**CHAPTER SEVEN**

**7. ESTABLISHMENT OF AQUACULTURE**

**7.1. Introduction to Establishment of Aquaculture**

* There are many factors to consider during aquaculture development
* The two important factors are **species and site selections.**
* **Species** are selected according to their biological characteristics, economic and market conditions, and effects on environment
* In aquaculture one should go for the selection of species with desirable biological characteristics such as;
* Feeding habit
* reproduction rate
* Growth rate, etc.
* **Site selection** is another important factor in establishing fish farming.
* In selecting site for both for the water-based and land-based farms the limnological characteristics such as water quality and quantity should be studied.
* The various limnological characteristics that need to be studied include;
* the amount of dissolved oxygen,
* water temperature
* Conductivity
* pH,
* Amount of various nutrients such as nitrogen and phosphorus.

**7.2. Types of Aquaculture**

* Aquaculture establishment comes in various forms including;
* Pond, cage, pen, tank raceway aquaculture etc.
* Aquaculture may be classified as land-based & open water based

**7.2.1. Cage and Pen**

* Cage and pen are constructed from the supporting frames (of various materials such as bamboo, wood, or metal) and covered with nets
* **Limitations of cage and pen aquaculture** include various environmental impacts.
* Wastes produced by the fishes in the cages or pens enter the water body and cause various environmental problems such as; eutrophication, depletion of oxygen and other consequences
* Farmed fish can also escape and compete with wild fish for natural resources or interbreed with wild fish of the same species. fish disease transfer in both directions



Fig.7.1. A typical fish pen

**7.2.2. Tank Culture**

* It involves the use of tanks (more or less similar to the water tank used to temporarily store water)
* constructed from different materials in various designs
* Fish tanks are constructed in various designs such as rectangular or circular and
* Often used in intensive indoor fish rearing activities such as in hatchery.
* Tank culture is important in areas where water supply is restricted or insufficient and unsuitable soil and terrain.



Fig 7.2. Recirculating tank system

**7.2.3. Raceways Culture**

* It allows farmers to divert water from a waterway, like a stream or well, so that it flows through channels containing fish



 Fig.7.3. Raceway culture system

**7.2.4. Pond Culture**

* Pond aquaculture has been practiced since 4000 years ago in Asia and later adopted to Europe.
* Aquaculture ponds can be either with soil bottom (earthen ponds)or concrete-lined ponds
* Successful pond aquaculture requires us to regularly accomplish pond water management and pond maintenance activities. regular application of fertilizers to facilitate the growth of phytoplankton that serve as food for planktivorous or herbivorous fish

 

**Fig 7.4 Types of pond (Concrete and earthen ponds)**

* The size of the pond is varying from very small size measured with meter square to very large size measured in hectare. Small shallow ponds between 1 and 10 hectares are generally recommended for tilapia production.
* For fresh water fish pond culture, the following points are very important:

1. Site selection

2. Construction of the ponds

3. Conditioning of the pond

4. Fertilization of the pond

5. Species selection

6. Stocking of the pond

7. Management of the pond

8. Harvesting the fish

1. **Site selection**; depends on availability of water, soil types and topography

 **2. Pond construction**

* There are two common types of fish pond construction.
* These are mechanical and manual pond constructions.
* The choice of construction methods depends on site characteristics, economic factors and desired pond size.
* The most common shape of the ponds is rectangular ponds which are more suitable for harvesting fish with a net.
* The length of the pond does not matter much but the preferred width is 15–20m, to suit the standard size of seine nets used for harvesting
* The pond bottom slopes gently towards the outlet end of the pond

**3. Conditioning of the pond**

* It is addition of lime to buffer or to reduce acidity of the system.
* The amount of lime varies depending on the acidity of the soil.

**4. Fertilization**

* The purpose of adding fertilizer to fish ponds is to encourage growth of natural food organisms (plankton).
* The more natural food faster fish growth and less supplementary feed will need to be added.
* Fertilization provides nutrients for phytoplankton

**5. Species selection**

* Selection of species is depending on different factors. This includes

 a) Culturing systems; monoculture system or polyculture system.

 b) Growth rate- fast growing rate,

 c) Ability to withstand adverse condition, and ability to reproduce in captive

**6. Stocking density**

* The stocking density needs to be as high as possible, in order to maximize the profit from the fish farm. Fish stocked at low density will grow faster than fish stocked at a high density in fertilized ponds
* Densely-stocked fish can also grow fast if they are given supplementary food and managed properly.

**7. Routine pond management**

* Periodic fertilization
* checks on water quality and fish and shellfish health; supplementary feeding;
* control of predators; checking of pond walls (for leaks)

 **8. Harvesting**

* When the size of fish reached to market size,
* The fish should be starved before harvesting.
* This allows the fish to empty their guts, improve the survival and condition of the fish during handling
* It is preferable to harvest early in the morning so that the pond water is still cool while the pond is emptied

 There are two types of harvest partial harvest It is catching only some of the fish in the

 Pond. While complete harvest requires draining of the pond.

**7.3. Aquaculture Systems**

Three main kinds of culture systems

 **1) Extensive culture**

* Where fish depend on the natural food present in the pond, stimulated by fertilization.
* No supplemental feed is given to the fish
* stocking density is 1 fish/m2 (10,000 fish/ha),

**2) Semi-intensive culture**

* Fish are given supplementary feeds in addition to the natural food present in the pond
* The stocking density is 3-8 fish/m2 (30,000–80,000 fish/ha).

**3) Intensive culture**

* the stocking density is more than 8 fish/m2,
* Intensive feeding, Water quality is monitored regularly.

. **Integrated system** fish farming is combined with other animal husbandry such as poultry or cattle farming. The purpose of such integration is to use excreta or faeces released from the animals husbandry that will serve as manure to stimulate the growth of phytoplankton

**Circulatory system** is a system of aquaculture or fish farming whereby the exhausted water is chemically treated and circulated to be re-used. This system of farming is often practiced as an extreme case of intensive farming.

**Monoculture farming**, in fish aquaculture it is possible to rear only a single species in one water body.

**Polyculture farming**, to rear many species of fish in one water body

**7.4. Sustainability of Aquaculture**

* Aquaculture is an important sector in providing fish especially to the poor. Yet, its sustainability is confronted with some limitations.
* Studies indicate that aquaculture practices compromise water quality, cause environmental and public health problems,
* involves risks of introduction of exotic or non-native species and genetic problems to the wild populations
* Management activities including cleaning of the tanks and disease treatment using antibiotics may also affect water quality.
* in cage and pen fish culture fish wastes collect on the bottom, damaging or eliminating bottom-dwelling life
* can be the cause of the introduction of non-native species from one area to another

 **CHAPTER EIGHT**

**8. STATUS AND PROSPECTS OF CAPTURE FISHERIES AND AQUACULTURE**

**8.1. World Case**

* Millennium Development Goals (MDGs) have eight objectives set to be achieved by all the United Nation member states, which Ethiopia is a member, by the year 2015
* Eradication of extreme poverty and hunger is one of those eight goals of MDGs.
* In this regard, capture fisheries and aquaculture can be considered potential sectors that can contribute to the improvement of the livelihood of many people in the poorest countries, and thus help in the achievement of the MDG goal.
* In most cases, capture fisheries production comes from marine fishing; whereas most of the aquaculture production is obtained from inland waters.
* However, the production of capture fisheries has shown an increasing trend at a decreasing rate
* from 6% per annum in 1950s and 1960s, to 2% per annum in 1970s and1980s, to almost zero growth rate in 1990s.
* production from the capture fisheries has already reached its maximum potential and even started declining
* In order to reverse the declining trend of capture fisheries production proper management actions need to be implemented

**8.2. Ethiopian Case**

* Ethiopia is a landlocked country without maritime access.
* about 7000 km2 wide lakes
* 250 km2 wide reservoirs and ponds
* 7400 km long rivers

The Ethiopian fishery comes entirely from inland water bodies (i.e. lakes, reservoirs, ponds and rivers) per year.

* both the capture fisheries and aquaculture sectors of the country are underdeveloped
* The annual capture fishery potential of the country estimated to be between 30,000-50,000 tons of fish
* There are also reports that indicate the country’s capture fishery potential to be between 44, 000-49, 000 tons of fish
* Out of the country’s total annual fishery potential 72 % is ascribed to lakes, 15 % to rivers,and

13 % to reservoirs and other small water bodies

Table 8.1. Summary of the Ethiopian fisheries resource potential and actual production for the year 2001/02 (Source: Ethiopian Institute of Agricultural Research, EIAR)

|  |  |  |  |
| --- | --- | --- | --- |
| Type of Water body  | Production potential  | Actual production Tons  | Percent  |
| Major Lakes  | 30,963-35,963  | 10,441  | 34 %  |
| Major Rivers  | 7,000  | 700  | 10 %  |
| Reservoirs & Ponds  | 6.067  | 1, 150  | 19 %  |
| **Total**  | **44,030-49,030**  | **12,291**  | **25-28 %**  |

* Most of the Ethiopian actual Lake fisheries are derived from the rift valley lakes (e.g. Abaya, Chamo, Awassa, Langano, and Zeway) and a high land lake (i.e. Tana Lake), which are located in SNNP, Oromia, Amhara and Regions.
* In contrast, most of the country’s actual riverine fisheries originate from Baro-Akobo Rivers in Gambella and Benishangul Regions
* In April2009, a National Aquaculture Development Strategy (NADS**),** funded and supported by the Food and Agriculture Organization Sub-Regional Office for East Africa, has been prepared
* The NADS project has been planned in short-term (2009-2012) and long-term (2010-2019) bases