippers for swimming and moving on land. Males have brown or black fur, a bulky upper body, and a thick mane over the shoulders. A crest, or a distinctive bump on the forehead, is topped with blonde or light brown hair. They weigh as much as 772 pounds (350 kilograms). Females are much lighter, weighing up to 220 pounds (100 kilograms), and are tan in color.

Geographic range: California sea lions live in the Pacific Ocean along central Mexico to southern California. In between breeding seasons, males migrate, travel, to feeding sites off Oregon, Washington, and British Columbia, Canada.

Habitat: California sea lions breed on sandy, gravel, or rocky beaches.

California sea lions are the fastest marine carnivore and can swim up to 25 miles (40 kilometers) per hour. (Phillip Colla/Bruce Coleman Inc. Reproduced by permssion.)



Diet: California sea lions are opportunistic feeders, eating whatever is available. They feed mainly on squid and octopuses, but also consume fish, including anchovies, salmon, rockfish, and small sharks. They eat at all hours of the day. They typically swallow small prey whole in water but take bigger prey to land to shake them into small pieces. Males prey on northern fur seal pups and small true seals.

Behavior and reproduction: California sea lions are active the whole day. They are the fastest marine carnivore and can swim up to 25 miles (40 kilometers) per hour. They often swim in groups, covering large distances by porpoising, leaping over water. They also rest together on the water surface in a horizontal position called rafting.

Breeding season lasts from May through July. Bulls wait for the pregnant cows to come ashore before establishing territories. After giving birth to one pup, mothers nurse their young, then forage at sea, sometimes taking the newborn with them. Three or four weeks later, mating occurs in the water. Mothers recognize their pup by sound and smell. A pup may nurse for a whole year at the rookery. The males leave for the ocean soon after breeding.

California sea lions and people: California sea lions are most familiar as talented performers in marine parks and circuses. Some fishermen consider them pests because they steal fish from nets. Sea lions have been trained by the U.S. Navy to detect suspicious swimmers and divers near military ships and ports because they have excellent underwater directional hearing and low-light vision and are able to make repeated deep dives. A sea lion can approach an intruder without being heard. Using its flippers, it will clamp a handcuffs-like device carried in its mouth onto the person's leg, allowing sailors to apprehend the suspect. The U.S. Navy has normally relied on sea lions to recover practice mines undersea.

Conservation status: The California sea lion is not a threatened species. ■

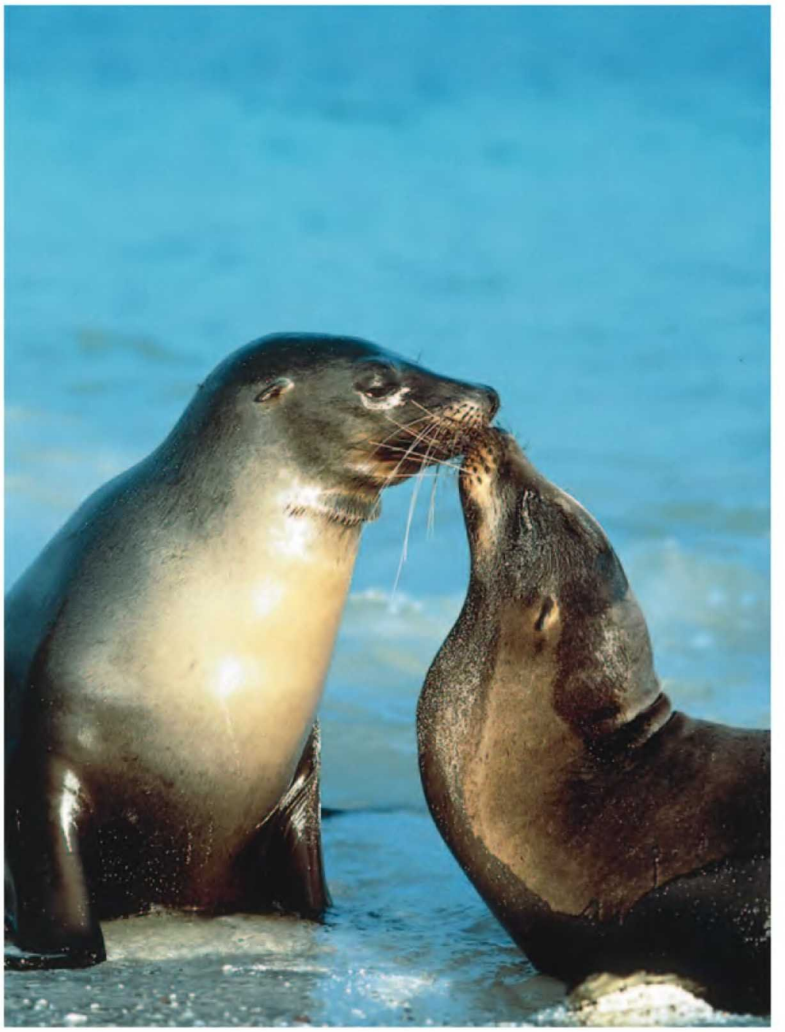


GALÁPAGOS SEA LION
Zalophus wollebaeki

Physical characteristics: Male Galápagos sea lions are dark brown to black, weigh up to 550 pounds (250 kilograms), and have a bump on the forehead. Females are lighter, weighing as much as 176 pounds (80 kilograms) and are tan or blonde in color.

Geographic range: Galápagos sea lions inhabit the Galápagos Islands, a group of islands considered a province of Ecuador.

Habitat: Galápagos sea lions favor gently sloping sandy and rocky beaches for breeding.



Galápagos sea lion pups nurse for up to a year, or until a sibling is born. (Tui De Roy/Bruce Coleman Inc. Reproduced by permission.)

Diet: Galápagos sea lions feed on squid and fish, including sardines, anchovies, mackerel, and rockfish in the upwelling waters, nutrient-rich waters rising from the ocean depths, along the coasts. During El Niño events, when fish populations either die or migrate, sea lions dive down deeper into the ocean to feed on lantern fish.

Behavior and reproduction: Galápagos sea lions stay on the islands year round. During the day, they forage in waters close to the islands. The breeding season is long, lasting from May to January. The cow nurses her pup for about a week, then feeds at sea, returning periodically to nurse. Three weeks after giving birth, cows are ready to mate. A bull may have as many as thirty cows in his territory. Some

cows ignore boundaries, seeking males in other territories. Mating occurs in shallow water or on land. Bulls may help guard pups from sharks by a warning call or by moving them away from the water. Pups nurse for up to a year or until a sibling is born. Some cows nurse both the yearling and the newborn for another year.

Galápagos sea lions and people: Galápagos sea lions are popular tourist attractions on the islands. They are illegally hunted for their teeth for adornment, and the male genitals are believed to be aphrodisiacs, items that intensify or arouse sexual desires, in some Asian cultures.

Conservation status: The IUCN lists the Galápagos sea lion as Vulnerable due to El Niño events, tangling in fishing gear, and illegal hunting for body parts. ■

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WALRUS

Odobenidae

Class: Mammalia

Order: Carnivora

Family: Odobenidae

One species: Walrus (*Odobenus rosmarus*)

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The walrus is the second largest pinniped, after the elephant seal. Walruses are 44 to 126 inches (112 to 320 centimeters) long and weigh 139 to 2,662 pounds (63 to 1,210 kilograms). Their streamlined, smooth, body allows for easy movement through water. They are sparsely covered with short, cinnamon brown hair, which is darker in young walruses. In older males, the hair is almost absent, giving a naked appearance. The wrinkled skin measures 0.75 to 2 inches (2 to 5 centimeters) thick. Adult males have large, coarse bumps on the neck and shoulders. Underneath the skin is a layer of blubber, or fat, about 0.4 to 6 inches (1 to 15 centimeters) thick, which protects against the cold and serves as storage for food energy.

Although its head is quite small compared to the rest of its body, the walrus has a powerful skull. If the seawater freezes while the walrus is underwater, it uses its skull like a sledgehammer to break through the ice overhead, up to 8 inches (20 centimeters) in thickness. The walrus has no external ears, just small openings covered by a fold of skin. About 600 to 700 stiff whiskers form a mustache and act as antennas for detecting prey. The thickened upper lip is used to feel around for food in the muddy sediments of the ocean floor. Two air pouches in the throat extend to the shoulders. They can be inflated to function as life preservers, enabling the walrus to sleep or rest in an upright position with its head above water. Males produce bell-like sounds with these inflated air pouches when courting females.

Walruses have webbed flippers. The back flippers act as paddles for swimming, while the front flippers do the steering. On land or ice, walruses use their flippers the same way eared seals use theirs. The back flippers are turned forward and, together with the front flippers, are used for moving around. However, unlike eared seals, walruses cannot lift their enormous body off the ground. They walk by pushing off the ground with the help of the belly and flippers. The thick blubber helps cushion its underparts while walking.

The walrus is known for its long, ivory tusks, which are enlarged upper canine, dagger-like, teeth. The teeth first extend out of the mouth when they are about one year old. The tusks serve many functions. They are used for hauling out (getting out of the water) onto the ice. This is where the first part of the walrus's scientific name came from. The Greek word *odobenus* means "tooth walker" or "one who walks on his teeth." The tusks are also used to threaten rivals for breeding territories and for actual fights. Dominant males typically have larger tusks and use them as power displays. Walruses sometimes use their tusks to support their head while sleeping or resting on ice. They sleep or rest vertically in water with the tusks hooked over the edge of an ice floe, a large sheet of floating ice. The tusks grow with age. In adult males, they can grow up to 3 feet (1 meter) long and weigh about 12 pounds (nearly 5.5 kilograms) each.



WHY DOES A WALRUS TURN WHITE THEN BRIGHT PINK?

In cold seawater, the walrus closes its blood vessels in the skin to prevent blood flow to that area, thus preventing heat loss. The absence of blood gives the skin a pale appearance. On land under the sun, the walrus's thick blubber makes it feel hot. To prevent overheating, blood vessels in the skin are opened to carry heat from inside the body and get rid of it through the skin, turning it pink.

GEOGRAPHIC RANGE

Walruses are found mainly in the coastal areas of the Arctic Ocean and adjoining seas. There are two populations of walruses. Pacific walruses are found in the Bering, Chukchi, and Laptev Seas. Atlantic walruses occupy the coastal regions of Greenland and northeastern Canada.

HABITAT

Walruses live mainly in the sea, occupying pack ice, large pieces of ice frozen together, that floats on the continental shelf, the shallow part of the ocean floor that starts at the shoreline. Males haul out on sandy, cobble, or boulder beaches.

Though not considered Threatened, the walrus is protected by the governments of the countries in which it lives. Only native people are allowed to hunt walruses legally. (Dotte Larson/Bruce Coleman Inc. Reproduced by permission.)

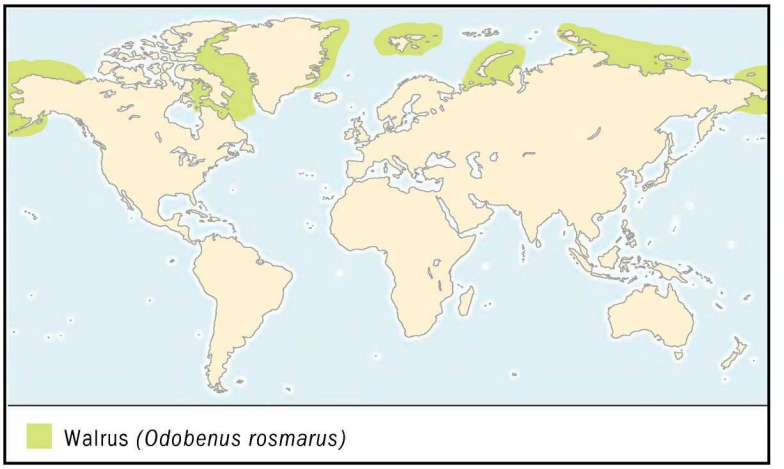


DIET

Walruses eat primarily bivalve mollusks, clams and mussels. They also feed on marine worms, crabs, shrimp, octopus, squid, and sea cucumbers. They occasionally eat fish and seals, including spotted, ringed, and bearded seals. The walrus squirts the muddy sediments on the ocean floor with water from its mouth, exposing the mollusks. Then it sucks the meat out of the shell. An adult walrus consumes about 4 to 6 percent of its total body weight daily. It can eat 3,000 to 6,000 clams per meal.

BEHAVIOR AND REPRODUCTION

Walruses socialize in groups called herds, although males and females keep to their groups except when mating in the winter. They travel and forage together in small groups, and several hundred may haul out on ice floes. Thousands of walruses congregate on beaches to molt, shed, or rest. They typically lie close together, oftentimes draped over one another. However, they can annoy one another, at which point they hit their neighbors with their tusks. Sometimes fighting occurs. However, walruses are supportive of one another. They will help a neighbor who is being attacked by a polar bear or attempt to get a dead animal off an ice floe into the water to get it away from a hunter.



Walruses follow the pack ice throughout the year. In spring, they migrate north toward the Arctic Ocean to feed. Males haul out onto beaches along the Alaskan and Russian coasts to molt and rest, while females migrate farther north. Females give birth on pack ice in the spring and summer. Unlike other pinnipeds, walruses do not mate right after giving birth.

In the fall, they follow expanding pack ice, this time heading south. In the winter, males follow herds of females and their young at sea. When the mother-offspring groups haul up on ice floes, the males remain in the water close by. The males go through a courtship display of producing bell-like sounds underwater, followed by whistles and teeth-clacking above the water. The males also fight for dominance, and only the winner will mate with the females of a certain herd. Mating occurs underwater, after which males rejoin their all-male group. This yearly migration north and south covers about 2,000 miles (3,000 kilometers), with walruses swimming or riding on moving ice.

Walruses spend about two-thirds of their lives in the water. They are slow swimmers, typically going up to 4.3 miles (7 kilometers) per hour, but can reach a speed of up to 22 miles (35 kilometers) per hour. They can stay underwater for 25 minutes, although they usually remain underwater for just 10 minutes because they forage on shallow ocean floors.

Pregnancy lasts fifteen months due to delayed implantation, during which the fertilized egg grows a little then waits four to five months before attaching to the uterus for further development. A single calf is born during the spring migration north. Nursing usually occurs in water, with the calf hanging upside

down. The calf can swim at birth. Calves remain with their mothers for two years, although they forage for other food before being completely weaned from their mother's milk. Young females stay with female herds, while young males leave to join all-male herds. The long nursing period means that females do not give birth annually. Mothers are very protective of their young, fighting off intruders with their tusks. They carry their newborn on their back in the water. On land, they hold their calf close to their body with their front flippers when they perceive danger. Walruses have been known to guard one another's young and to adopt orphans.

WALRUSES AND PEOPLE

Native people of the Arctic have always associated the walrus with spiritual power. For thousands of years, they depended on walruses for subsistence, hunting them for food and fuel, as well as material for shelter, clothing, boats, sled, tools, and handicrafts. In the seventeenth century, Europeans first harvested walruses commercially, especially for their ivory tusks, eventually causing declining populations. Today, walruses are legally protected by the governments of the United States, Canada, and Russia. Only native people are allowed to hunt them.

CONSERVATION STATUS

Walruses are not a threatened species.

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TRUE SEALS
Phocidae

Class: Mammalia
Order: Carnivora
Family: Phocidae
Number of species: 19 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

True seals have a tapered shape, with short hair covering their body. Underneath the thick skin are 5 to 6 inches (11 to 13 centimeters) of blubber, or fat, that conserves body heat and stores food energy. They are also called earless seals, because they do not have external ears. The ears are just tiny openings on each side of the rounded head. Unlike eared seals, true seals cannot rotate their back flippers for walking. For movement on land, they crawl on their undersides, with the rear end and front flippers pushing the body along. In water, the webbed back flippers act as paddles, while the front flippers are used for steering and balance.

GEOGRAPHIC RANGE

True seals inhabit all oceans, except the Indian Ocean. Some species live in inland lakes in Siberia, Russia, and Finland.

HABITAT

True seals forage, search for food, at sea, but haul out (get out of the water) to land to breed, molt, or shed fur, and rest. They prefer ice floes, large sheets of floating ice, or fast ice, ice attached to a land mass. They also inhabit sand, cobble, and boulder beaches, as well as caves and rocky outcrops.

DIET

True seals eat mostly fish. They also feed on krill, squid, octopuses, and other seals.

BEHAVIOR AND REPRODUCTION

True seals congregate on land or ice to breed and molt. The males and females of some species migrate, travel, separately from breeding to foraging areas. Others species do not migrate. Only the male elephant seals and gray seals gather groups of females during the breeding season. In some species, cows, females, nurse their young for just a few days, fattening up the pup, and then letting it fend for itself.

TRUE SEALS AND PEOPLE

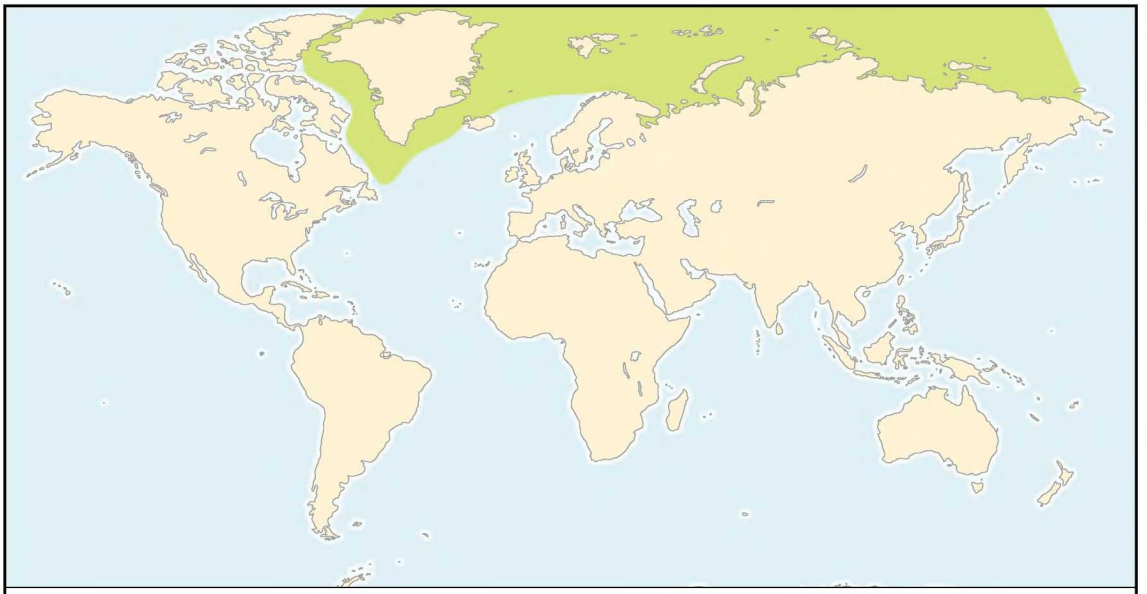
Native people have always depended on seals for food, oil, and fur, taking only what they need for their local populations. Commercial sealers, on the other hand, have overhunted some species.

CONSERVATION STATUS

Three true seals are considered threatened species due mainly to habitat loss or degradation. The Caribbean and Hawaiian monk seals are listed as Endangered, facing a very high risk of extinction, by the U.S. Fish and Wildlife Service. The World Conservation Union (IUCN) lists the Mediterranean monk seal as Critically Endangered, facing an extremely high risk of extinction in the wild, the Hawaiian monk seal as Endangered, and the Caspian seal as Vulnerable, facing a high risk of extinction in the wild.

DEEP DIVERS

Northern elephant seals are able to dive to deep ocean depths because of certain bodily adaptations. They reduce oxygen use in the muscles, tissues, and other organs and redirect that oxygen supply to the important organs, the heart and brain. Human divers may suffer decompression sickness, or the "bends," when rising to the water surface because of nitrogen bubbles trapped in the blood. Seals collapse their lungs when diving, ridding the lungs of any air, and therefore avoid the bends.



Harp seal *(Pagophilus groenlandicus)*

SPECIES ACCOUNTS

HARP SEAL
Pagophilus groenlandicus

Physical characteristics: Harp seals got their name from the harp pattern on their back. Adult males and females are light silvery gray with a black face. In males, the harp marking is black. In females, the marking may be broken into smaller patterns. Each seal measures about 5.6 feet (1.7 meters). Males weigh about 297 pounds (135 kilograms) and females about 240 pounds (109 kilograms). Harp seals have a thick layer of blubber that protects them from the cold and stores food energy. The front flippers have strong, sharp claws for hauling out of the water and moving across ice. The back flippers function as oars for swimming but cannot be turned forward for walking.

Geographic range: Harp seals live in the Arctic and the North Atlantic Oceans. They breed off the coast of northeastern Canada, off the east coast of Greenland, and in the White Sea off the northwestern coast of Russia.



Harp seals nurse their pups for about two weeks, then leave the pups on their own. After another two weeks, the pup sheds its white downy coat, replacing it with a shorter silvery gray coat. (Tom Brakefield/Bruce Coleman Inc. Reproduced by permission.)

Habitat: When not foraging or migrating, harp seals live on ice floes in the open sea. They breed and molt on offshore pack ice. They forage, search for food, under the ice or in open water.

Diet: Harp seals feed on a variety of fish, including capelin, cod, and herring. They also eat shrimp, crabs, and squid.

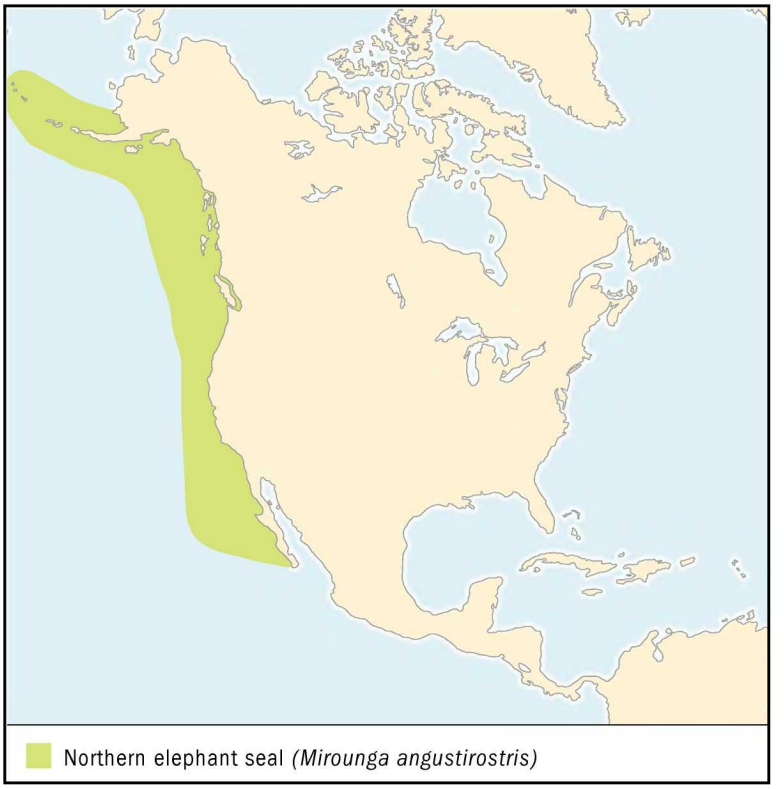
Behavior and reproduction: Harp seals feed and travel in large groups. They are playful, porpoising or making arcing leaps over water, like dolphins and sea lions. They are excellent divers, able to stay underwater for thirty minutes at a time. They vocalize underwater and on land.

Females gather on pack ice in late winter to give birth to single pups and nurse for about two weeks. Soon after, each cow mates in the water, then returns to sea, leaving her pup permanently. Within those two weeks, the pup grows from about 24 pounds (11 kilograms) to about 80 pounds (36 kilograms). After another two weeks, it sheds its white downy coat, replacing it with a shorter silvery gray coat. They learn to swim and find their own food. After mating, the adult

males leave to feed at sea, hauling up on shore to molt for about a month before continuing their northward journey.

Harp seals and people: In the 1970s and 1980s, pressure from conservationists caused the closing of American and European markets for seal products. The seal trade has continued, with new markets in Russia, China, Poland, and Ukraine bringing in millions of dollars for the fur alone. In addition, seal genitals are marketed to Asian markets as aphrodisiacs (aff-roh-DEE-zee-acks), substances that are supposed to increase sexual desire. In 2004, the Canadian government announced an additional quota of 100,000 seals available for hunting for an annual total of 350,000 seals.

Conservation status: Harp seals are not a threatened species. ■



Northern elephant seal *(Mirounga angustirostris)*

NORTHERN ELEPHANT SEAL
Mirounga angustirostris

Physical characteristics: The northern elephant seal got its name from the male's nose, which resembles an elephant's trunk. Males weigh three or four times as much as females, averaging 3,750 pounds (1,704 kilograms) and measuring about 13.2 feet (4 meters). Females are about 1,122 pounds (510 kilograms) and 10.6 feet (3.2 meters) long. Males are dark brown. The thickened, pinkish throat and neck protect them against sharp teeth during fights at the rookeries, breeding grounds. The nose can be inflated to give a bigger appearance and to make loud noises for threat displays. Females are light to chocolate brown.

Geographic range: Northern elephant seals forage in the North Pacific Ocean and breed off the coast of northern California to Baja, Mexico.



The northern elephant seal's nose can be inflated to give a larger appearance and to make loud noises for threat displays. (Jen and Des Bartlett/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Northern elephant seals forage at sea as far north as the Gulf of Alaska and the Aleutian Islands. They breed on sandy, cobble, and pebble beaches.

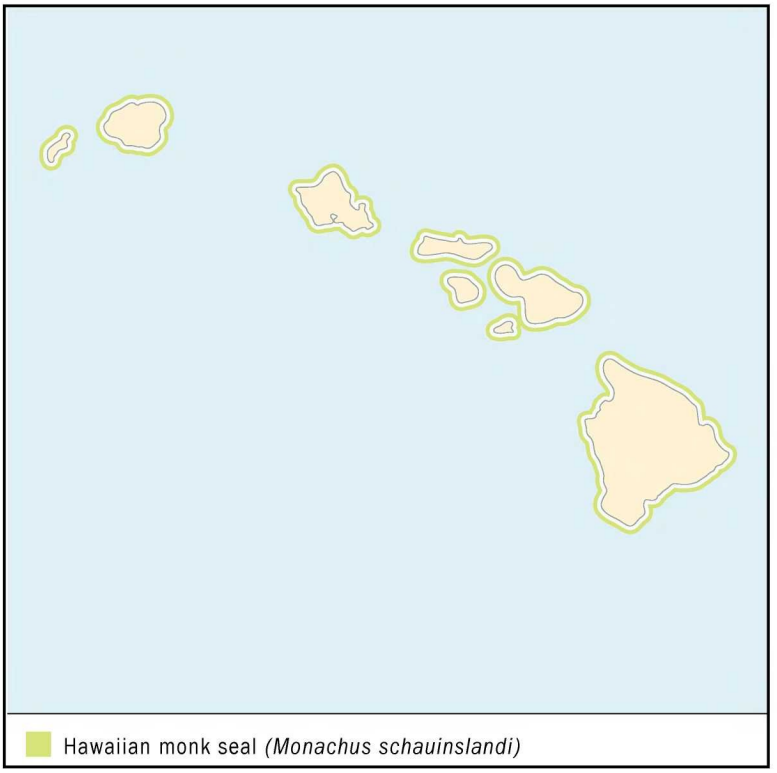
Diet: Northern elephant seals feed on deep-sea fish, such as Pacific whiting, ratfish, and shark, as well as squid, octopuses, crabs, and eels.

Behavior and reproduction: Northern elephant seals spend up to 90 percent of their time underwater, diving for twenty to thirty minutes, and then coming up for air for about three minutes. They have been recorded diving as deep as 1 mile (1.6 kilometers). Average diving depths range from 1,650 to 2,300 feet (about 500 to 700 meters). In winter, bulls haul out to establish breeding territories. Pregnant cows go ashore a month later, giving birth to single pups. After nursing for about a month, females mate with the territorial bull and with other subordinate males. She then goes back to the sea, leaving the pup to fend for itself. Both sexes fast, go without food, while on land, up to three months for the males. After foraging at sea, each migrates back to the breeding grounds to molt. Each year, seals shed both old skin and hair in what is called catastrophic molt. Northern elephant

seals migrate a long distance twice a year, to breed and then to molt, traveling over 6,000 miles (10,000 kilometers) each way.

Northern elephant seals and people: Northern elephant seals were thought extinct by the late 1800s due to overharvesting for its blubber, primarily used in lamp oil. Since the early 1900s, when the seals appeared in Mexico and California, the U.S. government and Mexican government have taken steps to protect them.

Conservation status: Northern elephant seals are not a threatened species. ■



HAWAIIAN MONK SEAL
Monachus schauinslandi

Physical characteristics: Adult Hawaiian monk seals have short, silvery gray coats, which turn lighter on their undersides. As a seal ages, its coat turns a deep brown with each molt. Females, at about 7.5 feet (2.3 meters) and 528 pounds (270 kilograms), are larger than males. Males measure about 6.9 feet (2.1 meters) long and weigh 385 pounds (175 kilograms).

Geographic range: Hawaiian monk seals are found in the United States.

Habitat: Hawaiian monk seals inhabit the Pacific Ocean waters surrounding the northwestern Hawaiian islands. They breed, rest, and molt on coral reef islands. A small number are found on the main



Hawaiian monk seals live in the Pacific Ocean waters surrounding the northwestern Hawaiian islands. They breed, rest, and molt on coral reef islands. (© Frans Lanting/Photo Researchers, Inc. Reproduced by permission.)

Hawaiian Islands. Cows choose breeding areas with a coral shelf that affords protection from the sun and sharks.

Diet: Hawaiian monk seals feed on deep-water fish and other fish found in the coral reefs. They also eat squid, octopuses, and lobsters.

Behavior and reproduction: Hawaiian monk seals are solitary, living alone, except during the breeding season. Females give birth to a single pup that they nurse for four to six weeks. A cow sometimes nurses another cow's pup. Females mate soon after they leave their pups, typically in the water. Bulls are believed to have several partners. In areas where males outnumber females, mobbing occurs, in which a group of adult males attempt to mate at once with an adult or an immature female, sometimes fatally injuring that individual.

These seals are active at night, sleeping during the heat of day. They do not migrate, but may spend many days foraging at sea before going ashore to sleep. They do not tolerant humans. When disturbed, they either do not go ashore to breed or give birth in a less preferred site. Pups usually do not survive under these conditions.

Hawaiian monk seals and people: Hawaiian monk seals have recently inhabited the main Hawaiian islands. Since they are listed as Endangered and, therefore, legally protected, their appearance on tourist beaches has prompted restrictions or closure that may turn people against them.

Conservation status: The U.S. Fish and Wildlife Service and IUCN lists the Hawaiian monk seal as Endangered due to habitat loss to human expansion, lack of young females for mating, male mobbing of females, reduced prey, and entanglement in ocean debris and commercial fishing gear. ■

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order

CHAPTER

WHALES, DOLPHINS, AND PORPOISES

Cetacea

Class: Mammalia

Order: Cetacea

Number of families: 14 families

phylum

class

subclass

order

monotypic order

suborder

family

PHYSICAL CHARACTERISTICS

Cetaceans (sih-TAY-shunz) are whales, dolphins, and porpoises. These mammals live, eat, reproduce, and rest in the water. They range in size from that of a small human—5 feet (1.5 meters) and 110 pounds (50 kilograms)—to huge, building-sized animals of 110 feet (33 meters) and 400,000 pounds (180,000 kilograms). Their ancestors were land mammals. More than fifty million years ago, these ancestors evolved physical characteristics that allowed them to live successfully in the water. Today scientists believe that the closest living land-based relative of whales, dolphins, and porpoises is the hippopotamus.

All cetaceans share certain physical characteristics that allow them to live their entire life in the water. Most notably, they all have streamlined, smooth, bodies to cut down on friction and turbulence as they move through the water. This streamlining has come about because the bones in their front legs are shortened and compressed to form paddles called flippers that have no fingers or claws. In addition, their back legs are so reduced that all that remains are a few internal pelvic bones. Likewise, they have no external reproductive organs. Male cetaceans have a retractable penis, which means that they can draw it up inside their body. The nipples of the female are also hidden in a slit within their belly.

The need to be streamlined has affected the shape of the skull and the sense organs found it in. The bones of the skull and the jawbones have become elongated, stretched out. The nostrils, usually on the front of the face in land mammals, have

WHY DON'T WHALE CALVES DROWN WHEN THEY NURSE?

Whale calves must nurse from their mothers while in the water. How can the baby suckle and not suck huge amounts of water into its lungs when it breathes? The answer lies in an adaptation to aquatic life. Unlike land mammals where air and food share a single passage into the body, the digestive system and the breathing passage of the whale are separate. The whale's blowhole leads directly to the lungs, while the mouth and esophagus, throat, lead only to the stomach. This allows the whale calf to eat and breathe at the same time.

moved to the top of the head and are called blowholes. There can be one or two blowholes, depending on species, or a single slit on the top of the head. Blowholes are connected to the lungs and can be closed to keep out water when the animal dives.

Cetaceans have no external, outside, ears, although they have very good hearing. Sound is transmitted to the internal ear through bones. Most members of this order have good eyesight, although some species that live in cloudy water have lost most of the ability to see. Cetaceans use a complex system of communication and are thought to be highly intelligent. They have large brains in proportion to their body size.

All members of this order are hairless, they may have a few hairs at birth, but have a thick layer of oil and fat called blubber under the skin. They are warm-blooded; their core body temperature stays about the same as that of a human, even in cold Arctic waters. Cetaceans have no sweat glands. They regulate their temperature by controlling the amount of blood flowing through their flippers and fins, which are not covered with blubber.

Members of this order are known for their ability to make deep dives and remain underwater for long periods. Sperm whales have been known to dive more than 6,080 feet (1,853 meters). They have an efficient circulatory system that allows them to store and retrieve large amounts of oxygen in their blood and muscle tissue. In addition, when they dive, they reduce blood flow to their skeletal muscles, decreasing oxygen use in the muscles while keeping blood flow to the brain. Finally, when they dive, they expel, push out, the air in their lungs. Reducing the amount of air in the lungs helps them withstand the high pressure that occurs when they dive deeply.

Although all cetaceans have common characteristics that suit them to life in the water, different species have evolved physical and behavioral features that allow them to eat certain foods or inhabit specific zones. There are two suborders of whales, each with identifying physically characteristics. Mysticeti are

the baleen (buh-LEEN or BAY-leen) whales. These whales have no teeth. To feed, they filter large amounts of water through flexible plates in their mouth called baleen. The baleen strains out krill, small shrimp and plankton, which they collect with their tongue and swallow. This suborder includes the largest whales on Earth.

Odontoceti, the other suborder of whales, all have teeth that they use to catch fish, squid, octopus, and marine mammals such as seals, dolphins, and other whales. They are often referred to as toothed whales to distinguish them from baleen whales. These whales use echolocation (eck-oh-loh-KAY-shun) to navigate and find prey. Echolocation involves making sounds that bounce off objects. Sense organs pick up the echo or reflected sound and use the timing, direction, and strength of the echo in order to locate objects. In some species, echolocation is so sensitive that it can locate an object less than 0.5 inches across (1.25 centimeters) at a distance of 50 feet (15 meters). Unlike toothed whales, baleen whales do not have a highly developed sense of echolocation.

This order also contains porpoises and dolphins. These animals are smaller than most whales, and some dolphins and porpoises live in fresh water rivers rather than in salt water. Strictly speaking, porpoises belong to only one family and are distinguished by their spade-shaped teeth. However, casual language makes little distinction between the terms porpoise and dolphin.

GEOGRAPHIC RANGE

Cetaceans are found in all oceans of the world. In the Arctic and Antarctic they avoid ice-covered water, since they must rise to the surface to breathe. Dolphins live in the ocean, but are also found in several freshwater rivers in Asia and South America.

HABITAT

The ocean is divided into different zones or regions based on depth, closeness to land, and underwater features. Cetaceans inhabit virtually all ocean zones, including zones in semi-enclosed water such as the Red and Black Seas. Cetaceans that live in freshwater rivers inhabit clear, rapidly flowing water and dark muddy water.

DIET

Members of this order are primarily carnivores, meat eaters. Baleen whales have evolved special filter-like structures to gather small shrimp, small fish, squid, and plankton. Other cetaceans actively hunt prey, either alone or in cooperative groups. Typically they eat whatever fish are found in the oceanic zone that they inhabit. Many also eat squid, octopus, shrimp, and crabs. A few species, especially the killer whale, hunt other whales, seals, sea lions, sea turtles, and sea birds.

BEHAVIOR AND REPRODUCTION

Cetaceans generally have pregnancies that last ten to sixteen months. Like all mammals, they nurse their young. The young tend to stay with their mothers for at least a year and often much longer. Many cetaceans give birth only every two to five years. These animals do not become capable of reproducing for about three to ten years. Large whales may live for close to 100 years and are slow to mature.

Cetaceans have evolved a wide spectrum of behaviors. Some species such as the spinner dolphin are known for the way they leap out of the water, while other species, like almost all porpoises, rarely jump when they come to the surface. Some members of this order live in groups of up to one thousand, while others live in groups of ten or fewer animals. Some groups show great social stability and communication. Killer whales, for example, are known to hunt in packs. Other social groups are simply casual associations, with members coming and leaving at will. Communication seems to involves several different types of sounds combined with echolocation.

CETACEANS AND PEOPLE

People have been fascinated with cetaceans from the earliest times. These animals have figured in stories and mythology in many countries. Perhaps the best known example is the biblical story of Jonah being swallowed by a whale.

Whales have been hunted for their oil, meat, baleen, and bones for hundreds of years. As sailing and hunting technologies improved, increasing pressure was put on some whale species. Whaling, whale hunting, reached its peak in 1847 when about 700 American ships, along with ships from many other nations, took part in whale hunts. In 1935, the United States and several European countries entered into the first international agreement

to protect certain species of whales. Since then, there have been other international agreements, all of which have loopholes that allow at least some whale hunting to continue. In 1972, the United States passed the Marine Mammal Protection Act. This legislation extended protection to all cetaceans as well as other marine mammals such as seals, sea lions, and sea otters. Today, whale hunting, along with regulation of other types of fishing, continues to be a source of international tension.

Other pressures on cetaceans include being trapped and exhibited, put on display, for entertainment. Many tourist destinations offer visitors the opportunity to swim with dolphins in confined areas, and businesses trap wild dolphins for this purpose. In addition, the United States Navy trains dolphins to retrieve potentially dangerous materials from under water.

CONSERVATION STATUS

Interest in protecting cetaceans is high, and several organizations such as the American Cetacean Society and the Whale and Dolphin Conservation Society in Great Britain work hard at promoting conservation awareness among the public. Public pressure has lead to the development of "dolphin-safe" fishing nets and "dolphin-free" tuna, but many cetaceans are still drowned when they accidentally become trapped in fishing gear. Estimates of populations of different species are difficult to make, but the population of many species appears to be declining. Some, such as the baiji, a Chinese river dolphin, are Critically Endangered, facing an extremely high risk of extinction.

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family CHAPTER

GANGES AND INDUS DOLPHIN
Platanistidae

Class: Mammalia
Order: Cetacea
Family: Platanistidae
One species: Ganges and Indus dolphin (*Plantanista gangetica*)

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The single member of this family is a dolphin that lives in freshwater rivers on the Indian subcontinent. At one time, scientists thought that there were two species in this family, the Indus river dolphin and the Ganges river dolphin. However, recent genetic testing shows that even though these groups are separated geographically, they are the same species. Native people call these dolphins "susu," which sounds like the noise they make when they breathe.

Ganges and Indus river dolphins are small, gray-brown dolphins. Adults measure between 5 and 8 feet (1.5 to 2.5 meters) and weigh between 150 and 200 pounds (70 to 90 kilograms). These dolphins have a long beak, or snout, and when they close their mouth, their sharp front teeth are still visible. They use these teeth to catch their prey, animals they hunt for food, mainly fish. Ganges and Indus river dolphins have a small hump behind the center of their back instead of a dorsal (back) fin. Their flippers are broad and paddle-shaped, and their blowhole is a single slit, set off-center on the top of their head. Unlike other dolphins, the opening to their ear is below their eyes.

Ganges and Indus river dolphins have poorly developed eyes. They are able to see only light and dark patterns, which is why they are sometimes called blind river dolphins. Instead of relying on sight to find food, they use a system called echolocation (eck-oh-loh-KAY-shun). Dolphins make sounds (scientists disagree about how this is done) that seem to be focused through the melon, a lump of fatty tissue in the dolphin's

LOW WATER

Ganges and Indus river dolphins have developed an unusual method of swimming on their side with their tail held slightly higher than their head. As they swim, they drag one flipper along the bottom to stir up food. Scientists believe that this is an adaptation that allows them to live in water as shallow as 3 feet (1 meter) deep. While swimming like this, these dolphins sometimes carry their young on their back.

forehead, and skull and then sent out into the environment. When the sounds bounce back, the echo is passed through special tissue in the lower jaw to the inner ear. From the time it takes to collect the echoes, their strength, and their direction, dolphins construct a "sound picture" of their environment. This process is so sensitive, that they can "see" an object the size of a kernel of corn at a distance of 50 feet (15 meters), and can find their way around muddy waters as well as clear waters. Ganges and Indus river dolphins also use sound to communicate with each other.

GEOGRAPHIC RANGE

The Ganges and Indus river dolphin is found only on the Indian subcontinent. Indus river dolphins live in about a 100-mile (160-kilometer) stretch of the Indus River where it flows through the Sind and Punjab provinces of Pakistan. Their distribution is limited by two dams built in the 1930s.

Ganges river dolphins live in the Ganges, Meghna, Brahmaputra, and Karnaphuli Rivers, and their tributaries (streams that flow into these rivers). These rivers flow through western India, Nepal, Bhutan, and Bangladesh. The dolphins' range has been reduced, and populations have been fragmented or separated from each other by the construction of dams and water control projects, especially along the Ganges River.

HABITAT

These dolphins live in freshwater rivers from sea level to an elevation of 820 feet (250 meters). They can be found in clear, swift-moving water or muddy, cloudy water. They are often found where streams feed into the main river or where there are eddies, which are currents in the water that run opposite the main current. These river dolphins prefer living in water 10 to 30 feet deep (3 to 9 meters), but they are able to live in water as shallow as 3 feet (1 meter). They can survive a wide range of water temperatures, from about 46 to 91°F (8 to 33°C).



Scientists once thought the Ganges river dolphin and the Indus river dolphin were two separate species. But genetic testing shows there is just one species, the Ganges and Indus river dolphin. (Illustration by Patricia Ferrer. Reproduced by permission.)

DIET

Ganges and Indus river dolphins eat bottom-dwelling fish such as carp and catfish, and occasionally shrimp and clams. In captivity they eat from 1 to 3.3 pounds (0.5 to 1.5 kilograms) of fish daily.

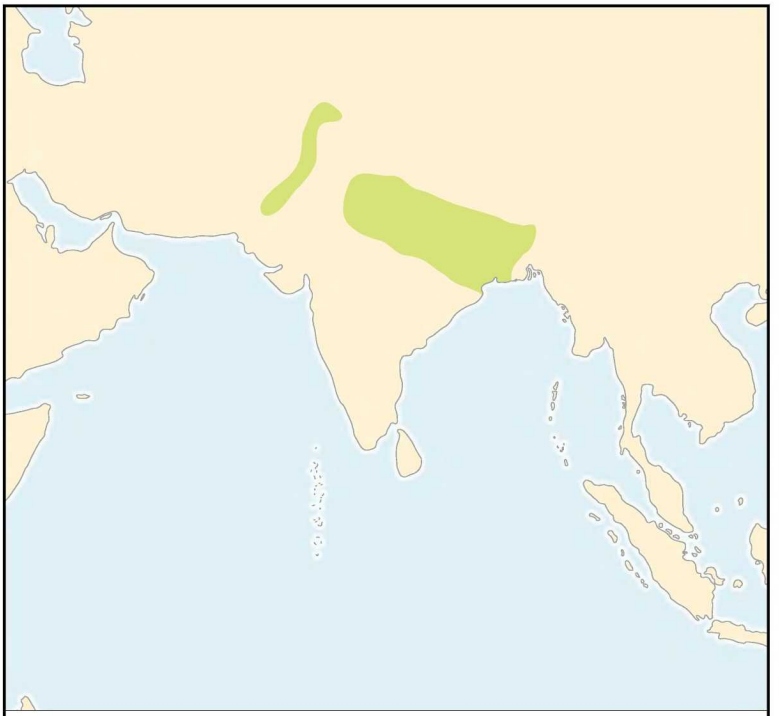
BEHAVIOR AND REPRODUCTION

Unlike some social dolphins, Ganges and Indus river dolphins swim alone or with one or two other dolphins. Adults rarely leap out of the water or expose much more of their body than their beak (snout) and melon. Compared to other dolphins, they swim slowly, although they are capable of short bursts of speed. Ganges and Indus river dolphins use echolocation to find their food and navigate around objects in the river. They also communicate with each other frequently through pulses of sound.

Not much is known about the reproductive behavior of these dolphins. Pregnancy is believed to last eight to eleven months. Newborns are about 3 feet (1 meter) long when they are born, and weigh about 17 pounds (7.5 kilograms). It appears that births occur throughout the year. Scientists are not certain, but they think the young nurse anywhere from two months to one year. These dolphins are capable of living long lives and do not become sexually mature (able to reproduce) until they are about ten years old.

GANGES AND INDUS RIVER DOLPHINS AND PEOPLE

River dolphins live in rivers that run through heavily populated and extremely poor areas. These dolphins are sometimes



Ganges and Indus dolphin *(Plantanista gangetica)*

hunted for their oil, which is used in folk medicines for humans and livestock. Occasionally dolphin meat is eaten, and it is often used as bait to attract other fish. Dolphins are also accidentally trapped and drowned in fishing nets. Human development, such as dam building, water control projects, and pollution have all decreased the river dolphin population.

CONSERVATION STATUS

River dolphins are Endangered, facing a very high risk of extinction. There may be fewer than one thousand individuals remaining in the Indus River, while the outlook is equally grim in other river systems, including the Ganges River.

River dolphins are threatened mainly by human development. Dam building, begun in the 1920s, still continues today. Not only do dams isolate groups of dolphins, they interfere with migration and water flow. Heavy fishing, reducing water flow, and preventing flooding all decrease the population of fish that are the main source of food for these animals. In addition, pollution

puts a strain on their health and may shorten their lives. Hunting and "accidental intentional" killing of dolphins in fishnets also are threats to their survival.

To combat the decline in population, the Whale and Dolphin Conservation Society recommends establishing protected habitats, training local people to manage river dolphins as a protected resource, educating the public to substitute other oils for dolphin oil, and enforcing protection laws already in existence.

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BAIJI

Lipotidae

Class: Mammalia

Order: Cetacea

Family: Lipotidae

One species: Baiji (*Lipotes vexillifer*)

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The baiji is a freshwater river dolphin that lives in the Yangtze (yang-see) River in eastern China. It has a long, narrow beak (snout), which curves slightly upward and grows longer with age. It has a steeply sloped forehead and tiny eyes that are set high on the sides of the head. These eyes are only slightly functional and leave the dolphin almost completely blind. This is why baijis use echolocation (eck-oh-loh-KAY-shun) to navigate and find food. Baijis have about 130 teeth, which are all alike in size and shape. The cone-shaped teeth are made for catching fish, not chewing.

The baiji has short, round flippers and a low, triangular shaped dorsal (back) fin. It has a very distinctive notch in the middle of its fluke, or tail. The body is a bluish gray, fading into white on its stomach. The average length for a baiji is between 6.5 and 8 feet (2 and 2.4 meters). Females grow to be larger than males. They weigh between 220 and 355 pounds (100 and 160 kilograms).

GEOGRAPHIC RANGE

The baiji lives along the 1,056 miles (1,700 kilometers) of the Yangtze River in eastern China. During the late spring and early summer, this freshwater dolphin moves to smaller streams and lakes if the water is high enough. At one time the lakes of Dongting and Poyang were home to the baiji year-round, but with the drop in water level these lakes can no longer support its presence.

HABITAT

The baiji is often found at places where tributaries (smaller streams) enter the river or along sandbars and dikes. When resting, it spends a lot of its time where the river is wide and slow moving. The baiji comes closer to shore to feed. During this time, it uses its long beak or snout to probe through the mud on the river's bottom.



THE LEGEND OF THE BAIJI

There is a legend about the baiji that says there was once a young girl who was beaten by her stepfather. One day while they were out in a boat, the boat capsized and both the girl and her stepfather were thrown into the water. It is said that the girl emerged as a baiji while the stepfather emerged as a black finless porpoise.

DIET

Baijis, like many dolphins, are carnivores and have a diet consisting only of fish. A wide variety of species is consumed, limited only by the size of fish that can fit down its throat. Most of the fish are less than 2.6 inches (6.5 cm) long and weigh less than 9 ounces (250 grams). The baiji does not chew its food. It eats the whole fish at once, head first.

BEHAVIOR AND REPRODUCTION

Little is known about the baiji because so few of them are left in the world. In the wild they are extremely shy, easily frightened, and difficult to approach. The baiji are thought to live in groups of two to seven individuals, but groups as large as sixteen have been observed. They do not leap out of the water the way some other dolphins do, but only expose their head and beak when they come to surface after dives.

The baiji's dives are often short, only lasting ten to twenty seconds, but they can be as long as two minutes. While underwater, they emit a wide range of sounds. These includes a whistle sound used to communicate and a variation of clicks used in echolocation.

Echolocation involves making sounds that bounce off objects. Sense organs pick up the echo or reflected sound and use that information to locate objects. The forehead of a dolphin is a lump of fatty tissue called the melon. The dolphin makes sounds (scientists disagree about how this is done) that seem to be focused through the melon and skull and then sent out into the environment. When the sounds bounce back, the echo is passed through special tissue in the lower jaw to the inner ear. From the time it

takes to collect the echoes, their strength, and their direction, dolphins construct a "sound picture" of their environment. This process is so sensitive that they can "see" an object less than one-half inch (1.25 centimeters) across at a distance of 50 feet (15 meters).

The baiji is a very fast and strong swimmer and has been seen swimming over 60 miles (100 kilometers) in three days going against the current. While resting, the baiji stays in areas of very slow current.

Little is known about how this animal reproduces, because there have been no studies conducted on baiji reproduction. It is thought that males become mature at four years of age, while females mature at the age of six. A single calf is born in the spring, after a pregnancy of ten to eleven months. These calves are about 3 feet (91 centimeters) long and weigh between 6 and 11 pounds (2.5 and 4.8 kilograms). The baiji can live up to twenty-five years in the wild.

BAIJI AND PEOPLE

The baiji is very shy and has little interaction with humans. The presence of humans has made a major disturbance in the life of baijis. Chemical pollution, accidents, hunting, and habitat loss are all reasons for the decline in its numbers. Another large problem is the number of dams located along the Yangtze River. These dams alter the water level and flow of the current along the river and block fish migration. They also separate and isolate groups of baiji.

Propellers interfere with the dolphin's use of echolocation. Baijis often get confused and run into boats, hurting themselves. They can also be accidentally hooked or netted by fishermen. Many scientists believe that there are only a few dozen of these animals left in the world today. The baiji is the world's most endangered cetacean. There are no baijis held in captivity. Both a male and female who had been hurt and taken into captivity in different locations died.

CONSERVATION STATUS

Hope of saving the baijis is dim. Although it was declared a National Treasure of China and has been protected from hunting



since 1975, the population continues to decline. Human use of the Yangtze River may be too intense for the baiji to survive.

There have been many ideas about how to help this dolphin survive, including capturing animals for breeding, developing "semi-natural reserves," and conducting population surveys. One idea even involved cloning the dolphin to help its population grow. In order to clone one of these dolphins at least three would need to be caught, which is a next to impossible task considering that fewer than ten are seen each year. Many successful breeding techniques have been developed for other dolphin species, including the bottlenosed dolphin. However, the baiji has not had the same luck as the bottlenosed, and every attempt to breed a baiji in captivity has failed. Now the idea of starting a breeding program seems even more unlikely because the only male who had ever been in captivity died in 2002 after living alone in a tank for twenty-three years. Sadly, despite what is being done to protect the baiji, it seems that they are doomed to extinction.

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FRANCISCANA DOLPHIN
Pontoporiidae

Class: Mammalia
Order: Cetacea
Family: Pontoporiidae
One species: Franciscana dolphin (*Pontoporia blainvillei*)

family CHAPTER

PHYSICAL CHARACTERISTICS

Franciscana dolphins are also called La Plata dolphins, because the first described specimen, or animal, came from the mouth of La Plata River, Uruguay, in 1884. These dolphins are considered river dolphins, even though they live in the ocean near the shoreline. Originally scientists thought that the franciscana dolphin moved from fresh water to salt water during its lifetime, but now they know that it spends its entire life in the ocean. In the past, franciscana dolphins have been classified in several different dolphin families, but they are currently classified in a family of their own.

The franciscana dolphin is one of the smallest members of the cetacean order. They measure between 4.4 and 5.7 feet (1.3 and 1.7 meters) and weigh between 75 and 115 pounds (34 and 53 kilograms). Females are larger than males. Franciscana dolphins are gray-brown on their back and lighter underneath. Young franciscana dolphins are darker than older animals. Very old animals can appear almost white.

The most notable feature of the franciscana dolphin is its long, slender beak, or snout. They have the longest beak of any dolphin. Their beak may be 15 percent of their body length. Franciscana dolphins have triangular dorsal, or back, fins with rounded tips. Their flippers are broad and short. This dolphin has between 208 and 242 teeth small teeth. The blowhole, or nostril, is a crescent-shaped slit. Unlike the Ganges and Indus river dolphins, franciscana dolphins have good eyesight.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

HOW DO DOLPHINS SLEEP?

Dolphins must rise to the surface to breathe every few minutes. How can they do this and still sleep? The answer is found in the way their brain functions. One half or hemisphere of the brain rests, while the other stays alert and makes sure the dolphin surfaces and breathes. When one half of the brain is rested, it takes over and the other half sleeps.

Even though franciscana dolphins can see well, they use echolocation (eck-oh-loh-KAY-shun) to find food and navigate through their environment. The forehead of a dolphin is a lump of fatty tissue called the melon. Echolocation is a sensory system in which dolphins make sounds that seem to be focused through the melon and then sent out into the environment. When the sounds bounce back, the echo is passed through special tissue in the lower jaw to the inner ear. From the time it takes to collect the echoes, their strength, and their direction, dolphins construct a "sound picture" of their environment. This system is extremely sensitive and allows the animal to locate very small objects. Scientists disagree about just how the dolphins actually make the sounds.

GEOGRAPHIC RANGE

Franciscana dolphins are found in the Atlantic Ocean along the coasts of Brazil, Uruguay, and Argentina in South America. Their northern boundary is near Rio de Janeiro, Brazil, and their southern boundary is the Valdes Peninsula in Argentina. Their distribution within this range is uneven. In some places they are rare or absent, and in others they are more common.

HABITAT

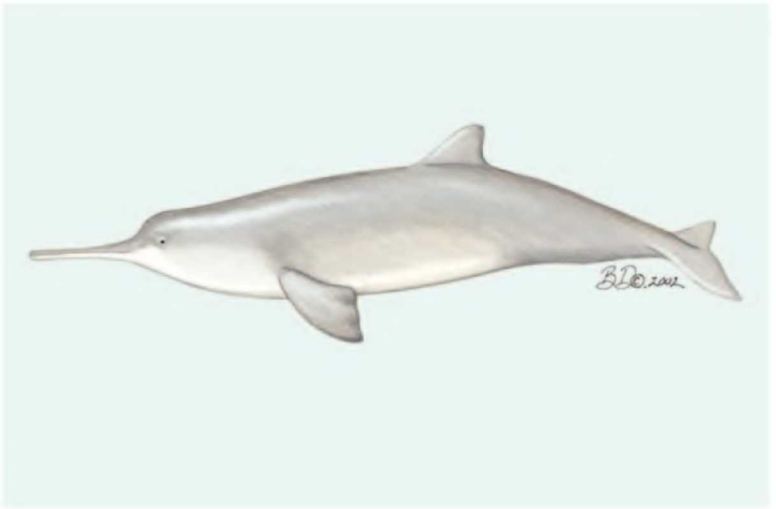
Franciscana dolphins are usually found within 33 miles (53 kilometers) of shore in waters no more than 30 feet (10 meters) deep. Often they are found in muddy, murky water with poor visibility. They seem to prefer estuaries, which are places where rivers empty into the ocean and fresh water mixes with salt water.

DIET

Franciscana dolphins eat a wide variety of small bottom-dwelling fish, squid, octopus, and shrimp. Most of the fish they feed on are less than 4 inches (10 centimeters) long.

BEHAVIOR AND REPRODUCTION

Franciscana dolphins usually swim alone or in small groups. Several dolphins may cooperate when feeding. They will swim



The franciscana dolphin is called a river dolphin, but it spends its life in the ocean. (Illustration by Barbara Duperron. Reproduced by permission.)

in a tight circle, surrounding the fish and pushing them together.

Franciscana dolphins are very quiet and shy at the surface. They rarely jump and often only raise their heads out of the water enough to breathe. They are preyed upon by sevengill sharks, hammerhead sharks, and possibly killer whales.

Female franciscana dolphins give birth to one calf after an eleven-month pregnancy. Most calves are born between October and January, spring in the Southern Hemisphere. Newborns are about 28 inches (71 centimeters) long and weigh 16 to 19 pounds (7 to 8.5 kilograms). They nurse, feed on their mother's milk, for about three months. After that, they continue to nurse, but also eat fish until they are completely weaned and not dependent on their mother's milk at about nine months. There is some disagreement about when these dolphins become sexually mature and able to reproduce. Estimates range from two to four-and-a-half years. Their average natural lifespan is about fifteen years.

Franciscana dolphins do not strictly migrate. However, it appears that in areas off the coast of Argentina where there is noticeable seasonal variation in water temperature, they may change their range. This movement does not seem to happen off the coast of Brazil, where water temperatures remain more constant throughout the year.



FRANCISCANA DOLPHINS AND PEOPLE

Franciscana dolphins are shy and rarely intentionally interact with people. However, these dolphins are sometimes caught in fishing nets. In these cases, their oil is used in tanning leather, and their flesh is used as pig feed or shark bait.

CONSERVATION STATUS

The wild population of franciscana dolphins is unknown. Because of this, they are given a Data Deficient conservation status. However, it is estimated that up to 1,500 of these animals are drowned every year by becoming tangled in gillnets and other fishing gear. Scientists believe that as a result, the wild population is decreasing. In addition, because these dolphins live close to shore, they are more at risk for habitat pollution than dolphins that live in the open ocean.

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BOTO

Iniidae

Class: Mammalia

Order: Cetacea

Family: Iniidae

One species: Boto (*Inia geoffrensis*)

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Botos, also called Amazon river dolphins or pink river dolphins, live only in fresh water rivers in South America. They are the largest and most abundant of the river dolphins. Adult botos range in length from 6.6 to 8.5 feet (2 to 2.5 meters) and in weight from about 185 to 400 pounds (85 to 180 kilograms). Males are larger than females. Young animals are usually dark gray. As they mature, their color changes and they become pink. However, individuals that live in dark, muddy water tend to remain darker than those that live in clear water.

Botos have thick bodies and a large slender beak (snout) that contains about 140 teeth. Instead of a distinct dorsal (back) fin, they have a small triangular peaked ridge along their back. Their flippers are large and pointed. Botos are very flexible, allowing them to live in shallow, cluttered environments. One reason for their flexibility is that their cervical vertebrae, or neck bones, are not fused or joined, giving them the freedom to twist and turn their head easily.

Botos have good eyesight both above and under water. However, because they often live in dark, murky water, they usually rely on echolocation (eck-oh-loh-KAY-shun) to avoid objects and find food. The forehead of a dolphin is a lump of fatty tissue called the melon. Dolphins make sounds (scientists disagree about how this is done) that seem to be focused through the melon and skull. These sounds are then sent out into the environment. When the sounds bounce back, the echo is passed through special tissue in the lower jaw to the inner ear. From the time it takes to collect the echoes, their strength,

and their direction, dolphins construct a "sound picture" of their environment. This system is extremely sensitive and allows the animal to locate objects very small objects.

GEOGRAPHIC RANGE

Botos are found in the Amazon and Orinoco River systems in Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru, and Venezuela. They require fresh water and do not live in estuaries (EST-yoo-air-eez) where rivers meet the ocean.

HABITAT

Botos live mainly in dark, cloudy water. They seem to prefer areas where water currents meet and cause turbulence. Several studies have found that they are attracted to places where streams flow into the main river channel or to areas around sand bars or sharp bends in the river. Botos live in water with temperatures ranging from about 73 to 86°F (23 to 30°C). During the rainy season (November to May) when rivers flood, they move out of the main river channel into the shallow flooded forests. As the waters go down, they move back into the deeper main channels.

DIET

Botos eat a broad range of food, including up to fifty different species of fish. Most of the fish they eat are from 8 to 12 inches (20 to 30 centimeters) long, although they are able to eat fish as long as 31 inches (80 centimeters). During the rainy season, the forests flood, fish swim into the flooded areas to eat seeds and fruits, and botos follow the fish. They are able to move easily in this shallow water, because they are so flexible and they have a well-developed sense of echolocation. When the water level starts to fall, the fish and the botos return to the deeper main channel.

Botos also eat small turtles, mollusks (hard shelled animals like clams), freshwater shrimp, and crabs. Other species of dolphins have only sharp cone-shaped teeth. Botos have this type of tooth, but also have some teeth that are modified for grinding. This allows them to eat a wide variety of food.



SAVED BY BAD LUCK

Along the South American rivers where the botos live, the dolphin is associated with unhappiness. The boto is said to turn into a man at night, one who seduces young girls and impregnates them. The boto is also said to turn into a lovely girl who leads men into the river and takes them away forever. Seeing a boto is supposed to be bad luck and burning boto oil in a lamp is supposed to make people who look at the lamp go blind. The boto's connection to bad luck and unhappy events may have helped save it, since the boto has never been hunted for oil or food.



BEHAVIOR AND REPRODUCTION

Botos usually swim alone or occasionally with one or two other botos. They communicate with each other using a series of "clicks" that are above the range of human hearing. These communication sounds are not well understood. Botos kept in captivity have been aggressive toward each other, suggesting that in the wild they need to keep a certain distance between themselves and other botos. They are occasionally observed in larger groups when feeding.

Botos swim slowly, sometimes on their backs. They come to the surface to breathe every thirty to sixty seconds, but rarely leap out of the water or even show much of their body above the surface. They are, however, playful and curious. Botos have been seen playing with floating logs or turtles and have been known to come up to boats and rub against them.

Female botos give birth to a single calf after an eleven-month pregnancy beginning when they are three to five years old. After that, they have a single calf every two to five years. Most births occur between May and August, newborns being about 30 inches long (75 centimeters) and weighing about 15 pounds (7 kilograms). They nurse, feed on their mother's milk, for more than a year. Natural lifespan is estimated at about thirty years. Botos do not appear to migrate.

BOTOS AND PEOPLE

Botos are not hunted, but are sometimes intentionally killed to prevent them from destroying fishing gear. Botos are associated in folklore with misfortune and bad luck.

CONSERVATION STATUS

Although the population of botos in the wild is not known, it is estimated to be in the tens of thousands. Botos are considered Vulnerable, facing a high risk of extinction. The biggest threat comes from human development. In 2000, there were ten dams on the Amazon River that fragmented, or separated, groups of botos and interfered with their free movement. More dams are planned on the rivers that botos inhabit. In addition, water control projects that prevent the forest from flooding during the rainy season reduce food available for fish. This causes the fish population to decrease, meaning the botos will also have less food. Other threats to the boto include mercury pollution from the mining of gold near the rivers, other types of pollution associated with human development, and accidental drowning in fishing gear. Although the boto is protected by law in some parts of its range, enforcement is difficult and not very effective.

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PORPOISES

Phocoenidae

Class: Mammalia

Order: Cetacea

Family: Phocoenidae

Number of species: 6 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Porpoises are mostly ocean-dwelling marine mammals, although some species can also live in freshwater rivers. They are often confused with dolphins. In casual conversation many people incorrectly use the terms dolphin and porpoise to mean the same thing. Both porpoises and dolphins came from a common ancestor, ancient relative, however they have been distinct families for about eleven million years.

Porpoises have a blunt snout, as opposed to the beak and elongated snout of dolphins. Their dorsal, back, fins are triangular. They have thick, stocky bodies that help them to conserve heat in cold waters. There are several differences between the skulls of porpoises and dolphins, but the most obvious is in the teeth. Porpoises have between sixty and 120 almost triangular, spade-shaped teeth, while dolphins have cone-shaped teeth. Most members of this family lack a melon. The melon is a fatty organ on the forehead. This gives their heads a tapered rather than a bulging look.

Porpoises range in weight from 90 to 485 pounds (40 to 220 kilograms) and in length from 4 to 7 feet (1.2 to 2.2 meters). The smallest porpoise is the vaquita (vah-KEE-tah), which lives in the Gulf of California in Mexico. Dall's porpoise and the spectacled porpoise are the two largest porpoises. In all species except the spectacled porpoise, females are larger than males.

Porpoises range in color from black to gray to tan. Generally, their backs are dark and their bellies are lighter. Some, such as the spectacled porpoise and Dall's porpoise, have quite

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

distinctive black and white markings. Others, such as the finless porpoise, are a single dull color.

GEOGRAPHIC RANGE

Porpoises are found along the coasts of large parts of North and South America (except the tropics and subtropics), Europe, and in the Mediterranean and Black Sea. They are also found off the coast of Siberia and northern Japan.

HABITAT

Porpoises live in a variety of ocean habitats. The spectacled porpoise lives in cold, open ocean in the Southern Hemisphere. Another Southern Hemisphere porpoise, Burmeister's porpoise, lives in warmer, shallow waters along the coast of South America. This porpoise can also live in freshwater rivers. The finless porpoise and the vaquita also like shallow warm water. The harbor porpoise and Dall's porpoise both live in cold water habitats.

DIET

Porpoises are carnivores, meat eaters. They eat mainly fish. The type of fish they prefer depends on the habitat in which they live. They also eat squid and octopus. Some also eat shrimp and mollusks (hard shelled animals like clams). Many porpoises migrate seasonally in order to follow the fish they feed on. Their natural predators, animals that hunt them for food, are some sharks, killer whales, and bottlenosed dolphins.

Porpoises use echolocation (eck-oh-loh-KAY-shun) to help find food. They make sounds (scientists disagree about how this is done) that are sent out into the environment. When the sounds bounce back, the echo is passed through special tissue in the lower jaw to the inner ear. From the time it takes to collect the echoes, their strength, and their direction, the animal can construct a "sound picture" of its environment. This system is extremely sensitive and allows the animal to locate very small objects.

BEHAVIOR AND REPRODUCTION

Except for the finless porpoise on the Yangtze (yang-see; or Chang) River in China, which seems to have become used to heavy boat traffic, porpoises tend to avoid boats. This makes them difficult to study. They rise to the surface to breathe quietly without showing much of their bodies. Rarely do they leap above the surface of the water. Generally porpoises live in small

groups of no more than ten individuals. When larger groups occasionally gather, it may be to feed or follow schools of fish.

Very little is known about the reproduction of vaquita and spectacled porpoises. Other porpoises become mature at three to five years, and have a single calf every year after that. Pregnancy lasts about eleven months and mothers nurse their young, feed them breast milk, for more than a year. Porpoises live about fifteen years.

PORPOISES AND PEOPLE

Because porpoises are shy and avoid boats, they have very few interactions with people. Until the mid 1940s, they were hunted for food and oil, but now intentional hunting occurs only occasionally in Greenland and in the Black Sea. They are, however, often caught and drowned in fishing gear.



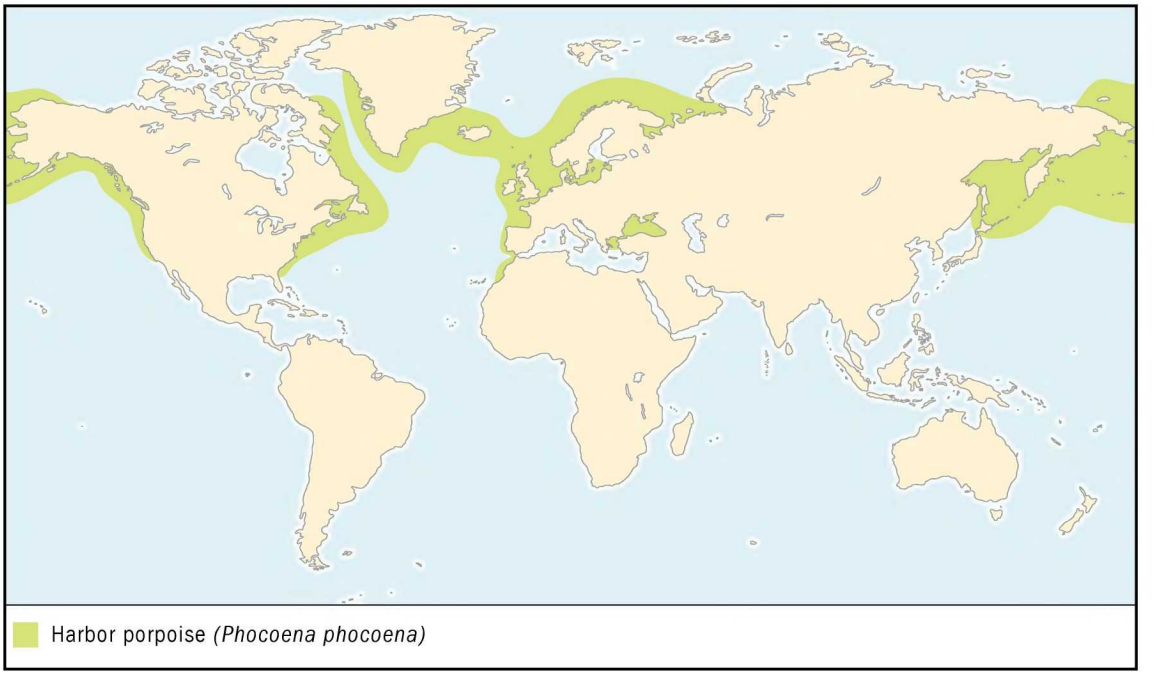
BLACK PORPOISE

Like some other cetaceans, Burmeister's porpoise turns entirely black almost as soon as it dies. Early descriptions of this animal were based on dead specimens, so scientists mistakenly named the animal the "black porpoise." Although Burmeister's porpoise is mostly dark gray with a paler underside, the name stuck, and it is still often called the black porpoise today.

CONSERVATION STATUS

The vaquita is the least abundant porpoise. There may be only a few hundred individuals remaining. The vaquita is considered Critically Endangered, facing an extremely high risk of extinction in the wild. It lives in northern Mexico in the Gulf of California where there is a lot of commercial fishing. The main threat to its survival is being accidentally killed by becoming entangled in fishing nets.

The harbor porpoise is listed as Vulnerable, facing a high risk of extinction. It is a protected species in the United States and Canada. Threats to its survival include pollution and accidental death in fishing gear. Little is known about the population levels of the other four species of porpoises.



SPECIES ACCOUNTS

HARBOR PORPOISE
Phocoena phocoena

Physical characteristics: Harbor porpoises have short, thick bodies with brown or dark gray backs and whitish bellies. Their lips and chin are black. They have a rounded forehead and no beak. Females are larger than males with an average weight of 130 pounds (60 kilograms) and an average length of 5.5 feet (1.6 meters). Males weigh about 110 pounds (50 kilograms) and measure about 4.8 feet (1.4 meters).

Geographic range: Harbor porpoises are found along the U.S. and Canadian coasts in the North Atlantic, around Greenland and northern Europe, in the Mediterranean Sea, and the northern Pacific along the North American coast and in Asia as far south as northern Japan.

Habitat: These animals live in cold costal waters, bays, tidal channels, and estuaries. They appear to prefer water between 65 and 200 feet (20 and 60 meters) deep.

Diet: Harbor porpoises eat cold water fish such as herring and mackerel. They also eat squid and octopus.

Behavior and reproduction: Harbor porpoises are shy and avoid people. They rarely leap out of the water when they go to the surface to breathe. They are heard more often than they are seen, because they make a loud puffing sound when they surface to breathe.

Harbor porpoises and people: From 1830 to about 1950, these animals were hunted for food and oil, but today little hunting takes place.

Conservation status: Harbor porpoises are considered Vulnerable, because they are often drowned accidentally by commercial fishing gear. ■



BURMEISTER'S PORPOISE
Phocoena spinipinnis

Physical characteristics: Burmeister's porpoise, sometimes called the black porpoise, measures between 4.6 and 6 feet (1.4 and 1.8 meters) and weighs 88 to 154 pounds (40 to 70 kilograms). This porpoise has a dark gray to black back and a dark gray belly. Its small dorsal (back) fin is located farther back on its body than the fin of any other porpoise.

Geographic range: Burmeister's porpoise is found in South America from Brazil south to Tierra del Fuego in the Atlantic Ocean, and then north in the Pacific Ocean as far as the coast of Peru. It is more common on the Atlantic side of South America than on the Pacific side.



Burmeister's porpoises make quick, jerky movements when they swim, and are barely visible when they come up to breathe. (Illustration by Michelle Meneghini. Reproduced by permission.)

Habitat: This porpoise prefers cold, coastal water no more than 500 feet (152 meters) deep.

Diet: Burmeister's porpoise eats about nine species of fish, mainly hake and anchovies. It also eats squid, small shrimp, and mollusks.

Behavior and reproduction: Burmeister's porpoises make quick, jerky movements when they swim. They do not leap out of the water and are barely visible when they come up to breathe. They seem to live in groups of fewer than eight individuals. They are very shy and difficult to study, so little is known about their behavior or reproductive cycle. They appear to mate between June and September and give birth about ten months later.

Burmeister's porpoise and people: Burmeister's porpoises have been hunted for meat in Chile and Peru.

Conservation status: Information about the population of Burmeister's porpoise is not known, so they have been given a Data Deficient conservation rating. The greatest threat to this species is drowning by becoming caught in fishing gear. This species became protected by law in 1994, and since then the number of individuals killed has decreased. ■

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DOLPHINS

Delphinidae

Class: Mammalia

Order: Cetacea

Family: Delphinidae

Number of species: 34 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Dolphins are found in all oceans and many rivers of the world. They are often confused with other aquatic animals. Dolphins arose from the same ancestor as porpoises, but have been a separate family for at least eleven million years. In addition, the common names of some dolphins lead to confusion. For example, the killer whale is actually a dolphin. With genetic testing now available, some re-classification of individual dolphin species is occurring.

Dolphins have long, streamlined, torpedo-shaped bodies adapted to life in the ocean. Generally they are fast, acrobatic, agile swimmers. The bones in what would be the hand and arm of a land animal are compressed into a web of bones to make flippers. Their back legs are so reduced that all that remains are a few internal pelvic bones. They have strong, muscular tails. Dolphins breathe through a single blowhole on top of their head. All dolphins have a melon, a fatty organ on their forehead that they use for echolocation. Echolocation (eck-oh-loh-KAY-shun) involves making sounds that bounce off objects. Sense organs pick up the echo or reflected sound and use information about the echo's timing, direction, and strength to determine the location of objects. They have a single type of cone-shaped tooth, but the number of teeth ranges from four to about 260, and the size varies with the size of the species. Dolphins are able to taste, but not smell.

Within this family there are many physical differences in size and color. The smallest dolphin is the endangered Hector's

dolphin. They are about 4.5 feet (1.4 meters) long and weigh about 117 pounds (53 kilograms). The largest is the killer whale, which can measure 30 feet (9 meters) and weigh 12,000 pounds (5,600 kilograms). Dolphins come in many colors, including black, white, gray, tan, brown, orange, and pink. Some have distinctive color patterns, while others are a single color.

GEOGRAPHIC RANGE

Dolphins are found in every ocean and sea and in many major river systems. They are the largest family of cetaceans.

HABITAT

Dolphins live in salt water, fresh water, and brackish water, a mixture of salt and fresh water. They live in both the open ocean and in coastal waters, although more live shallow water. Their distribution is determined mainly by the availability of prey.

DIET

Dolphins are carnivores, meat eaters. They eat fish and squid and capture their food one fish at a time. The type of fish they prefer depends on the zone of the ocean that they inhabit. Killer whales eat fish, but they also hunt seals, sea lions, other dolphins, whales, porpoises, and sea birds.

Dolphins use echolocation to navigate and find prey. Echolocation allows dolphins to use high-pitch sounds that bounce off objects in order to determine their location. In some species, echolocation is so sensitive that it can locate an object less than 0.5 inch across (1.25 centimeters) at a distance of 50 feet (15 meters).

BEHAVIOR AND REPRODUCTION

Dolphins are highly intelligent social animals. Many species appear to live in cooperative groups, groups that work together. They may live in groups called pods of fewer than five or as many as several thousand. To some extent, group size depends on the availability of food. Within a large group, animals often separate by age and sex.

Dolphins have excellent hearing and communicate with each other by producing a variety of different sounds, often identified as "clicks," "pulses," and "whistles." Some of these sounds may be identifiers for individual animals, but this communication is not well understood. Dolphins living in

clear water may also communicate by flipping and flashing patches of color on their bodies.

There are many examples of dolphins working cooperatively. They may work together to locate and round up a school of fish or chase them into shallow water or to attack a predator, an animal that hunts them for food. They have been seen helping newborn or injured animals to the surface to breathe. They are best known for their acrobatics. They often leap and spin out of the water, sometimes in large, coordinated groups. They are curious and playful. Some dolphins will catch a ride on the waves a boat makes as it passes through the water. Dolphins can be taught behaviors or tricks when in captivity.



DOLPHIN COMMUNICATION

Scientists who have recorded dolphin whistles have found that individual animals react much more strongly to the whistle of an individual that is related to them than to a whistle of a stranger. It appears that each dolphin has a signature whistle all its own that is recognized by its family.

Dolphins mate and give birth in the water. From an early age, both sexes do a lot of touching and stroking, rubbing and sex play behavior with their own and the opposite sex. Sexual maturity, the ability to reproduce, occurs when individuals are between five and sixteen years old. Larger species tend to mature later than smaller ones. A single calf is born after a pregnancy lasting ten to fifteen months.

The bond between mother and calf is extremely important and may last many years. Calves begin to catch fish when they are a few months old, but may continue to nurse for three-and-a-half years or more. Even after they are weaned, no longer nursing, they remain with their mother for a year or longer.

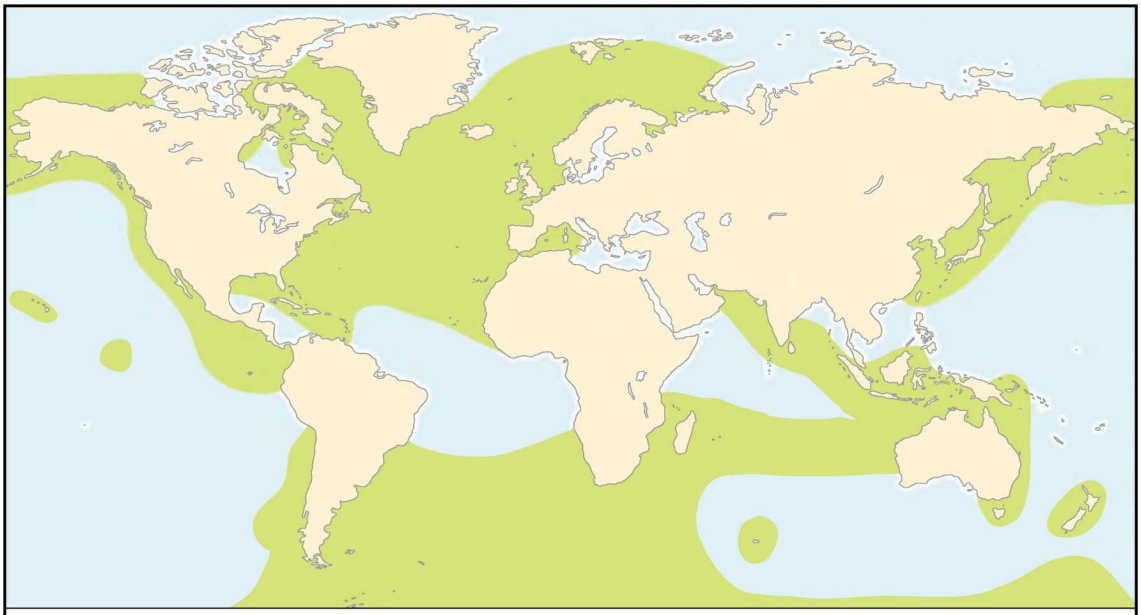
DOLPHINS AND PEOPLE

Dolphins are familiar to most people from exhibitions at marine parks and movies and television programs such as "Flipper." Dolphin-watching tours attract thousands of ecotourists, who travel to observe these animals without interfering with them. More controversial are resorts where tourists can swim with captive dolphins. Dolphins are hunted for food in some places in the world. They are also trained by the United States military to retrieve small underwater objects.

CONSERVATION STATUS

The conservation status of dolphins depends upon the species. Hector's dolphin is considered Endangered, facing a very high risk of extinction in the wild, because it is often killed accidentally by fishing gear. Population estimates are not available for most species.

Dolphins are threatened by hunting, accidental capture in fishing nets, pollution, and capture for display in captivity. In the 1990s public pressure resulted in the development of dolphin-free fishing nets and the sale of dolphin-free tuna. These changes have resulted in a substantial decrease in the number of dolphins accidentally harvested during fishing. Dolphins are protected in the United States under the 1972 Marine Mammal Protection Act and are the focus of many conservation and research organizations.



KILLER WHALE
Orcinus orca

Physical characteristics: Killer whales, or orcas, are the largest dolphins, measuring 30 feet (9 meters) and weighing up to 12,000 pounds (5,600 kilograms). They have a striking black and white pattern of mainly black above and white below, and they have the tallest dorsal fin of any cetacean. The dorsal fin can reach 6 feet (2 meters) in height. They are the top predators in the ocean.

Geographic range: Killer whales live in all the oceans of the world, but are most abundant in cold water areas such as the Arctic and Antarctic.

Habitat: Killer whales prefer cold water, but can live in warmer temperatures. They tend to live in water that is less than 650 feet (200 meters) deep. Rarely they have been known to swim up rivers such as the Columbia in the United States and the Thames in England.

Diet: Killer whales have the most varied diet of any dolphin. They hunt fish, seals, sea lions, other dolphins, porpoises, and whales. Their



Killer whales chase sea lions onto the beach, and then attack them. (© François Gohier/Photo Researchers, Inc. Reproduced by permission.)

diet depends primarily on what is available in their region of the ocean. They are swift swimmers and hunt in packs. They can successfully attack a blue whale, the largest animal on the planet, or a great white shark. In some places they chase sea lions up onto the beach and attack them. They are able to swallow a small seal whole. Adults eat 3 to 4 percent of their body weight daily.

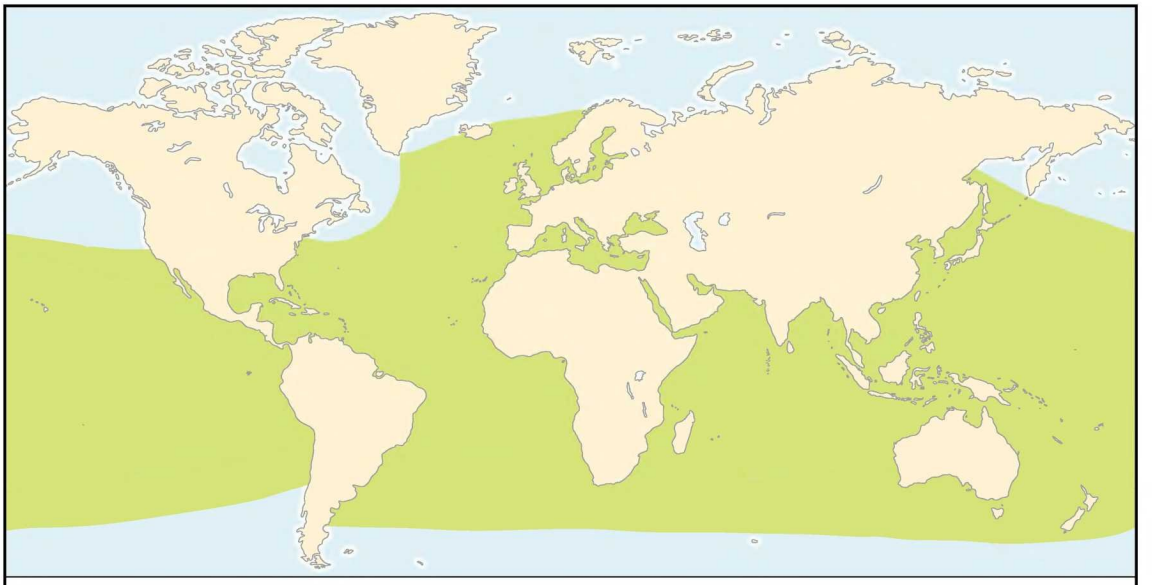
Behavior and reproduction: Killer whales live in stable pods. Males often stay with their mothers for years after they are weaned. Like other dolphins, they use echolocation and make sounds to communicate with members of their pod.

Killer whales have pregnancies that last from fifteen to eighteen months and produce a single calf. Calves stay dependent on their mothers for several years. New calves are born only every three to eight years.

Killer whales and people: Most people know of killer whales from exhibits at marine parks and movies. Since they can regularly be seen near shore, they are often the object of dolphin-watching tours. In 1985, the first killer whale was successfully born in captivity. That

whale lived to adulthood and produce calves of her own. It is not clear how long killer whales live in the wild. Estimates range from thirty to fifty years.

Conservation status: Killer whales are not threatened. Their main threat appears to be pollution of their habitat. ■



Common bottlenosed dolphin *(Tursiops truncatus)*

COMMON BOTTLENOSED DOLPHIN
Tursiops truncatus

Physical characteristics: Common bottlenosed dolphins, also called Atlantic bottlenosed dolphins, range in size from 8 to 12.5 feet (2.5 to 3.8 meters) and in weight from 500 to 1,100 pounds (227 to 500 kilograms). These dolphins can be colored brown to gray on their backs and light gray to white on their bellies. There are several distinct subpopulations in different regions of the world.

Geographic range: These dolphins are found worldwide in warm and temperate, moderate temperature, waters. In the United States they are the most abundant dolphin along the Atlantic coast from Massachusetts to Florida.

Habitat: Common bottlenosed dolphins prefer warm shallow water and are often found along the coast in harbors and bays, although they also inhabit open ocean.

Diet: These animals eat fish, squid, and shrimp. They often feed cooperatively, herding fish together to make them easier to catch. In

shallow water they may chase fish into a sandbar where they are trapped.

Behavior and reproduction: Common bottlenosed dolphins form pods of varying size. Pods in the open ocean seem to be larger than those close to shore. The pods are moderately stable and tend to migrate in order to follow the fish. Those pods living in cooler waters usually migrate to warmer water in the winter.

Common bottlenosed dolphins are curious and playful. They often ride the waves produced by the passage of a boat through the water. They can jump as high as 16 feet (4.9 meters) out of the water.

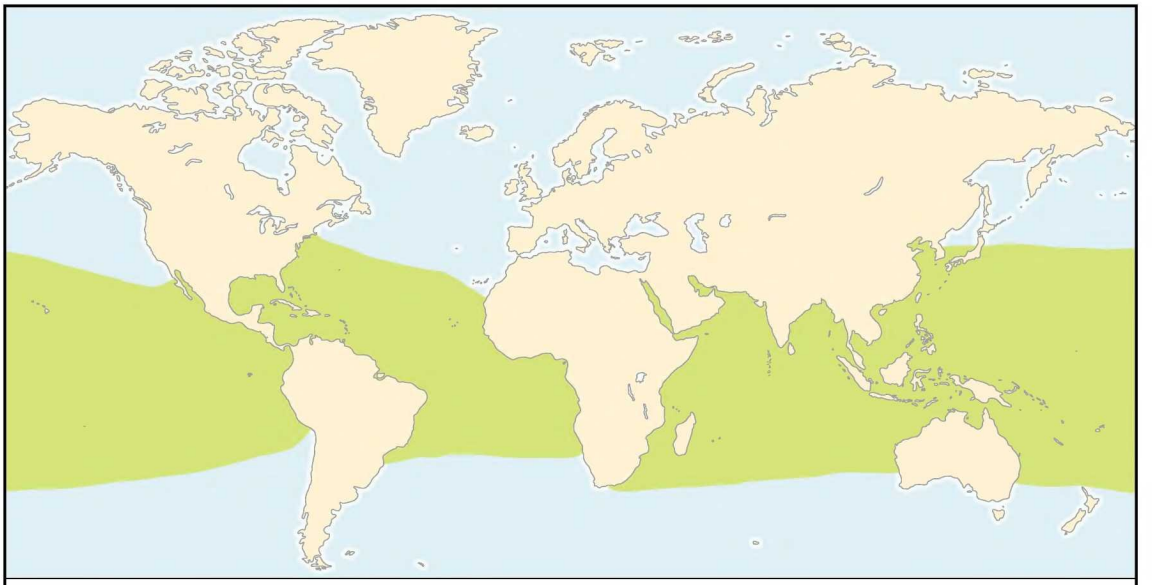
Female bottlenosed dolphins have their first calf between the ages of five and twelve years. Pregnancy lasts about twelve months and produces a single calf. Calves stay with their mothers for about three years, after which another calf is born. Bottlenosed dolphins have been successfully born and raised in captivity.



Bottlenosed dolphins often ride the waves produced by passing boats. (Tom Brakefield/Bruce Coleman Inc. Reproduced by permission.)

Common bottlenosed dolphins and people: Common bottlenosed dolphins are the dolphins most frequently exhibited in marine park shows. They are very acrobatic and can be taught many behaviors in captivity.

Conservation status: Not enough information is available to give the common bottlenosed dolphin a conservation rating, however, they do not appear to be threatened. The main threat to their habitat is pollution. ■



Spinner dolphin *(Stenella longirostris)*

SPINNER DOLPHIN
Stenella longirostris

Physical characteristics: Spinner dolphins, also called long-snouted dolphins, are known for their acrobatic displays. Spinner dolphins are about 7.7 feet (2.3 meters) long and weigh about 170 pounds (78 kilograms). Males are usually larger than females. They vary in color from individuals that are all gray to ones having black backs, gray sides, and white bellies.

Geographic range: Spinner dolphins are found worldwide in tropical and subtropical waters.

Habitat: Spinner dolphins mainly live in the open ocean, although they may come into shallow waters to feed.

Diet: Spinners are carnivores. They tend to feed at night and eat mainly fish, squid, octopus, and shrimp.



Spinner dolphins form pods that may contain more than 1,000 individuals. They are very social and communicate with each other by sound and touch. (© Tony Wu/ www.silentsymphony.com. Reproduced by permission.)

Behavior and reproduction: Spinner dolphins form schools or pods that may contain more than 1,000 individuals. They are very social and communicate with each other by sound and touch. They are best known for their ability to leap out of the water and turn on their longitudinal, long, vertical, axis. Some can spin as many as seven times on one jump. This behavior gave them their common name.

Less is known about the reproductive behavior of spinner dolphins than some other species because they live farther out in the ocean and they do not survive well in captivity. Females produce one calf after about a ten-and-a-half-month pregnancy. New calves are born about every three years.

Spinner dolphins and people: Spinners were the first dolphins captured for display in marine parks because of their ability to leap and spin, but they do not survive well in captivity. Their amazing leaps and spins attract ecotourists who want watch these animals in their natural habitat. Because they often associate with tuna, they are sometimes accidentally killed by fishing gear.

Conservation status: Spinner dolphins are not threatened. ■

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BEAKED WHALES
Ziphiidae

Class: Mammalia
Order: Cetacea
Family: Ziphiidae
Number of species: 21 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Beaked whales are the second largest family of living whales. They get their name from their long, narrow snout, or beak. In some species, the snout slopes gradually into the forehead. In others, the forehead bulges out over the beak. Beaked whales breathe through a blowhole on top of their head. They have a melon, a fatty organ in their forehead that they use for echolocation (eck-oh-loh-KAY-shun).

Beaked whales are toothed whales. However, all species except Shepherd's beaked whale have very few teeth. Males usually have only one or two teeth in the lower jaw and just stubs or no visible teeth at all in the upper jaw. The lower jaw teeth grow into tusks in some species. In females of some species, the teeth never erupt, or break through the skin, although in x rays they can be seen in the jaw.

Beaked whales are medium-sized whales ranging from about 13 to 42 feet (4 to 13 meters) in length and weighing up to 25,000 pounds (11,500 kilograms). They have cigar-shaped bodies that are thicker in the middle than at either end. Their dorsal (back) fin is small and set farther back toward the tail than in other whales. The bones in what would be the hand and arm of a land animal are compressed into a web of bone to make small flippers that fit against their body in depressions called flipper pockets. The back legs are so reduced that all that remains are a few internal pelvic bones. Beaked whales have strong, muscular tails that, unlike most other whales, are not notched. They range in color from light brown to gray to black. Males and females may have different color patterns.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

GEOGRAPHIC RANGE

Beaked whales live in every ocean of the world. The only place they are not found is under the permanent ice pack at either pole.

HABITAT

Beaked whales are mainly deep water whales. They can be found beyond the continental shelf in water as shallow as 660 feet (200 meters) and as deep as 9,900 feet (3,000 meters). Most live at depths of 3,300 to 9,900 feet (1,000-3,000 meters). These whales are often found around underwater formations such as canyons, shelf edges, and seamounts. A seamount is an underwater mountain that does not break the surface.

DIET

Beaked whales are good divers. Scientists believe that they feed on squid, fish, shrimp, and crabs that live on or near the ocean floor, because they have discovered these animals plus stones in the stomachs of dead beaked whales.

Beaked whales have well-developed melons and use echolocation to find and catch their prey. Echolocation involves making sounds or clicks that are then focused through the melon and skull. These to sounds bounce off objects. Sense organs pick up the echo or reflected sound and use information about its the timing, direction, and strength to determine the location of objects. This is particularly useful, since little sunlight penetrates to the depths where these animals feed.

Since beaked whales have few teeth, they feed by sucking in their food. They have up to six groves in their throat that can expand and along with their strong tongue suck prey into their mouth. These whales also have between four and fourteen chambers, or sections, to their stomach.

BEHAVIOR AND REPRODUCTION

Not too much is known about beaked whale behavior or reproduction, because these animals live mainly in the open ocean and are hard to observe. They usually are seen in pods (groups) of ten or fewer animals, and within a pod they seem to swim or dive all at the same. This suggests that like other cetaceans, they have a good communication system. Some species regularly migrate, while others seem to stay within a home range.

From the scars that appear on the skin of some males, it appears that they fight each other with their tusks for the right to mate with females. One calf is born at a time. It stays with the mother and nurses for at least one year.

BEAKED WHALES AND PEOPLE

Three species of beaked whale were hunted mainly from the 1880s to the 1920s for their oil and spermaceti: the northern bottlenosed whale, Cuvier's whale, and Baird's whale. Otherwise beaked whales have few interactions with humans because they live so far off shore.

CONSERVATION STATUS

Not enough is known about most species of beaked whale to give them a conservation rating. However, four species, the northern bottlenose whale, the flathead bottlenose, Baird's beaked whale, and Arnoux's beaked whale, although not vulnerable to extinction, are listed as in need of conservation efforts.



STRANDED ON LAND

Scientists cannot explain why whales strand themselves on shore. Individual whales that strand are usually old or sick. However, sometimes whole pods, meaning dozens of animals, will strand at once. Usually these are deep-water toothed whales. Some scientists believe that their echolocation system does not function well when they accidentally stray into shallow water. Others think the whales are escaping a predator or are frightened by human-made underwater noises. Another theory is that disease or pollution makes them disoriented. Whatever the reason, people have recorded strandings for hundreds of years all over the world. Stranded animals that cannot be re-floated often die because they are so heavy out of water they cannot expand their lungs to breathe.



SPECIES ACCOUNTS

NORTHERN BOTTLENOSED WHALE
Hyperoodon ampullatus

Physical characteristics: The northern bottlenosed whale is also called the Atlantic bottlenosed whale, the flathead, or bottlehead. Males reach a maximum length of about 30 feet (9 meters), while females grow only to about 25 feet (7.5 meters). In addition, males develop a large, bulging forehead. The forehead of the female is much smoother. Both sexes have a short beak or snout and range in color from dark brown on the back to pale yellow on the belly. Mature males often have a white or light patch on the forehead. Males have one pair of small teeth in the lower jaw. In females, the teeth never break through the skin.

Geographic range: These whales are found in pockets in the North Atlantic off Norway, Finland, Greenland, Iceland, and as far south as Spain and North Africa on the European side. On North American side, they are found off the Labrador and Nova Scotia in Canada and as far south as Rhode Island in the United States. One particularly well-studied group lives in an area called the Gully, a deep canyon off Sable Island, Nova Scotia.

Habitat: Northern bottlenosed whales prefer deep, cold to moderate (32 to 63°F; 0 to 17°C) water, and sometimes travel into broken ice fields. They are usually seen in areas where the water is more than

3,300 feet (1,000 meters) deep and are more common in the northern part of their range than in the southern part.

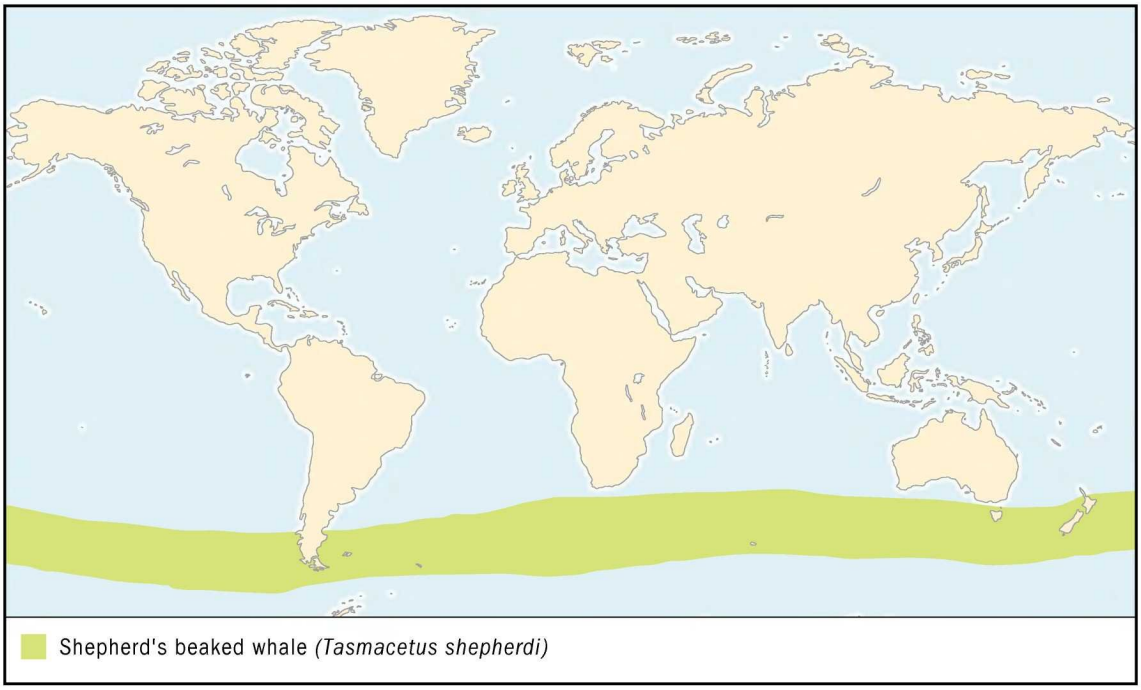
Diet: Northern bottlenosed whales feed near or at the ocean floor. They eat mainly squid, but will also eat fish, sea cucumbers, starfish, and shrimp. Like all toothed whales, they use echolocation to hunt their prey.

Behavior and reproduction: Northern bottlenosed whales live in groups of four to ten individuals. They are excellent deep divers and have been known to regularly dive to depths of between 2,600 and 4,600 feet (800-1400 meters) and stay under water for seventy minutes. These whales seem to migrate north in the summer and south in the winter in a regular pattern.

Not much is known about bottlenosed whale reproduction, although it is believed that males buck each other in the head in competitions to breed with females. Females are thought to be sexually mature (able to reproduce) at about seven to ten years old. A single calf is born in the spring or early summer after a twelve-month pregnancy. It stays with its mother and nurses for at least one year. Northern bottlenosed whales are thought to live for thirty to forty years.

Northern bottlenosed whales and people: These whales have few interactions with people.

Conservation status: These whales were hunted from the 1880s until the 1970s, mostly in Norway. One estimate is that Norwegian fisherman killed 60,000 northern bottlenosed whales between 1880 and 1930 and 5800 from 1930 to 1973. Hunting stopped in 1973, and in 1977 the whale became legally protected from hunting. Another threat to this species is human development. In Nova Scotia, a large undersea oil and gas field is being developed only about 3 miles (5 kilometers) from the Gully where these whales live. ■



SHEPHERD'S BEAKED WHALE
Tasmacetus shepherdi

Physical characteristics: Shepherd's beaked whale, also called the Tasman beaked whale, has not been well studied. What is known about it comes mainly from about twenty stranded whales that have been found in various places in the Southern Hemisphere.

Shepherd's beaked whale is the only whale in this family to have more than half a dozen teeth, It has about 90 to 100 small peg-like teeth in both the upper and lower jaw. Two teeth in the lower jaw of males develop into tusks. Shepherd's beaked whale is about 23 feet (7 meters) long. It has a dark brown or gray back, two light stripes along its side and a light cream-colored belly.

Geographic range: These whales are found in temperate (moderate) water from Chile to South Africa to New Zealand.

Habitat: Shepherd's beaked whale lives in deep water in open ocean.



Shepherd's beaked whale lives in deep water in the open ocean, and was not discovered until 1937. Scientists do not know much about its behavior. (Illustration by Bruce Worden. Reproduced by permission.)

Diet: Unlike other members of this family that eat squid, the Shepherd's beaked whale appears to eat mainly fish.

Behavior and reproduction: This whale was not discovered until 1937. It is very rare. Almost nothing is known about its behavior or reproduction.

Shepherd's beaked whale and people: There have been only about half a dozen sightings of this whale outside of strandings.

Conservation status: Not enough information is available to give this whale a conservation ranking, although the absence of sightings suggests that it is rare. ■

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SPERM WHALES
Physeteridae

Class: Mammalia
Order: Cetacea
Family: Physeteridae
Number of species: 3 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The family of sperm whales contains the largest toothed whale—the giant sperm whale—and two smaller toothed whales. All are dark gray above, lighter gray on the belly, and have erupted (visible) teeth only in the lower jaw. Although these animals range in size and weight from 9 feet (2.7 meters) and 600 pounds (270 kilograms), to 60 feet (18.3 meters) and 125,000 pounds (57,000 kilograms), they have other physical features in common.

All members of this family have a spermaceti (spur-mah-CEE-tee) organ in their forehead. This produces a waxy substance called spermaceti. At the animal's body temperature, it is a clear yellowish liquid. After processing, it becomes a white waxy solid. It was prized in the 1800s and 1900s for making smoke-free candles and soap and as a way to waterproof cloth (called oilskins). Later it was used in cosmetics, ointments, as a lubricant for watches and machinery, and in automatic transmission fluid. Today it has been replaced by human-made oils and waxes.

The purpose of the spermaceti organ is not clear. Some scientists think that it helps the whale regulate its buoyancy, or ability to sink or float, during dives. Others believe that it is used to focus the sounds made for echolocation (eck-oh-loh-KAY-shun) and communication. Echolocation involves making sounds that bounce off objects. Sense organs pick up the echo or reflected sound and use information about the timing, direction, and strength to determine the location of objects. Echolocation allows whales to find food in water so deep that there is no natural sunlight.

Members of the sperm whale family share other physical characteristics. Their heads are asymmetrical, meaning that if they were divided in half along the long axis of the body, the features in the right half would look different from the features in the left half. This is not common in mammals. As a result, a single S-shaped blowhole that allows the whale to breathe is located on the left side of the body. The left nasal passage is used for breathing, but the right one is narrower and is thought to be used to produce sounds.

GEOGRAPHIC RANGE

Members of this family are found in oceans worldwide.

HABITAT

These are deep-water whales, living in water over 3,300 feet (1,000 meters) deep. Smaller species may live in slightly shallower water.



WHAT IS SPERMACETI?

Spermaceti or sperm oil is a waxy substance, not a true oil, found in the head of marine mammals, especially the giant sperm whale. At the animal's body temperature, it is a clear yellowish liquid. After processing, it becomes a waxy solid. It was prized in the 1800s for making candles and soap and as a way to waterproof clothing (called oilskins). It was later used in cosmetics, ointments, and as a lubricant for watches. Today man-made oils and waxes are used in its place. An average sperm whale has 1,900 liters (500 gallons) of spermaceti.

DIET

Sperm whales eat mainly squid, although they will also eat fish, crabs, and octopus that live on or near the ocean bottom.

BEHAVIOR AND REPRODUCTION

Sperm whales appear to be very social, communicating through a series of clicks, whistles, and similar sounds. It appears as if each whale has a personal identification sound called a coda, that it makes when it meets other whales. These animals live in small groups. The composition of the group with regard to age, gender, and size changes as these animals age.

Almost nothing is known about reproduction in the smaller species of this family. Female giant sperm whales give birth about every five years after a pregnancy that lasts between fourteen and sixteen months. Mothers and calves have strong social bonds, and calves nurse for many years after birth.

WHAT IS AMBERGRIS?

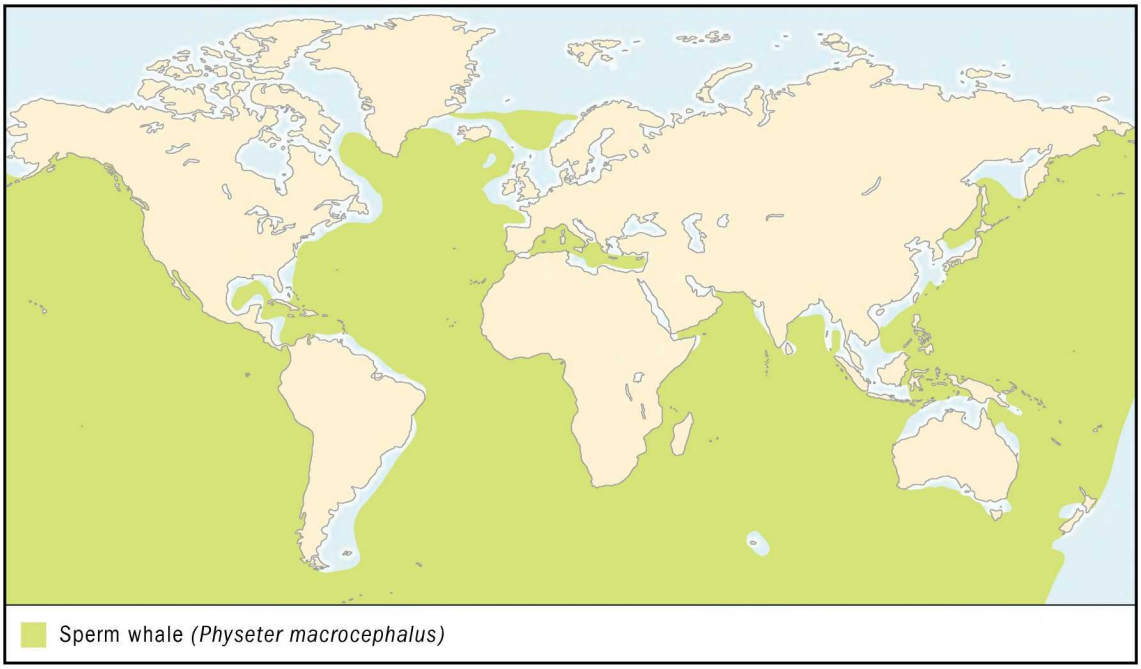
Ambergris is a substance made in the digestive system of sperm whales. Sperm whales eat squid, which have sharp beaks that they use for biting food. The whales cannot digest the beaks of the squid, and eventually they begin to irritate the whale's digestive system. In response, sperm whales produce a material to cover the beaks. This is known as ambergris. It is rare and valuable. Since ancient times, ambergris has been used in perfumes to make the scent remain longer. Today human-made additives are available that do the same thing.

SPERM WHALES AND PEOPLE

Sperm whales were hunted for their spermaceti, blubber, and meat for many years. Minimal hunting still occurs. In parts of New Zealand, sperm whales form the basis of whale watching ecotoursism, where tourists observe whales without disturbing them.

CONSERVATION STATUS

Not enough is known about the smaller sperm whales to give them a conservation rating. Although there is some debate about population size, giant sperm whales are considered Vulnerable, facing a high risk of extinction, because of slow recovery from population declines that resulted from hunting.



SPERM WHALE
Physeter macrocephalus

Physical characteristics: Sperm whales, sometimes called giant sperm whales to distinguish them from the smaller members of this family, are the largest toothed whales. They can reach 60 feet (18.3 meters) in length and weigh 125,000 pounds (57,000 kilograms). Males are much larger than females, who reach only about 36 feet (11 meters) and 33,000 pounds (15,000 kilograms). Although these whales are usually dark gray, they can also be black or white (albino). An albino sperm whale is famous as the monster great white whale in Herman Melville's story *Moby Dick*.

Sperm whales, especially males, have huge square asymmetrical heads that take up about one-third the length of their body. They have the largest brain of any mammal, larger even than the brain of the giant blue whale, the largest mammal on earth. Their brain weighs an average of 20 pounds (9.2 kg). For comparison, the average adult human brain weighs less than 3 pounds (1.3 kilograms). The spermaceti organ can contain more than 500 gallons (1,900 liters) of spermaceti



Sperm whales can dive to depths of more than a mile (2.2 kilometers), and stay underwater an hour before coming to the surface to breathe. (© François Gohier/Photo Researchers, Inc. Reproduced by permission.)

oil. Their blubber can be almost 14 inches (35 centimeters) thick. Sperm whales have about thirty-five to fifty large cone-shaped teeth in their lower jaw only. When the whale closes its mouth, these teeth fit into pockets in the roof of the mouth. These teeth were prized by sailors who carved pictures on them in an art form known as scrimshaw.

Geographic range: Giant sperm whales are found in every ocean of the world.

Habitat: These whales live in deep water and are often found near underwater features such as seamounts (underwater mountains that do not rise above the surface of the ocean) and sharp drop-offs.

Diet: Sperm whales hunt their prey by echolocation deep in the ocean where there is no sunlight. They mainly eat squid, including the giant squid that can be over 50 feet (15 meters) long. Many whales have scars on the head made by the suckers of these squid as they battle the whale. They also eat smaller squid, fish, and sharks.

Behavior and reproduction: Giant sperm whales are champion divers and are able to dive deeper than any other whale. They can

dive to depths of more than a mile (2.2 kilometers), and stay under water for an hour. Some scientists believe that they may be able to dive to depths of 10,000 feet (3,000 meters). More typically, these whales dive to depths of 1,000 to 2,600 feet (300-800 meters) and remain under water for thirty to forty-five minutes. They then rest at the surface for about ten minutes before diving again. Females do not dive as deep as males and may spend more time at the surface with their calves. These whales swim at about 6 miles per hour (10 kilometers per hour) but can reach speeds of 19 miles per hour (30 kilometers per hour) when hunting or avoiding danger.

Females become sexually mature and able to reproduce when they are about eight years old. Males may be capable of reproducing earlier, but usually do not do so until they are nineteen or twenty years old. Females give birth every five to seven years. The mother-calf bond is strong and socially important. Mothers may continue to nurse their young for up to thirteen years. Mothers and calves form groups of about twenty to forty individuals (although one group of 3,000 to 4,000 animals was seen off the coast of South America) that appear to stay together and assist each other. For example, since calves cannot make deep dives, some females will take turns staying at the surface guarding the young from killer whales while their others dive for food.

As the young mature, the males leave the group and swim with other young males in groups of about twelve to fifteen individuals. As they grow older, they split off into smaller and smaller groups. It is common for an old male to swim alone. Males tend to move toward the poles and come back to warmer water where the female groups stay when it is time to breed. The males fight for the right to breed, which is why young males rarely start reproducing until age twenty. Once mating has occurred, the males leave the group of females and calves and go off on their own again. Sperm whales are thought to live about seventy years.

Sperm whales make a wide variety of sounds with the help of specially modified nasal passages and air sacs. The sounds they make are loud and carry well over long distances. It appears that each whale has a signature "song" to identify it to other whales. They also make clicks for echolocation and ringing sounds that may be involved in attracting a mate.

Sperm whales and people: Sperm whales have been hunted since the early 1700s, with peak whaling activity between 1880 and 1930 and 1950 to 1975. They are valued for their spermaceti, oil, and ambergris (AM-bur-gris), a waste product used in manufacturing perfumes. Whale meat is also eaten in some countries such as Japan.

Conservation status: Sperm whale hunting stopped in 1985. However, in 2000, Japan resumed hunting for what they called "scientific research" and has continued to kill between five and ten sperm whales each year. Sperm whales are considered Vulnerable. Because it takes them so long to mature and they have calves only every five to seven years, it will take a long time for their populations to recover from hunting. They are also at risk from collisions with ships and accidental entanglement in fishing nets and transatlantic communication cables. ■



PYGMY SPERM WHALE
Kogia breviceps

Physical characteristics: The pygmy sperm whale is one of two small species in this family. These whales are about 11 feet long (3.4 meters) and weigh about 600 pounds (400 kilograms). They have blue-gray backs and a shape that makes them look something like a shark. Unlike the giant sperm whale, their head is only about 15 percent of their body length. They also have a much smaller spermaceti organ, and their blowhole is located on the left side of the forehead. Pygmy sperm whales have about thirty sharp, curved teeth only in the lower jaw.

Geographic range: These whales are found worldwide in temperate and tropical water.

Habitat: Pygmy sperm whales live in deep ocean and less deep water over continental shelves. They prefer moderate or warm waters and avoid the very cold waters of the Arctic.



Pygmy sperm whales are rarely seen, and little is known about their behavior. (Illustration by Bruce Worden. Reproduced by permission.)

Diet: Pygmy sperm whales feed on squid, octopus, fish, and crabs. They eat deep-dwelling species as well as species that live in the less deep waters over continental shelves.

Behavior and reproduction: Little is known about these animals. They have been seen floating without moving on the surface or swimming slowly. They are not often observed, but when they are seen, they are often in mother-calf pairs or in groups of fewer than five animals. These animals appear to give birth to a single calf every year after a pregnancy lasting eleven months. Beyond that, little is known about their mating behavior.

Pygmy sperm whales and people: These animals are rarely seen. Occasionally they are accidentally caught in fishing gear.

Conservation status: Too little is known about the population of pygmy sperm whales to give them a conservation rating. ■

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family CHAPTER

BELUGA AND NARWHAL
Monodontidae

Class: Mammalia
Order: Cetacea
Family: Monodontidae
Number of species: 2 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Beluga whales and narwhals are the only two living species in this family. Although they look quite different, these species share certain physical characteristics, including a very small beak and small head. Their neck bones (cervical vertebrae) are not fused or joined together, giving them the ability to turn their head without turning their entire body. Neither species has a dorsal (back) fin, only a ridge where the fin normally is found. The lack of a fin is unusual in whales. Members of this family range in size from 13 to 16 feet (4 to 5 meters) and in weight from 1,500 to 3,500 pounds (680 to 1,600 kg).

Both species change color as they age. Belugas are born gray, but gradually become white by the time they reach maturity at seven to nine years. Narwhals are born gray. As young animals, they become almost completely blue-black. In adulthood they become mottled (spotted) dark gray, with more dense splotches on the back and less dense ones on the belly. In old age, they become white.

The main difference in these species is in their teeth. Belugas have simple teeth in both the upper and lower jaw. Narwhals have only two teeth in the upper jaw. In females, these teeth do not erupt or become visible. In males, one tooth becomes a spiraled tusk that may be 10 feet (3 meters) long.

GEOGRAPHIC RANGE

Both these species live in the Arctic oceans, although their distribution is not continuous.

NOW THAT'S FAT!

In order to keep from freezing in the from cold Arctic water, beluga whales are covered with a layer of blubber that is 10 inches (25 centimeters) thick. This fat makes up half of the animal's weight or on average 1,700 pounds (800 kilograms) of fat.

HABITAT

Narwhals live in deep water farther north than any other whale, following the ice pack as it grows and recedes. Beluga whales live in shallower water and are sometimes found farther south. In the summer, they move into estuaries (places where rivers empty into the ocean). They can survive in fresh water and have occasionally been found swimming hundreds of miles (kilometers) up river from the ocean.

DIET

Both these species are bottom feeders, diving deep to eat squid, fish, and shrimp. Narwhals have a more limited diet than belugas.

BEHAVIOR AND REPRODUCTION

Both narwhals and beluga whales live in small groups or pods, although these pods may gather in groups of hundreds or thousands of animals during migrations. These species are social and communicate with a wide range of sounds. Both species migrate. The narwhal follows the ice pack, moving north as it melts in summer and south as it grows in winter. The migration of belugas appears to be triggered by day length. Not all groups of belugas migrate. One well-studied group that live at the mouth of the St. Lawrence River in Canada appears to stay there year round.

These whales give birth to a single calf at a time after a pregnancy lasting thirteen to sixteen months. The calf nurses, feeds on breast milk, and remains dependent on its mother for up to two years. Mating usually occurs in late winter or early spring and births occur in the summer of the following year.

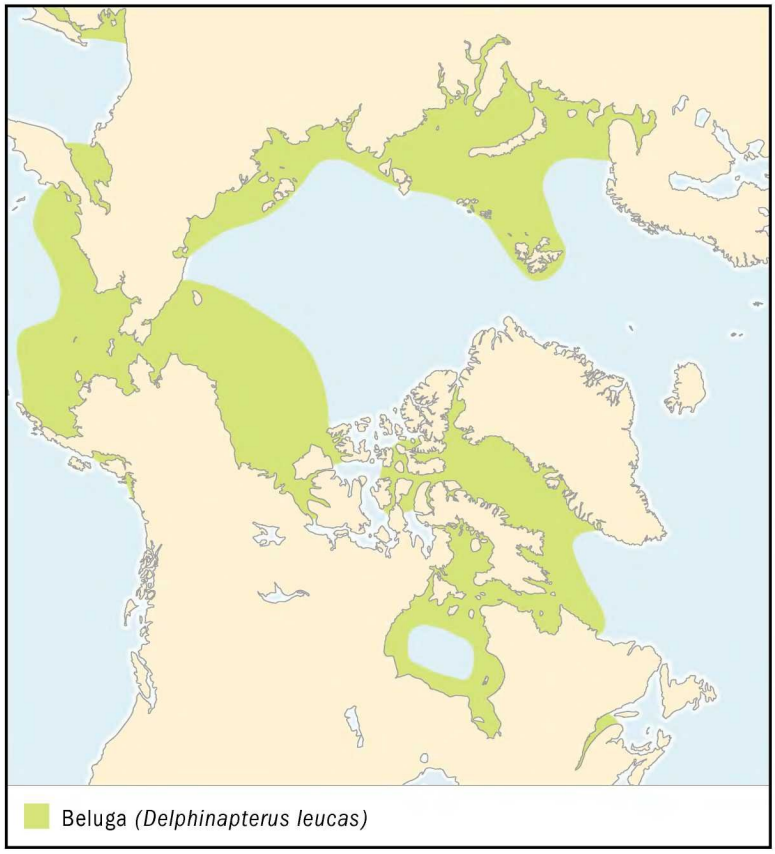
BELUGAS, NARWHALS, AND PEOPLE

The native people of the Arctic, the Inuit, have hunted narwhals and beluga whales for hundreds of years. These animals are an important part of their diet and culture. Both species have also been hunted commercially.

CONSERVATION STATUS

Beluga whales are considered Vulnerable, facing a high risk of extinction, dying out. Not enough is known about the size

of the narwhal population to give them a conservation rating. All narwhals that have been taken into captivity have lived only a few months. However, beluga whales do well in captivity and are often exhibited at marine parks.



SPECIES ACCOUNTS

BELUGA
Delphinapterus leucas

Physical characteristics: Beluga whales, sometimes called white whales, begin life colored light gray, then turn darker gray and become white as they mature. They are the only species of whale that is completely white. Beluga whales range in length from 13 to 16 feet (4 to 5 meters) and in weight from 1,500 to 3,500 pounds (700 to 1,600 kilograms). Males are about 25 percent larger than females.

Geographic range: These whales are found worldwide in the Arctic. Isolated populations also exist in the Gulf of St. Lawrence, Canada, and in Cook Inlet, Alaska.

Habitat: Belugas live in cold water of almost any depth. During the summer they gather in shallow water at the mouths of rivers. At other



Belugas live in pods of fewer than ten animals, but these pods often gather into large herds of hundreds of animals. (© François Gohier/Photo Researchers, Inc. Reproduced by permission.)

times, they migrate through deep, open ocean. They can survive in fresh water, and have been occasionally found in rivers far from the ocean.

Diet: Belugas eat a wide variety of squid, fish, crabs, shrimp, clams, worms, and octopus that they find by echolocation (eck-oh-loh-KAY-shun). They can easily dive to depths of 3,300 feet (1,000 meters). Their teeth are not made for capturing prey. Instead, they suction food into their mouths and swallow it whole.

Behavior and reproduction: Belugas are some of the most playful whales. They have been seen swimming and playing either alone or with other whales with all kinds of floating objects. They live in pods of less than ten animals, but these pods often gather into large herds of hundreds of animals.

Belugas are the most vocal species of whale. Their voices are loud and varied. They make clicks, chirps, whistles, squawks, and other high-pitched sounds.

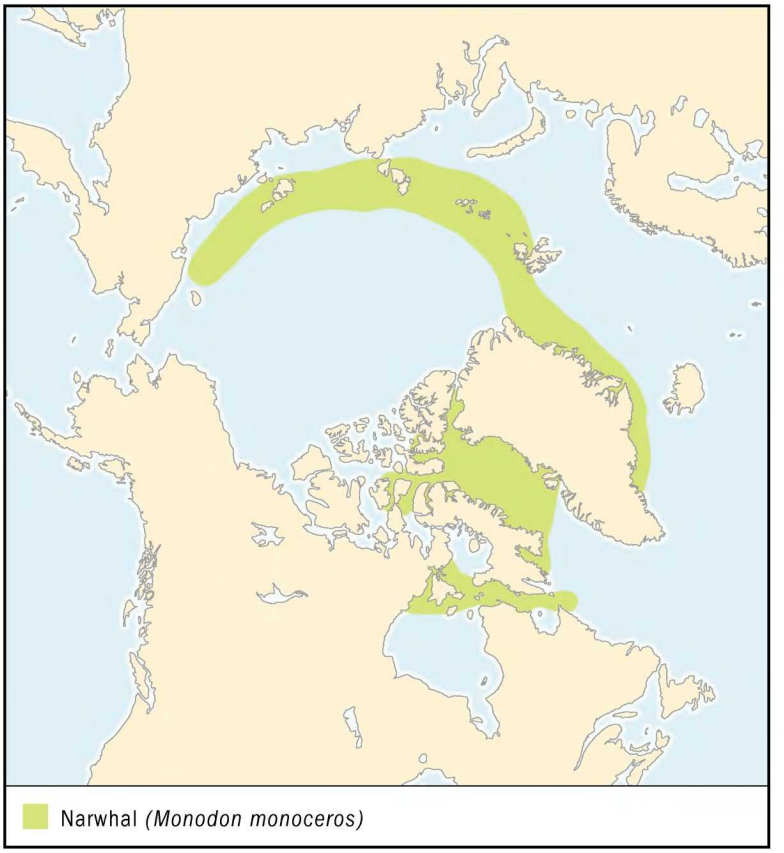
Mating occurs in early spring and a single calf is born about fourteen months later. During the summer, females gather in shallow

waters at the mouths of rivers to give birth, probably because the water there is warmer than in the open ocean. Calves nurse for about two years. A new calf is normally born every three years. Belugas are thought to live between thirty-five and forty years in the wild.

Natural predators, animals that hunt them for food, of the beluga whale include killer whales and polar bears. Polar bears lie in wait at breathing holes in the ice and attack when the whale surfaces to take a breath.

Beluga whales and people: Belugas have been hunted commercially for food mainly by the Russians. They adapt well to captivity and are also captured for display in marine entertainment parks. Ecotourists visit the population in the St. Lawrence River to observe them in their natural environment.

Conservation status: Beluga whales are considered Vulnerable. Some populations, like the one at the mouth of the St. Lawrence River are coming under increasing pressure from chemical pollution, shipping, and the development of undersea oil and gas fields. ■



NARWHAL
Monodon monoceros

Physical characteristics: Narwhals grow to be about 14 to 15.5 feet (4.2 to 4.7 meters) long and weigh 2,200 to 3,500 pounds (1,000 to 1,600 kilograms). Males are much larger than females.

The most outstanding physical feature of the narwhal is its ivory tusk. The tusk is a tooth that in males grows out of the left side of the upper jaw in a counter-clockwise spiral. Tusks can grow to be one-third the length of the body, or 30 feet (10 meters) long, and weigh 20 pounds (10.5 kilograms). Narwhals have two teeth in the upper jaw, and occasionally the right tooth will also grow into a tusk. Once in a great while, a female will develop a tusk. Tusks are often broken, but will heal and continue to grow.

Geographic range: Narwhals are limited to the coldest Arctic waters. They are not evenly distributed and are rare along Alaska, Siberia, and parts of Arctic western Canada.

Habitat: Narwhals live in colder water than any other whale. They follow the ice pack, moving north in the summer as it retreats and south in the winter as it grows. They often swim long distances under thick ice, coming up to breathe in small cracks called leads.

Diet: Narwhals feed along the sea bottom, eating squid and deep water fishes. They can dive to depths of about 3,300 feet (1,000 meters) and stay under water for up to twenty-five minutes. They locate their food by echolocation. Echolocation involves making sounds that bounce off objects. Sense organs pick up the echo or reflected sound and use information about its the timing, direction, and strength to determine the location of objects.

Behavior and reproduction: Narwhals are social animals. They live in groups or pods of three to eight individuals, usually of the same sex and

age. When they migrate, these pods may gather to form groups of hundreds or even thousands of animals. Narwhals have been known to work cooperatively to open breathing holes in the ice. Several animals will simultaneously butt their foreheads against the ice sheet in order to break it. This suggests that they have some form of group communication.

Narwhals mate in the early spring and have a single calf in July or August of the following year. Scientists are not sure, but they think that males fight each other with their tusks for the right to mate. Females normally produce a calf every three years. Pregnancy lasts about fifteen months. Newborns are 5 feet (1.6 meters) long and weight about 175 pounds (80 kilograms). They are born with a 1-inch (2.5-centimeter) thick layer of blubber to protect them from the cold water. Calves nurse for about twenty months and may remain with their mother longer. They become physically mature between four and seven years of age and can live fifty years in the wild. Natural predators of the narwhal are the killer whale and the Greenland shark.

Narwhals and people: The ivory in the tusks of narwhals has commercial value. It is often carved into jewelry or decorations. The tusks are also sold as curiosities to collectors. In earlier times, narwhal tusks brought back by sailors may have given rise to the story of the unicorn, a one-horned horse.

Conservation status: Not enough is known about the population of narwhals to give them a conservation ranking. Threats include being hunted for food and for their tusks. Global warming is of particular concern to the survival of this species, because they live in and around the ice pack. ■

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family CHAPTER

GRAY WHALE
Eschrichtiidae

Class: Mammalia
Order: Cetacea
Family: Eschrichtiidae
One species: Gray whale (*Eschrichtius robustus*)

PHYSICAL CHARACTERISTICS

Gray whales are very large animals that weigh 30 to 40 tons (27,200 to 36,300 kilograms) and are 45 to 50 feet (13.8 to 15 meters) in length. Females are larger than males. These whales have a streamlined body with a narrow head. The upper jaw overlaps with the lower jaw, and they have two to four throat grooves. Each groove is about 5 feet (1.4 meters) long and allows the throat to expand when the whale takes in water for filter feeding.

Gray whales are baleen (buh-LEEN or BAY-leen) whales. They do not have teeth. They filter feed using 130 to 180 overlapping plates called baleen plates that hang from the upper jaw. These plates are made of a material called keratin (KARE-ah-tin). This fingernail-like material frays out into thin hairs at the end of each strand to make a strainer. Each baleen plate is white and about 2 to 10 inches (5 to 25 centimeters) in length.

Gray whales have a 10-inch (25-centimeter) layer of blubber, or fat, to keep them warm in freezing cold water. Their skin is dark with gray patches and white splotches. Their skin also shows many scars and patches from white barnacles and orange whale lice. Often many more of these patches are found on the left side of the whale than on the right because of the way the whale scrapes along the ocean floor while feeding.

Although the gray whale does not have a dorsal (back) fin, it does have a large dorsal hump about two-thirds of the way back on its body. Behind the hump is a row of six to twelve knuckles that extend to its fluke, otherwise known as its tail.

DEVIL FISH

Gray whales got the nickname "devil fish" from early whalers who hunted off the coast of the Baja Peninsula. They got this name because the gray whale mother is so protective of its calf. The mother will make any sacrifice, including death, to protect her young. Soon whalers found that it was too dangerous to hunt these whales from boats in the water, so they started a new technique where they would herd the whales toward the beach and harpoon them from land.

The fluke is 10 to 12 feet (3.7 meters) across with a deeply notched center and pointed tips. The flippers are shaped like paddles and are also pointed at the tips.

GEOGRAPHIC RANGE

Gray whales migrate between northwest Alaska in the Chukchi Sea, where they live during the summer, and the Baja Peninsula of Mexico, where they live during the winter. A few individual gray whales live year-round in the Straits of Juan de Fuca, located between the state of Washington and Vancouver Island, Canada, and off the coast of California. Most whales, however, make the 10,000-mile (16,000-kilometer) trip from Mexico to the Arctic yearly.

HABITAT

Gray whales prefer shallow coastal water but dive to the ocean floor to feed. Every year gray whales spend two to three months migrating 10,000 miles (16,000 kilometers) from their summer home in Alaska to the warmer coastal waters off of the Baja Peninsula, Mexico, where they stay all winter.

DIET

Gray whales eat a variety of small shrimp, krill, squid, and octopus, along with plankton and mollusks. They are seasonal feeders, doing most of their feeding between May and November in the Arctic, but they are unique among baleen whales because they are bottom feeders. To eat, they dive to the bottom and roll on to their right side. They suck the stirred-up bottom mud and water into their mouth. This is filtered through the whale's baleen plates, trapping the food near the tongue where it can be eaten.

BEHAVIOR AND REPRODUCTION

Gray whales live in small groups (called pods) of about three whales, although some pods may have as many as sixteen whales. In feeding waters, pods come together, and hundreds of whales will temporarily feed in the same area.

Although gray whales are large, they are quite agile. Normally gray whales swim only 2 to 6 miles per hour (3 to 10 kilometers per hour), but when in danger, they can reach speeds of 10 to 11 miles per hour (16 to 17.5 kilometers per hour). While feeding, gray whales usually swim at speeds of 1 to 2.5 miles per hour (1.6 to 4 kilometers per hour).

Gray whales can do many different maneuvers (mah-NOO-verz) including breaching, where they jump partially out of the water and fall back in at an angle. This makes a loud noise and is thought to either help clean off some of the barnacles and lice on their skin or to communicate with other gray whales. Spy hopping is another favorite maneuver. This is when the whale pokes its head up to 10 feet (3 meters) out of the water and looks around while turning slowly.

Gray whales can stay underwater for thirty minutes and dive to depths of 500 feet (155 meters) while searching for food. When they come back to the surface, they take in air through two blowholes located near the top of their head. Before they go under water for a long time, they spend two to five minutes taking deep, slow breaths. When at rest, gray whales breathe about two to three times per minute. While sleeping, they keep their blowhole just above the surface. Each spout, or breath, is very noisy and can be heard up to a half mile away. The stream of water that comes from the blowhole rises 10 to 13 feet 3 to 4 meters) above the water and is a very impressive sight.

Gray whales reach sexual maturity when they are about 36 to 39 feet (11 to 12 meters) long. This usually occurs between five and eleven years of age. Courtship and mating involves three or more whales of both sexes and is very complex. Both mating and calving usually occur off the coast of Baja California, Mexico. After breeding, which usually takes place in late winter or early spring, females are pregnant for twelve to thirteen months. When the calf is born, it is about 15 feet (4.5 meters) long and weighs somewhere between 1,100 and 1,500 pounds (500 to 600 kilograms). The calf spends seven to eight months nursing on its mother's milk, which is 53 percent fat. Females have a single calf only every two to four years.

When the calf is born, it immediately swims to the surface. Its mother helps it, because the newborn cannot swim for the first half hour of its life. Gray whales stop growing at the age of forty and usually live to be between fifty and sixty years old.

A LONG TRIP

Gray whales migrate 10,000 miles every year between Alaska and Mexico. This is the longest migration of any mammal. During this time, they do not eat, but live off their stored blubber.



Adult gray whales can stay underwater for thirty minutes. But when calves are first born, their mothers must help them to swim to the surface for air, because the newborn cannot swim for the first half hour of its life. (© François Gohier/Photo Researchers, Inc. Reproduced by permission.)

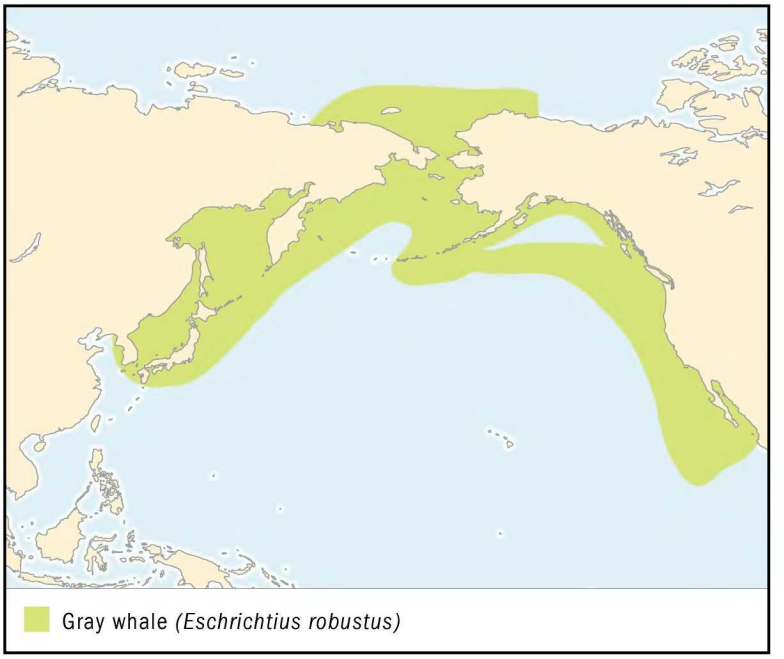
Gray whales do not have many predators, animals that hunt them for food. The largest and most significant are humans, who spent thousands of years hunting these whales almost to extinction. Killer whales, also known as orcas, will attack gray whales and often kill them. Killer whales make most of the scars on the backs of gray whales. Most of these attacks happen off the coast of northwest Oregon. Large sharks have also been known to attack gray whales, but that is much less common.

GRAY WHALES AND PEOPLE

For thousands of years, people have hunted the gray whale for oil, meat, hide, and baleen. This has caused a major decline, and two of the three populations located throughout the world were killed off. As the gray whale became protected by the International Whaling Commission, whale watching has replaced hunting. Now millions of people watch gray whales along the peninsula of Baja California and as they migrate along the West Coast of North America. Some gray whales are known as "friendlies" and will come up to small boats and allow themselves to be touched.

CONSERVATION STATUS

At one time there were three separate gray whale populations in the world. A population in the North Atlantic became



extinct during the mid-1700s because of overhunting. The western Pacific population was also overhunted to extinction in the 1930s. Now, only the eastern Pacific stock remains. These whales were hunted almost to extinction in the 1850s. In 1937, the International Whaling Commission gave the gray whale partial protection, and in 1947 this was changed to full protection. The Eastern Pacific gray whale population has made an extraordinary recovery. Their numbers now range between 19,000 and 23,000 individuals. This number is close to their original population.

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family CHAPTER

PYGMY RIGHT WHALE
Neobalaenidae

Class: Mammalia
Order: Cetacea
Family: Neobalaenidae
One species: Pygmy right whale (*Caperea marginata*)

PHYSICAL CHARACTERISTICS

The pygmy right whale is the smallest of the baleen (buh-LEEN or BAY-leen) whales. It ranges from 5.2 to 7.2 feet (1.6-2.2 meters) in length and weighs around 4.5 tons (4,000 kilograms). Females are larger than males. The largest female ever recorded was 21.3 feet (6.45 meters), while the largest male was 20 feet (6.05 meters). The pygmy right whale is the only species in this family and should not be confused with right whales in the family Balaenidae.

Like all baleen whales, the pygmy right whale is a filter feeder. Pygmy right whales do not have teeth. Instead, it has many overlapping plates, called baleen plates, which hang like a curtain from the upper jaw. These plates are made of a material called keratin (KARE-ah-tin). This horny, fingernail-like material frays out into thin hairs at the end of each strand to make a strainer. The whale opens its mouth to feed and sucks in a lot of water. It then pushes the water out through the baleen plates and uses its tongue to lick up food that remains.

The pygmy right whale's head is one-fourth the size of its body. Its most noticeable characteristics are a highly arched jaw and large lips. Inside the pygmy's mouth are 460 ivory-colored baleen; these are lined up, with 230 on each side of the upper jaw. This baleen is thought to be more flexible and tougher than the baleen of any other species. Each piece varies from 1 to 28 inches (2.5 to 70 centimeters) wide and can be as long as 4 inches (10 centimeters). The size of each baleen depends on where it is in the mouth.

THE RAREST WHALE

The pygmy right whale is the rarest and least understood of all the baleen (filter feeding) whales. Only about two dozen specimens have been studied. Some things about this whale resemble whales in the rorqual family. Other characteristics are similar to whales in the right whale family. In the past, pygmy right whales have been classified as part of the right whale family, but today, scientists believe that it is different enough to be put in a family of its own.

The head of the pygmy right whale has more hair than most other whales, with 100 hairs on the upper jaw and over 300 on the tip of the lower jaw. This whale has very small eyes, but good sight is not very important to it in finding food.

The pygmy right whale has a dark gray head that, with age, gets lighter along the lower jaw until it turns white on its underside. The back of the whale is also dark gray and has two blowholes located near the front of the head. Two-thirds of the way back is a very small dorsal (back) fin. The fin grows to be only about 6 inches (15 centimeters) high. The flippers are darker than the rest of the body. They are very narrow and are rounded at the ends.

GEOGRAPHIC RANGE

The pygmy right whale lives deep in Southern Hemisphere in the Atlantic, Pacific, and Indian Oceans. Most often this species is seen around Australia, Tasmania, New Zealand, South Africa, and the southern tip of South America.

HABITAT

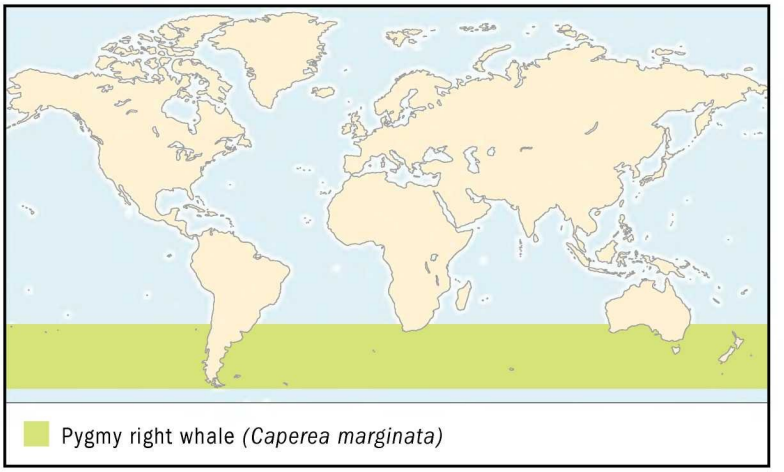
Pygmy right whales live where the surface water is between 41 and 68°F (5 and 20°C). Not much else is known about the habitat preferences of this whale.

DIET

The pygmy right whale eats small squid, octopus, krill, and shrimp-like marine animals. Their method of feeding has never been observed, but it is thought that this whale uses a surface-skimming technique instead of diving deep to feed.

BEHAVIOR AND REPRODUCTION

There have been very few sightings of pygmy rights, so little is known about their behavior. They are often seen in pairs or pods of up to ten individuals, but there have been occasional sightings of groups as large as eighty. To communicate, pygmy right whales use intense thumps or tones, each quickly rising and slowly falling, as the frequency drops.



The pygmy right whale is a very slow swimmer. It often spends only a few seconds on the surface when it comes up for air, usually just sticking its snout out of the water. The longest recorded dive of a pygmy lasted only four minutes. This whale is not known to do any acrobatic leaps out of the water. It is rarely seen at sea.

Since so little is known about the pygmy whale, there is little information about the mating season, mating practices, or length of pregnancy. Calves are around 6.5 feet (2 meters) at birth. Many researchers believe that calving may take place year-round. Calves stop nursing when they are between 9 and 11.2 feet (3 and 3.5 meters) long. Sexual maturity (the ability to reproduce) is reached when the animals are about 16 to 20 feet (5 to 6 meters) in length. Their average lifespan has not been determined.

PYGMY RIGHT WHALE AND PEOPLE

The pygmy whale has little to no contact with humans. Because it is so rare, the pygmy has never been hunted. The only human-caused deaths come from occasional entanglement in fishing nets.

CONSERVATION STATUS

Only a few dozen pygmy right whales have ever been examined, and only a few hundred have been identified. They are not on the endangered species list because of a lack of information, but are still thought to be threatened with extinction.



Only about two dozen pygmy right whales have been studied, and they are rarely seen at sea. There is still a lot to learn about how they live. (Illustration by Brian Cressman. Reproduced by permission.)

They are the only baleen whales not to have been threatened by large-scale commercial hunting. There is concern that this whale might be confused with the Antarctic minke whale, which it resembles. The Antarctic minke whale is still hunted by Japanese whalers. The pygmy is thought to be threatened by global climate change, but not by toxic pollution. Overall, it seems to be so rare not because of the lack of animals, but because of a lack of data and research.

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family CHAPTER

RIGHT WHALES AND BOWHEAD WHALES

Balaenidae

Class: Mammalia
Order: Cetacea
Family: Balaenidae
Number of species: 4 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Right whales and bowhead whales are baleen (buh-LEEN or BAY-leen) whales. Like all baleen whales, these whales are filter feeders. Right whales and bowhead whales do not have teeth. Instead, they have many overlapping plates, called baleen plates that hang like a curtain from the upper jaw. These plates are made of a material called keratin (KARE-ah-tin). This horny fingernail-like material frays out into thin hairs at the end of each strand to make a strainer. The whale opens its mouth to feed and sucks in a lot of water. It then pushes the water out through the baleen plates and uses its tongue to lick up food that remains, caught by the plates.

Right whales and bowhead whales are generally between 43 and 65 feet (13 to 20 meters) long. They weigh between 168,000 and 224,000 pounds (76,200 to 101,600 kilograms). They have large heads and a curved mouth that allows them more baleen surface than baleen whales with a straight mouth. Because they are mammals, whales must come to the surface of the water to breathe. They breathe through a blowhole located on top of their head. The blowhole is connected to the lungs.

Bowhead and right whales are almost entirely black, but they do have a patch of white around their chin, as well as a band of lighter color on their tail. The easiest way to tell the difference between a bowhead whale and a right whale is that right whales have bumps around their head, near their mouth, and around their eyes. These bumps are actually places where small animals known as whale lice live. These parasites are not

WHALES AND MYTHS

Whales have played an important role in popular culture. In the story of Pinocchio, a father and his wooden boy are swallowed by a whale. In *Moby Dick,* Captain Ahab pursues a white whale that attacks his ship. While these tales tell us of the fear that people have had of whales for centuries, it is important to remember that whales do not feed on people. Most large whales are not even capable of swallowing a person.

thought to be harmful to the whales. Bowhead whales do not have these bumps.

GEOGRAPHIC RANGE

Right and bowhead whales can be found throughout most of the world's oceans and seas. They go farther into the Arctic than many other whales and are capable of breaking through newly formed ice up to 9 inches (23 centimeters) thick. These whales do not generally enter the warmest waters close to the equator.

HABITAT

Right whales and bowhead whales travel long distances and can live in a variety of habitats. They generally find warmer temperatures for birthing along coastal regions and bays. They are capable of traveling far into the polar regions and navigating through icy waters to find krill for feeding.

DIET

Right whales and bowhead whales feed on small marine animals called krill by using their baleen. They do this by taking in water and krill as they open their large mouth. Next, they close their mouth most of the way, until only the baleen is exposed between their lips at the sides of the mouth, like a sieve (SIV). Then they push the water through the baleen and out between their lips, but the krill are trapped in the baleen and are left in the whale's mouth. By scraping the baleen with their huge tongue, the whales are able to swallow the food that is left after the water rushes out.

BEHAVIOR AND REPRODUCTION

Like all baleen whales, bowhead whales and right whales migrate. They spend the colder times of the year in warmer water closer to the equator and then move towards the polar regions of the Arctic and Antarctica where they spend the rest of the year. They do most of their feeding in the colder regions, and give birth in the warmer areas. Female right whales and bowhead whales give birth to one young at a time after a year

of pregnancy. The young are nursed for about six months. They reach maturity after eight or nine years. Right whales can live as long as seventy years, but bowheads can live even longer, some past one hundred years.

Right and bowhead whales are known for their songs and the other types of sounds they make. Some people have described these sounds as grunts, roars, growls, belches, complex screams, or pulses. In the springtime, bowhead whales send out complicated songs with themes, sets of notes that are repeated. It is thought that these serve as communication between males and females.



ANCIENT TREASURES

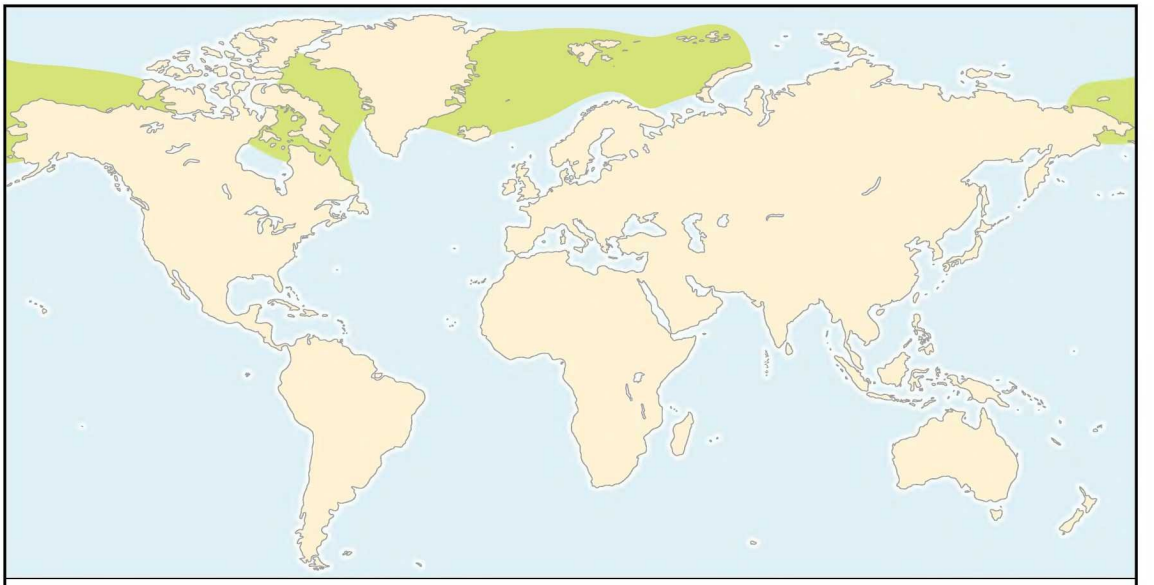
In 1995, a bowhead whale was killed in Alaska. When it was processed, it was found to have two stone harpoon blades in its flesh. This type of harpoon has not been used to hunt whales since the late 1800s. This means that the whale had to be over one hundred years old when it was killed.

RIGHT WHALES AND BOWHEAD WHALES AND PEOPLE

Throughout the nineteenth century and until recent times, right and bowhead whales were among those whales most sought by hunters. Whalers would bring in thousands of whales every year. Not only were whales a plentiful source of meat, but their blubber could be used to make oil for lamps. The baleen whales were particularly prized, because baleen could be used to make hoop skirts, shirt collars, and other clothing items because it was stiff, yet flexible. The invention of electric lighting, as well as new kinds of metal and plastic, has eliminated the need for almost all whale products in the modern world. In the 1930s, the International Whaling Commission banned the hunting of right and bowhead whales, although some hunting still occurs illegally. Native people of the Arctic are still allowed to hunt whales, and they use them for food, oil, and in the construction materials of sleds, baskets, traps and other items.

CONSERVATION STATUS

Bowhead whales and southern right whales are considered at low risk for extinction, dying out. However northern Pacific right whales and northern Atlantic right whales are considered Endangered, facing a very high risk of extinction in the wild, and it is thought that fewer than 250 mature individuals remain. Since commercial whaling began, the population of these two endangered species has been reduced by 95 percent. It is questionable whether they will ever recover.



Bowhead whale *(Balaena mysticetus)*

SPECIES ACCOUNTS

BOWHEAD WHALES
Balaena mysticetus

Physical characteristics: Bowhead whales grow to a length of 46 to 65 feet (14 to 20 meters) and can weigh as much as 112 tons (102 metric tons). They have the longest of all whale jaws and can have as many as 350 baleen plates in their mouth. They have no dorsal, or back, fin, but they do have a muscular bulge around the blowhole. They are almost entirely black except for a white patch at the front of their jaw. The bowhead has longer baleen than any other whale—its baleen can measure 25 feet (4.5 meters) long.

Geographic range: Bowhead whales are found mostly in the northern polar regions.

Habitat: Bowhead whales are accustomed to the icy waters found in the northern polar region and can navigate waters where there is a lot of ice.

Diet: Bowheads feed both near the surface and on the ocean floor. This gives them a highly varied diet of small marine animals. They eat as many as sixty different species.

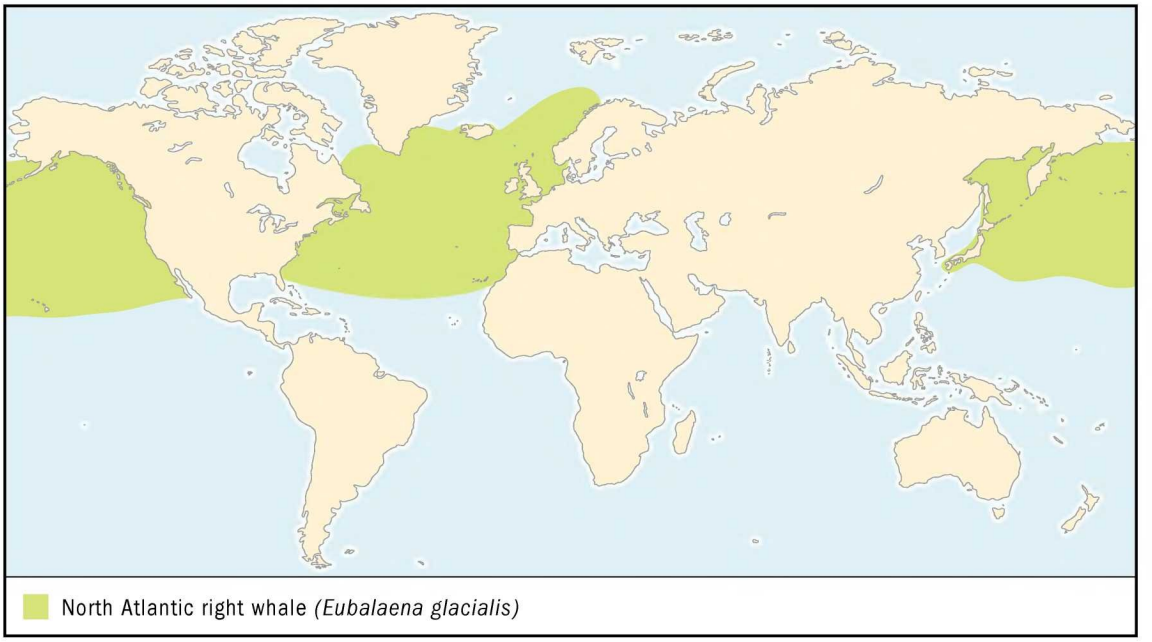


Bowheads eat as many as sixty different species of small marine mammals. They feed both near the surface and on the ocean floor. (Illustration by Michelle Meneghini. Reproduced by permission.)

Behavior and reproduction: Bowhead whales swim slowly and migrate with the forming and melting of ice in the northern pole region. In females pregnancy lasts fourteen months, and young are fed for a year after birth.

Bowhead whales and people: Inuit in Alaska have hunted and eaten bowhead whales for centuries. During the nineteenth century, bowhead whales were hunted commercially by a number of countries. This commercial whaling was one of the reasons that people first began to explore the Arctic region.

Conservation status: It is estimated that 10,000 bowheads still exist, and they are considered at low risk for extinction. However, certain populations have been greatly diminished and it is questionable whether the few animals left in these areas will be able to recover their once great numbers. ■



North Atlantic right whale *(Eubalaena glacialis)*

NORTH ATLANTIC RIGHT WHALE
Eubalaena glacialis

Physical characteristics: North Atlantic right whales are usually 43 to 53 feet (13 to 16 meters) in length and can weigh up to 100 tons (91 metric tons). They are black, but can have white areas on their belly and chin. Like other right whales, they have rough areas of skin that appear bumpy around their head. Barnacles and whale lice live in these bumps.

Geographic range: North Atlantic right whales are found throughout the seas and oceans of the Northern Hemisphere.

Habitat: These whales spend most of their time in shallow coastal waters. They migrate between cold polar waters for feeding and warmer southern waters for birthing and feeding their young.

Diet: North Atlantic right whales feed on almost any small marine animal that it can filter through its baleen. They are known to feed at the surface and to also dive in order to feed off the ocean floor where the water is not too deep.



North Atlantic right whales migrate between cold polar waters for feeding and warmer southern waters for birthing and feeding their young. (Illustration by Michelle Meneghini. Reproduced by permission.)

Behavior and reproduction: These whales usually dive for ten to twenty minutes. They are slow swimmers. Males compete over a female by pushing and shoving each other. The young are born in the warmer waters during winter and they are fed by their mother for a year after birth.

North Atlantic right whales and people: North Atlantic right whales have been hunted for almost a thousand years because of the meat, oil, and baleen that they can provide. Today large amounts of money are spent on preserving and restoring the small remaining population. They are also an important part of the whale watching industry.

Conservation status: North Atlantic right whales are Endangered. It is estimated that fewer than 250 exist in the world today. Because of accidents with fishing vessels and accidental entanglement in fishing nets, these whales have had a difficult time recovering their numbers. ■

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family CHAPTER

RORQUALS
Balaenopteridae

Class: Mammalia
Order: Cetacea
Family: Balaenopteridae
Number of species: 7 or 8 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Rorquals (ROAR-kwulz) are large baleen (buh-LEEN or BAY-leen) whales. Like all baleen whales, they are filter feeders. These whales do not have teeth. Instead, they have many overlapping plates called baleen plates that hang like a curtain from the upper jaw. These plates are made of a material called keratin (KARE-ah-tin). This horny, fingernail-like material frays out into thin hairs at the end of each strand to make a strainer. Rorquals also have a set of ridges and groves along the bottom of their mouth and throat. When they open their mouth to feed, the grooves expand and make the inside of their mouth very large so that they can suck up a lot of water. They then push the water out through the baleen plates and use their tongue to lick up food that remains.

Rorqual whales can be anywhere between 32 to 102 feet (10 to 31 meters) long and weigh as much as 200 tons (181 metric tons). Some rorquals have a dorsal fin on their backs, and others have particular bumps or ridges on their head and back that help to distinguish them from other rorquals. Females are usually larger than males.

GEOGRAPHIC RANGE

Rorquals are found in all of the oceans of the world and the seas that connect to these oceans. They do not live in the parts of the Arctic and Antarctic Ocean that are covered by ice, since they must come to the surface to breathe. Rorquals are more often found in shallower parts of the ocean that are closer to land. These areas are called continental shelves.

HABITAT

Rorquals can be seen most often in open waters over continental shelves. They can sometimes be found in bays and inlets near land.

DIET

Rorqual whales eat small fish, squid, and other small marine animals. Much of their diet is made up by krill, which are tiny shrimp-like animals. They obtain their food by filtering large quantities of water through their baleen. Normally they feed at depths no greater than 300 feet (91 meters) and stay under water no longer than ten minutes.

To capture the large amount of food that they need, rorquals expand their mouth and open it wide. Then they close their mouth most of the way, leaving only the baleen exposed, like a sieve (siv) between their lips, and squeeze the water out by ramming their tongue against the baleen. This pushes out the water and leaves the food behind. The blue whale, the largest rorqual, can eat 8 tons (7.3 metric tons) of krill per day.

BEHAVIOR AND REPRODUCTION

Rorquals normally swim at around 10 to 20 miles per hour (16 to 32 kilometers per hour). Some species, such as the fin whale can swim at speeds of 23 miles per hour (37 kilometers per hour) for short periods. Groups, or pods, are usually made up of two to five individuals, but sometimes large groups of rorquals come together where food is abundant. Generally rorquals do not dive deeper than 300 feet (91 meters) below the surface.

Even though different rorqual species live in different parts of the world, they all follow a migration pattern. This means that they spend part of the year in a warmer area and then move, often over great distances, to a cooler area for the other part of the year. Rorquals time their reproduction with this yearly cycle by giving birth in the warmer area and feeding in the cooler area. A female rorqual is pregnant for about a year, depending on the species, before she gives birth to a single calf. When the calf is born, it measures between 9 and 23 feet (2.7 and 7 meters) long. The young nurse, feed on their mother's milk, for about a year and grow rapidly. They become mature between five and fifteen years and live, on average, fifty to eighty years.

RORQUALS AND PEOPLE

All species of rorquals have been hunted by people for their oil and meat. Their oil was used in making margarine, soap, and lubricants, or industrial oils, until the 1980s. During the early 1900s humpback whales were hunted heavily, because they live close to land and their population was severely reduced. Hunters then began hunting of a number of other rorqual species. The blue whale became a preferred target of whalers, whale hunters, because of its size and the quantity of oil, meat, and blubber that it could provide. Larger blue whales could contain as much as 9,000 gallons (34,000 liters) of oil. Through efforts of the International Whaling Commission, environmental groups and other agencies, large scale commercial whaling ended by 1990. Today, whale watching is more popular and profitable than hunting. According to the World Wildlife Fund, this ecotourism, travel for the purpose of observing wildlife and learning about the environment, generated approximately one billion dollars in 2000.



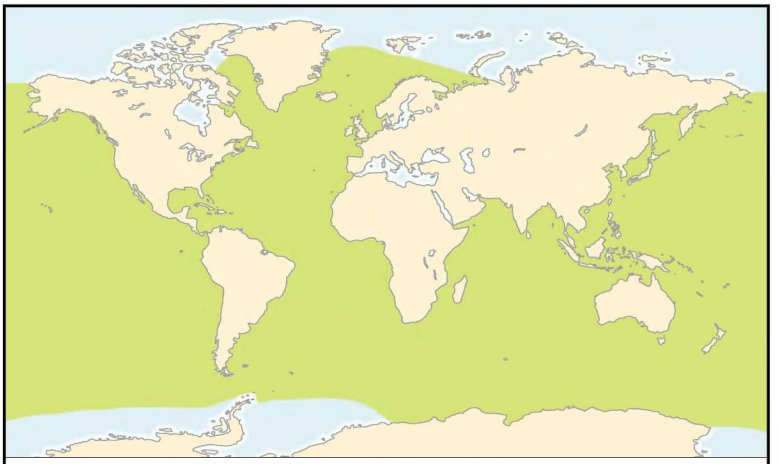
A WHALE'S FINGERPRINT

Scientists have discovered that each humpback whale's dorsal, back, fin and tail markings are unique. This is the whale's fingerprint. Knowing this, scientists can follow individual whales by photographing them when they leap out of the water and matching their fin and tail pattern to known individual whales. Being able to track a single whale has helped scientists learn where they migrate, when they mate, how long they live, and other important information.

CONSERVATION STATUS

The International Whaling Commission, set up in 1946 by twenty countries, has attempted to monitor and establish limits on the number of whales and the kinds of whales that are killed each year. In 1972, the United States Congress passed the Marine Mammal Protection Act banning hunting of marine mammals and the purchasing of their products from other countries. While these efforts have brought an end to most whale hunting worldwide, they may have been too late for many rorqual species. Today, the blue whale, the sei whale, and the fin whale are considered Endangered, facing a very high risk of extinction in the wild. Humpback whales are considered Vulnerable, facing a high risk of extinction in the wild. Studies done by the International Whaling Commission have estimated that there are fewer than five hundred blue whales remaining in the world.

SPECIES ACCOUNTS



BLUE WHALE
Balaenoptera musculu

Physical characteristics: The blue whale is the largest animal on the planet. Their skin is gray or blue-gray with lighter colored splotches. Blue whales grow to between 74 and 79 feet (23 and 24 meters) and weigh up to 200 tons (181 metric tons). Females are slightly larger than males.

Geographic range: Blue whales are found in all oceans worldwide.

Habitat: Blue whales spend the spring months in the colder waters close to the poles, but migrate toward the warmer regions closer to the equator for the other eight months.

Diet: Blue whales eat only during the spring for about four months when they feed in colder waters. The rest of the year, they live off stores of blubber, fat, that they build up during the feeding season. Blue whales eat krill and generally avoid other marine life. When they are feeding, they can eat 8 tons (7.3 metric tons) of krill per day.

Behavior and reproduction: Although they usually swim at about 14 miles per hour (22 kilometers per hour), blue whales have been

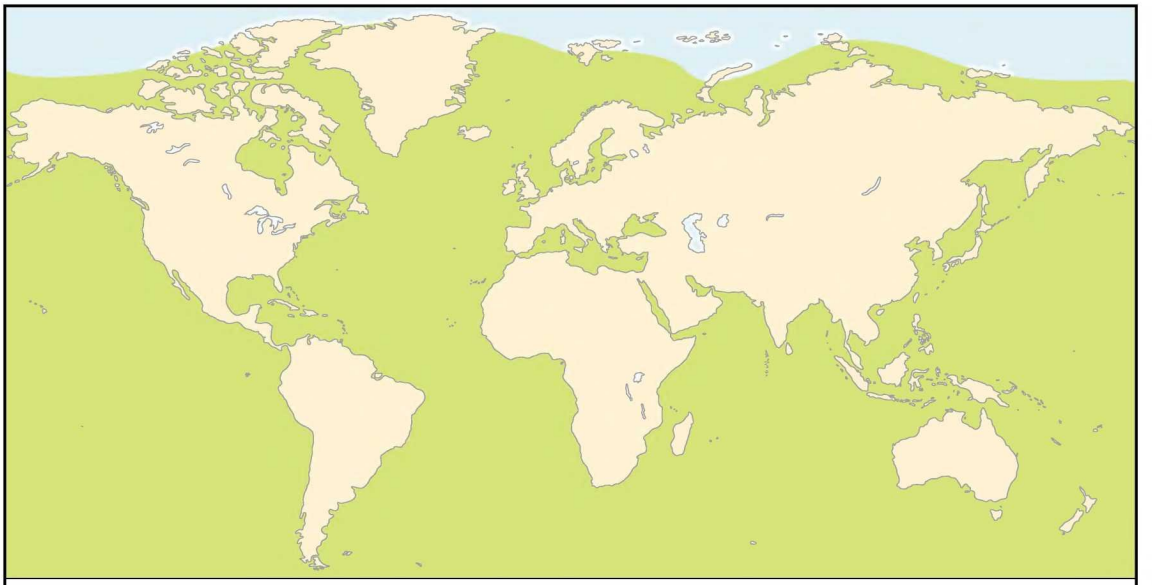


Blue whales are the largest mammals on Earth, and can live over one hundred years. (Phillip Colla/Bruce Coleman Inc. Reproduced by permission.)

known to swim as fast as 30 miles per hour (48 kilometers per hour). They dive for ten to twenty minutes to feed and generally do not dive more than 300 feet (91 meters) below the surface. Female blue whales give birth in late spring and summer after twelve months of pregnancy to young that are about 23 feet (7 meters) long. Blue whales can live past one hundred years of age.

Blue whales and people: When whalers began using ships that allowed them to haul up whales no matter how large they were, the blue whale populations dropped dramatically. Because of their size, blue whales were highly prized, as whalers could bring in large amounts of oil, blubber, and meat with a single kill. During the years of 1930 and 1931, almost 30,000 blue whales were killed. During the 1960s, the blue whale gained protection from the International Whaling Commission. The blue whale may not survive much longer. Some scientists predict that the remaining population of about five hundred whales is not large enough to support a recovery. In recent decades the blue whale has taken a place in popular culture, and its image has helped to promote conservation efforts and ecotourism activities such as whale watching.

Conservation status: Blue whales are Endangered. ■



Northern minke whale *(Balaenoptera acutorostrata)*

NORTHERN MINKE WHALE
Balaenoptera acutorostrata

Physical characteristics: The northern minke whale is the smallest rorqual whale, but is still between 26 and 33 feet (8 and 10 meters) long. They are sleek whales with black, brown or gray backs and lighter bellies. They have light stripes across their flippers.

Geographic range: Northern minke whales migrate from tropical waters to the polar oceans in the Northern Hemisphere. There are two separate populations, one in the North Atlantic and one in the North Pacific.

Habitat: Northern minke whales live at the edge of the polar ice fields, and sometimes even enter the fields of ice. They prefer water close to shore, and will enter bays and inlets.

Diet: Although a large part of their diet is krill and small schooling fish, the northern minke whale feeds on many foods that other rorquals generally avoid, including larger fish such as salmon, cod, and mackerel.

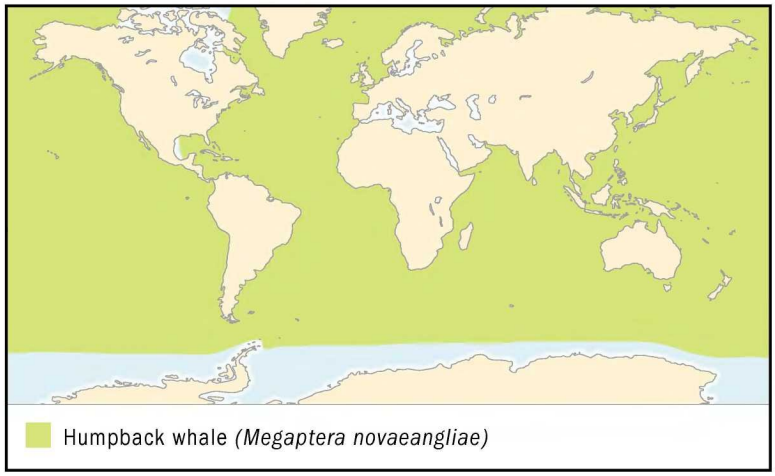


Unlike other members of the family, the northern minke whale is abundant, though it is still protected from hunting. (© François Gohier/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: Northern minke whales are most often seen alone, in pairs, or groups of three. However, there are times when they gather in large groups of up to fifty in rich feeding areas. Female northern minke whales are pregnant for ten months, after which the calves nurse for about six months. Calving usually occurs in the winter. Calves stay with their mothers for about two years, even when they have stopped nursing. These rorquals often live to be sixty years old.

Northern minke whales and people: Meat from this rorqual, as well as many other rorquals, is sought after in Japan and Korea as a special delicacy. Their meat is extremely expensive. Despite the International Whaling Commission's 1986 ban on hunting, these whales are still taken illegally because of the high price their meat brings.

Conservation status: Northern minke whales, unlike many of their fellow rorquals, are abundant and considered at low risk for extinction. ■



HUMPBACK WHALE
Megaptera novaeangliae

Physical characteristics: Humpback whales grow to between 38 and 49 feet (12 to 15 meters) in length and weigh between 27 and 33 tons (25 to 30 metric tons). The tail can be 18 feet (5.5 meters) wide. They are black except for their underside, flippers, and throat, which are white. Their head, jaw, and flippers are covered with bumps. Each bump has at least one hair growing out of it. Scientists do not know what these bumps or hairs are for. The humpback whale has the longest flippers of any whale.

Geographic range: Humpback whales live in the Pacific and Atlantic Oceans.

Habitat: Humpback whales spend the cooler months closer to the equator and then migrate towards the north or south pole for the warmer months.

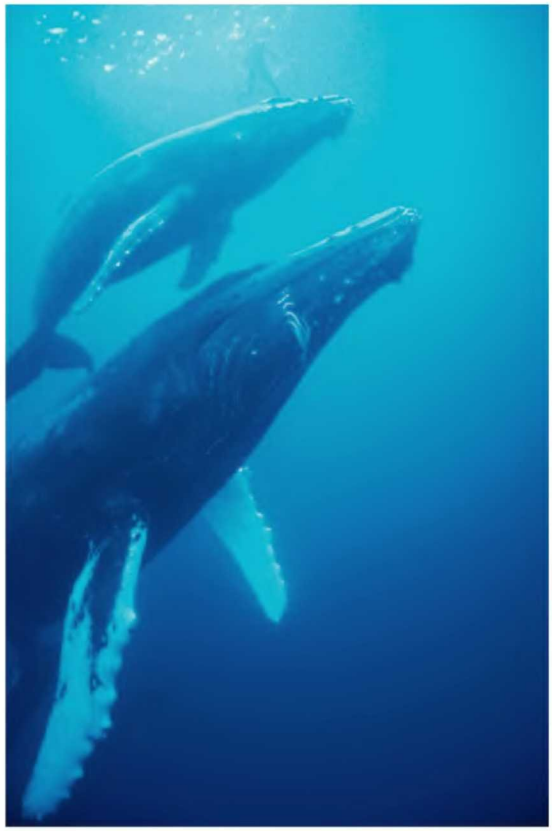
Diet: Like most rorquals, humpback whales eat krill or small marine animals that they catch by filtering large quantities of water through their baleen. While the largest part of their diet is krill, the humpback whale also eats a variety of small fish. Each whale eats about 1.5 tons (1.4 metric tons) of food a day.

Behavior and reproduction: Humpback whales tend to gather in groups of two to five. Not only are they known for their acrobatic

ability to leap out of the water and slap the water with their tail and flippers, but humpback whales do some of the most complex and intricate singing of any mammal. These songs last about twenty to thirty minutes and are repeated for hours. The North Atlantic whales all sing the same song, and it is different from the song the North Pacific humpback whales sing. Females are pregnant for twelve months and nurse their young for another year after birth. They usually have a new calf every other year. Humpback whales can live up to seventy-five years.

Humpback whales and people: Because humpback whales tend to stay closer to the land than other rorquals, they were hunted heavily. Although their numbers have decreased substantially, the humpback whale is less likely to go extinct than several other whales.

Conservation status: Humpback whales are considered Vulnerable. ■



Female humpback whales nurse their young for about one year, and have a new calf about every other year. (V. & W. Villoch/ Bruce Coleman Inc. Reproduced by permission.)

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AARDVARK
Tubulidentata

Class: Mammalia
Order: Tubulidentata
One family: Orycteropodidae
One species: Aardvark (*Orycteropus afer*)

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

Aardvarks have elongated, or stretched-out, heads with a pig-like snout and tubular ears. Their muscular, arched bodies are protected by a thick, grayish brown skin that is covered with bristles. The front feet have four toes as well as sharp claws, while the back feet have five toes. The cone-shaped tail is short and tapered, smaller at the end. The long tongue is sticky to help catch insects. Adult aardvarks are 67 to 79 inches (170 to 200 centimeters) long and weigh anywhere from 88 to 143 pounds (40 to 65 kilograms).

The word aardvark means "earth pig" in Dutch. In addition to having a pig-like snout, this mammal resembles a pig in the way it uses its front feet to dig. Like the tail, the snout tapers at the end, and it has two nostrils that can be closed. Although the legs are short, they are powerful—strong enough to break through rock-solid termite mounds. The back legs are slightly longer than the front legs. Despite having soles on the hind feet, aardvarks move on their toes and use the front feet, with their long claws, for digging.

Adults have about twenty teeth, and they are located in the back of the mouth. These column-shaped teeth grow throughout the aardvark's lifetime and, unlike human teeth, do not have protective enamel coating. Instead, each tooth is made of dentin, a material that is harder than bone.

GEOGRAPHIC RANGE

Though not common anywhere, aardvarks live primarily in the grassland and woodlands of the part of Africa south of the Sahara desert. They have also been seen in rainforests.

HABITAT

The deciding factor for where aardvarks live is availability of food. They also require sandy soil, as opposed to rocks, so that they can dig for termites. Aardvarks live in underground burrows that are 6.5 to 9.8 feet (2 to 3 meters) long, at 45 degree angles. At the end of the tunnel is a rounded "room" where the aardvark curls up to sleep. Female aardvarks give birth in this chamber. Although burrows usually have just one entrance, some have numerous entryways as well as several tunnels extending from the main passage.



Termites are the aardvark's preferred food. Aardvarks will dig at a termite mound and eat the escaping termites, or look for a whole colony on the move and eat them as they march along. (© Nigel J. Dennis/Photo Researchers, Inc. Reproduced by permission.)

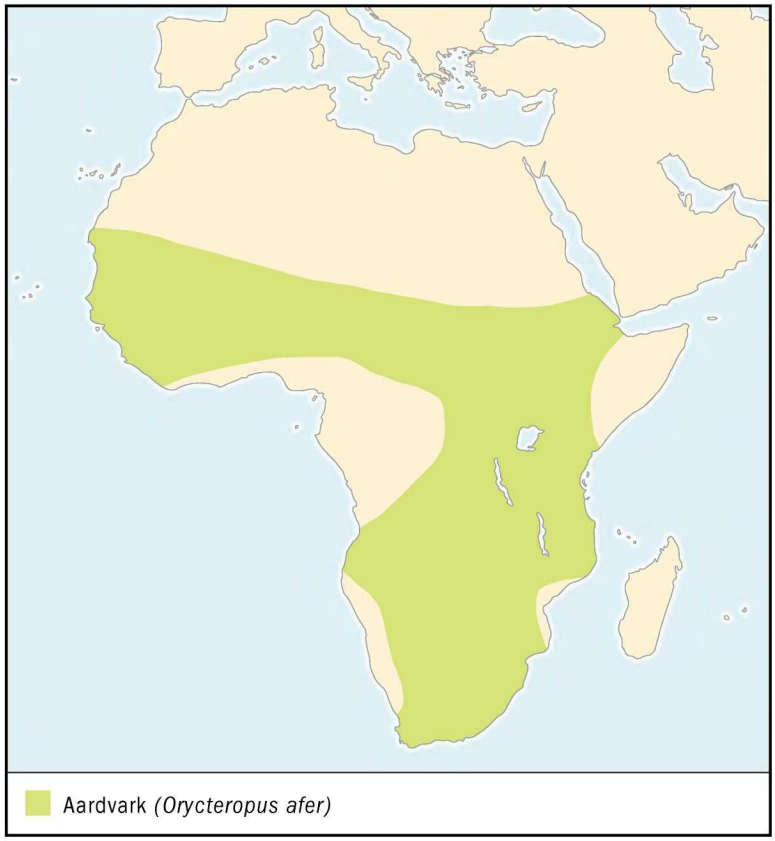
DIET

Aardvarks began eating termites thirty-five million years ago, and that's still their preferred meal. A hill of termites is not enough to satisfy an aardvark, however, so it searches for entire termite colonies. These colonies march in columns 33 to 130 feet (10 to 40 meters) long, which makes it easy for the aardvark to suck the termites through its nostrils. When attacking a termite mound, the aardvark starts digging at the base with his front claws. Once the termites begin escaping, it extends its tongue and traps them with its sticky saliva. Aardvarks also eat ants and locusts, a type of grasshopper.

In addition to these insects, aardvarks eat an underground fruit of the cucumber species, probably as a source of water. *Cucumis humifructus* is known in South Africa as the "aardvark pumpkin" or "aardvark cucumber." One tribe of native people, the !Kung San, call this plant "aardvark dung" because the aardvark buries its feces outside abandoned aardvark burrows and the plant grows from seeds left in the aardvark's feces.

BEHAVIOR AND REPRODUCTION

Aardvarks are solitary creatures, they prefer to live alone and have never been found in large numbers. Because they are nocturnal, nighttime, animals, they are not seen very often. In the warmer seasons, they come out of their burrows just after the sun sets. They are able to hunt and forage, gather food, even if it is a moonless night because they rely on their sense of smell to locate termites. Aardvarks cover 1.2 to 3 miles (2 to 5 kilometers) each night at a rate of 1,640 feet (500 meters) per hour.



When searching for food, aardvarks move about in a zigzag formation with their noses to the ground. It is thought that the fleshy tentacles, hair-like growths, around the nostrils might actually be chemical receptors that help find food.

Aardvarks are known for their digging abilities. In fact, aardvarks can dig a burrow 3.3 feet (1 meter) deep faster than a group of six adults with shovels!

The mating season of the aardvark varies. In some areas, mating occurs between April and May, with offspring born in October or November. In other regions, offspring are born in May or June. Females carry their offspring for seven months before giving birth, and they bear only one offspring with each pregnancy. The baby weighs approximately 4 pounds (2 kilograms). Newborn aardvarks are hairless with pink, tender skin. They remain in the burrow with their mothers for two weeks. After two weeks they follow their mothers in the nightly search

for food. The infant aardvark does not eat solid food until around three months, preferring its mother's milk until that time.

Aardvarks move away from the mother's den after six months and build burrows a few feet (meters) away, but they continue to forage together. Male aardvarks leave their mothers completely during the next mating season, but females stay with mothers until the birth of the next baby. Male aardvarks roam while females remain in a consistent home range. Because of this, experts believe aardvarks to be polygamous (puh-LIH-guh-mus), having more than one mating partner.

Humans are not the only hunters of aardvarks. Lions, leopards, and hyenas are the main predators, animals that hunt them for food, of aardvarks. Pythons feed on young aardvarks as well. When they sense danger, aardvarks retreat to the nearest hole. If a hole is not nearby, they use their powerful claws to dig one. The claws push the dirt backwards while the tail sweeps it away. In the event they cannot get to safety, aardvarks will lie on their back and fight with all four feet.

AARDVARKS AND PEOPLE

European colonialists hunted aardvarks for their meat and hide. Africans continue to hunt aardvarks and consider it a sport as well as a means of survival.

CONSERVATION STATUS

Aardvarks are classified as Vulnerable, facing a high risk of extinction in the wild, by the World Conservation Union (IUCN).

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ELEPHANTS
Proboscidea

Class: Mammalia
Order: Proboscidea
One family: Elephantidae
Number of species: 3 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

Elephants weigh 200 to 265 pounds (90 to 120 kilograms) when they are born. Even after they reach adulthood, elephants continue to grow. Females stop growing between twenty-five and thirty years and males between thirty-five and forty-five years. Adult females weigh anywhere from 3.3 to 7.7 tons (3 to 7 metric tons), depending on the species of elephant.

When compared to the size of its body, an elephant's head is large. It weighs up to half a ton (half a metric ton) and is supported by a short neck. Elephants have four, very strong legs with feet containing five splayed, spread out, toes. The toes are buried inside the flesh of the foot so that they are invisible to the naked eye. When elephants stand, they are actually on their tip-toes, and though the first visible joint looks like a knee, it is more like a wrist or ankle. Elephant feet also have pads of tissue to help support their massive weight. The long tail ends in a cluster of coarse, rough, hair.

Elephants have no sweat glands, but their large ears contain a great number of blood vessels to assist with heat loss to help keep them cool. Their gray hide is sparingly covered with tiny, short hairs.

The tusks of an elephant are actually teeth and are covered in dentin, a material that is harder than bone. A third of each tusk is hidden inside the skull, and additional dentin forms there, pushing each tusk out at a rate of up to 6 inches (15 centimeters) yearly. The tusks of a male elephant can weight 110 pounds (50 kilograms) each and measure 79 inches (200 centimeters). If an

elephant were human, its trunk would be comparable to the nose and upper lip. The trunk is extremely sensitive and flexible and contains no bone or cartilage. Instead, it is made up of about 150,000 moveable muscles, which makes it incredibly powerful. An elephant's nostrils run the whole length of the trunk.

GEOGRAPHIC RANGE

African elephants live in central Africa, from Democratic Republic of the Congo to Mauritania. Asian elephants inhabit India, Sri Lanka, Myanmar, Indonesia, Thailand, Cambodia, Vietnam, Laos, Malaysia, Nepal, Bangladesh, and southern China.

HABITAT

Elephants live only in tropical and subtropical regions, but they occupy a wide range of habitats, including savannas (a mixture of grassland and woodland), rainforests, mountains, semi-deserts, and deciduous (trees that lose their leaves every year) forests. Elephants eat a wide variety of plants, so it is important that they live in an area that provides this essential diversity. Water is another requirement. They must live within a day's walking distance of water in order to survive. Also of great importance is that the elephant has room to move about freely without coming into contact with humans.

Elephants have been known to change wooded area into open grassland by destroying trees.

DIET

Elephants are herbivores, plant eaters, who eat a wide range of various plant types, including grasses, trees, vines, and shrubs. They consume between one hundred and five hundred species of plants, and eat everything edible on each plant, including twigs, bark, flowers, roots, bulbs, leaves, and shoots. Tree bark is favored because it provides essential minerals and other nutrients.

What elephants eat depends on the season. During the rainy season, 50 to 60 percent of an elephant's diet is made up of new grasses. As those grasses dry out in the African and Asian sun, the elephants eat more fruit and shrubs, which account for about 70 percent of their diet. Bamboo is a staple, basic food, for elephants residing in the forests of Asia. Elephants in the rainforests of Africa and Malaysia eat more leaves and fruits.

Elephants eat 220 to 660 pounds (100 to 300 kilograms) of food daily. Anywhere from twelve to eighteen hours of each day

is spent eating. Where elephants live determines their behavior in terms of food gathering. Elephants in forest areas travel slowly, eating plants as they cover about 3 miles (5 kilometers) each day. Elephants who live in woodlands and grasslands spend the hottest parts of the day in the wooded areas and graze in the grassland as the temperatures cool down. Elephants drink up to 53 gallons (200 liters) of water each day in hot weather. When water is hard to find, they dig holes in dried-up streams or lake beds until water seeps in, then they suck it up through their trunks.

An elephant's trunk is a major eating utensil. Smaller items are plucked or picked up with the trunk while larger items like branches are torn away from the tree by putting the trunk around them and twisting. To reach the top of trees, elephants stand on their hind legs, which give them a total reach, combined with the stretch of the trunk, of 26 feet (8 meters). Elephants have also been observed pushing over and uprooting trees. The trunk is also important for drinking and is used like a straw. The elephant sucks water up its trunk only until it can be squirted into its mouth. Water never reaches the elephant's nose. An elephant's trunk can hold 2.2 gallons (8.5 liters) of water. The only time elephants eat without the use of their trunks is when they are nursing from their mothers.

Tusks are also useful for eating. They can strip bark from trees, dig for roots and water, and scrape salt and other nutrients from soil or rock. Food is chewed by grinding the lower jaw against the upper jaw, using a forward and backward motion. The molars, back teeth, of an elephant are flat-topped, each one independent from its own root. The molars are held together by a cement-like material and form blocks of enamel and dentin about 11.8 inches (30 centimeters) long. As each set wears down, another larger set moves forward to replace it. Elephants have a total of six pairs of teeth blocks, each weighing up to 8.8 pounds (4 kilograms). The final pair emerges into place around forty years of age and takes about twenty years to wear out. At that time, the elephant dies of a combination of starvation, malnutrition, and old age.

Because elephants do not digest food effectively, only about 40 percent of food by weight is used. The intestine is 115 feet (35 meters) long in comparison the human adult intestine is about 12 to 13 feet (3.7 to 4.0 meters) long. When the elephant is full the intestine weighs up to a ton (0.9 metric tons). An elephant expels an average of 220 pounds (100 kilograms) of feces daily.

BEHAVIOR AND REPRODUCTION

The female elephant, or cow, is sexually mature between the ages of twelve and fourteen and begins to reproduce shortly after that. Cows typically give birth to one calf at a time every four or five years. One of every one hundred births results in a twin delivery. The gestation period, length of pregnancy, for an elephant cow is twenty-two months. This ensures that the calf will be born during the rainy season, when grass will be plentiful for both mother and baby. Mating takes place at sixteen-week intervals year round.

Elephant cows give birth standing up, with the help of other females. Within hours, the calf will stand and take its first steps. Calves nurse, feed on their mother's milk, until they are two or three years old, sometimes longer, depending on the timing of the mother's next birth. Male calves nurse more frequently than do females, which becomes evident by the difference in size after the first few years.

Elephants have socially complex lives. The social structure is matriarchal (may-tree-ARK-ul), female-led, and the family is at the core. Each family unit has three to twenty-five members of adult females and their offspring. The females remain close throughout their lifetimes. Male elephants are typically solitary, preferring their own company to that of herds. They leave their birth families between the ages of twelve and fifteen and have no long-term bonds with them or any other elephants.

Groups are led by the older females, who make all decisions. Calves remain very close to their mothers, but all the females of the group will assist in raising the calves. Elephants are highly intelligent, and social interaction is complex. For example, within families, individuals greet one another by making sounds and touching each other with their trunks.

ELEPHANT EMOTIONS

Studies have shown that elephants lead highly complex social lives marked by emotions such as joy, grief, and compassion. In a 2001 *Los Angeles Times Syndicate* article, Steve Newman reported on a train wreck in India that killed a group of elephants. The rest of the herd began trumpeting and giving off shrill cries as they encircled their dead. The police official described the grieving elephants "with tears rolling down their faces." In *The Astonishing Elephant,* Shana Alexander recalled an incident when a young circus elephant began to sob when scolded during a circus training session.

ELEPHANTS AND PEOPLE

Elephants and humans have interacted for tens of thousands of years. As long ago as thirty thousand years, people in Europe carved tools and ornaments from ivory tusks. Ivory has

been used for carving because it's hard yet has elasticity, flexibility. Elephants play an important role in Asian culture especially. Evidence points to their domestication, taming for human use, as early as the third millennium B.C.E. in India. Soon after, they were used in the military to knock down enemy buildings. Royalty used to hunt while riding on elephants' backs. In the United States, elephants are raised in captivity in zoos and circuses.

CONSERVATION STATUS

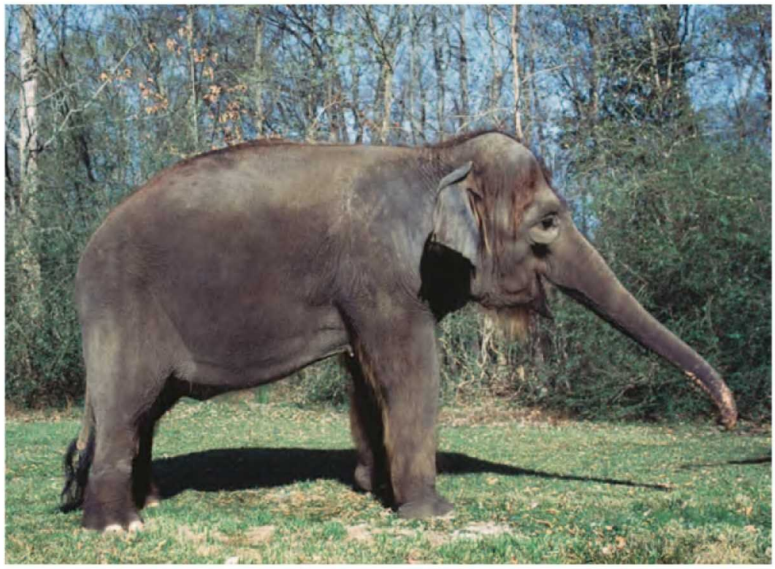
All elephants are listed as Endangered, facing a very high risk of extinction in the wild, by the World Conservation Union (IUCN). They are threatened by habitat loss and poaching, illegal hunting, for ivory, meat, and hides.



ASIAN ELEPHANT
Elephas maximus

Physical characteristics: Asian elephants weigh 3.3 to 5.5 tons (3 to 5 metric tons) with shoulder heights of 6.6 to 9.8 feet (2 to 3 meters). They have heads that are large compared to their bodies with large ears—but smaller ears than the African elephant—that fold forward at top. Their trunks have one finger at tip. Asian elephants have gray skin that fades to pink spotting on ears, face, and trunk with age. Only males have tusks. Some males lack tusks but make up for this by have an especially strong upper trunk region.

Geographic range: Asian elephants live in Myanmar, Cambodia, India, Indonesia, Laos, Malaysia, Sri Lanka, Thailand, and Vietnam.



Asian elephants have just one finger at the tip of their trunk. The finger helps them to grasp leaves and pull them off trees for eating. (C. C. Lockwood/ Bruce Coleman Inc. Reproduced by permission.)

Smaller populations can be found in Bangladesh, Bhutan, southwest China, Indonesia, and Nepal.

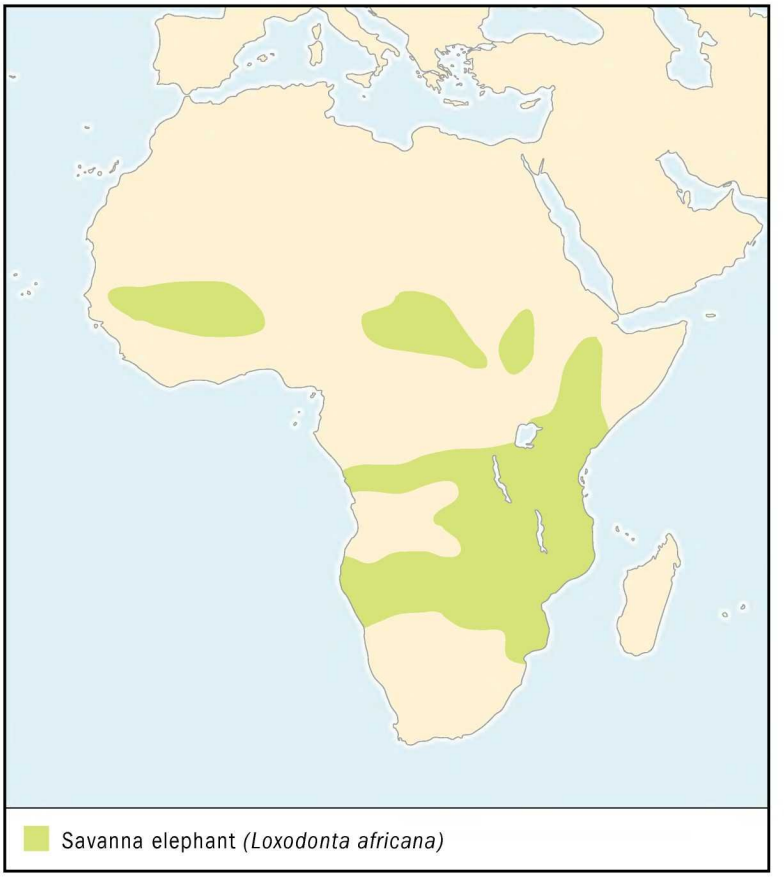
Habitat: Asian elephants live primarily in forests that are wet or partially moist, those containing bamboo, and grassland. They must live with a day's walking distance of water.

Diet: Asian elephants spend eighteen to twenty hours a day eating and searching for food. Adults eat 220 to 440 pounds (100 to 200 kilograms) of food daily. They consume a variety of plants, which they chew with their molars, and drink up to 53 gallons (200 liters) of water each day.

Behavior and reproduction: Asian elephants have matriarchal social structures that are complex. They live in family units within larger groups. Asian elephants mate throughout the year, and the gestation period lasts twenty-two months. Females assist each other in raising the calves within family units. They communicate by touching one another and making sounds. Given their size, elephants do not have many predators. Calves and weakened adults may be attacked by hyenas, lions, and tigers.

Asian elephants and people: Asian elephants are important in Asian cultures. They are revered in religion. Asian elephants are also used for domestic work and in the military.

Conservation Status: Listed as Endangered by the IUCN due primarily to habitat loss, but also because of poaching for ivory, meat, and hides, especially in southern India. ■



Savanna elephant *(Loxodonta africana)*

SAVANNA ELEPHANT
Loxodonta africana

Physical characteristics: The savanna elephant, the better-known of the two African elephants, weighs anywhere from 4.4 to 7.7 tons (4 to 7 metric tons), with a shoulder height of 8.2 to 13 feet (2.5 to 4 meters). The savanna elephant's head is not as high as the Asian species and has just a single dome; their ears are larger and fold back at the top. The trunk has two fingers on its end. Both sexes have tusks, but the females have smaller tusks.

Geographic range: Savanna elephants live in Mali, Namibia, Botswana, Zimbabwe, and South Africa.



Adult African savanna elephant (Loxodonta africana) and calf drinking water (© St. Meyers/ OKAPIA/Photo Researchers, Inc. Reproduced by permission.)

Habitat: There are 250,000 to 350,000 savanna elephants living in Africa. Savanna elephants also live in dry woodlands as well as on savannas, which are a combination of woodland and grassland.

Diet: Adults consume 220 to 660 pounds (100 to 300 kilograms) of plant food daily, which they chew with their molars. These elephants tend to spend the hottest parts of the day in the wooded areas and graze in the grassland as the temperatures cool down. Savanna elephants drink up to 53 gallons (200 liters) of water each day.

Behavior and reproduction: A female cow will signal her readiness to mate by making loud sounds through her trunk. She also has a special courtship walk, in which she holds her head high while looking back over her shoulder. Gestation period lasts twenty-two months. Newborns weigh 265 pounds (120 kilograms). Males are competitive and solitary. Savanna elephants live in a matriarchal society of family units within the larger social structure, with up to seventy elephants in a multi-family group. Females remain bonded for life.

Savanna elephants and people: The savanna elephant is at higher risk of habitat loss than the forest elephant because it prefers environments similar to those that humans prefer.

Conservation status: Because the savanna elephant was not recognized as a species separate from the African forest elephant until 2001, both species are still considered together in legal terms. Excessive hunting and habitat loss has caused the African elephant to be listed as Endangered by the IUCN. ■



FOREST ELEPHANT
Loxodonta cyclotis

Physical characteristics: Forest elephants weigh 2.2 to 4.4 tons (2 to 4 metric tons), with a shoulder height of 6 to 9.8 feet (1.8 to 3 meters). Compared to the savanna elephant, it is smaller physically. Their heads are not as high as the Asian species, nor as large as the savanna elephant, and it has just a single dome. Forest elephant ears are rounded and fold back at the top. The trunk has two fingers on its end. Both sexes have tusks, but the female's tusks are smaller. The ivory is long and thin, straight with a pinkish hue to it. It is a harder material than the ivory of the savanna elephant.



After a pregnancy of twenty-two months, female African forest elephants give birth to a newborn that weighs 265 pounds (120 kilograms). (© Christophe Ratier/Photo Researchers, Inc. Reproduced by permission.)

Geographic range: The forest elephant is thinly scattered throughout West Africa but has substantial populations in Central African rainforests.

Habitat: Forest elephants must live near water, and in areas with varied vegetation.

Diet: Adults consume 220 to 660 pounds (100 to 300 kilograms) of plant food daily, which they chew with their molars. Forest elephants drink up to 53 gallons (200 liters) of water each day.

Behavior and reproduction: Similar to the savanna elephants, a female cow signals her readiness to mate by making loud sounds through her trunk, and has a special courtship walk, in which she holds her head high while looking back over her shoulder. Gestation period lasts twenty-two months. Newborns weigh 265 pounds (120 kilograms). Males are competitive and solitary. Forest elephants live in a matriarchal society of family units within the larger social structure, though group size is much smaller for forest elephants than for the savanna elephants. Females remain bonded for life.

Forest elephants and people: African elephants are rarely domesticated. Their numbers have been reduced by hunting for ivory and meat as well as by loss of habitat due to logging.

Conservation status: Because the forest elephant was not recognized as a species separate from the African savanna elephant until

2001, both species are still considered together in legal terms. Excessive hunting and habitat loss has caused the African elephant to be listed as Endangered, by the IUCN. ■

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HYRAXES
Hyracoidea

Class: Mammalia
Order: Hyracoidea
One family: Procaviidae
Number of species: 5 to 11 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

Hyraxes are herbivores, plant eaters, that resemble guinea pigs. They have short legs, a stubby tail, and round ears. There is no average size, as the species vary greatly across Africa, but the growth of the hyrax seems to be directly linked to precipitation, or rainfall—the largest hyraxes are in the areas with the most rainfall.

The feet have pads on them that contain sweat glands. The hyrax sweats as it runs, which help its feet pads grip, making it easier to climb. The feet are flexible and can turn upwards. The front foot has four toes and the hind foot has three toes. All toes have flat nails except for the second toe of the hind foot. This toe sports a long, curved claw used for grooming.

All hyraxes have fur, but the length of it depends on the climate in which they live. The colder the temperature, the longer the fur. Coat color ranges from light to dark, and may be brown, white, or gray. The bulging eyes are framed by bushy white eyebrows. The head is flat on top, and the muzzle, nose and mouth area, is shaped like a skunk's muzzle.

GEOGRAPHIC RANGE

Hyraxes live mainly in Africa. The rock hyrax has been seen from Lebanon to Saudi Arabia.

HABITAT

Hyraxes easily adapt to their surroundings and can work with any kind of shelter so long as it provides the necessary

protection from weather and predators, animals that hunt them for food.

Each species is distinct in terms of where it lives. The bush and rock hyraxes need mountain cliffs and an abundance of rocks for refuge. Tree hyraxes prefer moist forests and savannas, a tropical environment that contains trees and shrubs and has a dry season. At higher elevations they can survive among rocks.

DIET

The hyrax eats mostly twigs, fruit, and bark as well as leaves, but it also feeds on lizard and bird eggs. Because their food is plant based, hyraxes can go for long periods of time without water, getting the moisture they need from the plants they eat.

BEHAVIOR AND REPRODUCTION

Rock and bush hyraxes are active during daylight hours and tend to live in groups whereas tree hyraxes are nocturnal, active at night, and prefer to live on their own. The social unit of the rock and bush hyraxes includes one adult male and about seventeen adult females, with their young. Though solitary, tree hyraxes have been found in groups of two or three. In this group, too, there is a hierarchy, rank structure, and the male is at the top.

Hyraxes mate once a year. Gestation, pregnancy, lasts twenty-six to thirty weeks, and the number of babies per female ranges from one to four. Mothers suckle only their own babies, and the young stop nursing anywhere from one to five months. Both sexes are ready to mate between sixteen and seventeen months of age. At this time, females join the adult female group while males take off on their own. Adult females live longer than adult males and may reach eleven years or more.

Young hyraxes are playful, with normal behavior including biting, climbing, chasing, and fighting.

HYRAXES AND PEOPLE

Some African people hunt hyraxes for food and skin. The tree hyrax is harvested to be used in medicine. Deep coughs



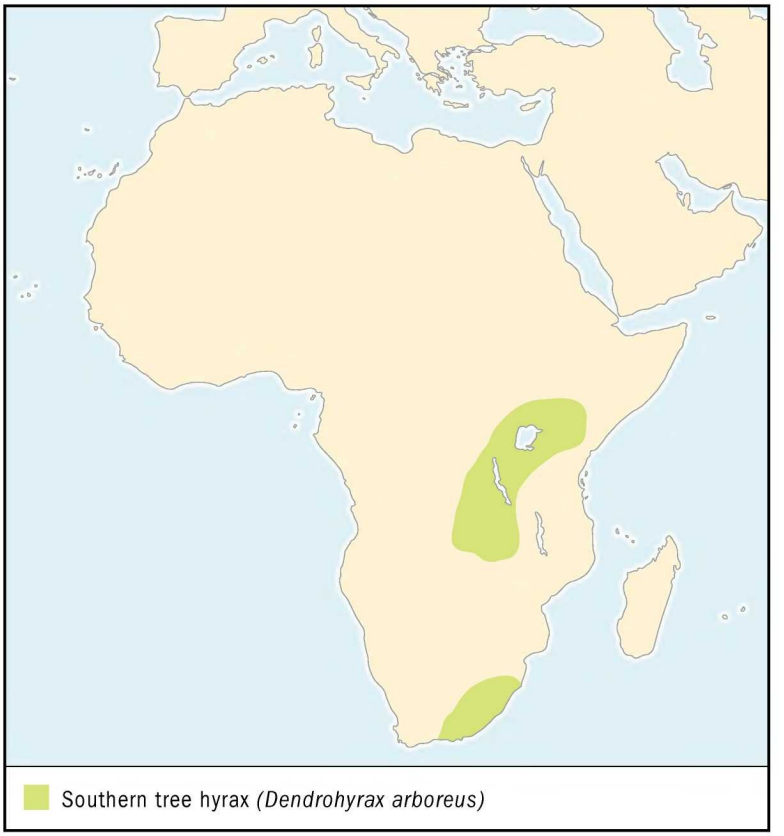
A PATCHWORK MAMMAL

Although the hyrax resembles a rabbit or guinea pig, it is actually closely related to elephants and other hoofed animals. Its anatomy is like an elephant and a horse. Its brain is like an elephant's while the stomach is like a horse's. It has a skeleton similar to that of a rhinoceros, and its upper incisors, chisel-shaped teeth at the front of the mouth, look like those found on rodents. The upper cheek teeth are like those of a rhinoceros and the lower cheek teeth are similar to those of a hippopotamus.

are relieved by drinking the ash of burnt hairs mixed with honey or water. Also, some tribes wrap newborn babies in hyrax skin to ensure health and vitality.

CONSERVATION STATUS

Three hyrax species are listed as Vulnerable, facing a high risk of extinction in the wild. Because these three species are found primarily in the African forests, their status is probably the result of habitat destruction, as well as being hunted for food and their fur. No other species has been given special status.



Southern tree hyrax *(Dendrohyrax arboreus)*

SOUTHERN TREE HYRAX
Dendrohyrax arboreus

Physical characteristics: From head to hind end, the southern tree hyrax is anywhere from 12.5 to 24 inches (32 to 60 centimeters) long and weighs 3.7 to 9.9 pounds (1.7 to 4.5 kilograms). The soft coat is made of long, dark brown hair.

Geographic range: Southern tree hyraxes are distributed throughout South Africa.

Habitat: They live in evergreen forests up to 13,500 feet (4,500 meters), and among boulders in the Ruwenzori Mountains.

Diet: Tree hyraxes eat leaves, twigs, and fruit year-round.



The male southern tree hyrax emits shrill shrieks in order to claim his territory, and to keep in contact with his family throughout the night. (Illustration by Joseph E. Trumpey. Reproduced by permission.)

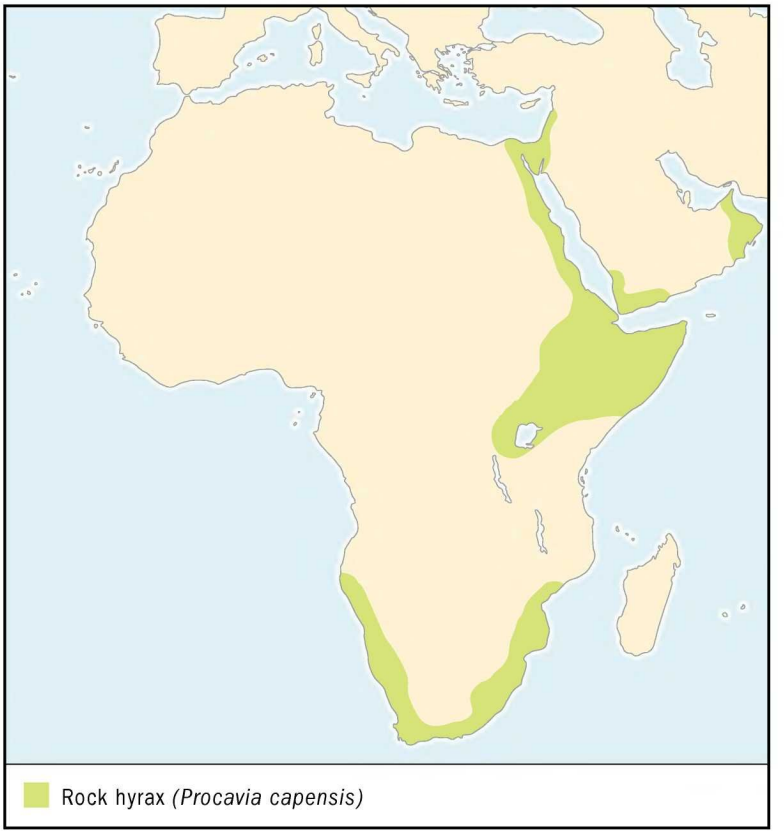
Behavior and reproduction: Southern tree hyraxes spend daylight hours nestled in the hollows of trees and venture out only in the safety of the night. More often heard than seen, the male tree hyrax emits shrill shrieks in order to claim his territory, and as an effort to keep in contact with his family throughout the night.

Southern tree hyraxes are very good climbers but are awkward on the ground.

Not much is known about the reproductive behavior and cycle of the tree hyrax. Gestation lasts from 220 to 240 days, and each pregnancy yields one to two babies. Babies are competent tree climbers by the end of their first day. Southern tree hyraxes live at least ten years.

Southern tree hyraxes and people: Some African people eat the southern tree hyrax and use the skin to make rugs and clothing. They are also used as medicine. Southern tree hyraxes play important roles in African spiritual traditions as well.

Conservation status: Southern tree hyraxes are not threatened. ■



Rock hyrax *(Procavia capensis)*

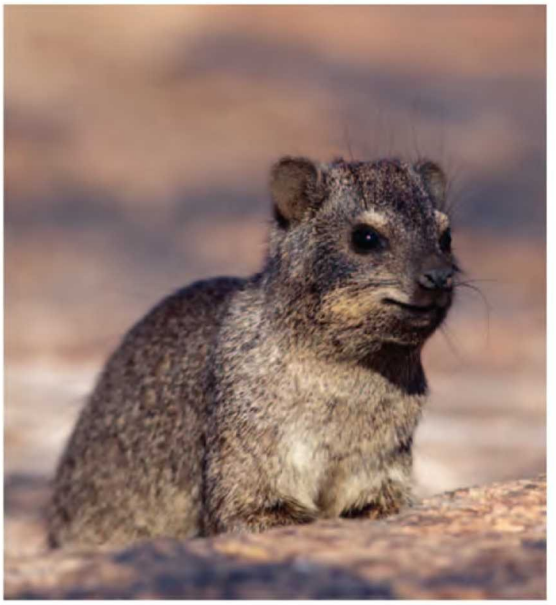
ROCK HYRAX
Procavia capensis

Physical characteristics: Rock hyraxes are 17 to 21 inches (44 to 54 centimeters) long and weigh 4 to 12 pounds (1.8 to 5.4 kilograms). Their fur is light to dark brown.

Geographic range: Rock hyraxes are found from southwest to northeast Africa, Sinai to Lebanon, and the southeast Arabian Peninsula.

Habitat: Rock hyraxes prefer mountain cliffs and rocky outcrops or boulders. They live in the crevices of rocks.

Diet: Rock hyraxes eat quickly, with some members of the colony keeping watch for predators while the rest feed on leaves, fruit, lizard



Birds are important predators of rock hyraxes. Rock hyraxes have a protective film over their pupils that allows them to look directly into the sun without damaging their eyes, so they can keep a look out for birds in the sky. (Ann & Steve Toon Wildlife Photography. Reproduced by permission.)

and bird eggs, and long grasses. When they eat, rock hyraxes take a mouthful of food, then quickly check out their surroundings. Because their greatest predators are birds of prey, the rock hyrax must be able to look into the sky to avoid being swooped down upon and eaten. For this reason, they have a protective film over their pupils that allows them to look directly into the sun without damaging their eyes.

Behavior and reproduction: Rock hyraxes are social creatures and live in colonies up to fifty members. As many as twenty-five hyraxes can share one den. Unlike tree hyraxes, rock hyraxes are busy during daylight hours, but since they are unable to regulate their body temperature, they will not be found foraging during very hot or very cold temperatures.

The social unit is comprised of one adult male, up to seventeen females, and their young. Although several groups may live in one area, the head male will defend his territory from other males. Predators of the rock hyrax include leopards, snakes, and birds of prey.

Rock hyraxes have more than one mate, but they give birth just once a year. Pregnancy results in one to four babies per female after a gestation period of 212 to 240 days. Once a baby reaches one to five months of age, it is weaned, taken off its mother's milk. By sixteen or seventeen months, the rock hyrax is ready to breed.

Rock hyraxes live anywhere between nine and twelve years, with females living longer than males.

Rock hyraxes and people: Some African tribes hunt the rock hyrax for food, and it is mentioned numerous times in the Bible as "conie," which means "rabbit."

Conservation status: Rock hyraxes are not threatened. ■

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DUGONGS, SEA COWS, AND MANATEES

Sirenia

Class: Mammalia

Order: Sirenia

Number of families: 2 families

order CHAPTER

phylum
class
subclass
order
monotypic order
suborder
family

PHYSICAL CHARACTERISTICS

Dugongs, sea cows, and manatees are mammals that vary in length from 9.8 feet (3 meters) to 32.8 feet (10 meters) and weigh anywhere from 992 pounds (450 kilograms) to more than 9,920 pounds (4,500 kilograms). Sirenians (sye-REEN-ee-unz), members of the order Sirenia, are nearly hairless and skin texture varies from smooth to rough. They have no back limbs, only short, flexible forelimbs that they use to help them swim. The tail of the manatee is paddle-shaped while that of the dugong and sea cow is fluked with long, horizontal fins, like a whale. Eyes are small, and their ears are not visible. Sirenians vary in color from gray to brown. The manatee has both upper and lower molars, flat teeth suitable for chewing, which are replaced on a regular basis throughout its lifetime. Male dugongs have tusks, and all dugongs have molars that are not replaced. Sea cows were toothless. All appear to have whiskers.

GEOGRAPHIC RANGE

Sirenians live in tropical, subtropical, and temperate, or mild, regions throughout the world. The exception to this is Steller's sea cow, now extinct, which lived only in the frigid waters of the northwestern Pacific Ocean.

HABITAT

Manatees and dugongs live in shallow, warm coastal waters that contain plentiful vegetation. Some manatees exist in estuaries (EST-yoo-air-eez), mouth of a river where fresh water mixes with salt water, others occupy both sides of the Atlantic Ocean.

The Amazonian manatee lives only in freshwater. The dugong lives in the Indian Ocean, Red Sea, Persian Gulf, and the west coast of India, in strictly saltwater habitats. The sea cow preferred an exceedingly cold environment, and history indicates it liked a mix of salt water and freshwater.

DIET

All sirenians are vegetarians, feeding on vegetation such as sea grasses and other marine plants. While the dugong is strictly a bottom-feeder, eating only what lives on the ocean floor, manatees feed from above the water's surface all the way to the bottom. Sirenians use their flippers to uproot vegetation and use their molars to chew or crush food. Although male dugongs have tusks, it is not clear what role these teeth play in feeding, if any. It takes about one week for food to digest. Manatees consume about 10 percent of their body weight every day. Because they need so much food, sirenians spend a great portion of their time feeding.

The toothless sea cow ate algae (AL-jee) and plankton, plants that are easy to digest without chewing.

BEHAVIOR AND REPRODUCTION

Sirenians are semi-social mammals with the primary unit a female and her calf. Dugongs feed in herds of tens or hundreds of individuals. They have been recorded as traveling hundreds of miles (kilometers) in a matter of days, an impressive feat given that they must surface for air every few minutes. Dugongs have poor eyesight but an acute sense of hearing.

Manatees also travel long distances in short amounts of time and have a north-south migratory pattern, the direction or path taken during seasonal movement from one region to another, that keeps them swimming in warmer waters. Although most marine mammals use echolocation (eck-oh-loh-KAY-shun), a sensory system in which high-pitched sounds are used to determine location and distance, sirenians are not known to. Little is known about the behavior of Steller's sea cow.

TWIN SEA COWS CAUSE FOR CELEBRATION

In December 2003, Beauval Zoo, located in France, celebrated the birth of twin sea cows—the first twin sea cow birth in captivity.

Quito, a male, and Luna, a female, weighed around 44 pounds (20 kilograms) each and measured 3.3 feet (1 meter). Although Daphne, the mother, was watched around the clock during the final days of her pregnancy, no one anticipated that she would give birth to twins.

As of mid-2004, mother and calves were doing well.

Manatees reach sexual maturity between the ages of two and eleven years. Gestation, pregnancy, is believed to be twelve or thirteen months. Usually a single calf is born every two-and-a-half to three years. Manatees do not bond, which means they have numerous mates throughout their lifetimes. In fact, when a female is ready to breed, she may mate with as many as twenty males, often at the same time. Calves can swim to the surface at birth, and they are nursed, fed with mother's milk, until around the age of one. Though they have no vocal cords, calves also vocalize at birth, which is an important part of the mother-calf bonding process. The calf remains close to its mother for up to two years.

Pregnancy for the dugong lasts about one year and results in the birth of a single calf, which will nurse from and remain close to its mother for about eighteen to twenty-four months. Birth takes place in shallow water and the calf will rise to the surface to take its first breath. Dugong calves are about 3.3 to 3.9 feet (1 to 1.2 meters) and weigh 44.1 to 66.2 pounds (20 to 30 kilograms). Dugongs can live for seventy years.

Because Steller's sea cow died out so quickly, most of what we know is speculation, an educated guess based on facts. Gestation lasted at least one year, and calves were seen throughout the year, suggesting that there was no specific breeding season. Pregnancy resulted in single births, but physical data is not available. It is believed that the sea cow was monogamous (muh-NAH-guh-mus), having only one mate.

SIRENIA AND PEOPLE

Sirenians have been hunted by humans for food, hides, and bone, a fact that has endangered a number of their species. Steller's sea cow lived for just a few decades before hunting caused its extinction. Manatees and dugongs help balance the marine ecosystem by recycling nutrients in sea grass beds and keeping the plants in a continual state of growth. Without them, the biodiversity, variety, of marine life would be in danger.

Manatees are being closely studied by scientists in hopes that their immune systems can provide clues as to how humans can fight cancer. Because their immune systems, which protect against disease, are very powerful, doctors are looking for tips on how to boost human immune systems. Specifically, they are studying a manatee population that has become infected with papillomavirus (pap-ih-LOH-mah-vye-rus), a virus that develops into cervical

cancer in humans. The manatees became infected in the wild and seem to fall victim to cancers as a result. Researchers study tumor tissue and blood samples taken from the infected population, which live in a rehabilitation tank at the Harbor Branch Oceanographic Institution.

CONSERVATION STATUS

Several species of manatees are threatened, according to the World Conservation Union (IUCN). The dugong is listed as Vulnerable, facing a high risk of extinction. It is also listed as Endangered under the U.S. Endangered Species Act. Sirenia are in danger due to habitat destruction brought on by human activities such as recreational boating and fishing. Today great conservation efforts are being made around the world in hopes of keeping the dugong and manatee from the sharing the fate of Steller's sea cow.

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DUGONG AND SEA COW
Dugongidae

Class: Mammalia
Order: Sirenia
Family: Dugongidae
Number of species: 2 species

family CHAPTER

PHYSICAL CHARACTERISTICS

The near-hairless dugong and sea cow can be as long as 9.8 feet (3 meters) for the dugong and from 23 to 33 feet (7 to 10 meters) for Steller's sea cow. They have no hind limbs, and the tail is forked, similar to that of a whale. Their front limbs are flipper-like and without nails. Dugongs are found in various colorations of gray and brown, though it is unknown what color the sea cow was. Dugongs can weigh more than 881 pounds (400 kilograms), and scientists estimate that Steller's sea cow weighed more than 9,920 pounds (4,500 kilograms).

GEOGRAPHIC RANGE

Dugongs live in the tropical and subtropical Indo-Pacific. Steller's sea cow was found in the western North Pacific Ocean.

HABITAT

Dugongids live in coastal waters that contain sea grass. Steller's sea cow lived with macroalgae, large, plant-like algae (AL-jee) also called kelp.

DIET

Dugongs primarily feed on sea grasses that grow on the ocean's floor in shallow water. Steller's sea cow reportedly fed on the surface and was never recorded as diving. Because the sea cow was toothless, it had to crush its food between studded plates at the front of their upper and lower jaws.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

DUGONGS AND SHARKS: AN UNLIKELY DUO

Shark Bay, Australia has a dugong population estimated at ten thousand to fifteen thousand. Dugongs seasonally migrate to the warmer waters off Australia's coast. Tiger sharks prey on dugongs and recognize their migration pattern. As the dugongs migrate, so do the tiger sharks.

Dr. Aaron Wirsing of th e Behavioral Ecology Research Group at Simon Fraser University studied the dugong-tiger shark relationship. Wirsing determined that Shark Bay has an abundance of sea grass and dugongs may spend more time there because the sea grass allows dugongs to escape sharks more easily.

BEHAVIOR AND REPRODUCTION

Dugongs are semi-social and can be found in units that include the mother and her most recent calf. These pairs have been known to live together in herds of up to hundreds when sea grass is abundant. Not much is known about Steller's sea cow behavior or reproduction.

Female dugongs give birth every three to seven years. The typical pregnancy, which lasts for about one year, usually results in the birth of one calf; twins are rare. The female provides all care for the calf, and nurses, feeds with the mother's milk, until eighteen months to two years of age. Georg Wilhelm Steller, a naturalist and physician who was responsible for the first recorded observations of the sea cow, reported seeing calves year-round, which suggests that mating occurred any time of year. According to Steller's accounts, only single calves were born after a gestation period, pregnancy, of around one year, possibly longer.

DUGONGS, SEA COWS, AND PEOPLE

Steller's sea cow was hunted to extinction within thirty years of its discovery. Dugongs have been hunted for their meat and other body parts, and increasingly are victims of boating and fishing accidents.

CONSERVATION STATUS

The sea cow is Extinct, no longer exists, and the dugong is Vulnerable, facing a high risk of extinction in the wild, primarily due to habitat destruction and human activities such as recreational boating and fishing. In 2004, the largest dugong population was located in Australia.



HERE AND GONE IN THIRTY

Georg Wilhelm Steller, a naturalist and physician, recorded the first descriptions of the sea cow while at sea. His physical measurements and descriptions of anatomy allowed scientists to reconstruct the sea cow's skeleton, though it is unlikely that the reconstruction is 100 percent accurate.

Steller went home with his reports as well as samples of the meat and almond-tasting fat. Hunters flocked to Kamchatka, Russia, the location of Steller's discovery, where they quickly destroyed the sea cow population.

Steller discovered the sea cow in 1741, and in 1768, explorer Martin Sauer recorded the death of the last known sea cow.



STELLER'S SEA COW
Hydrodamalis gigas

Physical characteristics: Steller's sea cow was 23 to 33 feet (7 to 10 meters) long and weighed anywhere from 9,920 to 13,000 pounds (4,500 to 5,900 kilograms). The tail resembled that of a whale. The sea cow had a small head and no teeth.

Geographic range: Unlike other sirenians (sye-REEN-ee-unz) that prefer warm water, Steller's sea cow lived in frigid waters in the northwestern Pacific Ocean.

Habitat: Steller's sea cow lived in coastal waters where kelp grew.

Diet: The sea cow ate kelp by crushing it with studded plates located at the front of its mouth, on both the upper and lower jaw.

Behavior and reproduction: Steller's sea cow lived in coastal waters but reportedly had some affinity, preference, for the mouths of freshwater creeks as well. Steller's sea cow did not migrate, but could

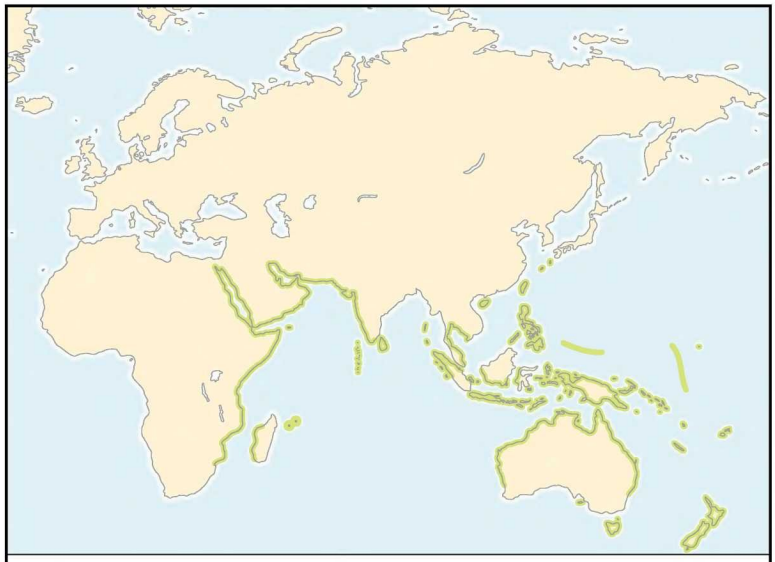


Steller's sea cow was hunted to extinction within thirty years of its discovery. (Illustration by Wendy Baker. Reproduced by permission.)

be found near islands year-round. Very little is known about this mammal's reproductive behavior.

Steller's sea cow and people: Steller's sea cow was a source of meat for sailors. Within the span of three decades, it was hunted to extinction.

Conservation status: Steller's sea cow is Extinct. ■



DUGONG
Dugong dugon

Physical characteristics: Dugongs are usually gray, with nearly hairless skin. They can grow to be 9.8 feet (3 meters) and weigh around 880 pounds (400 kilograms). Their whale-like tail helps them navigate the waters, as do their flipper-like front limbs. Although both sexes have tusks, they rarely can be seen in females.

Geographic range: Dugongs live in sea grass beds and shallow tropical and subtropical waters of the Indo-Pacific from eastern Africa to the Philippines and the South China and East China Seas.

Habitat: Dugongs live only in shallow coastal saltwater up to about 98 feet (30 meters) deep. The waters must contain sea grass beds.

Diet: Dugongs eat various sea grasses from the ocean floor. Sometimes, in its consumption of sea grass, it will ingest bottom-dwelling invertebrates such as crabs and shrimp. Unlike other sirenians, dugongs cannot hold their breath for long and must surface often for air, which is why the shallow waters are their preferred habitat.

Behavior and reproduction: Despite their large size, dugongs are graceful swimmers. Their tails propel them slowly through the water while the flippers help keep balance. Although their eyesight is poor, dugongs have a well-developed sense of hearing and find sea grass with the help of whiskers that line the upper lip of their large snout.

Dugongs migrate, travel from one region to another on a yearly basis, making regular, short distance (9 to 25 miles [15 to 40 kilometers]) round-trip journeys between feeding areas and warmer coastal areas. In Australia, they have been recorded as making longer trips, ranging from 62 to 373 miles (100 to 600 kilometers).

Dugongs are semi-social, often found in mother-calf pairs, sometimes in a herd with hundreds of individuals. They do not reproduce quickly, just once every three to seven years. After a year of pregnancy, the dugong gives birth to one calf, which will be nursed for anywhere from eighteen to twenty-four months. Dugongs are ready for mating around ten years of age. Males compete for mating rights, and mating often involves numerous males with one female. Male dugongs do not seem to participate at all in the care of the calf.

Dugongs can live for seventy years.



Dugongs live shallow waters of the Indian and western Pacific Oceans. (Kelvin Aitken/Bruce Coleman Inc. Reproduced by permission.)

Dugongs and people: Of cultural significance to many native peoples of the Indo-Pacific region, the dugong has been hunted for meat, bones, and hide.

Conservation status: Listed as Vulnerable, the dugong is a protected species in Australia. Dugongs are often victims of boating and fishing accidents. Pollution and dredging, a form of fishing in which nets are scraped along the ocean floor to catch shellfish, are also responsible for the declining dugong population. ■

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MANATEES
Trichechidae

Class: Mammalia
Order: Sirenia
Family: Trichechidae
Number of species: 3 species

family
CHAPTER

PHYSICAL CHARACTERISTICS

The almost-hairless manatee is 9 to 13 feet (3 to 4 meters) long and weighs between 1,100 and 3,300 pounds (500 to 1,500 kilograms), depending on the species. Manatees never stop growing as long as they are alive. The tail is paddle-like, and the flipper-like forelimbs have three to four fingernails except in the Amazonian manatee, which has no fingernails. Manatees are brownish gray. Their eyes are tiny and are placed on the sides of the head. Their flexible lips help them manipulate food so that they can get it into their mouths.

Manatees have a well-developed sense of smell and hear very well. Their eyesight, however, is not very good. Manatees communicate through a series of whistles and chirps.

The manatee is a relative of the elephant. The nose or snout of a manatee acts much like the trunk of an elephant in that it is used to gather food and bring it to the mouth. Their fingernails or toenails, depending on how you look at it, are also similar to those of the elephant.

GEOGRAPHIC RANGE

Manatees live on both sides of the Atlantic Ocean. In the west, they are found from the southeastern United States throughout the Caribbean region to southeastern Brazil and in rivers of the Amazon River Basin. Manatees migrate, travel from one region to another, seasonally, to Florida coastal waters during the winter months. In the east, they live along the African coast, from Senegal to Angola.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

YOU ARE NOT THE ONLY ONE WHO CATCHES A COLD

Water colder than 68°F (20°C) can lead to sicknesses, such as pneumonia, in manatees. The colder waters make it harder for the manatees to get proper nutrients, so they are more likely to get sick. That is why they migrate to warmer waters in Florida during the winter, but even those waters can get too cold.

The waters surrounding Florida's power plants are warmer and 60 percent of manatees now spend time there. Scientists are worried because some of these power plants are getting too old and must be closed, and without the warmer waters more manatees may die as a result of illness.

HABITAT

Manatees live in shallow coastal waters and estuary (EST-yoo-air-ee) waters, where saltwater and fresh water mix. They also need areas where marine vegetation is plentiful.

DIET

Manatees are primarily vegetarian, though they do sometimes ingest shrimp, snails, or crabs as they feed on ocean-floor plants. A large manatee eats up to 200 pounds (91 kilograms) of sea grass and algae (AL-jee) each day.

BEHAVIOR AND REPRODUCTION

Manatees are semi-social and usually found in mother-calf pairs. They communicate using sound, sight, taste, and touch. Communication is particularly important for developing and maintaining the cow-calf bond.

Manatees are polygamous (puh-LIH-guh-mus), having more than one mate. In fact, a female can be pursued by as many as twenty males during the breeding season, so it is virtually impossible to determine who the father of a calf is. Males do not seem to take part in caring for the young.

Female manatees give birth every two-and-a-half to three years. Usually only one calf is born after a year-long pregnancy. Depending on the species, manatees are ready to breed anywhere between the ages of two to eleven, and they do so throughout the year. Calves are born weighing 60 to 70 pounds (27 to 32 kilograms).

Manatees are unable to hold their breath for long periods of time, so they surface for air about every three minutes except during sleep, at which time they can rest for twenty minutes before surfacing. Manatees have no large predator, animal that hunts them for food, other than humans.

MANATEES AND PEOPLE

It is not uncommon for a manatee to have scars on its back due to collision with a recreational boat, and these accidents are the primary cause of death for the manatee population.

Though law prohibits the deliberate killing of manatees, they are still hunted for food in many areas.

CONSERVATION STATUS

All manatees are considered Endangered, facing a very high risk of extinction in the wild, according to the World Conservation Union (IUCN). The main cause of death is habitat destruction and human activity, specifically recreational boating accidents.



SPECIES ACCOUNT

WEST INDIAN MANATEE
Trichechus manatus

Physical characteristics: Also known as the Florida manatee, the West Indian manatee grows to 13 feet (4 meters) in length, and can weigh up to 3,300 pounds (1,500 kilograms). The nearly hairless skin is gray, and the body has no hind limbs. The tail is wide and paddle-like, and the front limbs each have three to four fingernails. The eyes



West Indian manatees live in shallow water—they must surface for air about every three minutes while they are active. (Douglas Faulkner/Bruce Coleman Inc. Reproduced by permission.)

are small and located on the sides of the head, and though there are only tiny ear openings, the manatee has a keen sense of hearing. The West Indian manatee uses its flexible lips in conjunction with its flippers to get food into its mouth.

Manatees communicate by whistling, chirping, and squeaking.

Geographic range: Found in the eastern coastal waters of the United States, from upper Virginia to the tip of Florida, around the west coast of Florida to Louisiana. Rare sightings have occurred in waters off New York, Texas, and the Bahamas.

Habitat: The West Indian manatee lives in coastal and estuary waters.

Diet: West Indian manatees eat more than sixty species of vegetation including sea grasses, algae, and water hyacinths. They eat between 10 and 15 percent of their body weight every day.

Behavior and reproduction: The basic social unit of the Florida is the female-calf pair, although these manatees do congregate in herds

during mating season as well as the winter months, when they migrate to seek refuge in warmer waters.

These polygamous manatees are ready to breed between the ages of two-and-a half and six years, and females give birth every two-and-a-half to three years. Each one-year pregnancy results in the birth of one calf, though twins make up 1 to 2 percent of all births. Mothers nurse, feed with mother's milk, their young. The West Indian manatee can live for more than fifty years.

The manatee has no major predator. Death is usually caused by human activity.

West Indian manatees and people: The West Indian manatee has been hunted as a source of meat, fat, oil, bone, and hide, though it is now protected under law. Those laws, however, are difficult to enforce. The U.S. Fish and Wildlife Service estimates that 25 percent of all Florida manatee deaths are due to boating accidents.

Conservation status: The West Indian manatee is Endangered according to the IUCN, and is protected throughout its range. It is not known how many are illegally hunted for food each year. The primary reason for the decimation of the population is human activity, including pollution, habitat destruction, and recreational boating and fishing.

According to *Boat/US Magazine*, 2003 proved one of the most deadly years for the West Indian manatee. A record 380 manatees were killed that year. Ninety-eight of those deaths were the result of red tide. Red tide is a naturally occurring phenomena that happens when a type of phytoplankton, microscopic plants, produces chemical toxins, or poisons. These toxins are then released into the water, killing thousands of fish, dolphins, manatees, and other marine life.

Seventy-three Florida manatees died from boating accidents in 2003, the lowest total since 1997. The most recent surveys indicate that the Florida manatee population is over three thousand, a significant increase from six hundred recorded in 1974. ■

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ODD-TOED UNGULATES
Perissodactyla

Class: Mammalia
Order: Perissodactyla
Number of families: 3 families

order
CHAPTER

phylum
class
subclass
● **order**
monotypic order
suborder
family

PHYSICAL CHARACTERISTICS

Ungulates (UNG-gyuh-luhts) are hoofed mammals. What makes perissodactyls (puh-RIH-suh-dack-tuhlz) different from artiodactyls (ar-tee-oh-DACK-tuhlz), is the number of toes. The presence of a single toe links the horse family (including horses, zebras, and asses), tapir, and rhinoceros together. This single toe is actually a combination of three toes that bear the weight together, with the middle toe being the largest of the three. Tapirs have four toes on the front feet and three on the back, while rhinoceroses (frequently called "rhinos") have three on all feet, and horses have just one.

The smallest perissodactyl is the mountain tapir, which weighs up to 485 pounds (220 kilograms). The white rhinoceros is the largest and can weigh more than 7,700 pounds (3,500 kilograms). Male rhinos and horses are bigger than females, but the opposite is true for tapirs.

Horses are medium sized with long heads and the ears stand up. The long neck is covered by a short-haired mane except in the domestic horse, whose mane falls to one side. All horses have long tails, and the ass and zebra have short hair at the tip.

The large, heavy body of the rhino sits on top of short, thick legs. The eyes are small and located on each side of the head. Though their vision is not well developed, their hearing is excellent and their erect ears are rather big. Some rhinos' skin is all but naked, while other rhinos are covered with fine hair. The horns of the white rhino can grow to reach 70 inches (175 centimeters).

Rhinos' horns continue to grow throughout their lifetimes, and if lost, will grow back.

Tapirs are heavy with short, fat limbs, a short tail, and medium-sized ears that grow out and up. Their eyes are small. The hind legs of the tapir are about 4 inches (10 centimeters) higher than the front legs. Due to this difference, most of the weight is supported by the longer hind legs. Tapir skin is tough and sparingly covered with hair except for the mountain tapir, whose hair is thick to protect against the cold.

Because perissodactyls eat large quantities of hard-to-chew food, their lower jaw is deep and the mouth muscles are large. The lips are thick and flexible. The stomach is simple and food passes through the digestive system quickly. This makes digestion less efficient than in other animals with more than one stomach, such as the cow. In fact, a horse digests food only 70 percent as efficiently as a cow does.

GEOGRAPHIC RANGE

Perissodactyls are found in Asia, Africa, and America in limited populations. Tapirs are found in Central and South America and in southeastern Asia. Rhinos live throughout Central and East Africa below the Sahara Desert and in the tropical region of Asia. Horses are found in eastern and southern Africa and Asia from Near East to Mongolia. Domestic horses live throughout the world, and there are several wild populations in North America and western Australia.

HABITAT

Tapirs prefer to live near permanent bodies of water and enjoy tropical forests. The exception is the mountain tapir, who lives in the Andes Mountains.

Rhinos can be found in rainforests, grasslands, and scrublands (region similar to grassland but which includes scrub vegetation). These mammals must live near water for drinking and bathing. Asian rhino fossils have been found in the Himalayas at an altitude of 16,100 feet (4,900 meters), though today they're found at altitudes of up to just 6,600 feet (2,000 meters).

Horses live in grasslands and desert scrublands. Plains zebra and the mountain zebra prefer greener grasslands and savannas where vegetation is more plentiful.

DIET

Perissodactyls are herbivorous (plant-eating). The plants they eat depend on what is available in the region in which they live. Tapirs eat leaves, twigs, fallen fruit, and aquatic vegetation. Rather than eat entire plants, they consume just a few leaves from a plant and move on.

Using their upper lip to grab plants, rhinos prefer woody or grassy vegetation. They will eat fruit occasionally, but leafy greens are their favorite food. Because of their size, rhinos eat a large amount of food and drink a large amount of water almost daily. The African species, however, can live for up to five days without water if their food is moist. While black rhinos will eat bushes and trees, the white rhino prefers short grasses.

Horses eat primarily grasses, but they will also eat bark, leaves, fruits, and roots. Wild asses have adapted to their drier environment and are able to graze the desert. Horses spend 60 to 80 percent of every twenty-four hours foraging (browsing or grazing). Although most horses can go without water for three days, zebras must drink frequently. Some are able to dig waterbeds with their hooves.

BEHAVIOR AND REPRODUCTION

Rhinos are solitary creatures seldom seen in pairs other than the mother-offspring combination. Even mated pairs don't remain together. Rhinos are territorial and have obvious displays to prove their authority, including rolling eyes, lowered head, and strutting. Males engage in brutal fights, and African rhinos inflict injury by jabbing each other with upward blows of their horns. Rhinos enjoy wallowing in mud holes because it helps keep their body temperature down and repels insects.

Female rhinos are ready to breed between the ages of three and five years. Gestation is fifteen to sixteen months in all species but the Sumatran rhino has a gestation period of seven to eight months. Mating often takes hours to complete and usually results in the birth of one calf. Rhinos weigh 55 to 145 pounds (25 to 65 kilograms) at birth and drink up to 5.5 gallons (25 liters) of their mothers' milk each day to gain 5.5 pounds (2.5 kilograms) daily. Zebras drink their mothers' milk for up to four years, though the white rhino begins eating solid food by one week of age. Males begin breeding at age ten and rhinos can live up to fifty years. What was true in the past remains true today: humans are the main predator, hunter, of rhinos.

PRISONERS AND MUSTANGS: FORGING A FRIENDSHIP

According to HorsesAmerica.com, there are more than two hundred wild horses that are unfit for adoption and must be euthanized (YOO-thuh-nihzd), put to death, each year, so that the land can be used for the grazing of cattle. Still others are slaughtered and sold to foreign countries for human consumption. Despite this, about eight thousand mustangs (another word for "wild horses") are adopted to individuals and organizations across the country. All of this occurs under the authority of the Bureau of Land Management (BLM).

Adoption fees range from $125 to $740, and half of the horses are adopted from residents on the East Coast. Before adoption, mustangs are "re-trained" to be around humans by inmates from prisons in Colorado, New Mexico, Montana, Wyoming, Oklahoma, and California. The BLM sees this as a win-win situation. In the 90 to 150 days it takes to train a horse, the inmate develops job skills as well as a sense of trust and cooperation while the horse becomes ready for re-entry into a more domestic society.

All persons wanting to adopt a mustang must first apply and be granted approval from the BLM. Anyone with a history of physical abuse toward animals is rejected. Between two and six months after adoption, a representative from the BLM makes a surprise visit to check on the horse and determine that it is being taken care of properly.

Records show that 99 percent of (Montana) inmates who work with the mustangs and re-enter free society never commit another crime. And since 1973, more than one hundred forty thousand wild horses have been adopted.

Tapirs are also solitary mammals. They spend part of the day wallowing in mud or standing water, or simply rest in the shade. Territorial by nature, tapirs mark their territory with their urine. Most activity takes place at night. Tapirs swim with ease and water is at the center of their existence. Water provides not only food, but also safety from intruders. Able to hold their breath for minutes at a time, tapirs will seek safety from predators by immersing themselves in water. They have an acute sense of smell and hearing, but like other perissodactyls, cannot hear well. Though usually silent, they do communicate through grunts and whimpers at closer range, through whistles over greater distances.

Tapirs are sexually mature at two to four years of age. They breed year round, and females are receptive every two months.

Courtship is a noisy affair. One baby is born after a gestation (pregnancy) period of 383 to 395 days. Young tapirs stay with their mothers until six to eight months of age. Tapirs have been known to live for thirty years. The primary predator of tapirs is the jaguar.

Unlike their relatives, horses are highly social. Zebras live in families of ten to fifteen individuals. These families include a territorial male, several females, and their offspring. Home ranges overlap with ranges of other families, and measure anywhere from 31 to 232 square miles (80 to 600 square kilometers). Zebras communicate via vocalization and adult males are especially noisy at night. Within groups, other males are tolerated, but only the territorial male may mate with the numerous females of the family. The black and white stripes of the zebra trigger visual neurons that attract males and females to each other. Zebras are believed to see in color, and they have binocular vision in front.

Horses are sexually mature around the age of two years, but males do not breed until around the age of five. After a gestation period of about one year, a single foal is born. The baby is able to walk on its own within an hour of birth and doesn't mind being left alone while the mother replenishes her water supply. Offspring are weaned (removed from mother's milk) at six to thirteen months. Some horses live to see forty years. Lionesses and hyenas are the main predators of horses.

PERISSODACTYLA AND PEOPLE

Humans are largely responsible for adversely (negatively) affecting the perissodactyl populations. Tapirs and rhinos have been relentlessly hunted for food and sport, as well as for their skins, which are used to produce high quality leather goods. Rhinos are illegally hunted for their horns and other body parts, which are used in Asian medicine, supposedly to relieve headaches, heart and liver trouble, and skin disease. Horns are also used to make dagger handles. Horses are the least affected by human activity, and it wasn't until about four thousand years ago that they were first domesticated for use as transportation. Since that time, cross-breeding has become common. A mule, for example, is a cross between a male donkey and a female horse.

CONSERVATION STATUS

Nine species of Perissodactyla are listed as Endangered, facing a very high risk of extinction, or Critically Endangered,

facing an extremely high risk of extinction, on the 2003 IUCN Red List. All species of rhinoceroses are included on this list. Tapir populations are declining due to deforestation leading to habitat destruction. Since 1970, the rhino population has decreased by 90 percent due to hunting. Wild horses are facing extinction due to an increase in livestock farming, which forces them from their pastures and watering holes.

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HORSES, ZEBRAS, AND ASSES
Equidae

Class: Mammalia
Order: Perissodactyla
Family: Equidae
Number of species: 7 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Equids (EH-qwidz; horses, zebras, and asses) are built for speed, with long legs that allow them to move efficiently. Their single stomachs allow them to eat foods high in fiber because digestion occurs rapidly, and their single-toed hooves make navigating over rocks and hard surfaces easy.

There are three species of zebra, and each has a different stripe pattern. All equids have short coats, though those living in higher altitudes may grow thicker coats. There is very little size difference between the sexes.

GEOGRAPHIC RANGE

Equids live in Africa below the Sahara Desert, in the Middle East, Arabia, Central Asia, and Mongolia.

HABITAT

Equids graze throughout the day, and various species live in deserts to grassland and shrubland (similar to grassland, only with small trees and shrubs as well).

DIET

Equids eat grasses high in fiber, which makes them more difficult to chew and digest. Their teeth are made for breaking down the reedy plants, however, and their single stomach allows for quick digestion.

BEHAVIOR AND REPRODUCTION

Equids are social mammals and form groups in which individual needs for feeding, reproduction, and survival are met. Females form especially strong bonds and maintain stable communities even without the presence of a territorial male. Usually, one male heads a group and mates with several of the females. He spends a good deal of his time defending the group against "bachelor" or roaming males who might try to mate with the females. Offspring also live with the group, usually until the age of two or three years.

Groups are in the best interests of equids as they provide greater defense against predators, animals that hunt them for food, like the lion. When in herds, it is more difficult for lions to determine which zebra or horse is young, weak, or lame. When threatened, equids will run away rather than fight, but if forced to fight, they'll kick with their hind feet and bite.

Equids communicate through vocalizations but also by changing the position of their tails, ears, and mouths.

The mating system varies, depending on environmental conditions. Pregnancy lasts from eleven to twelve months and usually results in the birth of one foal. And although equids are capable of producing one foal each year, it is more likely that a foal will be born every other year if nutritional food is readily available. Wild equids are ready to breed at the age of one or two years but don't normally produce a foal until the age of three to five. There is not enough data to determine how long wild equids live. Experts estimate that 90 percent of female plains zebras die by the age of sixteen years. Their main predators are the lion and hyena.

WHY ZEBRAS NEED STRIPES

Although humans think a zebra's stripes make the horse easy to find and identify, the stripes actually act as camouflage (KAM-uh-flaj). The wavy lines of a zebra blend in with the wavy-line patterns found in nature, such as blowing grasses among which the zebra lives. The fact that zebra stripes are black and white while the lines of grass are yellowish green and brown doesn't matter. The zebra's primary predator, the lion, is colorblind!

Those stripes serve another purpose, which is to help zebras identify and recognize each other. Stripes are to a zebra as fingerprints are to humans: no two are identical. Scientists believe this is how zebras identify one another in a herd. It's how mothers and babies recognize each other, and how a zebra knows which herd it belongs to.

EQUIDS AND PEOPLE

Domestic horses have played a significant role in the social and agricultural progress of humankind. Ironically, however, it has

been humankind that has decimated the wild equid populations through hunting, habitat destruction, and the demand for livestock farming.

CONSERVATION STATUS

Of the seven species, one is Extinct, died out, in the Wild; one is Extinct altogether; one is Critically Endangered, facing an extremely high risk of extinction; two are Endangered, facing a very high risk of extinction; and one is Vulnerable, facing a high risk of extinction. Wild equids are threatened primarily by hunters, but also by livestock grazing in their habitat, and inter-breeding with domestic horses and donkeys.



GREVY'S ZEBRA
Equus grevyi

Physical characteristics: This zebra measures about 9.8 feet (3 meters) in length, with a shoulder height of 5.3 feet (1.6 meters). It weighs around 990 pounds (450 kilograms) and is the largest wild equid. The ears are large and round, and the short coat is black and white striped. The muzzle is white, and there is a dark stripe surrounded by white running down the length of the back.

Geographic range: Grevy's zebra inhabits parts of Kenya as well as southern Ethiopia. It is believed that a small population exists in southeastern Sudan.

Habitat: Grevy's zebras live in grassland, and must live near a permanent water source.



Grevy's zebras may fight one another in disputes over their territories. (K. and K. Ammann/Bruce Coleman Inc. Reproduced by permission.)

Diet: This zebra eats grasses, but will feed on shrubs and small trees or plants if drought conditions deplete the supply of grasses.

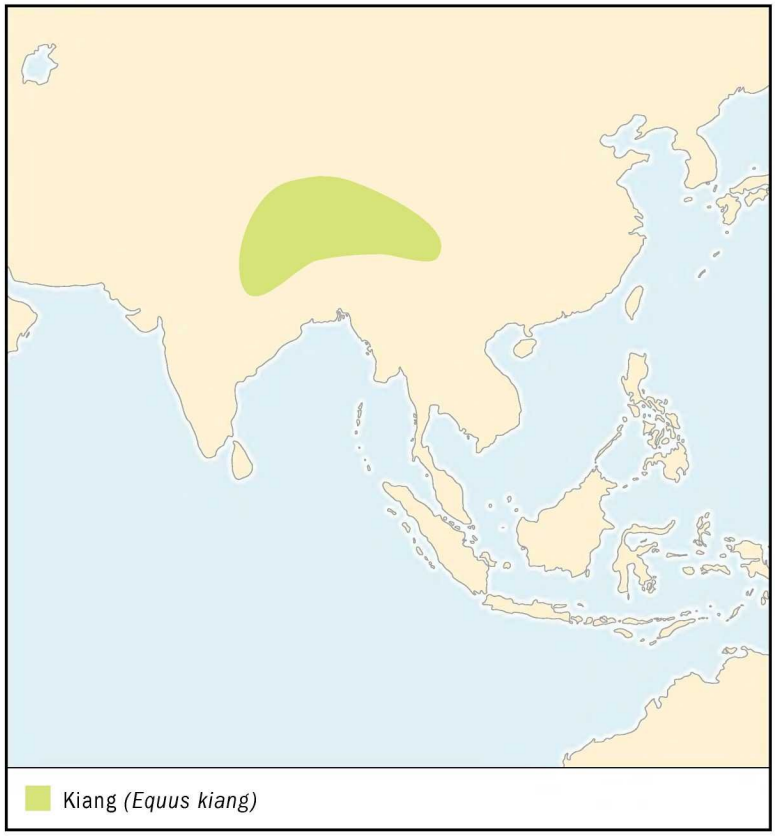
Behavior and reproduction: As with other equids, Grevy's zebra participates in a territorial mating system in which one male resides over a large herd consisting of numerous females and their offspring. Because pregnant and nursing females need water daily or every other day, they are usually located near a permanent water source. This

species differs from other zebras in that it doesn't form lasting bonds. In fact, the composition of the herd can change on an hourly basis.

Pregnancy lasts for about thirteen months, and the foal is able to recognize its mother by smell and sight within an hour of its birth. This is also the time it begins to stand up and run with the herd.

Grevy's zebra and people: Grevy's zebra is killed for its meat and hide as well as for medicinal purposes. Although these zebras eat the coarse grasses that livestock cannot feed upon, their habitat continues to be threatened and depleted by domestic livestock, which competes for grazing land.

Conservation status: Grevy's zebra is considered Endangered due to overhunting as well as competition for water and food with people and domestic livestock. ■



KIANG
Equus kiang

Physical characteristics: This medium-sized wild ass stands between 3.3 and 4.7 feet (1 and 1.4 meters) and has a coat that changes with the seasons. It is dark brown in winter and chestnut red in summer. To keep warm, the length of the hair doubles in winter. The belly is white, and there are patches of white on the neck, chest, and shoulder. The muzzle, too, is white.

Geographic range: The kiang (kee-YANG) lives in China, India, Nepal, and Pakistan.

Habitat: This wild ass is found in altitudes up to 16,500 feet (5,000 meters) in grasslands and steppes (regions characterized by grasses and shrubs, with few or no trees).



Kiang are strong swimmers, and spend time in the water on hot days. (Illustration by Barbara Duperron. Reproduced by permission.)

Diet: The kiang eats primarily grasses and low shrubs.

Behavior and reproduction: Kiang live in close-knit herds ranging from 5 to 400 individuals, which do not scatter. The herd, composed of females and offspring, is led by an older female, and they travel in single file. The herd seems to move in unison (as one), whether they're drinking, eating, or running. Unlike other horse species, kiang do not physically touch one another. They are strong swimmers and enjoy spending hot summer days in water.

Male kiang begin following the female herds in July, and breeding takes place in August. After a year-long gestation (pregnancy) period, females form breakaway herds of two to five and retreat to nearby rocky areas to give birth to single foals. The foals thrive on mother's milk for the first year, after which time they become independent. Kiang live to be around twenty years of age; the main predator is the wolf.

Kiang and people: Kiang are hunted for their meat in some areas.

Conservation status: The kiang is listed as threatened by the IUCN. Kiang populations are most threatened by commercial hunting, habitat destruction, and competition for food and water. ■



Przewalski's horse *(Equus caballus przewalskii)*

PRZEWALSKI'S HORSE
Equus caballus przewalskii

Physical characteristics: This horse stands 4 to 4.8 feet (1.2 to 1.5 meters) tall and weighs around 772 pounds (350 kilograms). Its legs are rather short while the head is large. During summertime, the coat is short and reddish brown, a color also known as "dun." The hairs grow thicker and longer during the winter to provide insulation from the cold. The mane is short and stands straight up, and the top of the tail has short hairs. The muzzle is white with gray around the nostrils.

Geographic range: Przewalski's horse is considered Extinct in the Wild, but has been reintroduced in certain areas of Mongolia.

Habitat: Like the kiang, this horse lives in grassland and steppe regions. It was last seen in the steppes of the Gobi desert.

Diet: Przewalski's horse eats whatever grasses are available.

Behavior and reproduction: These horses form a stable family composed of one male, numerous females, and their offspring. Other males form what is called "bachelor" groups.



Przewalski's wild horse spends the majority of the day foraging for food. (© Tom McHugh/Photo Researchers, Inc. Reproduced by permission.)

After 340 days of pregnancy, females deliver a single foal, usually in April, May, or June. Foals are weaned (removed from mothers' milk) around six to eight months and are ready to breed around the age of two years. Wolves are the primary predators of Przewalski's horse, and it is believed they live to an average age of twenty years.

Przewalski's horse and people: This horse is of great significance to the people of Mongolia as it is their national symbol.

Conservation status: Listed as Extinct in the Wild, though reintroduction into Mongolia has begun. They became extinct due to overhunting, capture by zoos, and loss of habitat. Today, reintroduction is difficult because there are so few left that genetic diversity (variation of genes that create distinct differences within a species) is nearly gone. ■

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family CHAPTER

TAPIRS
Tapiridae

Class: Mammalia
Order: Perissodactyla
Family: Tapiridae
Number of species: 4 species

PHYSICAL CHARACTERISTICS

Tapirs (TAY-purz) have muscular bodies that are powerful enough to push through thick jungle growth. Males are slightly smaller than females. The head is small with flat sides and a slight upward arch. The front trunk acts as a nose. Eyes are small and the ears are round and able to move on their own. The rump is flat. Tapirs are skinnier than rhinos, and their short legs are powerful.

The tapir's weight rests on the third toe of each of the four feet. Hind feet are three-toed, while front feet are four-toed. In three of the four species, the coat is short; the mountain tapir has longer fur. Coat color varies and can be dun, a reddish brown color, whitish gray, coal black, and black-and-white two-tone. Newborns have horizontal stripes and dots for the first year.

GEOGRAPHIC RANGE

Tapirs live in South America, Central America, and Southeast Asia, including Myanmar, Thailand, Cambodia, Vietnam, and Sumatra.

HABITAT

With the exception of the mountain tapir, these mammals live in lowland rainforests and other moist forest regions. Mountain tapirs prefer cloud forests, tropical forests that are covered with constant clouds year-round, and paramo, treeless plateaus of tropical South America and the Andes Mountains. Lowland tapirs are found in grasslands and woodlands at lower elevations

in South America. All tapirs swim and spend a good deal of time in rivers and lakes. Females often need secluded forests in which to give birth and raise their young.

DIET

Tapirs eat small branches and leaves as well as fresh sprouts. They pull the food from trees using their teeth and their mobile snout. They also eat fallen fruit and water plants. On mountains, they eat in a zigzag pattern and eat just a little bit from each plant. This method of eating keeps food plentiful. If food is out of reach, they will reach up, with hind feet planted firmly on the ground and front feet pushing against rocks or other natural objects. Lowland tapirs have been reported eating stranded fish in the Amazon. Tapirs tend to eat before the sun rises and after it sets.

BEHAVIOR AND REPRODUCTION

Despite their bulk, tapirs are swift runners and agile climbers. They are able to climb and jump vertical fences or walls measuring 9.8 feet (3 meters) high. They are shy animals and depend on concealment, being hidden, for safety. For this reason, not much is known about their sleep habits. Some tapirs have been seen sleeping in the water. In fact, tapirs will spend extra time in the water during very hot weather, a habit that not only keeps them cool, but protects them from insects. They can even walk on the bottom of rivers and lakes for short periods of time.

Although tapirs prefer the dawn and dusk hours of the day, in densely populated areas the lowland tapir becomes strictly nocturnal, active at night, for its safety. Tapirs generally establish a central location and use the same paths to travel around time after time. They mark their territory with urine and piles of dung, or feces.

Tapirs are more social during the dry season and at full moons and interact at salt licks and river banks. This is also where courtship displays take place. These rituals include grunting and squealing. After a thirteen-month pregnancy, the female secludes herself and gives birth to a single calf. The calf hides in thick shrubbery for the first two weeks, feeding off the mother's milk. After a few weeks, the calf begins foraging, or searching, for food with the mother, and begins to include the food in its diet. Calves nurse, or drink their mother's milk, for up to one year. Though it is not certain, male tapirs in the wild

seem to take responsibility for some of the calf-rearing. Tapirs are monogamous (muh-NAH-guh-mus), having only one mate, during the breeding season, but change partners from year to year.

Tapirs live about thirty years in the wild. Aside from humans, it is believed that their main predators include jaguars, pumas, leopards, tigers, and anacondas.

TAPIRS AND PEOPLE

The tapir is hunted for its skin, which is used to make leather goods. It is also hunted for its meat as well as other parts of its body, which are used to make medicine.

CONSERVATION STATUS

All four species are listed as Endangered, facing a very high risk of extinction in the wild, or Vulnerable, facing a high risk of extinction in the wild, due to habitat destruction and hunting.



FOLKLORE AND FACTS ABOUT THE TAPIR

- The word "tapir" comes from a Brazilian Indian word meaning "thick," which refers to its hide.
- Some cultures claim that the powder from a tapir's ground-up hoof can cure epilepsy.
- A Malay myth claims that God made the tapir from leftover parts of other animals already created.
- The tapir is known as the "mountain cow" in Belize.



SPECIES ACCOUNTS

LOWLAND TAPIR
Tapirus terrestris

Physical characteristics: Lowland tapirs are 6 to 7 feet (1.8 to 2.2 meters) in length with a tail that measures 2 to 4 inches (5 to 10 centimeters) long. They weigh 396 to 660 pounds (180 to 300 kilograms) and have a shoulder height of 2.5 to 3.5 feet (.77 to 1.10 meters). This species is tan to black or dun in color. Their black mane runs from the forehead to mid-back.

Geographic range: Lowland tapirs are found in Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, northern Argentina, and the Guianas.



The lowland tapir is a good swimmer, and spends time in the water to cool off during hot weather. (Tom Brakefield/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Lowland tapirs live in lowland rainforests and mountain cloud forests up to 4,920 feet (1,500 meters) in Ecuador. They live in higher altitudes in other locations.

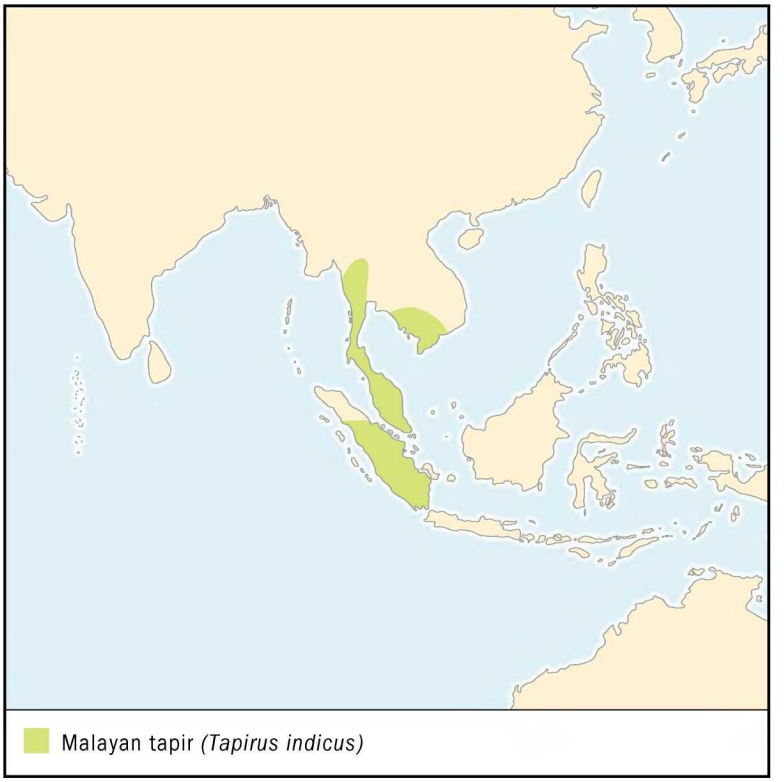
Diet: Lowland tapirs eat trees, bushes, and herbs. They also eat aquatic plants and walk on river bottoms as they feed. Lowland tapirs play an important role in their ecosystem by dispersing seeds. When they eat, they spit some of the seeds out, which can grow into plants. This keeps food and plant life plentiful.

Behavior and reproduction: Lowland tapirs gather together around salt licks, which they require to obtain nutrients. Otherwise, they are mostly solitary creatures. They are agile swimmers and spend time in the water. When frightened, they squeal loudly. On land they stand absolutely still to avoid detection. In the water, they immerse themselves until only the tip of their snouts is sticking out of the water.

Pregnancy lasts 385 to 412 days and results in a single birth. During the breeding season, lowland tapirs are monogamous. They will change partners from season to season. In captivity, this species lives to be about twenty-five years old. In the wild, their main predator is the jaguar.

Lowland tapirs and people: In native religions, the tapir is endowed with magical powers. This species is hunted for its meat, leather, and body parts for use in medicine. Lowland tapirs are important to their ecosystem because of their ability to disperse seeds.

Conservation status: Lowland tapirs are listed as Vulnerable due to forest destruction, hunting, and competition from domestic livestock. A renewed interest in the wild-meat industry is also taking its toll on the population. ■



MALAYAN TAPIR
Tapirus indicus

Physical characteristics: This species is 6 to 10 feet (1.85 to 2.50 meters) long with a tail measuring 2 to 4 inches (5 to 10 centimeters). They weigh 550 to 825 pounds (250 to 375 kilograms) and have a shoulder height of 35 to 41 inches (90 to 105 centimeters). This large tapir has a black coat except for the rear half above the legs, which is white.

Geographic range: Malayan tapirs are found in Southeast Asia, including Myanmar, Laos, Cambodia, Vietnam, Malaysia, Indonesia, and Thailand.

Habitat: Malayan tapirs live in the lowland forests of swamps and mountains up to an elevation of 6,560 feet (2,000 meters). This species needs a permanent water source with plenty of water for drinking and bathing. Highest populations are found in swamps and lowland forests.



Young tapirs are born with stripes and spots on their coat, which they lose as they mature. This Malayan tapir's adult coat is growing in. (© Terry Whittaker/Photo Researchers, Inc. Reproduced by permission.)

Diet: Malayan tapirs prefer tender leaves and shoots from certain trees and bushes. They eat moss and a variety of fruits. A Thailand study revealed that this species preferred thirty-nine plant species of which 86.5 percent were eaten as leaves, 8.1 percent as fruit, and 5.4 percent as twigs with leaves. Because they do not digest the seeds as well as multi-stomached animals, their feces contains seeds that eventually lead to new plant life.

Behavior and reproduction: Malayan tapirs are nocturnal and rest in seclusion during daylight hours. These excellent swimmers emit shrill whistles when alarmed or trying to settle down their offspring. They follow paths with the head down, sniffing the ground. Their sense of smell is good while their eyesight is weak.

Pregnancy lasts between 390 and 407 days and results in a single birth. The calf nurses for the first six to eight months, at which time it begins eating the vegetation of adults. This species is ready for breeding around the age of three years. Malayan tapirs live for about thirty years in the wild, and their main predators are tigers and leopards.

Malayan tapirs and people: Malayan tapirs are hunted in some areas of Asia for meat and other products and illegally traded in other areas. Humans have always been the prime enemy of the Malayan tapir.

Conservation status: This species is listed as Endangered. Their forest habitat is being destroyed at an alarming rate for agricultural

purposes. Asian countries have laws protecting Malayan tapirs, but they are still killed for their meat. ■

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RHINOCEROSES
Rhinocerotidae

Class: Mammalia
Order: Perissodactyla
Family: Rhinocerotidae
Number of species: 5 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Rhinoceroses (commonly called "rhinos" [RYE-nose]) weigh more than 2,200 pounds (1,000 kilograms) as adults. Their barrel-shaped bodies are supported by short legs that end in three-toed feet. The mobile ears are large, tiny eyes are situated on either side of the head, and the neck and tail are short. Rhino horns are not made of bone, but of keratin (KARE-ah-tin), the same material in hooves, hair, and fingernails. They are not attached to the skull. These horns never stop growing, and they will re-grow should they be knocked out in battle or otherwise.

Skin thickness varies with the species. Rhinos have large sweat glands scattered over the skin that allows them to sweat often and a lot to help keep them cool. Their eyesight is poor, but their sense of hearing is well developed and facilitated by ears that can swivel. Their most acute sense is that of smell. Rhinos vary in coloration from gray to brown.

GEOGRAPHIC RANGE

Found in Africa and Southeast Asia.

HABITAT

Different species prefer different habitats. The white rhino likes grasslands and savannas (similar to grasslands but with small trees and bushes), while the black rhino prefers bushland and semidesert. The Indian rhino is found on meadows

and swamplands, and Sumatran and Javan rhinos occupy rainforests.

DIET

Rhinos are vegetarians and feed primarily on leaves, fruit, grasses, and stems. They have one stomach, which could lead to poor digestion. Because of their large size, however, rhinos have longer periods of digestion, making it more efficient. Rhinos need water not only for drinking, but for wallowing in as well.

BEHAVIOR AND REPRODUCTION

Rhinos are solitary (lone) animals, but are primarily found in the mother-offspring pair. Their poor eyesight prohibits them from clearly seeing anything farther away than 100 feet (30 meters). Their sense of smell alerts them to danger. Rhinos are normally gentle creatures and they will only charge an intruder if they feel threatened.

Courtship behavior (mating rituals) of the rhino is so aggressive that it sometimes ends in injury to one or both parties. Rhino males are territorial and will fight with other males to defend territory or to mate with females. Rhinos do not form bonds and the sexes do not associate with each other outside of mating.

Pregnancy lasts fifteen to sixteen months and results in a single birth. Rhino calves remain with their mothers for two to four years, at which time they live independently. Baby rhinos nurse (drink mother's milk) for one year, but begin supplementing with vegetation at one to two months. Rhinos are ready to mate between the ages of four to five years, but males often wait until the age of ten due to competition from other males. Babies are born every two to five years. Rhinos can live to be forty years old and have no natural predators.

RHINOCEROSES AND PEOPLE

Humans have long been fascinated with the rhinoceros, as indicated in cave art from the Early Stone Age. Unfortunately, this fascination hasn't kept humans from reducing all rhino populations. Rhinos are especially valued for their horns, which are used to make dagger handles in Yemen (believed to give the owners invincibility) as well as medicine in China and

HUMAN GREED SPELLS DEATH FOR BLACK RHINOS

For nearly twenty years, the African Wildlife Foundation has been committed to rhinoceros conservation. Much of its funding supports black rhino protection and conservation in the Tsavo East National Park in Kenya.

In the 1970s, the black rhino population was between six and eight thousand. By 1989, however, the population had dwindled to twenty. Poaching is the sole reason for the decline of the rhino population throughout Africa. As a way to counterbalance this tragic pattern, Tsavo East created the Ngulia Rhino Sanctuary (NRS) in 1985. It began with three rhinos in a fenced-in area less than 1 square mile (less than 1 square kilometer). Today it is larger than 38 square miles (98 square kilometers) and is home to fifty-seven rhinos, half of whom were born in the sanctuary.

Although the numbers are slowly rising, it isn't happening without a cost. In May 2003 two park rangers were murdered in an effort to protect the rhinos from poachers. Poaching continues throughout rhino ranges, but sanctuaries like NRS are key to bolstering the rhino population.

India. Because the horn is made of keratin, the same as hair and fingernails, the there's no evidence to support the claim that it holds medicinal power.

CONSERVATION STATUS

The only species that isn't threatened is the white rhino, though it once was in serious jeopardy. Today, the Javan, Sumatran, and black rhinos are Critically Endangered, facing an extremely high risk of extinction, while the Indian rhino is considered Endangered, facing a very high risk of extinction. Poaching (illegal hunting) is to blame for the threat to all rhinos.



Sumatran rhinoceros *(Dicerorhinus sumatrensis)*

SUMATRAN RHINOCEROS
Dicerorhinus sumatrensis

Physical characteristics: This is the smallest and oldest living rhino species, with a weight from 2,200 to 4,400 pounds (999 to 1,998 kilograms) and a shoulder height of 48 to 58 inches (120 to 150 centimeters). From head to tail, this species measures 100 to 125 inches (250 to 315 centimeters). The body is covered sparingly with short hairs, and the hide is dark red-brown. The horn closest to the snout can measure up to 31 inches (79 centimeters), but that is unusually long, and it is normally much shorter. The other horn is no longer than 6 inches (15 centimeters). Both sexes have horns.



A newborn Sumatran rhinoceros, born at the Cincinnati Zoo in 2001, is the first Sumatran rhinoceros to be born in captivity in 112 years. (AP/Wide World Photo/Cincinnati Zoo. Reproduced by permission.)

Geographic range: Though they once roamed over Southeast Asia, they are found only on the island of Sumatra and in the Malay peninsula today.

Habitat: The Sumatran rhino lives in mountainous rainforests today, but experts believe it may have once occupied lowland forests, as well. They need to live near permanent bodies of water.

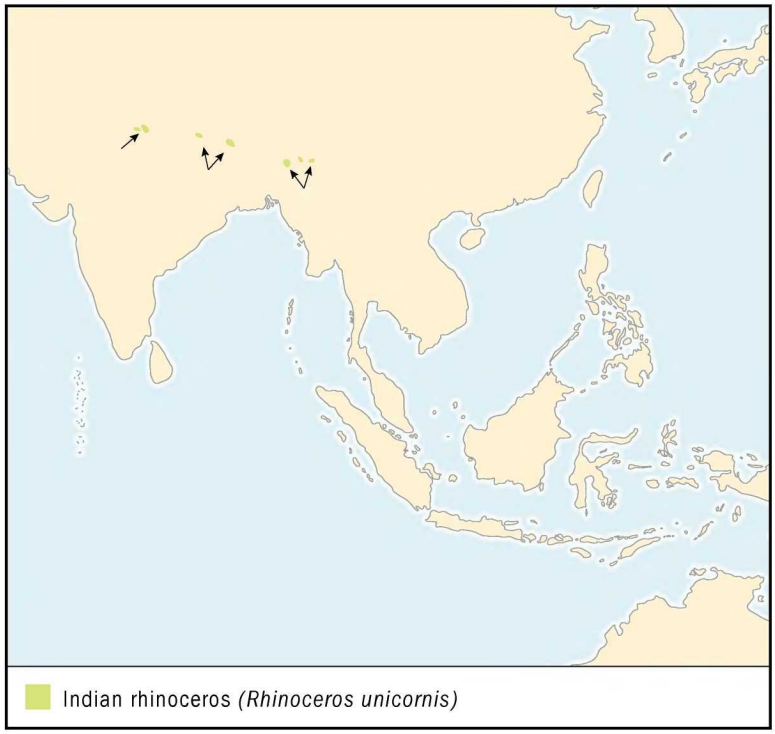
Diet: This species eats mostly twigs and leaves of small trees and shrubs. It also enjoys fruits and herbs. Although these rhinos feed on undergrowth along streams, they will reach higher shoots and twigs by walking on plants and pressing down on the trunk of saplings with their round bodies.

Behavior and reproduction: Sumatran rhinos are solitary and come together only to breed, although calves and mothers are frequently seen together. They like to wallow in mud holes, which not only keep them cool, but also protect their thin outer layer of skin from insect bites and thorns. Males roam whereas females have home ranges covering 4 to 6 square miles (10 to 15 square kilometers). Each territory has a salt lick, which the rhinos visit frequently.

Pregnancy lasts 475 days and calves weigh around 72.8 pounds (33 kilograms). While nursing, females confine their movements to small areas close to a salt lick. Calves leave their mothers between sixteen and seventeen months, at which time the mother returns to her non-breeding range. Females give birth about every four years.

Sumatran rhinoceroses and people: The number of Sumatran rhinos has decreased by 50 percent in the past twelve years due to poaching. It is believed that as of 2002, there are fewer than three hundred left in existence. Captive breeding has not been successful, as it has come to light that rhinos have strange mating habits that captivity cannot allow.

Conservation status: Listed as Critically Endangered since 1996. ■



INDIAN RHINOCEROS
Rhinoceros unicornis

Physical characteristics: This species has skin that is covered in what looks like plates of armor. Indian rhinos also have just one horn. Males can weigh up to 4,600 pounds (2,100 kilograms), while females weigh around 3,500 pounds (1,600 kilograms). Males measure to 150 inches (380 centimeters) in length, females to 135 inches (340 centimeters). Both sexes have the horn, which measures around 18 inches (45 centimeters). The hairless skin is gray and has flat bumps on it.

Geographic range: Indian rhinos are found in Pakistan, India, Nepal, and Bangladesh.

Habitat: The Indian rhino lives on floodplains and swamplands with tall grasses as well as adjoining woodlands on drier ground.

Diet: This species uses its upper lip to grasp grass stems and bushes. The lip folds back when the rhino wants to graze. The tall grasses of



Indian rhinoceros calves nurse until they are two years old, and leave their mother just before she has her next calf. (© Tom McHugh/Photo Researchers, Inc. Reproduced by permission.)

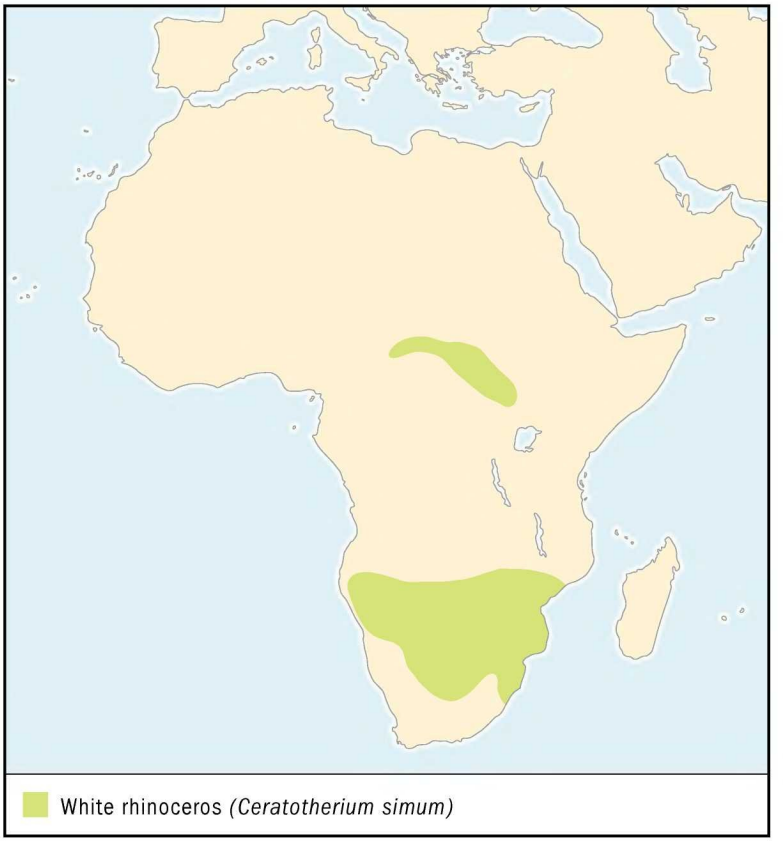
the preferred region supply food year-round. During winter, woody vegetation is important. The Indian rhino also eats aquatic plants and green fallen fruits. These rhinos will step on plants and pull down stems so they can bite off the tips of vegetation. In doing so, they disperse seeds, thus guaranteeing a plentiful food supply.

Behavior and reproduction: Solitary like other rhinos, the Indian rhino gathers around and wallows in bathing pools, as well as in feeding areas. Males are aggressive and fights break out when strange rhinos trespass on others' territory. This species is very vocal. Indian rhinos spend more than half of their time feeding.

After a courtship that includes the male chasing the female, sometimes for more than a mile (1.6 kilometers), the pair begins horn fighting. This can lead to biting, and it is common for them to inflict open wounds during mating. Pregnancy lasts sixteen months at which time the female gives birth in a secluded forest area or dense grassland region. Calves weigh 140 to 150 pounds (65 to 70 kilograms) and nurse until they are two years old. They leave their mothers a week or two before the birth of the next offspring, though females may remain on the maternal home range. Females give birth every three-and-a-half to four years. Indian rhinos can live up to thirty years in the wild with tigers as the only natural predator of the young.

Indian rhinoceroses and people: Tourists ride on elephants' backs to view Indian rhinos in some sanctuaries. Local people aren't as fond of the animals, as the rhinos tend to eat crops at night. In some instances, Indian rhinos have killed humans.

Conservation status: Indian rhinos are listed as Endangered by the IUCN due to poaching and competition from cattle and agricultural development. ■



WHITE RHINOCEROS
Ceratotherium simum

Physical characteristics: This is the largest rhino species. Males can weigh up to 5,000 pounds (2,300 kilograms), while females weigh around 3,800 pounds (1,700 kilograms). Males measure to 150 inches (380 centimeters) in length, females to 135 inches (343 centimeters). The body is covered sparingly with short hairs, and the hide is gray. The horn closest to the snout measures 20 to 62 inches (50 to 158 centimeters. The other horn is no longer than 15 inches (40 centimeters). Both sexes have horns.

Geographic range: In the nineteenth century, the white rhino was found in two separate regions of Africa: southern Chad, Central African Republic, southwest Sudan, northeast Democratic Republic of the Congo, and northwest Uganda; and southeast Angola, parts of



White rhinos live in groups of one dominant male, females and their offspring, and some young males. (Photograph by Harald Schütz. Reproduced by permission.)

Mozambique, Botswana, Zimbabwe, Namibia, and northeast South Africa. Today the white rhino occupies fragments of these areas and is restricted to game preservations and national parks.

Habitat: The white rhinoceros prefers the drier savanna regions in southern Africa, yet prefers the moist savanna in the northern range.

Diet: The southern white rhino eats grasses and also ingests herbs and occasionally woody shrubs. Short grasses are the preferred food year-round, though later in the dry season, interest turns to some of the taller grasses. The northern rhino prefers short grasses but includes medium-tall grasses in its foraging.

Behavior and reproduction: White rhinos seem to be the most complex species of the family. Their range varies in size from less than 1 square mile (less than 1 square kilometer) to 5 square miles (8 square kilometers). They spend their entire lives within these ranges, and live in small groups with one dominant male, numerous females and their offspring, and even some sub-adult males. Fighting is rare. Lions have been reported to prey on young calves, but that is the extent of natural predators.

Gestation lasts sixteen months, at which time the female seeks a quiet place to birth her single calf. Calves nurse until the age of fifteen to twenty-four months, though they begin eating vegetation after a couple months of age. Females are sexually mature between the ages of six and eight years while males begin breeding around ten to twelve years. White rhinos live no longer than about forty years in the wild.

White rhinoceroses and people: White rhinos are terrified of humans. Early European hunters brought the white rhino to near extinction as they harvested populations for their meat and other body parts. The southern population has recovered well, but the future of the northern species is questionable at best.

Conservation status: The white rhino is listed as Near Threatened by the IUCN because even though population levels are higher than other rhino species, this breed is easy to track down and hunt, so reintroduced herds have been easily eliminated. The horn of the white rhino is particularly valuable, fetching a couple thousand dollars per horn on the black market. Recently, a herd of young male elephants killed a number of white rhinos. This is normally highly unlikely, but these particular elephants were orphaned at a young age and had no older bulls in the herd. Once older bulls were introduced, the aggression of the younger elephants subsided, demonstrating the importance of hierarchy in elephant populations. ■

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EVEN-TOED UNGULATES
Artiodactyla

Class: Mammalia
Order: Artiodactyla
Number of families: 10 families

order
CHAPTER

PHYSICAL CHARACTERISTICS

Because there are as many as 227 species of artiodactyls (ar-tee-oh-DACK-tuhlz), they vary greatly in physical characteristics. The smallest is the mouse deer, which weighs less than 2 pounds (1 kilogram) and stands up to 14 inches (35 centimeters) to the shoulder. The hippopotamus is the largest, weighing in at nearly 10,000 pounds (up to 4,500 kilograms). Head and ear sizes and shapes vary, as do neck lengths, but the eyes are usually big, with long lashes. Tail and leg lengths vary, and fur can be short or long.

Ungulates (UNG-gyuh-luhts) are hoofed mammals. What makes artiodactyls different from perissodactyls (puh-RIH-suh-dack-tuhlz), is the number of toes. With the exception of two species, all artiodactyls have an even number of toes (two or four) on each foot. The hooves are hard and ideal for fast running, though they vary in size depending on the size and mass of the animal. Almost all species have weapons, including horns, antlers, and tusks or canines (the four pointed teeth near the front of the mouth, two on each jaw).

Artiodactyls' coats have two layers: a short underfur and longer guard hairs on top. The top hairs repel water, and the two layers together help control body temperature. Most species have glands that are used for communication. These glands secrete strong-smelling chemicals and substances. The animals use these to mark territory. Animal behaviorists agree that the role of these glands in general is not completely clear.

phylum
class
subclass
order
monotypic order
suborder
family

GEOGRAPHIC RANGE

Artiodactyls can be found on every continent except for Antarctica and Australia. They also do not inhabit oceanic islands.

HABITAT

Habitats vary greatly. Regardless of biome, though, every artiodactyl needs abundant vegetation in order to survive. These animals are found in valleys and on mountaintops, in deserts and tundras. Depending on the species, they will choose habitats that will protect them as they go about their daily activities. For example, bighorn sheep live in open grasslands and meadows near cliffs. The meadow allows them to feed while the cliffs provide security from predators, animals that hunt them for food.

DIET

Except for two species, artiodactyls are herbivores (plant eaters). This is probably one of the reasons the order has thrived—vegetation is an abundant food source in almost any ecosystem, and so these animals are able to live almost anywhere.

All artiodactyls have at least one "false stomach" located in front of the actual stomach. Some have three. These false stomachs aid digestion. Because mammals don't have the enzymes that make digestion of plants possible, they rely on microorganisms to help break down plant tissues. These microorganisms, in combination with the action of false stomachs, make for highly effective digestion. Artiodactyls are ruminants, meaning they chew their food, swallow it, then regurgitate (re-GER-jih-tate; vomit) it back into the mouth to be chewed another time.

BEHAVIOR AND REPRODUCTION

Though often seen in pairs or trios, artiodactyls are social and live in groups. Adult sexes live separately for most of the year (though they may share a range), and offspring live with females. Males tend to live where food is more plentiful because they require more energy due to their larger size. Females, on the other hand, tend to live in areas that are more protected from predators because they have the responsibility of raising the young, which are susceptible to predation during the first few months of life.

THE BUSHMEAT CRISIS

Many of the world's tropical forests are hunting zones for bushmeat (wild meat). Not only does the meat sustain people because it is a food source, but also because bushmeat hunting is the livelihood of local people. Where once bushmeat hunting was on a smaller scale, involving only low-impact technologies, it is now a booming international business, and one that can no longer be sustained.

According to the Overseas Development Institute (ODI), there are many reasons why bushmeat hunting is no longer a sustainable activity. Some of them are:

- Remote tropical forest areas are being opened up at an alarming rate through logging. Whereas inhabitants who live there once existed without interaction in the modern world, they are now being given access to a cash economy and modern consumer markets. No longer are inhabitants native to the area, but often landless migrants searching for work.
- Many forest people have lived in a trade economy—one in which they bartered or traded goods and services. Now that they are being forced into a cash economy, there may be the tendency to over-exploit their natural resources so that they can participate in the economy. Bushmeat hunters may begin to overhunt so that they can provide large quantities of the wild meat to wholesale resources.
- New hunting technologies are killing bushmeat animals at a faster rate than they are able to reproduce, thus decimating the herd numbers. This is what leads to extinction.

The bushmeat crisis has become such a concern that in 2004, the ODI began a project titled "Wild Meat, Livelihoods Security and Conservation in the Tropics." The project's aim is to consider the bushmeat crisis in terms of livelihood for humans as well as conservation for the environment and animals.

Artiodactyls are equipped with horns or antlers used for fighting, but physical confrontation is risky because it requires energy that could be used for mating or feeding. Because of this, many artiodactyls will use displays, or behaviors, such as vocalizations or postures, to force an opponent to withdraw. During these displays, the animals do their best to appear as big as possible by raising their fur or standing sideways. They seem to use color patterns in their communications as well, though to what degree we do not know. For example, white-tailed deer raise their tails as a warning signal to other deer that danger is near. This exposes the long white hairs on the rump

and underside of the tail, so as it waves the tail from side to side, the stark white contrasts with the darker fur and surroundings, such as plants, trees, etc.

Most species give birth to one or two young at a time. The pig is the exception, with four to eight young born each pregnancy. Artiodactyls breed once a year, and babies are usually born just as plants start to bloom. This allows plentiful food for mother and baby, which ensures nutrient-rich milk for the mother and a long growing period for the newborn.

Babies are able to walk and even run within hours of birth, and they either hide when mother is away or stay close to her during the first few weeks of life. Those who hide include the smaller species. The larger species live in more open habitats and have fewer places in which to hide.

Male artiodactyls mate with several females each mating season, and they usually do not form bonds. Pregnancy lasts from five to eleven months, depending on the species. Artiodactyls are ready to breed at eighteen months of age, and females give birth for the first time around the age of two. Artiodactyls can live to be ten to thirty years old, but the average age of death is much lower. Because of their keen senses and ability to run fast, artiodactyls don't often fall prey to other animals.

ARTIODACTYLS AND PEOPLE

For as long as people have inhabited the earth, artiodactyls have been hunted for their meat and skins. Still today they are valued as a source of animal protein. Domestic livestock such as cattle, pigs, goats, and sheep are artiodactyls. Historians believe sheep and goats were the first artiodactyls species to be domesticated, around nine thousand years ago. Whether domesticated or wild, humans still rely on artiodactyls for meat, bones, horns, fertilizer, milk, and other byproducts.

CONSERVATION STATUS

One hundred sixty species of Ariodactyla are on the IUCN Red List of threatened mammals. Two are Extinct in the Wild; seven are Extinct; eleven are Critically Endangered, facing an extremely high risk of extinction; twenty-six are Endangered, facing a very high risk of extinction; thirty-five are Vulnerable, facing a high risk of extinction; sixty-six are not currently threatened, but could become so; and thirteen are Data Deficient, not enough information to make a determination.

Threats include poaching (illegal hunting), habitat loss from deforestation and agricultural conversion, and competition with livestock. Regardless of the threat, all are based on human demands for natural resources that are slowly disappearing.

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PIGS

Suidae

Class: Mammalia

Order: Artiodactyla

Family: Suidae

Number of species: 16 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Pigs are medium-sized mammals whose thick bodies weigh anywhere from 77 to 770 pounds (35 to 350 kilograms). Some domesticated, tamed, breeds weigh up to 990 pounds (450 kilograms). Pigs measure 34 to 83 inches (86 to 211 centimeters) in length and stand 21 to 43 inches (53 to 109 centimeters) high. The exception is the pygmy hog, which is the smallest species and never grows longer than 28 inches (71 centimeters).

The neck is short and the head is long and pointed. The snout is able to move separately from the head. The eyes are small, the ears are long, and each foot has four toes. The two middle toes are flattened and have hooves. The upper canines, cone-shaped teeth on each side of the front of the mouth, are big and curve upward, protruding from the mouth. Skin color varies, depending on the species, from brown to near black. Some species have manes or tufts of hair. Others have warts on the face.

GEOGRAPHIC RANGE

Pigs live on every continent except Antarctica. They also occupy a number of oceanic islands. They are not indigenous (in-DIJ-un-us), native, to all ranges, but have been introduced by humans.

HABITAT

Pigs live in altitudes of up to 13,000 feet (4,000 meters) and choose their habitats depending upon the availability of food, weather conditions, and the predator, animals that hunt pigs for

food, population. African pigs occupy small territories or home ranges while other pigs tend to roam in search of better feeding grounds. Regardless of species, pigs build nests out of vegetation for protection from weather as well as for resting. Warthogs do not build their own nests but use those belonging to aardvarks. Home ranges must have sources of shade as well as water and mud holes. These three characteristics are important because some pigs do not have sweat glands to cool their bodies.

DIET

Wild pigs are omnivorous, eating meat and plants, feeding on leaves, grasses, seeds, fruits, eggs, young trees, carrion, or dead animals, invertebrates, or animals without backbones, and small vertebrates, animals with backbones. They also enjoy mineral licks where they ingest nutrient-rich soil or water.

BEHAVIOR AND REPRODUCTION

The basic group is the mother-offspring pair, and group sizes vary from one to fifteen pigs. Females live alone or in a group with other females, and offspring remain with their birth group up to two years. Female offspring sometimes remain with the group permanently, but males always leave. With the exception of the African species, males and females interact only during breeding season. African males live with the group year-round and help raise the young. Male warthogs breed, leave, and then return to help care for the offspring.

Pigs vocalize when they are alarmed or in pain as well as when they are comfortable or breeding. Displays are used to ward off intruders or rivals, but if that fails, pigs will fight using tusks. Cannibalism and infanticide, killing of young, have been observed in some species, and wild piglets have been known to be playful and social.

Wild pigs are active at night. Warthogs are active during daylight hours.

Male pigs breed with several females each season, but warthogs have been known to choose one mate for life. Courtship behavior includes chasing and calling. Pregnancy lasts 100 to 175 days, and during this time the female will build a nest from vegetation. Females give birth to one to twelve piglets in this secluded spot. The litters of domesticated pigs increase in number with age and may reach eighteen piglets. Piglets nurse, drink their mother's milk, up to twenty times each day. Some piglets are

GOOD NEWS FOR THE BABIRUSA

In February 2004, the Paguyaman Forest increased in size from 120 square miles (311 square kilometers) to 200 square miles (518 square kilometers). This forest is on Sulawesi, the island home to most of the remaining babirusa population.

In addition, a poacher, illegal hunter, was prosecuted in 2002 for participating in illegal trade. Such prosecution had never taken place before that, and it has served to discourage other would-be poachers. As a result, the number of babirusas sold weekly in the local markets fell from fifteen in 1991 to two in 2004.

taken off mother's milk as early as five weeks, while others wait until thirty-two weeks of age. Sexual maturity of young is reached at eight months in some species, and at two to five years in others.

Primary predators of wild pigs are bobcats, coyotes, and black bears.

PIGS AND PEOPLE

Wild pigs and humans do not get along well. Wild pigs seriously damage crops by eating them or digging them up by the roots. Humans hunt pigs for their meat and they provide natives in Asia and parts of Africa with income through commercial hunting. Some wild pigs carry disease that threatens domestic livestock. In some cultures, pigs are used in place of money. Domestic pigs are used in scientific and medical research, and their organs have been used as replacements for human organs. Humans have been the recipients of pig hearts, kidneys, livers, lungs, and pancreas (PAN-kree-us) tissue.

CONSERVATION STATUS

The babirusa and the Philippine warty hog are Vulnerable, facing a high risk of extinction in the wild. The Javan pig is Endangered, facing a very high risk of extinction in the wild. The pygmy hog and the Visayan warty pig are Critically Endangered, facing an extremely high risk of extinction in the wild. There is no enough data about the Vietnam warty pig, but it may be extinct, died out.

The main threats to these wild pigs are hunting and loss of habitat. Although some pigs are protected by law from hunting, those laws are not well enforced.



Forest hog *(Hylochoerus meinertzhageni)*

FOREST HOG
Hylochoerus meinertzhageni

Physical characteristics: Forest hogs measure 51 to 83 inches (130 to 210 centimeters) in length and stand anywhere from 30 to 43 inches (76 to 110 centimeters) high. Males weigh from 319 to 606 pounds (145 to 275 kilograms) while females weigh 286 to 449 pounds (130 to 204 kilograms). Their skin is gray to blackish gray and is sparsely covered with long, coarse hairs. Tusks are around 12 inches (30 centimeters) or shorter.

Geographic range: Western, central, and eastern tropical Africa.

Habitat: Forest hogs live in forests of all kinds up to altitudes of 12,500 feet (3,800 meters). They require a permanent water source and prefer thick vegetation that does not grow too high to easily reach.



Forest hogs are active mainly at night, though they come out during the day if humans are not around. They eat mostly grass. (David Madison/Bruce Coleman Inc. Reproduced by permission.)

Diet: Forest hogs eat mainly grass. They will eat carrion and eggs occasionally. This species also eats dung, feces.

Behavior and reproduction: Forest hogs are active mostly at night, though they will come out during daylight if humans are not around. The social group is made up of one male, several adult females, and offspring. Home ranges overlap, and each has a number of paths leading to feeding sites, mineral licks, and water holes. Hyenas are the primary predators.

Mating occurs most often towards the end of a rainy season, and pairs do not bond. After 151 days of pregnancy, sows give birth to a litter of two to four piglets, but sometimes as many as eleven. Piglets remain in thick cover for one week and then stay with the sow. Young are weaned, no longer drink mother's milk, at nine weeks.

Forest hogs and people: Forest hogs are hunted for their meat. Some tribes use the hides for war shields. Others believe that killing the forest hog brings bad luck.

Conservation status: Forest hogs are not threatened. ■



Babirusa *(Babyrousa babyrussa)*

BABIRUSA
Babyroussa babyrussa

Physical characteristics: Babirusas weigh 132 to 220 pounds (60 to 100 kilograms) and measure 34 to 39 inches (87 to 100 centimeters) in length. They stand 25 to 32 inches (65 to 80 centimeters) tall. Depending on location, some babirusas look naked while others have long, stiff coats. Skin is brownish gray, and the tusks come out the snout and curve back towards the head.

Geographic range: Babirusas are found on the island of Sulawesi, the Togian islands, the Sulu islands, and the island of Buru.

Habitat: Babirusas are found primarily in tropical rainforests and along the banks of rivers and lakes where water vegetation is plentiful.



Babirusas feed on fruit, nuts, leaves, roots, and some animal material. (© Kenneth W. Fink/ Photo Researchers, Inc. Reproduced by permission.)

Diet: Babirusas feed on fruit, nuts, leaves, roots, and some animal material. They also eat soil and rock at the mineral licks. Both sexes have been known to eat their young.

Behavior and reproduction: Babirusas are most active in the morning. Males live alone, but females form groups with one to five other adult females and their young. Tusks are used for attack as well as defense, but aggressive behavior is also met with body pushing, rubbing, and boxing. Pythons are the babirusa's main predator.

Though they give birth year-round in captivity, they may do so less frequently in the wild. Pregnancy lasts 155 to 175 days and result in a litter of one to two piglets. These small litters make for a slow-growing population. Offspring are weaned between twenty-six and thirty-two weeks, though they begin to eat solid foods at one week. Sexual maturity is reached at five to ten months of age.

Babirusa and people: Babirusas are hunted both commercially and for its meat. Babirusa skulls are sold in local markets to tourists and in department stores in Jakarta, Indonesia.

Conservation status: Babirusas are considered Vulnerable. The main threats to this species include hunting and loss of habitat. ■



Eurasian wild pig *(Sus scrofa)*

EURASIAN WILD PIG
Sus scrofa

Physical characteristics: Eurasian wild pigs weigh from 77 to 770 pounds (35 to 350 kilograms), though domestic species can reach 990 pounds (450 kilograms). They stand anywhere from 22 to 43 inches (55 to 110 centimeters) tall. Their skin is covered with short bristles of varying color. Males have larger tusks than females.

Geographic range: Eurasian wild pigs are found on all continents except Antarctica. They also live on islands.

Habitat: Eurasian wild pigs live in a variety of habitats, including tropical rainforests, woodlands, grassland, and agricultural lands.

Diet: About 90 percent of the Eurasian wild pig's diet is vegetation. They feed on roots, grasses, fruits, seeds, nuts, agricultural crops, carrion, invertebrates and vertebrates. Eurasian wild pigs have been known to migrate, travel to another region, when food is scarce.

Behavior and reproduction: Eurasian wild pigs are mostly active in the morning and afternoon. The basic social unit is a small group of



Eurasian wild pigs have been known to travel to other areas when food is scarce. (© Uwe Walz/Jacana/Photo Researchers, Inc. Reproduced by permission.)

females and their young. Adult males are solitary, lone. These pigs are active 40 to 65 percent of the time.

Eurasian wild pigs and people: Eurasian wild pigs are eaten by humans more than any other species of pig. Because they do major damage to crops, they are considered a pest by many locals. Eurasian wild pigs are hunted commercially and for food. Their skulls are displayed as protection from evil spirits. Domesticated pigs are used as money for the payment of fines or fees for brides in some cultures.

Conservation status: Eurasian wild pigs are not threatened. ■

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PECCARIES
Tayassuidae

Class: Mammalia
Order: Artiodactyla
Family: Tayassuidae
Number of species: 3 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Peccaries (PECK-ar-eez) weigh 30.9 to 110.3 pounds (14 to 50 kilograms), depending on the species, and are 20 to 24 inches (50.8 to 61 centimeters) tall. The body is similar to that of a pig, but the legs are longer and slimmer. Peccaries' coats are bristly and short but get longer from the midsection to the hindquarters. There is a scent gland located near the base of the tail that emits a musky smell. The snout is well developed. Peccaries have canines (the cone-shaped side teeth found in the front part of the mouth on both jaws). They have numerous stomachs, which enhance digestion, but do not have a gallbladder (a muscular organ attached to the liver used to store bile, which aids digestion).

GEOGRAPHIC RANGE

Peccaries are found in southwestern North America to Mexico and Central America, as well as South America.

HABITAT

Peccaries live in the desert areas of the southwestern United States and northern Mexico. They also occupy the tropical forests and rainforests of Central America as well as the wetlands and forests of South America. They can be found in the dry tropical thorn forests of Bolivia, Paraguay, and Argentina known as the Chaco.

DIET

Peccaries eat a wide variety of foods, allowing them to flourish in habitats other animals might find harsh. Depending on

the species and where they live, they feed on fruit (especially the prickly pear), roots, bulbs, grass, acorns, pine nuts, and thistles. They find food by rooting (digging with the snout) through mud and soil. White-lipped peccaries break through seed shells using their muscular jaws and strong teeth. The food is fermented (broken down) by microorganisms in the fore stomach, which makes it easier to digest.

BEHAVIOR AND REPRODUCTION

Peccaries are social animals that live in herds ranging in number from three to more than five hundred. Home ranges vary in size, depending on the species and location. For the most part, peccaries are active during the daytime, though in Arizona and Texas, the collared peccary becomes nocturnal (active at night) in summer.

These animals are territorial and will become aggressive when threatened by trespassers. They growl, click their teeth, squeal, and make alarm-like barking sounds when threatened. When alarmed, they bristle the hairs along their neck and back. Peccaries groom one another. They are hunted by jaguars, bobcats, coyotes, and pumas.

Peccaries can give birth year-round, and litter sizes range from one to four, with the average size being one to two offspring. Pregnancy lasts 145 to 162 days, depending on the species.

PECCARIES AND PEOPLE

Peccaries are hunted throughout their range for their meat, hides, and just for sport. Books abound on the subject of trapping and hunting these animals. Selling the meat and skins is how many local populations earn their living. The peccary skin trade has slowed down considerably in recent years, and Peru is the only exporter of peccary skin today. Peccaries are considered spiritual guides of several game animals in the native communities of Amazonia.

CONSERVATION STATUS

The Chacoan peccary is listed as Endangered, facing a very high risk of extinction, by the IUCN, primarily due to habitat loss, but also because it is hunted for bushmeat (wild meat).



SPECIES ACCOUNT

COLLARED PECCARY
Tayassu tajacu

Physical characteristics: Collared peccary adults measure 46 to 60 inches (11.8 to 152.4 centimeters) long and weigh between 40 and 60 pounds (18.2 to 27.2 kilograms). Their skin is black and gray, with a dark stripe running down their backs. They are easy to spot because of a whitish gray band of fur around their necks. Babies are yellow-brown or red.

Geographic range: Known in Spanish as the javelina (pronounced HAV-a-lee-nah), this species is found in the southwestern United



Female collared peccaries give birth to two offspring at the end of their pregnancy. (© G. C. Kelley/Photo Researchers, Inc. Reproduced by permission.)

States. It also lives in Central America and on the Pacific coasts of Colombia, Ecuador, and Peru, mainly inhabiting the Chaco, or dry tropical thorn forest.

Habitat: Collared peccaries live throughout a range of habitats, from open deserts to oak forests to tropical forests. They are also found occasionally on floodplains in the Amazon.

Diet: They eat cacti (KACK-tie, or KACK-tee), roots, fruit, seeds, shrubs, small lizards and mammals, and in Arizona, the prickly pear. This is an ideal fruit for the collared peccary, as it has a high water content.

Behavior and reproduction: Herd size varies depending upon habitat, so groups can be comprised from as few as two to as many as thirty individuals. This species lives in hollowed-out logs or hollows in the ground, near water if possible. They are most active during the cooler times of day, during the morning or after sunset.

After a pregnancy of 145 days or so, the female gives birth to two offspring. The approximate age at first breeding is sixteen months. Not much else is known about the reproductive behavior of this animal, though experts believe both sexes have several mates and do not bond.

Predators of the collared peccary include bobcats, coyotes, pumas, and jaguars.

Collared peccaries and people: This species is the most widely hunted of all peccaries. Its meat is a source of food and money for many rural Peruvians.

Conservation status: Collared peccaries are not considered threatened. ■

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family CHAPTER

HIPPOPOTAMUSES
Hippopotamidae

Class: Mammalia
Order: Artiodactyla
Family: Hippopotamidae
Number of species: 2 species

PHYSICAL CHARACTERISTICS

Hippopotamuses (often called hippos) have huge, round bodies that sit atop short legs. Males weigh 600 to 4,000 pounds (270 to 1,800 kilograms) and measure 60 to 106 inches (152 to 270 centimeters). Females weigh between 500 and 3,000 pounds (230 to 1,500 kilograms) and measure 58 to 106 inches (150 to 270 centimeters). Hippos have four toes on each foot with slight webbing between them. Though the skin looks hairless, there is a sparse covering of fine hairs over the entire body. The hippo has no sweat glands, but it does have skin glands that secrete a fluid. Experts believe this liquid acts as a sunscreen as well as an antiseptic (germ-killer). Hippos vary in color from slate brown to mud brown, and in certain lighting give off shades of purple.

The head is big with a wide mouth. The canines (pair of pointed teeth located in the front of the mouth on both jaws) and incisors (four front teeth, situated between the canines on both jaws) look like tusks and grow continuously throughout the hippo's lifetime.

The nostrils, eyes, and ears are located high on the face, which allows the animal to remain submerged for a long time with very little of its body showing. The hippo has a multi-chambered stomach, which allows for fermentation (breakdown) of food for more efficient digestion.

GEOGRAPHIC RANGE

Hippos live throughout Africa.

HABITAT

Common hippos like deep freshwater locations during the day, but venture out of the water at night to graze. The pygmy hippo lives in the forest and spends its day near or in water. Water is important to the hippo because if it can't submerge itself, its skin will crack from dehydration and overheating.

DIET

Hippos are vegetarians and eat mainly grasses, though the pygmy hippo also feeds on fruits and ferns. All hippos eat by nipping off the vegetation with their powerful lips. They eat about 88 pounds (40 kilograms) of grasses each night.

BEHAVIOR AND REPRODUCTION

Hippos do not feed in groups (with the exception of mother-offspring) because they are largely immune to predators and so are able to forage without fear of attack. Male hippos are in charge of home ranges, which they keep for four years in rivers and at least eight years in lakes. There have been reports of hippos retaining the same range for the entire span of their lives, twenty to thirty years. Herds average ten to fifteen in size, but vary from two to fifty. Nonbreeding males, though tolerated, are often the victims of territorial fights with breeding adult males. These "bachelor" males tend to live in herds of their own or alone.

Though large, hippos can run 18 miles per hour (30 kilometers per hour) when threatened, and they are able climbers. They are not able to jump and won't even attempt it.

Both hippo species mate and give birth in the water, but the pygmy hippo also mates and gives birth on land. Pregnancy lasts 227 to 240 days and results in the birth of a single calf. Calves nurse (drink mother's milk) underwater. Male hippos begin breeding between the ages of six and fourteen, whereas females are ready to breed between the ages of seven and fifteen. Calves are usually born in the rainy months.

Healthy adult hippos do not fall prey very often, but young hippos and old or sick hippos are in danger of being killed by lions, hyenas, and crocodiles.

HIPPOPOTAMUSES AND PEOPLE

Hippos are valued as a food source in Africa. Their teeth provide a high-quality ivory, and their hides are also of value.

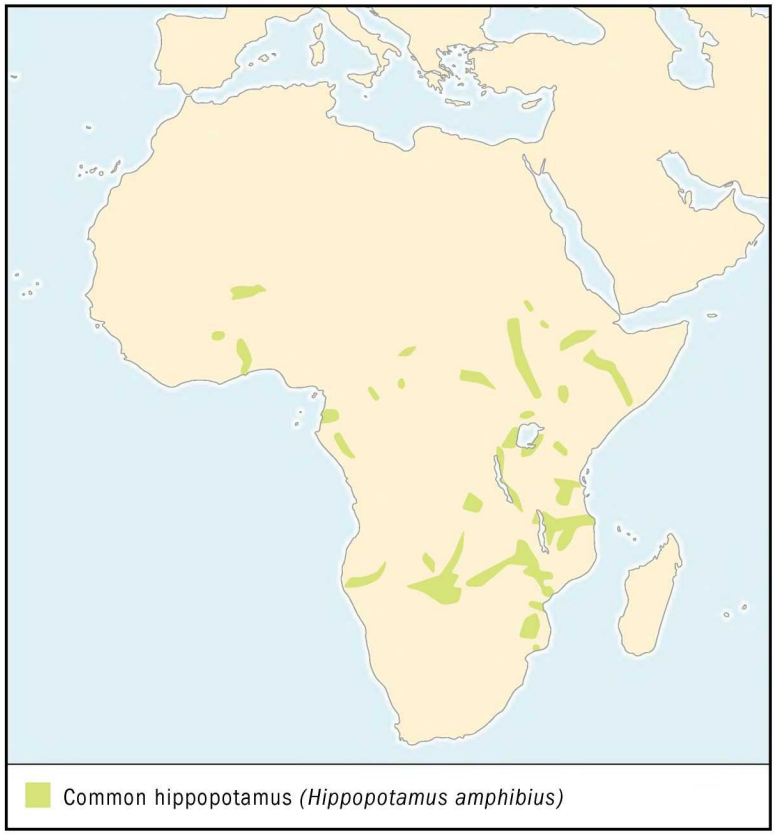
HIPPO TRIVIA

- The common hippo is the second largest living land animal, surpassed only by the Indian rhinoceros.
- The word "hippopotamus" means "river horse."
- Unlike other mammals, it is the female hippo who chooses a mate. If a male hippo does not treat her with respect upon approach, she will not choose him!
- Mother hippos punish their babies by rolling them over with the mothers' heads or even slashing them with mothers' tusk-like teeth.
- When hippos fight, their goal is to break the front leg of their rival so that it can no longer walk to feed.
- Hippos use the same trails over and over to travel on their ranges. These trails can become five to six feet deep, literally turning into tunnels.
- Since hippos are often born underwater, babies can swim the instant they're born.

Hippos are considered one of the most dangerous animals in Africa because they have no fear of humans and are aggressive. They also raid and damage agricultural crops.

CONSERVATION STATUS

The pygmy hippo is listed as Vulnerable, facing a high risk of extinction, dying out, by the IUCN, and two other species are Extinct. The common hippo has a healthy population, but is vulnerable to extinction in West Africa. The primary threat to hippos is loss of habitat.

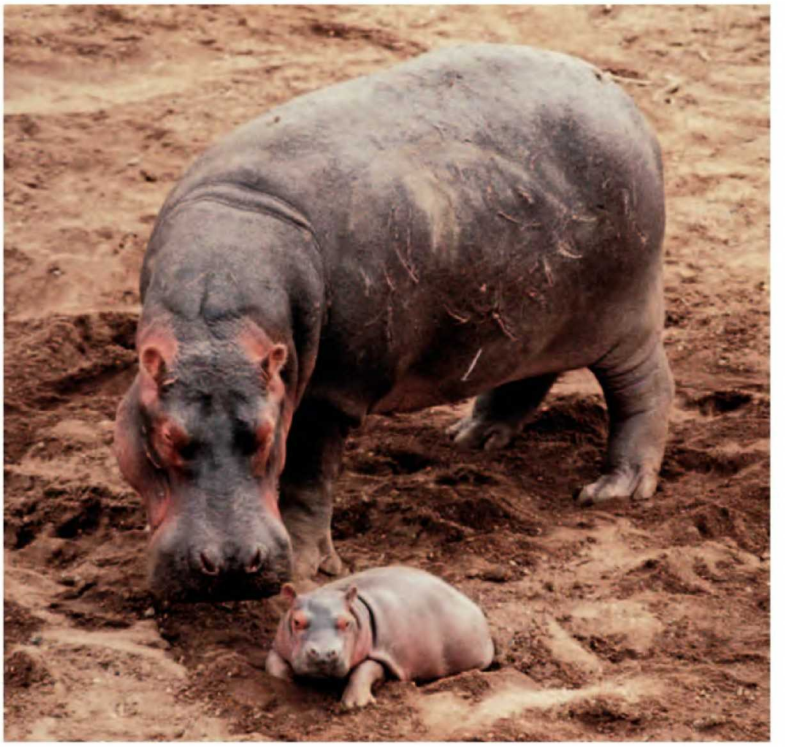


SPECIES ACCOUNTS

COMMON HIPPOPOTAMUS
Hippopotamus amphibius

Physical characteristics: The common hippo measures up to 106 inches (270 centimeters) in length and has a shoulder height of 54 to 60 inches (137 to 152 centimeters). It weighs up to 4,000 pounds (1,800 kilograms).

Geographic range: Although this hippo is found in thirty-five sub-Saharan countries, many of those populations are small, especially in West Africa. So, there aren't as many common hippos as it might seem there would be. Zambia, Tanzania, and the Democratic Republic of the Congo have larger populations of this species.



Common hippopotamus calves stay with their mothers until the next calf is born. (© Stephen J. Krasemann/Photo Researchers, Inc. Reproduced by permission.)

Habitat: The common hippo needs water deep enough to keep its body wet or the skin will crack from overheating. For the same reason, it enjoys wallowing in mud. Hippos leave the water at night to feed, sometimes traveling as far as 20 miles (32 kilometers) in one night.

Diet: The common hippo grazes on short grasses. The grasses become known as hippo lawns because they are nipped off so close to the ground. There has been one case of cannibalism (eating one's own species) documented.

Behavior and reproduction: The hippo is a difficult species to study because it is aggressive toward humans. The male common hippo is territorial in the water, where he defends mating rights with the female hippos in his range, but he is not territorial on land.

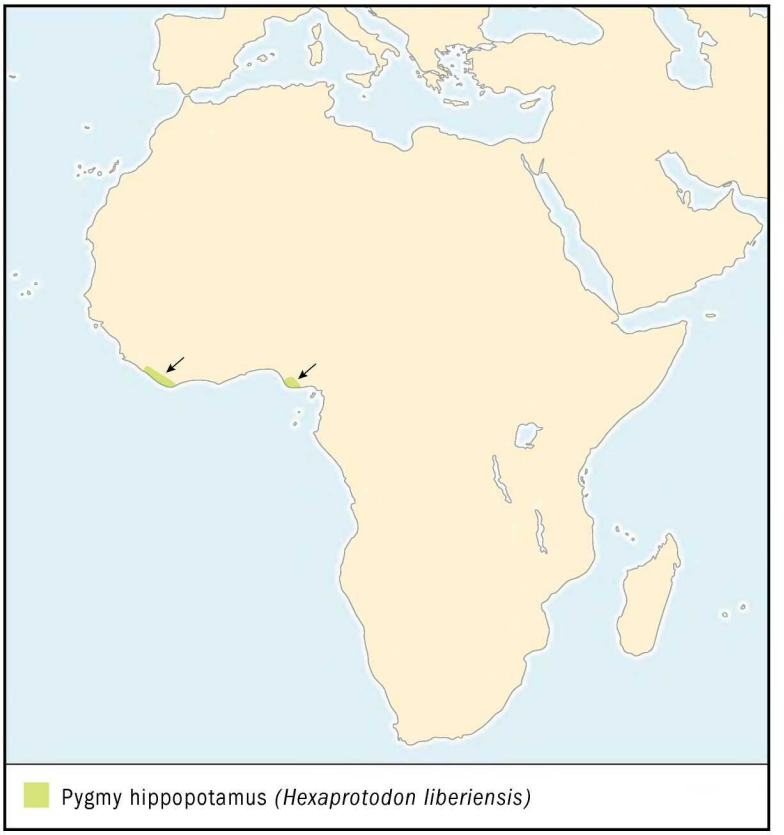
Hippos are known for their bellowing (shouting), but we don't know what role the bellowing plays in communicating between individuals. They also have at least three distinct calls underwater.

Common hippos mate and give birth in the water. Pregnancy lasts 240 days, at the end of which the female seeks solitude in the water. We do not know how long baby hippos nurse (drink mother's milk),

but calves remain with their mothers until after the birth of the next calf. Common hippos are polygamous (puh-LIH-guh-mus; have more than one mate).

Common hippopotamuses and people: This species is highly dangerous to humans, particularly fishermen who invade their territories. It raids crops and is particularly fond of rice. Humans hunt the common hippo for its meat and ivory.

Conservation status: Though not listed by the IUCN, the total number of common hippos is low, especially in West Africa, where populations are as low as fifty. In order to rule out extinction, populations need to number at least five hundred in any given region or area. ■



PYGMY HIPPOPOTAMUS
Hexaprotodon liberiensis

Physical characteristics: Measures 5 to 6 feet (1.5 to 1.8 meters) in length and weighs 350 to 600 pounds (159 to 272 kilograms). Though similar to the larger common hippo in body shape, the pygmy's head is proportionately smaller. Also, its eyes, ears, and nostrils do not sit as high on the head. Its legs and neck are longer, and the skin is closer to black than brown.

Geographic range: Found in Liberia, Guinea, Ivory Coast, and Sierra Leone.

Habitat: Pygmy hippos are forest animals that spend the day in or near water and roam the land at night to forage. They also live along swamp borders.



Pygmy hippopotamus calves stay with their mothers for about three years. (Tom Brakefield/ Bruce Coleman Inc. Reproduced by permission.)

Diet: Feeds on a diet of fruits, ferns, and grasses.

Behavior and reproduction: These hippos are usually found in pairs, as they are not as social as common hippos. They also are not as aggressive.

Females give birth either on land or in water after a pregnancy lasting 190 to 210 days. Each delivery results in one calf that weighs an average of 12.6 pounds (5.7 kilograms). Unlike the common hippo calves, pygmy calves will not follow their mothers on food expeditions, but stay in hiding and wait to be nursed two or three times a day. By the age of five months, they weigh ten times more than they did at birth. These calves live with their mothers until the age of three years.

Pygmy hippopotamuses and people: Pygmy hippos are not a threat to humans but have been known to injure hunters and damage crops.

Conservation status: Listed as Vulnerable by the IUCN due to hunting and habitat loss from logging. Several national parks in the Ivory Coast and Guinea have been established to give protection to the pygmy hippo. ■

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CAMELS, GUANACOS, LLAMAS, ALPACAS, AND VICUÑAS

Camelidae

Class: Mammalia
Order: Artiodactyla
Family: Camelidae
Number of species: 6 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The average height of camels is 6 to 7.5 feet (1.8 to 2.3 meters), and vicuñas, guanacos, llamas, and alpacas are 3 to 4.3 feet (.90 to 1.3 meters) tall. Camels weigh between 1,000 and 1,800 pounds (454 to 816 kilograms); vicuñas, guanacos, llamas, and alpacas weigh between 88.8 and 265.5 pounds (40 to 120 kilograms).

Camelidae have long, thin necks, small heads, and slender snouts. Their tough mouths allow them to eat thick grasses and thorny plants without pain. Camels have kneepads which protect them as they fold their legs beneath their bodies to rest.

Each foot has two flat toes. Their thick coats protect them from cold temperatures, and only the camel sheds its hair as temperatures rise. Camels also have special muscles that allow them to close their nostrils and lips for long periods of time so that they do not breathe in large amounts of sand or snow.

Camels also have humps that store fat as a source of energy when food reserves are low. The better they eat, the fatter the hump or humps grow.

GEOGRAPHIC RANGE

Camelidae are found from the Arabian Peninsula to Mongolia, and in western and southern South America. Alpaca and llamas are now found throughout North America since they have become popular ranch animals.

HABITAT

Wild camelids live in the desert and semi-arid environments that have a long dry season and short rainy season. Guanacos live in warm and cold grasslands up to 13,120 feet (4,000 meters) above sea level, while vicuñas live in grasslands of the Andes Mountains above 11,482 feet (3,500 meters).

DIET

Camelids need very little water. They graze on various grasses and salty plants, which help them retain what little water they do drink. Dromedaries and guanacos drink salty water no other animals could tolerate.

Both kinds of camel eat thorny desert shrubs as well as any other vegetation found in desert or semi-arid regions. Like some other mammals, they do not chew their food completely before swallowing it. After eating, they regurgitate, bring up from the stomach, the food, re-chew it, swallow again, and digest it.

BEHAVIOR AND REPRODUCTION

Camelids are active during the day. All species will spit or kick when threatened.

Bactrian camels usually live in herds of up to thirty individuals, concentrating in the mountain areas where there are springs and snow. Dromedaries form three types of herds during the mating season. One type is that comprised of bachelor, or single, males. The next is made up of female-offspring couples, and those made up of up to thirty adult females along with their offspring, led by one adult male. Vicuñas maintain family groups of one territorial male and subadults as well as females and offspring less than a year old. The guanaco population lives in three social groups as well including families with one adult male and one or several females with their most recent offspring, male groups whose numbers may reach fifty, and solitary males. Because they are now raised domestically, llamas and alpacas have lost their social structure.

Camelids have numerous mates and do not bond with one another. After twelve to thirteen months of pregnancy, female camels give birth to one newborn, which can walk within a few hours of birth. Young remain with their mothers until the age of two years but they not considered adults until the age of five years. Female llamas and vicuñas also give birth to one offspring

ALPACAS: BIG BUSINESS

According to Lisa Olsen, an alpaca rancher in North Carolina, pregnant female alpacas can sell for $12,000 to $22,000 each. That is a nice profit considering that they are not very expensive to feed, since they live on hay, grass, and grains.

According to the Alpaca Owners and Breeders Association, the record for the highest dollar sale of a male alpaca was set in 2002, when a sire sold for $265,000. Like any other livestock ranching, alpaca breeding is a business, and it is gaining popularity.

after an eleven-month pregnancy. The babies stay with the mother until one year of age.

Pumas and foxes are the primary predators of vicuñas and llamas, while alpacas fall prey to pumas and leopards. Camels have no known predators.

CAMELIDS AND PEOPLE

Camelids have been used for transportation as well as a food and clothing source for about seven thousand years. They are especially valuable as transportation in the North African and Asian deserts because they can travel up to 100 miles (161 kilometers) without water. They are also able to carry heavy loads and still keep a steady pace.

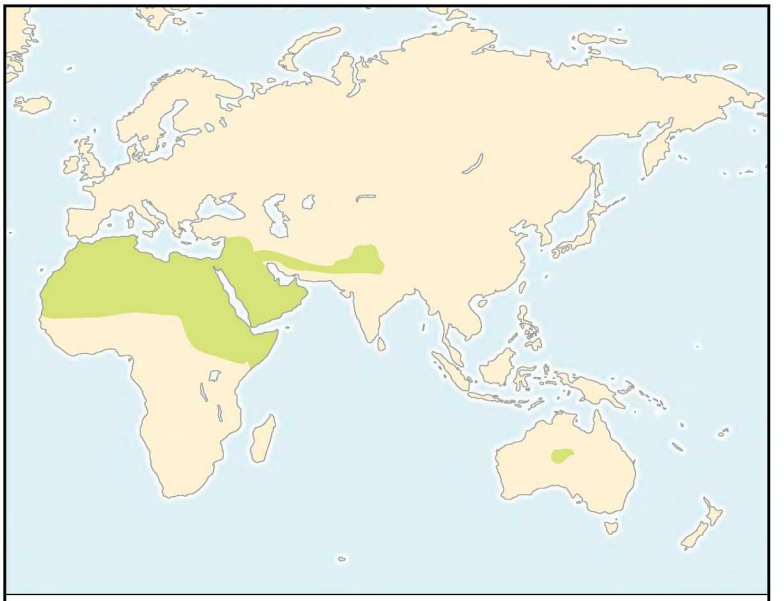
Camels are a sign of wealth to some desert populations. These species provide humans with milk, meat, and wool used to make clothing, blankets, and tents. The fat can be removed from their humps and melted for use in cooking.

Llamas and alpacas were domesticated thousands of years ago. Alpacas were first imported to the United States in 1984, and in 2004 there were more than fifty thousand registered alpacas in the United States. Llamas are believed to be domesticated, tamed, by about 4,000 B.C.E.

Vicuñas were used in religious rituals in the Inca empire. Guanacos provided food, hides, and fibers for South American cultures, but they have never been domesticated.

CONSERVATION STATUS

Camels, alpacas, and llamas are not listed by the World Conservation Union (IUCN) because they are domestic animals. However, wild Bactrian camels are listed as Critically Endangered, facing an extremely high risk of extinction in the wild, due to heavy hunting and competition with domestic livestock for water and land. Vicuñas and guanacos are listed as Vulnerable, facing a high risk of extinction in the wild. Vicuñas had been hunted almost to the point of extinction for their fur and meat.



Dromedary camel *(Camelus dromedarius)*

DROMEDARY CAMEL
Camelus dromedarius

Physical characteristics: Dromedary camels are 7 feet (2.1 meters) tall at the hump and weighs 1,600 pounds (726 kilograms). Their long neck is curved, and they have one hump. Hair is caramel brown or sandy brown, though shades can range from nearly black to white. The coat is long at the throat, shoulders, and hump area, and blocks the heat of the sun. The tail is short and the eyelashes are long.

Geographic range: Dromedary camels are found in dry regions of the Middle East through northern India, and in Africa, primarily the Sahara Desert. This camel has been introduced to Australia.

Habitat: Dromedary camels like the desert where temperatures often rise above 120°F (49°C).

Diet: Dromedary camels eat thorny plants, dry grasses, and salty plants that grow in the desert. Since they eat only a few leaves from each plant, their food supply is relatively stable. Because they do not drink much water, dromedary camels need six to eight times more



A camel's hump is mostly fat, which is used by the body when food is scarce. (© Dave G. Houser/Corbis. Reproduced by permission.)

salt than other animals. Salt helps the body retain water. Dromedary camels do not sweat easily, so they lose moisture more slowly than other animals. Dromedary camels have been known to drink one-third of their weight in water within ten minutes.

Behavior and reproduction: Families include two to twenty individual camels, including one dominant male, several females, and offspring. The dominant male chases away competitor males by pushing them, snapping, and spitting.

Females are ready to mate by three years, males by six years. Pregnancy lasts up to fifteen months. Mothers nurse, feed with mother's milk, their offspring for one year. Because they have no predators, dromedary camels live anywhere from thirty to forty years.

Dromedary camels and people: Dromedary camels have been hunted for their meat and used as transportation for thousands of years. They are also valuable for their milk, wool, leather, and manure, which is used for fuel.

Conservation status: There are about fourteen million dromedary camels across the globe. They are not threatened. ■



ALPACA
Lama pacos

Physical characteristics: Alpacas reach 3 feet (.90 meters) high and weigh 154.3 pounds (70 kilograms). They have small heads, short, pointed ears, and extremely long necks. Except for the face and legs, the entire body is covered by long, thick, soft wool. Legs are short. Alpacas are generally a dark chocolate or near-black color, but the fibers used to make clothing come in twenty-two colors. Their coats are water repellant and protect them from solar radiation.



Young alpacas are called "cria." They usually nurse for five or six months. (Francisco Erize/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Alpacas live in the Andes of Peru, Bolivia, and Chile. They live in high altitudes ranging from 9,840 to 15,750 feet (3,000 to 4,800 meters).

Habitat: Alpacas prefer grasslands of the high plateaus of the Andes.

Diet: Alpacas feed on grasses, shrubs, and trees. The digestive system of an alpaca is highly efficient, which allows them to thrive on poor vegetation where other animals could not.

Behavior and reproduction: Alpacas are gentle, even-tempered animals. They are friendly and show little sign of aggression, a fact that makes them easy to domesticate and raise commercially.

Females mate for the first time around two years, males around three years. Pregnancy lasts 324 to 345 days and results in one offspring, called a cria. Cria nurse for five or six months. The average lifespan is twenty to twenty-five years. Primary predators of wild alpacas are pumas and foxes.

Alpacas and people: When Spanish explorers arrived in Peru, they found the Incan culture to be based on textiles. In an effort to conquer the native peoples, the explorers slaughtered 90 percent of the alpaca population. As the natives went into hiding or escaped, they

took with them both sexes of alpacas, thereby keeping the species alive. Today alpacas are ranch-raised for their wool. Their friendly personalities and resistance to disease make them easy to care for.

Conservation status: Alpacas are not threatened. There are about 3.5 million alpacas in the world. ■



Llama *(Lama glama)*

LLAMA
Lama glama

Physical characteristics: The average height of a llama is 3.8 feet (1.2 meters). They weigh around 309 pounds (140 kilograms). Legs are long, and the coat is a reddish-brown. Face, ears, and legs can be tainted black, white, or a mix of other colors.

Geographic range: Llamas live in Peru, Argentina, Chile, Bolivia, Ecuador, and Colombia.



Llamas are typically found in herds, such as this one near Lake Titicaca, Bolivia. (Norman Owen Tomalin/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Llamas live in high-altitude grasslands up to 13,120 feet (4,000 meters).

Diet: Llamas eat grasses and salty plants.

Behavior and reproduction: Llamas do not touch one another, not even in mother-offspring relationships. They are very herd-oriented and travel in groups. Llamas live to be older than twenty years.

Llamas are believed to have numerous mates. One male can mate with up to thirty females. Pregnancy lasts about eleven months.

Llamas and people: Llama fiber is used in making ropes, cowboy hats, and rugs. Their skin is used to make leather goods, and their bones make instruments for weaving looms. Their meat is low in fat, and because they move rather slowly, llamas are easy to catch. They make great pack animals and are used throughout the world for commercial mountain treks.

Conservation status: Llamas are not threatened. There were around 2.5 million llamas throughout the world in 2004. ■

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CHEVROTAINS
Tragulidae

Class: Mammalia
Order: Artiodactyla
Family: Tragulidae
Number of species: 4 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Chevrotains look like tiny hornless deer with small heads, tapered snouts, skinny legs, and thick bodies. From head to rump, they measure 17 to 19 inches (44 to 85 centimeters), and they weigh 4.4 to 29 pounds (2 to 13 kilograms). Their backs are rounded and somewhat higher toward their rear ends, like the backs of rats. Their ears are tiny and covered with hair, which is short and thick over their entire body. The coat is reddish brown to brown with patterns of white and brown spots and stripes on various areas, depending on the species. Males have tusk-like teeth on top, but females have small, cone-shaped canines, teeth on either side of the four front teeth with one set on each jaw. Chevrotains have three fully developed stomach chambers, which allows for efficient digestion. Each foot has four toes.

GEOGRAPHIC RANGE

Chevrotains are found in Southeast Asia and east central Africa.

HABITAT

Asian chevrotains live in rainforests, lowland forests, mangrove forests, and thickets. They prefer areas with thick vegetation during the day and venture into open area at night. The vegetation provides refuge from predators. African chevrotains live in tropical rainforests and thick growth along water courses. This species escapes predators by diving into the water.

AN UNLIKELY TRICKSTER

Every culture has folklore, stories that have been passed down that provide explanations for events and natural phenomena. Most folklore includes a trickster, a creature who is able to trick other characters. Tricksters are usually animals that are small compared to the larger, heroic animals of folktales. But, they usually come out the wiser of the two.

A famous Southeast Asian folktale is about a mouse deer that outwits a fierce crocodile. The tale was put into print by Kathy and John Morris and I Nyoman Kartana in 1999 in the book *Mouse Deer and Crocodile: An Asian Folktale*.

DIET

Chevrotains eat grasses and leaves, favoring young shoots, fallen fruits, and seeds. They have been seen eating small animals occasionally.

BEHAVIOR AND REPRODUCTION

Because they are shy and come out only at night, chevrotains are difficult to study. They are easily frightened and jump at the first sign of danger. Chevrotains are loners and socialize only during mating and while rearing young. The exception to this is the lesser Malay mouse deer, which is monogamous (muh-NAH-guh-mus), has only one mate.

Chevrotains are territorial and mark their ranges using sounds and scent marks including feces, urine, and glandular secretions. Mouse deer bleat softly, like a lamb, when alarmed. Although they will fight, bouts are short and infrequent. Males fight with their tusk-like teeth.

Females are more active than males. All chevrotain sit on their hind legs or crouch with all legs folded to rest.

Little is known about the mating system of chevrotains. Gestation, pregnancy, lasts six to nine months and results in the birth of one offspring each year. Babies are nursed, fed with mother's milk, until the age of three to six months and can stand on their own within an hour after birth. Chevrotains are able to mate after nine to twenty-six months, and this is when the young leave home. These animals live to an age of eleven to thirteen years. Their primary predators are large birds of prey and reptiles.

CHEVROTAINS AND PEOPLE

Regardless of where they live, chevrotains are hunted by native populations for food. Some people keep them as pets. Although some zoos have had success in breeding water chevrotains, these animals have proven difficult to breed in captivity.

CONSERVATION STATUS

All four species are threatened by hunting and habitat destruction. The water chevrotain is listed by the World Conservation Union (IUCN) as Data Deficient, meaning there is not enough population information to evaluate its risk, and only one subspecies is Endangered, facing a very high risk of extinction in the wild.



SPECIES ACCOUNT

LESSER MALAY MOUSE DEER
Tragulus javanicus

Physical characteristics: The lesser Malay mouse deer is neither mouse nor deer, but it is the smallest living artiodactyl (ar-tee-oh-DACK-tuhl), weighing between 3.3 and 5.5 pounds (1.5 and 2.5 kilograms) and measuring 18 to 22 inches (45 to 55 centimeters) from head to rump. The tail is about 2 inches (5 centimeters). The large eyes are surrounded by a lighter ring of fur. The upper coat is brown tinged with orange, and the underside is white. Females are somewhat smaller than males.

Geographic range: Lesser Malay mouse deer are found in Malaysia, Cambodia, southwestern China, Indonesia, Borneo, Laos, Myanmar, Singapore, and Thailand.



Lesser Malay mouse deer were thought to be only active at night, but researchers have found that they are somewhat active during the day, as well. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Lesser Malay mouse deer live in lowland forests. They are also found near water in thick vegetation, hollow trees, and among rocks.

Diet: Lesser Malay mouse deer eat leaves, buds, grass, and fallen fruits.

Behavior and reproduction: Recent studies suggest that this species, once believed to be nocturnal, active at night, and solitary, is actually somewhat active during the day and tends to form monogamous pairs. Lesser mouse deer are territorial and routinely mark their territory. When upset, this species will tap the ground with its hooves at a rate of seven times per second. They will also emit a shrill cry when frightened, but otherwise are silent.

Lesser Malay mouse deer are ready to breed at five to six months. Pregnancy lasts four to five months and produces one fawn, rarely two. The young can stand within thirty minutes of birth and the mother nurses her baby while standing. Offspring are weaned, removed from mother's milk, between ten and thirteen weeks. Within 55 to 155 minutes after they give birth, female lesser Malay mouse deer are able to get pregnant again.

Lifespan of the lesser Malay mouse deer is up to twelve years. Their predators include reptiles and large birds of prey such as owls and hawks.

Lesser Malay mouse deer and people: This species is hunted for its smooth skin, which is used for the production of leather goods such as wallets and handbags.

Conservation status: Although not threatened according to the IUCN, the lesser mouse deer population is threatened by habitat destruction and hunting. Their range and numbers have increased due to conservation efforts. ■

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family CHAPTER

DEER
Cervidae

Class: Mammalia
Order: Ardiodactyla
Family: Cervidae
Number of species: 57 species

PHYSICAL CHARACTERISTICS

Deer have long bodies and long legs. Coats are various shades of brown; some species have white fur to blend in with the arctic environment. They have an enhanced sense of smell. All are capable swimmers and fast runners. Males of nearly every species have velvet-covered antlers that they shed each year; in some species, females also have antlers. Hooves help them navigate snow, but deep snows can lead to death due to lack of mobility, which results in predation and starvation. Males are usually larger than females. Deer species vary in weight from 22 pounds (10 kilograms) to 1,764 pounds (800 kilograms).

GEOGRAPHIC RANGE

Deer are found everywhere except Australia and Africa.

HABITAT

Depending on the species, deer live in a variety of habitats. Most deer species prefer areas with thick forest undergrowth.

DIET

Deer are herbivores (plant eaters) that eat lichens (fungus found on trees), leaves, twigs, shoots, berries, and grasses. They have four stomach chambers, which allow them to chew and swallow their food and then regurgitate (vomit) it later for further chewing. This makes digestion more efficient.

BEHAVIOR AND REPRODUCTION

Some deer are solitary (lone), but most species are polygynous (puh-LIH-juh-nus; one male to several female mates). Depending on species, they live in mother-offspring pairs or herds numbering into the tens of thousands of individuals.

Gestation (pregnancy) periods vary depending on species, but usually single births, sometimes twins, result. Calves are nursed (fed mother's milk) for a short time. Most babies are born able to walk, even run, within hours.

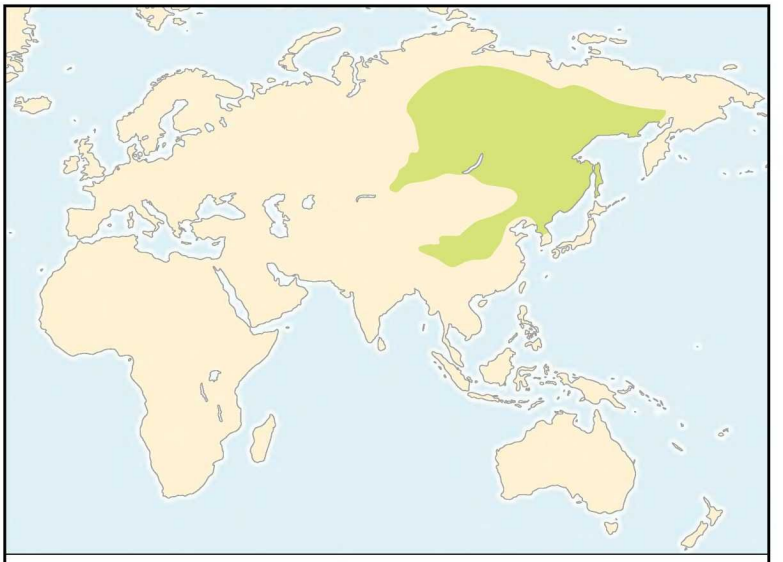
Predators include wolves, grizzly bears, coyotes, mountain lions, foxes, and wild cats. Life expectancy varies by species. Some deer live an average of two years, while others can live past the age of fifteen years.

DEER AND PEOPLE

A number of species are important game animals throughout the world. They are hunted for meat and sport, and the larger species are often a source of subsistence for native cultures that herd them.

CONSERVATION STATUS

Of the fifty-seven species, twenty-seven are included on the IUCN Red List. One is Extinct, died out; one is Critically Endangered, facing an extremely high risk of extinction; four are Endangered, facing a very high risk of extinction; six are Vulnerable, facing a high risk of extinction; four are Near Threatened, not currently threatened, but could become so; and eleven are considered Data Deficient, meaning there is not enough information to determine a conservation status. Reason for threats include overexploitation by humans as well as habitat destruction.



SIBERIAN MUSK DEER
Moschus moschiferus

Physical characteristics: The Siberian musk deer weighs 18 to 36 pounds (8 to 16 kilograms) and measures 24 to 39 inches (60 to 100 centimeters). Coat is various shades of brown, and there are fuzzy whitish yellow spots on the neck and chest, with rows of brighter spots on both sides of the body.

Geographic range: This musk deer is found in eastern Asia.

Habitat: This deer needs plenty of lichens (LIE-kenz) to eat and shelter from predators. It lives in coniferous forests with dense undergrowth and ground moss. Siberian musk deer can move easily on top of snow because of their light weight. Deep, loose snow is difficult for them to navigate and can kill them.

Diet: Lichens are the primary food source, comprising 80 percent of their diet in winter. They also eat fir needles, twigs, leaves, berries, and mushrooms in winter. Musk deer have been known to migrate up to 20 miles (35 kilometers) for food. Lichens aid digestion in summer, at which time they also eat flowers, moss, shoots, and grass.



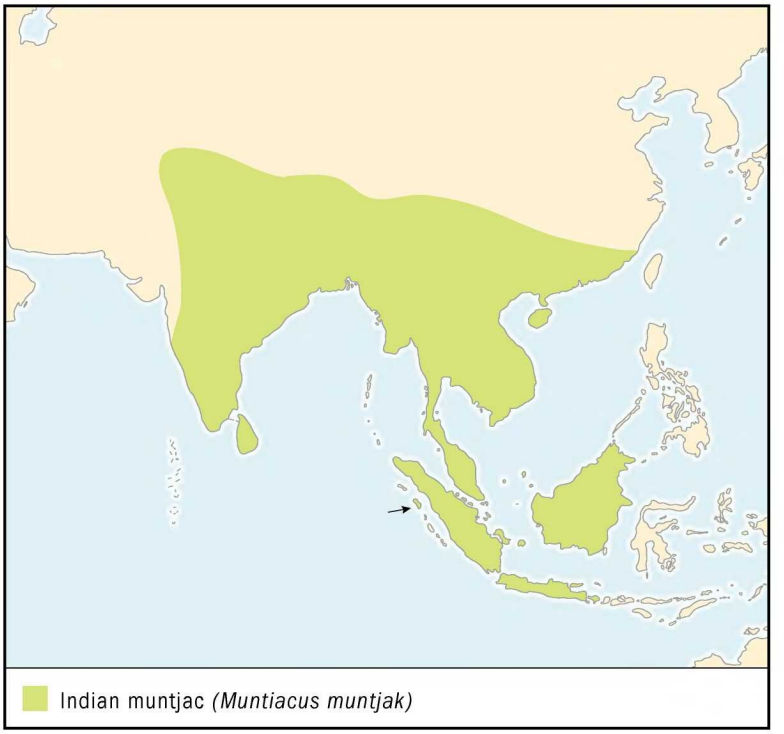
The Siberian musk deer's highly arched back distinguishes it from other species of deer. (© M. K. Ranjitsinh/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: Five to seven females and their offspring live together on a home range. This home range overlaps with that of a dominating male. The more important or stronger females live at the center of the range, and as old deer die, younger ones move toward the center. Musk deer are nocturnal (active at night). Although fast runners, they tire quickly, so they escape predators usually by jumping and leaping as they run.

These polygamous (puh-LIH-guh-mus) animals give birth in April, May or June, depending on the region. Fawns are hidden for up to two months. Primary predators include lynx, wolverine, foxes, wolves, tiger, bear, and the yellow-throated marten.

Siberian musk deer and people: Humans hunt this species for their musk, which is produced by an abdominal gland in males and valued for its cosmetic and medical uses.

Conservation status: Listed as Vulnerable by the IUCN due to overhunting. ■



INDIAN MUNTJAC
Muntiacus muntjak

Physical characteristics: Measures 35 to 53.2 inches (89 to 135 centimeters) long with a shoulder height of 15.7 to 25.6 inches (40 to 65 centimeters). Weight ranges from 33.1 to 77.2 pounds (15 to 35 kilograms), with males being larger than females. Males have small antlers about 6 inches (15 centimeters) long. Females have small knobs where antlers would be. Coat coloration is gold and white, with limbs and face being dark to reddish brown. Indian muntjacs have small ears and tusk-like upper canines measuring 1 inch (2.5 centimeters) in males.

Geographic range: Found in northeastern Pakistan, India, Sri Lanka, Nepal, southern China, Vietnam, Malay Peninsula and some nearby islands, Riau Archipelago, Sumatra and Nias Island to the west, Bangka, Belitun Island, Java, Bali, and Borneo.



Indian muntjacs eat some small animals. They catch them by biting with their canine teeth and "punching" them with their strong front legs. (© W. Perry Conway/Corbis. Reproduced by permission.)

Habitat: Indian muntjacs live in tropical rainforests, deciduous forests, and scrub forests as well as hilly areas, grasslands, and savannas. They must remain near a water source.

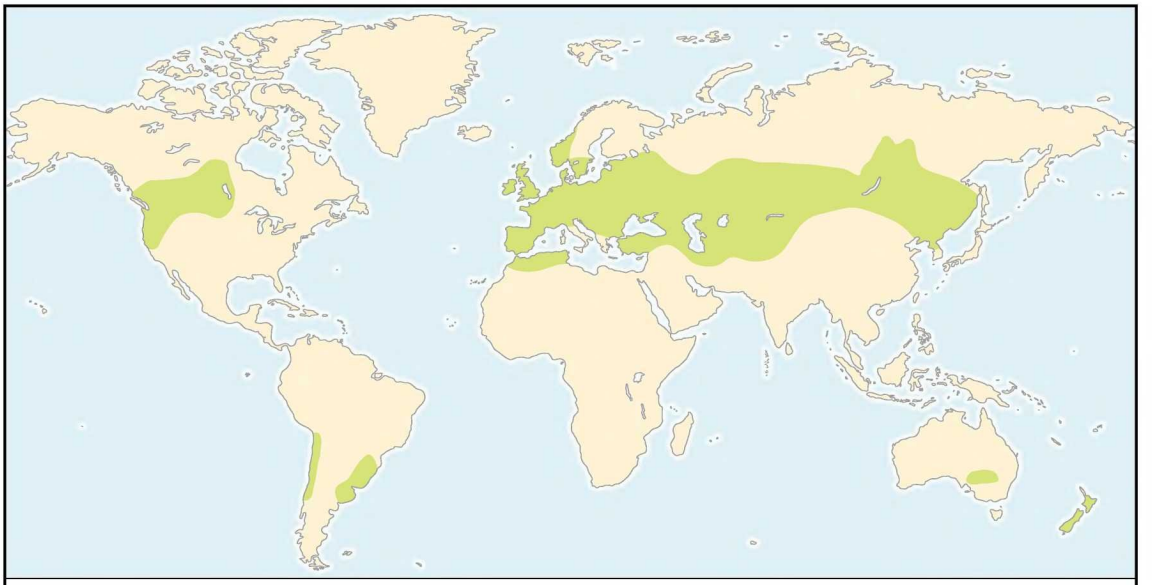
Diet: Feed on herbs, fruit, birds' eggs, small animals, seeds, sprouts, and grasses found at the edge of the forest or in a clearing. They catch animals by biting with their canines and punching with their strong forelegs.

Behavior and reproduction: Although they sometimes move in pairs or small groups, adults are solitary (lone). When in danger of predation, Indian muntjacs bark like dogs, sometimes for more than an hour, to scare away the predator. Pythons, jackals, tigers, leopards, and crocodiles are the primary enemies of this deer.

This deer is ready to breed between the ages of six and twelve months. After a six-month pregnancy, females give birth to one fawn, rarely two, which remains with the mother until the age of six months. Though no one is sure how long muntjacs live in the wild, this species lives about seventeen years in captivity.

Indian muntjacs and people: Muntjacs are hunted for their meat and skins, and hunters themselves make the barking sound of the muntjac to warn other hunters of approaching danger, such as a tiger. Muntjac populations are a threat when found in larger numbers because they tear bark from trees, which takes a toll on sources for humans' shelter and fuel.

Conservation status: The Indian muntjac is not considered threatened. ■



Red deer *(Cervus elaphus)*

RED DEER
Cervus elaphus

Physical characteristics: Males weigh up to 480 pounds (190 kilograms) and stand up to 48 inches (120 centimeters) high at the shoulder. Females weigh up to 240 pounds (110 kilograms) and stand up to 44 inches (110 centimeters) high at the shoulder. The coat is a rich red color that changes to grayish brown in the cold months. The rump sports a creamy white patch and short tail. Males have antlers that fall off from February to April each year. New ones grow in August.

Geographic range: Found in western Europe, northwest Africa, Asia to western China, and northwestern America. Red deer have been successfully introduced to New Zealand.

Habitat: Red deer prefer to live in forested areas, but in regions where forests have been cleared, this species has adapted. They can be found in open plains, marshlands, mountain terraces, and meadows.

Diet: Red deer feed mostly on twigs, leaves, and stems of broadleaf trees and shrubs, needles and branches of fir trees, herbs, lichens,



Red deer stags (adult males) roar at other males and then fight to get the chance to mate with a group of females. (Hans Reinhard/Bruce Coleman Inc. Reproduced by permission.)

fruits, and fungi. They enjoy willow, oak, poplar, and mountain ash trees. Those found in North America depend on western hemlock, fir, western red cedar, willow, and ferns. They also eat skunk cabbage, wall lettuce, and red elderberry.

Behavior and reproduction: Active throughout a twenty-four-hour cycle, red deer are most active at dawn and dusk. They live in small groups within woodlands, where the forest covering offers more protection. In open spaces, they live in larger herds. Males and females live separately except during breeding season, which is in October. At this time, herds separate and males gather together a group of females. During breeding (also known as "rutting") season, males become more aggressive and less tolerant of one another. Rival stags will roar at one another, lock antlers, and push at each other until one stag "wins" the group of up to forty or so females. Now and then stag antlers will lock, and the two deer will starve to death. Other than this, stags rarely kill each other in the fight for dominance.

After a pregnancy of thirty-three to thirty-four weeks, females give birth to one calf, which is weaned (taken off mother's milk) between

nine and twelve months. At one-and-a-half years of age, red deer are ready to mate. Stags live to the age of twelve years in the wild, females to ten. Predators include foxes, wild cats, golden eagles, and wolves, which prey on the young.

Red deer and people: This deer is hunted for its meat (venison) and for sport. Teams of red deer pulled coaches in ceremonial processions connected with the hunting goddess Diana in Ancient Rome. Humans are the red deer's primary predator today.

Conservation status: Not threatened. Red deer farming is becoming popular in all regions. Herds in Britain are large enough that they must be culled (reduced in number by selection according to those fittest for survival and reproduction) annually so they do not starve. ■



White-tailed deer *(Odocoileus virginianus)*

WHITE-TAILED DEER
Odocoileus virginianus

Physical characteristics: This is a small deer species, weighing 110 to 300 pounds (50 to 136 kilograms) and measuring 67 to 77 inches (170 to 195 centimeters) long. Summer coat is a foxy-red color. Coat changes to grayish brown in fall, and hairs grow thicker and longer. The underpart of the tail is white, as is the throat, nose, stomach, and area surrounding the eyes. Only males have antlers, but both sexes have scent glands on all four hooves. Although their eyesight and hearing are well developed, they rely on sense of smell to detect danger.



Almost 70 percent of the white-tailed deer's diet consists of tree and shrub leaves and twigs. (© Raymond Gehman/ Corbis. Reproduced by permission.)

Geographic range: This deer is found in southern Canada and all of the United States except for Hawaii, Alaska, and the southwest. Also lives throughout Central America to Bolivia.

Habitat: Although they have adapted to live in a variety of habitats ranging from swamps and farmland to forest, white-tailed deer prefer to live in areas with dense thickets (growths of bushes) and clear edges (for food).

Diet: Almost 70 percent of this deer's diet consists of tree and shrub leaves and twigs. Adults need 5 to 11 pounds (2.5 to 5 kilograms) of food daily. In winter, stored body fat allows them to subsist on 2 pounds (1 kilogram) daily. Though watering places are often at the center of home ranges, this animal can go without water if succulent (water-based) plants are available.

Behavior and reproduction: When sensing danger, this deer will stomp its hooves, snort, and point its tail up to alert other deer. Able to run at speeds of up to thirty miles per hour, these deer are also able jumpers and swimmers. Home ranges are usually less than one

square mile (2.59 square kilometers). Females live alone unless they are mothers, and bucks live in small herds of three or four individuals except during mating season.

White-tailed deer are polygynous and begin breeding in late September into December. Pregnancy lasts 188 to 222 days and usually results in the birth of twins. Within hours, they nurse and walk around following the mother, though they prefer to hide until around ten days, when they begin eating on their own. They nurse until eight to ten weeks of age. Usual rate of first breeding is two years for both sexes. Mortality rate among white-tailed deer is high, around 30 to 50 percent. Most live to be two or three years old. Predators include bears, mountain lions, wolves, jaguars, and coyotes.

White-tailed deer and people: This species is the most numerous of big game animals in the world. Hunters kill about three million each year, and still the population thrives. White-tailed deer carry Lyme disease, which has become more prevalent among humans, especially in the northeastern states. Some people consider this deer a pest because it gets into yards and eats shrubs, flowers, and other ornamental vegetation.

Conservation status: White-tailed deer are not threatened. ■



SOUTHERN PUDU
Pudu pudu

Physical characteristics: The smallest deer in the world weighs 20 to 33 pounds (9 to 15 kilograms) and stands 14 to 18 inches (35 to 45 centimeters) high at the shoulder. Its thick coat is a reddish brown, and the lips and insides of ears are tinged with orange. Males have short spiked antlers. Body is low to the ground. Eyes and ears are small. The tail of this deer is so small as to be almost nonexistent.

Geographic range: The pudu lives in Argentina and southern Chile.

Habitat: This deer lives in rainforests, bamboo groves, and in mountains. Prefers thickets for protection from wild cats and foxes.

Diet: The pudu eats twigs, leaves, fruits, seeds, and bark. Stands on back legs to reach food if necessary.

Behavior and reproduction: These solitary deer socialize only during mating season. They traverse the jungle via well-worn paths and form dung piles near resting places. Each pudu has a home range of 40 to 60 acres (16.2 to 24.3 hectares).

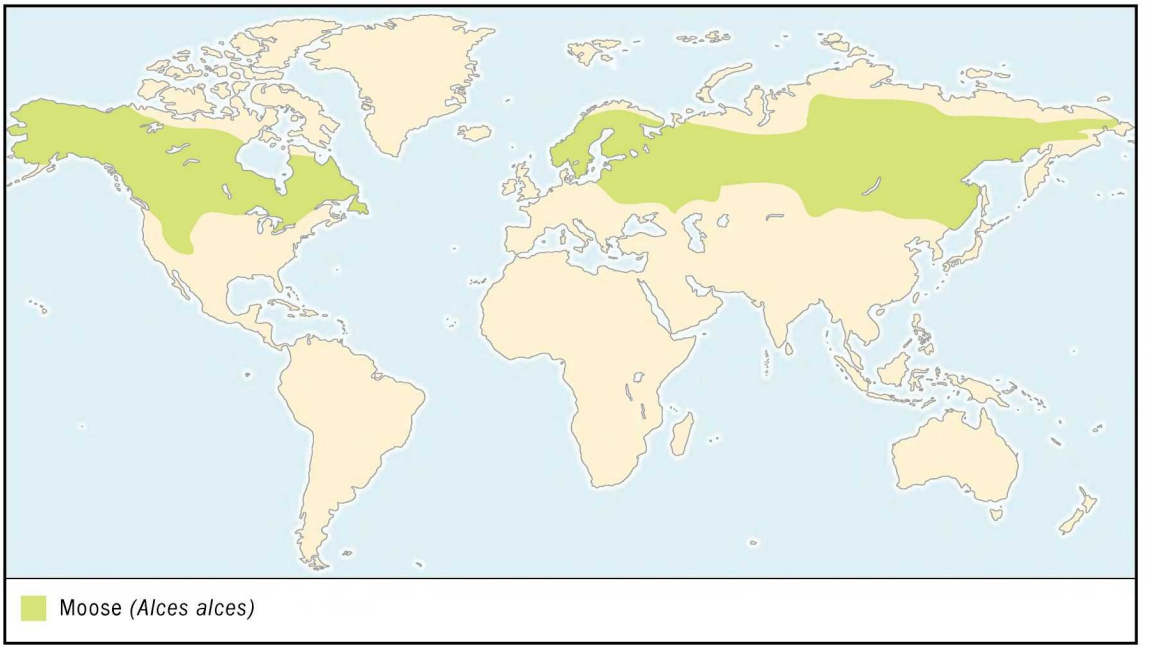
This polygynous deer mates in the fall. Pregnancy lasts about 210 days and results in the birth of a single fawn. Babies nurse for two months. Females are ready to mate at twelve months, males at eighteen. Life expectancy is eight to ten years.



The southern pudu is the smallest deer in the world. (© Tom McHugh/Photo Researchers, Inc. Reproduced by permission.)

Southern pudu and people: Hunted for food and sport.

Conservation status: Endangered due to habitat destruction and domestic dogs. ■



MOOSE
Alces alces

Physical characteristics: Adults weigh 594 to 1,320 pounds (270 to 600 kilograms) and measure 7.9 to 10.5 feet (2.4 to 3.2 meters) long. The antlers of the male are longer than those of any mammal in the world and can measure up to 6.6 feet (2 meters) wide from tip to tip. The head is huge and long, with a square upper lip that hangs over the lower one. Muzzle is hairy. Coat is dark brown, fading to light brown on the long legs. Hearing and sense of smell are excellent.

Geographic range: Moose are found in North America and Eurasia.

Habitat: Moose live in forests where there is snow in winter. They like territory with ponds and lakes. Because they are not able to sweat, moose need to live in cooler climates. In summer, they cool off in water.

Diet: Moose eat bark and branches during winter and enjoy leaves, herbs, and aquatic plants in summer. In winter, adults eat 22 to 30 pounds (10 to 13 kilograms) of food each day; that amount doubles in summer and spring. Moose can also eat toxic plants.



The antlers of the male moose are longer than those of any mammal in the world and can measure up to 6.6 feet (2 meters) wide from tip to tip. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

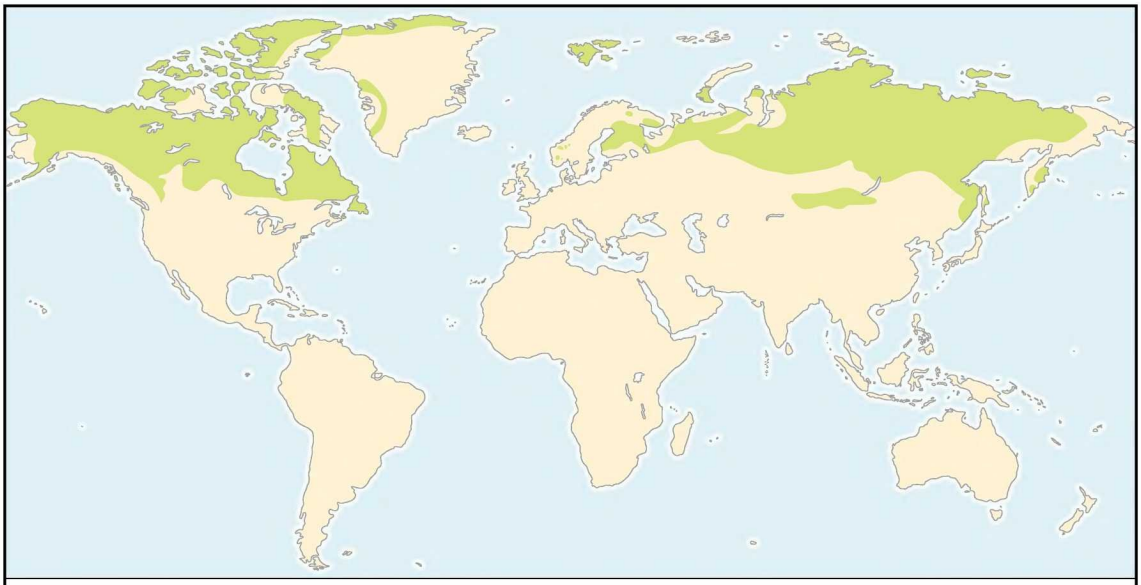
Behavior and reproduction: Moose live alone or in small groups. No social bonding occurs. Moose can run at 35 miles per hour (56 kilometers per hour) and swim at 6 miles per hour (9.7 kilometers per hour). They tend to stay in the same area, though some migrate between favored sites, up to 186 miles (300 kilometers) in European species. Home ranges are 3.1 to 6.2 square miles (5 to 10 square kilometers).

The polygynous moose begin breeding in August. Females attract males with a loud moaning bellow, and males groan in response. Females also emit a powerful scent. Males compete for females, and after a 215- to 243-day pregnancy, a single calf is born (though twins are common). Young moose nurse until five months of age, and they begin eating food as early as three weeks. They stay with their mother until they are one year, or the next calf is born.

Almost half of all moose young die within the first year of life. Though moose live to be five to twelve years, at eight years they begin to suffer from arthritis and dental disease. Although large, moose fall prey to grizzly bears and wolves.

Moose and people: Moose meat is a main source of food for many people. In North America, more than fifty thousand moose are harvested annually for meat and sport. They are a main attraction in the ecotourism industry.

Conservation status: Moose are not threatened. ■



Reindeer *(Rangifer tarandus)*

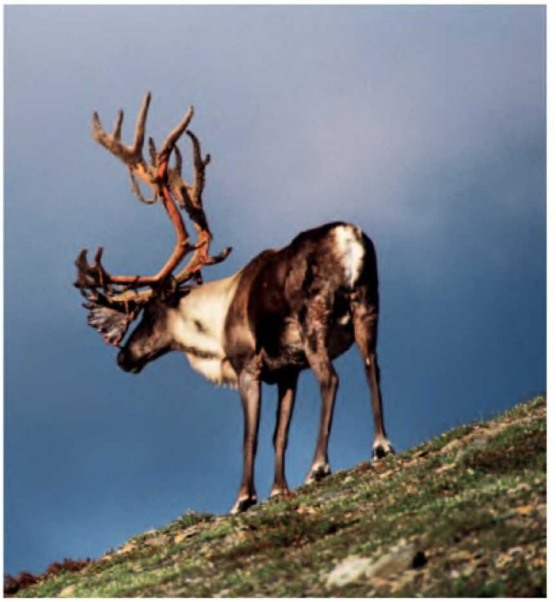
REINDEER
Rangifer tarandus

Physical characteristics: Acknowledged as the tame subspecies of caribou, this animal weighs 121 to 699.6 pounds (55 to 318 kilograms) and measures 381 to 584.2 inches (150 to 230 centimeters) long. Males can be twice as big as females. Tails are short, and coat color varies from dark brown to almost white, depending on the region. Hooves are large and broad, which assist the reindeer in swimming. Both sexes have antlers.

Geographic range: Reindeer are found throughout the upper latitudes of Eurasia and North America.

Habitat: Reindeer live in arctic deserts on Arctic Ocean islands as well as on arctic tundra (treeless region of north polar areas). They like coniferous forests of pine and larch trees where woody lichens are abundant. Forest swamps and marshlands also appeal to reindeer.

Diet: The summer diet includes willows, birches, mushrooms, and grasses. In winter, reindeer eat dry plants, cotton grass, and mosses.



Reindeer shed velvet, skin covering their antlers, in fall, when they are getting ready to mate. (John Shaw/Bruce Coleman Inc. Reproduced by permission.)

The moss is especially important because it contains a chemical that acts like antifreeze and keeps body fluids from freezing. Lichens are an important source of carbohydrates and are eaten year-round.

Behavior and reproduction: Reindeer migrate in spring and fall, sometimes covering as many as 3,105 miles (6,000 kilometers) in one year. They can travel at a rate of 50 miles per hour (80 kilometers per hour). They live in mother-offspring pairs, herds, and gatherings. Typical herds include 2,500 to 3,000 individuals with a single leader. During migration, herds can reach 80,000 to 100,000 animals.

The polygynous reindeer breed in September and October, and fights between rival males are frequent. Victors "win" seven to eight females. Pregnancy lasts 192 to 246 days and result in the birth of one calf. Newborns are able to stand within an hour and can outrun a human within twenty-four hours. They nurse for one month and then begin grazing with the mother. Calves retain a strong bond with mothers for three months. Females live longer than males, sometimes past fifteen years. Average life expectancy for males is 4.5 years. Primary predators are wolves, brown bear, raven, golden eagle, and sea eagle. Calves often die during migration due to cold and exhaustion; 40 percent die in the first year, 30 percent in the second.

Adult males shed antlers soon after breeding, but females don't shed them until spring. Reindeer are able swimmers and can cross water bodies that are 75 miles (120 kilometers) wide.

Reindeer and people: Native peoples of the north depend on reindeer for their survival in terms of food and skin. A number of native cultures in America, Siberia, and Scandinavia revolve around reindeer and caribou herding. Velvet antlers are used in Asian medicine.

Conservation status: Reindeer are not threatened. ■

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OKAPI AND GIRAFFE
Giraffidae

Class: Mammalia
Order: Artiodactyla
Family: Giraffidae
Number of species: 2 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Giraffes stand up to 18 feet (5.5 meters) to the top of the head and weigh 460 to 4,250 pounds (210 to 1,930 kilograms). When compared to the long neck (up to 8 feet, or 2.4 meters), the body is short. Legs are long and end in hooves the size of dinner plates. Their tails grow up to 39 inches (1 meter) and have a tassel at the end. Males are usually larger than females.

Eyes are large, and the long tongue (19 inches [45 centimeters]) is black. Both sexes have short horns of about 5 inches (13.5 centimeters) in length, though males' are thicker. Males also have a middle horn and four or more small bumps.

The okapi (oh-KOP-ee) never weighs more than 550 pounds (250 kilograms), and its head is horse-like in shape. Its neck is not as long as the giraffe's. Where the giraffe's coat is various shades of brown with patterns of cream-colored hair, the okapi's coat is dark brown with white stripes on the upper legs, white "socks" on the ankle, and dark rings at the leg joints. Both species walk with their weight supported alternately on their left and right legs, like camels. They use their necks to maintain balance.

GEOGRAPHIC RANGE

Giraffids (giraffes and okapis) are found only in sub-Saharan Africa.

DID YOU KNOW?

- Giraffes breathe twenty times a minute.
- Giraffes can run up to 35 miles per hour (60 kilometers per hour).
- Okapis weren't discovered until 1900.
- Female giraffes will return to the same site year after year to give birth.
- Newborn giraffes grow as much as an inch each day.
- The okapi is the only mammal that can clean its ears with its tongue.
- Because it takes a giraffe a long time to stand from the lying-down position, these animals will sleep using the buddy system: the herd sleeps while a designated individual keeps watch.
- The hind legs of the okapi have the same striped pattern and coloring as the zebra.
- Giraffes love the thorny acacia (uh-KAY-shah) tree and are able to eat it by closing their nostrils and producing a great deal of spit to help swallow the thorns. Their lips are protected by thick hair.
- Okapis find breeding partners by sense of smell.
- The okapi was first thought to be related to the zebra.

HABITAT

Giraffes live in savannas (tropical or subtropical community characterized by small trees and shrubs among herbs and grasses). Okapis live in tropical lowland forests.

DIET

Giraffes are browsers (eaters of shrubs, trees, and herbs) that eat mostly deciduous foliage in the rains and evergreen species during other seasons. They also eat fruit and grass now and then, and will drink water if available, but most of it comes through the plants they eat. Okapis eat buds, leaves, and branches as well as clay high in sulfur (to supplement their mineral intake).

BEHAVIOR AND REPRODUCTION

Giraffes are social whereas okapis keep to themselves. The home ranges of giraffes are large, while those of the okapi are small. The males of both species will fight other males to establish dominance, usually using their horns by swinging their long necks and butting into each other.

Giraffes are polygynous (puh-LIH-juh-nus; one male to several female mates), as okapi are believed to be. Pregnancy lasts fifteen months for the giraffe and results in the birth of a single calf. Calves nurse (drink mother's milk) for a year and supplement their diet with browse beginning at the age of one month. Females stay with the herd while males leave around the age of three years. Life expectancy is twenty to twenty-five years.

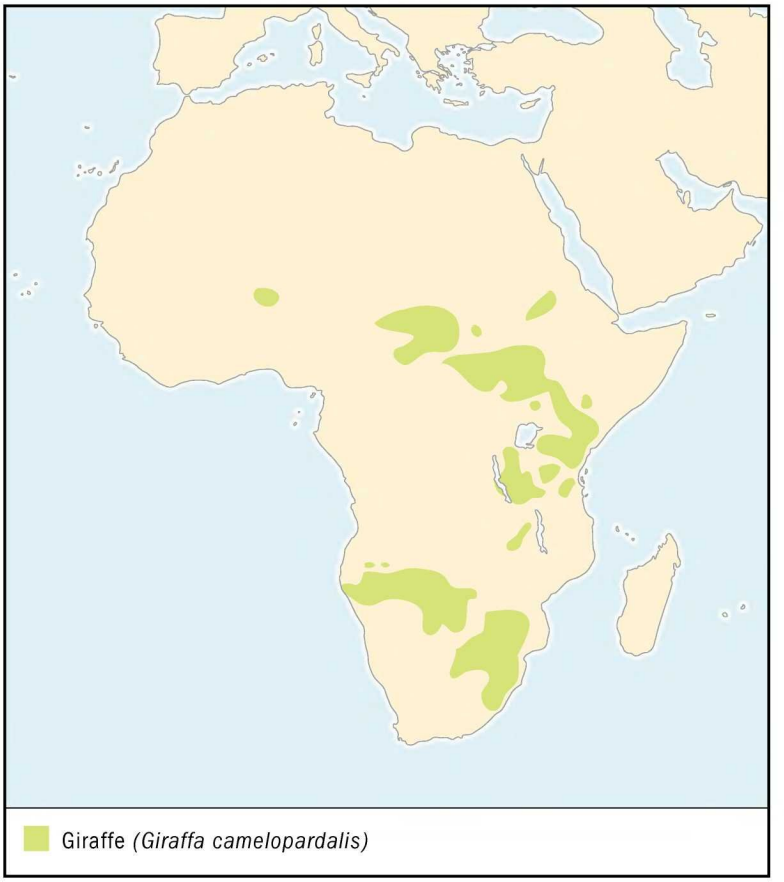
After fourteen to fifteen months of pregnancy, a single okapi calf is born deep in the forest, where it will remain hidden for weeks. It will spend up to 80 percent of its first two months in hiding. Calves nurse until the age of six months and live over thirty years in captivity.

GIRAFFES, OKAPIS, AND PEOPLE

Giraffes are poached (illegally hunted) for their hair, which is made into thread, bracelets, fly whisks, as well as for their meat and hide. Okapi breed successfully in zoos, though we know very little about their behavior in the wild.

CONSERVATION STATUS

Neither species is threatened.



Giraffe *(Giraffa camelopardalis)*

GIRAFFE
Giraffa camelopardalis

Physical characteristics: These animals stand up to 18 feet (5.5 meters) tall and weigh between 1,200 and 4,350 pounds (550 to 1,930 kilograms). Coat patterning helps to camouflage them, and no two coats are alike.

Geographic range: Giraffes live in sub-Saharan Africa.

Habitat: Giraffes are found in dry savannas.

Diet: Giraffes feed on leaves of more than 100 tree and shrub species. They use their tongues and thin lips to select only the most



Newborn giraffes are 6 feet (2 meters) tall and weigh between 110 and 120 pounds (50 to 55 kilograms). (© St. Meyers/OKAPIA/Photo Researchers, Inc. Reproduced by permission.)

nutrient-dense leaves. Male giraffes can eat up to 145 pounds (66 kilograms) of food a day, but can also survive on as little as 15 pounds (7 kilograms) a day when food is scarce. They have four stomach chambers, which allows them to digest food more efficiently by swallowing food whole, regurgitating (vomiting), chewing, and swallowing again. They will drink water if available, but this makes them vulnerable to predators, so they often drink with a friend keeping watch.

Behavior and reproduction: Giraffes live in herds of up to twenty animals. Herds can be all-female, all-male, mixed, or female with young. Home ranges vary from 2 to 252 square miles (5 to 654 square kilometers), depending on food and water availability. Male giraffes spend 43 percent of their time each day feeding, and 22 percent walking. Females feed for more than half the day, and walk for 13 percent of the time. Giraffes rest at night. Though usually silent, giraffes will vocalize when looking for lost calves or when in danger.

Females are ready to breed at four years, and do so year-round. They give birth standing up, sometimes while walking, so the baby falls about 6 feet (2 meters) to the ground. Newborns are 6 feet (2 meters) tall and weigh between 110 and 120 pounds (50 to 55 kilograms). Babies are born with horns. Predators include hyenas, lions, leopards, and wild dogs. Giraffes use their height to detect predators while they're still in the distance.

Giraffes and people: Giraffes are hunted and poached for meat, skin, and hair. They are a main attraction in zoos.

Conservation status: The giraffe is not currently threatened, but has disappeared from its former range in western Africa. ■



OKAPI
Okapia johnstoni

Physical characteristics: Okapis weigh 462 to 550 pounds (210 to 250 kilograms) and stand 5 to 5.6 feet (150 to 170 centimeters) at the shoulder. Females are taller than males.

Geographic range: Okapis are restricted to the Democratic Republic of the Congo.

Habitat: The okapi lives in tropical lowland forest near water.

Diet: Okapis feed on more than 100 species of plants, including some that are poisonous to humans. They also eat ferns, fungi, fruit,



Okapis feed on more than 100 species of plants, including some that are poisonous to humans. (© William Munoz/ Photo Researchers, Inc. Reproduced by permission.)

and grasses. Okapis ingest charcoal from trees burned by lightning. They use well-worn paths to travel between feeding sites.

Behavior and reproduction: Most active during the day. Not territorial, but males will fight for dominance. Okapis are usually silent but will make coughing sounds during rutting (mating) season. Okapi young are more vocal and make coughing and bleating sounds like a lamb. They groom one another and exhibit playful behavior.

Okapis give birth to a single calf from August to October after about fifteen months of pregnancy. Females retreat into the dense forest growth to give birth. Protective mothers warn off trespassers by beating the ground with their front legs. Lifespan is thirty years in captivity. The main predator of the okapi is the leopard.

Okapis and people: Zoos keep and breed okapis today. When the species was initially discovered, zoos lost many okapis in transport because they were unable to survive the long boat and train rides.

Conservation status: Okapis are not currently threatened, but are protected in the Democratic Republic of the Congo because their distribution range is so limited. Populations are healthy. ■

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PRONGHORN
Antilocapridae

Class: Mammalia
Order: Artiodactyla
Family: Antilocapridae
One species: Pronghorn (*Antilocapra americana*)

family CHAPTER

PHYSICAL CHARACTERISTICS

Pronghorn measure 52.1 to 58.8 inches (132.3 to 149.4 centimeters) long and have a shoulder height of 32.7 to 37 inches (83.1 to 94 centimeters). They weigh 87 to 129 pounds (40 to 59 kilograms). These long-legged runners have stocky bodies, and their coat is various shades of brown on top, with sides and underparts creamy white. Males have brownish black patches from below the ears and downward 3 to 4 inches (7.6 to 10.2 centimeters). Pronghorn have a short mane on the back of the neck, and their tails are short (4 inches, or 10.2 centimeters). The rump is covered by two patches of white hair. This animal is able to regulate the amount of insulation provided by its coat by erecting or flattening its hairs.

Both sexes have horns covered in keratin (KARE-ah-tin; protective material that makes up hair and fingernails). There are two branches, or prongs, one curving forward and another, shorter one pointing directly back. Males shed their horns every year; females shed them irregularly. Pronghorn have superb vision. Researchers believe that the placement of their eyes high on top of their skulls allows for them to keep a watch for predators while continuing to feed on lower-elevated grounds.

GEOGRAPHIC RANGE

Found in western North America.

HABITAT

Pronghorn can be found in abundant numbers in short-grass prairies where shrubs are readily available even with snow cover.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PRONGHORN IN COLORADO

According to NationalGeographic.com, one of the earliest mentions of the pronghorn is in the expedition diaries of explorers Meriwether Lewis and William Clark. As often happens today, they compared the pronghorn to goats, antelopes, and gazelles.

The pronghorn population has taken a rollercoaster ride in terms of numbers. From an estimated thirty to sixty million in the early 1800s, they declined to less than 15,000 by 1915. As of 2004, there are an estimated one million on the plains of North America.

According to Colorado Division of Wildlife biologist Mark Vieira, the number of pronghorn in that state fell to around 2,000 at the end of the twentieth century but has grown to a steady 55,000 as of 2004. He explained to *Rocky Mountain News* reporter Gary Gerhardt that pronghorn thrive in this region because they don't compete with cattle. The two animals eat different plants, so all have enough to eat.

Winter months have proven particularly harsh for the Colorado pronghorn population on the Pawnee National Grasslands, however. During the winter, the animals create herds of about 100 individuals. Because Colorado has suffered serious drought in the twenty-first century, there isn't enough food to go around. Vieira reported, "Our usual fawn production was fifty to sixty fawns per one hundred does. Now it's fallen to eighteen per one hundred." In addition to starvation, the lack of vegetation is prohibiting pronghorn from manufacturing antibodies necessary for warding off disease.

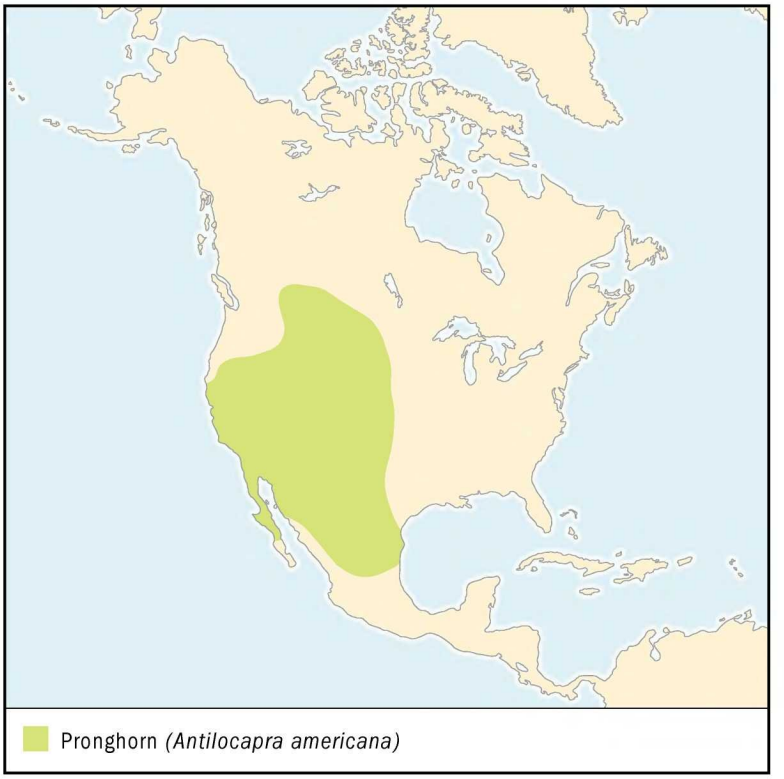
"We are really desperate for moisture now. If we could get two good years, we could bring the population back," Viera said. Most pronghorn live in Montana and Wyoming.

Steppes (vegetation zones characterized by shrubs, grasses, and few trees) are also popular habitats, and deserts are home to less than 1 percent of the population.

Pronghorn are usually found on treeless, flat terrain between altitudes of 3,000 to 8,000 feet (914 to 2,438 meters).

DIET

Pronghorn prefer succulent (water-based) forbs (drought-resistant herbs with broader leaves than grasses) over other food. During droughts and snowy months, pronghorn rely on shrubs to supplement their diet. They walk while they eat and seem to find food using smell as well as sight. They use their muscled



lips to grab hold of plants and vegetation, bring it to their mouths, then rip the plant apart with their teeth. Pronghorn will drink water if available, but pronghorn get most of their water from succulents, plants that contain a lot of water.

BEHAVIOR AND REPRODUCTION

Pronghorn are among the fastest land animals, able to reach speeds of 53.7 miles per hour (86.5 kilometers per hour) and maintain that pace for several miles (kilometers) before exhaustion sets in. They run with their mouths open to increase oxygen intake. Pronghorn are also strong swimmers.

Pronghorn are vocal animals, and make snorting and "sneezing" sounds when sensing something unfamiliar in their habitat. Fawns make soft bleating sounds (similar to lambs) that help parents locate hidden offspring. Adult females grunt or click when approaching hidden fawns or when being pursued by bucks. Bucks roar when chasing does or other bucks. During courtship, bucks smack their lips and flick their tongues, both of which create a low sucking sound.



Pronghorn males may fight during the breeding season. (© Stephen J. Krasemann/Photo Researchers, Inc. Reproduced by permission.)

Pronghorn live in herds, sometimes loosely scattered, but always highly organized. When threatened, they'll raise their white rump hairs and snort, alerting other herd members to gather together more closely. They are active during daylight and nighttime, with peak activity occurring just after sunrise and before sunset. They spend most of their time feeding or sleeping, the latter of which they do in short spurts and frequently throughout the day.

Home ranges vary greatly and are dependent on quality of habitat, group size, season, and history of land use. Winter and summer ranges may be as far apart as 100 miles (160 kilometers). Bucks will mark their territory with urine and feces.

Pronghorn are polygynous (puh-LIH-juh-nus; one male has several female mates), and mating occurs between July and early October. Pregnancy lasts eight and a half months; a single fawn is born in the spring if this is the doe's first birth. Successive births usually result in twins, rarely triplets. By day four, fawns are able to outrun humans. Fawns nurse (drink mother's milk)

until around four weeks of age, at which time they join their mothers on feeding trips.

Pronghorn are sexually mature at sixteen to seventeen months. Primary predators, animals that hunt them for food, include coyotes, wolves, and bobcats. Lifespan is seven to ten years.

PRONGHORN AND PEOPLE

Pronghorn have a long history with Native Americans. Many Indian myths involved this animal, and it was considered the personification of peace, good fortune, and speed. Pronghorn often appeared on prehistoric pottery and walls.

Late in the nineteenth century, pronghorn were slaughtered for their skins. Canada and the United States opened hunting seasons in the mid-1900s, and by the end of 2002, almost five million pronghorn had been legally harvested. This hunting season provides tons of meat and millions of dollars in profit for businesses located in pronghorn country.

Pronghorn are known to damage crops, sometimes extensively.

CONSERVATION STATUS

Pronghorn are not threatened.

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family CHAPTER

ANTELOPES, CATTLE, BISON, BUFFALOES, GOATS, AND SHEEP

Bovidae

Class: Mammalia
Order: Artiodactyla
Family: Bovidae
Number of species: 137 to 138 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Bovids (BOH-vidz) vary in weight, from 6.6 to over 2,867 pounds (3 to over 1,300 kilograms), with a shoulder height range of 9.85 inches to 6.56 feet (25 centimeters to 2 meters). Bodies range from slender with long legs to stocky and muscular. All bovid males have horns, as do many females. Horns are bony and covered with keratin (KARE-ah-tin; protective material that makes up hair and fingernails). Bovids do not shed the keratin layer. They have hooves and four stomach chambers, which allows for efficient digestion.

Bovids have a number of scent glands on different parts of their bodies. They secrete oil from these glands during mating season, when in danger, or to mark territory.

Bovids range in color from white to black to orange-yellow. Most are some shade of brown.

GEOGRAPHIC RANGE

Found in Africa, Europe, Asia, and North America.

HABITAT

Bovids occupy a wide variety of habitats, including grasslands, swamps, tropical forests, arctic tundra, desert, cliff faces, and mountain ledges. Most abundant in tropical forests and grasslands. They occupy different habitats at different times of the year, with migration (seasonal movement from region to region) dependent upon food supply.

DIET

Bovids are herbivores (plant eaters) with four stomach chambers. The fact that they have four chambers means they can survive on plants few other animals could digest. They feed mainly on grasses, first by winding them around their tongues and pulling them from the ground, then swallowing them. After some time has passed, bovids will regurgitate (vomit) the swallowed food, chew it, and swallow it again. Bacteria in the stomach breaks down the food and allows digestion to occur.

BEHAVIOR AND REPRODUCTION

Some species are solitary (lone) while others live in herds or groups with complex social structures. Some species are territorial and will defend their ranges year-round or only during the mating season. Others live on ranges that are used each year. Many bovids are vocal, and calls range from lion-like roars to whistles and grunts.

Bovids are primarily polygynous (puh-LIH-juh-nus; one male to several female mates). Males often defend mating territories. Most females give birth to their first young around the age of two or three years. Males usually wait until they are a little older, primarily because they have to compete with other, older males to mate. Gestation (pregnancy) times vary according to species, but usually one, sometimes two, babies are born each year. Females care for their young without the help of the father. Adult males live separately, either alone or in small herds, from the females for most of the year.

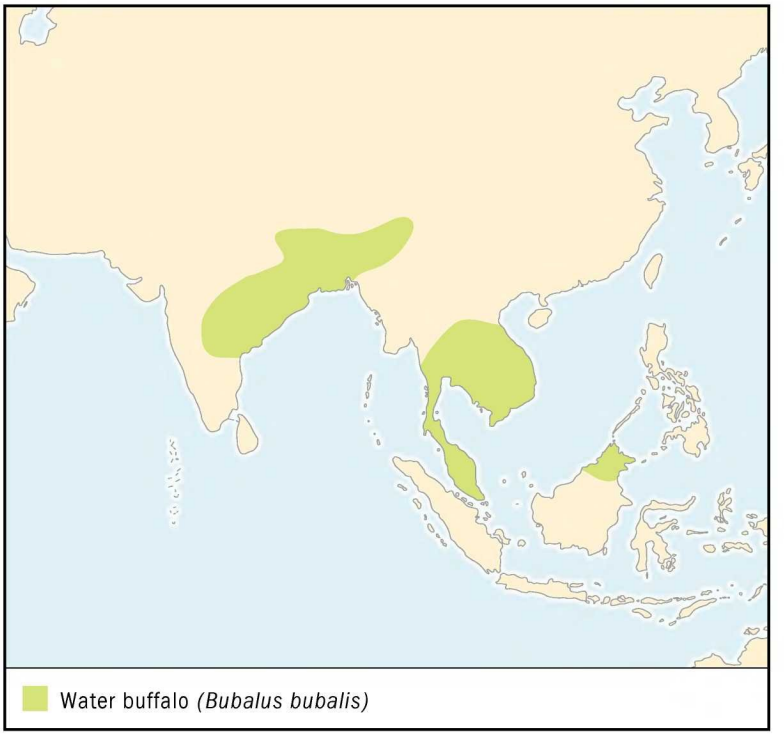
Bovid offspring nurse (drink mother's milk) for at least a month, sometimes until the age of two or three years. Predators include tigers, small cats, wolves, and leopards.

BOVIDAE AND PEOPLE

Bovids have been hunted extensively for meat, sport, and hides, some species to the point of serious threat to the population. Many species—goat, sheep, cattle, buffalo—have been domesticated (tamed) and are raised for their meat and skin.

CONSERVATION STATUS

As of 2004, 114 species are listed on the IUCN Red List of Threatened Species. Loss of habitat is the main reason for threat. Increasing human populations require more land and natural resources. Hunting has affected bovid populations as well, but to a lesser degree.



WATER BUFFALO
Bubalus bubalis

Physical characteristics: Water buffalo measure 98.4 to 118.1 inches (250 to 300 centimeters) long and stand 59 to 74.4 inches (150 to 189 centimeters) at the shoulder. They weigh between 1,543 and 2,645 pounds (700 to 1,200 kilograms), with females weighing about 20 percent less than males. They are the largest bovids, with disproportionately big feet and wide hooves. Fur is dark gray to black in wild species. Tail ends in a bushy ball of black hair. Males have crescent-shaped pointed horns that measure around 47.2 inches (120 centimeters) long. Females also have horns.

Geographic range: Found in India, Nepal, and Bhutan. A small population lives in a wildlife reserve in Thailand.

Habitat: Water buffalo live in tropical and subtropical forests as well as grasslands. They live near water, from swamps to woodlands and



Water buffalo spend part of their day in the water to stay cool and keep insects off of them. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

plains. They not only drink the water, but spend much of the day partially submerged so that they remain cool and ward off insects.

Diet: This bovid eats grasses, herbs, aquatic plants, and other vegetation.

Behavior and reproduction: Water buffalo form herds of females and offspring of up to thirty individuals. Old males are solitary. After a 300- to 340-day pregnancy, females give birth to one calf, sometimes to twins. Calves nurse for six to nine months. Female calves sometimes remain with the mother for life. Males leave around the age of three years. Females are ready to mate around eighteen months of age. This bovid will interbreed with domesticated cattle.

Water buffalo and people: Water buffalo were first domesticated in China more than seven thousand years ago. They provide meat, hides, horns, milk, and butter fat. For native cultures, they also provide an inexpensive method of power for plowing fields and transporting people.

Conservation status: Listed as Endangered, facing a very high risk of extinction, by the IUCN. Domesticated populations are abundant, but there are fewer than four thousand wild water buffalo in the world. Existing populations are small and separated by a great distance from each other, which limits reproduction. ■



AMERICAN BISON
Bison bison

Physical characteristics: Females are 20 percent shorter in length and 40 percent less in weight than males. Males measure 85.2 to 125.2 inches (242 to 318 centimeters) long and stand 65.7 to 73.2 inches (167 to 186 centimeters) at the shoulder. They weigh between 1,199 to 1,999.5 pounds (544 to 907 kilograms). This is the largest mammal in North America. Though it appears to hold its head low, there is actually a hump over the shoulders. Legs are short and tail is medium length with a tuft of black hair on the end. Coat is brown to dark brown, and hair is longer on front and top of head, along the neck, shoulders, and forequarters. Ears are partially hidden. Both sexes have a beard of long hair as well as a mane of dark hair along the lower portion of the neck to the chest. Males have short black



Millions of American bison once roamed the Great Plains. Now few bison remain in the wild, but many are kept on ranches. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

horns that go out on the sides and curve upward. Females' horns are shorter, skinnier, and more curved.

Geographic range: Found in a select few parks and refuges of North America.

Habitat: This bovid needs plenty of grassland and meadow for grazing. It lives in mixed wood forests as well as prairies and plains.

Diet: The American bison is not picky about what it eats. They eat huge quantities of low-quality forage (grasses, herbs, and shrubs) and supplement their diet with berries and lichen (fungi found growing on trees). Uses head to remove snow from vegetation during winter.

Behavior and reproduction: Form mixed groups consisting of females, calves, and males aged one to three years. During mating season, adult males may join these herds. Males form groups of up to thirty animals, though they also are found alone or in pairs. During migration, herds join together and may travel more than 124 miles (200 kilometers) to find ranges where food is more plentiful. American bison like to wallow in shallow holes which they dig in the ground.

These polygynous bovids mate from July through September, with seasons varying depending on the region. Females go through 285 days of gestation and deliver a single calf in the spring, usually each year. They like to give birth in heavily concealed areas for privacy and protection, and they stay separated from the rest of the herd for a couple days. Within three hours of birth, the calf can run, and it is nursed for seven to twelve months.

American bison and people: Bison were important game animals for native populations across North Americа. They provided meat, bones for tools, hides for blankets, leather for clothing, and sinews for twine. Today, bison is raised on ranches for its meat.

Conservation status: Bison are not considered threatened. They once ranged across half of North America and numbered in the millions. Because they are ranched throughout the continent, their population is not in danger of extinction, despite the fact that very few live in the wild. Disease and parasites are the main threats to the American bison. ■



Black wildebeest *(Connochaetes gnou)*

BLACK WILDEBEEST
Connochaetes gnou

Physical characteristics: Also known as the gnu, this bovid weighs 242 to 396 pounds (110 to 180 kilograms) and measures 5.6 to 7.3 feet (170 to 220 centimeters) long. Shoulder height of 3 to 4 feet (90 to 120 centimeters). Females are slightly smaller than males. Coats are dark brown to black, with males darker than females. A short mane on neck stands up and is whitish with black tips. The beard is black.

Geographic range: The black wildebeest lives in east-central South Africa.

Habitat: This bovid lives primarily in open grassland where water is available.



Black wildebeest females and young live in herds, while males form their own groups. (Illustration by Patricia Ferrer. Reproduced by permission.)

Diet: Prefers short grasses but is known to browse on bushes and other vegetation to supplement the winter diet. Need to drink every one to two days.

Behavior and reproduction: Females and young form herds while males form their own groups. Males will defend territories during mating season by horn wrestling and loud vocalizations. Some are migratory.

Males "perfume" themselves for courtship by rolling in their urine and dung. They further draw attention to themselves by bellowing out a "ge-nu" call, foaming at the mouth, and dashing madly around while shaking their heads.

Mates from February through April, and after a gestation period of 240 to 270 days, females give birth to a single calf. Young walk within ten minutes of birth and are nursed for about four months. Females are ready to breed between eighteen and thirty months, males at three years. Lifespan in captivity is around twenty years. Lion and hyenas will take down lame or sick adults, and babies fall prey to wild dogs, leopards, and cheetahs.

Black wildebeest and people: Settlers viewed this bovid as a pest and did their best to kill them all. They used their tails as fly swatters.

Conservation status: Extinct in the wild, but captive black wildebeest populations are abundant, so they are not considered threatened. ■



Thomson's gazelle *(Gazella thomsonii)*

THOMSON'S GAZELLE
Gazella thomsonii

Physical characteristics: Weighs 29 to 66 pounds (13 to 30 kilograms) and measures 3 to 4 feet (91 to 122 centimeters) with a tail length of 6 to 8 inches (15 to 20 centimeters). Females are slightly smaller than males. Coat is reddish brown on top with a white belly. A black stripe runs from the foreleg to the hindquarters, and there is a white patch on the rump that extends to the black tail. Eyes rimmed with white that reaches to the nose along the muzzle and above the black cheek stripes. Males' horns are slightly curved and measure 11.5 to 12.0 inches (29.2 to 30.5 centimeters) and are used solely for fighting other male gazelles. Female horns are shorter and thinner and are used to defend their feeding area.



Thomson's gazelles run away from predators, reaching speeds of 40 to 50 miles per hour (65 to 80 kilometers per hour). They can leap 30 feet (9 meters) in a single bound and up to 10 feet (3 meters) vertically. (Leonard Lee Rue III/Bruce Coleman Inc. Reproduced by permission.)

Geographic range: Found in Kenya, Ehtiopia, northern Tanzania, and southeast Sudan.

Habitat: Prefer the short grassy plains and savannas (tropical plant community characterized by shrubs and trees amidst cover of grasses and herbs) so that large herds can feed together. During the drier season, they move to the taller grasslands.

Diet: Grasses make up about 90 percent of this bovid's diet during the dry season, but it also feeds on shrubs and seeds, alfalfa, hay, and leaves.

Behavior and reproduction: This gazelle is most active early and late in the day. It rests during the hottest part of the day. Rather than fight, Thomson's gazelles will flee from predators, reaching speeds of 40 to 50 miles per hour (65 to 80 kilometers per hour). They are fantastic leapers, able to reach 30 feet (9 meters) in a single bound and up to 10 feet (3 meters) vertically. Their speed comes from long foot bones and anklebones.

They live in herds of two to twenty individuals, and members can change by the hour. Multiple herds interact with each other. Territories range from 6 to 495 acres (2 to 200 hectares) but are usually between 25 and 75 acres (10 and 30 hectares). Because they are water-dependent, they sometimes travel up to 100 miles (160 kilometers) to find water during the dry season.

Males establish territories during breeding season and mark them with urine and dung piles as well as secretions from scent glands. The polygamous (puh-LIH-guh-mus; having more than one mate at a time) Thomson's gazelle breeds twice annually. Females give birth to one offspring after a gestation lasting five to six months. Mother and baby stay separated from the herd for a couple weeks. Offspring can run by four weeks, and they nurse for four months. Predators include cheetahs, leopards, lions, and hyenas. Young gazelles are also killed by pythons, eagles, baboons, and jackals. Life span in the wild is roughly ten years.

Thomson's gazelle and people: These gazelles are hunted for food and skins.

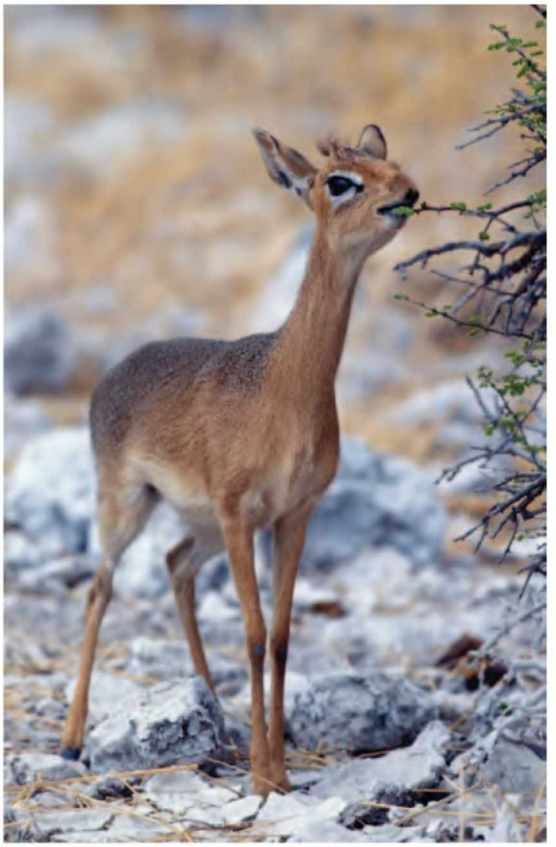
Conservation status: Although predation is high, populations are secure because they are fast breeders. Females are ready to breed again within two to four weeks after giving birth. Thomson's gazelle is not threatened. ■



KIRK'S DIKDIK
Madoqua kirkii

Physical characteristics: This small antelope measures 22.5 to 29.5 inches (57 to 75 centimeters) long and 14 to 18 inches (35 to 45 centimeters) high. It weighs just 6 to 14 pounds (2.7 to 6.5 kilograms). The fur on its back is gray with black and white flecks; face and legs are tan, and the chin, belly, and underside of the tail are white. The crest of fur on the head is yellow-orange, as are the face and legs. Ears are large, and big eyes are ringed with short white fur. Males have large glands beneath the eyes, and their sharp horns grow to be 4 inches (10 centimeters).

Geographic range: This dikdik is found in Tanzania, Kenya, Somalia, Angola, and Namibia.



Kirk's dikdik does not have to drink water—it receives enough moisture from dew and the vegetation that it eats. (Ann & Steve Toon Wildlife Photography. Reproduced by permission.)

Habitat: This dikdik lives in dry, hot regions of mixed woodland. Uses thickets and thorny bushes for cover.

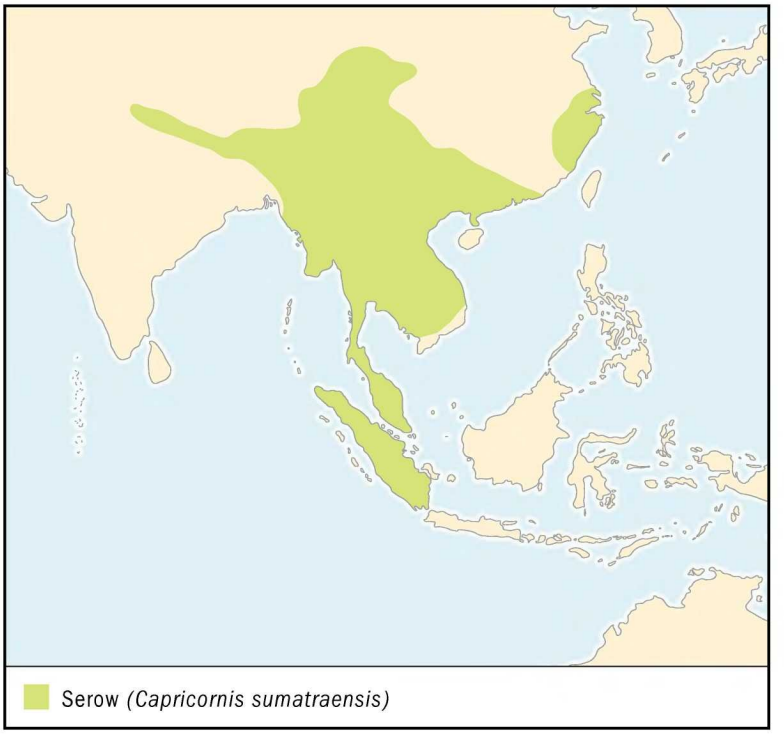
Diet: Kirk's dikdik browses on herbs, leaves, evergreen shoots, fruits and berries, and flowers during the day and night. It rises on hind legs to reach food if necessary, and gets minerals by eating soil and bones and by visiting saltlicks. It does not need regular water intake.

Behavior and reproduction: This dikdik lives in pairs and defends their territory by chasing same-sex intruders. Territory is marked with urine, dung, and secretions from scent glands. Males defend territory boundaries by butting bordering vegetation and raising the hair on their heads. It makes six different vocalizations.

Pairs are monogamous (muh-NAH-guh-mus; mate only with each other) for life. After a gestation period of 166 to 174 days, females birth one young. Offspring are able to join parents after six weeks of hiding in vegetation, and they nurse until eight or ten weeks of age. Dikdiks are ready to mate between six and eight months, and females are ready to breed again within ten days of delivering their babies. Predators include eagles, pythons, lizards, lions, cheetahs, wild dogs, and hyenas. Life span in the wild is three to four years.

Kirk's dikdik and people: Common source of meat throughout its range.

Conservation status: Kirk's dikdik is not considered threatened. Total population is estimated to be from the hundreds of thousands to two million. ■



SEROW
Capricornis sumatraensis

Physical characteristics: The serow weighs 110 to 300 pounds (50 to 140 kilograms) and measures 55 to 70 inches (140 to 180 centimeters) long. Stands 33 to 37 inches (85 to 94 centimeters) tall. Grayish black upperparts with whitish underparts. Horns are slim and curved back.

Geographic range: Serows are found in the Himalayas of India, Nepal, and Bhutan; western China; Southeast Asia, and Indonesia.

Habitat: Serows live in mountain forests between 6,000 and 10,000 feet (1,830 to 3,040 meters) altitude.

Diet: Eats a variety of grasses, shoots, and leaves. Does not migrate or move far in its feeding.

Behavior and reproduction: This goat-like bovid lives alone or in



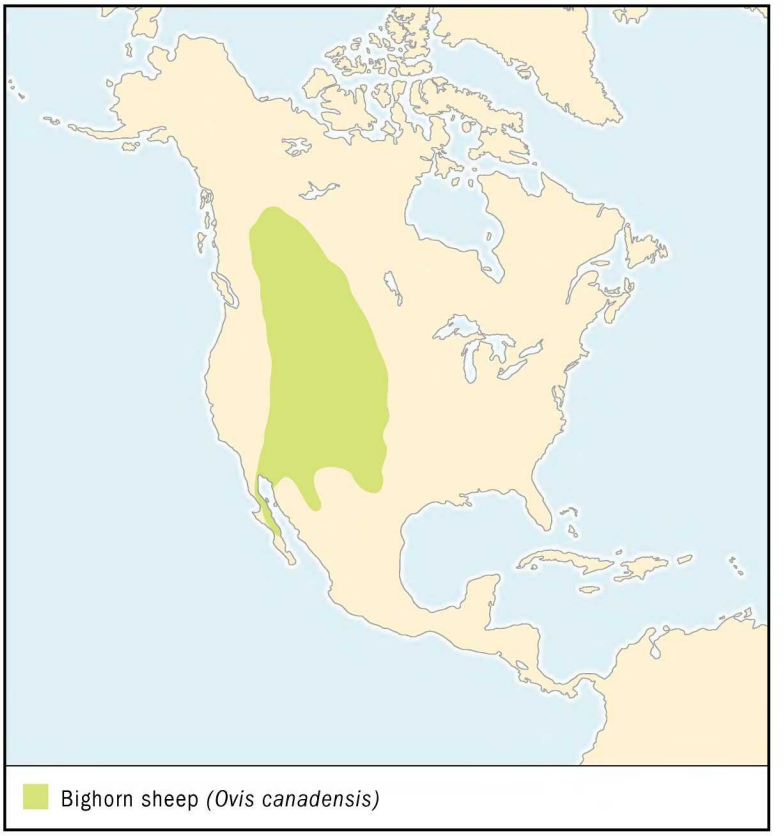
Serows live in high mountain forests, between 6,000 and 10,000 feet (1,830 to 3,040 meters) altitude. (Illustration by Emily Damstra. Reproduced by permission.)

groups of up to seven individuals. They rest below rock overhangs and cliffs during the day, and have been known to swim between islands off the coast of Malaysia. Moves along well-trodden paths.

Gestation lasts for seven to eight months, with a single baby being born in September or October. Life span is about ten years.

Serow and people: Hunted for meat and body parts used in medicine.

Conservation status: Listed as Vulnerable, facing a high risk of extinction, by IUCN, primarily due to poaching (illegal hunting) and habitat loss. ■



BIGHORN SHEEP
Ovis canadensis

Physical characteristics: The maximum weight in males is 300 pounds (137 kilograms), 200 pounds (91 kilograms) in females. They measure 49 to 77 inches (124 to 195 centimeters) long, with females being smaller. Males have huge horns curling round and forward. Females' horns are much smaller and curl just a little. Coats range from reddish brown to almost black-brown with white undersides, rump, muzzle, and back of legs. They have excellent eyesight. Bighorns vocalize during mating season and when in danger.

Geographic range: Bighorn sheep are found in western North America south to desert ranges of the southwest United States and Mexico.



Bighorn sheep do not defend territories, but they will fight over a female. (Bob and Clara Calhoun/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Bighorns live in deserts, but prefer mountain meadows, rocky cliffs, and mountains. They prefer regions where annual snowfall does not exceed 60 inches (152 centimeters) because they aren't able to paw through snow with their cloven (split) hooves.

Diet: Bighorns eat grasses, herbs, and shrubs. Those that live in the desert eat desert plants.

Behavior and reproduction: Bighorns live in small hers of two to nine, with mature males staying separate from the herd. They migrate to higher elevations in the summer and to sheltered valleys during the cold months.

Though males won't defend territories, they will fight each other over a female. Bighorns jump from ledge to ledge with ease and are able to climb mountains at a rate of 15 miles per hour (24.1 kilometers per hour). On level ground, they move at a rate of 30 miles per hour (48.3 kilometers per hour). They are capable swimmers.

These polygamous bovids mate in the fall. Gestation lasts 150 to 180 days and results in the birth of one or two lambs. Offspring are protected by their mothers for several months. Females are ready to

mate at thirty months, males between seven and eight years. Life span in the wild averages ten years, but can reach twenty. Coyotes and mountain lions are primary predators.

Bighorn sheep and people: Prized for its majestic horns, the bighorn is hunted as a trophy as well as for meat.

Conservation status: Though population numbers are lower than they were in the nineteenth century, they are stable, and the species is not considered threatened. ■

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PANGOLINS
Pholidota

Class: Mammalia
Order: Pholidota
One family: Manidae
Number of species: 7 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

Pangolins are unique looking animals covered with large, horny, overlapping scales. They were often referred to as scaly anteaters in the past. Typically, there are eighteen rows of scales. The scales are often described as looking similar to shingles on a roof. The weight of the scales and skin make up about 20 percent of the total body weight of most species. Scale color can be dark brown, dark olive-brown, pale olive, yellow-brown, or yellowish.

These animals have a small, pointed head that is smooth. Their eyes and ears are small. The tail is broad and long, ranging from 10 to 35 inches (26 to 88 centimeters). Limbs are short, small, and powerful. The front feet are longer and stronger than the hind feet. There are five curved claws on each foot.

Only the snout, chin, throat, neck, sides of the face, inner sides of the limbs, and the belly are not covered with scales. In some species the outer surface of the forelegs are also not covered. The parts of the body that are without scales are covered lightly with hair. The hairs of the scaleless areas are whitish, pale brown to reddish brown, or blackish. The skin is grayish with a blue or pink color in some areas. In the Asian species, there are both Asian and African species, there are three or four hairs at the base of each scale. The African species have no hair at the base of the scales.

In size, pangolins have a head and body length combined of 12 to 35 inches (30 to 90 centimeters). Females are generally smaller than males.

PANGOLIN TRAFFIC

Trafficking, buying and selling illegally, appears to be one of the most harmful threats to the population of pangolins. Authorities have seized trucks, crates, and bags full of pangolin flesh, scales, and entire animals. Traffickers sell the animals and their parts to buyers who use the animals for food, and because these animals are believed to have healing properties to help various other ailments. For example, trafficking in pangolins in China increases during colder months, because of the belief that pangolin blood helps keep the body warm and enhances sexual performance.

These animals have no teeth. To grab food they have a long and muscular tongue, able to extend a great distance. In the smaller species, the tongue measures about 6 to 7 inches (16 to 18 centimeters). In larger species the tongue stretches about 16 inches (40 centimeters). The tongue is sticky and either round or flat, depending on the species.

GEOGRAPHIC RANGE

Pangolins are found in the tropical, hot and humid climate, and subtropical areas of Africa and Asia.

HABITAT

Pangolins live in a variety of habitats, including forests, thick bush, sandy areas, and open grasslands. Some species of pangolins are arboreal, live in trees, and shelter in tree hollows. Other species live on the land and stay in burrows, holes, dug either by other animals or themselves.

DIET

Pangolins eat almost exclusively on ants and termites. They snatch up individual insects, and also dig up entire ant hills and termite nests.

BEHAVIOR AND REPRODUCTION

Pangolins move about slowly and deliberately. They often walk only on their hind legs. The smaller species are classified as arboreal and the larger ones as living on the land. Some species can live both on the ground and in trees. Most of these animals climb well and some also swim. These animals are solitary or sometimes found in pairs.

When they feel threatened, pangolins can roll themselves into a ball to defend themselves. When they are in a rolled-up position, the sharp-edged scales act as armor, shielding any unprotected skin and warding away predators, animals that hunt them for food. Once they are rolled into a ball it is very difficult to unroll them. A pangolin has been observed curling itself into a ball and then rolling down a slope, traveling 98 feet (30 meters)

in 10 seconds. Pangolins can also spray potential predators with a strong, foul smelling fluid that comes from the anal region.

Almost all pangolins are nocturnal, meaning they are active at night. Only one species is active during the day. The species that live on land use their powerful claws to make burrows and can make an 8-foot (2.4-meter) deep tunnel within three to five minutes. The arboreal pangolins use their long tails to balance and hang. Arboreal pangolins roll up in a ball in a tree hollow at night to sleep.

These animals have a well-developed sense of smell that they use to locate prey, animals hunted for food. In general, they have poor eyesight. As pangolins do not have teeth, they grab the prey with their long sticky tongue. They use their front claws to tear open anthills or termite mounds. The food enters their stomach whole, and is broken apart in the lower area of the stomach. All species drink water frequently, and lap it up by rapidly darting out their tongue.



DINNER AROMA

Pangolins are picky eaters and they depend upon their well-developed sense of smell to locate their preferred foods. Each animal produces a specific smell. One report found that pangolins appear to eat only nineteen species of ants and termites. They especially favor formacid ants, a family of ants that includes fire ants and harvester ants.

Most pangolins are born between November and May, although findings have suggested that some pangolins can breed throughout the year. Gestation, length of pregnancy, is approximately 120 to 150 days. Generally, female pangolins have a single offspring. At the time of birth, scales are soft, flexible and do not overlap, but they harden after two days. Young pangolins can walk soon after birth. Offspring are carried on the mother's tail or back. A threatened mother will fold her tail and keep her baby under her body. Male pangolins may also share a burrow with females and the young, a characteristic not common among most mammals.

Babies are nursed for three to four months, and they begin to eat termites at about one month. Young pangolins first eat insects they find between the mother's scales. At about five months old offspring become independent.

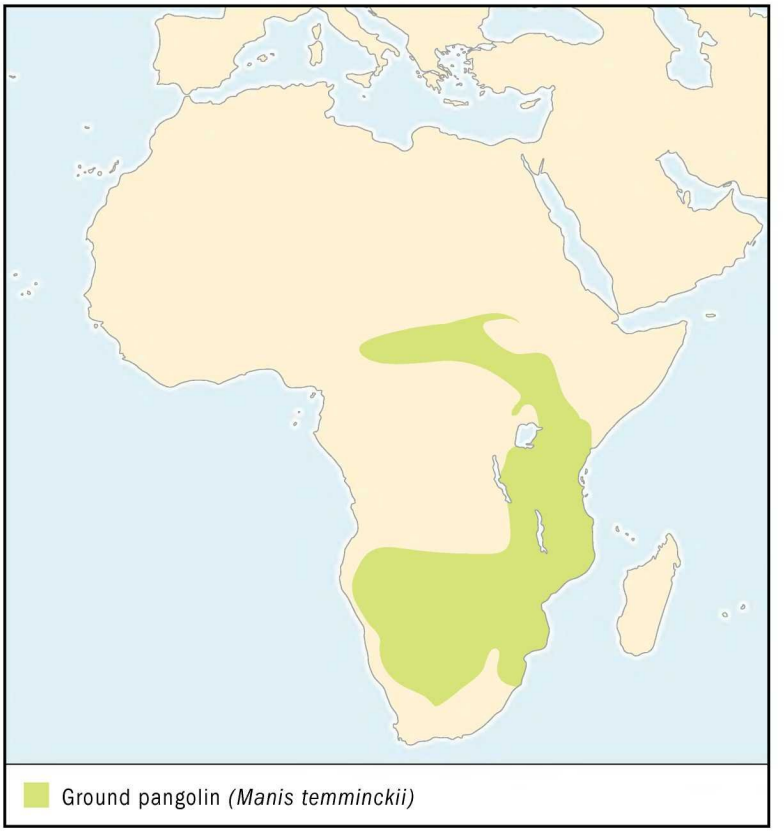
PANGOLINS AND PEOPLE

People hunt and kill pangolins for several reasons. These animals are considered a delicacy and eaten as food in parts of Africa. They are also believed to hold magical powers. The scales are made into a ring as a charm against rheumatic fever, a

disease that can damage the heart, and it used to treat other diseases. Certain groups of people mix the scales with bark from certain trees because it is believed to ward off witchcraft and evil spirits. Sometimes the scales are burned to keep wild animals away. Some tribes believe that pangolins flesh has aphrodisiac, enhancing sexual desire, values. And in certain areas, pangolins are sacrificed for rainmaking ceremonies.

CONSERVATION STATUS

Four species of pangolins are listed as Near Threatened, not currently threatened, but could become so, in the World Conservation Union (IUCN) Red List. Deforestation, the clearing of forests, has destroyed these animals natural habitat and caused a decrease in their population. In many areas, pangolins are legally protected animals. Aside from humans, leopards, lions, and tigers, are the main predatory threat of pangolins.



GROUND PANGOLIN
Manis temminckii

SPECIES ACCOUNT

Physical characteristics: Ground pangolins, also called Cape pangolins, have a combined head and body length of 20 to 24 inches (50 to 60 centimeters), and a tail length that ranges from 14 to 20 inches (35 to 50 centimeters). They have no external ears. The body and tail of these animals are covered with scales that are a grayish brown to dark olive brown. The scales are sharp and moveable. Skin is whitish with fine, dark hairs. Specialized thick eyelids protect their small eyes.

These animals have hind feet with blunt claws that are padded, like those of an elephant. Their forefeet have large, digging claws. Males are generally larger than the females.

Geographic range: Ground pangolins are found in Africa, specifically from Chad and Sudan in central Africa, down through Kenya



Ground pangolins live in forests, thick brush, and grasslands. During the day these animals sleep in burrows that they dig. (© Nigel J. Dennis/Photo Researchers, Inc. Reproduced by permission.)

and Tanzania, to the northern parts of South Africa. The ground pangolin is the most common and most widely distributed pangolin in Kenya and Tanzania.

Habitat: Ground pangolins live in forests, thick brush, and grasslands. They live in areas with both high and low rainfall amounts.

Diet: Ground pangolins feed on certain species of termites and ants. They tear open termite mounds and anthills, both on the ground and in trees.

Behavior and reproduction: This nocturnal species lives on the land, yet occasionally climbs trees and bushes. Ground pangolins can move quickly, up to 160 feet (50 meters) per minute. They often do move slowly, walking on the hind legs. They keep their body horizontal to the ground when moving, using their tail for balance as it drags behind them. During the day these animals sleep in burrows that they dig.

Ground pangolins locate prey by smell and feed frequently—about ninety times every night. Pangolins are known to crack pieces of

termite-infested wood across their chests to get to their prey. They also scratch in animal droppings for ants. When the baby is two to four weeks old the mother will carry it around on her back or tail. Offspring will feed by themselves at about three months old.

Ground pangolins and people: The pangolins are prized for the supposed medicinal properties of their various body parts.

Conservation status: The IUCN lists ground pangolins as Near Threatened. ■

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RODENTS

Rodentia

Class: Mammalia

Order: Rodentia

Number of families: 28 families

order

CHAPTER

phylum
class
subclass
order
monotypic order
suborder
family

PHYSICAL CHARACTERISTICS

Rodents make up the largest group of mammals, representing approximately 43 percent of all mammalian species. Families in the order Rodentia include rats, mice, porcupines, hamsters, beavers, squirrels, chipmunks, lemmings, muskrats, and guinea pigs (rabbits are not rodents). These families range in size from the pygmy mice, which are 4.7 inches long (12 centimeters) and weigh 0.1 ounces (4 grams), to the capybara, which is 39.4 inches long (100 centimeters) and can weigh 110 pounds (50 kilograms). Most rodents are relatively small animals, such as mice, rats, and squirrels.

While there is a broad range of characteristics among the families, the feature that sets rodents apart from other family members is their teeth. Rodents have one pair of upper incisors (the chisel-shaped teeth at the front of the mouth), and one pair of lower incisors. These teeth grow continually throughout their life. The outer surfaces of the incisors have a thick enamel (hard white substance) layer. Behind the incisors is a large gap in the tooth rows. There are no canines, spade-shaped teeth located next to the incisors. Typically there are only a few molars at the rear of the jaws. The number of teeth rarely is more than twenty-two.

The name Rodentia comes from the Latin verb *rodere* meaning to gnaw, a name suitable for a rodent that is constantly gnawing! Rodents' incisor teeth grow throughout their life and they grind their incisor teeth together to wear them down. If for some reason the rodent is unable to wear its incisors down,

the tips may grow past each other and continue to grow outward into spiral. This may result in the upper teeth piercing the roof of the mouth, and the lower teeth growing upward in front of the nose, which could kill the animal.

In general, rodents have a compact body with short legs. They typically have four to five digits on each of the front feet and three to five digits on the rear feet. Generally, the sole of the foot is bare. Some rodents, such as hamsters and pocket gophers, have cheek pouches, which allow the animals to store and transport food. The tails of some rodent species break off when these animals are caught by the tail, which allows them to escape. The tail will partially grow back.

Other physical characteristics of rodents vary widely depending upon the species and where it lives. For example, rodents that live in the desert, such as American kangaroo rats, Australian hopping mice, and north African jerboas, have long, narrow hind legs and feet with a long tail used for hopping over the sandy desert floor. They all have well-developed hearing, small front limbs, and pale coloration. Animals that live in and around the water, such as the capybara and beaver, may have webbed or partially webbed feet and tails modified for swimming.

GEOGRAPHIC RANGE

Rodents are found in all parts of the world, including the Arctic tundra, desert, and oceanic islands. About 70 percent of all rodents are rats and mice, and these animals are found on every continent.

HABITAT

The habitats of rodents are varied and numerous, from arid (extremely dry) deserts to the arctic tundra. There are rodents that live predominantly underground, others that live on land, and others are primarily arboreal (living in trees). Some species spend most of their life in the water, while others live in the desert. Some live close to humans in urban areas and even houses, while others make their home deep inside wetlands and rainforests. Rodents can be found in almost every habitat and on every continent except Antarctica.

DIET

All the families of rodents eat a wide range of foods. Most rodents are herbivorous, plant eaters, eating a wide range of

plant materials, including seeds, stems, leaves, roots, and flowers. Many of these species eat primarily seeds. Some species, such as the grasshopper mouse, eat insects and spiders. Other species, such as the Australian water rat, are primarily carnivorous (meat-eating), preying (eating animals for food) on small fish, frogs, and mollusks. Many are to some degree omnivorous, eating both plants and animals. Still others have highly specialized meals, eating only a few species of invertebrates, animals without a backbone, or fungi.

BEHAVIOR AND REPRODUCTION

Rodents show a wide range of lifestyles and habits, depending upon the family and species. There are rodents that form burrows (holes or tunnels), such as gophers and moles; those that live in trees, such as the commonly called flying squirrels; rodents that spend most of their time in water, such as the capybara; and those that are specialized to life in the desert, such as kangaroo rats and jerboas.

Many rodents are social animals, living in large groups and interacting with one another frequently. Prairie dogs, naked mole-rats, and ground squirrels all live in these large colonies (groups). Other rodents live in smaller colonies. The beaver lives in a colony made up of the adult male and female, and their offspring. Each colony lives in a specific territory.

The prairie dog, for example, lives in a set area that can contain hundreds of these small animals (they look similar to squirrels, not dogs). These colonies or towns are broken up into certain neighborhoods. The prairie dogs post guards, they babysit and they help build one another's homes. There is a great deal of playing, mutual grooming, and vocal communication among the prairie dogs.

Some rodents are solitary, such as porcupines, pocket gophers, and pocket mice. Many desert species are solitary. Some of these species that burrow, dig, will construct and live in their own burrow system. However, during the mating season there may be more than one individual, or a mother and her offspring may live together.

Most rodents are active throughout the year. Some species, such as ground squirrels, may hibernate for several months. Species communicate with one another using sounds, smells, and sights. For example, squeaks, grunts, and calls can be used as alarm calls in mating and when a parent is searching for its young.

Many rodents have large numbers of offspring, which is one of the primary reasons they make up the largest group of mammals. Rodent reproduction can be divided into two forms. One group of families has a short gestation (pregnancy) period, produces multiple litters per year, and has large numbers of helpless offspring. Gestation periods can range from seventeen to forty-five days and the number of litters can be up to four. Rodents in this group include mice, rats, and pocket gophers. The other group of families has longer gestation periods (60 to 238 days), fewer litters per year (generally one to two), and have a relatively fewer number of offspring.

The mating system of rodents depends upon the species. A few species of rodents are monogamous (muh-NAH-guh-mus), such as the Patagonian mara, which forms male-female pairs that can last for multiple mating seasons. Other species have a harem-based (HARE-um based) mating system, one male with a set group of females for the mating season. Many rodents are promiscuous (prah-MISS-kyoo-us), meaning they mate randomly.



THE APPEARANCE OF MODERN RATS

Fossils show that the first rodents began scampering about an estimated fifty-four million years ago in Asia and North America. These original rodents were themselves descendants of rodent-like ancestors called anagalids, which also gave rise to the rabbits. It was not until about five million years ago that the modern Muridae family of rodents came on the scene. The murids (MYOO-rids) now make up more than half of all rodent species, including rats, mice, and hamsters. These mammals have flourished due to multiple, large litters and their ability to adapt quickly to environmental changes.

RODENTS AND PEOPLE

Rodents play a vital role in the ecosystem. They serve as the prey for many animals and some animals will use their burrows for shelter and protection.

People have caused the loss of population of many species of rodents by destroying their natural habitat, harming them directly, or introducing species that prey on rodents. Many species of rodents are considered pests and even dangerous to humans. Rodents cost billions of dollars in lost crops each year, eating the grain stored during the winter and the seeds of plants. Beavers can cause destruction by damming up creeks, causing water to back up into areas where its not wanted.

Rats carried the fleas that caused the plagues of Europe. Rats and mice help spread other deadly diseases as well, such as bubonic (byoo-BON-ik) plague and typhus (TIE-fus).

PLAGUE OF RATS

In 1347 a ship from Caffa, on the Black Sea, came ashore at Messina, Sicily. Along with its goods, the ship was also carrying flea-infested rats. Most people on board were already dead, and the ships were ordered out of the harbor, but it was too late—the plague, or Black Death, had reached Europe. The disease, which may have begun in Asia or Egypt, killed within days of infection and the European population was quickly decimated. (The nursery rhyme "Ring Around the Rosy" is traced to the plague's rose-colored wounds). By 1349, the Black Death had swept through nearly every town and village in Britain. It is estimated that the plague killed a quarter of the European population, about twenty-five million people.

At that time, people blamed the plague on many causes, including fumes, God's wrath, and the unlucky alignment of planets. It is now known that the plague was caused by a bacterium that lived in the stomach of fleas. These fleas mainly infect rodents, particularly black rats. When the flea bites, either a rat or a human, it spits some bacteria out into the bite wound. The bacteria were passed from one rat to another by these fleas, causing the bacterium to spread. Large numbers of infected rats died and the fleas began biting humans.

Rodents are important as sources of food for many people. Roasted, stuffed, or fried guinea pig, for example, is a popular dish in Ecuador, Peru, and other South American countries. In many parts of the world they have an economical importance for their fur, such as the chinchilla of South America, a rodent almost extinct in the wild but thriving in captivity.

Rodents such as mice and rats are also used extensively in medical research because their bodily processes are similar to humans' and they have a rapid reproduction rate. They are used to study many diseases and test medicines. People also use these and other rodents, such as guinea pigs, to test the safety of cosmetic and human food products. Many people also keep the small and "cute" rodents as pets.

CONSERVATION STATUS

The IUCN lists 669 species of rodents under varying degrees of threat and endangerment (facing varying risks of extinction in the wild) as of 2004. There are 32 species that are listed as

Extinct (died out). Loss of habitats and the introduction of species are the two main reasons for the loss of populations.

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family CHAPTER

MOUNTAIN BEAVER
Aplodontidae

Class: Mammalia
Order: Rodentia
Family: Aplodontidae
One species: Mountain beaver (*Aplodontia rufa*)

PHYSICAL CHARACTERISTICS

This animal is also commonly called sewellel, named after the Chinook (American Indian tribe) word for a robe made from its pelts. There is only one species of mountain beaver and they are not closely related to the true beaver. These animals are about the same size as a squirrel, with a head and body length of 14.3 inches (36 centimeters), and a tall length of approximately 1.2 inches (3 centimeters).

They have a thickset, heavy body and short limbs. Eyes and ears are small. The head is broad and relatively flat. The neck is short and thick. All the limbs have five well-developed claws. These animals appear nearly tail-less because the tail is so short. They have strong incisors (chisel-shaped teeth at the front of the mouth).

The fur on these animals is thick, short, and typically a grayish, dark brown or reddish brown color, with sparse guard hair, which are coarse hairs that form the outer fur. Lighter, thick fur lies underneath, which is called the underfur. Guard hairs protect the underfur. Its belly is a slightly paler color, a white or chestnut brown. There is a small white patch of short fur at the bottom of its ears.

GEOGRAPHIC RANGE

Mountain beavers are found in North America along the Pacific Coast. They live in southwestern British Columbia to northwestern California, in certain coastal areas as far south as San Francisco Bay, and in the Sierra Nevada of eastern California.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

HOST TO WORLD'S LARGEST FLEAS

The largest flea in the world, the rare *Hystricopsylla schefferi,* is known from collections plucked from mountain beavers and their burrows. These fleas can grow up to one-third of an inch (9 millimeters) in length!

HABITAT

Mountain beavers generally live in moist forests, especially near streams, which are dense with herbs and shrubs. They are found on mountains with deciduous forest to areas at sea level, and also in coniferous forests. Mountain beavers must live in places with deep soils so that they can burrow (dig holes or tunnels).

DIET

Mountain beavers are herbivores (plant-eaters) and feed on almost any plant material. These animals eat leaves, branches, bark, and twigs. They also drink large amounts of water.

BEHAVIOR AND REPRODUCTION

These animals spend much of their time along the banks of rivers and streams. They frequently wash themselves by dipping their front feet into the water and then scrubbing their body. These animals are strong swimmers.

Mountain beavers live alone or in small colonies. They may live in the same area as other mountain beavers that are sometimes referred to as colonies (groups). The concentration of these animals is most likely due to the fact that the colony sites make good habitats.

These animals have small home ranges, about 0.6 acres (0.25 hectares). Within this range mountain beavers build complex burrows with chambers for food storage, sleeping, and shelter. The burrows are long and close to the surface. The majority of a mountain beaver's time is spent in the underground burrows. They emerge only to forage or during the brief period of time when the young animals leave the nest to establish their own burrow sites. Other animals may also use their burrow system. The tunnels are cleaned and worked on regularly. If a tunnel is flooded by rain, the mountain beaver will swim in it.

Mountain beavers are primarily nocturnal, active at night. They are occasionally active for short periods of time during the daytime, especially in the autumn. When foraging for food, they seldom wander more than a few feet (meters) from their burrow. Although food is sometimes eaten above ground, it is generally brought to the burrow. It cuts off the plants desired



and drags it to the mouth of the burrow. The food is placed over some logs or some rocks to wilt, then is either stored or eaten. It eats holding its food in its front feet like a raccoon.

While not a great climber, the mountain beaver climbs shrubs and small trees to cut off small limbs and twigs. It cuts off the branches as it climbs. Occasionally, it will let the small limbs and twigs drop to the ground. More typically, the mountain beaver will carry the wood down by climbing down the tree headfirst.

Mountain beavers do not hibernate (slow down their body temperature to conserve energy) and are active year round. In the cooler months they rarely appear above ground and at this time, eat supplies of stored food. In the winter when vegetation is sparse, the beavers will eat bark and small twigs.

Mountain beavers have a brief breeding season. Pregnant females have been collected from late February to early April. Gestation (length of pregnancy) typically lasts twenty-eight to thirty days. Females generally have one litter per year, bearing two or three offspring, and rarely four. Newborns' eyes are



Mountain beavers spend most of their time in their complex burrows, which have chambers for food storage, sleeping, and shelter. The burrows are long and close to the surface. (Joseph Van Wormer/Bruce Coleman Inc. Reproduced by permission.)

tightly closed and may not open fully until about fifty days later. After about eight weeks, offspring are nearly half-grown and able to leave the nest. Offspring reach sexual maturity late in the second year of life.

MOUNTAIN BEAVERS AND PEOPLE

Humans have caused this family to decrease in population by destroying its natural habitat through development and other activities. In the Pacific Northwest, mountain beavers are considered a pest by many foresters and gardeners because they eat seedlings and young trees. They can also cause damage to trees by peeling off the bark. To prevent damage to their crops and gardens, people may use herbicides (substance used to kill or control plants) and traps, factors that contribute to the decline of mountain beavers.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists the mountain beaver as Near Threatened, not currently threatened, but could

become so. Two of the seven subspecies of mountain beavers are listed as Vulnerable (facing a high risk of extinction in the wild) by the IUCN.

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SQUIRRELS AND RELATIVES
Sciuridae

Class: Mammalia
Order: Rodentia
Family: Sciuridae
Number of species: 260 species

family
CHAPTER

phylum
class
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monotypic order
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PHYSICAL CHARACTERISTICS

Squirrels are some of the most familiar rodents. They are small to medium-sized animals with relatively long tails. Squirrels have five toes on the back feet and four on the front feet, with a well-developed claw on each digit. Eyes are relatively high on the head and spread apart to allow them a wide range of vision. Size, fur, shape, and tail features depend upon the type of squirrel. There are three general body forms in these animals: flying squirrels, ground squirrels, and tree squirrels.

Flying squirrels have large, bushy tails and bodies adapted for moving between trees. They are generally slim with long legs. A furred membrane, double layer of thin skin, extends between the wrist and ankle, which allows them to glide. They have large eyes. Their fur is soft and dense and is generally brown, gray, or blackish in color. The underside is a paler color.

Ground squirrels range widely in size. The marmots are the largest ground squirrels, with weights of up to 16.5 pounds (7.5 kilograms); the smallest are the American chipmunks, which weigh up to 5 ounces (142 grams). These squirrels are typically short legged with muscular bodies. Their tails are furry, but generally not as bushy as those of tree squirrels.

Tree squirrels have long, bushy tails, sharp claws and large ears. Some have well-developed ear tufts. Tree squirrels also range extensively in size, from the pygmy squirrels that is about the size of a mouse, to the fox squirrels that can measure 18 to 27 inches (46 to 69 centimeters). Their hind legs are extremely long and they have long curved claws. Their tails are almost as long as their bodies.

GEOGRAPHIC RANGE

Squirrels are found throughout the world, except in Australia, Madagascar, southern South America, and certain desert regions, such as in Egypt.

HABITAT

There are many types of flying squirrels found in south and southeast Asia, especially in tropical, hot and humid, forests. Some species live in northern temperate, not too hot or too cold, regions, up to the Arctic Circle.

Ground squirrels live in many different habitats, such as grassland, forests, meadows, and the arctic tundra. Chipmunks are the one type of ground squirrel that are often found in dense shrubs or closed forests.

Tree squirrels live in forests, woodlands, gardens, cities, and farmlands.

DIET

Most squirrels eat primarily plant materials. Tree squirrels and flying squirrels often eat nuts and seeds, and will occasionally also feed on fungi, eggs, insects, young birds, and small snakes. Ground squirrels also eat seeds, fruits, and nuts, but often have diets made up of large amounts of grasses and leafy materials.

BEHAVIOR AND REPRODUCTION

Most squirrels are active during the day, yet some species, such as all the flying squirrels, are nocturnal, active at night. Squirrels communicate by making shrill sounds. They also communicate by tail gestures, such as "flicking" the tail to indicate that another squirrel should go away. Most squirrels wrap their tail around themselves when resting. Squirrels build nests high in the trees called dreys, which are made of twigs and leaves. They line the inside of dreys with fur, feathers, or other soft material. The nest typically will have two exits. Squirrels also will build a nest called a den in the hollow of a tree.

Flying squirrels do not actually fly, as bats and birds do—they leap and glide. They leap from a high point, flattening their bodies and extending the legs widely, and then land at a lower point.



NEW TREES FROM FORGETFUL SQUIRRELS

For squirrels, a little forgetfulness can turn into a lot of trees. Every autumn, squirrels "squirrel away" numerous nuts. For example, it is estimated that each gray squirrel buries at least 1,000 nuts every fall, possibly as many as 10,000 nuts in one season. The squirrels can bury the nuts several inches deep. They locate their buried nuts by smell, and are able to find nuts buried under a foot or more of snow. But they can forget. It is estimated that millions of trees in the world are accidentally planted by squirrels that bury nuts and then forget where they hid them.

Some species can glide for as much as 1,476 feet (450 meters). The squirrels can even turn at a right angle to avoid a branch.

Ground squirrels make burrows, tunnels or holes, which they use to rest in during the heat of the day and escape predators, animals hunting them for food. Many of the ground squirrels hibernate, become inactive to conserve energy, for varying periods of time. Some squirrels can hibernate for up to nine months.

Tree squirrels are solitary animals, yet some African species travel in pairs or small groups. These squirrels build nests of leaves or needles in hollow trees or limbs. They are active and maneuver (mah-NOO-ver) easily in trees.

For ground squirrels, the breeding season follows shortly after hibernation. Some species will skip a year of breeding; others can reproduce more than once a year. Baby ground squirrels are generally born underground without fur. There are usually four in a liter. Flying squirrels typically give birth to small litters of one to two offspring, which are generally blind and naked at birth. Tree squirrels generally have a polygamous (puh-LIH-guh-mus) mating system, meaning the male and female can have more than one mate. Litter sizes vary, depending upon the habitat and food availability.

SQUIRRELS AND PEOPLE

People have hunted squirrels for their fur and meat, and for sport. While squirrels are generally considered playful and harmless creatures, these animals can destroy crops and some people consider them pests. Their burrows occasionally damage irrigation systems and can harm livestock, but these rodents also destroy undesirable weeds and insects. Some squirrels are also carriers of organisms that transmit human disease, such as the plague and Rocky mountain tick fever. People have caused a decline in many squirrel populations by destroying their habitats and hunting them.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists two squirrel species as Critically Endangered, facing an extremely high risk of extinction in the wild; nine species as Endangered, facing a very high risk of extinction; twenty-six species as Vulnerable, facing a high risk of extinction in the wild; and thirty-four species as Near Threatened, not currently threatened, but could become so.



Southern flying squirrel *(Glaucomys volans)*

SOUTHERN FLYING SQUIRREL
Glaucomys volans

Physical characteristics: Southern flying squirrels are generally about 8 to 10 inches (20 to 25 centimeters) long, and have a black ring around their large eyes. They have gray fur with white bellies.

Geographic range: These squirrels are found in eastern Canada south through the eastern United States. Isolated populations stretch to Honduras.

Habitat: Southern flying squirrels live primarily in deciduous forests. They usually make their nests in tree hollows.

Diet: These squirrels eat nuts, seeds and berries. They will also eat bird eggs, bird nestlings, insects and occasionally dead mice.



A southern flying squirrel spreads its hands and feet, stretching the thin membrane that connects them to glide up to 80 yards (73 meters). (© Joe McDonald/Corbis. Reproduced by permission.)

Behavior and reproduction: Southern flying squirrels are nocturnal. These squirrels will form small groups in the winter and share a common nest to keep warm. They typically glide an estimated 20 to 30 feet (6 to 9 meters) from the top of one tree down to the trunk of another tree, though they may glide farther.

Southern flying squirrels mate in early spring and summer. Females give birth to two litters of two to seven offspring. Mothers will defend their young and move them to another nest if they are threatened.

Southern flying squirrels and people: These squirrels are considered gentle and are popular as pets.

Conservation status: Southern flying squirrels are not listed as threatened by the IUCN. They are generally common with some isolated populations threatened due to habitat loss. ■



Eastern chipmunk *(Tamias striatus)*

EASTERN CHIPMUNK
Tamias striatus

Physical characteristics: The largest of the chipmunks, eastern chipmunks are about 8.9 to 10.6 inches (22.5 to 26.8 centimeters) long. They have grayish to reddish brown fur, white fur on their bellies, and five stripes from the neck to their tail. Two of the stripes are white bordered by black stripes, and one black stripe is in the center. They also have light strips above and below their eyes, and pouched cheeks.

Geographic range: Eastern chipmunks are found in southeastern Canada and most of the northeastern United States, south to Mississippi and Virginia and west to North Dakota and Oklahoma.

Habitat: Eastern chipmunks generally live in open deciduous forests with rocks, logs, and stumps. They can also be found in more open, bushy areas.



The eastern chipmunk is the largest of the chipmunks, and is common in the northeastern United States. (Illustration by Brian Cressman. Reproduced by permission.)

Diet: Eastern chipmunks primarily eat nuts, acorns, seeds, mushrooms, fruits, berries, and corn. They also eat insects, bird eggs, snakes, snails and small mammals, such as young mice.

Behavior and reproduction: Eastern chipmunks construct elaborate burrow systems. They are solitary, prefer to burrow alone, except for offspring. In warmer months they spend much of their time gathering and storing large amounts of food—they can gather up to 165 acorns in a single day. These animals remain in their dens for the winter and sleep frequently. They wake up every few weeks to eat the food they have stored.

These chipmunks breed from late June to early July. Litter sizes average three to five offspring. In some areas a female may have a second litter. Offspring will come above ground five to seven weeks after birth.

Eastern chipmunks and people: There is no special connection between these chipmunks and people.

Conservation status: Eastern chipmunks are not considered threatened. ■



Black-tailed prairie dog *(Cynomys ludovicianus)*

BLACK-TAILED PRAIRIE DOG
Cynomys ludovicianus

Physical characteristics: Black-tailed prairie dogs have sharp teeth, a black-tipped tail, and are about 14 to 15.7 inches (35.5 to 39.8 centimeters) long. Their fur is brown, golden brown, or reddish brown, and whitish on the underside.

Geographic range: These prairie dogs are found in areas from Canada to Mexico. In Canada they are found in Saskatchewan; in the United States they live from Montana to eastern Nebraska, south to northern Mexico.

Habitat: Black-tailed prairie dogs live in open, flat and arid, extremely dry, grassy plains.



Black-tailed prairie dogs are very social, living together in underground burrows called "towns." (© George D. Lepp/Corbis. Reproduced by permission.)

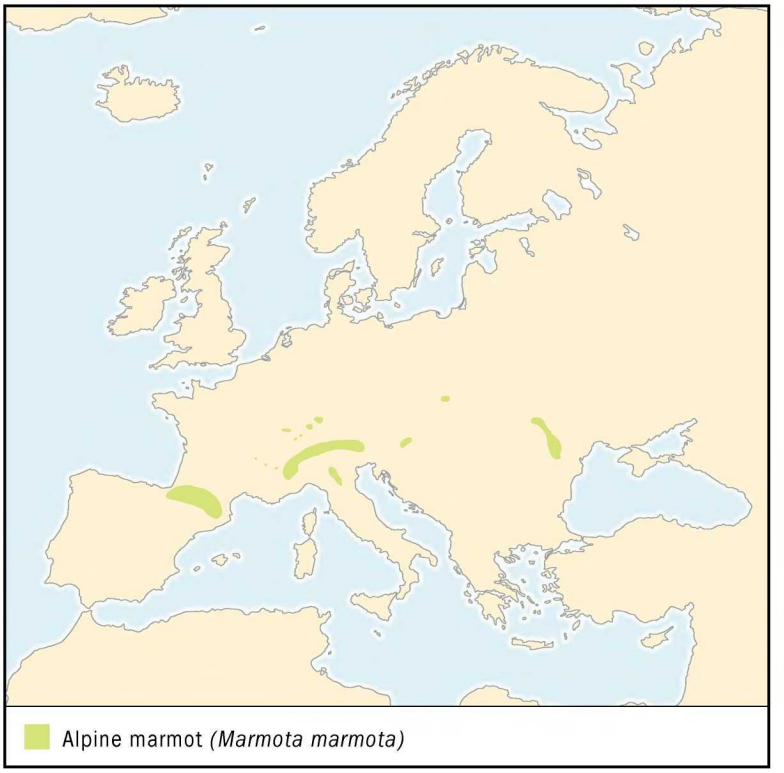
Diet: These animals eat primarily leaves, stems, grass roots, weeds, and wildflowers. They will sometimes eat grasshoppers, beetles and other insects.

Behavior and reproduction: Black-tailed prairie dogs are extremely social. They dig a complex series of tunnels deep into the ground, which is called a town. Towns can spread over hundreds of acres and contain thousands of prairie dogs. They communicate to one another frequently, using yips, growls, chattering, barks and chirps.

Black-tailed prairie dogs have one litter a year. Breeding occurs from February to March. A month after mating, the female will have three to four offspring. Female prairie dogs are extremely protective of their young. They will often fight with other females to guard their territory and babies.

Black-tailed prairie dogs and people: Some farmers and ranchers consider black-tailed prairie dogs pests. Livestock can hurt a leg if they step into a prairie dog's burrow, and they may compete with livestock for food.

Conservation status: Black-tailed prairie dogs are listed as Near Threatened by the IUCN. ■

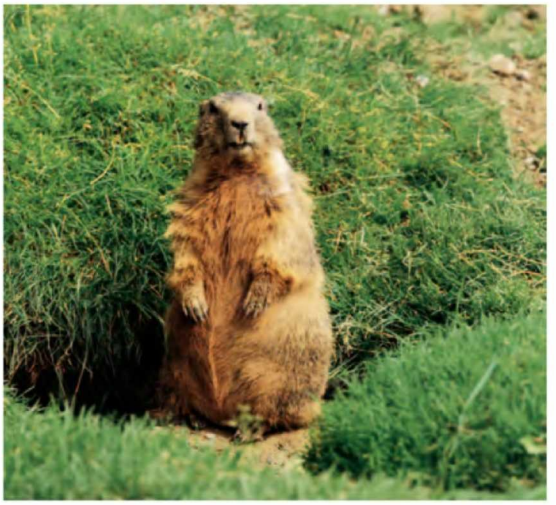


ALPINE MARMOT
Marmota marmota

Physical characteristics: Alpine marmots are relatively large with a head and body length of about 20 to 24 inches (50 to 60 centimeters). Their fur is thick and color varies from gray to yellow-brown to reddish. They have large heads; short, powerful legs; short, hairy tails; and a white bridge on their noses.

Geographic range: Alpine marmots are found in the French, Swiss and Italian Alps, South Germany, West Austria, the Carpathian mountains, and the Tatra Mountains. They have been introduced into the Pyrenees, east Austria, and Yugoslavia.

Habitat: These animals live in open mountainous grassland areas, at approximately 4,300 to 9,800 feet (1,300 to 3,000 meters).



The thumb of the alpine marmot has a nail instead of a claw to aid in digging. (© St. Meyers/ Okapia/Photo Researchers, Inc. Reproduced by permission.)

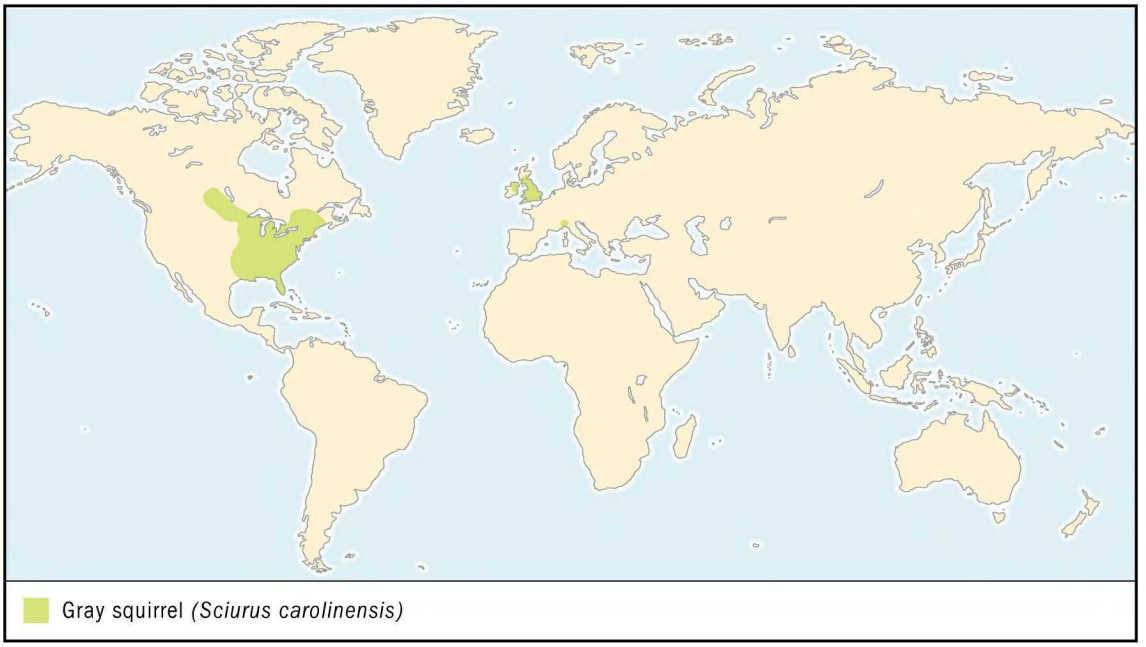
Diet: Alpine marmots feed primarily on a wide variety of vegetation, including grasses, flowers, bulbs and seeds. They may also eat insects, birds' eggs and occasionally each others' young.

Behavior and reproduction: Alpine marmots are social animals that form burrows. They live in family groups generally made up of an adult pair and their offspring from previous years. Colonies, groups, can be as small as two or three to as large as fifty, all living in one burrow system. During warmer weather they eat heavily, and then hibernate as a family from September to mid April or May. The last animal into the burrow, usually an adult male, plugs the entrance with hay and earth to keep the burrow warm and safe from predators. These animals have distinctive calls. One long whistle warns of a threat in the air, such as an eagle, while a series of whistles may warn of an approaching fox.

Female marmots are able to breed at the age of two. Breeding occurs once a year, a few days after they emerge from hibernation, but females do not typically reproduce as long as the offspring remain in the family group. Females have an average of three to four offspring.

Alpine marmots and people: Some people have long believed that alpine marmot fat rubbed into the skin could relieve arthritis. In Europe these animals have been a source of fur, meat, and fat for the last thousand years. The reliance of these animals for their food has decreased and some people consider them agricultural, farming, pests. They are also hunted for trophies in some areas, and hunting has caused the population of these animals to decline. Alpine marmots have become a symbol for the Alps.

Conservation status: Alpine marmots are not listed as a threatened species by the IUCN. ■



GRAY SQUIRREL
Sciurus carolinensis

Physical characteristics: Gray squirrels have a head and body length of 9.4 to 11.2 inches (24 to 29 centimeters). Fur color varies widely within the species, generally fur is black to pale gray with a white to pale gray belly. They have broad, bushy tails that are about the length of their head and body combined.

Geographic range: Gray squirrels are found in eastern and central United States, reaching southern Canada in the north. They have also been introduced into Texas, California, Quebec, Vancouver Island, and South Africa.

Habitat: Gray squirrels prefer forests and woodlands but they are often seen in urban parks and yards.

Diet: Gray squirrels eat primarily tree seeds and nuts, including acorns, hickory nuts, beechnuts, and butternuts. They also feed on berries, mushrooms, buds, and flowers.



The eastern gray squirrel, despite its name, can be colored gray or black. (© M. H. Sharp/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: Gray squirrels climb and jump well. They are considered solitary. They have well-developed senses of sight, smell, and hearing and are alert, especially on the ground. They are active year round, sheltering in tree hollows during the winter months. In the fall, gray squirrels gather and bury, at random, a winter food supply. When food is needed, these squirrels sniff the ground to recover their supply.

Gray squirrels have two breeding peaks during the year, generally December to February and May to June. After a forty-four–day gestation period, females give birth to a litter of two to seven young. Offspring are blind and helpless at birth, becoming somewhat independent at eight to ten weeks old.

Gray squirrels and people: These squirrels are hunted for sport and food. They are considered attractive and enjoyable for many park visitors. For homeowners, these squirrels may enter their homes for shelter, dig up their gardens, or eat the seeds in their birdfeeders. They are also considered a pest in areas where they damage the trees by stripping them of bark.

Conservation status: Gray squirrels are not considered threatened by the IUCN. ■

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BEAVERS

Castoridae

Class: Mammalia

Order: Rodentia

Family: Castoridae

Number of species: 2 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Beavers are among the largest of the rodents. They have a combined head and body length of 31 to 58 inches (80 to 140 centimeters). The flat, paddle-like tail is about 9.8 to 17.7 inches (25 to 45 centimeters) long. The tail is broad and scaly. A typical beaver can weigh 33 to 75 pounds (15 to 33 kilograms), with a few beavers weighing in at 100 pounds (45 kilograms). Males and females are similar in size.

Beavers' bodies are stocky with short limbs. Each limb has five clawed digits. The back feet, which are larger than the front, are webbed. The claws on the hind feet's first and second toes are split, appearing as a double claw. They have long, curved incisors, chisel-shaped teeth at the front of the mouth, that are an orange-brown color. The incisors grow continuously.

Their eyes are small and their ears are short. Their ears are set far back on their heads, which are broad and rounded. Beavers can close both their ears and nostrils when underwater. Beavers have a skin fold inside their mouths, which allows them to grasp onto items in their teeth without water entering their throat.

Beavers' fur is dense, made up of a fine coat of soft fur, called underfur, beneath long guard hairs, coarse hairs that form the outer fur and protect the underfur. The short underfur helps the beaver with water shedding and insulation. Fur color is a glossy yellowish brown to black. Their bellies are slightly paler in color, ranging from a brown to yellowish brown. The tail and feet are black.

The family name "Castoridae" refers to beavers' castor glands, or "castors." A gland is a group of special cells that make substances so that other parts of the body can work. This pair of glands, along with a pair of anal glands, releases a pungent, musky odor. Both sets of glands lie at the base of the tail.

GEOGRAPHIC RANGE

Beavers are found in North America, northern Europe, and northern Asia. After a decrease in population, these animals have been reintroduced to Russia, Scandinavia, and Argentina. They are also found in Chile.

HABITAT

Beavers live primarily along streams, ponds, lakes, swamps and other waterways, in areas where they can build dams. They are found mainly in areas with a year-round water flow, but are found occasionally in roadside ditches, drainage ditches, and sewage ponds. They are have also become more common in urban areas.

DIET

Beavers feed primarily on the bark and outer layers of deciduous trees such as birch, willow, alder, sweet gum, magnolia, maple, and dogwood. They eat twigs, leaves, and roots of trees and shrubs. They also eat various parts of aquatic plants, especially the young shoots of water lilies. During the warmer months, they may add grasses, corn, and other plants to their diet.

BEHAVIOR AND REPRODUCTION

Beavers are generally nocturnal, active at night. They are active year round. These animals are semiaquatic, living partly on land and partly in water, and are graceful moving about in water. They use their webbed feet and paddle-like tails to swim.

Beavers are hard workers and are considered the engineers of the animal kingdom because of the complex dams and lodges they build. Dams can be extensive, reaching over 10 feet (3 meters) high and stretching hundreds of feet long. A typical dam is 65 to 98 feet (20 to 30 meters) long. Mud and stones may set the foundation, base, for the dam. Brush and poles are added with the butt ends facing upstream, and mud, stones, and soggy vegetation are used as plaster on top of the poles. A dam is built higher than the water level. With maintenance and upkeep,

COUSINS TO A MAMMOTH

Today's beaver had a mega cousin that lived millions of years ago and was one of the largest rodents ever known. The giant beaver was estimated at 7 to 8 feet (2.1 to 2.4 meters) long and weighed 450 to 700 pounds (204 to 318 kilograms). The giant beaver roamed North American marshlands until about 10,000 years ago, when they disappeared. The giant beaver ate plant materials and spent a lot of time in the water. Unlike today's beavers, giant beavers had ridged cutting teeth and did not build dams. Fossil evidence of the giant beaver ranges from Florida to northern Canada.

dams are used by several generations of beavers.

Beavers may create multiple homes in their territory. Homes can take the form of a burrow, hole or tunnel, along a bank to make a den, or a wood lodge. Built of sticks and mud, the dome-shaped lodge is generally surrounded by the water backed up by the dam. The lodge may eventually reach more than 6.6 feet (2 meters) above the surface of the water. Each home may have several underwater entrances, which must reach below the winter ice. In some areas, especially near large rivers, beavers dig complex dens instead of building lodges. Burrows also may have underwater entrances that lead to the dry areas.

Beavers live in colonies, groups, of four to eight related individuals. Generally, the colony consists of a mated pair of adults and young that are less than two years old. There is usually only a single breeding female in a colony. A single beaver colony sometimes maintains several dams to control water flow.

The oil that beavers' glands produce is used to mark their territory. This oil is also used to grease the beaver's fur coat to make it water repellent. Constant grooming and this oil keeps beavers' fur waterproof. It uses its second claw on its hind feet for grooming. Males and females display territorial behavior and will fight trespassing beavers. Communication is through postures, scent marking, tail slapping, and vocalizations, including a whistling or whining call.

In the winter, beavers anchor sticks and logs underwater to feed on during winter. If their pond freezes over, they swim beneath the ice and feed on previously stored food. The senses of hearing, smell, and touch are well developed.

Beavers usually mate for life and are monogamous, have one mate. If one of the pair dies, the beaver may then find another mate. Females are dominant. Mating takes place once a year from January to March. Gestation, pregnancy, is 100 to 110 days. Females generally have three to four offspring, called kits, but can have anywhere from one to nine. Offspring generally will nurse for two to three months.

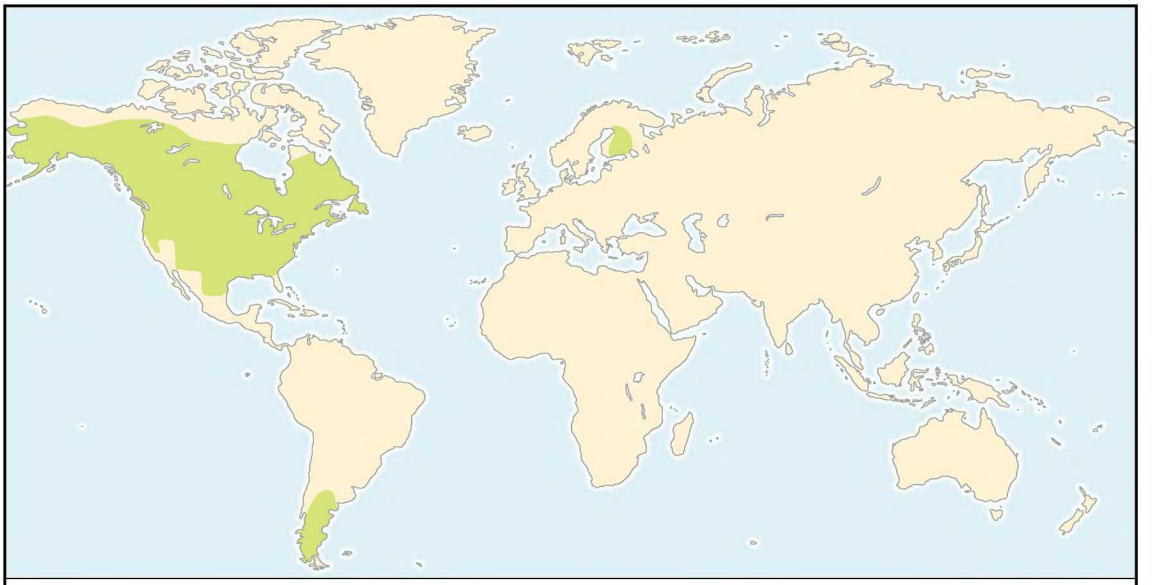
BEAVERS AND PEOPLE

Beavers were once common throughout Europe, Asia, and North America before people began hunting them for their thick, glossy pelts, fur. People used these pelts for coats and hats. People also dined on beaver and used the scents produced by their castor glands for perfume. In Europe, beavers were almost hunted to extinction, no longer existing, by 1860 C.E.

Beavers also can affect the water flow of an ecosystem. By constructing dams and burrowing into banks, they increase the wetland area and overall growth in an area. This helps organisms around the area flourish. For people, beaver's altering of a landscape can be a nuisance. Damming can flood roads, crops, and homes.

CONSERVATION STATUS

Populations of beavers, once extremely low, are gaining in numbers. The Eurasian beaver is listed as Near Threatened, not currently threatened, but could become so, by the World Conservation Union (IUCN).



North American beaver *(Castor canadensis)*

SPECIES ACCOUNT

NORTH AMERICAN BEAVER
Castor canadensis

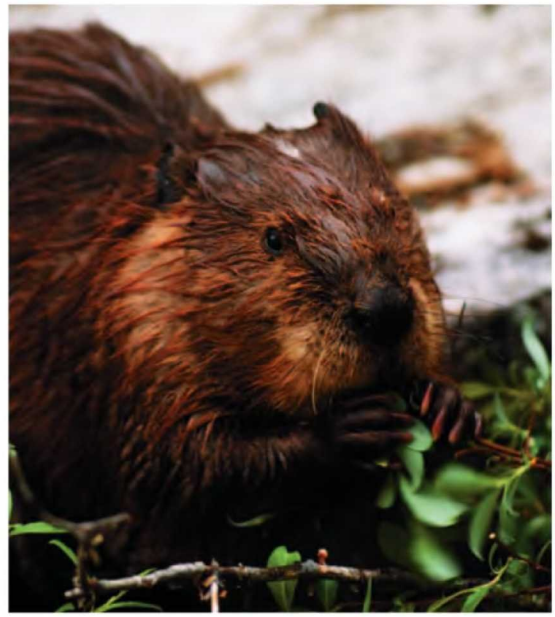
Physical characteristics: Also commonly called simply the American beaver, the North American beaver weighs from 33 to 75 pounds (15 to 35 kilograms). They have yellowish brown to black fur.

Geographic range: North American beavers are found in Alaska, Canada, throughout the continental United States, and the extreme northern areas of Mexico. These animals are not found in desert regions or southern Florida. They have also been introduced in Finland, Russia, and Argentina.

Habitat: Like all beavers, the North American beaver is aquatic and lives near water in the form of a pond, stream, lake, or river.

Diet: North American beavers eat a variety of plant material. They prefer the cambium, the soft layer between the wood and bark, and leaves of trees such as aspen, birch, aspen, willow, cottonwood, and alder. Their diet also can include aquatic plants, such as pond weeds, water-lilies, and cattails. North American beavers also eat grasses, shrubs, and herbs.

Behavior and reproduction: North American beavers build more extensive dams that alter the landscape than their European counterparts. They are primarily nocturnal but are also frequently active during the day. As the weather gets cooler, beavers stockpile food for the winter by storing it underwater in their lodge or den. When they are able to break through the winter ice, these animals continue to cut down trees. In the northern areas, this underwater food storage may be the beaver's main food supply for months. In the southern areas, beavers are more active year around.



North American beavers eat mostly cellulose, which is broken down by microorganisms in their cecum (SEE-kum), a part of the digestive system. (© Phil Schermeister/Corbis. Reproduced by permission.)

North American beavers and people: North American beavers are part of Native American myths. An Apache myth says that beavers have the magic of the medicine men. Beavers have played an integral role in the development of the United States and Canada. These animals were highly valued for the pelts. The beaver pelt became a unit of currency in colonial times, often leading to fights over trapping territories. The potential for profit, money, encouraged trappers to continue to move west, and settlers soon followed the trappers. Beavers were hunted so intensively throughout North America that the population was reduced by 90 percent by the late twentieth century.

Altering its environment with dams and the creation of ponds benefits the beaver's ecosystem. The ponds help control runoff and help the fish and other organisms flourish. There are over fifty species of animals that live in beaver ponds. The damming of streams raises the level of the water. This causes the tree species that cannot survive in permanently wet soil to die, allowing for the spread of other species. Some people consider these animals a pest. The cutting of trees can damage crops and timber. Their creation of dams can cause flooding that can also harm woodlands and farms.

Conservation status: The IUCN does not list the North American beaver as a threatened species. ■

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family CHAPTER

POCKET GOPHERS
Geomyidae

Class: Mammalia
Order: Rodentia
Family: Geomyidae
Number of species: 36 species

PHYSICAL CHARACTERISTICS

Pocket gophers have stout, heavy set bodies that have a tube-like shape. The length of their bodies varies depending upon the species from 5 to 14 inches (13 to 36 centimeters). Males are generally larger than females. Their legs are relatively short and powerful. The five claws on their thick front legs are long, sharp, and curved. The third claw is the longest. Their hands are broad.

The pocket gopher does not appear to have a neck. They have short, almost hairless tails, which are extremely sensitive to the touch. Eyes and ears are small, and surrounded by numerous hairs that prevent soil from getting in. They have large and sharp incisors, chisel-shaped teeth at the front of the mouth. They also have whiskers that extend from their nose.

The "pocket" part of their name refers to fur-lined pouches, one on each side of their mouth, in which they carry food. The name gopher comes from the French word *gaufre* meaning waffle or honeycomb, and refers to the network of passages that it digs. The pouches open into the mouth and extend from the mouth region back to the shoulders. When filled with food, the pouches make the pocket gopher's head appear almost twice its size. Pocket gophers can turn these pouches inside out for cleaning.

Pocket gophers have loose and flexible skin. The skin is thick around the head and throat. Fur color varies widely, even within a species. The color generally matches the color of freshly turned soil, a light brown to almost black. Fur is generally soft, and is short in species living in hot environments.

GEOGRAPHIC RANGE

Pocket gophers are found in North America and extend into Central America. They are found from southern Canada through western North America, southward to northwestern Colombia in South America. One species occurs in the southeastern United States, in Alabama, Georgia, and Florida.

HABITAT

Pocket gophers live in almost any area that has soil that they can dig. They are found in meadows, forests, deserts, rainforests, and fields, from dry, extremely hot, climates at sea level to extremely cold climates in mountainous areas. They do not travel far, and occur in isolated areas. They spend most of their lives underground, though they surface at times to gather food. In certain parts of the country, the older animals may move to moister areas during dry periods.

DIET

Pocket gophers are herbivores, plant eaters. These animals feed primarily on the underground parts of plants, especially the roots, bulbs, and tubers. They also cut stems and carry them in their cheek pouches to their storage chambers.

BEHAVIOR AND REPRODUCTION

Pocket gophers are rarely seen because they spend almost their entire lives underground. Also, these animals are generally crepuscular (kri-PUS-kyuh-lur), active at dawn and dusk, and some are nocturnal, active at night. Pocket gophers do not hibernate, go into a resting state to conserve energy, and in general, are active year round.

These animals forage, look for food, through the ground, burrowing, or digging, a set of complex tunnels. Where the digging is easy, pocket gophers are able to tunnel as much as 200 to 300 feet (61 to 91 meters) in a single night. They dig primarily with their powerful front claws. They use their upper incisors to cut roots and loosen soil and rocks. They use their sensitive tail and whiskers to feel their way around in the dark.

Pocket gophers generally dig two kinds of tunnels. One type of tunnel is long, winding, and shallow. They use this type to get food from above. The second type of tunnel is deeper. They use these tunnels for shelter, with chambers for nests, food storage,

and fecal, waste, deposits. The tunnels are usually marked above ground by small mounds of earth. When not in use, these animals plug up burrow entrances with dirt. Pocket gophers can run backward in their burrows almost as fast as they can run forward. Burrows may be occupied by the same animal for several years and spread over an acre (0.4 hectares) of ground.

Pocket gophers are extremely unsocial. They live alone in their burrow system. When one pocket gopher meets another, they squeal and hiss at one another, and their teeth chatter. They may fight violently. One is often killed in the fight.

The only time pocket gophers spend time with others of their species is during the mating season. Generally in the spring, the male leaves his den and briefly goes into the burrow of a female. Pocket gophers typically breed only once per year, although some species are capable of breeding in the spring and fall. Gestation, pregnancy, ranges from eighteen to more than thirty days, with the smaller species having the lower gestation times. Litter size varies from one to ten offspring. Until they are five weeks old the babies' eyes and ears are sealed shut. Offspring stay with the mother in the burrow for one to two months, and then each sets off to burrow its own system of tunnels.

POCKET GOPHERS AND CHEWING LICE

Studies have shown that relationships among species of pocket gophers mirror relationships among species of chewing lice, suggesting they have a long history of living together. Lice are small organisms that live, grow, and eat on other organisms. When pocket gophers mate, the lice on one gopher can jump to the other gopher to mate with the lice infesting it. Since pocket gophers mate only with their own species, the lice are limited to mating with other lice that live on that same species of pocket gopher. In this way, as pocket gophers formed separate species, the lice that live on them are also likely to form separate species.

POCKET GOPHERS AND PEOPLE

Pocket gophers play an important role in the ecosystem in which they live. They loosen and enrich the soil when they burrow. The occupied or abandoned burrows of these rodents are used extensively by other animals for shelter or foraging.

Some people consider these animals to be pests. In some areas, a single pocket gopher can destroy a family garden in less than a month. Their burrows can harm agricultural fields, causing extensive crop damage. They can consume a great deal of the underground parts of plants. Commercial farmers may trap and poison pocket gophers. Humans have also destroyed or altered these animals natural habitat, causing a decline in the population

of some of these species. Some people in Latin America consider the meat of the pocket gopher to be a delicacy, luxury.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists fifteen species of pocket gophers as threatened. The Oaxacan (wah-HAH-kan) pocket gopher and Querétaro pocket gopher are listed as Critically Endangered, facing an extremely high risk of extinction. The Michoacan pocket gopher is considered Endangered, facing a high risk of extinction.



Valley pocket gopher *(Thomomys bottae)*

VALLEY POCKET GOPHER
Thomomys bottae

SPECIES ACCOUNT

Physical characteristics: The valley pocket gopher is also commonly know as Botta's pocket gopher, smooth-toothed pocket gopher, and western pocket gopher. Valley pocket gophers have a combined head and body length of 6 to 13 inches (15 to 33 centimeters). Claws on their front feet are relatively small. Fur color varies among individuals, ranging from pale gray to reddish brown to black. The belly is grayish white, white, light yellowish brown, or mottled, splotched. An identifying characteristic of these animals is a single indistinct groove on each incisor.

Geographic range: Valley pocket gophers are found in the western United States into northern Mexico. They can live at altitudes from sea level to 10,000 feet (3,000 meters).



Valley pocket gophers spend 90 percent of their time below ground. By the roots, they can pull entire plants underground into their burrows. (© Tom McHugh/Photo Researchers, Inc. Reproduced by permission.)

Habitat: These animals can live in a wide range of habitats. They occur in soils ranging from loose sands to tight clays, and in dry deserts to mountainous meadows. They commonly live in valleys, woodlands, deserts, and agricultural fields.

Diet: Valley pocket gophers feed on below ground plants such as roots and tubers. They especially like the roots of alfalfa. From its root, pocket gophers can pull the entire plant into its burrow to eat or store the food. They will also come to the surface to feed and clip off vegetation near the entrance of their burrow.

Behavior and reproduction: Valley pocket gophers are solitary animals that are active throughout the year. They burrow a system of tunnels and spend about 90 percent of their time below ground.

During the breeding season males will briefly join females in their burrows. The main breeding season is in spring, however these animals will sometimes breed in the fall also. Females generally bear two to four offspring per litter.

Valley pocket gophers and people: Farmers and gardeners may consider these animals pests. Valley pocket gophers can be

destructive to plants, and people will trap or poison them. Yet the burrowing activity of these animals cultivates the soil, and vegetation and many organisms are dependent upon their continued activity.

Conservation status: This species is not listed as threatened by the IUCN. ■

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POCKET MICE, KANGAROO RATS, AND KANGAROO MICE

Heteromyidae

Class: Mammalia
Order: Rodentia
Family: Heteromyidae
Number of species: 60 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Pocket mice, kangaroo rats, and kangaroo mice, sometimes called heteromyids (members of the family Heteromyidae), are small- to medium-sized rodents with external, fur-lined cheek pouches. The pouches open in front of the mouth and go back along the shoulders. They have fairly large eyes and short, rounded ears. Pocket mice use all four feet while walking, while kangaroo rats and mice use only their rear two feet for walking. Kangaroo rats and mice have long tails with white tips or tufts on the end, along with relatively short front limbs. Pocket mice have shorter, less noticeable tails. Kangaroo rats and mice have good hearing. Kangaroo rats and mice have soft and silky fur, while pocket mice have coats that range from silky to spiny. The coat color varies from light to dark, depending on species and habitat, often matching the soil color on which they live.

Adults are 1.7 to 14.6 inches (4.3 to 37 centimeters) long and weigh between 0.2 and 6.9 ounces (5 and 195 grams). Kangaroo rats weigh between 1.2 and 6.9 ounces (33 and 195 grams); kangaroo mice weigh between 0.4 and 0.6 ounces (10 and 17 grams); and pocket mice weigh between 0.2 and 3.0 ounces (5 and 85 grams).

GEOGRAPHIC RANGE

Heteromyids are found in the western United States, southwestern Canada, Mexico, Central America, and northern South America.

HABITAT

Heteromyids live in deserts, dry grasslands, and, in a few cases, wet and dry tropical forests. Desert pocket mice and kangaroo rats like arid, dry, climates that contain sand, scrubs, sagebrush, grasses, and chaparral. Kangaroo mice prefer sandy habitats. In all cases, heteromyids like areas that contain many seeds.

DIET

Heteromyids eat mostly seeds, but also eat green vegetation and, in some species, insects. Desert species can go without water for long periods of time. They leave their burrows at night to dig through soil with their forelimbs to gather seeds into their cheek pouches. When pouches are full, they return to one of their caches (KASH-uhz), hidden supply areas, which are used throughout the animal's home range. Heteromyids defend their territory aggressively when they have collected many seeds.

BEHAVIOR AND REPRODUCTION

Heteromyids are nocturnal, active at night, rodents. Kangaroo rats and mice move about mostly by hopping on their hind limbs, while pocket mice use all four of their limbs in a walking motion. They have a very basic social structure, mostly living alone except for females and young. They do interact with nearby neighbors, which are often relatives. Most species burrow tunnel systems with multiple chambers and surface openings.

Heteromyids have well-developed communication systems. Medium- and large-sized kangaroo rats communicate by drumming or thumping the ground with their large hind feet; familiar thumping identifies neighbors, while strangers are not recognized. Each species has its own set of drumming patterns, which are heard through the air and ground.

Male home territories overlap with those of other males and females. Females occupy a territory that contains no other females. They regularly bathe in sand, which helps to clean their hair and to deposit their scents onto the ground. Their scent informs other heteromyids and other animals about their sex, identity and mating status. When a predator, an animal that hunts other animals, is seen, heteromyids use their body coloring to hide and avoid them. If needed, they will run away along a crooked path. Desert heteromyids also have strong hearing that lets them hear approaching predators.

Males always travel to female territories during breeding season in order to mate. Mating relationships range from one male and one female, to several males competing for access to one breeding female. Larger and medium sized kangaroo rats drum their feet in order to chase away competing males. Females prefer to mate with males they know, but will mate with strangers if necessary. Males will mate with any females. Breeding occurs only when enough moisture is available for nursing females to provide milk to young. Females produce several litters, group of young animals born at same time from the same mother, each year, but the number depends on environmental conditions. Litter sizes range from one to nine, but average three to four in most species. They live ten years or longer.

POCKET MICE, KANGAROO RATS, KANGAROO MICE, AND PEOPLE

Kangaroo rats are considered keystone species because their burrows provide habitat for a variety of plants and animals. A keystone species is a species that is important in maintaining the biodiversity, the variety of different animals and plants, of an area.

CONSERVATION STATUS

Four species of pocket mice, kangaroo rats, and kangaroo mice are listed by the World Conservation Union (IUCN) as Critically Endangered, facing an extremely high risk of extinction in the wild. One species is listed as Endangered, facing a very high risk of extinction in the wild, and one species is Vulnerable, facing a high risk of extinction. The IUCN also lists nine species as Near Threatened, not currently threatened, but could become so. Many species are threatened with excessive destruction and fragmentation, breaking up, of habitat and the loss of plant life.



San Joaquin pocket mouse *(Perognathus inornatus)*

SAN JOAQUIN POCKET MOUSE
Perognathus inornatus

Physical characteristics: San Joaquin (san-wah-KEEN) pocket mice are small sand-colored mice with soft coats, sparse darker back hairs, and yellowish undersides. They do not have spiny hairs that are often found on other pocket mice species. A line separates the lighter belly hairs from the darker back hairs. San Joaquin pocket mice have short ears that sometimes have a base patch of lighter hair. Their hind feet have hair on the soles and their long tails are covered with hair with a small hair tuft on tip. They have external fur-lined cheek patches that are used for storing and transporting food. Adults are 5.0 to 6.3 inches (13 to 16 centimeters) long and weigh between 0.22 and 0.39 ounces (7 and 12 grams).

Geographic range: They are found in west-central California.



San Joaquin pocket mice not only eat seeds, but help to scatter them, which helps to maintain a healthy environment. (Illustration by Michelle Meneghini. Reproduced by permission.)

Habitat: San Joaquin pocket mice inhabit arid grasslands, deserts, and scrublands, especially areas with fine soils.

Diet: Their diet consists of seeds of grasses, shrubs, and forbs, broad-leaved herbaceous plants that grow in prairies and meadows. San Joaquin pocket mice forage, search for food, within shrub branches. They also eat soft-bodied insects such as cutworms and grasshoppers, and rarely drink water, getting almost all moisture through their food.

Behavior and reproduction: San Joaquin pocket mice do not travel far to forage, and stay away from open areas. They bathe by rubbing their sides and ventrum, external opening by which wastes pass in primitive mammals, in the sand. Their breeding season is from March to July. Females have at least two litters of four to six babies per litter.

San Joaquin pocket mice and people: San Joaquin pocket mice help to scatter seeds, which helps to maintain a healthy environment where it lives.

Conservation status: San Joaquin pocket mice are listed by the U.S. Fish and Wildlife Service as a species of special concern. Two subspecies, populations of a species in a specific area, are listed as Near Threatened. ■



Giant kangaroo rat *(Dipodomys ingens)*

GIANT KANGAROO RAT
Dipodomys ingens

Physical characteristics: Giant kangaroo rats are the largest members of heteromyids. They have long and powerful hind limbs that are used for hopping, and small and relatively weak front limbs that are used for digging. These animals have very long tails that are used for balance. Their dark tail has white lines along either side. They have large eyes, small rounded ears, and a somewhat rounded body. Their coat is sandy-colored with a white underside and a white stripe across the hindquarters. Adults are 12.3 to 13.7 inches (31 to 35 centimeters) long and weigh between 3.0 and 6.3 ounces (93 and 195 grams).

Geographic range: Giant kangaroo rats are found in San Joaquin Valley, California.

Habitat: They inhabit arid grasslands that contain sandy soils and are sparsely populated by desert shrubs.



Giant kangaroo rats use their strong hind limbs to hop around. They can jump up to 6 feet (2 meters) to escape from a predator. (© Richard R. Hansen/Photo Researchers, Inc. Reproduced by permission.)

Diet: Their diet consists of seeds, which are first stored in burrows. Sometimes seed heads are cured, preserved, in surface caches. They also eat insects and other vegetation.

Behavior and reproduction: Giant kangaroo rats are nocturnal animals, hiding in their burrows during the hottest parts of the day. Burrows are usually shallow tunnels that contain larger chambers, one that acts as a nest and the others used to store food. They are usually found alone, and move by hopping on their back legs. Their back, hind, legs let them jump over 6 feet (2 meters) when escaping predators. Their front limbs are smaller and used only for digging. They defend their territory, but live peacefully with their close neighbors.

Both sexes drum their hind feet in order to tell visitors to stay away, or to tell other giant kangaroo rats that predators, such as snakes and kit foxes, are around. Males drum their feet while competing with other males for the right to mate with a mature female. This mating sound may include up to 300 individual thumps that are repeated many times. The breeding season is from January to May. Females have more than one breeding cycle per year, and have an average of three breeding cycles in a breeding season. The gestation, pregnancy, period is thirty to fifty-five days. Typically, females are able to breed again three days after giving birth. Young are able to breed after only two to three weeks of being born.

Giant kangaroo rats and people: Giant kangaroo rats are considered keystone species.

Conservation status: Giant kangaroo rats are listed by the IUCN as Critically Endangered. They are also considered endangered by the California Fish and Game Commission and the U.S. Fish and Wildlife Service. Their populations have drastically decreased due to habitat loss as deserts are converted to agricultural lands. They no longer occupy over 95 percent of their former habitat, but are protected within the Carrizo Plain Natural Heritage Reserve and a number of federal lands. ■

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BIRCH MICE, JUMPING MICE, AND JERBOAS

Dipodidae

Class: Mammalia
Order: Rodentia
Family: Dipodidae
Number of species: About 50 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The Dipodidae family includes small to medium-sized rodents that walk on two or four legs. In general, their back legs are slightly or much longer than their front legs. They have long tails, and the jerboas' tails often have a distinctive black-and-white "banner" at the end. These mammals' fur is either coarse or soft and colors range from soft brown to brownish yellow to purplish-brown. The Dipodidae rodents range in length from 1.8 to 9 inches (4.5 to 23 centimeters) and weigh from 0.2 to 15 ounces (6 to 415 grams). The birch mice and jumping mice walk on four legs and are small, mouselike creatures with long tails and small, narrow heads. Birch mice have four legs of equal length, while the back legs of jumping mice are somewhat longer than their front legs. Both birch mice and jumping mice have short, blunt claws. Jerboas can be small or medium sized, and jump or walk on their back legs. Unlike the birch mice and jumping mice, which are mainly nocturnal but are sometimes active during the day, jerboas are strictly nighttime creatures. They can run very quickly through sparse brush. Their heads are large, with wide muzzles and flat snouts, and they have large eyes for better nighttime vision. Jerboas have compact, short bodies with short front legs and long, strong back legs. They can have either long or short claws and three, four, or five toes. All members of the Dipodidae family are remarkable for their jumping ability—probably an adaptation for evading predators in open country. Many of the mammals can cover 10 feet (3 meters) in a single jump, using their long tails to balance. In most species, the three central bones of the

foot are fused, creating a single bone that provides major strength and support.

GEOGRAPHIC RANGE

The Dipodidae family is widespread throughout the world, and its species are present in North America, northern Africa, the Arabian Peninsula, Europe, and Asia, where they are believed to have originated.

HABITAT

Birch mice, jumping mice, and jerboas occupy a wide range of habitats around the world. Birch mice are most often found in thickets, forests, fields, moors, and steppes. Jumping mice tend to live in woodlands, grasslands, and alpine meadows, where they concentrate in the thick growth near streams, rivers, and marshes. Jerboas are adapted to desert environments and occupy moving sands, rocky plateaus, dry mountainsides, and even clay depressions. Many of the species will live in only very specific places, while others are less selective.

DIET

Birch mice and jumping mice eat berries, fungus, nuts, fruits, and insects. Jerboas are omnivores, and eat insects, fruits, seeds, bulbs, plant parts, and even other jerboas.

BEHAVIOR AND REPRODUCTION

Birch mice are able to mate after their first hibernation, and usually have one litter per year containing three to eleven pups. Their gestation period is two to five weeks, and parents care for the young for one month, which is quite long by rodent standards. In jumping mice, which (with a few exceptions) are also ready to mate after hibernation, mating pairs sometimes produce two or three litters. The gestation period is seventeen to twenty-three days and the litter size is usually two to nine pups. Among jerboas, some species breed only once a year during the spring and summer and produce litters of two to nine pups. Others breed in the spring and fall and can produce up to three litters a year, although their litter size is smaller (one to eight pups). In the majority of jerboa species, pups stay in the burrow for five to six weeks before emerging, probably because it takes extra time for them to develop the coordination required for bipedal movement.

SANDSHOES FOR THE JERBOA

Jerboas have evolved tufts of coarse, bristly hair under the soles and toes of the hind feet. These act like snowshoes, keeping the animals from sinking into or slipping on loose sand. The tufts also help jerboas to kick sand backward while digging, preventing it from sliding back into their burrows.

Birch mice and jumping mice, while quadrupeds (animals that move about on all fours), also hop and use their tails to hang onto twigs and grasses. Jumping mice can hop up to 6 feet (1.8 meters) long and 3.3 feet (1 meter) high. Both types of mice are strong swimmers as well, and hop straight up when startled. Jerboas move on their hind feet exclusively and are very fast runners. The five-toed jerboa, for instance, can maintain speeds of 25 miles per hour (40 kilometers per hour).

Jumping mice and birch mice seldom dig, finding shelter under logs, in other animals' abandoned burrows, among roots, or under boards. Jerboas, on the other hand, typically dig and live in complex burrows with multiple chambers that they plug during the day to seal out heat and keep in moisture. Sometimes they have different burrows for daytime shelter and for nighttime escape from predators.

Most members of the Dipodidae family hibernate, but for how long and when varies widely based on geography and species. Birch mice hibernate for six or seven months of the year, and can lose up to half of their body weight. Species that breed in the spring and fall hibernate for shorter periods, while those that live in tropical regions experience only a few days of lethargy.

Species of this family are typically solitary and every individual has its own burrow for sleeping and hibernating. In general, these mammals seem tolerant of other individuals' presence, although females are reportedly more aggressive in defending their areas. Neighboring birch mice and jumping mice species even share shelter burrows, but jerboas actively avoid contact with other jerboas in overlapping areas. This is problematic in places where the abundance of jerboas results in population densities of forty to fifty individuals per 2.5 acres (1 hectare). Some jerboas mark their territories by rolling in sand, while others rub their genital areas on the ground.

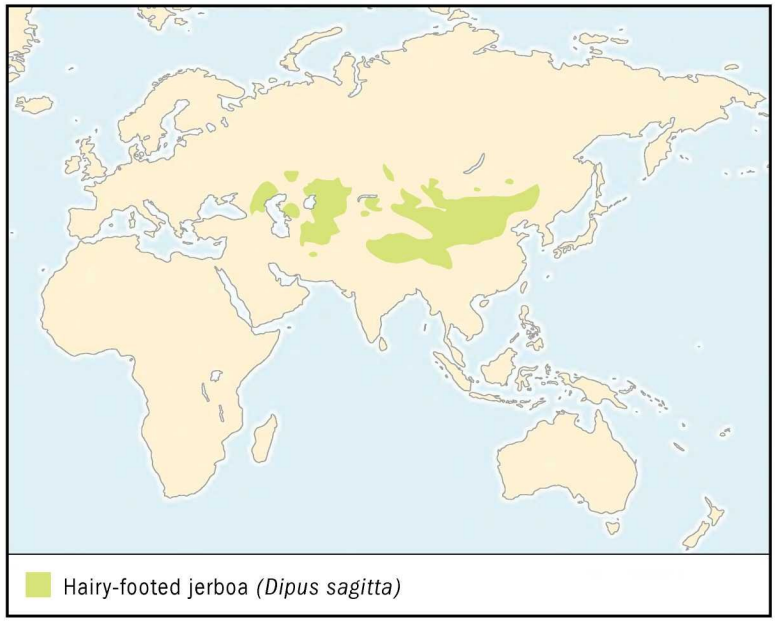
None of the species in this family store food. Many of them, however, have specialized ways of finding prey, such as highly developed inner ears that help them hear tiny vibrations in the earth and powerful hind legs that allow them to jump extremely quickly into the air to catch passing insects.

BIRCH MICE, JUMPING MICE, JERBOAS, AND PEOPLE

While the Dipodidae family plays an important role in numerous ecosystems, they have very little interaction with or significance to humans.

CONSERVATION STATUS

Two species, the Armenian birch mouse and the Iranian jerboa, are listed as Critically Endangered, facing an extremely high risk of extinction, dying out, by the IUCN. Three other species are Endangered, facing a very high risk of extinction; three are Vulnerable, facing a high risk of extinction; and nine are considered Near Threatened, not currently threatened, but could become so.



SPECIES ACCOUNT

HAIRY-FOOTED JERBOA
Dipus sagitta

Physical characteristics: Also known as the feather-footed jerboa, rough-legged jerboa, and northern three-toed jerboa, the hairy-footed jerboa was first discovered in 1773. Its body ranges in length from 4.5 to 6 inches (11.5 to 14.5 centimeters), while its tail is typically 7 to 7.1 inches (17.5 to 18 centimeters) long. These mammals weigh between 2.4 and 4 ounces (69 to 104 grams). Underparts are white, and upperparts change from orangey and black in the winter to pale, sandy buff color in summer.

Geographic range: A resident of the Middle East, Asia, and Europe, the hairy-footed jerboa occupies ten isolated, large areas and several smaller fragments of habitat in the northern Iranian sand deserts, Turkmenistan, Uzbekistan, southwestern Kazakhstan, Mongolia, China, and eastern Russia.

Habitat: At the northern extreme of its range, the hairy-footed jerboa lives in sparsely vegetated areas of pine forests, but in general this mammal occupies sandy expanses of steppes, deserts, and semi-deserts.



The hairy-footed jerboa eats mainly desert plants and seeds, but also occasionally eats insects. (Illustration by Patricia Ferrer. Reproduced by permission.)

In central Asia, this jerboa also lives in places with hard rocky or gravel-strewn surfaces.

Diet: While the hairy-footed jerboa subsists mainly on desert plant greens and seeds, it occasionally preys on insects as well.

Behavior and reproduction: Hairy-footed jerboas mate with more than one individual during the breeding season in spring. Female bear two or three litters per season, in spring and fall. The spring-born animals can mate at two-and-a-half to three months, and usually participate in the fall mating. Pregnancy lasts thirty-five days, and the number of young varies from one to eight. In springtime, female adults are usually still nursing their fall litter when they mate again.

Hairy-footed jerboas are solitary creatures, although they willingly tolerate overlapping home ranges. The vast majority of their contacts in nature (versus those in captivity) are non-aggressive. When captive, males and females form pairs and sleep together in a single nest.

Hairy-footed jerboas and people: There are no records of significant interactions between this species and humans.

Conservation status: The hairy-footed jerboa is common in all of its habitats, with the exception of one subspecies, which is listed as Vulnerable because of the expansion of steppes through areas of open sand dunes in southeastern Russia. ■

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family CHAPTER

RATS, MICE, AND RELATIVES
Muridae

Class: Mammalia
Order: Rodentia
Family: Muridae
Number of species: More than 1,326 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Rats, mice, and relatives, sometimes called murids (MYOO-rids; members of the family Muridae), are divided into seventeen subfamilies, including voles and lemmings, hamsters, Old World rats and mice, South American rats and mice, and many others. As a result of the large number of species, there is much variation in the physical characteristics of murids.

Voles and lemmings are small rodents with a broad, rounded head; small eyes and ears; thick, cylindrical body; and short legs and tail. Most species' fur is some shade of brown with paler underparts. Lemmings look a lot like voles, but most species are stockier, with heavier bodies and shorter tails. Adults are 3.5 to 24.5 inches (8.5 to 62 centimeters) long and weigh between 0.5 ounces and 4 pounds (15 grams to 1.8 kilograms).

Hamsters are mouse-like Old World rodents with large cheek pouches used to carry food; stout body; short legs; wide, (sometimes) furry feet; and short, furry tails. They have front paws with four digits and a short thumb, and hind feet with five digits. Their soft, thick fur varies in color (depending on the species) from gray to reddish brown, and their underparts can be white, gray, or black. They have excellent senses of hearing and smell, but poor eyesight (even though they have large, round eyes). Adults are 2 to 13.4 inches (5 to 34 centimeters) long and weigh between 0.9 and 31.7 ounces (25 to 900 grams).

Old World rats and mice have long tails (sometimes longer than the body) that are either furry or scaly; strong feet; long hind feet; and opposable digits on their front feet. Adults have

a length of 1.9 to 14.7 inches (5 to 36 centimeters) and a weight of 0.2 to 52.9 ounces (5 grams to 1.5 kilograms).

South American rats and mice are small- to medium-sized rodents with brownish or blackish upper coats; very small or no external ears; grayish or whitish underparts; thinly haired tails that sometimes have a penciled tip; and relatively small feet. They have a head and body length of 2.4 to 11.4 inches (6.1 to 29.0 centimeters); tail length of 1 to 6.3 inches (3 to 16 centimeters); and weight of 0.4 to 18 ounces (12 to 510 grams).

All other rats, mice, and relatives vary widely in physical characteristics. Most species are small, usually with somewhat long tails and brownish fur.

GEOGRAPHIC RANGE

Rats, mice, and relatives are found throughout the world except for the extreme polar regions of Earth.

HABITAT

Rats, mice, and relatives live in many different habitats including open flatlands, savannas (flat grasslands), grasslands, prairies, steppes (treeless plains that are often somewhat dry and grass-covered), woodlands, forests, deserts, scrublands, foothills, jungles, rainforests, wetlands, cultivated lands and fields, and along waterways and water bodies. They are found from dry temperate (mild) climates to wet tropical environments.

DIET

Most species of rats, mice, and relatives eat at least a few of the following foods: grasses, seeds, grains, root vegetables such as bulbs and tubers, green plant parts, conifer needles, nuts, berries, fruits, insects and insect larvae (LAR-vee), fish, lizards, frogs, baby birds, crabs, tadpoles, salamanders, fungus, lichens, mosses, other small vertebrates (animals with a backbone) and invertebrates (animals without a backbone), and carrion (decaying animals).

BEHAVIOR AND REPRODUCTION

Rats, mice, and relatives are active during the day, at night, or both night and day (depending on the species). For their size, they can be very aggressive to predators and even to other members of their species. The rodents can be vocal, with various communicative sounds such as chattering, screaming, and

whistling. They set up territories and defend them vigorously. Murids are sometimes found alone, but often are social, and are found traveling and sleeping together. They use nests for shelter and to raise their young. Some species breed throughout the year but others only during certain seasons. Murid rodents generally have high reproduction rates (lots of offspring) and large populations. Litters (groups of young born at the same time from the same mother) have one to seventeen offspring. Young are born blind and naked, although they develop fast, are weaned (stop drinking their mother's milk) quickly, and are able to reproduce within weeks or months.

RATS, MICE, RELATIVES, AND PEOPLE

Rats, mice, and relatives are generally considered pests in agricultural and forested lands. Large species are often trapped for their fur. Some species carry diseases that can sicken and kill people. Rats, mice, and relatives are frequently used as laboratory research animals. Some, such as hamsters and gerbils, are kept as pets. They are often important in maintaining a healthy ecosystem in their natural habitats.

CONSERVATION STATUS

Almost 450 species of murids are listed on the World Conservation Union's (IUCN) Red List. Of these, twenty-one are Extinct, died out; fifty are Critically Endangered, facing an extremely high risk of extinction in the wild; seventy-four are Endangered, facing a very high risk of extinction in the wild; and 110 are Vulnerable, facing a high risk of extinction in the wild.



SPECIES ACCOUNTS

MUSKRAT
Ondatra zibethicus

Physical characteristics: The muskrat has dark brown upperparts and light grayish brown underparts. Adult head and body length is 15.5 to 24.5 inches (40 to 62 centimeters) and weight is 1.1 to 4 pounds (0.55 to 1.82 kilograms).

Geographic range: They range in the western part of North America, and have also been introduced into Europe, Asia, and South America.

Habitat: Muskrats are found around water, specially rivers, lakes, marshes, and lagoons.

Diet: They eat aquatic plants, invertebrates, and small vertebrates.

Behavior and reproduction: Muskrats either dig burrows in earthen banks or build large floating lodges of vegetation. They sometimes



Muskrats are typically found near water, and eat aquatic plants and small animals. (© Alan D. Carey/The National Audubon Society Collection/Photo Researchers, Inc. Reproduced by permission.)

live in families of several generations. Females have a gestation, pregnancy, period of twenty-five to thirty days, and then have a litter of four to eight young. Five or six litters are possible each year.

Muskrats and people: People hunt and raise muskrats for fur. They are often considered pests in some regions.

Conservation status: Muskrats are not threatened. ■



NORWAY LEMMING
Lemmus lemmus

Physical characteristics: Norway lemmings have brown to black fur. Adult head and body length is 3 to 7 inches (8 to 17.5 centimeters) and weight is 0.5 to 4.5 ounces (20 to 130 grams).

Geographic range: They are found in Scandinavia (the northern European region of Norway, Sweden, Denmark, Finland, Iceland, and the Faroe Islands).

Habitat: These lemmings inhabit open tundra and subarctic bog areas.

Diet: Their diet consists of mosses, lichens (LIE-kenz), bark, and some grasses.

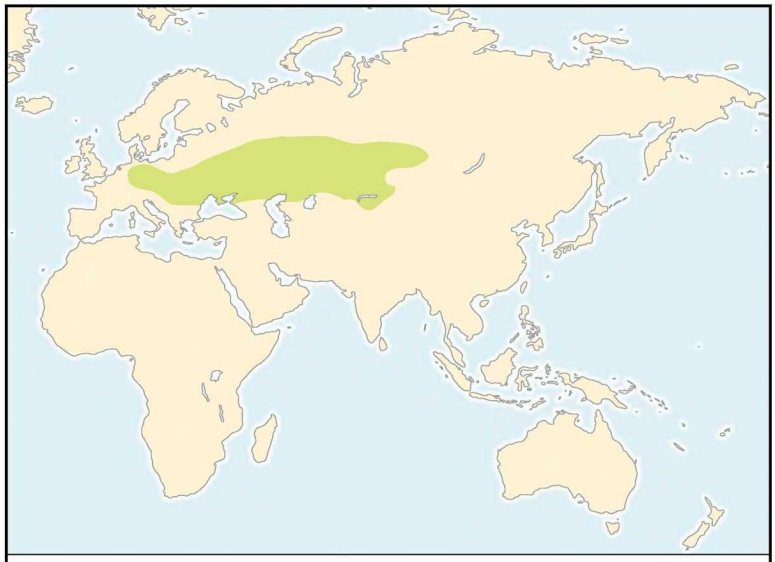


Norway lemmings eat mosses, lichens, bark, and some grasses. (© Tom McHugh/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: Norway lemmings are mostly nocturnal (active at night). They travel long distances in mass migrations, and are active year-round, remaining mostly beneath snow cover. The gestation period is about sixteen days, with a litter of up to thirteen young and up to six litters produced each year.

Norway lemmings and people: Scandinavian people have made lemmings a popular animal in their myths and legends.

Conservation status: Norway lemmings are not threatened. ■



BLACK-BELLIED HAMSTER
Cricetus cricetus

Physical characteristics: Black-bellied hamsters have a short hairless tail; a thick fur that is reddish brown above with white patches on the flanks, nose, cheeks, and throat; and black underparts. Males are larger than females. Adults are 8 to 12 inches (20 to 34 centimeters) long and weigh between 4.5 and 36.3 ounces (112 to 908 grams).

Geographic range: These hamsters are found in central and eastern Europe, from Belgium to the Altai region of Siberia.

Habitat: Black-bellied hamsters live in lowlands such as steppes, agricultural lands, and along riverbanks.

Diet: Their diet includes grains, beans, roots, green plant parts, insect larvae (especially beetle larvae), frogs, earthworms, and field mice. They often store cereal grains, seeds, peas, and potatoes in winter burrows.

Behavior and reproduction: Black-bellied hamsters generally live alone; are active at night; and hibernate in winter. Winter burrows can

extend more than 6 feet (2 meters) below the soil surface. Older females with young have the most complex burrows with several entrance tunnels, numerous chambers for nesting and food storage, and a dead-end tunnel for waste disposal. Breeding takes place from June to August. A courting male enters a female's territory by marking an area with his secretions, running after the female, and making loud sniffing noises. The female drives away the male after mating. The gestation period is eighteen to twenty days, with a litter of four to twelve pups. Two litters are raised each year. They sometimes live to the age of eight years old.

Black-bellied hamsters and people: People hunt black-bellied hamsters for food and trap them for clothing. They are considered pests when around cornfields, but do help to control other pests such as mice and insects. The rodents are also used as laboratory animals.

Conservation status: Black-bellied hamsters are protected under European Community Habitats Directive as a threatened species in Belgium, Germany, the Netherlands, France, and Austria. They are also protected in Croatia, Bulgaria, and Slovenia. ■



Black-bellied hamsters often store cereal grains, seeds, peas, and potatoes in their winter burrows. (Hans Dieter Brandl/FLPA—Images of Nature. Reproduced by permission.)



EGYPTIAN SPINY MOUSE
Acomys cahirinus

Physical characteristics: Egyptian spiny mice have large ears; gray-brown to sandy spiny hairs covering its back; gray to white bellies; and scaly, hairless tails. Adults have a body length of 2.7 to 6.7 inches (7 to 17.0 centimeters); tail length of 1.9 to 4.7 inches (5 to 12 centimeters); and weight of 1 to 2.4 ounces (30 to 70 grams).

Geographic range: These mice are distributed through Africa and the Middle East.

Habitat: Egyptian spiny mice live in arid (dry) and semi-arid environments like deserts and savannas, often preferring to be around rocks. They live in burrows and are sometimes found in trees, but are considered to be terrestrial, ground-living, animals.

Diet: They eat mostly arthropods, along with snails, plant materials, grains, and grasses.

Behavior and reproduction: Egyptian spiny mice are fairly social animals, living in small groups with a dominant male who fights to maintain his control. They are good jumpers, and build simple nests. The gestation period is five to six weeks, with a litter of one to five pups. Young are well developed when born, having thin hair, open eyes (within a few days), and are able to breed almost immediately. Females help each other with the birthing process.

Egyptian spiny mice and people: People keep Egyptian spiny mice as pets.

Conservation status: Egyptian spiny mice are not threatened. ■



When threatened, the Egyptian spiny mouse expands its bristles to appear larger, hoping to scare off the intruder. (© E. R. Degginger/Photo Researchers, Inc. Reproduced by permission.)



AUSTRALIAN JUMPING MOUSE
Notomys alexis

Physical characteristics: Australian jumping mice have light sandy brown to gray upperparts; white to light gray bellies; long tails with fine fur; large ears; narrow, large hind feet; and sebaceous (secretion) glands that are used for territorial marking. Adults have a body length of 3.9 to 5.9 inches (10 to 15 centimeters); tail length of 3.5 to 8.2 inches (9 to 21 centimeters); and weight of 0.7 to 1.7 ounces (20 to 50 grams).

Geographic range: They are found throughout central Australia.

Habitat: They inhabit arid desert environments; living around dunes and grasslands so that they can easily dig large, complicated burrows.

Diet: Their diet consists of berries and other vegetation. They can live without water as long as they receive enough moisture from their food.

Behavior and reproduction: Australian jumping mice are nocturnal, social creatures. As a group, they groom, huddle, walk over and crawl under each other, and sleep together. Their large hind feet allow them to jump higher than 3.2 feet (1 meter). When angry with another animal, they rush and leap at it, and punch it with their forelegs. They generally walk on all four limbs, but when necessary will leap with their hind legs. The gestation period is about one month. Females produce a litter with an average of three pups that are born naked and blind, but open their eyes within three weeks. They are weaned after five weeks and ready to reproduce within three months.

Australian jumping mice and people: People keep these animals as pets.

Conservation status: The Australian jumping mouse is not threatened. ■



The Australian jumping mouse's large hind feet allow it to jump higher than 3.2 feet (1 meter). (© Tom McHugh/Photo Researchers, Inc. Reproduced by permission.)



Hispid cotton rat *(Sigmodon hispidus)*

HISPID COTTON RAT
Sigmodon hispidus

Physical characteristics: Hispid cotton rats have a gray streaked coat with blackish or dark brownish hairs; pale to dark grayish underparts; dark tail; and five pairs of nipples, although some have four or six pairs. Adults have a total length of 8.8 to 14.4 inches (22.4 to 36.5 centimeters); tail length of 3.2 to 6.5 inches (8.1 to 16.6 centimeters); and weight of 3.5 to 8 ounces (100 to 225 grams).

Geographic range: They are found from southeast and south-central United States through the interior and eastern part of



Hispid cotton rats usually live in grasslands, which have plenty of grass, their main food. (Illustration by Barbara Duperron. Reproduced by permission.)

Mexico, into Central America, and to northern Colombia and Venezuela.

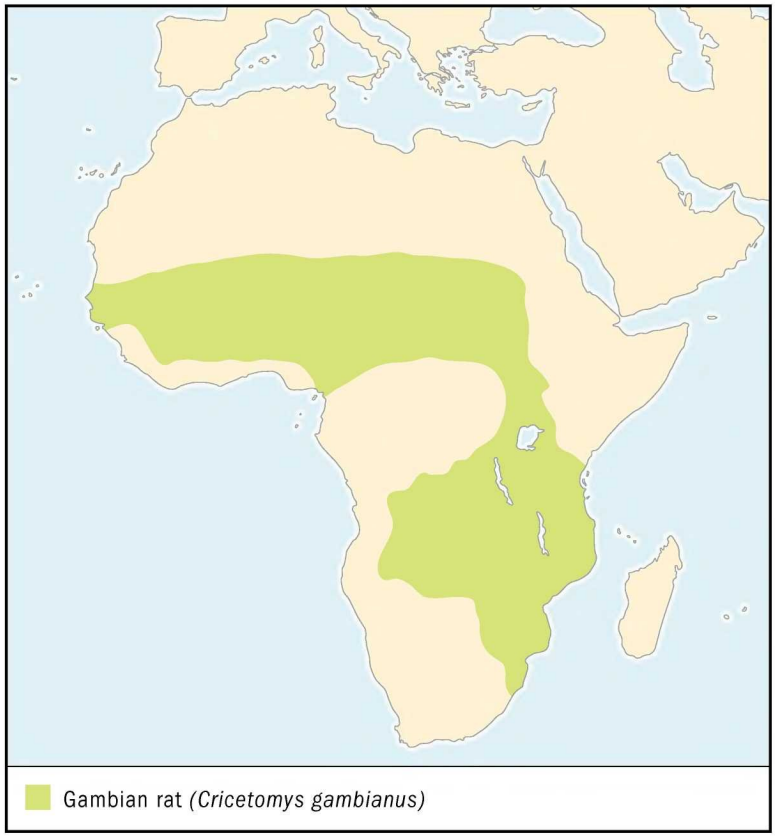
Habitat: Hispid cotton rats usually live in grasslands.

Diet: Their diet consists mostly of grasses.

Behavior and reproduction: Hispid cotton rats are active during the day and night, and are able to swim. They breed throughout the year. The gestation period is about twenty-seven days. Litter size is from one to fifteen pups, with northern populations having larger litters. Young are well developed at birth; eyes open within thirty-six hours of birth; and are weaned in ten to fifteen days. Males are able to reproduce within sixty to ninety days, and females within ten to forty days.

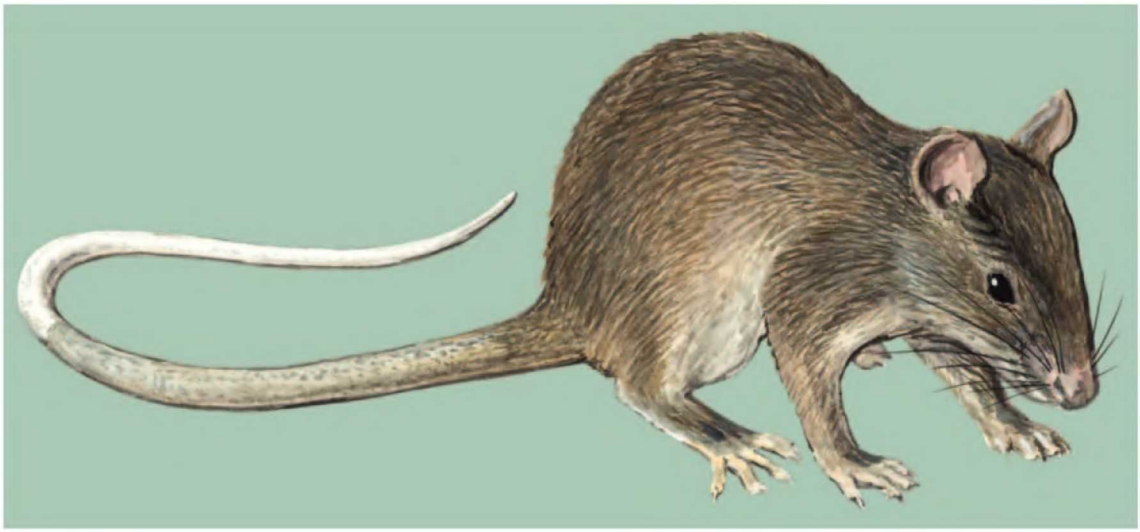
Hispid cotton rats and people: Scientists observe hispid cotton rats to help them determine how environmentally healthy an area is.

Conservation status: The hispid cotton rat is not threatened, though two subspecies, populations that live in specific areas, are Near Threatened (likely will be threatened in the future). ■



GAMBIAN RAT
Cricetomys gambianus

Physical characteristics: Gambian rats are fairly large rodents with short fur that can range from soft to coarse. Some species are mottled, or splotched, with darker colors or may have an indistinct white line running across the shoulders. They have large ears; dark rings around the rather small eyes; a long and narrow head and face; cheek pouches to collect food and other materials; smooth incisor teeth; dark or grayish brown upperparts with red tinges; creamy underparts; and a long, scaly tail that is hairless and completely white for the last half of the length. They have good senses of smell and hearing, but have poor eyesight. Adults have a body length of 9.4 to 17.7 inches (24 to 45 centimeters); tail length of 14.3 to 18.1 inches (36.5 to



Female Gambian rats may have up to ten litters of pups each year, with an average of four pups per litter. (Illustration by Brian Cressman. Reproduced by permission.)

46.0 centimeters); male weight of about 6.1 pounds (2.8 kilograms); and female weight of about 3 pounds (1.4 kilograms).

Geographic range: Gambian rats are found in Africa, specifically from Senegal and Sierra Leone in the west to Sudan and Uganda in the east and as far south as Angola, Zambia, and northern South Africa.

Habitat: They inhabit forests, forest edges, thickets, and sometimes grasslands.

Diet: Their diet consists of insects, fruits (especially palm fruits and kernels), seeds, roots, nuts, leaves, snails, and crabs.

Behavior and reproduction: Gambian rats are mostly nocturnal although sometimes active during the day. They climb and swim well, and are usually seen alone. The rodents sometimes dig a simple burrow that has long passageways with side chambers for bedding and storage and is covered by dense vegetation. At other times, they use burrows of other animals, termite mounds, or natural crevices in rocks and hollow trees. Breeding occurs throughout the year. Up to ten litters per year are possible for females. The gestation period is twenty-seven to thirty-six days, with one to five pups born, although four pups in a litter is average. Young develop quickly and are able to breed as early as twenty weeks old.

Gambian rats and people: People buy and sell Gambian rats within the pet trade. These animals transmit diseases, such as monkeypox, to humans. Some people hunt them.

Conservation status: Gambian rats are listed as Rare in South Africa. Otherwise, they range from common to less common in their other ranges, and are not listed as threatened by the IUCN. ■

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family CHAPTER

SCALY-TAILED SQUIRRELS
Anomaluridae

Class: Mammalia
Order: Rodentia
Family: Anomaluridae
Number of species: 7 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The scaly-tailed squirrels range in size from 7.3 to 18.5 inches (18.5 to 46 centimeters) along their head and bodies, with tail length measuring between 5.4 and 18.4 inches (13.8 to 45 centimeters). They generally weigh between 7 ounces and 4 pounds (200 to 1,800 grams). The family Anomaluridae (from words meaning "strange-tailed") look very much like regular squirrels (family Sciuridae) from the outside because they have adapted to similar environments, but major differences in their skulls, teeth, and other internal items show that they have no close relationship. Scaly-tailed squirrels, unlike regular tree squirrels, have a furred "gliding membrane" on each side of their bodies that stretches in a square shape between the front legs and the back legs and also between the hind legs and the tail. Only one genus, the mainly diurnal (active during the day) *Zenkerella,* lacks this membrane and cannot glide. The membrane is supported in front by a strut-like, rigid section of cartilage that extends from the elbow joint, rather than from the wrist, as in the true flying squirrels. They are the only gliding mammals in Africa. Scaly-tailed squirrels are so named because of the double rows of overlapping, spiky scales on the underside of the tails for one-third of its length along the base. When the animals land after a glide, the scales help to keep them from skidding on tree trunks, and also help them climb up trees. Their silky tails are bushy on top and have strongly colored tufts. They have strong digits for manipulating food and climbing, and very long whiskers and large ears for their mainly nocturnal activity. Their heads are large and placed

INTESTINAL FORTITUDE

Because bark has few nutrients, the scaly-tailed squirrels who eat it have very long intestines so that their bodies have a longer time to extract nourishment. In fact, about half of an adult scaly-tailed squirrel's body weight and mass is made up of its intestines. To compensate for this heavy load, the animals' skeletons are extremely light so that they can still glide effectively.

forward on the face, providing excellent binocular vision for finding prey and good landing places.

GEOGRAPHIC RANGE

Scaly-tailed squirrels are native to the middle region of Africa, and live mainly south of the Sahara Desert in west, central, and east Africa. Countries in which they appear regularly are Sierra Leone, Kenya, Angola, Mozambique, Ghana, Liberia, Senegal, Congo, Cameroon, Gabon, the Central African Republic, and Ivory Coast.

HABITAT

Scaly-tailed squirrels prefer the open woodlands of east, central, and west Africa and the rainforests of west and central Africa.

DIET

Larger scaly-tailed squirrels eat bark and twigs from more than a dozen species of tree, but their favorites are miombo, velvet tamarind, ironwood, owala oil, and awoura. They occasionally also eat insects and gum (tree sap). The smaller squirrels eat almost nothing besides gum and insects.

BEHAVIOR AND REPRODUCTION

Because of the remoteness of their habitats and the animals' secretive nature, scientists know relatively little about the anomalurids, members of the Anomaluridae family. However, it has been observed that the scaly-tailed squirrels clear out small branches that obstruct their habitual gliding paths. In doing so, along with their method of pruning the tops of non-food trees to keep them from crowding out their favorite food trees, the squirrels perform important functions in their ecosystems. They dislike coming to the ground, and when forced to do so move in a clumsy, kangaroo-like fashion to the nearest tree. Their gliding membranes fold away neatly when not in use, and do not prevent the squirrels from quickly scurrying along tree branches like their familiar garden-variety counterparts.

Anomalurids compete with hornbill birds for dens, which they typically make in old, hollowed out trees up to 131 feet

(40 meters) high. They also battle eagles, which sometimes come in to snatch their young for prey. Females have litters of up to three pups, which are born with open eyes and thick fur. Their parents wean them from milk onto solid food by feeding the pups already chewed food from special cheek pouches. The squirrels communicate largely by scent, and use large glands in their groins to mark areas, but observers have heard them making a twittering noise as well. Field biologists believe that scaly-tailed squirrels may reach population densities of 500 individuals per 1.2 square miles (1 square kilometer). They often spend their days clinging to the side of a tree. The squirrels usually associate in pairs, but some species have been seen collected into large groups within a single den.

SCALY-TAILED SQUIRRELS AND PEOPLE

The mammals are sometimes accused of raiding oil palms for their nuts, but in general they have very little interaction with humans. Conservationists have worked to limit or stop the harvesting of the squirrels' food trees, many of which are valuable sources of high-quality commercial lumber.

CONSERVATION STATUS

Despite logging of their food trees and a general decline in habitat quality and quantity, scaly-tailed squirrel species are not considered threatened.



Lord Derby's anomalure *(Anomalurus derbianus)*

SPECIES ACCOUNT

LORD DERBY'S ANOMALURE
Anomalurus derbianus

Physical characteristics: Although Lord Derby's anomalure's appearance varies across its range, this species is generally grey to a rich reddish brown with silver throughout. All of the 16 subspecies share the same facial pattern, however, of white cheeks, forehead, and snout with a black band over the nose, around the eyes, and on the back of the head. The fur on their heads is dense and soft, and the silky fur on their bodies can be up to 1 inch (25 millimeters) long. They also all have six pairs of scales underneath their tails. Their tails are shorter than their bodies, the last half being black. Lord Derby's anomalure has furless, pink ears.

Geographic range: This species is widely distributed in an area across central Africa, from Sierra Leone in the west to Kenya in the



Lord Derby's anomalures supplement their diet of tree bark with insects, tree sap, nuts, fruits, and flowers. (Illustration by Barbara Duperron. Reproduced by permission.)

east, and, less commonly, from Angola in the north to Mozambique in the south.

Habitat: This anomalure favors habitat in moist rainforests and seasonally dry woodlands from sea level to 7,875 feet (2,400 meters), although they are particularly attracted to areas that contain their favorite food trees. With regard to shelter, any tree will do for roosting as long as it is hollow in places. Roosting holes have been observed at both the tops and bottoms of trees, with entryways just large enough for anomalures to fit through. The dens are constructed so that temperature and humidity remain fairly consistent.

Diet: Like most of the larger anomalurids, Lord Derby's anomalure eats the bark of such trees as the miombo, velvet tamarind, ironwood, owala oil, and awoura, preferring the thickest portions of the main truck and large branches. The animals forage among several different trees, taking a thin strip from a tree one night and returning to take another strip during the next night's feeding, stopping when the removal site reaches about 6 inches (15 centimeters) wide to prevent permanent damage to the tree. Lord Derby's usually start a feeding site at natural wounds in a tree's bark caused by growth splits, elephant damage, or falling branches. Interestingly, the trees and this species have evolved together for so long that unlike most other trees, the rodents' food tree species can grow replacement bark.

The anomalures supplement their nutrient-poor bark diet with insects, tree sap, nuts, fruits, and flowers.

Behavior and reproduction: Although biologists have yet to study the social aspects of Lord Derby's anomalure behavior, they do know that the animals tend to share dens, and may crowd up to eight individuals into one roosting hole. They are mainly active at night, but seem to enjoy lying in the sun in the early morning and late afternoon. Using their gliding membrane to move across longer distances, they perform a final abrupt upturn to cause their flight to stall and allowing them to land safely. Biologists have measured the glide distances of Lord Derby's anomalure females at 1,770 feet (540 meters), but most are under 328 feet (100 meters). Males typically achieve even greater gliding distances and move through more territory. The Lord Derby's are fairly quiet animals, with vocalizations that include a variety of twitters and purrs along with growling and hissing when threatened or disturbed.

For Lord Derby's anomalures living in the rain forest, breeding occurs year round. For residents of the dry forests, breeding occurs seasonally. Pregnant females often move to a special nursery den, where they give birth to an unknown number of pups. Although the young are large, well formed, and able to move in a coordinated fashion soon after birth, they stay with the female parent until they are almost fully mature. After weaning, they receive chewed-up food from both parents. Observers have noted that mothers and pups will often glide among trees and chase each other playfully.

Lord Derby's anomalures and people: Although biologists have long sought to learn more about this secretive and easily frightened species, there are no records of any significant interactions between Lord Derby's anomalure and humans.

Conservation status: Despite their specialized diet and habitat requirements, Lord Derby's anomalure is not threatened. However, in Ghana, their population is on a conservation watch list due to habitat destruction and degradation. ■

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SPRINGHARE
Pedetidae

Class: Mammalia
Order: Rodentia
Family: Pedetidae
One species: Springhare (*Yerbua capensis*)

family
CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Springhares look like very small kangaroos. Their name actually means "jumping hare" in Afrikaans (one of the official languages of the Republic of South Africa). They have a body length of 13 to 17 inches (33 to 44 centimeters) when standing upright on their hind legs, a tail length of 14 to 19 inches (35 to 49 centimeters), and weigh 6 to 9 pounds (2 to 5 kilograms). Springhares have short front legs and long, powerful hind legs. Their front legs are one quarter of the length of their hind legs. Each front leg has five toes with long, sharp, curved claws that are used for digging. Each hind leg has four toes with claws that look like hoofs. The second toe from the outside is longer than the other toes. The heels, soles of their feet, and base of their toes do not have any hair covering them.

Springhares have short, blunt heads, big eyes, and long eyelashes. Their ears are narrow, have thin hairs on the upper half, are naked on the inside, and are about 3 inches (7 centimeters) long. At times, their ears have the tendency to droop to their sides. They also have a tragus (TRAY-gus; prominence in front of the ear's opening) that folds back and closes the opening of the ear to keep out sand when digging. Their necks are thin and muscular.

Long, soft, straight hairs cover springhares' bodies. Springhares are colored pink-brown to gray on their upper half with some black or white hairs in the fur. On the lower half, they are brown-white. This same color also spreads upward in front of their thighs and on the inside of their legs. Their tails are

mostly tan with a thick, dark brown or black brush at the tip. The shading of their colors depends on the area where they live. For example, springhares from eastern South Africa have fur that is paler than those that live in the western areas of South Africa.

GEOGRAPHIC RANGE

Springhares can be found in Angola, Botswana, Congo, Kenya, Mozambique, Namibia, South Africa, Tanzania, Zambia, and Zimbabwe.

HABITAT

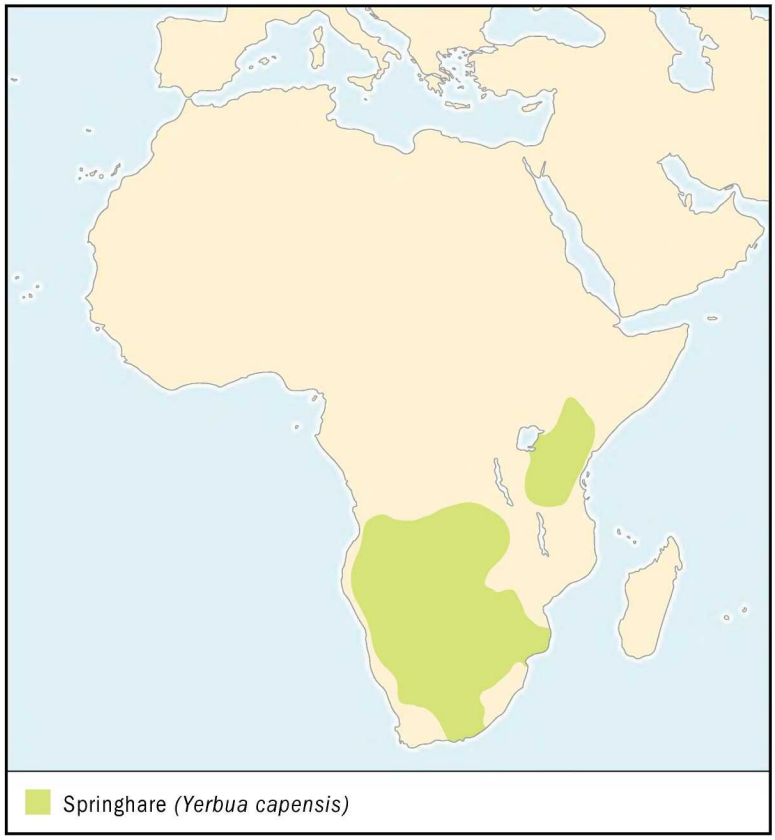
Springhares live in areas that have dry and sandy soil. They also live where there are cattle grazing and crop cultivation (areas where preparation for growing crops is occurring). They stay away from rocky ground and areas with a lot of trees, and live in grassland areas.



DEFENSE AGAINST PREDATORS

Springhares have several lines of defense against predators. The first is early detection, which is aided by their wonderful senses of sight, sound, and smell. In the case that these senses do not alert them enough in advance, the second is their ability to quickly hop away with their powerful hind legs. Finally, their third line of defense is to viciously bite and kick, making use of the sharp claws on their hind feet.

Springhares build burrows (also known as warrens) for shelter and protection in the grasslands. They will oftentimes build more than one warren, and they can be up to 32 inches (82 centimeters) deep and can cover up to 1,200 square feet (112 square meters). The burrows are usually created near the largest tree or a clump of bushes within their living area. When digging these burrows, they fold their ears back and seal their nose, so sand does not disturb them. It is easiest for the springhares to dig these burrows when the soil is wet during the rainy season. Sometimes during digging, they will stop, turn around, and push the soil they have collected back with their legs and chest. They then use their hind legs to kick this soil above the burrow to be redistributed on the ground. They sometimes cover the entrance of the burrow with soil from the inside. Springhares also create tunnels within their burrows that can be up to 51 yards (46 meters) long. Springhares also sometimes close down entrances to tunnels within their burrows by sealing them closed. Their burrows are formed in a circular shape and have many entry areas. There can be up to eleven entrances in a burrow. This makes it easier for springhares to escape if a predator, an animal that hunts it for food, gains access into their burrow.



DIET

Springhares mostly eat grass stems, bulbs, and fleshy roots. When they live in crop-cultivated areas, they will eat corn, peanuts, barley, oats, and wheat. Sometimes, they eat plant stems. This can be seen especially in grazed areas where they eat the lower stems or roots after other animals have already eaten the upper grass layers. When they have a very difficult time finding food, they will eat beetles, locusts, or other insects. When springhares eat, they sit up and use their tails as support. They like to eat in darkness, so they do not usually stay out and feed when there is a full moon.

BEHAVIOR AND REPRODUCTION

When springhares sleep, they sit on their hind legs, with their front feet and head in between their thighs and their tail placed around their head and body. They sleep during the day, because they are nocturnal (active at night), although they can



The springhare uses its powerful hind legs to jump quickly, and may also use its hind legs to fight an attacking animal. (© Gregory G. Dimijian/Photo Researchers, Inc. Reproduced by permission.)

occasionally be seen during the day. Their large eyes are signs that they are active during nighttime.

Springhares live alone or with another adult and young. They are not known for creating social units and usually do not communicate, with the exception of occasional low grunts. They can get along with one another in captivity, but aggression can also occur. When in the wild, they can also make male-female pairs.

Birds of prey, large carnivores, and humans are the main predators of springhares. Sometimes, when springhares first come out of their burrows at the beginning of the night, they leap into the air to try to scare off any predators that may be waiting for them. They cannot fight very well, but if they are very close to a predator, in an enclosed area, they will bite and kick fiercely with their hind feet, which have very sharp claws. However, it is more typical that they hop away from predators using their hind legs and head toward their burrow. Their great senses of sound, smell, and sight help them to stay away from predators. They also help them to notify other springhares of predators.

Springhares can be born at any time of the year. Females give birth in bare areas of their burrows, usually having only one offspring at a time, but twins do occur in rare cases. The average female springhare will have one young three times per year. At

birth, springhares weigh around 9 to 11 ounces (256 to 312 grams). When they are seven weeks old, the young leave their mothers. They eat a lot of grasses at this point. They are then finished growing and go off to make their own burrows.

Springhares stand on their hind feet when in an upright posture and can travel using all four feet when they are eating or moving from place to place. When they jump, their tail becomes horizontal or curled upward. They can jump around 6 to 9 feet (1 to 3 meters) high and can also swerve sharply when they're chased by humans or other predators.

SPRINGHARES AND PEOPLE

Humans hunt springhares in areas where they cause damage to crops. The springhares cause problems by destroying seed and root systems in these areas. They can also be hunted as a source of food to humans, especially in South Africa. People may also kill them for their fur. One method they use to capture springhares, whether for fur or food, is to flood their burrows with water, so that the springhares must come out, and can be more easily captured. Another method is to chase them by foot, but it can be difficult to grab hold of them. Springhares may also be dangerous to humans since they can transmit diseases like the bubonic plague, rickettsiasis, babesiasis, theileriosis, and toxicosis paralysis through parasites they may carry.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists springhares as Vulnerable, facing a high risk of extinction in the wild. This is due to the fact that their population is decreasing from poor habitat quality and hunting by humans.

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GUNDIS
Ctenodactylidae

Class: Mammalia
Order: Rodentia
Family: Ctenodactylidae
Number of species: 5 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Gundis are small rodents with soft, thick, and silky fur. Their fur helps to insulate their bodies from harm due to extreme sun exposure. They have large, blunt heads, flat skulls, and short, round ears. Their very round, large eyes help them to adjust quickly to bright sunlight when they come out of their rock shelters. They have a fringe of hair around the inner margin of their ears that protects the ears from sand that can be easily blown by the wind. Gundis have long vibrissae (stiff hairs that can be found near the nostrils or other parts of the face in many mammals). They also have short legs and short, furry tails. Their back feet are longer than their front feet, each foot having four digits (fingers or toes). On the hind feet, the two inner digits have stiff bristles that serve as a comb for the gundis' fur. The digits also have small, very sharp claws. Gundis have flexible ribcages, which help them squeeze into small spaces.

The color of gundis is anywhere from gray to yellow-red, the underparts usually having a whitish color. The rocks that they live among determine their overall color, because blending into their surroundings serves as protection. Overall, they have the appearance of guinea pigs. Their head and body length is 6 to 10 inches (15 to 25 centimeters). Their tail length is 0.3 to 2 inches (1 to 6 centimeters), and they can weight up to 6 ounces (171 grams), and the females are larger than the males.

GEOGRAPHIC RANGE

Gundis can be found in northern Africa.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

HABITAT

Gundis live in rocky hills, cliffs, and mountains in deserts, sub-deserts, or on the edges of deserts. The rocks that make up their habitat can be of any age, but they cannot be extremely large. Gundis may even be found housed in building sites. Within these living areas, gundis find fissures (long, deep, and narrow openings or cracks), crevices, and caves to use for permanent or temporary shelter. They find ledges, flat rocks, and boulder tops to use for sunbathing. They prefer to live in areas where they can get exposure to the morning, as well as the evening sun. Gundis do not have adaptations for water conservation or temperature control, so they take advantage of the shade and wind in the areas where they live. This helps them to cool off during hot afternoons in the desert.

DIET

Gundis are herbivores (plant-eating animals) and mainly eat leaves, stalks, flowers, and plant seeds. They cannot gnaw well, so they mainly eat these softer foods. Food is usually somewhat difficult to find in their habitat, so they have to travel far to find it. Gundis do not store food or reserve fat in their bodies, so their search for nourishment is never-ending. They usually will take food back to their shelter so that they can safely eat.

BEHAVIOR AND REPRODUCTION

Gundis are diurnal (mainly active during daytime). They can run quickly when necessary, but they are usually slow, and also shy. When they move, their bodies are very close to the ground; their bellies almost touch the ground. They have rough friction pads on their feet that help them climb rocks and surfaces that are almost vertical. They come out of their shelters during the first light of the day, and they are active for up to five hours after this point. When the hottest part of the day arrives, they rest. Then, for the two to four hours before dusk, they become active again. However, they may not come out of their shelters when it is cold, wet, or windy. It can become very dangerous for gundis when it rains, because the water causes their fur to stick together and expose their skin, which makes them very cold very quickly. In order to retain heat in the winter, they pile on top of one another in their shelters. Their lives basically consist of foraging (wandering in search of food), sunbathing, playing, chasing, and exploring.

Gundis live in colonies, or groups. These colonies have different densities that are related to the food supply and terrain of the region being inhabited. Shelters of the gundis serve the purpose of keeping the heat from the day in the shelter during cold nights as well as staying cool during the day when the weather is hot. Gundis also have communal dunghills.

When gundis encounter predators, animals that hunt them for food, they become immobile, in order to make the predators believe that they are dead. They may also go under rocks in order to escape from predators. When they are excited or alarmed, they thump their feet against the ground. Their predators include snakes, lizards, foxes, jackals, and cats.

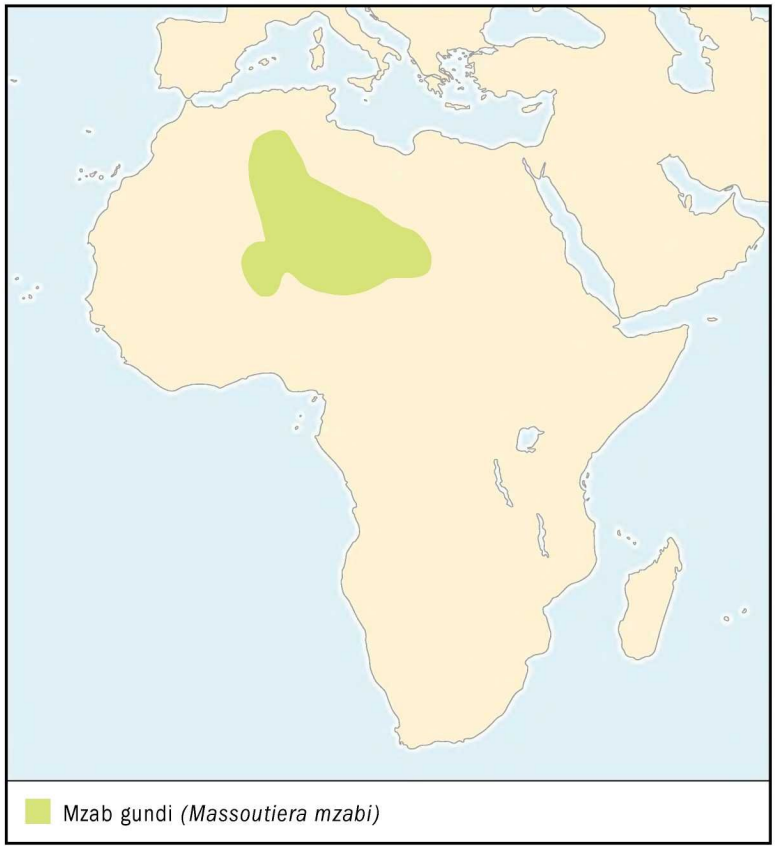
When female gundis give birth, there are usually one to three young in a litter. Female gundis typically only have one litter per year. Young are born with all their fur as well as their eyes open and feed on chewed leaves.

GUNDIS AND PEOPLE

Gundis are hunted as food by some North African tribes. They could possibly be harmful to crops and gardens, if there were any near their living areas.

CONSERVATION STATUS

The felou gundi is the only species that is listed as Vulnerable, facing a high risk of extinction, by the World Conservation Union (IUCN), due to a decrease in its range and habitat. The other species are not globally threatened, although they could be threatened locally by human disturbances.



SPECIES ACCOUNT

MZAB GUNDI
Massoutiera mzabi

Physical characteristics: Mzab gundis are yellow or brown in color with flat, round ears that are flattened against their heads and do not move. They have powerful limbs and bushy tails. They have rough, friction pads on their feet that help them climb rocks and almost vertical surfaces. These pads can also stand extreme heat. Bristles above their claws help them when they dig through sand and also when grooming themselves. They have long, thick fur to keep them warm during cold winters. The females weigh more than the males, adult males weighing around 6 ounces (171 grams), and adult females weighing around 6.7 ounces (190 grams). Their length, which includes their head and body, is 6 to 10 inches (15 to 26 centimeters). Their tail is about 1.4 inches (3.6 centimeters) long.

Geographic range: Mzab gundis live in the central Sahara Desert in Algeria, northern Niger, northwestern Chad, northeastern Mali, and southwestern Libya.

Habitat: Mzab gundis can be found in rock outcrops in mountainous areas above the Sahara Desert. They live in rock crevices and have many temporary shelters that they use.



Mzab gundis are active for most of the day. When it is very hot, they rest in the shade, and if it is cold and wet, they stay inside their burrows. (Illustration by Bruce Worden. Reproduced by permission.)

Diet: Mzab gundis eat leaves, stems, flowers, and seeds. They sometimes drink water, but they also obtain it just from eating plants.

Behavior and reproduction: Mzab gundis sleep during the night and forage in the early morning. They are active for most of the day, with the exception of when it becomes very hot, which is when they seek out shade. Their main activities are grooming and sunbathing. When they are grooming, a hind leg strokes the body while their other legs provide balance. They do not come out of their shelters when it is cold or wet. They communicate with chirps, but not very often. Even though males of the same and different groups can show aggressive behavior toward one another, Mzab gundis live in family groups that form close ties to one another. This can be seen especially in the fact that females will help out one another during pregnancy and when they are giving birth.

Young are usually born anywhere from March to June. Within an hour of their birth, young are roaming and sunbathing. They weigh around 0.7 ounces (20 grams) and have an adult weight within three months of being born.

If approached by a predator, Mzab gundis lie motionless on their side with their legs stretched out, their mouth half open, and their eyes wide open, so they look like they are dead. They will take flight after about two to three minutes of staying in this position.

Mzab gundis and people: Mzab gundis do not typically interact with people.

Conservation status: Mzab gundis are not globally threatened. ■

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family CHAPTER

DORMICE
Myoxidae

Class: Mammalia
Order: Rodentia
Family: Myoxidae
Number of species: 26 species

PHYSICAL CHARACTERISTICS

Dormice look a lot like squirrels or chipmunks. Their fur is thick and soft and most species have long, bushy tails. Their tails help them to balance. Species are different sizes, but their average head and body length falls into the range of 1.6 to 8 inches (4.1 to 20.3 centimeters), their tail length ranges from 1.5 to 6.5 inches (3.8 to 16.5 centimeters), and they weigh from 0.5 to 7 ounces (15 to 200 grams). They are nocturnal, active at night, so they have large eyes and sensitive vibrissae, stiff hairs that can be found near the nostrils or other parts of the face in many mammals. They can also hear very well. These traits help them to function at night. Dormice also live in trees, so they have pads on the soles of their feet and strong, short curved claws on their four front toes and five hind toes so that they can grab onto the trees. Both their legs and toes are short. They can also hang upside down from branches by turning their hind feet backwards and grabbing onto the branches.

GEOGRAPHIC RANGE

Dormice are found in Europe, Africa, central and western Asia, and Japan.

HABITAT

Dormice can be found in deciduous forests, woodlands, grasslands, gardens, parks, rocky areas, or scrub areas. Within these areas, they create nests where they rest during the day. These nests are built off of the ground in holes in trees, rocky crevices, abandoned burrows, building attics, or in wedges of

tree branches. The nests are ball-shaped, and are made out of leaves, grass, moss, lichen, shredded bark, other plant pieces, and saliva. They are lined with hair or feathers.

DIET

Dormice are omnivores, they eat plants and animals. Most of the time, they get their food from the trees in which they live. In the early spring and early summer, they eat buds and tree flowers. In the summer, they eat insects, small rodents, and bird eggs. In the late summer and fall, they eat fruit, berries, seeds, and nuts. They also eat snails and young birds. The specific type of food that they eat depends on their lifestyles and living areas, which is different from species to species. They also eat a lot during the fall in order to build up a layer of body fat to live on when they hibernate, go into a resting state during the winter season.

BEHAVIOR AND REPRODUCTION

Dormice usually live in small groups where half are younger dormice. Families hibernate together during winter. Hibernation occurs for about seven months. During this time period, their body temperature drops and their breathing and heartbeat slows down. They curl into a ball, with their tail covering their mouth so that they lose the least amount of water. They may wake up during this period in order to eat stored food, but this does not happen frequently. This extended resting time helps the dormice survive when there are low temperatures and little food to be found. Hibernation ends around April, when the weather gets warmer. At that time, they eat a lot of food and begin their mating season.

Dormice usually are not protective of their territory, but this changes during the mating season, when males become aggressive about their territory. Males use calls to attract the females. Males mate with more than one female during the mating season. The females can give birth from May to October. They are pregnant for three to four weeks. They can have anywhere from two to ten babies in a litter, although four babies is an average. The mother gives birth in her nest, in a tree hollow, on a branch, or maybe even underground in a shelter. When the young are born, they are pink, blind, and weigh around 0.07 ounces (2 grams). They grow gray hair by the time they are seven days old. When they are eighteen days old, they can see and hear and have brown hair. They are soon able to go out and find food with

their mothers. When they are four to six weeks old, they are ready to go off and live on their own, but they may stay with their mothers through the next hibernation period. At the end of their first hibernation, the young are around a year old, and are ready to mate that spring. Dormice can live up to six years.

DORMICE AND PEOPLE

Due to the fact that dormice store food in their bodies in the form of fat, humans use dormice as a food source. They typically run into humans when they are trying to find areas in which to hibernate. They may even enter human homes for this very purpose. They can cause problems for humans when they eat the fruit in orchards.

CONSERVATION STATUS

More than half of dormice species are at risk. Dormice are threatened by loss of habitat and climate change, which changes their habitats and causes temperature shifts. The World Conservation Union (IUCN) lists four dormice species as Endangered, facing a very high risk of extinction; four as Vulnerable, facing a high risk of extinction; and five as Near Threatened, not currently threatened, but could become so.



SPECIES ACCOUNT

EDIBLE DORMOUSE
Myoxus glis

Physical characteristics: Edible dormice are a silver-gray color with white or yellow undersides. They have black areas around their eyes. They look like squirrels. They have large, round ears, small eyes, and long, very bushy tails. They use the rough pads on their feet to climb trees. Their head and body length is 5 to 8 inches (13 to 20 centimeters), their tail length is 4 to 7 inches (10 to 18 centimeters), and their weight is 2.4 to 6.3 ounces (68 to 179 grams). They are the largest of all the dormice.

Geographic range: Edible dormice live in Europe, Iran, and Turkmenistan.

Habitat: Edible dormice can be found in deciduous and mixed forests, and fruit orchards. Within these areas, they build their nests in woodpecker holes, fake nest boxes, hollow trees, rocks, and barns. They use hairs and feathers to line their nests. If there is not enough food available in their living area, they will move elsewhere.

Diet: Edible dormice eat a lot. By the winter, their weight will be almost double the weight they were at the beginning of the summer. They will eat insects in the summer, since fruit and seeds are not ripe enough. Once fruit and seeds become suitable for eating, they will eat them, as well as nuts, acorns, berries, and buds. They are mostly herbivores, plant-eating, and only eat insects or small birds when they have no other choice.



Edible dormice eat mainly plant material, such as fruit and seeds. They eat insects in the summer, before the fruit and seeds are ripe. (© B. Brossette/ OKAPIA/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: Edible dormice can be very quick and can also jump more than 23 feet (7 meters) when going from tree to tree. The males are territorial and tough fighters during mating season, which goes from June until August. They will mark their territories by scent, so that other males know not to cross over into their areas. The males make a squeaking sound during mating season while they follow around the females, in hopes of attracting a mate. The females will only give birth once a year and the males help raise, clean, and protect the young. The families may stay with one another during the hibernation months. Edible dormice can make a variety of sounds, including clicks, whistles, and growling. These sounds can take on different meanings. If predators attack them, they can make their tails fall off as a form of defense—the predator keeps the tail, but the dormouse escapes.

Edible dormice and people: Edible dormice can serve as food to people. In some areas, they are even considered to be a delicacy. They can also cause damage to humans when they destroy fruit or vine crops. They may also be captured for their fur.

Conservation status: Edible dormice are listed as Near Threatened by The World Conservation Union (IUCN), meaning that the species is not threatened now, but could be in the near future. ■

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DASSIE RAT
Petromuridae

Class: Mammalia
Order: Rodentia
Family: Petromuridae
One species: Dassie rat (*Petromus typicus*)

family CHAPTER

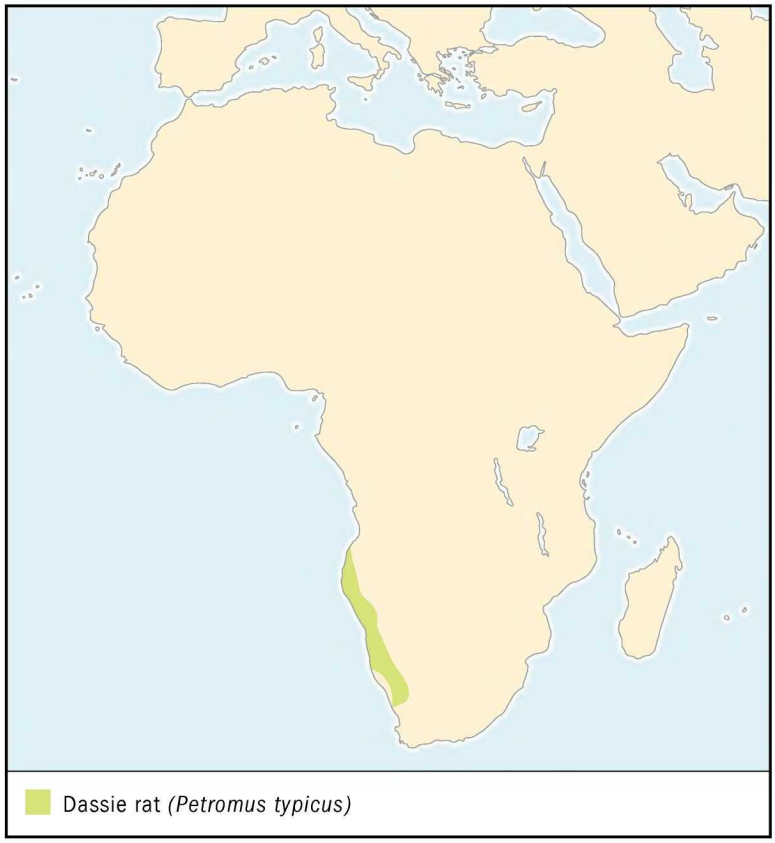
PHYSICAL CHARACTERISTICS

Dassie rats look a lot like squirrels. Soft and silky hair covers their bodies, with the exception of the undersides, which are yellow and hairless. The hairs are joined together in groups of three or five. Their fur color is usually brown, gray, or buff, or a combination of those colors. These colors help them blend into the surrounding rocks in their habitat. This sort of camouflage helps keep birds from spotting them from above.

Dassie rats have blunt heads; big eyes; short, black, round ears; and long, black vibrissae, stiff hairs that can be found near the nostrils or other parts of the face in many mammals. The tail is shorter than the head and body length, and long hairs cover the end part of their tails. Their tails have soft joints, which allow the tail to break off at the base if a predator, animal that hunts it for food, grabs a dassie rat by the tail. The dassie rat can simply release its tail and escape, relatively unharmed.

Dassie rats' front feet have four toes with claws. The thumbs on the front feet are short. Their hind feet have five toes with short, curved claws. The hind feet also have thicker hairs that look like tiny combs and are probably used for grooming. The soles of their feet have round, naked pads that help them to move around in the rocky areas where they live. Their feet are narrow. The head and body length of males is 10.9 to 14.0 inches (27.9 to 36.0 centimeters) and the head and body length of females is 9.9 to 14.0 inches (25.3 to 35.8 centimeters). Males weigh 6.0 to 7.4 ounces (170 to 210 grams) while females weigh 8.8 to 9.2 ounces (250 to 261 grams). Their flexible ribs

phylum
class
subclass
order
monotypic order
suborder
▲ **family**



and flat skulls help them to flatten their bodies, and squeeze into small areas when necessary. This can be helpful when escaping from predators. The nipples on females are on their sides, rather on their undersides, so if they are squeezed into a small space, the young can still feed.

GEOGRAPHIC RANGE

Dassie rats can be found in the Southwest Arid Zone of Africa, from southwestern Angola to the central and western parts of Namibia to the northwestern Northern Cape Province in South Africa.

HABITAT

Dassie rats live in areas with a lot of rocks on hills or mountains. This environment allows them to find small areas between or under the rocks to crawl into in case of an attack by a predator. When examining living areas, dassie rats will

choose an area with good shelter over an area with good plant life. The rocky shelters that they choose include lookout areas and sunbathing platforms. They make sure to choose shelters that have protecting rocks over the sunbathing platforms as a defense against birds of prey that may try to attack while they are sunbathing. In addition, feeding areas are near their shelters, so they do not have to travel long distances.



Dassie rats can make their bodies almost flat, and squeeze into small crevices or cracks to escape predators. (Nigel Dennis/African Imagery.com. Reproduced by permission.)

DIET

Dassie rats are herbivores, plant-eating animals. They eat leaves, berries, seeds, grasses, twigs, and shrubs. They look for this food on the ground or in bushes, and take it back to their shelters. They may use grasses and leaves to build a nest in the shelter. Dassie rats can regurgitate (re-GER-jih-tate), throw up partially digested food, into their mouths where they chew it again and then swallow it. They are also coprophagous (kuh-PRAH-fuh-gus), which means that they eat their own pellets, or dung, for additional nutrients. They do not usually drink water, but get all the water they need from their food instead.

BEHAVIOR AND REPRODUCTION

Dassie rats are active during the daytime, especially during the early morning and the late afternoon. They sunbathe under rocks that shelter them from possible attacks by birds. They often urinate in one spot, which makes the rocks at this spot become white due to stains from the urine. A dassie rat may live alone, with another dassie rat, or in a group. However, they only travel alone or with one other dassie rat.

When a predator attacks, dassie rats squeeze into a crack or other small area, quickly escape by jumping on rocks, or let out a warning whistling call to show that they are scared. Dassie rats are able to squeeze into very small cracks that most other animals would not be able to enter.

The dassie rat mating season is from November to December. Females give birth to one or two babies once a year, when the

raining season is just beginning. The young are born almost fully developed.

DASSIE RATS AND PEOPLE

Dassie rats do not have any special relationship with humans.

CONSERVATION STATUS

Dassie rats are not listed as threatened by The World Conservation Union (IUCN), but there is only a small population and they are not present in a large number of areas.

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family CHAPTER

CANE RATS
Thryonomyidae

Class: Mammalia
Order: Rodentia
Family: Thryonomyidae
Number of species: 2 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The two species in the cane rat family, the greater cane rat and the lesser cane rat, are very similar in appearance, except for the fact that one is larger and heavier than the other. The second-largest rodents in their native continent of Africa after the South African porcupine, the cane rats range in length from 1.3 to 2.6 feet (40.9 to 79.3 centimeters) and in weight from 3.1 to 14.3 pounds (1.4 to 6.5 kilograms). Males are much larger and heavier than females. Cane rats are sturdy-looking animals, with solid, stocky bodies, short, brown, bristly, scaly tails, and small ears. Their speckled fur is sharp-ended and coarse, and can be any shade between grayish and yellowish brown. Cane rats have white lips, chins, and throats, with large, chisel-like incisor teeth that grow continuously. The upper teeth are grooved and bright orange. Their muzzles are squared and padded at the nose. These rodents have short, thick legs with heavily padded feet and straight, powerful claws with five digits in front and four in back. Their skin is very thin and tears easily, although it also heals quickly. Likewise, the tail will break off easily if the animal is caught by it. Sexually mature, those ready to mate, cane rats have orange-tinted fur in their genital areas. Cane rats do not seem to see well, but their senses of hearing and small are keen. Despite their heavy appearance, they are extremely fast and agile creatures.

GEOGRAPHIC RA\NGE

Both species are native to Africa, where they occupy habitats south of the Sahara Desert. They may be found everywhere

A GENTLE GIANT

When threatened, cane rats thump their powerful rear feet on the ground to alert others while emitting a piercing whistling sound. Although its teeth are formidable, a frightened cane rat will virtually always run with great speed into dense vegetation and toward the nearest open water rather than turning to fight. If captured, the animals thrash frantically and are frequently injured. When enclosed in a box or crate, the rats often use their padded noses as battering rams to try to escape.

in west, central, and southern Africa all the way down to the eastern Cape in South Africa.

HABITAT

Although they look similar, the greater and lesser cane rats prefer different environments. The greater species is semi-aquatic and searches out marshes and reed beds near rivers and streams, while the lesser species looks for dry ground in moist savannas, or grasslands. Both animals are excellent swimmers and require tall grasses for hiding and foraging purposes.

DIET

Cane rats are herbivores, plant eaters, and eat a wide variety of grasses and other plant matter, as well as fruits, nuts, bark, and cultivated crops. Cane rats ferment their food in a special organ called the cecum (SEE-kum) to help digest it. They produce two kinds of feces: hard and soft pellets. Both are excreted, but the animals eat the soft pellets to extract any nutrients remaining in them.

BEHAVIOR AND REPRODUCTION

Cane rats earned their African nickname of "grass cutter" because of their method of eating: after using their powerful incisors to cut grasses at their base, the animals take the bunch of grass in their forefeet, sit upright on their haunches, and begin to feed the grass into their mouths slowly, cutting it up into small bits. When eating and when relaxed, they make soft grunting noises.

Primarily nocturnal, cane rats create and use narrow trails through the grass and reeds to move around their territories. Biologists think they live in groups of no more than twelve individuals. Males, who live with their young and a few mature females, do not tolerate the presence of other mature males, and aggressively defend their family groups. Males fight by pressing their padded noses together until one eases up on the pressure, at which point his opponent may swiftly swing his rump around to knock the weaker rat off balance.

Despite their well-developed claws, cane rats use burrowing only as a last resort for shelter and even then would rather use abandoned porcupine or aardvark burrows or holes in stream banks cause by erosion if dense vegetation for hiding is absent. Cane rats have been observed gnawing on rocks, pieces of tusk, and bones, presumably to sharpen their teeth.

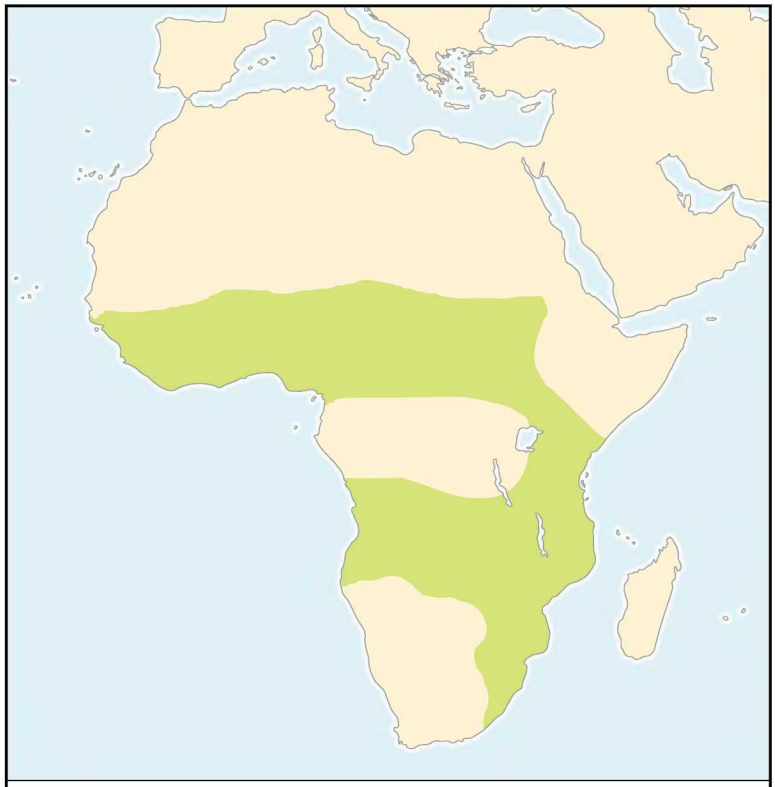
The cane rats mate with multiple partners throughout the year, although primarily during the rainy season when more food is available. In captivity, pairs reproduce at any time of the year. Pregnant females create a special nursery nest, carving out a shallow depression in a sheltered area and using leaves and grass to line it. She gestates, is pregnant, for 137 to 172 days, and may have two litters of one to eight pups each year. The pups are born with open eyes and are completed furred. They nurse for about a month, but stay with the adults until they reach sexual maturity at five months of age, when males begin to show aggression toward each other.

CANE RATS AND PEOPLE

The meat of both cane rat species is highly prized as an excellent and good-tasting protein source in an often harsh environment. Organized hunts for the animals are frequently held. Some farmers have even started to domesticate "microherds" of them, and families sometimes rely on sale of their meat for income. In Ghana, the price of cane rat meat reportedly surpasses that of beef, sheep, and pork. Farmers are often angered by the rats' frequent raids on their crops, and encourage pythons to come into their fields to feed on the animals.

CONSERVATION STATUS

Abundant in all areas with suitable habitat, neither the lesser nor the greater cane rat is threatened.



SPECIES ACCOUNT

GREATER CANE RAT
Thryonomys swinderianus

Physical characteristics: The larger of the two cane rat species, the (male) greater cane rat ranges in length from 26.1 to 30.9 inches (67.0 to 79.2 centimeters) and in weight from 11 to 14.3 pounds (5 to 6.5 kilograms), although there are reports of these animals weighing as much as 19.8 pounds (9 kilograms). Females are generally smaller. Greater cane rats have powerful, stocky bodies, massive heads, and small, broad, fur-covered ears. Perhaps their most striking feature is their gigantic, bright-orange incisor teeth. The animals have thick, coarse, pointed hair over its body that varies in shades of brown on top and much lighter fur underneath, with orange-tinted fur in the genital areas of mature adults. The forefeet are smaller than the back

feet, but both have large, well-formed claws. The forefeet have five digits, but the first and fifth are very small. There are reports of captive greater cane rats living for four years or more.

Geographic range: The greater cane rat is present in almost all countries west of the Sahara Desert except in areas of rainforest, dry scrubland, or desert. Their existence has been recorded in Gambia, Cameroon, the Central African Republic, Uganda, Sudan, Kenya, Tanzania, Malawi, Zambia, Mozambique, Angola, Namibia, Botswana, South Africa, and Zimbabwe.

Habitat: Greater cane rats favor low-lying, swampy places along streams and riverbanks where there are dense patches of reeds and tall grasses.



The greater cane rat is a good swimmer, and prefers to live in marshes and reed beds near rivers and streams. (© Yann Arthus-Bertrand/Cobris. Reproduced by permission.)

Diet: This species eats primarily the tender new shoots of elephant grass, pennisetum grass, kikuyu (kee-KUH-yuh), and buffalo or guinea grass, along with the plant roots and stems. They feed on bark, fruits, and nuts in more limited quantities. The greater cane rat also eagerly forages for vegetables in cultivated gardens and are voracious consumers of such crops as cane sugar, maize, pumpkins, sweet potatoes, millet, peanuts, sorghum, wheat, and cassava.

Behavior and reproduction: Mostly nocturnal, this polygamous (puh-LIH-guh-mus) cane rat lives alone or in small family groups with a dominant male, several adult females, and their young. They startle easily and run immediately for the closest water, using their excellent swimming, speed, and agility to outmaneuver predators. Females gestate for 152 to 156 days, giving birth to two to four pups on average, although the range is from one to six.

Greater cane rats and people: Like their smaller cousins, the greater cane rat is viewed by humans as both an important food source and a serious threat to cultivated crops.

Conservation status: These animals are abundant in all locations with habitat suitable for them, and not threatened. ■

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family CHAPTER

AFRICAN MOLE-RATS
Bathyergidae

Class: Mammalia
Order: Rodentia
Family: Bathyergidae
Number of species: 14 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

African mole-rats are small to medium-sized rodents with streamlined bodies 3.2 to 11.0 inches (83 to 281 millimeters) in length and with a weight of 1.2 to 31.0 ounces (34 to 896 grams). African mole-rats bodies are covered in hair that is thick and short, except for one species. They have robust heads, small eyes, very small ears, and flattened pig-like noses. The stiff hairs are thicker on the front of the face and around the eyes. Their necks are muscular so there is not much change in size from their head to body and their limbs are short giving their bodies an overall cylindrical appearance. On the outer edges of their hind feet and on their short tail they also have stiff hairs, except for one species. They also have stiff hairs that are used for touching that are scattered all over their bodies. Under their loose skin they have long, strong muscles. The African mole-rats have large, ever growing, white incisors, sharp-edged teeth which are flat, in the front of the mouth used for cutting and tearing food.

GEOGRAPHIC RANGE

African mole-rats are found in sub-Saharan Africa.

HABITAT

African mole-rats inhabit dry regions such as savannas, or flat grasslands, and open woodlands. The rodents are not found in dense forests. They are usually found in areas with plants that provide an underground food source such as bulbs, tubers, and rootstalks. African mole-rats live in burrow systems consisting of a complicated network of foraging tunnels. The tunnels

usually include a deeper nest complex with an area for relieving bodily waste, and usually one or more food storage areas. The surface opening is sealed except when dug-out soil is taken out.

DIET

They eat bulbs, tubers, and corms, the underground stem base of plants such as the crocus or gladiolus. Food is either eaten when it is found or brought back to a central storage area near the nest. Large food sources are often left to grow, and eaten on from time to time.

BEHAVIOR AND REPRODUCTION

African mole-rats are considered by experts to show the widest range in social structure of all mammals. They are solitary rodents, and spend much of their time underground. Almost all species dig by biting the soil with their large incisor teeth or in one genus (JEE-nus), a group of animals with similar characteristics, by loosening soil with strongly developed forefeet. Muscular lips with strong hairs keep soil out of the mouth. The loosened soil is pushed under their bodies with their forefeet and then collected and kicked behind them with their hind feet until it is kicked out of the surface opening.

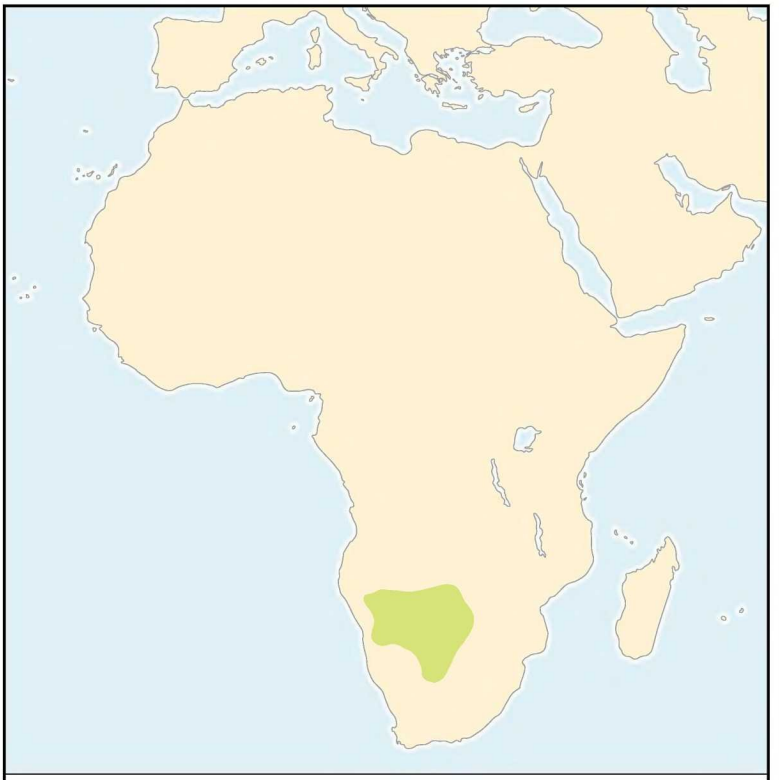
Courtship and mating activities are short encounters between a male and female. Pups at about two months of age begin to make their own burrows. Colonies of social African mole-rats have divisions of labor for reproductive activities. A single female, the queen, and a few chosen males do the mating. Remaining members, who are related to the breeders, are helpers. They remain members of the colony unless environmental conditions allow them to go out on their own or if a breeder dies. If the breeding female dies, some of the oldest females in the colony become sexually active and often fight for the highest position of breeding female. The gestation period, the amount of time the offspring is in the womb, is forty-four to 100 days. Litter, a group of young animals born at the same time from the same mother, size is from less than four up to twenty-eight, depending on the species.

AFRICAN MOLE-RATS AND PEOPLE

African mole-rats are considered pests in farmlands and in urban developments. Their burrows often damage roads, airport runways, and other such structures. They can also chew through underground cables, irrigation pipes, and other human-made objects.

CONSERVATION STATUS

One species of African mole-rat is listed as Vulnerable, facing a high risk of extinction in the wild, and six species are listed as Data Deficient, meaning there is not enough information available to decide their status.



Damaraland mole-rat *(Cryptomys damarensis)*

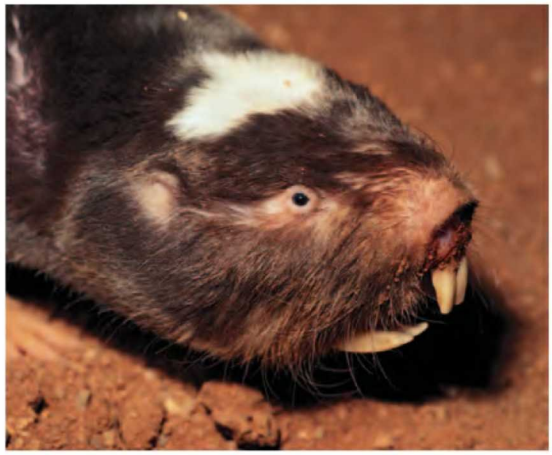
DAMARALAND MOLE-RAT
Cryptomys damarensis

Physical characteristics: Damaraland mole-rats have either grayish yellow-brown or dark brown coat colors. In either case, they have a large white patch on the top of the head. Damaraland mole-rats have a flattened nose; very small eyes; two large incisor teeth on top and another set of large incisors on the bottom of the mouth; five thin claws on each foot; and a stubby tail. They weigh about 4.6 ounces (130 grams), with males a little larger than females. Weight varies depending on social status.

Geographic range: They are widely found in Namibia, most of Botswana, and extending into western Zimbabwe and northwestern South Africa.

Habitat: They inhabit dry regions with an average annual rainfall of under 15.6 inches (40 centimeters). They prefer red Kalahari desert arenosols, sandy soils featuring very weak or no soil development; loose deposits of rivers and streams; and sands.

Diet: They eat geophytes (JEE-oh-fites), plants with underground organs such as bulbs, tubers, and rootstalks. Large geophytes are eaten at the place they grow, while the smaller ones are carried back to a communal storage area. The animals dig together as a group in search for food.



The Damaraland mole-rat uses its incisors for digging. (Wendy Dennis/FLPA—Images of Nature. Reproduced by permission.)

Behavior and reproduction: Damaraland mole-rats are highly organized and social creatures. They use their incisor teeth for digging. These rodents live in colonies of up to forty animals. The colony consists of a single breeding female, her several male partners, and their non-breeding offspring. The breeding animals control the colony. Pups of breeders remain as non-breeding helpers. Breeding occurs throughout the year. The gestation, pregnancy, period is seventy-eight to ninety-two days. The litter size is one to five, but averages three. The breeding female can have up to four litters in one year. Breeders can live more than ten years.

Damaraland mole-rats and people: There is no known significance between people and Damaraland mole-rats.

Conservation status: Dameraland mole-rats are not threatened. ■



NAKED MOLE-RAT
Heterocephalus glaber

Physical characteristics: Naked mole-rats, sometimes called sand puppies, are the smallest of the mole-rats. Even though they are called both moles and rats, they are much more closely related to porcupines, chinchillas, and guinea pigs. They are nearly hairless except for scattered sensory hairs. They lack the fur typically found on rodents have underdeveloped eyes and pinkish brown to pinkish gray wrinkled skin, long buck teeth, and long tails. Adults have an average length of 3 inches (7.6 centimeters), and an average weight of about 1.2 ounces (34 grams). Males and females look alike but size varies with social status; and dominant individuals can weigh up to 2.8 ounces (80 grams).



Naked mole-rats live almost their entire lives in the total darkness of underground burrows, living in the same home range for many years. (© Gregory G. Dimijian, M.D./Photo Researchers, Inc. Reproduced by permission.)

Geographic range: They are widely found in the regions of the Horn of Africa; that is, the east-central Africa area that includes Ethiopia, Somalia, and Kenya.

Habitat: Naked mole-rats inhabit dry regions with an average annual rainfall of under 15.6 inches (40 centimeters). They like fine sandy soils that become very hard in dry seasons.

Diet: Their diet consists of geophytes that are found through the coordinated foraging, searching for food, of colony members. They almost constantly dig tunnels in search of irregular food supplies and to escape snakes, their primary predator. The animals also eat feces, solid bodily waste; in fact, the breeding female and the weaning pups often beg for feces from colony members.

Behavior and reproduction: Naked mole-rats are highly social animals, living in complex underground colonies, which is unique among mammals, and much more common among insects, with 20 to 300 animals, but with an average of 75. They live almost their entire lives in the total darkness of underground burrows, living in the same home range for many years. The rodents have very underdeveloped eyes so,

instead, use highly accurate sensitivities to vibrations in the ground. They show a very highly developed division of labor that is centered on reproduction. One breeding female mates with several males, often one to three; all such animals are called the breeders. All other members are non-breeding worker and soldier animals that are offspring of the breeders and do all the jobs necessary within their territory in order to ensure the success of the group.

The breeding female stops non-breeding members from breeding with aggressive behaviors. Most non-breeders never leave the colony or breed. Odors separate friends from enemies, which is achieved by all members from rolling about in the burrow's toilet chamber, and coating their bodies with the familiar scent of the colony's feces and urine. Naked mole-rats will fiercely attack unfamiliar intruders, such as when another colony breaks into another colony's burrow system. Some breeding occurs outside the colony from animals that are highly sexed and attracted to animals from other colonies.

The breeding female has a distinctive elongated body and up to seven pairs of nipples. Her breeding occurs throughout the year. The gestation period is sixty-six to seventy-four days. The average litter size is one to twenty-eight, but the average size is twelve. Up to four litters are born each year. They live long lives, and females are able to reproduce into old age.

Naked mole-rats and people: There is no known significance between people and naked mole-rats.

Conservation status: Naked mole-rats are not threatened. ■

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family CHAPTER

OLD WORLD PORCUPINES
Hystricidae

Class: Mammalia
Order: Rodentia
Family: Hystricidae
Number of species: 11 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The Old World (living in Africa, Asia, and Europe) porcupines (called "quill pigs" in Latin) take their English name from the formidable spines, quills, and bristles that cover their sides, back, and tail. Their heads and bodies together range in length from between 13.8 to 36.6 inches (35 to 93 centimeters) and the animals usually weigh between 3.3 to 66.1 pounds (1.5 to 30 kilograms). The eleven species fall into three genera (JEN-uh-ruh; plural of genus): *Hystrix,* the Old World porcupines; *Trichys,* which are more slender mammals with flatter, shorter, and less-developed quills; and *Atherura,* which includes the brush-tailed porcupines. Most of the species have short tails, but others can have tails up to half of their head-body length. Eyes are usually small and can see only poorly, but the mammals' small ears are very keen. Nostrils are often S-shaped and contribute to a strong sense of smell.

Species in the *Hystrix* genus (JEE-nus) are stocky, somewhat lumbering animals with rounded, blunt heads; mobile, fleshy noses; split upper lips; and coats of thick flattened or cylindrical spines. The mammals stay on the ground at all times, never venturing into trees like their cousins, the New Age porcupines of North America. *Hystrix* alone among the porcupines has chambers in its skull that can be inflated, possibly to increase the ability to smell underground food sources. This slow-moving genus has short, thick front and back feet, with five digits on each foot, although the "thumb" on the front feet is much smaller than the other digits. Their claws are short and the pads on their feet are bare and smooth. The whole sole of

the foot touches the ground when the animals run or swim. These porcupines have black or brown white-banded, barbless (no barb, or hook on the end) quills that can reach up to 7.9 inches (20 centimeters) in length. The longest spines are usually on the hindquarters and the shortest on the cheeks. Their short tail is tipped with many thin, open-ended quills that rattle loudly whenever the animal moves. If some quills detach during a fight, the area will grow back new ones.

In animals of the genus *Trichys,* spines are short, relatively flat, and not well developed. These more slender species, which look almost more like bristly weasels than porcupines, do not rattle their spines when they move or when threatened. The species of the genus *Atherura* are rat-like creatures with unusually long tails tipped with a tuft of bristles. The tail is easily broken. Their spines are also flattened, but stiletto-sharp quills on their backs and sides make them intimidating opponents. Webbed feet make them good swimmers, and they readily climb trees as well. All of the Hystricidae species are primarily nocturnal, hiding from predators during the day. Except for the genus *Trichys,* spines normally lie flat when the animals are relaxed, but can be raised instantly into a bristling, quivering mass when threatened. All of the Old World porcupines have large, chisel-shaped upper and lower cutting teeth (incisors) that grow continuously throughout their lives. They are reputed to be quite intelligent animals, as evidenced by their uncanny ability to avoid traps. They normally live about ten years in the wild, and average twenty years in captivity, which they seem to tolerate well.

GEOGRAPHIC RANGE

Old World porcupines tend to live in the warmer habitats of southern Europe, many islands of the East Indies, across southern Asia (particularly India and the Malay Archipelago), and through all of Africa.

HABITAT

Old World porcupines generally like to live in deep burrows, which they often dig themselves or appropriate after the former occupants leave. However, they will also live in caves, rotting logs, nooks in rock walls, and hollow trees.

DIET

Mostly herbivores, plant eaters, Old World porcupines eat numerous kinds of plant material and human-cultivated crops.

Some of their favorite foods are sweet potatoes, onions, bananas, grapes, corn, pineapple, cucumbers, and mangoes. They sometimes eat rotten meat (carrion) and chew up the bones as well, probably for calcium. They also chew on bark, branches, and tree trunks to keep their incisor teeth worn down to acceptable levels.



A MYTH DISPELLED

It is not true that porcupines can "throw" or project their quills in any way, but they do detach easily—sometimes just when the animals rattle them to try to scare away predators. The quills do not carry poison, although bacteria on the shafts often cause serious infections if they puncture deeply enough. Infections eventually kill many predators unlucky enough to tangle with a porcupine.

BEHAVIOR AND REPRODUCTION

Legendary for their ability to defend themselves, Old World porcupines (like their New World relatives) use their formidable spiny armor to fend off predators (mainly birds of prey, hyenas, pythons, large owls, leopards, and wild cats). Except for *Trichys* species, these shy, rather anxious creatures generally try to scare away an opponent first by clicking their teeth together, grunting and huffing, and stamping their hind feet, which rattles their quills to make an intimidating buzzing noise. If that tactic fails, the porcupines launch a lightning-fast backward or sideways charge toward the predator in an effort to puncture the offender's skin deeply with its quills.

The mating habits of porcupines are the subject of many jokes and much curiosity. The truth is close to the old punchline, "Very carefully." Old World porcupines engage in a complex courtship that occurs once (occasionally twice) a year from March to December. It involves a mating dance during which the male showers the female with urine. If she rejects her suitor, the female becomes very aggressive, stamping her feet and shaking her quills. If she approves of the male, he will stand still in front of her and then move toward and away from her many times while making certain sounds. The final phase of the courtship occurs when the female raises her hindquarters into the air and lowers her chest to the ground. The male approaches and mounts her with one paw on each of her sides, holding on loosely but not leaning on her at all. Their intercourse is accompanied by loud squeals, grunts, and whines.

The female will carry her young (gestate) for 93 to 112 days, and gives birth to one or two pups (sometimes up to four) in a grassy nest within the multichambered burrow. The 12-ounce

(340-gram) pups have fur when they are born and can move on their own immediately. They nurse for three or four months, but after just a week the pup's quills begin to form and they may leave the nest with their mother. Old World porcupines reach sexual maturity at anywhere from nine to 18 months.

OLD WORLD PORCUPINES AND PEOPLE

Porcupines are hunted in many countries for their meat, which is considered a delicacy, and for their quills, which many cultures use for decoration and religious symbols. Because of their fondness for human-grown crops, they are also hunted as a pest species. Often infested with fleas and ticks, porcupines carry the sometimes deadly bubonic (byoo-BON-ik) plague and rickettsiasis, a potentially serious bacterial infection.

CONSERVATION STATUS

Although many porcupine species are extremely adaptable to changing environmental conditions, some are threatened, according to the World Conservation Union (IUCN). The Malayan porcupine is listed as Vulnerable, facing a high risk of extinction in the wild; and the thick-spined and North African crested porcupines are Near Threatened, not currently threatened, but could become so.



Indian crested porcupine *(Hystrix indica)*

INDIAN CRESTED PORCUPINE
Hystrix indica

SPECIES ACCOUNTS

Physical characteristics: The Indian crested porcupine is known among the other *Hystrix* species for its ability to produce an especially loud rattle with its quills. It ranges in head-to-rump length from 27.6 to 35.4 inches (70 to 90 centimeters) and is the largest of the African porcupines, ranging from 24.3 to 39.7 pounds (11 to 18 kilograms). This species has a short, high head that features a prominent mane of quills on its head and neck that can be up to 16 inches (40 centimeters) long and which the animal can raise into a tall, threatening crest immediately. Its sides and back are covered with thick, cylindrical spines and its tail is layered with white, shorter quills. Each of the porcupine's feet is broad and has a thick, well-developed claw for digging burrows and finding food.

Geographic range: This porcupine is endemic throughout southwest and central Asia, including India, Bhutan, Nepal, Bangladesh, and Sri Lanka, and in some parts of the Middle East, such as Iran, Israel, and Saudi Arabia.



An Indian crested porcupine with relaxed quills. The porcupine can quickly raise the quills on its head and neck into a tall crest when it's threatened. (© S. Nagendra/Photo Researchers, Inc. Reproduced by permission.)

Habitat: This species prefers to live on rock-strewn hillsides to as high as 7,875 feet (2,400 meters), but can adapt to just about any environment. They also make homes in scrublands where trees are sparse and in grasslands and forests. Like most of the porcupine species, the Indian crested shelters in caves, crevices, or burrows they or other animals have dug. When used for a period of time, their burrows become quite complex, with multiple entrances, chambers, and exits.

Diet: Like its cousins, the Indian crested porcupine eats human-grown crops of almost all kinds, in addition to wild vegetation, carrion, small bugs and mammals, and bones or antlers. Except when parents are teaching their young to forage, the search for food is usually solitary. They seems to prefer wandering along roads or tracks, and have been observed traveling more than nine miles in a single nighttime foraging trip.

Behavior and reproduction: Females of this species carry their young for an average of 112 days before giving birth, usually in February or March, in a grass-lined nest to a litter of one to four pups. Most females have only one litter per breeding season. Adults form monogamous (muh-NAH-guh-mus) pairs and both care for the young during the three-and-a-half–month nursing period. Up to fifteen members of a family group will share one burrow.

Indian crested porcupine and people: This porcupine species is hunted as a source of food in many cultures, and its voracious appetite for human-grown crops makes it a major threat to agriculture. Its extensive burrowing is damaging in gardens and other landscaped areas, and run-ins with the porcupines can cause serious illness and injuries to domestic animals and humans.

Conservation status: The Indian crested porcupine is common throughout its range. Its ability to adapt to multiple habitats and environmental changes make it a hardy species. Hunting of the creatures, however, has all but eliminated them from areas heavily populated by humans. ■



South African porcupine *(Hystrix africaeaustralis)*

SOUTH AFRICAN PORCUPINE
Hystrix africaeaustralis

Physical characteristics: The South African porcupine is the biggest rodent in its native region, ranging in head-to-rump length from 2.3 to 2.8 feet (71 to 84 centimeters) and weighing from 39.7 to 66.1 pounds (18 to 30 kilograms). Females tend to weigh slightly more than males. Even among animals known for their sharp senses of smell and hearing, this species has exceptionally keen senses. Their bodies are stocky, with sharp quills up to 11.8 inches (30 centimeters) long emerging from among the course, black hair that covers them. Their spines, as in the other species, are even longer, reaching up to 19.7 inches (50 centimeters). The animals can voluntarily erect the crest of spines and quills on their backs and napes, which are colored in black and white bars. The quills on the tips of their tails are



South African porcupines eat bulbs and tubers, and many aboveground plants. Here one feeds on gemsbok cucumbers. (Clem Haagner/Bruce Coleman Inc. Reproduced by permission.)

hollow at the ends, which cause them to make a startling whizzing sound when shaken. The South African porcupine has long whiskers and air-filled cavities in the facial area of its skull, while its nasal bones are larger than normal for a creature of its size. All of these are probably adaptations to help the porcupine find food more easily. The creatures walk with an alternating gait, as a dog or cat would. They can swim and climb trees well, and often live twelve to fifteen years even in the wild.

Geographic range: This porcupine is found only African countries south of the Sahara, not including the southwestern coastal desert.

Habitat: This species seeks out habitat with rocky outcroppings and hillsides, but may be found at elevations up to 11,480 feet (3,500 meters) where vegetation is abundant. It requires shelter during the day, and uses caves or other animals' abandoned holes for that purpose.

Diet: The South African porcupine uses its powerful claws to dig up tubers, roots, and bulbs of many kinds. They especially like such cultivated crops as sugar cane, pineapples, bamboo, melons, cocoa

and oil palms, and corn, but also occasionally eat carrion and gnaw on bark and bones. This species has special microorganisms in its front large intestine and appendix that help digest tough plant fibers.

Behavior and reproduction: The animals dig out cavernous, extensive dens that can reach up to 65.6 feet (20 meters) in depth, with a 6.6-foot (2-meter) deep central living chamber. As many as six family members may live together in the den, and they sometimes use it for defensive purposes by running into an entrance and erecting its spines to make it difficult (if not impossible) for predators to pull them out.

Reaching sexual maturity at between eight and eighteen months, the South African porcupine is a devoted parent that cares for its young over the long term. Females are "in heat" (estrus) for thirty-five days, during which they mate with their chosen partner. This species usually has two litters a year, during the wettest months between March and April. Females gestate for 93 to 105 days, then give birth to one to four pups in the family's grass-lined nesting chamber. Although they can eat solid food from birth, the pups nurse for about 100 days. The female cannot conceive another litter for three to five months after her season's first litter is weaned, stops feeding on breast milk.

South African porcupine and people: This species is hunted for its meat in many locations where people consider it a delicacy, while the porcupine's destructive and voracious feeding habits make them the enemy of many farmers, gardeners, and landscapers.

Conservation status: The South African porcupine is not threatened anywhere in its range, although humans and large cats sometimes reduce populations significantly for a short time. ■

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family CHAPTER

NEW WORLD PORCUPINES
Erethizontidae

Class: Mammalia
Order: Rodentia
Family: Erethizontidae
Number of species: 19 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

New World porcupines are some of the largest North American rodents. They are stocky animals with many sharp quills, modified guard hairs, and spines that in most species are hidden beneath long fur but are visible in others. Quills lie facing downward and spines cover most of their upper bodies and tail, except for a few species that have no spines. The animals have a prehensile, able to grasp by wrapping around, tail that can reach about one-fourth to over one-half its length. Its head consists of a blunt muzzle, small rounded eyes that are nearly hidden by hair, and small rounded ears. Its body has humped shoulders, short bowed legs, and long curved claws. Adults are 15.5 to 51.0 inches (40 to 130 centimeters) long and weigh between 6.5 and 22.0 pounds (3 to 10 kilograms).

GEOGRAPHIC RANGE

New World porcupines are found in North, Central, and South America, from Canada and Alaska to Argentina.

HABITAT

These porcupines live primarily in trees throughout rainforests and deciduous and coniferous woods, except for one species that lives in deserts and a few others that are found in plantations and other cultivated areas.

DIET

New World porcupines eat fruits, seeds, leaves, and bark.

BEHAVIOR AND REPRODUCTION

New World porcupines are assumed to be nocturnal, active at night, and arboreal, living in trees, spending their days sleeping in trees or in private ground places. They spend most of their time alone, but during winter months, several animals often share a winter den. Their winter territory averages 12 acres (5 hectares), while the larger summer territory reaches a maximum of 35 acres (14 hectares). Although not territorial, they defend feeding grounds during winters. They can spear their quills into attackers with spines that are detached. When faced with a predator, an animal that hunts and eats other animals, they erect their quills so they stick out in many directions and chatter their teeth. New World porcupines either remain stationary in a defensive position, or may charge the predator by quickly whipping out with their quill-laden tail.

Most of the time New World porcupines do not communicate with each other. Females do touch their young with their nose, giving them gentle grunts and whines. During the mating season, porcupines become noisy with various grunts, moans, screams, and barks. It is believed that females are either pregnant or lactating, producing milk, for most of their lives. The gestation period, the time period the offspring are in the womb, lasts about 200 days. When gestation is over the female mates again. Females nurse, feed on mother's milk, their newborns for eight to twelve weeks. A litter, young animals born together from the same mother, is usually only one young, which is born with fur and soft quills that harden quickly. The young reach adult size in about one year, and become sexually mature (able to mate) in one-and-a-half to two-and-a-half years. Their average lifespan is fifteen years.

NEW WORLD PORCUPINES AND PEOPLE

Some New World porcupines are hunted by people. The quills of some species are used in artwork.

CONSERVATION STATUS

New World porcupines are not threatened.



North American porcupine *(Erethizon dorsatum)*

NORTH AMERICAN PORCUPINE
Erethizon dorsatum

Physical characteristics: North American porcupines have stiff, dark-brown or black hair on their back along with scattered white barbed quills at the head, rear of body, and on the tail. They may have more than 30,000 barbed quills, many of which have a yellow-white base with a dark tip. Their face is a dark brown, with a woolly belly that does not have quills. Their undersides are covered with stiff, dark hairs. North American porcupines have a short, thick tail that contains quills above and stiff bristles below and large, naked feet. Their large incisor teeth are deep orange. Adults have a length of about 39 inches (1 meter) with the tail being one-fifth to one-third of the total length. Body weight is less than 26 pounds (12 kilograms), but a large male can be up to 33 pounds (15 kilograms). Juveniles



Most of the time, North American porcupines do not communicate, but mothers do touch their young with their nose, giving them gentle grunts and whines. (D. Robert Franz/Bruce Coleman Inc. Reproduced by permission.)

have a nearly all-black head, back, and tail. Their quills are short but sharp. Females have two pairs of mammae (MAM-ee), milk-secreting organ of female mammals.

Geographic range: North American porcupines range throughout Canada, except the far north-central regions, and down into the northeastern and north-central part of the United States and almost all of the western United States except the most southern regions. They also extend into the northern edge of central Mexico.

Habitat: North American porcupines are found in mixed hardwood and softwood forested areas, tundra, and occasionally in open areas and even deserts as long as plenty of water sources are around. They prefer rocky areas, ridges, and slopes.

Diet: North American porcupines are herbivores, animals that eat plant material, such as fruits, grains, and seeds. They feed on foliage for much the year and on inner bark of pine and oak trees in winter. They also eat seeds, fruits, nuts, berries, and plant stems, buds, twigs, leaves, roots, and flowers. Their chisel-like teeth scrape away the

tough outer bark, and then slice off pieces of inner bark to eat. North American porcupines eat alone, except for mothers and their young. They feed at night, but sometimes during the day, especially if the weather has been bad.

Behavior and reproduction: North American porcupines are mostly arboreal and nocturnal animals. They are good at climbing trees, although their slow movements seem awkward, and are good swimmers. They use hollow trees and logs, or gaps beneath rocks for their winter dens. The animals normally live alone, but will share a winter den when few good locations are available. They are not territorial, but will defend a feeding site if resources are few. During the breeding season, females produce bodily odors to show males they are ready to mate. Several males fight over the right to mate with one female. One of their courtship rituals is for the male to spray the female with urine. When females are ready, they will dance with their chosen male, rising on their hind feet, embracing while whining and grunting loudly, and pushing one another playfully to the ground. Their main predators include mountain lions, lynx, fishers, coyotes, bobcats, red foxes, wolves, wolverines, and great horned owls. During winter months they stay close to their den but go further out during summer months.

They are polygynous (puh-LIH-juh-nus), having more than one mate. Mating occurs only once a year, in the late summer and early autumn, and only during an eight to twelve hour period when the female is receptive. Females give birth to one but sometimes to two young. The gestation period is about seven months. Young weigh about 1.0 to 1.1 pounds (450 to 490 grams) at birth, and are born with both spines and fur. They double their weight within the first two weeks. They usually feed on their mother's milk for only a short period then begin to feed on vegetation shortly after birth. They soon become entirely independent of the mother. Young males move in and out of the mother's range for months or years, while young females leave the range permanently. They become sexually mature at about one-and-a-half years and most can live to about fifteen years of age.

North American porcupines and people: Native Americans used their quills for artwork and as a type of currency. North American porcupines were also hunted for food. They are often considered as pests when they gnaw through valuable wood and trees.

Conservation status: North American porcupines are not threatened. ■



Prehensile-tailed porcupine *(Coendou prehensilis)*

PREHENSILE-TAILED PORCUPINE
Coendou prehensilis

Physical characteristics: Prehensile-tailed porcupines have a grayish to yellowish brown body with short, thick spines that are whitish or yellowish and mixed with darker hair. Their face is whitish and undersides are gray. Their padded feet have four long-clawed toes. The tail is small, long, black, and prehensile with a curled tip. The last one-third of the tail does not contain spines on its upper surface, which helps it to wrap around thin branches. Juveniles have an orangish brown to brown body with longer fur that sometimes hides its spines. Adults are 3 to 4 feet (0.9 to 1.2 meters) long with half of



The prehensile-tailed porcupine uses its prehensile (grasping) tail to help it climb from branch to branch. (© Martin Harvey; Gallo Images/Corbis. Reproduced by permission.)

the length being its tail. They weigh between 9 and 12 pounds (4.0 and 5.5 kilograms).

Geographic range: They are found in eastern South America from eastern Venezuela and Trinidad to northeastern Argentina and Uruguay.

Habitat: The animals inhabit vine-covered rainforests and jungles, but can also be found in agricultural areas, gardens, and drier forests near water sources.

Diet: Prehensile-tailed porcupines are herbivores, eating mostly fruits, seeds, stems, leaves, roots, small twigs and shoots, and bark. They usually eat during the late part of the day.

Behavior and reproduction: Prehensile-tailed porcupines are shy, nocturnal porcupines that are solitary, alone, or live in pairs or gather in groups occasionally. They spend most of their time high in tree

branches; going from tree to tree by climbing down one tree, walking across the ground, and climbing up another tree. The animals move slowly, but can move fast when they must. They are good climbers, mostly due to their long, prehensile tail and padded, clawed feet. Prehensile-tailed porcupines sleep during the day, usually within a clump of vegetation in the forest's canopy. When threatened by a predator, they are not aggressive but will defend themselves if attacked. Prehensile-tailed porcupines often roll into a ball and raise their quills. Sometimes they attack the predator by quickly moving toward the intruder with spines erect. They will also stomp feet, shake spines, and make threatening snarls and grunts. They communicate with each through long moaning sounds.

During breeding periods, a male will spray urine onto a female and may also spray newborns. Females reproduce about every seven months. They often give birth during the rainy season, but it is not clear if this is always the case. The gestation period is 195 to 210 days. After giving birth usually to one young, the female will almost immediately mate again. Newborns are covered with red hairs and small spines, which harden shortly after birth. Young are weaned, no longer fed its mother's milk, after three months. Adulthood is reached in about eleven months and sexual maturity in about nineteen months.

Prehensile-tailed porcupines and people: People occasionally hunt prehensile-tailed porcupines for food. They are sometimes considered an agricultural pest.

Conservation status: Prehensile-tailed porcupines are not threatened. ■

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VISCACHAS AND CHINCHILLAS

Chinchillidae

Class: Mammalia
Order: Rodentia
Family: Chinchillidae
Number of species: 6 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Known for their luxuriously thick fur, these cuddly-looking, rabbit-like animals range in head-and-body length from 11.8 to 23.6 inches (30 to 60 centimeters) and can weigh from 1.1 to 19.8 pounds (0.5 to 9 kilograms). Females are usually larger than males. The animals' fur, which vary in color from brown to bluish gray to pearly white, have a uniform, soft underfur. The chinchillas and mountain viscacha have especially fine, silky fur, as well as special bristles on their back feet to groom themselves. As many as sixty hairs can grow out of one hair follicle. All the species have bushy tails. Viscachas are generally larger than chinchillas, while chinchillas have much larger ears and longer tails relative to their size. All of the species have broad, large heads, thick necks, and strong feet and rear legs. With its distinctive black-and-white facial pattern, the plains viscacha is unique among the family. Depending on their native environment, some of the animals are adapted to jumping, while others have evolved to burrow. The pads of their feet are hairless, and front feet are usually shorter than the back feet, which are long and bony. The four digits on their front feet are dexterous and useful in manipulating food. Their cheek teeth grow continuously and must be worn down regularly. The pupils of their eyes are cat-like, with vertical slits.

GEOGRAPHIC RANGE

This family of mammals occurs only in western and southern South America, but their largest populations are in

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

southern Peru, Argentina, Bolivia, and northern Chile to the foothills of the Andes Mountains in Patagonia (Argentina).

HABITAT

While most of the viscacha species tend to remain at elevations below 1,640 feet (500 meters), the mountain viscacha and chinchillas colonize areas from 13,120 to 16,400 feet (4,000 to 5,000 meters). The plains viscacha lives in grasslands with sparse vegetation, but all the other species seek out rocky areas where they can dig their burrows and hide from numerous predators.

DIET

Chinchillids (members of the Chinchillidae family) are mainly herbivores, plant eaters, and live on seeds and grass, although those species endemic at higher elevations also eat mosses and lichens. All species occasionally eat insects as well.

BEHAVIOR AND REPRODUCTION

The mountain viscacha and all the chinchillas eat, sunbathe, and groom while sitting erect on their hindquarters. The plains viscacha and all the chinchillas look for food at sunset and throughout the night, but the mountain viscacha is alert and active by day and hides by night. All of these animals live in colonies of some sort, but some are more tightly knit and structured than others. For instance, the plains viscacha is compelled to use a communal burrow system, and the colony is dominated by a strong male and an assistant he chooses from the fifteen to thirty members of the family group. On the other hand, chinchillas and mountain viscachas have a more relaxed social structure in which the colony is more spread out and can consist of from four up to 300 animals, with different burrows housing individual family groups. As colonial animals, there is always at least one individual on guard to watch for predators and other dangers. The mountain viscacha has a warning call that sounds like a high whistle, whereas the plains viscachas have a more varied palette of sounds, including a characteristic "uh-huh" sound, numerous whines, and their own species-specific warning calls. All six species have been observed taking dust baths and engaging in play chases, and all but the plains viscacha are amazingly agile as they jump among rocky outcroppings.

Female chinchillids are very aggressive to other females and even many males, with much growling, teeth chattering, and urinating, although there are rarely serious fights in the wild. They have unusually long gestation periods for rodents of their size, carrying their young 90 to 154 days before giving birth to one to six pups. The average female, which reaches sexual maturity (able to mate) at from eight to fifteen months, can produce one to three litters every year. Pups are born with open eyes and are fully furred, and their mothers nurse them for six to eight weeks. This species usually has more than one mating partner during the breeding season.



LONG LIVE THE CHINCHILLA

Many chinchilla species live up to ten years in the wild and sometimes over twenty in captivity. Some have even been known to start families at fifteen years old, having been sexually mature since eight months of age.

VISCACHAS, CHINCHILLAS AND PEOPLE

All species in this family, but especially the chinchillas, have been intensively harvested and farmed commercially for their valuable fur as well as for their meat. Their pelts are still the most expensive in the world. Plains viscachas are considered a pest and are destroyed in large numbers in many areas because their foraging leaves large swaths of bare ground (ten of them are rumored to eat as much as a sheep daily) and their burrows cause many cows and horses to break legs when they accidentally step into them.

CONSERVATION STATUS

Due to overharvesting, the long-tailed chinchilla is listed as Vulnerable, facing a high risk of extinction, by the World Conservation Union (IUCN), while the short-tailed chinchilla is Critically Endangered, facing an extremely high risk of extinction. The animals are now protected by law in their native habitats, although this is of limited benefit due to their remote habitats. Conservation groups have attempted to reintroduce chinchillas to Andean habitats, but with no success so far.



SPECIES ACCOUNT

LONG-TAILED CHINCHILLA
Chinchilla lanigera

Physical characteristics: As its English name indicates, the long-tailed chinchilla has an unusually long and bushy tail, averaging 5.6 inches (141 millimeters). The animals weigh about one pound (0.5 kilogram) and measure about 14.4 inches (365 millimeters) from nose to rump. Females can be much larger than males. This chinchilla has gray and black fur on its back and sides, with lighter fur on its belly. Every hair on its body has a black tip.

Geographic range: Also known as the Chilean chinchilla, it lives only in the mountainous regions of northern Chile.



Mother and baby long-tailed chinchillas may greet one another by rubbing snouts. (Jane Burton/Bruce Coleman Inc. Reproduced by permission.)

Habitat: This species lives in semiarid, rocky, and sparsely vegetated areas between 9,840 and 16,400 feet (3,000 to 5,000 feet).

Diet: The long-tailed chinchilla eats mainly grass and seeds of any available plants, but sometime eats insects and bird eggs as well.

Behavior and reproduction: Biologists report that female long-tailed chinchillas are generally monogamous, meaning that they have only one mate. They carry their young for an average of 111 days, usually delivering two pups. Most will have two litters a year. Mating seasons are from May to November in the Southern Hemisphere and from November to May in the Northern Hemisphere.

This species is active mostly at dusk and at night. Females are the dominant species in the colonies, which can reach up to 300 individuals, and show high levels of aggression with much vocalization. Long-tailed chinchillas are famous for their feats of agility as they leap about their rocky homes. Captive-bred chinchillas are very shy and bond easily with their owners.

Long-tailed chinchillas and people: Even among mammals prized by humans for their pelts, the long-tailed chinchilla is especially sought after. Coats made of their fur have sold for more than $100,000. Many of the animals are cross-bred with other species in captivity for this purpose.

Conservation status: The IUCN has listed this species as Vulnerable. With the last sighting of the animal in 1953, it is virtually unknown in the wild. Before laws had been put in place to protect the species, seven million pelts (individual furs) had been exported to buyers in other countries. They are also threatened by habitat destruction—specifically the burning and harvesting of the algarobilla shrub. ■

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family CHAPTER

PACARANA
Dinomyidae

Class: Mammalia
Order: Rodentia
Family: Dinomyidae
One species: Pacarana (*Dinomys branickii*)

PHYSICAL CHARACTERISTICS

Also known as Branick's giant rat after the Polish count who first described the species in 1873, the pacarana is the sole member of the Dinomyidae ("terrible mouse") family. The name pacarana comes from a Tupi Indian term meaning "false pig." Full-grown pacaranas weigh between 22 and 33 pounds (10 to 15 kilograms), and from nose to rump measure from 28 to 31 inches (730 to 790 millimeters). Their tails are usually 7.5 inches (190 millimeters) long. Sturdy and compactly built, their heads are broad and large in proportion to their bodies. They have short but extremely powerful limbs with four digits and formidable claws on each. Pacaranas have a thick coat of coarse, grayish brown or blackish hair with rows of white spots on the back half of the body. The animal has bushy, white whiskers on either side of its blunt snout and a deeply split upper lip. It is the third-largest rodent on Earth, after the capybara and the beaver, and some people say it looks like a gigantic guinea pig or spineless porcupine.

GEOGRAPHIC RANGE

A South American rodent, pacaranas' sparse populations may be found in the mountainous areas of a band running through western Venezuela, western Colombia, central Ecuador, Peru, part of western Brazil, and into northwestern Bolivia.

HABITAT

In Peru, this species occupies suitable habitat from 800 to 6,600 feet in elevation (240 to 2,000 meters), but in Venezuela they

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PACARANAS IN SAN DIEGO?

Although their ancestors' native land of Colombia is thousands of miles away, a thriving colony of pacaranas has been established at the San Diego Zoo. The animals can live for at least thirteen years in captivity, and are easily trained to perform in shows.

occur up to 7,870 feet (2,400 meters). Pacaranas live in montane forests and rainforest valleys of the Andes Mountains. They prefer to live in cracks in rock walls or outcroppings, but caves are also attractive habitats.

DIET

Pacaranas are mainly vegetarian and especially favor palm berries and other fruits as well as the stems and leaves of tender young plants.

BEHAVIOR AND REPRODUCTION

Because most pacarana behavior has been studied among captive animals, biologists know little about how these animals act in the wild. However, we do know that they are active mostly at night, when they spend most of their time in solitary searches for food. They occasionally climb trees to get to food sources, but spend most of their time on the ground, sitting up on their haunches to manipulate food with their forelimbs. They do not seem to dig, despite their sturdy claws. Although their Latin name indicates a placid nature and slow-moving ways, pacaranas are well equipped to defend themselves and have a strong will to do so. They can be surprisingly vicious in attacks on interlopers and predators, animals that hunt them for food, alike, including pet dogs and other pacaranas. They can climb well and walk on two feet occasionally for various purposes. Adults often live alone, but have also been observed cohabitating in pairs and family groups. Their communication with each other is fairly sophisticated and features seven different sounds, including singing, hissing, tooth chattering, stamping their front feet, and whining.

Pacaranas make a sound like crying to attract mating partners, and then engage in an elaborate courtship ritual during the breeding season in about November through January. The ritual has been described as a mixture of dancing and wrestling, with much sniffing, growling, and whimpering as a male and female stand on their hind legs to grapple with each other and interlock their front cutting teeth. Head-tossing is common prior to the male mounting the female, which he does after approaching her with dramatically trembling legs. Females



gestate, or experience pregnancy, for about 222 to 283 days and can be quite aggressive during the pregnancy. Scientists have never observed pacaranas building nests. Litter sizes are usually one or two pups, each of which weighs about 32 ounces (900 grams). Young can move around independently almost immediately and are born with eyes open and fully furred.

PACARANAS AND PEOPLE

Many native South Americans hunt pacaranas as a food source.

CONSERVATION STATUS

The IUCN has classified the pacarana as Endangered, facing a very high risk of extinction. Its normally low population



The pacarana is a slow-moving, nocturnal herbivore found in the Andes Mountains. (Francisco Erize/Bruce Coleman Inc. Reproduced by permission.)

levels, which in past years led scientists to believe the animals were extinct, are especially vulnerable to human predation and to habitat loss from human activities.

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family CHAPTER

CAVIES AND MARAS
Caviidae

Class: Mammalia
Order: Rodentia
Family: Caviidae
Number of species: 17 species

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Cavies and maras, also called cavids (members of the family Caviidae), range in size from 8 to 30 inches (20 to 75 centimeters) and have a vestigial, no longer functional, tail. They generally have plump, robust bodies with large heads, and short limbs and ears. Their fur in the wild is short and coarse. Cavids have high-crowned jaw teeth that grow continuously. The size and shape of cavids range from small, tailless, short-legged cavies with body lengths of 5.9 to 15.7 inches (15 to 40 centimeters) and weights of 7.0 to 21.1 ounces (200 to 600 grams) to the larger, rabbit-like salt-desert cavies and maras with shorter tails and, slender limbs, that are 17.7 to 29.5 inches (45 to 75 centimeters) in length and weighs 2.2 to 35.2 pounds (1 to 16 kilograms). Cavies have four clawed front toes and three clawed rear toes. The rock cavy has padded feet and claw-like toes that help it climb rocks and trees. Cavies have flat-crowned teeth that are always growing.

GEOGRAPHIC RANGE

Cavies are found over most of South America, except Chile and some areas of the Amazon River basin. Maras inhabit southern Bolivia, Peru, and Argentina.

HABITAT

Cavies and maras are found in a variety of habitat, depending on the species. These include marshes, tropical floodplains, rocky mountain meadows, grassland, desert, and areas with lots

NAME GAME

Guinea pigs are neither pigs nor from the African country of Guinea. So how did they get their common name? One theory is that when they were first introduced into Great Britain in the 1500s, they were the closest animal to a pig that could be bought for a guinea, an old British coin. Another is that the sounds they make reminded people of pigs, and since they were shipped to Europe via Guinea, people thought they originated from there.

of trees and bushes near water, grasslands, and cultivated lands. They are generally not found in dense jungle or rainforests.

DIET

Cavies and maras are herbivores, meaning they eat only plants, including grasses and cacti (KACK-tie, or KACK-tee), and plant material, such as seeds, flowers, and fruits.

BEHAVIOR AND REPRODUCTION

Cavies and maras are diurnal, meaning they sleep at night and are active during the day, or crepuscular (kri-PUS-kyuh-lur), meaning they are active at twilight. They do not hibernate and live in burrows they dig or were dug by other animals. They are generally very social, living in pairs or groups. Cavies and maras have a variety of mating regimens, including hierarchical promiscuity (HI-uh-raar-kick-al prah-miss-KYOO-it-ee), which is frequent sexual intercourse based upon ranking or status in the group; polygamy (puh-LIH-guh-mee), where they have multiple mates in a single breeding season; and monogamy (muh-NAH-guh-mee), which is having sexual relations with a single partner during the breeding season. They breed year round and produce multiple litters per year. Cavids have a gestation period, pregnancy, of fifty to seventy days. The number of offspring per litter is usually one to three but can be up to seven. Maras and salt-desert cavies have seasonal breeding patterns and have litters of one or two young.

CAVIES, MARAS AND PEOPLE

Cavies, commonly known as guinea pigs, have been domesticated, tamed, and used as pets for three thousand years. Scientists also use them extensively as laboratory animals. They are raised for food in areas of Ecuador, Peru, and Bolivia. Guinea pigs are believed to have been used by the ancient Incas in religious sacrifices. Small cavies are considered to be pests by farmers in agricultural areas. Larger cavies are hunted for food and their pelts, or fur.

CONSERVATION STATUS

No cavy species are currently listed as endangered by the World Conservation Union (IUCN). Maras, sometimes called Patagonian hares, are listed as Near Threatened, not currently threatened, but could become so, by the IUCN.



FAMILY TREE FEUD

Taxonomists, scientists who classify living things, have always placed cavies and maras in the order of rodents (Rodentia) because they most resemble rats and mice. However, newer research into the genes of cavies and maras indicate they are not related at all to rodents. Instead, some scientists suggest that their genes, the basic units capable of transmitting characteristics from one generation to the next, more closely resemble those of primates.



ROCK CAVY
Kerodon rupestris

Physical characteristics: Rock cavies are about the same size or slightly larger than the common guinea pig, 11.8 to 15.7 inches (30 to 40 centimeters) long and weigh 31.7 to 35.2 ounces (900 to 1,000 grams). They have long, slender legs with well-developed, blunt nails on their padded feet and one claw used for grooming. The upper body fur is generally gray with irregular black and white patches. The lower body fur is yellow and brown while the throat fur is white. The face has a muzzle shape with a longer, blunter snout, similar to that of a dog.

Geographic range: Rock cavies are found in eastern Brazil from the state of Piaui to northern Minas Gerais.

Habitat: The species prefers dry areas with rocky outcroppings near mountains and hills.

Diet: Rock cavies are herbivores, meaning they eat only plants and plant material. Their diet primarily consists of tender leaves and shoots of plants.

Behavior and reproduction: Rock cavies received their name because they are excellent rock climbers. They are generally most active late in the day. Males claim one or several rock piles as their territory, which they will defend. Each male has a number of female mates and each group has a hierarchy, a structured order of rank. The gestation period is about seventy-five days. Rock cavies reach sexual maturity, the age when they can produce offspring, at two months. Females produce several litters per year from July to March, each with one or two young. Individuals make several vocal sounds, including a slow whistle when they leave their rock piles to search for food, and an alarm whistle. The average lifespan is six to eight years.

Rock cavies and people: Rock cavies are easily tamed and make suitable pets. Brazilians who live in the rock cavy habitat area use the mammal as food and medicine.

Conservation status: Rock cavies are not listed as threatened by the IUCN. ■



Mara *(Dolichotis patagonum)*

MARA
Dolichotis patagonum

Physical characteristics: Maras, also called Patagonian maras or Patagonian hares, have a head and body length of 27.6 to 30 inches (69 to 75 centimeters) and a tail length of 1.6 to 2 inches (4 to 5 centimeters). They weigh form 17.6 to 35.2 pounds (8 to 16 kilograms). Their body shape looks like that of a long-legged rodent. The hind legs are slightly larger than the front legs, making them fast runners. The front feet have four toes and the back feet three toes with sharp claws. The fur of maras is grayish brown on the upper body and cream or white on the lower body. The rump has a large white patch of fur.

Geographic range: Maras are found in central and southern Argentina.



Maras are generally social, living in pairs or groups. Here a mother is shown with her offspring. (Ernest A. James/Bruce Coleman Inc. Reproduced by permission.)

Habitat: Maras prefer milder foothill regions where there is coarse grass and scattered shrubs. They also are found in forested canyons and open grasslands.

Diet: Maras are herbivores. Their diet includes a variety of vegetation, such as leaves, grass, herbs, fruits, cactus, and seeds. In captivity, they eat primarily hay, leaves, vegetables, and oats.

Behavior and reproduction: Maras are diurnal and they live in groups of up to forty. They use a variety of movements, including walking, hopping like a rabbit, galloping like a horse, and stotting, which is bouncing on all four legs at once. They are very fast runners, capable of reaching 27.9 miles per hour (45 kilometers per hour). They make several vocal sounds, including a "wheet" when they want contact with another mara, and a grunt they use to threaten others. Maras are monogamous, meaning they have a sexual relationship with only one mate, for several years. Females give birth to three or four litters a year, each consisting of one to three offspring. Females reach sexual maturity at eight months. Gestation is 93 to 100 days. The average lifespan of the Pantagonian mara is five to seven years in the wild and up to ten years in captivity.

Maras and people: Maras are hunted in the wild for food and their skin. They are also tamed and used as pets.

Conservation status: Maras are listed as Near Threatened by the IUCN. Their numbers appear to be declining in the wild, due primarily to destruction of their habitat by humans. ■

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CAPYBARA
Hydrochaeridae

Class: Mammalia
Order: Rodentia
Family: Hydrochaeridae
One species: Capybara (*Hydrochaeris hydrochaeris*)

family CHAPTER

PHYSICAL CHARACTERISTICS

Capybaras are the world's largest rodents. They resemble guinea pigs but are much larger. They have large, broad heads with short, rounded ears and eyes placed far back on the head. Their snout is heavy and blunt with a large upper lip and big nostrils. Their neck and legs are short. Adults weigh between 110 and 173.8 pounds (50 to 79 kilograms) and have a head and body length of 39.4 to 51.2 inches (100 to 130 centimeters).

Capybaras have four toes on their front legs and three on their back legs, all with short and strong claws. Their feet are partially webbed, making them good swimmers. Their front legs are shorter than the hind legs.

Their bodies are covered with short, coarse fur ranging in color from reddish brown to grey on the upper body and light yellow to brown on the lower body. Adult males have a bare, raised area at the top of their snouts that contains a scent gland that is used to mark their territories. The tail is short and not functional. Female capybaras are usually larger than males.

GEOGRAPHIC RANGE

Capybaras are found on the eastern side of the Canal Zone in Panama, and on the east side of the Andes Mountains in South America, including Peru, Colombia, Venezuela, French Guiana, Guyana, Uruguay, Paraguay, Bolivia, Ecuador, Brazil, and northeastern Argentina.

FISHING FOR CAPYBARAS

Capybara meat is considered a delicacy in parts of South America, especially Venezuela and Colombia. It is particularly popular during Lent, the period of forty days before Easter, when eating meat is prohibited by some Christian religions such as the Catholic Church. The reason for its popularity is that in the 1700s, the Vatican declared capybaras to be fish, allowing them to be eaten during Lent. The Catholic Church has never reclassified the capybara as a mammal.

HABITAT

Capybaras live in areas of dense trees and plants near rivers, streams, lakes, ponds, marshes, and swamps. There are four areas in South America where there are large concentrations of capybaras: the llanos (plains) in Venezuela, the Pantanal wetlands in western Brazil, the Taim lowlands in southern Brazil, and Marajó Island, at the mouth of the Amazon River in northeastern Brazil.

DIET

Capybaras are herbivores, meaning they are plant-eaters. Much of their time is spent grazing and foraging for food, which consists primarily of protein-rich grasses. An adult eats 6 to 8 pounds (2.7 to 3.6 kilograms) of grasses a day. They also eat water plants, fruits, and vegetables, including wild melons and squashes.

Since grasses are difficult for most mammals to digest, the capybara's digestive system has adapted to make it easier. One of these adaptations is a large fermentation chamber in the intestines called the cecum (SEE-kum). Capybaras also engage in coprophagy (kuh-PRAH-fuh-gee), which means they eat some of their own feces. These softer feces are rich in nutrients.

BEHAVIOR AND REPRODUCTION

Capybaras are social, living in groups of six to twenty animals, although groups of one hundred or more have been reported. The group has a dominant male, several adult females, their offspring, and several submissive adult males. The group is usually composed of family members and outsiders are rarely accepted. There is a social hierarchy in the group as a whole and within female members. The dominant male aggressively and sometimes viciously enforces this hierarchy.

In the wild, capybaras are usually active in the early morning and twilight. During the heat of the day, they rest intermittently in shallow beds in the ground or shaded areas of shallow water. In areas where there are higher concentrations of people, the capybara has become nocturnal, meaning it is most active at night.



When a capybara becomes startled or alarmed on land, it will run with a gallop much like that of a horse. If it feels it is in immediate danger, it will seek safety in water where it can stay submerged for about five minutes. With its partially webbed feet, the capybara is an extremely capable swimmer and diver. It can swim while submerged or with its eyes, nostrils, and ears just above the water's surface, much like a hippopotamus. It can also hide among water plants, with just its nostrils above the water line. Capybaras can make several vocal sounds, including a low-pitched clicking noise when it is content; long, sharp whistles; short grunts; and a purr to indicate submissiveness. When a capybara spots a predator or feels it is in imminent danger, it will bark. Nearby capybaras will stand motionless at alert. If the caller continues to bark, they will race into the nearest water and gather closely in a group, with their young in the center for protection.

Capybaras are somewhat territorial and the home territory of a herd or group averages about 200 acres (80 hectares). The



Newborns capybaras can see soon after birth and eat grass after one week. Young capybaras stay together in a group and females will allow infants other than their own to nurse. (Erwin and Peggy Bauer/Bruce Coleman Inc. Reproduced by permission.)

size of the range varies, depending on the season. Home ranges of groups often overlap. A group tends to get larger during the dry season and smaller in the wet season when groups tend to break into smaller groups as more marshes and wetlands are available. There are core areas within a group's range that it will protect for its exclusive use.

Mating occurs throughout the year but is highest in April and May. Females usually have one litter per year although two litters are not uncommon if conditions are favorable. The female gestation period, the time they carry their young in the womb, is 104 to 156 days. Litter size ranges from one to eight, with five being the average. Newborns can see soon after birth and can eat grass after one week. Young capybaras stay together in a group and females will allow infants other than their own to nurse. Both males and females reach puberty, the age of sexual maturity, at about fifteen months of age. The average lifespan in the wild is eight to ten years. In captivity, several capybaras have lived for more than twelve years.

Capybaras have several natural predators, animals that hunt them for food, in the wild, including jaguars, anacondas (large

water snakes), and caiman (KAY-mun), a large reptile similar to alligators and crocodiles. Young capybaras are eaten by foxes, vultures, and wild dogs.

CAPYBARAS AND PEOPLE

Capybaras are hunted in the wild by humans for their meat and skin, which is used to make wallets and purses. They are also raised on ranches, much like cattle, for their commercial value. Their meat when cooked is said to taste similar to pork or chicken but with a slight fishy flavor. Its fat is used in the manufacture of pharmaceuticals (medicinal drugs). Capybaras are considered agricultural pests in some areas because they raid crops of fruits, vegetables, and sugar cane.

CONSERVATION STATUS

The capybara is not currently threatened, according to the IUCN. Hunting and exterminations by humans have caused populations to decline in some areas, particularly Venezuela and Peru, while they remain stable in others. However, some conservationists say the overall numbers are in decline.

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AGOUTIS
Dasyproctidae

Class: Mammalia
Order: Rodentia
Family: Dasyproctidae
Number of species: 12 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Agoutis are medium sized rodents, about the size of a rabbit, with long, thin legs and a squirrel-like face. Their bodies are slender in the front and bulkier in the rear. There are two genera (JEN-uh-rah; plural of genus, a group of related animals): *Dasyprocta* and *Myoprocta*. Agoutis have a head and body length of 12.6 to 25.2 inches (32 to 64 centimeters) and weigh 1.3 to 8.8 pounds (0.6 to four kilograms). They have a large head, plump body, and glossy fur. Their faces have prominent noses with whiskers, large eyes, and small ears positioned high on their head.

The tail on *Dasyprocta* species is a barely visible nub, while the tail on *Myoprocta* species is longer and readily visible. There is a wide range of colors within agoutis. In most species, the fur on their lower bodies is usually white, yellow, or buff. Their upper body fur ranges from pale orange, several shades of brown, to black. Several species have faint stripes. Their hind legs have three toes and are longer than their front legs, which have four toes. All toes have sharp, hoof-like claws.

GEOGRAPHIC RANGE

Agoutis are found from southern Mexico to southern Bolivia and northern Argentina. Their range includes Brazil, Belize, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Honduras, Nicaragua, Panama, Peru, Paraguay, El Salvador, and Venezuela. They have also been introduced into the Cayman Islands.

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

SOWING THE SEEDS

The agouti is an important component in the health and regeneration of the rainforests. When food is plentiful, they will bury seeds of fruit and other forest trees to eat later when food is scarce. This helps distribute seeds of a wide variety of tropical trees, including *Virola nobilis*, a giant canopy tree of the rainforest. They often follow groups of monkeys and eat fruit the monkeys drop from trees.

HABITAT

Agoutis are found throughout the forests of Central and South America, usually in areas with heavy brush, and near streams, rivers, ponds, and marshy areas. They generally graze in open areas and grassland.

DIET

Agoutis are primarily herbivores, meaning they are plant-eaters, although they will occasionally eat seafood. Their diet consists primarily of fruit. They also eat tender leaf plants, seeds, wild vegetables, freshwater crabs, and fungi. They have extremely hard teeth, which they use to crack open nuts, including the tough Brazil nut.

BEHAVIOR AND REPRODUCTION

The agouti is diurnal, meaning it is most active during the day. Agoutis are fast and agile. Their movements include walking, trotting, galloping, and they can jump up to 6.6 feet (2 meters) from a stationary position. They live mostly on the ground, making nests inside hollow logs or under aboveground tree roots. They also make burrows under stream banks.

Agoutis have a remarkable sense of direction and are able to find nuts or fruits easily, even months after they have buried them. In the wild, the agoutis' main predators are jaguars, ocelots, snakes, birds of prey, cats, dogs, and humans. In the wild, agoutis have a lifespan of thirteen to twenty years.

Agoutis are monogamous (muh-NAH-guh-mus), meaning they mate with only one partner during a period of time, and mate for life. They are able to breed throughout the year but especially when there is an abundance of fruit. Agoutis reach puberty, the age of sexual maturity, at six months. The female agouti has one or two litters per year, each consisting of one to four babies. Her gestation period, the time she carries her young in the womb, is 104 to 120 days.

AGOUTIS AND PEOPLE

Agoutis are hunted for their meat and skin. They are important seed dispersers in the tropical forests of South America. They can also be tamed as pets.

CONSERVATION STATUS

Two species, the Ruatan Island agouti and the Coiban agouti are listed as Endangered, facing a very high risk of extinction, by the IUCN. Azara's agouti is listed as Vulnerable, facing a high risk of extinction, by the IUCN. No other species are considered currently threatened by the IUCN.



SPECIES ACCOUNT

CENTRAL AMERICAN AGOUTI
Dasyprocta punctata

Physical characteristics: The Central American agouti has a head and body length of 12.6 to 25.2 inches (30 to 64 centimeters) and weighs 1.3 to 8.8 pounds (0.6 to 4 kilograms), about the size of a small cat. The body is slender. It has short ears, four toes on its front feet and three on its back feet, all with sharp hoof-like claws.

Its fur is coarse and glossy and it increases in length from the front to the rear of the body. Fur color ranges from pale yellow and orange to several shades of brown. The fur on the rump is usually a contrasting darker color. Central American agoutis in eastern Panama and Costa Rica have dark brown fur on their front, orange fur on



The Central American agouti lives in lowland rainforest in Central and South America. (© Gregory G. Dimijian/Photo Researchers, Inc. Reproduced by permission.)

their middle back, and a cream-colored rump. Some Central American agouti have faint stripes.

Geographic range: Central American agoutis are found from the states of Tabasco and Chiapas in southern Mexico to southern Bolivia and northern Argentina. Their range includes Brazil, Belize, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Honduras, Nicaragua, Panama, Peru, Paraguay, El Salvador, and Venezuela. They have also been introduced into the Cayman Islands.

Habitat: The Central American agouti prefers to live in rainforests, thick bushes, savannas, and in areas farmers have cultivated for crops. In Peru, they are concentrated around the Amazon River in the surrounding dense, low lying tropical rainforests, and in higher rainforests up to about 6,600 feet (2,000 meters) in elevation.

Central American agoutis prefer to be near water and are frequently found along the banks of rivers, streams, and lakes. They usually build dens where they sleep in hollow logs, among rock outcroppings, and under above-ground tree roots.

Diet: Central American agoutis are primarily herbivores, meaning they eat plants, although they occasionally eat seafood. Their diet consists primarily of fruit, which they are able to hear falling to the ground from far away. They also eat tender leaf plants, wild vegetables, freshwater crabs, fungi, and insects. When feeding, the Central American agouti sits on its hind legs and holds the food in its front paws, much like a common squirrel. It turns the fruit around several times, peeling it with its teeth.

Behavior and reproduction: A pair of Central American agoutis claims a territory of about 2.5 to 5 acres (1 to 2 hectares), an area containing fruit trees and a water supply. When other agoutis enter the territory, the male drives them off, fighting occasionally becoming vicious and causing serious wounds.

This agouti species is diurnal, meaning they are most active during the day. They are fast and agile. Their movements include walking, trotting, galloping, and they can jump up to 6.6 feet (2 meters) from a stationary position. When in danger, the Central American agouti stands motionless with one front paw raised. They spend much of their time grooming to remove parasites, such as ticks and mites.

Central American agoutis have a courtship ritual in which the male sprays the female with his urine several times, causing the female to jump around in frenzy, before mating. The female has one or two litters a year, each usually with two young although she can have three or four. Her gestation period, the time they carry their young in the womb, is 104 to 120 days.

Central American agoutis and people: Central American agoutis are hunted extensively for their meat and skin. They are important seed dispersers in the tropical forests of South America. They are also easily tamed as pets.

Conservation status: The Central American agouti is not listed by the IUCN. ■

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PACAS
Agoutidae

Class: Mammalia
Order: Rodentia
Family: Agoutidae
Number of species: 2 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

There are two species of paca: *Agouti paca*, commonly known as the paca, and *Agouti taczanowskii*, commonly known as the mountain paca. Though the genus name *Agouti* may be confusing, pacas and agoutis (family Dasyproctidae) are not in the same family. Pacas are among the largest of all rodents, with a head and body length of 20 to 30.5 inches (50 to 77.4 centimeters) and weight of 13.2 to 31 pounds (6 to 14 kilograms.) Their tail length is 5 to 9 inches (13 to 23 centimeters).

The paca resembles the mountain paca in most features, except the paca is slightly larger, has thinner and harsher fur, shorter nostrils, larger eyes, and thicker claws.

In both species, the upper body fur varies from reddish brown to dark chocolate or smoke-gray. There is a pattern of white or pale yellow irregular spots on the sides, arranged in rows of two to seven. The average number of rows is four. One or two upper rows are shorter and limited to the rear half of the body. Two or more middle rows run from the neck to the rump.

GEOGRAPHIC RANGE

Pacas are found from southern Mexico to northern Argentina. Their range includes Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, French Guiana, Guatemala, Guyana, Honduras, Nicaragua, Panama, Paraguay, Peru, Suriname, and Venezuela.

HABITAT

Pacas primarily live in tropical rainforests but are also found in a wide variety of forest habitats, including mangrove swamps, deciduous and semi-deciduous forest, dense upland scrub, and narrow growth along river banks.

DIET

Both species of paca eat mainly fruit but their diet changes throughout its range and based on the seasons. Other foods include roots, seeds, leaves, buds, and flowers. In the wild, pacas are herbivores, meaning they eat only plants. In captivity, they are omnivores, meaning they eat both plants and flesh. Pacas in zoos eat fruits, vegetables, raw meat, lizards, and insects.



NAME CHANGE

In the 1700s, the scientific name for the paca was *Cuniculus brisson* and in the twentieth century it was called *Odobenus brisson*. In the early twentieth century, it was known by the common name of coelogenys. The paca is called conejo pintado in Panama, tepezcuintle in Costa Rica, guardatinajas in Mexico, hee in Suriname, and lapa in Venezuela. Paca is the common name in Brazil and Argentina.

BEHAVIOR AND REPRODUCTION

Pacas are nocturnal, meaning that they are most active at night, and solitary animals. In the wild, they have sometimes been seen active in the early morning and late afternoon. During the day, they sleep in a den dug under tree roots or rock outcroppings, or in hollows in trees, usually along riverbanks or hillsides. The den usually has several entrances or exits concealed by leaves.

Pacas are capable swimmers and when they feel threatened, take to the water where they can remain submerged for up to fifteen minutes. They have an acute sense of smell and hearing. They walk along fixed trails, but should a trail become disturbed by humans or other animals, they will abandon it.

Pacas breed year-round. Females are sexually mature, able to mate, at nine months, while males are sexually mature at one year. The gestation, or pregnancy, period is 114 to 119 days. Females have one or two litters of young a year, each usually with one baby but in rare instances, two babies.

PACAS AND PEOPLE

Pacas are hunted by humans for their meat and are often killed by farmers who see them as agricultural pests. However, pacas are important dispersers of seeds from the *Attalea oleifera* palm tree in the Brazilian Atlantic Forest, and *Virola surinamensis*, a commercial timber tree.

CONSERVATION STATUS

Pacas and mountain pacas are not listed as threatened by the IUCN. However, several wildlife surveys show their numbers in the wild are dwindling, due to extensive hunting and habitat destruction by humans.



Paca *(Agouti paca)*

PACA
Agouti paca

SPECIES ACCOUNT

Physical characteristics: The paca has a head and body length of 20 to 20.5 inches (50 to 77.4 centimeters) and a weight of 13 to 31 pounds (6 to 14 kilograms). They have course, slick, glossy fur that is gray, red, black, or brown on the upper body and white on the lower body. They may also have four horizontal rows of cream, gray, or white spots or marks on their sides. Pacas have four toes on their front paws and five on their back feet. They also have a somewhat arched back.

Geographic range: Pacas live in east-central Mexico to Paraguay, including Belize, Brazil, Colombia, Costa Rica, El Salvador, French

Guiana, Guatemala, Guyana, Honduras, Nicaragua, Panama, Suriname, and Venezuela.

Habitat: Pacas live primarily in rainforests near rivers and streams. They can also be found in seasonally dry areas, swamps, and deciduous forests bordering water sources.

Diet: Pacas are herbivores that feed on leaves, stems, roots, seeds, and fruit, especially avocados and mangos. Pacas do not climb trees so they depend on tree-climbing animals such as monkeys, to drop fruit from trees.

Behavior and reproduction: Pacas are nocturnal, meaning they are most active at night. During the day, they sleep in a den dug under tree roots or rock outcroppings, usually along riverbanks or hillsides. The den usually has several entrances and exits concealed by leaves. Pacas are capable swimmers and take to the water when they feel threatened. They have an acute sense of smell and hearing.

The paca is monogamous and territorial, with a mated pair sharing a territory, which can be up to 8.6 acres (3.5 hectares). However,

their territories are not exclusive and may overlap with other pairs of pacas.

Female pacas usually have one litter of babies a year but can have two or three. A litter contains one or two babies. Their gestation period, the time they carry their young in the womb, is 114 to 119 days.

Pacas and people: Pacas are hunted by humans for their meat. They are often killed by farmers who see them as pests.

Conservation status: Pacas are not listed as threatened by the IUCN. ■

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TUCO-TUCOS
Ctenomyidae

Class: Mammalia
Order: Rodentia
Family: Ctenomyidae
Number of species: 58 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Tuco-tucos are small to medium-sized rodents with heavily built bodies, strong and large heads, and short, powerful legs. Their general appearance is that of the pocket gopher (Geomyidae), found in North America. The head and body length is 8.6 to 16.9 inches (22 to 53 centimeters) and they weigh from 3.5 ounces to 2.4 pounds (100 grams to 1.1 kilograms). Their skin is loose on their bodies, making it easier for them to turn around in their narrow burrows. They have tiny ears and short, stiff, hairless tails. The front paws of tuco-tucos are longer than the hind legs.

They have very distinct bright orange incisors, the two long, flat, sharp teeth at the front of the mouth, that are wide and powerful. Their fur is thick and long. It varies in color between species, including different shades of cream, red, brown, gray and black. The upper body fur is generally darker than the lower body fur.

GEOGRAPHIC RANGE

Central and southern South America, including Argentina, Bolivia, Brazil, Chile, Paraguay, Peru, and Uruguay.

HABITAT

Tuco-tucos range from the tropics to the sub-Antarctic regions at the tip of South America. They seem to prefer coastal areas, grassland, rainforest, deciduous forest, the large treeless semi-arid grassy plains called steppes, and meadows. They are

found from sea level up to 13,120 feet (4,000 meters) in the Andes Mountains.

Most species live in a very small geographic area, including the Bolburn's tuco-tuco and the silky tuco-tuco that inhabit extreme southwestern Argentina. There are only several species that have a wider geographic range, such as the collared tuco-tuco, which lives in Argentina, Brazil, and Uruguay, and the highland tuco-tuco, found in Argentina, Bolivia, Chile, and Peru.

DIET

All species of tuco-tucos are believed to be herbivores, meaning they are plant-eaters. Their primary food sources are roots, grasses, herbs, and shrubs.

BEHAVIOR AND REPRODUCTION

Tuco-tucos are extremely solitary animals and are found in pairs only when mating. The one known exception is the social tuco-tuco, found in Argentina, which lives in colonies. They are diurnal, meaning they are most active during the day, and polyrhythmic, meaning they alternate between short periods of activity and resting throughout the day.

Tuco-tucos build burrows that are an intricate system of connecting tunnels and small caverns. The main tunnel is about 46.2 feet (14 meters) long, about 2 to 2.8 inches (5 to 7 centimeters) wide, and 12 inches (30 centimeters) below the surface. The burrow usually contains a grass-lined chamber for nesting, and several chambers for storing food. At least two species, the talas tuco-tuco and collared tuco-tuco, keep the temperature of their borrows at 68 to 71.6°F (20 to 22°C) by blocking and unblocking their burrow entrances based on sun and wind.

Tuco-tucos use sounds, smells, and touch to communicate with each other. The name "tuco-tuco" is an attempt by native South Americans to express in words the sound that several species of tuco-tuco make when they are giving a warning to animals that invade their territory. The actual sound is more like "tloc-tloc." Tuco-tucos have several other sounds including a deep rumbling noise made by the male when courting a female.



GOOD DIGGERS

Tuco-tucos are natural diggers. They prefer soil that is sandy or loamy, meaning it is a fertile mixture of clay, sand, silt, and other organic matter. They live in burrows that they dig. These burrows are very long and usually have several branching tunnels, along with many entrances and exits, usually concealed with plant material or plugged with rocks. Within these tunnels, they dig chambers for nesting and storing food. Tuco-tucos dig with their incisors, the two long, flat, sharp teeth at the front of their mouths, and kick the dirt out of the tunnel with their strong hind legs.

Tuco-tucos have one or two mating periods each year where the female produces a litter of babies. The gestation period, the time they carry their young in the womb, varies from species to species but generally is 100 to 120 days. Litter sizes vary from one to seven babies, called pups. Males and females reach are sexually mature, able to mate, at about eight months. The average lifespan of a tuco-tuco in the wild is about three years.

TUCO-TUCOS AND PEOPLE

Tuco-tucos are hunted for their meat by several native South American groups, including the Tehuelches and Onas. Farmers who consider them an agricultural pest because they eat crops often kill them. They can also cause problems for horseback riders when their burrows cave in under the weight of the horses, causing broken legs to the horses and often injury to the riders when they fall.

CONSERVATION STATUS

The Magellanic tuco-tuco is listed as Vulnerable, facing a high risk of extinction, by the IUCN due to declining habitat. In southern Patagonia, an area of Argentina between the Andes Mountains and the south Atlantic Ocean, extensive grazing by sheep on grasses and plants eaten by the highland tuco-tuco and other agricultural activities, have caused the animal to become rare and endangered. Three species are listed as Near Threatened, at risk of becoming threatened, by the IUCN: mottled tuco-tuco, Natterer's tuco-tuco, and social tuco-tuco. No other species are listed as threatened by the IUCN.



Pearson's tuco-tuco *(Ctenomys pearsoni)*

PEARSON'S TUCO-TUCO
Ctenomys pearsoni

SPECIES ACCOUNT

Physical characteristics: The head and body length for Pearson's tuco-tuco is 7.5 inches (19 centimeters) and they weigh about 7 ounces (200 grams). They have brown-red fur with a white band of fur under the neck and white patches on the sides of the neck.

Geographic range: Pearson's tuco-tucos live in Peru, Chile, southwest Uruguay, and Entre Rios province in Argentina.

Habitat: These tuco-tucos prefer coastal sand dunes and grassland.



Pearson's tuco-tuco leaves its burrow only to find food and to mate. It defends its burrow against intruders. (Illustration by Joseph E. Trumpey. Reproduced by permission.)

Diet: Pearson's tuco-tuco are herbivores. Their diet consists primarily of grasses, herbs, shrubs, and roots.

Behavior and reproduction: The Pearson's tuco-tuco is solitary and individuals come together only to mate. The animal is territorial, meaning it is protective of an area it considers home and claims exclusively for itself. It will aggressively defend its territory and burrow from other tuco-tucos. It leaves its burrow only to find food and to mate. It has several vocalizations, including a sound to warn intruders away from its territory. It also has an excellent sense of hearing and can detect a human moving from about 165 feet (50 meters) away.

The mating season for Pearson's tuco-tuco in Peru is during the dry season and the babies are born in the wet season, when there is an abundance of plants. Female Pearson's tuco-tucos have one litter of babies per year. The number of babies ranges from two to four. They are believed to be polygamous, meaning they take more than one mate during the breeding season.

Pearson's tuco-tuco and people: They are rarely hunted and because they are so solitary, they have no known significance to humans.

Conservation status: Pearson's tuco-tuco is not listed as threatened by the IUCN. ■

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OCTODONTS
Octodontidae

Class: Mammalia
Order: Rodentia
Family: Octodontidae
Number of species: 13 species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Octodonts are similar in appearance and size to gerbils and rats. They have stocky bodies, large heads, pointed noses, and medium-sized rounded ears. Octodonts have rear legs that are slightly shorter than their front legs. They have four clawed toes on their front paws and five on their back paws.

Octodonts have a head and body length of 5 to 8.7 inches (125 to 221 millimeters) and a tail length of 1.5 to seven inches (40 to 180 millimeters). Their weight ranges from 2.8 to 10.6 ounces (80 to 300 grams). They have long, dense, silky fur that is yellow, brown, or gray on their upper bodies and white or cream on their underside. One exception is the coruro, which is almost entirely black.

GEOGRAPHIC RANGE

Octodonts are found in southwest Peru, Chile, Argentina, and southwest Bolivia.

HABITAT

The octodont habitat ranges from coastal scrub brush to barren rocky outcroppings in mountains. They are found in desert, deciduous forest, grassland, and foothills.

DIET

Octodonts are herbivores, meaning they eat only plants. All but one species eat mainly at night. The degu feeds during the early morning and early evening. Most species eat a diet of grass,

leaves, herbs, bark, and seeds. The coruro feeds mostly on underground portions of plants.

BEHAVIOR AND REPRODUCTION

All but one species of octodont are nocturnal, meaning they are most active at night. Degus are diurnal, meaning they are most active during daylight hours.

Octodonts are extremely talented and organized diggers. They build burrows consisting of many branched tunnels and multiple entrances. When digging a burrow, the adults form a chain that speeds up the activity. Most octodonts, such as degus, coruros, and rock rats exhibit a complex system of social behavior, living in colonies of five to ten adults and their young. They groom each other, lay bunched together when sleeping, and the females nurse each other's babies. Other species of octodonts are solitary.

The mating system for octodonts is not well understood although in several species it appears to involve courtship rituals. Most species, including the degu and coruro, usually breed twice a year. Females reach puberty, the age of sexual maturity at which they can bear offspring, at six months. The gestation period, the amount of time the young are carried in their mother's womb, is seventy-seven to 105 days. Litters usually consist of four to nine babies.

OCTODONTS AND PEOPLE

Most octodonts have little interaction with humans. Degus are used for laboratory research. They are also sold as pets in the United States. In the wild, degus and coruros are often killed by farmers who consider them agricultural pests, blaming them for destroying grain fields, orchards, and vineyards.

CONSERVATION STATUS

The Mocha Island degu is listed by the World Conservation Union (IUCN) as Vulnerable, facing a high risk of extinction, due to their small distribution area. The plains viscacha rat is listed as Vulnerable due to a loss of at least 20 percent of its population within ten years. Other species are not listed by IUCN.



TALE OF THE DEGU TAIL

Never try to catch or pick up a degu by its tail. As a defense against predators in the wild, the end of the tail will come off when it is pulled, allowing the degu to make an escape. However, it results in a bloody injury and can become infected. Usually, part or all of the remaining tail will either dry up and fall off or the degu will chew it off. The lost part never grows back.



SPECIES ACCOUNT

DEGU
Octodon degus

Physical characteristics: Degus, also called trumpet-tailed rats, are similar in body size and appearance to gerbils, except for the fact that their faces share more of a resemblance with squirrels. They have chubby, round bodies, large heads and short necks. The head and body length of degus are from 9.8 to 12.2 inches (25 to 31 centimeters, with a tail length of 2.9 to 5.1 inches (7.5 to 13.0 centimeters. They weigh 6 to 10.5 ounces (170 to 300 grams).

They have long whiskers and relatively long tails that have very little hair, except for a tuft of fur at the tip. The degus' rear legs are

slightly shorter than their front legs. They have four clawed toes on their front paws and five on their back paws. Degus have yellow or brown fur mixed with some black on their upper bodies, and white fur on their underside. Their teeth are bright orange.

Geographic range: In Chile, from the coastal areas of the west slopes of the Andes Mountains to about 9,000 feet (2,700 meters).

Habitat: Degus live in the brush, shrubs, and grassy plains of grasslands and deciduous forests.

Diet: Degus are herbivores, meaning they eat only plants. They eat mainly during the early morning and early evening. Their diet consists mainly of grass, leaves, herbs, bark, and seeds.



Degus eat mostly plants, and search for their food in the early morning and early evening. (© Fletcher & Baylis/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: Degus are extremely social and live in groups of five to ten adults and their young. They groom each other, lay bunched together when sleeping, and the females nurse each other's babies. A degu group builds burrows consisting of many branched tunnels and multiple entrances. When digging a burrow, the adults form a chain that speeds up the activity.

Degus are diurnal. In the wild, they live about one to three years. In captivity, their average lifespan is five to nine years, with some reportedly living up to thirteen years.

Degus usually breed twice a year. Females are sexually mature, able to bear offspring, at six months. Litters usually consist of four to nine babies.

Degus and people: Degus are used for laboratory research. They are also sold as pets in the United States. In the wild, degus are often killed by farmers who consider them to be agricultural pests, blaming them for destroying grain fields, orchards, and vineyards.

Conservation status: Degus are not listed as threatened by the IUCN. ■

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family CHAPTER

CHINCHILLA RATS
Abrocomidae

Class: Mammalia
Order: Rodentia
Family: Abrocomidae
Number of species: 4 species

PHYSICAL CHARACTERISTICS

Chinchilla rats have large, round ears, large eyes, and an elongated head. They have short legs with four toes on the front feet and five toes on the back feet. The head and body length of the chinchilla rat is 6 to 10 inches (15 to 25 centimeters with a tail length of 2.4 to 7.2 inches (6 to 18 centimeters). They weigh from 7.1 to 10.6 ounces (200 to 300 grams).

The fur of the chinchilla rat is thick and soft. Fur coloring is silver-gray or gray-brown on the upper body and light brown, cream, white, or yellow on its underside.

GEOGRAPHIC RANGE

They are found from coastal areas to the Andes Mountains in southern Peru, northern Chile, northwest Argentina, and central Bolivia.

HABITAT

Chinchilla rats live in rock crevices and elaborate burrows under rocks or at the base of shrubs.

DIET

Chinchilla rats are herbivores, meaning they eat only plants. The feed at night on seeds, fruits, and nuts.

BEHAVIOR AND REPRODUCTION

There is very little scientific information on the behavior of chinchilla rats, due to their small population. Only a handful of research has been done on the small rodents. What is known

ROCK CLIMBERS

Chinchilla rats love to climb and are extremely talented. Although they spend most of their time on or under the ground, they do climb rock outcroppings, plants, and trees. Sometimes they live within crevices of rocky cliffs. Often they will build sidewalls inside their rocky dens up to 10 feet (3 meters) high. They use a construction material made of their own feces and urine. When dry, the mixture is almost as hard as rock.

has usually been gained by observing the behavior of only a few of each species.

Chinchilla rats live inside burrows in colonies of up to six individuals. Colonies are usually close together, sometimes as little as 59 feet (18 meters) apart. Little is known about the reproductive behavior of chinchilla rats. They usually mate in January or February. The gestation period, the length of time the female carries the babies in her womb, is 115 to 118 days. Litters are usually one or two babies.

There are four species: Bennett's chinchilla rat, which lives in the coastal foothills and high plains of the Andes Mountains in Chile; Bolivian chinchilla rat, which is found in central Bolivia; ashy chinchilla rat, found in the high plains of the Andes in Bolivia, Chile, and Peru; and *Cuscomys ashaninki*, which does not have a common name, found in Peru.

Cuscomys ashaninki was discovered in 1999 when a single dead body was found. As a result, there is virtually no information available on this species. The skeletal remains of another species, *Cuscomys oblativa*, have been found in Peru but the species is believed to be extinct.

Bennett's chinchilla rat sometimes shares burrows with similar-sized degus. A Bennett's chinchilla rat in captivity lived two years and four months. Their lifespan in the wild is believed to be one to two years.

CHINCHILLA RATS AND PEOPLE

Chinchilla rats are sometimes hunted by humans for their fur, which is sold at local fur markets and has a low value. It is sometimes sold to tourists as real chinchilla fur. They were hunted extensively for their fur in the early twentieth century and all species were nearly extinct by the 1920s when several South American countries passed laws to protect them.

CONSERVATION STATUS

The Bolivian chinchilla rat is listed as Vulnerable, facing a high risk of extinction in the wild, due to its population being confined to a small area. The other chinchilla rats are not listed as threatened by the IUCN.



Ashy chinchilla rat *(Abrocoma cinerea)*

ASHY CHINCHILLA RAT
Abrocoma cinerea

SPECIES ACCOUNT

Physical characteristics: The head and body length of the ashy chinchilla rat is 6 to 10 inches (15 to 25 centimeters) with a tail length of 2.4 to 7.2 inches (6 to 18 centimeters). They weigh from 7.1 to 10.6 ounces (200 to 300 grams). They have large, round ears, large eyes, and an elongated head. They have short legs with four toes on the front feet and five toes on the back feet. The fur of the ashy chinchilla rat is thick and soft. Fur coloring is silver-gray on the upper body and cream, white, or yellow on its underside.



The ashy chinchilla rat communicates through grunts and squeaks. (Hernan Torres. Reproduced by permission.)

Geographic range: Ashy chinchilla rats live in the Altiplano, a high plateau area of the Andes Mountains, from southern Bolivia and Peru to central Chile.

Habitat: They are found in rocky regions of 12,000 to 16,400 feet (3,700 to 5,000 meters). They usually live in burrows under rocks or at the base of shrubs.

Diet: Ashy chinchilla rats are herbivores, meaning they eat only plants. They feed at night on seeds, fruits, and nuts.

Behavior and reproduction: Ashy chinchilla rats live in burrows in colonies of up to six individuals. Colonies are usually close together, sometimes as little as 59 feet (18 meters) apart. Little is known about the reproductive behavior of ashy chinchilla rats. They usually mate in January or February. The gestation period, the length of time the female carries the babies in her womb, is 115 to 118 days. Litters are usually one or two babies.

This species of chinchilla rat makes several vocal sounds, including a grunt when it is fighting or about to fight, a squeak when it is frightened, and a low gurgle when being groomed by one of its colony members.

Ashy chinchilla rats and people: Ashy chinchilla rats are sometimes hunted by humans for their fur, which is sold at local fur markets and has a low value. It is sometimes sold to tourists as real chinchilla fur.

Conservation status: The ashy chinchilla rat is not listed as threatened by IUCN. However, its population is believed to be low and in decline due to hunting and habitat destruction by humans. ■

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SPINY RATS
Echimyidae

Class: Mammalia
Order: Rodentia
Family: Echimyidae
Number of species: 78 species

family
CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The physical characteristics of spiny rats vary greatly from species to species, from rat-sized to the size of a small cat. Their head and body length is from 4.13 to 18.9 inches (10.5 to 48 centimeters) and a tail length of 0.2 to 16.6 inches (0.5 to 42 centimeters). They weigh from 0.46 to 2.9 pounds (210 to 1,300 grams). In appearance, most species of spiny rat are rat-like, with pointed noses, although several species have blunt noses and resemble squirrels. Their front feet have four toes while their hind feet have five.

Spiny rats got their name because most species have spiny or bristly fur, most noticeably on their backs and rumps. The spiny qualities vary between species: the armored rat has well-developed spines, spiny rats, or casiragua, have broad and stiff hair, and the punaré has soft fur with no hint of spines.

Fur color also varies greatly between species, with upper body fur being gray or various shades of brown, and white or cream on their undersides. Several species, including the toro and the white-faced arboreal spiny rat have black-and-white or white faces.

GEOGRAPHIC RANGE

Spiny rats are found throughout southern Central America and northern and central South America, from southern Honduras to northern Argentina and Chile.

HABITAT

Spiny rats live in a wide variety of habitats, from species that live exclusively in treetops, to forest floor dwellers to those that

live underground in complex burrow systems. Many species live near the coast, rivers, or streams. The rato de Taquara lives exclusively in bamboo thickets along stream and river banks. They are found in both old growth and new-growth forests, but are most abundant in forests of intermediate age where there are large numbers of fruit trees, such as palm and fig. Spiny rats are often the most abundant animal in their geographic range.

DIET

Spiny rats are mostly herbivores, meaning they eat only plants, although some species eat insects. Their diet includes fruits, nuts, grass, and sugar cane. Several species, including rato de Taquara, eat only bamboo shoots and leaves.



A RAT'S TAIL

As a defensive feature against predators, spiny rats have a tail that easily breaks off. If grasped by the tail, it will break off between the fourth and fifth vertebrae. The rat can then escape to its burrow. There is little blood loss and the break does not appear to harm the rats. However, this way of escape can only be used once since the tail does not grow back. A survey of spiny rats in central Panama found that 15 to 20 percent of all adult spiny rats did not have tails.

BEHAVIOR AND REPRODUCTION

Spiny rats are nocturnal, meaning they are mostly active at night. Most die if they are exposed to heat or dryness. Depending on the species, they live either individually, in small groups, or like the broad-headed spiny rat, in large colonies. The average lifespan is two to four years in the wild.

They are generally territorial, meaning they are protective of an area they consider home and claim exclusively for themselves. Males and females have separate territories. Males defend their burrows against other males but females are less aggressive and their territories frequently overlap. Territories are usually small, from 1.2 to 14.8 acres (0.5 to 6 hectares) and can vary greatly between the seasons.

Spiny rats play a critical role in the health of the rainforest of Central and South America by dispersing the seeds from a wide variety of trees and other forest plants through their excretions. They are also an important source of food for predators such as ocelots, owls, boa constrictors, anacondas, and jaguars.

Little is known about the breeding habits of many species. In general, spiny rats breed throughout the year and females can give birth to four to six litters a year. The litter size ranges from one to seven babies, with the average being two to four.

Gestation period, the time the female carries the young in her womb, varies but is generally sixty to seventy days. In the punaré, a species of spiny rat, the females produce two or three litters per year and gestation period is from ninety-five to ninety-eight days.

SPINY RATS AND PEOPLE

Several species are hunted and eaten by humans, some are killed by farmers who consider them agricultural pests, and several species are used as laboratory animals.

CONSERVATION STATUS

The IUCN lists three species of spiny rats as Extinct, or died out; one species as Critically Endangered, facing an extremely high risk of extinction; five species as Vulnerable, facing a high risk of extinction in the wild; and nine species are Near Threatened, not currently threatened, but could become so. The remaining species are not listed as threatened by the World Conservation Union (IUCN).



Spiny rat *(Proechimys semispinosus)*

SPECIES ACCOUNT

SPINY RAT
Proechimys semispinosus

Physical characteristics: The spiny rat is about the size of a common house rat, except with a larger head and smaller ears. Head and body length is 6.4 to 12 inches (16.0 to 30.0 centimeters) and a tail length of 4.4 to 12.8 inches (11.2 to 32.5 centimeters). They weigh from 10.5 to 17.5 ounces (300 to 500 grams). Their fur is orange-brown on the upper body and white underneath.

Geographic range: The spiny rat is found in Colombia, Costa Rica, Ecuador, Honduras, Nicaragua, and Panama.

Habitat: The spiny rat lives in rainforest, usually in dense underbrush and near rivers and streams.



The spiny rat doesn't dig its own burrow, but will live in burrows dug by other animals. Males defend the burrow against other males. (Illustration by Barbara Duperron. Reproduced by permission.)

Diet: They are mostly herbivores, feeding primarily on fallen fruit but sometimes on fungi.

Behavior and reproduction: The spiny rat is nocturnal, meaning it is mostly active at night. It sleeps, nests, and stores food in burrows dug by other animals, rock crevices, or hollows in trees or logs. It does not dig its own burrow. The male defends its burrow against other males. The lifespan of the spiny rat is two to four years.

The species breeds throughout the year and the females may have three to six litters per year. The gestation period, the time the female carries a litter in her womb, is sixty-three to sixty-six days, with the number of babies ranging from one to five. They reach sexual maturity at six to seven months.

Spiny rats and people: Spiny rats are trapped and eaten by local people.

Conservation status: The IUCN does not consider the spiny rat to be threatened. ■

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HUTIAS

Capromyidae

Class: Mammalia

Order: Rodentia

Family: Capromyidae

Number of species: 14 living species

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

Hutias are medium to large, stocky rodents with broad, round heads. They have small eyes and short, rounded ears. Their head and body length is 14 to 32 inches (36 to 80 centimeters) and their tail length is 1.4 to 17 inches (3.5 to 43.1 centimeters). They weigh 1.1 to 18.7 pounds (0.5 to 8.5 kilograms). Their stomachs are divided into three compartments, making it one of the most complex stomachs in all rodents.

Hutias have short legs and five toes on each foot. Each toe has a strong, usually curved, claw. Their fur is generally thick and coarse and the color is usually various shades of black, brown, or gray, with the underside fur being slightly lighter.

GEOGRAPHIC RANGE

Hutias are found exclusively in the Caribbean, particularly Cuba, the Bahamas, Jamaica, Haiti, and the Dominican Republic.

HABITAT

Hutias usually live in forests, plantations, scrublands, marshy areas, and mountainous, rocky areas of rainforest. Brown's hutia, also known as the Jamaican hutia, usually lives on exposed areas of limestone in the interior of Jamaica. They build their nests in rock crevices or tunnels. The largest populations of hutia are in Cuba, including the Cuban hutia, black-tailed hutia, and prehensile-tailed hutia.

DIET

Some hutias, such as the eared hutia, are omnivores, meaning that they eat both plants and flesh, but eat mostly plants. Their diet includes leaves, fruit, and bark, and occasionally lizards, and small animals. Some species, such as Brown's hutia, are herbivores, meaning that they eat only plants.

BEHAVIOR AND REPRODUCTION

While very shy towards humans, hutias are usually extremely social with each other. They engage in various activities as a group, including foraging for food and grooming. They generally live in social groups and do not seem to be territorial.

Some hutias are terrestrial, meaning they live mainly on the ground, while other species of hutia are primarily arboreal, meaning they live mostly in treetops. Most species are diurnal, meaning they are mostly active during the day. Brown's hutia is nocturnal, meaning it is most active at night.

Hutias breed year-round and have one to three litters of babies a year. Females have a gestation period, the length of time they carry their young in the womb, of 110 to 150 days. Females have one to six babies per litter with an average litter size of one or two. The mothers nurse their young until they are about five months old, and the young are able to reproduce at ten months. The average lifespan is eight to eleven years.

HUTIAS AND PEOPLE

Some species of hutia are widely hunted by humans for their meat, such as Brown's hutia in Jamaica, despite its threatened status. In some areas of Cuba hutias are abundant and considered an agricultural pest by farmers. There is growing concern among conservationists that more species will become extinct soon due to human activities. Brown's hutia is continuing to drop in population despite its protected status under Jamaica's Wildlife Protection Act of 1945, which is rarely enforced.

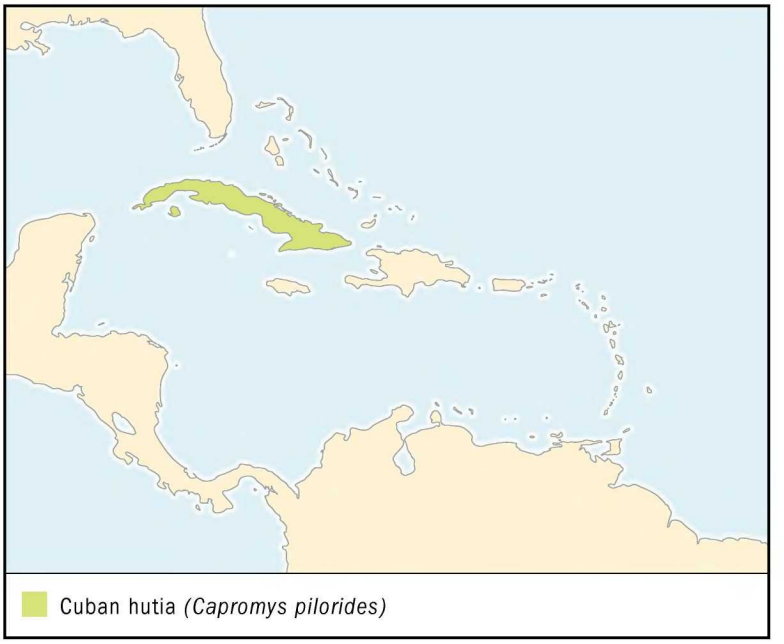


BACK FROM THE DEAD

The Bahamian hutia was once common throughout the Bahamas until the first European settlers arrived in the 1600s. Their numbers then started to drop due to hunting and destruction of its habitat and it was believed extinct by the 1800s. In 1966, however, a survey expedition discovered hundreds of Bahamian hutias living on the small remote uninhabited island of East Plana Cay. The mammal became a protected species in 1968 and by the start of the twenty-first century, numbered about 10,000. It has been introduced to several nearby small, uninhabited islands where it is thriving. It is listed by IUCN as Vulnerable due to its limited geographic range.

CONSERVATION STATUS

The World Conservation Union (IUCN) lists five species that have recently become Extinct, died out; six species that are Critically Endangered, facing an extremely high risk of extinction; and four species that are Vulnerable, facing a high risk of extinction.



CUBAN HUTIA
Capromys pilorides

SPECIES ACCOUNT

Physical characteristics: Cuban hutias, also known as Desmarest's hutias, are the largest species of hutia. They have a head and body length of 18 to 35 inches (46 to 90 centimeters), a tail length of 6 to 12 inches (15.2 to 30 centimeters) and a weight of 6.6 to 18.7 pounds (3 to 8.5 kilograms). They have short, stocky legs and "waddle" when they move. Their feet are broad and each foot has five toes with prominent claws.

They have thick, coarse fur and on the upper body, which can be various shades of black, gray, brown, red, yellow, and cream. Their underside fur is usually softer and a lighter shade.

Geographic range: These hutias live on mainland Cuba and its surrounding islands.

Habitat: Their habitat includes tropical rainforest, mangrove forests, marshy areas, scrubland, and the mountains of eastern Cuba.



The Cuban hutia uses its strong claws to climb trees. (Frank W. Lane/FLPA—Images of Nature. Reproduced by permission.)

Diet: Cuban hutias are omnivores, meaning they eat both plants and flesh, but eat mostly plants. Their diet includes leaves, fruit, bark, lizards, and small animals.

Behavior and reproduction: Cuban hutias are shy and usually live in pairs, although pairs have often been observed living in larger, loosely-associated groups. They are extremely social among others of their species. They are primarily arboreal, meaning they live mostly in treetops, and diurnal, meaning they are most active during the day. One of the Cuban hutias' main types of social behavior is a combination of grooming and play wrestling between a pair.

Cuban hutias breed all year but births peak in June. Females have a gestation period, the length of time they carry their young in the womb, of 110 to 140 days. Females have one to six babies per litter with the average litter size of two or three offspring. The mothers nurse their young until they are about five months old and reach sexual maturity at ten months. The average lifespan is eight to eleven years.

Cuban hutias and people: Cuban hutias are hunted by humans for their meat. In some areas of Cuba they are in such abundance that they are considered an agricultural pest by farmers.

Conservation status: The Cuban hutia is not currently threatened. While the Cuban hutia is abundant in many areas of the

island-nation, their population has decreased drastically in the mountains of eastern Cuba. ■

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COYPU

Myocastoridae

Class: Mammalia

Order: Rodentia

Family: Myocastoridae

One species: Coypu (*Myocastor coypus*)

family CHAPTER

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

PHYSICAL CHARACTERISTICS

The coypu, sometimes called the South American beaver or nutria, looks like a muskrat, only larger. It has a stout body that is highly arched and a large, somewhat triangular head. It has small eyes and ears on the upper part of its head. Coypus have a head and body length of 1.4 to 2.1 feet (43 to 63.6 centimeters), and a tail length of 0.8 to 1.4 feet (25.5 to 42.5 centimeters. They weigh from 11 to 37 pounds (5 to 17 kilograms).

They have short, hairless legs with the hind feet longer than the front feet. Each hind foot has five toes, four of which are connected by webbing. The fifth toe is used for grooming. The front feet have four long, flexible toes without webbing, and a non-functioning thumb. Their tails are long, round, and hairless. One of the coypu's most distinguishing features is its large, wide, bright orange incisors, the flat, sharp-edged teeth at the front of the mouth used for gnawing and cutting and tearing food. They can close their lips behind the incisors, allowing them to gnaw while underwater. Their ears, nose, and nostrils are located near the top of the head so they are above water when the coypu is swimming.

Coypus have two types of hair; soft, dense under fur, and outer fur of long, course, bristly hair, called guard hair. The undercoat is dark gray and the outer coat is various shades of red, brown and yellow. The stomach fur is soft and dense and usually a pale yellow. The fur on the chin and around the nose is usually white.



GEOGRAPHIC RANGE

The coypu is native to southern South America, from the middle of Bolivia and southern Brazil to Tierra del Fuego at the southern tip of the continent, including Argentina, Chile, Paraguay, and Uruguay. It has been introduced into North America, Europe, northern Asia, east Africa, and the Middle East where there are populations in the wild. In the United States, it is found in fifteen states coast to coast but particularly in Louisiana, Florida, Oregon, and Maryland. In Canada, it is found in British Columbia, Ontario, and Quebec. It is found throughout continental Europe, including France, Germany, Scandinavia, Austria, Russia, and Poland. Other non-native populations include those in Israel, Zimbabwe, and Japan.

HABITAT

Coypus adapt well to a wide range of habitats, including rainforest, deciduous forest, coniferous forest, scrub forest,



Coypus are not native to the United States, but were brought to Louisiana to raise for fur. A number escaped, and now breed in the wild. (© YVA Momatiuk and John Eastcott/Photo Researchers, Inc. Reproduced by permission.)

grassland, wetland such as swamps and marshes, and the banks or shores of lakes, ponds, rivers, and streams.

DIET

South American coypus are omnivores, meaning they eat both plants and flesh, although they eat mostly plant material. Coypus in other parts of the world are herbivores, meaning they eat only plants. Their diet consists of a wide variety of plants and plant material, including aquatic plants such as rushes, arrowhead, smartweed, reeds, cattail, bullwhip, alligator weed, and duckweed. They also eat plant leaves, stems, roots, bark, clover, and cultivated crops such as sugarcane, sugar beets, and soybeans. On occasion, coypus in South America will eat insects, mussels, snails, mollusks, and earthworms.

BEHAVIOR AND REPRODUCTION

Coypus are extremely passive and rarely aggressive. They are shy and fearful; the slightest disturbance will send them scurrying to the shelter of water, burrow, or other hiding places.

Depending on their habitat, coypus are nocturnal, meaning they are most active at night, or crepuscular (kri-PUS-kyuh-lur), meaning they are most active at dawn and twilight.

Coypus are semi-aquatic, meaning they live both on land and in water. On land, they walk with slow, clumsy, awkward movements but if threatened, they can run fast and jump short distances. They are excellent swimmers and can remain submerged in water for more than ten minutes. Coypus can close their nostrils and lips behind their incisors while cutting vegetation under the water. The coypu is social and territorial, meaning it is protective of an area it considers home and claims exclusively for itself and its mate or family group. They live in groups of two to thirteen individuals, usually related female adults, their offspring, and one adult male. Young adult males usually live alone. Males and females have separate territories. The average home range is 6.1 acres (2.47 hectares) for females and 13.8 acres (5.68 hectares) for males.

Coypus sleep and nest in burrows, which range from a single, short tunnel, to multiple tunnels with small nesting chambers. Tunnels are often 50 feet (15 meters) or more in length. Above ground, they make raised beds of vegetation where they feed and groom.

Breeding occurs year-round and females have two or three litters per year. The gestation period, the time the females carry their young in the womb, is 127 to 139 days. The average litter size is six babies although it can range from one to thirteen. Coypus born in the summer reach sexual maturity at three to four months of age. For those born in the fall, it is reached at six or seven months of age. The average lifespan is less than one year in the wild. In a few cases under ideal conditions, coypus have lived for three to six years in the wild. However, in captivity, they can live for ten years.

In the wild, coypus have many predators, including large snakes like the anaconda and boa constrictor, large cats such as ocelots and jaguars, red wolves, crocodiles, and otters.



WANTED: DEAD OR ALIVE

In 1938, about 20 coypus were imported into Louisiana from Argentina to be bred for their fur. But many escaped captivity and adapted well to the warm, wet climate and swampy habitat, breeding voraciously. They spread quickly to nearby states. As of 2004, there were an estimated twenty million coypus in the Louisiana. In 1998, it is estimated coypus destroyed 100,000 acres of swamp and marshland, posing a serious threat to many native species of birds, mammals, and amphibians. To combat the threat to the environment, the Louisiana Department of Wildlife and Fisheries received a $10 million, five-year federal grant to help eradicate, remove, coypus from the state. In 2002, the state began paying hunters $4 for each coypu they brought into state wildlife offices. Most are brought in dead but wildlife workers kill any that are trapped and brought in alive. In the first two weeks of the program, 9,000 coypus were killed. The goal is to kill 400,000 per year.

COYPUS AND PEOPLE

The fur of coypus is valued for its soft, velvety texture and people in South America, North America, Europe, and Japan eat the meat. Much of the meat and fur from South American comes from captive coypu breeding farms while in the United States it comes from coypus hunted in the wild, especially in Louisiana and Maryland.

In the 1930s, coypus were introduced into southeast England and the population there quickly grew. Coypus were blamed for destroying native marsh plants along riverbanks and raiding cultivated crops. Their burrows were also believed to weaken and damage river and stream banks. In the 1980s, the British government began an intensive campaign to eradicate (remove completely) coypus from England and in 1989, the government officially declared the program a total success with the killing of the last coypu.

There are eradication efforts underway in the United States, Japan, and France.

CONSERVATION STATUS

Coypus are not currently threatened, according to the World Conservation Union (IUCN). Their numbers are declining along many rivers and lakes in Argentina due to hunting and trapping by humans. The eradication efforts in the United States, France, and Japan are likely to significantly reduce populations in those areas.

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PIKAS, RABBITS, AND HARES
Lagomorpha

Class: Mammalia
Order: Lagomorpha
Number of families: 2 families

order
CHAPTER

phylum
class
subclass
order
monotypic order
suborder
family

PHYSICAL CHARACTERISTICS

Lagomorphs are small to medium-sized mammals categorized into two families: Leporidae (rabbits and hares) and Ochotonidae (pikas [PEE-kuhz]). Rabbits and hares have long hind legs adapted for running at fast speeds over open ground. Pikas are small mammals with large, round ears and resemble guinea pigs in size and appearance. Adult rabbits and hares have a body length of 10 to 28 inches (25.4 to 71.1 centimeters) and weigh 14 ounces to 15.3 pounds (400 to 7,000 grams). They have short, furry tails and ear sizes vary greatly and generally are shorter in rabbits and longer in hares. The main exceptions are the rabbit breeds known as lops, which have long, floppy ears. Females are generally larger than males. Hares generally are larger than rabbits and have black-tipped ears.

Rabbits and hares usually have thick, soft fur that comes in a wide spectrum of colors, shades, and combinations, including black, white, brown, beige, tan, blue, orange, red, pink, cream, lilac, silver, and lavender.

Pikas are small, compact mammals with short front and rear legs. They range in length from 5 to 12 inches (125 to 300 millimeters) and weigh 3.5 to 7 ounces (100 to 200 grams). Pikas lack a noticeable tail. They have long, soft fur that is usually gray or brown.

Lagomorphs have eyes set high on their head, looking sideways, giving them a wide field of vision. They have weak but flexible necks, allowing them to turn their heads with a wide range of motion. Lagomorphs have a single opening to pass

both urine and feces. They also have a specialized part of their large intestine, called the cecum (SEE-kum), which acts as a fermentation chamber and aids in digestion of grasses.

GEOGRAPHIC RANGE

Lagomorphs are found on every continent except Antarctica. They are native to every continent they are found on, except Australia where they were introduced.

HABITAT

Pikas are found in two distinct habitats. Some live among rocks and rocky areas. Others live in meadows, steppes (semi-arid, grass-covered plains), shrubs and desert. Hares live in arctic tundra, steppes, wetlands, forests, and deserts. Rabbits live in pine and deciduous forests, desert, mountainous areas, scrubland, tropical rainforest, near rivers and streams, rocky outcroppings, grasslands, and areas of dense brush or other low-lying vegetation.

DIET

Lagomorphs are herbivores, meaning they are plant-eaters, with a primary diet of grasses and herbs but also will feed on fruit, seeds, leaves, shoots, and bark.

BEHAVIOR AND REPRODUCTION

Behavior and reproduction differs widely between rabbits and hares, and pikas, and within each group. Pikas are mainly diurnal, meaning they are mostly active during the day. Rabbits and hares are generally nocturnal, meaning they are mostly active at night. Some species are crepuscular (kri-PUS-kyuh-lur), meaning they are most active at dawn and twilight. Various environmental conditions and the effects of nearby humans may cause species to alternate between nocturnal, diurnal, and crepuscular activities.

Pikas have several types of social structures. Those that live in rocky areas of North America are unsocial, with males and females having separate territories and rarely interacting except to mate. Pikas in rocky areas of Asia live in pairs within a communal territory. Burrowing pikas, in contrast, are extremely social animals. Families of up to thirty individuals live within burrows and there are about ten family groups within a territory. There is a lot of interaction between family members, including grooming, playing, and sleeping together.

FROM RODENTS TO PRIMATES

Lagomorphs were originally classified in the order rodentia, or rodents, until 1912, when researchers recognized that they had several distinct features lacking in rodents.

These features are:

- Lagomorphs have four, rather than two, incisors in the upper jaw.
- The male's scrotum is in front of the penis.
- The penis has no bone as it does with a rodent.
- Lagomorphs re-digest certain soft feces to obtain nutrients.

In the early twentieth century, the order Lagomorpha was established with two families, Leporidae (rabbits and hares) and Ochotonidae (pikas). There are about 91 living species of lagomorphs. Genetic testing done in the 1990s show lagomorphs are more closely related to primates, such as apes, and tree shrews than they are to rodents.

Rabbits and hares have similar differences in social organization. Most rabbits and hares in the wild live solitary lives, although they will often graze together, and are not territorial. The European rabbit is very social. They live in "warrens" or groups of six to twelve adults controlled by a dominant male. The warren consists of a maze of burrows and chambers.

Pikas breed in the spring, with peak breeding occurring in May and early June. Female pikas reach sexual maturity at about one year of age. The gestation period, the time the females carry their young in the womb, is about thirty days. Litters consist of two to six babies and are cared for exclusively by the mother. Females breed for a second time shortly after the first litter is born and usually produce a second litter before the end of summer. Babies are born blind and nearly hairless but grow quickly, reaching adult size in forty to fifty days.

Rabbits breed throughout the year, depending on climate. Generally the breeding season in the wild is spring and summer. Females have multiple litters per year with litter sizes of two to eight babies on average, although it can be as high as fifteen babies. The gestation period is twenty-five to fifty days, with the longer periods occurring in hares.

There is extremely limited parental care of babies in lagomorphs. Most mothers visit the young in their nest once a day, usually between midnight and 5:00 A.M. for a short period of nursing. In rabbits and hares, the young are weaned, stop feeding on their mother's milk, at about one or two months of age. They reach sexual maturity, able to reproduce, in four to six months.

LAGOMORPHS AND PEOPLE

Pikas have little economic importance to humans. They are too small to be used as food, although they are sometimes hunted for their fur, particularly in China. Pikas are sometimes considered

agricultural pests and killed by farmers. Rabbits and hares are hunted worldwide for sport and for their meat and fur. They are also raised commercially for their fur and meat. Several species are used extensively by humans as experimental subjects in laboratories. Rabbits are also raised as pets, primarily in the United States, Canada, and Western Europe. They are sometimes considered agricultural and horticultural pests and killed by farmers and other humans.

CONSERVATION STATUS

Six species of lagomorphs are listed by the World Conservation Union (IUCN) as Critically Endangered, facing an extremely high risk of extinction. Twelve species are listed as Endangered, facing a very high risk of extinction; fourteen species are listed as Vulnerable, facing a high risk of extinction; and one species, the Sardinian pika is listed as Extinct, died out. Eight species are listed as Near Threatened, not currently threatened, but could become so.

The primary reason for declining populations of lagomorphs are loss of habitat, disease, especially the pox virus myxomatosis (mix-oh-mah-TOE-sus), and conversion of habitats to agricultural use by humans.

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family CHAPTER

PIKAS
Ochotonidae

Class: Mammalia
Order: Lagomorpha
Family: Ochotonidae
Number of species: 30 species

PHYSICAL CHARACTERISTICS

All pikas (PEE-kuhz) are similar in appearance, being small, compact mammals with large, round ears and short front and rear legs. They resemble guinea pigs in size and appearance, ranging in length from 5 to 12 inches (12.5 to 30.0 centimeters) and weighing 3.5 to 7 ounces (100 to 200 grams). Pikas lack a noticeable tail. They have long, soft fur that is usually gray or brown, often with red accents.

GEOGRAPHIC RANGE

Pikas are found in the mountains of western North America, including Alaska and the Yukon, and the mountains and plains of central Asia, including the Himalayan and Ural mountain ranges. The countries they live in include Iran, Afghanistan, Pakistan, Nepal, Tibet, Bhutan, Russia, Japan, Mongolia, North Korea, and China.

HABITAT

Pikas are found in two distinct habitats. Some live among rocks and rocky areas. Others live in meadows, steppes (semi-arid, grass-covered plains), shrubs and desert.

DIET

Pikas are herbivores, meaning they eat primarily plants.

BEHAVIOR AND REPRODUCTION

Pikas are mainly diurnal, active during the day. An exception is the steppe pika, which is nocturnal, meaning it is most active

phylum
class
subclass
order
monotypic order
suborder
▲ **family**

VICTIM OF GLOBAL WARMING

Many scientists believe the American pika will become the first mammal to become extinct due to the effects of global warming. The American pika lives in the high mountains of the western United States and Canada but as the climate gets warmer, the mammals are forced to move to higher elevations to find suitable habitats. A study between 1994 and 1999 in the Great Basin, eastern Sierra Nevada, and western Rocky Mountains found a 30 percent drop in the population of American pikas. Scientists believe the decline of the American pika should be a wake-up call about the consequences of global warming, which many blame on human pollution of the atmosphere.

at night. They have several types of social structure. Those that live in rocky areas of North America are unsocial, with males and females having separate territories and rarely interacting except to mate. Pikas in rocky areas of Asia live in pairs within a communal territory. Burrowing pikas, in contrast, are extremely social animals. Families of up to thirty individuals live within burrows and there are about ten family groups within a territory. There is much interaction between family members, including grooming, playing, and sleeping together.

Pikas breed in the spring, with peak breeding occurring in May and early June. Female pikas reach sexual maturity as early as twenty-one days of age. The gestation, or pregnancy, period is about thirty days. Litters consist of one to thirteen babies and are cared for exclusively by the mother. Females breed for a second time shortly after the first litter is born and usually produce a second litter before the end of summer. Some pika species can have as many as five litters per years, including the Afghan pika, with each litter having up to eleven babies. Pikas are born blind and nearly hairless but grow quickly, reaching adult size in forty to fifty days.

Pikas have a keen sense of sight and hearing, which helps them detect predators, such as weasels, hawks, eagles, and owls. When a pika feels threatened, it issues a loud, shrill, alarm bark and nearby pikas immediately hide in their burrows or in rock crevices. The one exception is when a weasel is detected, the pika remains silent, since the small weasel can follow pikas into their hiding places. Pikas live an average of one to two years and more rarely, four to six years in the wild.

PIKAS AND PEOPLE

Pikas have little economic importance to humans. They are too small to be used as food, although they are sometimes hunted for their fur, particularly in China. Pikas are sometimes considered agricultural pests and killed by farmers.

CONSERVATION STATUS

Four species of pika are listed by the World Conservation Union (IUCN) as Critically Endangered, facing an extremely high risk of extinction, dying out, in the wild; four species are listed as Endangered, facing a very high risk of extinction; and ten species are listed as Vulnerable, facing a high risk of extinction. One species, the Sardinian pika is considered Extinct.



AMERICAN PIKA
Ochotona princeps

Physical characteristics: The American pika is a medium-sized pika with short ears, an oval body shape, and no apparent tail. American pikas have a body length of 6 to 8.5 inches (16.2 to 21.6 centimeters) and weigh about 6 ounces (168 grams). Their hind feet are relatively large compared to their body, 1 to 1.4 inches (2.5 to 3.5 centimeters).

Geographic range: The American pika is found in the western United States in Oregon, Washington, Idaho, Montana, Wyoming, Colorado, Nevada, California, and New Mexico, and in British Columbia in western Canada.

Habitat: American pikas are found in rocky mountain areas, grassland, coniferous forest, deciduous forest, and the border between meadows and rocky terrain.



The American pika lives in the western United States and Canada. (John Shaw/Bruce Coleman Inc. Reproduced by permission.)

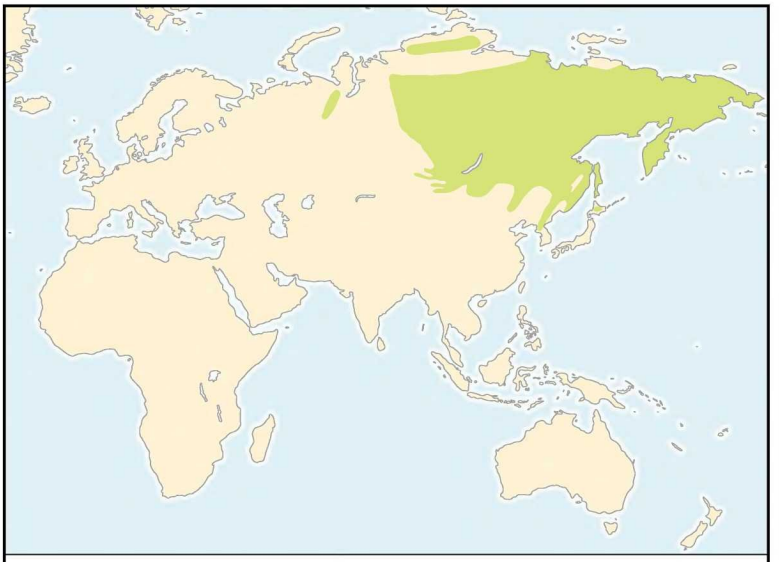
Diet: American pikas are herbivores, meaning they eat mainly plants. Their diet includes grasses, thistles, sedges (a wetland plant that resembles grass), and fireweed. Because pikas live in climates with harsh winters, most species build large hay piles during the summer to provide food during the winter. They cut off grass stems at the root and bring them to selected places on the surface, piling them into conical-shaped mounds. Once dry, each hay pile can weigh from 2 to 5 pounds (0.9 to 2.25 kilograms). Some pikas store their hay in tree hollows, under tree stumps, and in rock cavities. Each of these stashes can weigh from 15 to 40 pounds (6.75 to 18 kilograms).

Behavior and reproduction: American pikas are diurnal, meaning they are most active during the day. They are territorial, meaning they defend an area they consider their home from intruders. Males and females have separate territories. They spend most of their day looking for food, guarding their territory, and sunning themselves on rocks.

American pikas usually breed from late April to early July. The female gives birth to two to four babies in the spring or summer. The gestation period is about thirty days.

American pikas and people: American pikas play an important role in maintaining the diversity and abundance of alpine meadow plants through their storage of grasses for food during the winter.

Conservation status: The American pika is not listed as threatened by the IUCN. However, populations have drastically declined between 1994 and 1999 and continued to decline into 2004. Seven subspecies (populations of a species living in specific areas) are listed by the IUCN as Vulnerable and several subspecies are considered threatened or endangered by other conservation groups. ■



NORTHERN PIKA
Ochotona hyperborea

Physical characteristics: The northern pika, also known as the Siberian pika, is slightly larger than the American pika. It has a body length of 7 to 12 inches (17.5 to 30.0 centimeters) and weighs about 7 ounces (200 grams). Northern pikas have medium brown fur on their upper bodies and orange to cream fur on their undersides.

Geographic range: The northern pika has the largest distribution range of any pika species. It ranges from eastern Siberia to Sakhalin Island in the Sea of Okhotsk and the northernmost Japanese island of Hokkaido. It is found in eastern Russia, Japan, Mongolia, North Korea, and Manchuria in northern China.

Habitat: Northern pikas live in high grassy plains, coniferous forest, tundra, among rocky outcroppings and crevices, and in burrows under large stones on the land surface.

Diet: Northern pikas are herbivores, meaning they eat mainly plants. Their diet consists mostly of grasses and herbs. Like other

pikas, they build hay piles of grasses that they feed on during the harsh winters.

Behavior and reproduction: Northern pikas are generally very social and curious. They are believed to be monogamous (muh-NAH-guh-mus), meaning a male and female pair for life. The pairs usually live in small colonies. Most females have two litters of babies during the summer, with each litter consisting of one to five babies.

Northern pikas do not survive in captivity. The subspecies Manehurian (Manchurian) pika dies within an hour after being caught by humans.

Northern pikas and people: Northern pikas have little economic importance to humans.

Conservation status: Northern pikas are not listed as threatened by the IUCN. However, the subspecies *Ochotona hyperborea yesoensis* found on Hokkaido Island is considered endangered by the Japanese government. ■



Male and female pairs of northern pikas usually live in colonies with other pikas. (© D. Robert & Lorri Franz/Corbis. Reproduced by permission.)

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HARES AND RABBITS
Leporidae

Class: Mammalia
Order: Lagomorpha
Family: Leporidae
Number of species: 62 species

family CHAPTER

PHYSICAL CHARACTERISTICS

Adult rabbits and hares have a body length of 10 to 28 inches (25.4 to 71.1 centimeters) and weigh 14 ounces to 15.3 pounds (400 grams to 7 kilograms). They have short, furry tails and ear sizes vary greatly and generally are shorter in rabbits and longer in hares. The main exceptions are the rabbit breeds known as lops, which have long, floppy ears. Females are generally larger than males. Hares generally are larger than rabbits and have black-tipped ears.

Rabbits and hares usually have thick, soft fur that comes in a wide spectrum of colors, shades, and combinations, including black, white, brown, beige, tan, blue, orange, red, pink, cream, lilac, silver, and lavender.

Hares and rabbits have eyes set high on their head, looking sideways, giving them a wide field of vision. They have weak but flexible necks, allowing them to turn their heads with a wide range of motion. They have a single opening to pass both urine and feces. They also have a specialized part of their large intestine, called the cecum (SEE-kum), which acts as a fermentation chamber that aids in digestion of grasses.

GEOGRAPHIC RANGE

Hares and rabbits are found on every continent except Antarctica. They are native to every continent they are found on, except Australia where they were introduced.

TEN-YEAR CYCLE

A unusual and striking feature of the snowshoe hare is its ten-year cycle of population increase and decline. The number of litters per year and the number of young per litter is higher for about three years, declines in the next three or four years, and then drops significantly in the last three or four years of the cycle. Why this happens is not completely understood by scientists but they believe it is caused by one or more factors, such as food availability, predation, and social interactions.

HABITAT

Hares live in arctic tundra, steppes, wetlands, forests, and deserts. Rabbits live in pine and deciduous forests, desert, mountainous areas, scrubland, tropical rainforest, near rivers and streams, rocky outcroppings, grasslands, and areas of dense brush or other low-lying vegetation.

DIET

Hares and rabbits are herbivores, meaning they are plant-eaters. With a primary diet of grasses and herbs but also will feed on fruit, seeds, leaves, shoots, and bark.

BEHAVIOR AND REPRODUCTION

Rabbits and hares have several types of social structure. Most rabbits and hares in the wild live solitary lives, although they will often graze together, and are not territorial. The European rabbit is very social. It lives in "warrens," groups of six to twelve adults controlled by a dominant male. The warren consists of a maze of burrows and chambers.

Rabbits breed throughout the year depending upon the climate, with spring and summer being the general breeding seasons in the wild. Females have multiple litters per year with litter sizes of two to eight babies on average, although it can be as high as 15 babies. The gestation period, the length of time the mother carries her babies in the womb, is twenty-five to fifty days, with the longer periods occurring in hares.

HARES AND RABBITS AND PEOPLE

Rabbits and hares are hunted worldwide for sport. They are both hunted and raised commercially for their meat and fur. Several species are used extensively in laboratories. Rabbits are also raised as pets.

CONSERVATION STATUS

Two species are listed by the World Conservation Union (IUCN) as Critically Endangered, facing an extremely high risk of extinction; eight species are listed as Endangered, facing a very

high risk of extinction; four species are listed as Vulnerable, facing a high risk of extinction; and six species are listed as Near Threatened, not currently threatened, but could become so.

The primary reasons for declining populations of hares and rabbits are loss of habitat, disease, especially the pox virus myxomatosis (mix-oh-mah-TOE-sus), and conversion of habitats to agricultural use by humans.

In the United States, the pygmy rabbit has experienced a sudden decline that has caught even conservation groups off-guard. Although it is listed by IUCN as Near Threatened, it is listed as an endangered species by the state of Washington. Wildlife officials estimate that as of 2003, only thirty pygmy rabbits existed in the wild in the state's Columbia Basin. The decline is blamed on loss of sagebrush, its primary habitat. Mexico's volcano rabbit is found only on the slopes of four volcanoes near Mexico City. Its population is estimated at about 1,000 and declining due to encroachment on its habitat by human development. The Davis Mountains cottontail is not listed by the IUCN but Portland (Oregon) State University biologist Luis Ruedas has tried unsuccessfully to get the state of Texas to list it as endangered. It is found only in a small mountain range in Texas.



SPECIES ACCOUNTS

SNOWSHOE HARE
Lepus americanus

Physical characteristics: Snowshoe hares range in length from 16.5 to 20.7 inches (41.3 to 51.8 centimeters). They weigh from 3.12 to 3.4 pounds (1.4 to 1.56 kilograms). Females are slightly larger than males.

In the summer, their fur is rust or gray-brown with a black line running down their mid-back, cream colored on the sides of their lower body, and a white underside. Their face and legs are cinnamon colored. Their ears are brown with black tips and white or cream edges. During the winter, they turn white except for their black eyelids and black ear tips. The bottom of their paws are covered with dense fur, hence the name snowshoe hare.

Geographic range: Snowshoe hares are found throughout Canada and the northern United States, including Alaska, and the Rocky Mountains as far south as northern New Mexico.

Habitat: Snowshoe hares live in open fields, swampy areas, riverside thickets, coniferous forests, including subarctic coniferous forests located south of tundra, and tundra.

Diet: Snowshoe hares have a varied diet. In the summer, it includes grasses, flowers, wild strawberry plants and fruit, dandelion, clover, horsetails, and new growth of aspen, birch, and willow trees. In the winter, they forage, search, for buds, twigs, bark, and evergreens.

Behavior and reproduction: Snowshoe hares are generally solitary but large populations often live within a small geographic area. They are nocturnal, meaning they are most active at night, and crepuscular (kri-PUS-kyuh-lur), meaning they are also active during dawn and twilight.



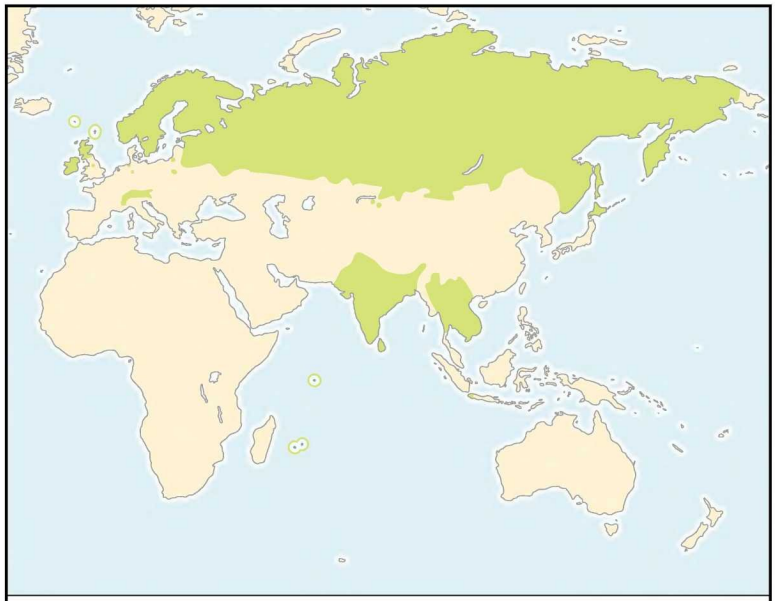
This snowshoe hare's color is changing from a winter white coat to a summer brown. (Leonard Lee Rue/Bruce Coleman Inc. Reproduced by permission.)

When snowshoe hares sense a predator is near, they often stand completely still, blending in with their surroundings. They are also fast runners, and have been clocked at speeds of up to 27 miles (43 kilometers) per hour. They can cover 10 feet (3 meters) in a single leap. They have acute hearing and are capable swimmers, able to swim across small lakes and rivers, usually to escape predators.

Snowshoe hares breed from mid-March through August. Females can have up to four litters per season, with litter sizes ranging from one to eight babies. The average litter size is two to four babies. The gestation period, the time the females carry the young in their womb, is thirty-six days. The young reach sexual maturity, ability to reproduce, at one year of age.

Snowshoe hares and people: The snowshoe hare is widely hunted by humans for its meat and fur.

Conservation status: The snowshoe hare is not listed as threatened by the IUCN. They are common throughout their range and populations seem to be remaining steady. ■



MOUNTAIN HARE
Lepus timidus

Physical characteristics: The mountain hare is medium-sized with short ears and hind legs. It has a body length of 18 to 24 inches (46 to 61 centimeters) and weighs 2.2 to 8.8 pounds (1 to 4 kilograms.) Their fur changes from brown in the summer to white in the winter.

Geographic range: Mountain hares are found in Arctic and adjacent temperate areas of northern Europe and Asia, from Ireland to eastern Siberia.

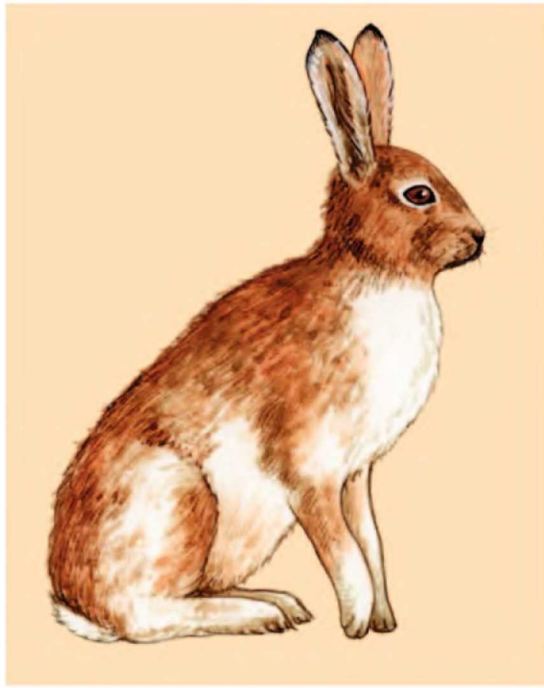
Habitat: Mountain hares live in tundra, subarctic coniferous forests, mixed coniferous and deciduous forests, and transitional zones with open clearings, swamps, and river valleys.

Diet: Mountain hares are herbivores, meaning they are plant-eaters. Their diet varies by habitat and season. In the summer, forest dwellers eat mostly grasses, leaves, and twigs. Tundra inhabitants eat primarily alpine plants along with grasses, lichen, and bark. In the winter, heather is the main food source.

Behavior and reproduction: The mountain hare is primarily solitary and is seen in groups only when breeding. The breeding season is from January to September. Females have one or two litters per year, with a litter size of one to four babies. If there is an early spring, females can have up to three litters. The gestation period, the time the female carries the young in her womb, is forty-seven to fifty-four days.

Mountain hares and people: Hunted by humans for its meat and fur.

Conservation status: The mountain hare is not considered threatened by the IUCN. ■



The mountain hare is usually solitary, only coming together into groups to breed. (Illustration by Amanda Smith. Reproduced by permission.)



Desert cottontail *(Sylvilagus audubonii)*

DESERT COTTONTAIL
Sylvilagus audubonii

Physical characteristics: A larger cottontail with large ears. Head and body length of 14 to 15 inches (37 to 40 centimeters) and its weight is 26.5 to 44 ounces (750 to 1,250 grams).

Geographic range: Desert cottontails are found in North America, from Montana south to central Mexico and west through California.

Habitat: Desert and forest, from coastal areas to higher altitudes.

Diet: Desert cottontails are herbivores, eating mainly grasses but some wood and bark.

Behavior and reproduction: The breeding season for the desert cottontail is from January to August, with multiple litters per year, and

an average litter size of two to four babies. They reach sexual maturity at eighty days.

Desert cottontails and people: Hunted by humans mainly for sport.

Conservation status: The desert cottontail is not listed as threatened by the IUCN. ■



Desert cottontails live in desert and forest areas. (John Shaw/Bruce Coleman Inc. Reproduced by permission.)

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SENGIS
Macroscelidea

Class: Mammalia
Order: Macroscelidea
One family: Macroscelididae
Number of species: 15 species

monotypic order
CHAPTER

PHYSICAL CHARACTERISTICS

Sengis (SEN-jeez) are commonly known as elephant shrews, although they are not related to the shrew. Sengis range in size from that of a mouse to a rabbit.

They have a head and body length of 3.5 to 12.5 inches (9.0 to 31.5 centimeters), a tail length of 3 to 11 inches (8.0 to 26.3 centimeters) and weigh from 1 ounce to 10 pounds (28 grams to 4.5 kilograms). They have long, spindly legs and a nose that is turned down. They have large heads and ears and large, dark eyes. Their hind legs are larger then their front legs. Sengis walk on their toe tips rather than the feet bottoms.

The larger species of sengis have brightly colored fur ranging in color from olive, brown, black, and red, while the smaller species are various shades of brown and gray. Some are multi-colored, such as the golden-rumped sengi, which has upper body fur of a deep reddish brown and black, lighter fur on its undersides, and black feet, ears, and legs. Its tail is black except for the lower third, which is white with a black tip. There is a large patch of fur on its rump that is bright yellow. In the rufous sengi, the long, soft fur ion the upper body is light brown, light gray, or light orange. The underside fur is white or gray. The fur on its face is a patchwork of white spots and black streaks.

GEOGRAPHIC RANGE

Sengis are found throughout Africa except western Africa and the Sahara Desert region. They are most common and diverse in southern and eastern Africa.



IDENTITY CRISIS

Sengis or elephant shrews have been one of the most often misclassified species of animals. Scientists who first classified the mammal in the mid 1800s placed it in the order Insectivora along with true shrews (family Soricidae). It got its name because its long down-turned nosed resembled an elephant's trunk and physically looked like a shrew. It was reclassified in the order Scandentia (tree shrews) and then reclassified again as an ungulate, a group of mammals with hooves that include horses and giraffes. Later, it was classified as a lagomorph, along with rabbits and hares. More recently, examination of the elephant shrew's molecular structure indicates it is a distinct order and the order Macroscelidea was established. Based on genetic evidence, the elephant shrew, now called the sengi, is related to the proposed superorder Afrotheria composed of six orders, whose members include elephants, manatees, and aardvarks.

HABITAT

Sengis live in deciduous forest, rainforest, grassland, and desert areas of Africa, especially where there is an abundance of water. They are found in the thick ground cover of coastal bush forests, rocky outcroppings, and highland and lowland forests.

DIET

Sengis are insectivores, meaning they eat primarily insects. Their diet of insects includes ants, termites, beetles, spiders, caterpillars, and worms. However, several species are omnivores, meaning they eat insects, flesh, and plants. Their diet includes toads, frogs, lizards, fruits, seeds, and plants. One species, the golden-rumped sengi, is an omnivore, meaning it eats only flesh, mainly insects and small animals.

BEHAVIOR AND REPRODUCTION

Sengis are mainly diurnal, meaning they are most active during the day, but during hot weather, they can be nocturnal, meaning they are most active at night. Several species are crepuscular, meaning they are most active during early morning and twilight. They have well developed senses of sight, hearing, and smell. Most species are territorial, meaning they are protective of an area they consider home and claim exclusively for themselves. Pairs of males and females usually have separate but overlapping and sometimes identical territories.

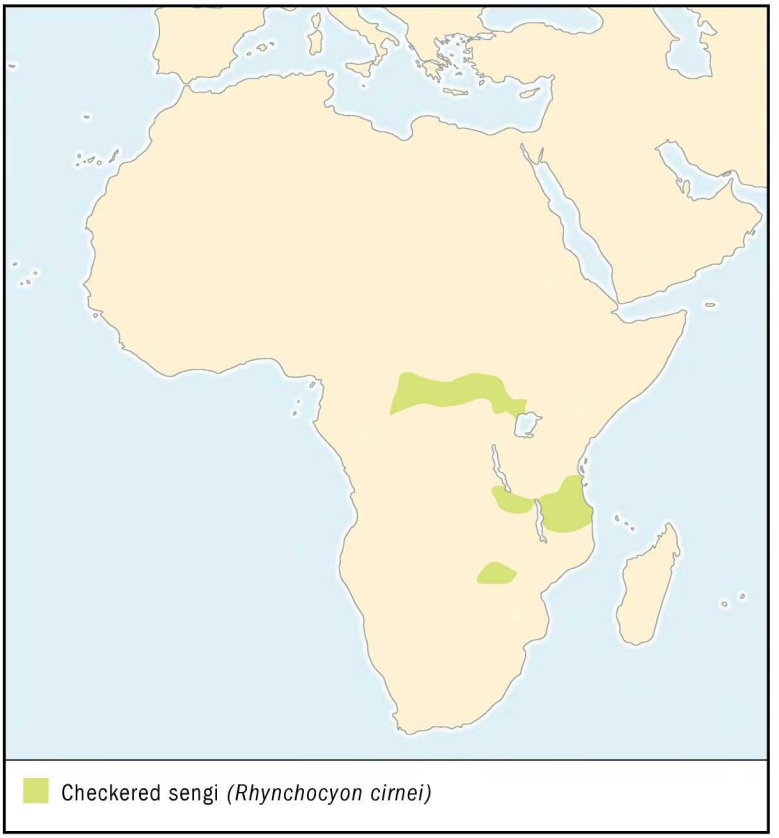
Most species of sengis are believed to be monogamous (muh-NAH-guh-mus), meaning they have only one sexual partner during a breeding season or lifetime. Several species are solitary and males and females get together for only several days to mate. Females usually produce several litters a year, each with usually one or two babies, but more rarely with three or four. The gestation period, the time the female carries the young in her womb, is about sixty days.

SENGIS AND PEOPLE

Sengis are sometimes hunted in areas of Africa for their meat. Since they eat mostly insects, they help control insects such as termites, ants, and grasshoppers, that are problems for farmers because of the damage the insects cause to crops.

CONSERVATION STATUS

Three species of sengi are listed by IUCN as Endangered, facing a very high risk of extinction: Somali sengi, the golden-rumped sengi, and the black and rufous sengi. One species is listed as Vulnerable, facing a high risk of extinction: the checkered sengi. The reasons for the listings are severely fragmented populations and declining habitats. No other species are listed as currently threatened.



SPECIES ACCOUNT

CHECKERED SENGI
Rhynchocyon cirnei

Physical characteristics: The checkered sengi adult has a head and body length of 9 to 12.5 inches (23.5 to 31.5 centimeters) and a tail length of 7 to 10 inches (19.0 to 26.3 centimeters).

Geographic range: The checkered sengi is found in northern and eastern Democratic Republic of the Congo, Uganda, southern Tanzania, northeastern Zambia, Malawi, and northern Mozambique.

Habitat: Checkered sengis live in dense, lowland and mountain regions of tropical rainforest.

Diet: Checkered sengis are mainly insectivores, meaning they eat primarily insects. Their diet includes ants, termites, and beetles.

However, they have also been known to eat small mammals, birds, bird eggs, and snails.



A checkered sengi searches for food. Checkered sengis eat mainly insects, but they also may eat small mammals, birds, bird eggs, and snails. (© Tom McHugh/Photo Researchers, Inc. Reproduced by permission.)

Behavior and reproduction: Checkered sengis are primarily diurnal, meaning they are most active during the day, They can on occasion become nocturnal, meaning they are most active at night, especially during hot weather. They can live alone, in mated pairs, or in small groups. They are monogamous, meaning they have only one sexual partner for life. They are extremely nervous animals and are always on the lookout for predators, such as pythons and other snakes, and birds of prey such as eagles, hawks, owls, and kestrels. Checkered sengis have an average lifespan in the wild of three to five years.

Checkered sengis are territorial, meaning they are protective of an area they consider home and claim exclusively for themselves. Pairs of males and females usually have separate but overlapping territories. Individuals` sleep in nests made of small pits covered with leaves. Checkered sengis build new nests every few days, digging a shallow depression in the ground and lining and covering it with leaves. Once constructed, it is difficult for humans to detect. A pair may build up to ten shelters in their territories.

The checkered sengi breed year-round and have several litters per year. The gestation period, the time the female carries the young in her womb, is about forty-two days. The litter size is one baby, which stays in the nest for about ten days before going out with its mother to forage for food. It goes its own way after five to ten weeks.

Checkered sengis and people: Checkered sengis are of no known significance to humans.

Conservation status: The checkered sengi is listed by the IUCN as Vulnerable, due primarily to severely fragmented populations and declining habitats. ■

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Species List by Biome

CONIFEROUS FOREST

American black bear
American pika
American water shrew
Asian elephant
Bobcat
Brown-throated three-toed sloth
Chimpanzee
Common bentwing bat
Coypu
Desert cottontail
Eastern mole
Edible dormouse
Ermine
Gambian rat
Geoffroy's spider monkey
Giant panda
Gray squirrel
Gray wolf
Greater sac-winged bat
Hairy-footed jerboa
Human
Indian crested porcupine
Kirk's dikdik
Lar gibbon
Little brown bat
Malayan moonrat
Mandrill
Moose
Mountain beaver
Mountain hare
Nine-banded armadillo
North American beaver
North American porcupine
Northern pika
Pacarana
Pallas's long-tongued bat
Pallid bat
Pileated gibbon
Puma
Red deer
Red panda
Red-shanked douc langur
Reindeer
Rhesus macaque
Serow
Siamang
Siberian musk deer
Snow leopard
Snowshoe hare
South African porcupine
Southern tree hyrax
Star-nosed mole
Striped skunk
Tasmanian devil
Three-striped night monkey
Tiger
Valley pocket gopher
Venezuelan red howler monkey
Virginia opossum
Weeper capuchin
Western barbastelle
White-tailed deer
White-throated capuchin

DECIDUOUS FOREST

Aardvark
African civet
American bison
American black bear
American least shrew
American pika
American water shrew
Ashy chinchilla rat
Asian elephant
Aye-aye
Bobcat
Bornean orangutan
Bridled nail-tailed wallaby
Brush-tailed phascogale
Brush-tailed rock wallaby
Capybara
Central American agouti
Chimpanzee
Collared peccary
Common bentwing bat
Common brush-tailed possum
Common genet

Common ringtail
Common tenrec
Common wombat
Cotton-top tamarin
Coypu
Crowned lemur
Degu
Desert cottontail
Eastern chipmunk
Eastern gray kangaroo
Eastern mole
Eastern pygmy possum
Edible dormouse
Ermine
Eurasian wild pig
European badger
Forest elephant
Forest hog
Funnel-eared bat
Gambian rat
Geoffroy's spider monkey
Giant panda
Goeldi's monkey
Gray squirrel
Gray wolf
Greater dog-faced bat
Greater glider
Greater horseshoe bat
Greater sac-winged bat
Ground pangolin
Human
Indian crested porcupine
Indian muntjac
Indian rhinoceros
Koala
Lar gibbon
Lesser Malay mouse deer
Lesser New Zealand short-tailed bat
Lion
Little brown bat
Lord Derby's anomalure
Lowland tapir
Malayan moonrat
Mara
Mountain beaver
Mountain hare
North American beaver
North American porcupine
Northern raccoon
Numbat
Paca
Pacarana
Pallas's long-tongued bat
Parnell's moustached bat
Pileated gibbon
Puma
Pygmy glider
Red deer
Red fox
Red kangaroo
Red panda
Red-tailed sportive lemur
Rhesus macaque
Ringtailed lemur
Rock cavy
Senegal bushbaby
Serow
Siamang
Silky anteater
South African porcupine
Southern flying squirrel
Spotted hyena
Star-nosed mole
Striped skunk
Sugar glider
Three-striped night monkey
Tiger
Valley pocket gopher
Venezuelan red howler monkey
Virginia opossum
Water buffalo
Weeper capuchin
Western barbastelle
Western European hedgehog
White rhinoceros
White-tailed deer
White-throated capuchin

DESERT

Australian jumping mouse
Bighorn sheep
Bobcat
Brazilian free-tailed bat
California leaf-nosed bat
Collared peccary
Damaraland mole-rat
Dassie rat
Desert cottontail
Dromedary camel
Egyptian slit-faced bat
Egyptian spiny mouse
Grant's desert golden mole
Gray wolf
Hairy-footed jerboa
Hardwicke's lesser mouse-tailed bat
Human
Kirk's dikdik
Lion
Mzab gundi
Naked mole-rat
North American porcupine
Pallid bat
Parnell's moustached bat
Pink fairy armadillo
Pronghorn
Puma
Red fox
Rhesus macaque
San Joaquin pocket mouse
Savanna elephant
Short-beaked echidna
Southern marsupial mole
Spotted hyena
Striped skunk
Trident leaf-nosed bat
Valley pocket gopher
Virginia opossum
White-footed sportive lemur

GRASSLAND

Aardvark
Aardwolf
African civet
Alpaca
Alpine marmot
American bison

American black bear
American least shrew
American pika
Ashy chinchilla rat
Asian elephant
Australian false vampire bat
Australian jumping mouse
Black wildebeest
Black-bellied hamster
Black-tailed prairie dog
Brazilian free-tailed bat
Bridled nail-tailed wallaby
California leaf-nosed bat
Capybara
Central American agouti
Chimpanzee
Common bentwing bat
Common genet
Common tenrec
Coypu
Degu
Dwarf epauletted fruit bat
Eastern barred bandicoot
Eastern chipmunk
Eastern gray kangaroo
Eastern mole
Egyptian rousette
Egyptian slit-faced bat
Egyptian spiny mouse
Ermine
Eurasian wild pig
Forest elephant
Gambian rat
Giant anteater
Giant kangaroo rat
Giraffe
Grant's desert golden mole
Gray wolf
Greater bilby
Greater dog-faced bat
Greater horseshoe bat
Grevy's zebra
Ground pangolin
Hardwicke's lesser mouse-tailed bat
Hispaniolan solenodon
Hispid cotton rat
Human
Indian crested porcupine
Indian muntjac
Indian rhinoceros
Kiang
Lesser New Zealand short-tailed bat
Lion
Llama
Long-tailed chinchilla
Lowland tapir
Maned wolf
Mara
Naked bat
Nine-banded armadillo
Northern pika
Numbat
Paca
Pallas's long-tongued bat
Pallid bat
Parnell's moustached bat
Pearson's tuco-tuco
Pink fairy armadillo
Pronghorn
Przewalski's horse
Puma
Red deer
Red fox
Red kangaroo
Rock cavy
Rock hyrax
San Joaquin pocket mouse
Savanna elephant
Senegal bushbaby
Short-beaked echidna
Smoky bat
Snow leopard
South African porcupine
Spix's disk-winged bat
Spotted hyena
Springhare
Star-nosed mole
Striped skunk
Tasmanian wolf
Thomson's gazelle
Tiger
Valley pocket gopher
Vampire bat
Virginia opossum
Water buffalo
Western European hedgehog
Western red colobus
White rhinoceros
Yellow-streaked tenrec

LAKE AND POND

American water shrew
Babirusa
Capybara
Central American agouti
Common hippopotamus
Coypu
Duck-billed platypus
European otter
Greater bulldog bat
Malayan tapir
Muskrat
North American beaver
North American porcupine
Prehensile-tailed porcupine
Tiger

OCEAN

Antarctic fur seal
Beluga
Blue whale
Burmeister's porpoise
California sea lion
Common bottlenosed dolphin
Dugong
Franciscana dolphin
Galápagos sea lion
Gray whale
Harbor porpoise
Harp seal
Hawaiian monk seal
Humpback whale
Killer whale
Narwhal
North Atlantic right whale
Northern bottlenosed whale
Northern elephant seal
Northern minke whale

Pygmy right whale
Pygmy sperm whale
Shepherd's beaked whale
Sperm whale
Spinner dolphin
Steller's sea cow
Walrus
West Indian manatee

RAINFOREST

Australian false vampire bat
Aye-aye
Babirusa
Bald uakari
Bennett's tree kangaroo
Bornean orangutan
Brazilian free-tailed bat
Brown-throated three-toed sloth
Brush-tailed rock wallaby
Central American agouti
Checkered sengi
Chevrotains
Chimpanzee
Collared peccary
Colombian woolly monkey
Common brush-tailed possum
Common ringtail
Common squirrel monkey
Common tenrec
Common tree shrew
Cotton-top tamarin
Coypu
Crowned lemur
Cuban hutia
Eastern pygmy possum
Eurasian wild pig
Forest elephant
Fossa
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Goeldi's monkey
Greater sac-winged bat
Ground cuscus
Hispaniolan solenodon
Hoffman's two-toed sloth
Human
Indian crested porcupine
Indian flying fox
Indian muntjac
Indri
Kitti's hog-nosed bat
Lar gibbon
Lesser New Zealand short-tailed bat
Lord Derby's anomalure
Lowland tapir
Malayan colugo
Malayan tapir
Mandrill
Masked titi
Milne-Edwards's sifaka
Monito del monte
Mountain beaver
Musky rat-kangaroo
Naked bat
North American beaver
Northern bettong
Northern greater bushbaby
Okapi
Old World sucker-footed bat
Paca
Pacarana
Philippine tarsier
Pileated gibbon
Potto
Prehensile-tailed porcupine
Proboscis monkey
Pygmy hippopotamus
Pygmy marmoset
Pygmy slow loris
Queensland tube-nosed bat
Red mouse lemur
Red-shanked douc langur
Rhesus macaque
Ring-tailed mongoose
Rock hyrax
Rufous spiny bandicoot
Short-beaked echidna
Siamang
Siberian musk deer
Silky anteater
Silky shrew opossum
Smoky bat
Southern pudu
Spiny rat
Spix's disk-winged bat
Sugar glider
Sumatran rhinoceros
Three-striped night monkey
Valley pocket gopher
Vampire bat
Venezuelan red howler monkey
Virginia opossum
Water opossum
Weeper capuchin
Western gorilla
Western red colobus
Western tarsier
White bat
White-faced saki
White-tailed deer
White-throated capuchin
Yellow-streaked tenrec

RIVER AND STREAM

American water shrew
Aye-aye
Babirusa
Baiji
Black-bellied hamster
Boto
Capybara
Central American agouti
Common hippopotamus
Common squirrel monkey
Coypu
Duck-billed platypus
European otter
Ganges and Indus dolphin
Greater bulldog bat
Greater cane rat
Lowland tapir
Malayan tapir
Mountain beaver
Muskrat
North American beaver

North American porcupine
Northern raccoon
Old World sucker-footed bat
Paca
Prehensile-tailed porcupine
Pygmy hippopotamus
Smoky bat
Tiger
Virginia opossum
Water opossum
West Indian manatee
White-footed sportive lemur

SEASHORE

Antarctic fur seal
California sea lion
Cape horseshoe bat
European otter
Galápagos sea lion
Grant's desert golden mole
Greater bulldog bat
Harp seal
Hawaiian monk seal
Honey possum
Lesser New Zealand short-tailed bat
Marianas fruit bat
Northern elephant seal
Pearson's tuco-tuco
Walrus

TUNDRA

American black bear
Ermine
Gray wolf
Hairy-footed jerboa
Human
Long-tailed chinchilla
Moose
Mountain hare
North American porcupine
Northern pika
Norway lemming
Polar bear
Red fox
Reindeer
Snowshoe hare
Striped skunk

WETLAND

American black bear
Bobcat
Bornean orangutan
Brazilian free-tailed bat
Capybara
Common squirrel monkey
Coypu
European otter
Giant anteater
Greater bulldog bat
Greater cane rat
Greater dog-faced bat
Indian flying fox
Malayan moonrat
Marianas fruit bat
North American beaver
Northern raccoon
Old World sucker-footed bat
Pacarana
Parnell's moustached bat
Proboscis monkey
Puma
Rhesus macaque
Spix's disk-winged bat
Star-nosed mole
Tiger
Valley pocket gopher



Species List by Geographic Range

AFGHANISTAN
Common bentwing bat
Dromedary camel
Eurasian wild pig
Gray wolf
Greater horseshoe bat
Hardwicke's lesser mouse-tailed bat
Red deer
Red fox
Rhesus macaque
Snow leopard
Trident leaf-nosed bat

ALBANIA
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Eurasian wild pig
European badger
European otter
Gray wolf
Greater horseshoe bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale

ALGERIA
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Dromedary camel
Eurasian wild pig
European otter
Greater horseshoe bat
Humpback whale
Killer whale
Mzab gundi
Northern bottlenosed whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Trident leaf-nosed bat

ANDORRA
European badger
Red fox

ANGOLA
Aardvark
African civet
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Dassie rat
Egyptian slit-faced bat
Gambian rat
Giraffe
Ground pangolin
Humpback whale
Kirk's dikdik
Lion
Northern minke whale
Pygmy sperm whale
South African porcupine
Sperm whale
Spinner dolphin
Spotted hyena
Springhare
Western gorilla
White rhinoceros

ANTARCTICA
Antarctic fur seal
Blue whale
Northern minke whale

ARGENTINA
Blue whale
Brazilian free-tailed bat
Brown-throated three-toed sloth

Burmeister's porpoise
Capybara
Central American agouti
Collared peccary
Common bottlenosed dolphin
Coypu
Franciscana dolphin
Giant anteater
Greater bulldog bat
Humpback whale
Killer whale
Llama
Lowland tapir
Maned wolf
Mara
Monito del monte
Northern minke whale
Pallas's long-tongued bat
Pearson's tuco-tuco
Pink fairy armadillo
Prehensile-tailed porcupine
Puma
Pygmy right whale
Red deer
Shepherd's beaked whale
Southern pudu
Sperm whale
Three-toed tree sloths
Vampire bat
Water opossum

ARMENIA

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Red deer
Red fox

AUSTRALIA

Australian false vampire bat
Australian jumping mouse
Bennett's tree kangaroo
Blue whale
Bridled nail-tailed wallaby
Brush-tailed phascogale
Brush-tailed rock wallaby
Common bentwing bat
Common bottlenosed dolphin
Common brush-tailed possum
Common ringtail
Common wombat
Duck-billed platypus
Dugong
Eastern barred bandicoot
Eastern gray kangaroo
Eastern pygmy possum
Greater bilby
Greater glider
Honey possum
Humpback whale
Killer whale
Koala
Musky rat-kangaroo
Northern bettong
Northern minke whale
Numbat
Pygmy glider
Pygmy right whale
Pygmy sperm whale
Queensland tube-nosed bat
Red fox
Red kangaroo
Rufous spiny bandicoot
Short-beaked echidna
Southern marsupial mole
Sperm whale
Spinner dolphin
Sugar glider
Tasmanian devil
Tasmanian wolf

AUSTRIA

Alpine marmot
Common bentwing bat
Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Mountain hare
Red deer
Red fox
Western European hedgehog

AZERBAIJAN

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Red deer
Red fox

BANGLADESH

Asian elephant
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Eurasian wild pig
Ganges and Indus dolphin
Gray wolf
Greater horseshoe bat
Humpback whale
Indian crested porcupine
Indian flying fox
Indian muntjac
Indian rhinoceros
Northern minke whale
Pygmy sperm whale
Red fox
Rhesus macaque
Serow
Sperm whale
Spinner dolphin
Tiger

BELARUS

Black-bellied hamster
Edible dormouse
Ermine
Eurasian wild pig
European badger
Gray wolf
Moose
Mountain hare

Red deer
Red fox

BELGIUM

Black-bellied hamster
Blue whale
Common bottlenosed dolphin
Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Harbor porpoise
Humpback whale
Killer whale
North Atlantic right whale
Northern minke whale
Pygmy sperm whale
Sperm whale
Western European hedgehog

BELIZE

Blue whale
Brazilian free-tailed bat
Central American agouti
Collared peccary
Common bottlenosed dolphin
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Humpback whale
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Pygmy sperm whale
Silky anteater
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Vampire bat
Virginia opossum
Water opossum
White-tailed deer

BENIN

Aardvark
African civet
Blue whale
Common bottlenosed dolphin
Common genet
Gambian rat
Humpback whale
Lord Derby's anomalure
Northern minke whale
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin

BHUTAN

Asian elephant
Common bentwing bat
Gray wolf
Greater horseshoe bat
Indian crested porcupine
Red fox
Red panda
Rhesus macaque
Serow
Snow leopard
Water buffalo

BOLIVIA

Alpaca
Ashy chinchilla rat
Boto
Brazilian free-tailed bat
Brown-throated three-toed sloth
Capybara
Central American agouti
Collared peccary
Coypu
Giant anteater
Goeldi's monkey
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hoffman's two-toed sloth
Llama
Lowland tapir
Maned wolf
Nine-banded armadillo
Pacarana
Pallas's long-tongued bat
Puma
Pygmy marmoset
Silky anteater
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
White-faced saki
White-tailed deer

BOSNIA AND HERZEGOVINA

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Greater horseshoe bat
Red deer
Red fox

BOTSWANA

Aardvark
Aardwolf
African civet
Common genet
Common hippopotamus
Damaraland mole-rat
Egyptian slit-faced bat
Giraffe
Ground pangolin
Lion
Savanna elephant
Springhare

BRAZIL

Bald uakari
Blue whale

Boto
Brazilian free-tailed bat
Brown-throated three-toed sloth
Burmeister's porpoise
Capybara
Central American agouti
Collared peccary
Common bottlenosed dolphin
Common squirrel monkey
Coypu
Franciscana dolphin
Funnel-eared bat
Giant anteater
Goeldi's monkey
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Lowland tapir
Maned wolf
Masked titi
Nine-banded armadillo
Northern minke whale
Paca
Pacarana
Pallas's long-tongued bat
Parnell's moustached bat
Prehensile-tailed porcupine
Pygmy marmoset
Pygmy right whale
Pygmy sperm whale
Red deer
Rock cavy
Silky anteater
Smoky bat
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Three-striped night monkey
Three-toed tree sloths
Vampire bat
Venezuelan red howler monkey
Water opossum
Weeper capuchin
White-faced saki
White-tailed deer

BULGARIA

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Harbor porpoise
Red deer
Red fox

BURKINA FASO

Aardvark
African civet
Common genet
Egyptian slit-faced bat
Rock hyrax
Senegal bushbaby

BURUNDI

Aardvark
African civet
Common bentwing bat
Common genet
Egyptian slit-faced bat
Gambian rat
Lord Derby's anomalure
Senegal bushbaby
South African porcupine

CAMBODIA

Asian elephant
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dugong
Eurasian wild pig
Greater horseshoe bat
Humpback whale
Indian muntjac
Lesser Malay mouse deer
Malayan tapir
Northern minke whale
Pileated gibbon
Pygmy sperm whale
Serow
Sperm whale
Spinner dolphin

CAMEROON

Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Dwarf epauletted fruit bat
Egyptian rousette
Forest elephant
Forest hog
Gambian rat
Greater cane rat
Humpback whale
Lord Derby's anomalure
Mandrill
Northern minke whale
Potto
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western gorilla
Western red colobus

CANADA

American bison
American black bear
American least shrew
American pika
American water shrew
Beluga
Bighorn sheep
Black-tailed prairie dog
Bobcat
California sea lion

Eastern chipmunk
Eastern mole
Ermine
Gray squirrel
Gray wolf
Harbor porpoise
Harp seal
Killer whale
Little brown bat
Moose
Mountain beaver
Muskrat
Narwhal
North American beaver
North American porcupine
North Atlantic right whale
Northern bottlenosed whale
Northern raccoon
Pallid bat
Polar bear
Pronghorn
Puma
Red deer
Red fox
Reindeer
Snowshoe hare
Southern flying squirrel
Star-nosed mole
Striped skunk
Virginia opossum
Walrus
White-tailed deer

CENTRAL AFRICAN REPUBLIC

Aardvark
African civet
Chimpanzee
Common genet
Dwarf epauletted fruit bat
Egyptian rousette
Forest elephant
Gambian rat
Giraffe
Greater cane rat
Lord Derby's anomalure
Rock hyrax
Senegal bushbaby
South African porcupine
Western gorilla
White rhinoceros

CHAD

Aardvark
African civet
Common genet
Dromedary camel
Egyptian slit-faced bat
Gambian rat
Ground pangolin
Mzab gundi
Rock hyrax
Senegal bushbaby
Spotted hyena
Trident leaf-nosed bat
White rhinoceros

CHILE

Alpaca
Ashy chinchilla rat
Blue whale
Brazilian free-tailed bat
Burmeister's porpoise
Common bottlenosed dolphin
Coypu
Degu
Humpback whale
Killer whale
Llama
Long-tailed chinchilla
Monito del monte
Northern minke whale
Pallas's long-tongued bat
Pearson's tuco-tuco
Pygmy right whale
Pygmy sperm whale
Red deer
Shepherd's beaked whale
Southern pudu
Sperm whale
Vampire bat

CHINA

Asian elephant
Baiji
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dugong
Edible dormouse
Ermine
European badger
Giant panda
Gray wolf
Greater horseshoe bat
Hairy-footed jerboa
Humpback whale
Indian muntjac
Kiang
Killer whale
Lar gibbon
Lesser Malay mouse deer
Moose
Mountain hare
Northern minke whale
Northern pika
Pygmy slow loris
Pygmy sperm whale
Red deer
Red fox
Red panda
Reindeer
Rhesus macaque
Serow
Siberian musk deer
Snow leopard
Sperm whale
Spinner dolphin
Tiger

COLOMBIA

Bald uakari
Blue whale
Boto
Brazilian free-tailed bat
Brown-throated three-toed sloth
Capybara

Central American agouti
Collared peccary
Colombian woolly monkey
Common bottlenosed dolphin
Common squirrel monkey
Cotton-top tamarin
Funnel-eared bat
Giant anteater
Goeldi's monkey
Greater bulldog bat
Greater sac-winged bat
Hispid cotton rat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Llama
Lowland tapir
Nine-banded armadillo
Northern minke whale
Paca
Pacarana
Pallas's long-tongued bat
Parnell's moustached bat
Prehensile-tailed porcupine
Pygmy marmoset
Pygmy sperm whale
Silky anteater
Silky shrew opossum
Smoky bat
Sperm whale
Spinner dolphin
Spiny rat
Spix's disk-winged bat
Three-striped night monkey
Three-toed tree sloths
Vampire bat
Water opossum
White-faced saki
White-tailed deer
White-throated capuchin

CONGO

African civet
Blue whale
Common bottlenosed dolphin
Common genet
Dwarf epauletted fruit bat
Egyptian rousette
Egyptian slit-faced bat
Forest elephant
Forest hog
Humpback whale
Lord Derby's anomalure
Northern minke whale
Potto
Pygmy sperm whale
South African porcupine
Sperm whale
Spinner dolphin
Springhare
Western gorilla

COSTA RICA

American least shrew
Blue whale
Brazilian free-tailed bat
Brown-throated three-toed sloth
Central American agouti
Collared peccary
Common bottlenosed dolphin
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Puma
Pygmy sperm whale
Silky anteater
Smoky bat
Sperm whale
Spinner dolphin
Spiny rat
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Virginia opossum
Water opossum
White bat
White-tailed deer
White-throated capuchin

CROATIA

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Eurasian wild pig
European badger
Greater horseshoe bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale

CUBA

Blue whale
Brazilian free-tailed bat
Central American agouti
Collared peccary
Common bottlenosed dolphin
Cuban hutia
Funnel-eared bat
Greater bulldog bat
Humpback whale
Killer whale
Northern minke whale
Pallid bat
Parnell's moustached bat
Pygmy sperm whale
Sperm whale
Spinner dolphin

CYPRUS

Blue whale

Common bottlenosed dolphin
Humpback whale
Northern minke whale
Pygmy sperm whale
Sperm whale

CZECH REPUBLIC

Black-bellied hamster
Common bentwing bat
Edible dormouse
Ermine
European badger
Greater horseshoe bat
Red deer
Red fox

DEMOCRATIC REPUBLIC OF THE CONGO

Aardvark
African civet
Blue whale
Checkered sengi
Chimpanzee
Common bentwing bat
Common bottlenosed dolphin
Common genet
Common hippopotamus
Dwarf epauletted fruit bat
Egyptian rousette
Egyptian slit-faced bat
Forest elephant
Forest hog
Gambian rat
Giraffe
Humpback whale
Lord Derby's anomalure
Mandrill
Northern minke whale
Okapi
Potto
Pygmy sperm whale
Rock hyrax
South African porcupine
Sperm whale
Spinner dolphin
Western gorilla
Western red colobus
White rhinoceros

DENMARK

Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
Harbor porpoise
Humpback whale
Killer whale
North Atlantic right whale
Northern minke whale
Norway lemming
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Western European hedgehog

DJIBOUTI

Aardvark
Blue whale
Common bottlenosed dolphin
Common genet
Dromedary camel
Dugong
Humpback whale
Northern minke whale
Rock hyrax
Senegal bushbaby
Sperm whale
Spinner dolphin

DOMINICAN REPUBLIC

Blue whale
Brazilian free-tailed bat
Common bottlenosed dolphin
Funnel-eared bat
Greater bulldog bat
Hispaniolan solenodon
Humpback whale
Killer whale
Northern minke whale
Parnell's moustached bat
Pygmy sperm whale
Sperm whale
Spinner dolphin

ECUADOR

Blue whale
Boto
Brazilian free-tailed bat
Brown-throated three-toed sloth
Capybara
Central American agouti
Collared peccary
Common bottlenosed dolphin
Galápagos sea lion
Giant anteater
Goeldi's monkey
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Llama
Lowland tapir
Nine-banded armadillo
Northern minke whale
Pacarana
Pallas's long-tongued bat
Pygmy marmoset
Pygmy sperm whale
Silky anteater
Silky shrew opossum
Sperm whale
Spinner dolphin
Spiny rat
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Water opossum
White-faced saki
White-tailed deer

EGYPT
Blue whale
Common bottlenosed dolphin
Common genet
Dromedary camel
Egyptian rousette
Egyptian slit-faced bat
Egyptian spiny mouse
Eurasian wild pig
Greater horseshoe bat
Hardwicke's lesser mouse-tailed bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Red fox
Rock hyrax
Sperm whale
Trident leaf-nosed bat

EL SALVADOR
Blue whale
Brazilian free-tailed bat
Brown-throated three-toed sloth
Collared peccary
Common bottlenosed dolphin
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Greater bulldog bat
Greater sac-winged bat
Hispid cotton rat
Humpback whale
Killer whale
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Pygmy sperm whale
Silky anteater
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Virginia opossum
Water opossum
White-tailed deer

EQUATORIAL GUINEA
African civet
Blue whale
Common bottlenosed dolphin
Common genet
Forest elephant
Humpback whale
Lord Derby's anomalure
Mandrill
Northern minke whale
Potto
Pygmy sperm whale
South African porcupine
Sperm whale
Spinner dolphin
Western gorilla

ERITREA
Aardvark
Blue whale
Common bottlenosed dolphin
Common genet
Dromedary camel
Dugong
Egyptian slit-faced bat
Humpback whale
Northern minke whale
Rock hyrax
Sperm whale
Spinner dolphin

ESTONIA
Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
Gray wolf
Harbor porpoise
Humpback whale
Moose
Mountain hare
Northern minke whale
Red deer
Red fox
Sperm whale

ETHIOPIA
Aardvark
Common genet
Dromedary camel
Egyptian slit-faced bat
Forest hog
Grevy's zebra
Lion
Naked mole-rat
Rock hyrax
Senegal bushbaby
Thomson's gazelle

FINLAND
Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
European otter
Gray wolf
Humpback whale
Moose
Mountain hare
Northern minke whale
Norway lemming
Red fox
Reindeer
Sperm whale
Western European hedgehog

FRANCE
Alpine marmot
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Edible dormouse

Ermine
Eurasian wild pig
European badger
European otter
Greater horseshoe bat
Harbor porpoise
Humpback whale
Killer whale
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Western European hedgehog

FRENCH GUIANA

Blue whale
Capybara
Collared peccary
Common bottlenosed dolphin
Common squirrel monkey
Funnel-eared bat
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Humpback whale
Lowland tapir
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Prehensile-tailed porcupine
Pygmy sperm whale
Silky anteater
Smoky bat
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Water opossum
Weeper capuchin
White-faced saki
White-tailed deer

GABON

African civet
Blue whale
Common bottlenosed dolphin
Common genet
Common hippopotamus
Dwarf epauletted fruit bat
Egyptian rousette
Forest elephant
Forest hog
Humpback whale
Lord Derby's anomalure
Mandrill
Northern minke whale
Potto
Pygmy sperm whale
South African porcupine
Sperm whale
Spinner dolphin
Western gorilla

GAMBIA

Aardvark
African civet
Blue whale
Common bottlenosed dolphin
Common genet
Gambian rat
Greater cane rat
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western red colobus

GEORGIA

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Harbor porpoise
Red deer
Red fox

GERMANY

Alpine marmot
Black-bellied hamster
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Harbor porpoise
Humpback whale
Killer whale
North Atlantic right whale
Northern minke whale
Northern raccoon
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Western European hedgehog

GHANA

Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Dwarf epauletted fruit bat
Egyptian rousette
Forest elephant
Forest hog
Gambian rat
Humpback whale
Lord Derby's anomalure
Northern minke whale
Potto

Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western red colobus

GREECE

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
European badger
European otter
Gray wolf
Greater horseshoe bat
Harbor porpoise
Humpback whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale

GREENLAND

Blue whale
Ermine
Harbor porpoise
Harp seal
Humpback whale
Killer whale
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Polar bear
Reindeer
Walrus

GRENADA

Nine-banded armadillo
Pallas's long-tongued bat

GUAM

Marianas fruit bat

GUATEMALA

American least shrew
Blue whale
Brazilian free-tailed bat
Central American agouti
Collared peccary
Common bottlenosed dolphin
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Humpback whale
Killer whale
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Puma
Pygmy sperm whale
Silky anteater
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Vampire bat
Virginia opossum
Water opossum
White-tailed deer

GUINEA

Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Egyptian slit-faced bat
Forest hog
Gambian rat
Humpback whale
Killer whale
Northern minke whale
Pygmy hippopotamus
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin

GUINEA-BISSAU

Aardvark
African civet
Blue whale
Common bottlenosed dolphin
Common genet
Forest hog
Gambian rat
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western red colobus

GUYANA

Blue whale
Boto
Capybara
Collared peccary
Common bottlenosed dolphin
Common squirrel monkey
Funnel-eared bat
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Humpback whale
Lowland tapir
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Prehensile-tailed porcupine

Pygmy sperm whale
Silky anteater
Smoky bat
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Water opossum
Weeper capuchin
White-faced saki
White-tailed deer

HAITI

Blue whale
Brazilian free-tailed bat
Common bottlenosed dolphin
Funnel-eared bat
Greater bulldog bat
Hispaniolan solenodon
Humpback whale
Killer whale
Northern minke whale
Parnell's moustached bat
Pygmy sperm whale
Sperm whale
Spinner dolphin

HONDURAS

American least shrew
Blue whale
Brazilian free-tailed bat
Brown-throated three-toed sloth
Central American agouti
Collared peccary
Common bottlenosed dolphin
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Pygmy sperm whale
Silky anteater
Sperm whale
Spinner dolphin
Spiny rat
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Virginia opossum
Water opossum
White bat
White-tailed deer
White-throated capuchin

HUNGARY

Black-bellied hamster
Common bentwing bat
Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Red deer
Red fox

ICELAND

Blue whale
Harbor porpoise
Humpback whale
Killer whale
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Norway lemming

INDIA

Asian elephant
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dromedary camel
Dugong
Ermine
Eurasian wild pig
Ganges and Indus dolphin
Gray wolf
Greater horseshoe bat
Hardwicke's lesser mouse-tailed bat
Humpback whale
Indian crested porcupine
Indian flying fox
Indian muntjac
Indian rhinoceros
Kiang
Killer whale
Lion
Northern minke whale
Pygmy sperm whale
Red fox
Red panda
Rhesus macaque
Serow
Snow leopard
Sperm whale
Spinner dolphin
Tiger
Water buffalo

INDONESIA

Asian elephant
Babirusa
Blue whale
Bornean orangutan
Common bentwing bat
Common bottlenosed dolphin
Common tree shrew
Dugong
Eurasian wild pig
European otter
Humpback whale
Indian muntjac
Killer whale
Lar gibbon
Lesser Malay mouse deer

Malayan colugo
Malayan moonrat
Malayan tapir
Naked bat
Northern minke whale
Proboscis monkey
Pygmy sperm whale
Serow
Siamang
Sperm whale
Spinner dolphin
Sumatran rhinoceros
Tiger
Western tarsier

IRAN

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dromedary camel
Dugong
Edible dormouse
Egyptian rousette
Egyptian spiny mouse
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Hairy-footed jerboa
Humpback whale
Indian crested porcupine
Killer whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Spinner dolphin
Trident leaf-nosed bat

IRAQ

Dromedary camel
Egyptian spiny mouse
Eurasian wild pig
Gray wolf
Greater horseshoe bat
Red fox
Trident leaf-nosed bat

IRELAND

Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
European otter
Harbor porpoise
Humpback whale
Killer whale
Mountain hare
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Red deer
Red fox
Sperm whale
Western European hedgehog

ISRAEL

Blue whale
Common bottlenosed dolphin
Dromedary camel
Egyptian rousette
Egyptian slit-faced bat
Egyptian spiny mouse
Eurasian wild pig
Gray wolf
Hardwicke's lesser mouse-tailed bat
Humpback whale
Indian crested porcupine
Northern minke whale
Pygmy sperm whale
Red fox
Rock hyrax
Sperm whale
Trident leaf-nosed bat

ITALY

Alpine marmot
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Ermine
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Humpback whale
Killer whale
Mountain hare
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Western European hedgehog

IVORY COAST

Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Dwarf epauletted fruit bat
Egyptian rousette
Forest elephant
Forest hog
Gambian rat
Humpback whale
Lord Derby's anomalure
Northern minke whale
Pygmy hippopotamus
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western red colobus

JAMAICA

Blue whale
Brazilian free-tailed bat
Common bottlenosed dolphin

Funnel-eared bat
Greater bulldog bat
Humpback whale
Killer whale
Northern minke whale
Pallas's long-tongued bat
Parnell's moustached bat
Pygmy sperm whale
Sperm whale
Spinner dolphin

JAPAN

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dugong
Ermine
Eurasian wild pig
European badger
European otter
Gray whale
Greater horseshoe bat
Harbor porpoise
Humpback whale
Killer whale
Marianas fruit bat
Mountain hare
Northern minke whale
Northern pika
Pygmy sperm whale
Reindeer
Siberian musk deer
Sperm whale
Spinner dolphin

JORDAN

Dromedary camel
Egyptian slit-faced bat
Egyptian spiny mouse
Eurasian wild pig
Gray wolf
Hardwicke's lesser mouse-tailed bat
Red fox
Rock hyrax
Trident leaf-nosed bat

KAZAKHSTAN

Black-bellied hamster
Common bentwing bat
Edible dormouse
Ermine
Eurasian wild pig
European badger
Gray wolf
Hairy-footed jerboa
Moose
Mountain hare
Red deer
Red fox
Snow leopard

KENYA

Aardvark
Aardwolf
African civet
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Dugong
Egyptian rousette
Egyptian slit-faced bat
Forest hog
Gambian rat
Giraffe
Greater cane rat
Grevy's zebra
Ground pangolin
Humpback whale
Kirk's dikdik
Lion
Lord Derby's anomalure
Naked mole-rat
Northern greater bushbaby
Northern minke whale
Potto
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Springhare
Thomson's gazelle

KUWAIT

Egyptian spiny mouse
Gray wolf
Trident leaf-nosed bat

KYRGYZSTAN

Common bentwing bat
Edible dormouse
Ermine
Eurasian wild pig
European badger
Gray wolf
Red deer
Red fox
Snow leopard

LAOS

Asian elephant
Common bentwing bat
Eurasian wild pig
Greater horseshoe bat
Indian muntjac
Lesser Malay mouse deer
Malayan tapir
Pileated gibbon
Pygmy slow loris
Red fox
Red-shanked douc langur
Rhesus macaque
Serow

LATVIA

Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
Gray wolf
Harbor porpoise
Humpback whale
Moose
Mountain hare

Northern minke whale
Red deer
Red fox
Sperm whale

LEBANON

Blue whale
Common bottlenosed dolphin
Dromedary camel
Egyptian spiny mouse
Hardwicke's lesser mouse-tailed bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Sperm whale
Trident leaf-nosed bat

LESOTHO

Aardvark
African civet
Common bentwing bat
Common genet
Egyptian slit-faced bat
South African porcupine

LESSER ANTILLES

Blue whale
Brazilian free-tailed bat
Common bottlenosed dolphin
Funnel-eared bat
Greater bulldog bat
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Sperm whale
Spinner dolphin

LIBERIA

Aardvark
African civet
Blue whale
Common bottlenosed dolphin
Common genet
Forest elephant
Forest hog
Humpback whale
Killer whale
Lord Derby's anomalure
Northern minke whale
Pygmy hippopotamus
Pygmy sperm whale
Rock hyrax
South African porcupine
Sperm whale
Spinner dolphin
Western red colobus

LIBYA

Blue whale
Common bottlenosed dolphin
Dromedary camel
Egyptian spiny mouse
Eurasian wild pig
Greater horseshoe bat
Humpback whale
Mzab gundi
Northern minke whale
Pygmy sperm whale
Red fox
Sperm whale
Trident leaf-nosed bat

LIECHTENSTEIN

Ermine
Eurasian wild pig
Greater horseshoe bat
Red deer
Red fox

LITHUANIA

Blue whale
Common bottlenosed dolphin
Edible dormouse
Ermine
Eurasian wild pig
European badger
Harbor porpoise
Humpback whale
Moose
Mountain hare
Northern minke whale
Red deer
Red fox
Sperm whale

LUXEMBOURG

Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Red deer
Red fox

MACEDONIA

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Red deer
Red fox

MADAGASCAR

Aye-aye
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common tenrec
Crowned lemur
Dugong
Fossa
Humpback whale
Indri
Killer whale
Milne-Edwards's sifaka
Northern minke whale
Old World sucker-footed bat
Pygmy sperm whale
Red mouse lemur

Red-tailed sportive lemur
Ringtailed lemur
Ring-tailed mongoose
Sperm whale
Spinner dolphin
White-footed sportive lemur
Yellow-streaked tenrec

MALAWI

Aardvark
African civet
Checkered sengi
Common bentwing bat
Common genet
Egyptian slit-faced bat
Gambian rat
Ground pangolin
South African porcupine

MALAYSIA

Asian elephant
Blue whale
Bornean orangutan
Common bentwing bat
Common bottlenosed dolphin
Common tree shrew
Dugong
Eurasian wild pig
Humpback whale
Indian muntjac
Killer whale
Lar gibbon
Lesser Malay mouse deer
Malayan colugo
Malayan moonrat
Malayan tapir
Naked bat
Northern minke whale
Proboscis monkey
Pygmy sperm whale
Serow
Siamang
Sperm whale
Spinner dolphin
Sumatran rhinoceros

MALI

Aardvark
African civet
Common genet
Dromedary camel
Egyptian rousette
Egyptian slit-faced bat
Gambian rat
Mzab gundi
Rock hyrax
Savanna elephant
Senegal bushbaby

MARIANA ISLANDS

Marianas fruit bat

MAURITANIA

Aardvark
Blue whale
Common bottlenosed dolphin
Dromedary camel
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Sperm whale
Spinner dolphin

MEXICO

American black bear
American least shrew
Bighorn sheep
Black-tailed prairie dog
Blue whale
Bobcat
Brazilian free-tailed bat
Brown-throated three-toed sloth
California leaf-nosed bat
California sea lion
Central American agouti
Collared peccary
Common bottlenosed dolphin
Desert cottontail
Eastern mole
Funnel-eared bat
Geoffroy's spider monkey
Gray whale
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Humpback whale
Killer whale
Little brown bat
Muskrat
Nine-banded armadillo
North American beaver
North American porcupine
Northern elephant seal
Northern minke whale
Northern raccoon
Paca
Pallas's long-tongued bat
Pallid bat
Parnell's moustached bat
Pronghorn
Puma
Pygmy sperm whale
Silky anteater
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Striped skunk
Three-toed tree sloths
Valley pocket gopher
Vampire bat
Virginia opossum
Water opossum
White-tailed deer

MOLDOVA

Black-bellied hamster
Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Red deer
Red fox

MONACO
European badger
Red fox

MONGOLIA
Ermine
Eurasian wild pig
Gray wolf
Hairy-footed jerboa
Moose
Mountain hare
Northern pika
Przewalski's horse
Red deer
Red fox
Reindeer
Siberian musk deer
Snow leopard

MOROCCO
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dromedary camel
Eurasian wild pig
European otter
Greater horseshoe bat
Harbor porpoise
Hardwicke's lesser mouse-tailed bat
Humpback whale
Killer whale
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Spinner dolphin
Trident leaf-nosed bat

MOZAMBIQUE
Aardvark
African civet
Blue whale
Checkered sengi
Common bentwing bat
Common bottlenosed dolphin
Common genet
Common hippopotamus
Dugong
Egyptian rousette
Egyptian slit-faced bat
Gambian rat
Ground pangolin
Humpback whale
Killer whale
Lord Derby's anomalure
Northern minke whale
Pygmy sperm whale
Rock hyrax
South African porcupine
Sperm whale
Spinner dolphin
Springhare
White rhinoceros

MYANMAR
Asian elephant
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Eurasian wild pig
Gray wolf
Greater horseshoe bat
Humpback whale
Indian flying fox
Indian muntjac
Kitti's hog-nosed bat
Lar gibbon
Lesser Malay mouse deer
Malayan moonrat
Malayan tapir
Northern minke whale
Pygmy sperm whale
Red fox
Red panda
Rhesus macaque
Serow
Sperm whale
Spinner dolphin
Tiger

NAMIBIA
Aardvark
African civet
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Common hippopotamus
Damaraland mole-rat
Dassie rat
Egyptian slit-faced bat
Giraffe
Grant's desert golden mole
Ground pangolin
Humpback whale
Killer whale
Kirk's dikdik
Northern minke whale
Pygmy sperm whale
Rock hyrax
Savanna elephant
Sperm whale
Springhare

NEPAL
Asian elephant
Common bentwing bat
Eurasian wild pig
Ganges and Indus dolphin
Gray wolf
Greater horseshoe bat
Indian crested porcupine
Indian muntjac
Indian rhinoceros
Kiang
Red fox
Red panda
Rhesus macaque
Serow
Snow leopard
Water buffalo

NETHERLANDS
Black-bellied hamster
Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
Harbor porpoise
Humpback whale
Killer whale
Northern minke whale
Northern raccoon
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Western European hedgehog

NEW ZEALAND
Blue whale
Brush-tailed rock wallaby
Common bottlenosed dolphin
Common brush-tailed possum
Dugong
Humpback whale
Killer whale
Lesser New Zealand short-tailed bat
Northern minke whale
Pygmy right whale
Pygmy sperm whale
Shepherd's beaked whale
Sperm whale

NICARAGUA
American least shrew
Blue whale
Brazilian free-tailed bat
Brown-throated three-toed sloth
Central American agouti
Collared peccary
Common bottlenosed dolphin
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Nine-banded armadillo
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Pygmy sperm whale
Silky anteater
Sperm whale
Spinner dolphin
Spiny rat
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Virginia opossum
Water opossum
White bat
White-tailed deer
White-throated capuchin

NIGER
Aardvark
Dromedary camel
Egyptian slit-faced bat
Gambian rat
Mzab gundi
Rock hyrax
Senegal bushbaby
Trident leaf-nosed bat

NIGERIA
Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Dwarf epauletted fruit bat
Egyptian rousette
Egyptian slit-faced bat
Gambian rat
Humpback whale
Lord Derby's anomalure
Northern minke whale
Potto
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western gorilla
Western red colobus

NORTH KOREA
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Eurasian wild pig
Humpback whale
Killer whale
Northern minke whale
Northern pika
Pygmy sperm whale
Red deer
Siberian musk deer
Sperm whale
Spinner dolphin

NORWAY
Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
European otter
Harbor porpoise
Humpback whale
Killer whale
Moose
Mountain hare
North Atlantic right whale
Northern bottlenosed whale

Northern minke whale
Norway lemming
Polar bear
Red deer
Red fox
Reindeer
Sperm whale
Western European hedgehog

OMAN

Blue whale
Common bottlenosed dolphin
Dromedary camel
Dugong
Egyptian rousette
Egyptian spiny mouse
Gray wolf
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Rock hyrax
Sperm whale
Spinner dolphin
Trident leaf-nosed bat

PAKISTAN

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dromedary camel
Dugong
Eurasian wild pig
Ganges and Indus dolphin
Gray wolf
Greater horseshoe bat
Hardwicke's lesser mouse-tailed bat
Humpback whale
Indian flying fox
Indian muntjac
Indian rhinoceros
Kiang
Killer whale
Northern minke whale
Pygmy sperm whale
Red fox
Rhesus macaque
Snow leopard
Sperm whale
Spinner dolphin
Trident leaf-nosed bat

PANAMA

American least shrew
Blue whale
Brazilian free-tailed bat
Brown-throated three-toed sloth
Capybara
Central American agouti
Collared peccary
Common bottlenosed dolphin
Funnel-eared bat
Geoffroy's spider monkey
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Nine-banded armadillo
Northern minke whale
Northern raccoon
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Puma
Pygmy sperm whale
Silky anteater
Smoky bat
Sperm whale
Spinner dolphin
Spiny rat
Spix's disk-winged bat
Three-toed tree sloths
Vampire bat
Water opossum
White bat
White-tailed deer
White-throated capuchin

PAPUA NEW GUINEA

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dugong
Ground cuscus
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Rufous spiny bandicoot
Short-beaked echidna
Sperm whale
Spinner dolphin
Sugar glider

PARAGUAY

Brazilian free-tailed bat
Brown-throated three-toed sloth
Capybara
Collared peccary
Coypu
Giant anteater
Greater bulldog bat
Maned wolf
Nine-banded armadillo
Paca
Pallas's long-tongued bat
Prehensile-tailed porcupine
Three-toed tree sloths
Vampire bat
Water opossum

PERU

Alpaca
Ashy chinchilla rat
Bald uakari
Blue whale
Boto
Brazilian free-tailed bat
Burmeister's porpoise

Capybara
Central American agouti
Collared peccary
Common bottlenosed dolphin
Giant anteater
Goeldi's monkey
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hoffman's two-toed sloth
Humpback whale
Killer whale
Llama
Lowland tapir
Maned wolf
Nine-banded armadillo
Northern minke whale
Pacarana
Pallas's long-tongued bat
Parnell's moustached bat
Pearson's tuco-tuco
Pygmy marmoset
Pygmy sperm whale
Silky anteater
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Vampire bat
Water opossum
White-faced saki
White-tailed deer

PHILIPPINES

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dugong
Humpback whale
Naked bat
Northern minke whale
Philippine tarsier
Pygmy sperm whale
Sperm whale
Spinner dolphin

POLAND

Black-bellied hamster
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Harbor porpoise
Humpback whale
Moose
Northern minke whale
Red deer
Red fox
Sperm whale

PORTUGAL

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Eurasian wild pig
European badger
European otter
Greater horseshoe bat
Harbor porpoise
Humpback whale
Killer whale
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Western barbastelle
Western European hedgehog

PUERTO RICO

Blue whale
Brazilian free-tailed bat
Common bottlenosed dolphin
Funnel-eared bat
Greater bulldog bat
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Sperm whale
Spinner dolphin

QATAR

Egyptian spiny mouse

ROMANIA

Black-bellied hamster
Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Harbor porpoise
Red deer
Red fox

RUSSIA

Beluga
Black-bellied hamster
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Ermine
Eurasian wild pig
European otter
Gray whale
Gray wolf
Harbor porpoise
Harp seal
Humpback whale
Killer whale
Moose
Mountain hare
Narwhal

Northern minke whale
Northern pika
Northern raccoon
Polar bear
Red deer
Red fox
Reindeer
Siberian musk deer
Snow leopard
Sperm whale
Tiger
Walrus
Western European hedgehog

RWANDA

Aardvark
African civet
Chimpanzee
Common bentwing bat
Common genet
Egyptian slit-faced bat
Gambian rat
Lord Derby's anomalure
Rock hyrax
Senegal bushbaby
South African porcupine

SAUDI ARABIA

Blue whale
Common bottlenosed dolphin
Dromedary camel
Dugong
Egyptian slit-faced bat
Egyptian spiny mouse
Gray wolf
Hardwicke's lesser mouse-tailed bat
Humpback whale
Indian crested porcupine
Northern minke whale
Pygmy sperm whale
Rock hyrax
Sperm whale
Spinner dolphin
Trident leaf-nosed bat

SENEGAL

Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Egyptian slit-faced bat
Gambian rat
Hardwicke's lesser mouse-tailed bat
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western red colobus

SIERRA LEONE

Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Egyptian slit-faced bat
Forest hog
Gambian rat
Humpback whale
Killer whale
Lord Derby's anomalure
Northern minke whale
Potto
Pygmy hippopotamus
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Western red colobus

SINGAPORE

Lesser Malay mouse deer

SLOVAKIA

Black-bellied hamster
Edible dormouse
Ermine
European badger
Greater horseshoe bat
Red deer
Red fox

SLOVENIA

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale

SOMALIA

Aardwolf
African civet
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Dromedary camel
Dugong
Egyptian slit-faced bat
Humpback whale
Kirk's dikdik
Naked mole-rat
Northern greater bushbaby
Northern minke whale
Pygmy sperm whale

Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin

SOUTH AFRICA

Aardvark
Aardwolf
African civet
Black wildebeest
Blue whale
Cape horseshoe bat
Common bentwing bat
Common bottlenosed dolphin
Common genet
Damaraland mole-rat
Dassie rat
Egyptian rousette
Egyptian slit-faced bat
Gambian rat
Giraffe
Grant's desert golden mole
Ground pangolin
Humpback whale
Killer whale
Northern minke whale
Pygmy right whale
Pygmy sperm whale
Rock hyrax
Savanna elephant
Shepherd's beaked whale
South African porcupine
Southern tree hyrax
Sperm whale
Spinner dolphin
Springhare

SOUTH KOREA

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Eurasian wild pig
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Sperm whale
Spinner dolphin

SPAIN

Alpine marmot
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Edible dormouse
Eurasian wild pig
European badger
European otter
Gray wolf
Greater horseshoe bat
Harbor porpoise
Humpback whale
Killer whale
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Western barbastelle
Western European hedgehog

SRI LANKA

Asian elephant
European otter
Indian crested porcupine
Indian flying fox
Indian muntjac

SUDAN

Aardvark
African civet
Blue whale
Chimpanzee
Common bottlenosed dolphin
Common genet
Common hippopotamus
Dromedary camel
Dugong
Dwarf epauletted fruit bat
Egyptian slit-faced bat
Gambian rat
Giraffe
Greater cane rat
Ground pangolin
Humpback whale
Northern minke whale
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Spotted hyena
Thomson's gazelle
Trident leaf-nosed bat
White rhinoceros

SURINAME

Blue whale
Collared peccary
Common bottlenosed dolphin
Common squirrel monkey
Funnel-eared bat
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Humpback whale
Lowland tapir
Northern minke whale
Paca
Pallas's long-tongued bat
Parnell's moustached bat
Prehensile-tailed porcupine
Pygmy sperm whale
Silky anteater
Smoky bat
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Three-toed tree sloths

Vampire bat
Water opossum
Weeper capuchin
White-faced saki
White-tailed deer

SWAZILAND

Aardvark
African civet
Common bentwing bat
Common genet
Egyptian slit-faced bat
Gambian rat
Giraffe
Ground pangolin
South African porcupine

SWEDEN

Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
Gray wolf
Harbor porpoise
Humpback whale
Moose
Mountain hare
Northern minke whale
Norway lemming
Red deer
Red fox
Sperm whale
Western European hedgehog

SWITZERLAND

Alpine marmot
Common bentwing bat
Edible dormouse
Ermine
Eurasian wild pig
European badger
Greater horseshoe bat
Mountain hare
Red deer
Red fox
Western European hedgehog

SYRIA

Blue whale
Common bottlenosed dolphin
Dromedary camel
Egyptian spiny mouse
Eurasian wild pig
Gray wolf
Greater horseshoe bat
Hardwicke's lesser mouse-tailed bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Trident leaf-nosed bat

TAJIKISTAN

Common bentwing bat
Edible dormouse
Ermine
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Red deer
Red fox
Snow leopard

TANZANIA

Aardvark
African civet
Blue whale
Checkered sengi
Chimpanzee
Common bentwing bat
Common bottlenosed dolphin
Common genet
Common hippopotamus
Dugong
Egyptian rousette
Egyptian slit-faced bat
Gambian rat
Giraffe
Greater cane rat
Ground pangolin
Humpback whale
Killer whale
Kirk's dikdik
Lion
Lord Derby's anomalure
Northern greater bushbaby
Northern minke whale
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin
Springhare
Thomson's gazelle

THAILAND

Asian elephant
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common tree shrew
Dugong
Eurasian wild pig
Greater horseshoe bat
Humpback whale
Indian muntjac
Kitti's hog-nosed bat
Lar gibbon
Lesser Malay mouse deer
Malayan colugo
Malayan moonrat
Malayan tapir
Northern minke whale
Pileated gibbon
Pygmy sperm whale
Red fox
Rhesus macaque
Serow
Sperm whale

Spinner dolphin
Water buffalo

TOGO

Aardvark
African civet
Blue whale
Common bottlenosed dolphin
Common genet
Forest hog
Gambian rat
Humpback whale
Lord Derby's anomalure
Northern minke whale
Pygmy sperm whale
Rock hyrax
Senegal bushbaby
South African porcupine
Sperm whale
Spinner dolphin

TRINIDAD AND TOBAGO

Pallas's long-tongued bat
Prehensile-tailed porcupine
Silky anteater
Smoky bat
Vampire bat

TUNISIA

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Common genet
Dromedary camel
Eurasian wild pig
European otter
Greater horseshoe bat
Humpback whale
Killer whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale
Trident leaf-nosed bat

TURKEY

Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Egyptian rousette
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Harbor porpoise
Humpback whale
Northern minke whale
Pygmy sperm whale
Red deer
Sperm whale

TURKMENISTAN

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Hairy-footed jerboa
Red deer
Red fox

UGANDA

Aardvark
African civet
Checkered sengi
Chimpanzee
Common bentwing bat
Common genet
Dwarf epauletted fruit bat
Egyptian rousette
Egyptian slit-faced bat
Forest hog
Gambian rat
Giraffe
Greater cane rat
Ground pangolin
Lord Derby's anomalure
Potto
Senegal bushbaby
South African porcupine
White rhinoceros

UKRAINE

Alpine marmot
Black-bellied hamster
Common bentwing bat
Edible dormouse
Ermine
Eurasian wild pig
European badger
Gray wolf
Greater horseshoe bat
Harbor porpoise
Moose
Red deer
Red fox

UNITED ARAB EMIRATES

Dromedary camel
Egyptian spiny mouse
Gray wolf
Trident leaf-nosed bat

UNITED KINGDOM

Blue whale
Common bottlenosed dolphin
Ermine
Eurasian wild pig
European badger
European otter
Greater horseshoe bat
Harbor porpoise
Humpback whale
Killer whale
Mountain hare
North Atlantic right whale
Northern bottlenosed whale
Northern minke whale
Pygmy sperm whale
Red deer
Red fox
Sperm whale

Western barbastelle
Western European hedgehog

UNITED STATES

American bison
American black bear
American least shrew
American pika
American water shrew
Beluga
Bighorn sheep
Black-tailed prairie dog
Blue whale
Bobcat
Brazilian free-tailed bat
California leaf-nosed bat
California sea lion
Collared peccary
Common bottlenosed dolphin
Desert cottontail
Eastern chipmunk
Eastern mole
Ermine
Giant kangaroo rat
Gray squirrel
Gray whale
Gray wolf
Harbor porpoise
Hawaiian monk seal
Hispid cotton rat
Humpback whale
Killer whale
Little brown bat
Moose
Mountain beaver
Muskrat
Narwhal
Nine-banded armadillo
North American beaver
North American porcupine
North Atlantic right whale
Northern bottlenosed whale
Northern elephant seal
Northern minke whale
Northern raccoon
Pallid bat
Polar bear
Pronghorn
Puma
Pygmy sperm whale
Red deer
Red fox
Reindeer
San Joaquin pocket mouse
Snowshoe hare
Southern flying squirrel
Sperm whale
Spinner dolphin
Star-nosed mole
Steller's sea cow
Striped skunk
Valley pocket gopher
Virginia opossum
Walrus
West Indian manatee
White-tailed deer

URUGUAY

Blue whale
Brazilian free-tailed bat
Burmeister's porpoise
Capybara
Collared peccary
Common bottlenosed dolphin
Coypu
Franciscana dolphin
Giant anteater
Humpback whale
Killer whale
Maned wolf
Northern minke whale
Pearson's tuco-tuco
Prehensile-tailed porcupine
Pygmy right whale
Red deer
Sperm whale
Vampire bat

UZBEKISTAN

Common bentwing bat
Edible dormouse
Eurasian wild pig
European badger
Gray wolf
Hairy-footed jerboa
Red deer
Red fox
Snow leopard

VENEZUELA

Blue whale
Boto
Brazilian free-tailed bat
Capybara
Collared peccary
Colombian woolly monkey
Common bottlenosed dolphin
Common squirrel monkey
Funnel-eared bat
Giant anteater
Greater bulldog bat
Greater dog-faced bat
Greater sac-winged bat
Hispid cotton rat
Hoffman's two-toed sloth
Humpback whale
Lowland tapir
Northern minke whale
Paca
Pacarana
Pallas's long-tongued bat
Parnell's moustached bat
Prehensile-tailed porcupine
Puma
Pygmy sperm whale
Silky anteater
Silky shrew opossum
Smoky bat
Sperm whale
Spinner dolphin
Spix's disk-winged bat
Three-striped night monkey
Three-toed tree sloths
Vampire bat
Venezuelan red howler monkey
Water opossum

Weeper capuchin
White-tailed deer

VIETNAM

Asian elephant
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Dugong
Eurasian wild pig
Greater horseshoe bat
Humpback whale
Indian muntjac
Malayan tapir
Northern minke whale
Pygmy slow loris
Pygmy sperm whale
Red fox
Red-shanked douc langur
Rhesus macaque
Serow
Sperm whale
Spinner dolphin

YEMEN

Blue whale
Common bottlenosed dolphin
Dromedary camel
Dugong
Egyptian rousette
Egyptian slit-faced bat
Egyptian spiny mouse
Gray wolf
Hardwicke's lesser mouse-tailed bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Rock hyrax
Sperm whale
Spinner dolphin
Trident leaf-nosed bat

YUGOSLAVIA

Alpine marmot
Blue whale
Common bentwing bat
Common bottlenosed dolphin
Edible dormouse
Ermine
Gray wolf
Greater horseshoe bat
Humpback whale
Northern minke whale
Pygmy sperm whale
Red deer
Sperm whale

ZAMBIA

Aardvark
Aardwolf
African civet
Checkered sengi
Common bentwing bat
Common genet
Common hippopotamus
Egyptian rousette
Egyptian slit-faced bat
Gambian rat
Giraffe
Ground pangolin
Lord Derby's anomalure
South African porcupine
Spotted hyena
Springhare

ZIMBABWE

Aardvark
African civet
Common bentwing bat
Common genet
Damaraland mole-rat
Egyptian rousette
Egyptian slit-faced bat
Gambian rat
Ground pangolin
Savanna elephant
South African porcupine
Spotted hyena
Springhare