



## FISH FARMING AND PRODUCTION IN INDIA: A STUDY

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### **Abstract**

*The fisheries sector of India is immensely contributing to the economy of the country. It provides valuable foreign exchange and employment to millions of people. At the same time it is an instrument of livelihood for a large section of economically backward population of the country. More than 7 million fishers in the country depend on capture fisheries and aquaculture for their livelihood. Indian fisheries are an important component of the global fisheries. with India being the fourth largest producer of fish in the world and second in Inland fish production. Fish production was initially dependent on fish capturing. However, most of the captured fish were used for industrial purposes and were hardly consumed by man. Therefore, an alternative method to increase fish production was devised that includes farming and husbandry of economically important aquatic organisms. The fisheries and aquaculture activities have the significant role to play in Indian context across various facets of the economy viz., providing nutritional (food) security, generating income by export earnings, officering employment to more than 14 million people. The present paper analysed Fish farming importance and production in India.*

**Key words:** *Fisheries sector, India, Employment, fish Production, Aqua culture.*

### **Introduction**

Fish are a very high source of proteins and have great nutritional value. Fish production was initially dependent on fish capturing. However, most of the captured fish were used for industrial purposes and were hardly consumed by man. Therefore, an alternative method to increase fish production was devised that includes farming and husbandry of economically important aquatic organisms. This is known as aquaculture.

The fisheries and aquaculture activities have the significant role to play in Indian context across various facets of the economy viz., providing nutritional (food) security, generating income by export earnings, officering employment to more than 14 million people, etc. In India, the fish rearing is undertaking across diverse resources ranging from deep sea to lakes in mountains. India resumed the position of 3rd rank and 2nd rank in global fisheries and aquaculture production. The total fish production in India during 2017-18 was 12.60 million metric tonnes including 65 per cent of Inland fish and it contributes about 6.3 per cent to the global fish production. In India, states such as Gujarat, Maharashtra, Karnataka Kerala, and Tamil Nadu are the top five states in fish production.

The fisheries sector of India is immensely contributing to the economy of the country. It provides valuable foreign exchange and employment to millions of people. At the same time it is an instrument of livelihood for a large section of economically backward population of the country. More than 7 million fishers in the country depend on capture fisheries and aquaculture for their livelihood. Indian fisheries are an important component of the global fisheries. with India being the fourth largest producer of fish in the world and second in Inland fish production. India's share in the world's fish production has increased from 3.2% In 1981 to 4.5% at present. Fishery sector occupies an important place in the socio-economic development of the country. Fish production in the country has been showing an increasing trend and has reached a record level of 6.4 million tonnes.



Total fish production in India in 2018 is estimated at 6.24 million metric tons (MMT), which is close to two-thirds of the total fish production in the country from both capture and culture sources. The growth in the fish farming sector mainly comes from the freshwater aquaculture sector, as marine finfish culture is hardly practiced on a large scale. About 12.8 percent of total animal protein consumed in India comes from freshwater fish.

Historically, the Indian freshwater fish farming was based on a multi-species system. Natural fish food organisms were generated by adding organic and inorganic manure to water and the multi-species utilize this food based on the trophic system in the pond.

A combination of Indian major carps – including catla (*Labeo catla*), rohu (*Labeo rohita*) and mrigala (*Cirrhinus mrigala*) – were used as the main target species for culture, as well as a few Chinese carp species like silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*) and occasionally common carp (*Cyprinus carpio*). The very high level of technology developed for induced breeding of carps and the abundance of agri-byproducts used as supplemental feed led to the rapid development of freshwater aquaculture in the count.

### **Methods of Fish Production**

Fish production can be done in two ways:

#### **Capture Fishery**

Naturally occurring fish are harvested by capture fishery. Capture fishery is sometimes also known as wild fishery.

#### **Culture Fishery**

This is the controlled cultivation of fish in water bodies. It can also be referred to as fish farming or pisciculture. Note that pisciculture is a form of aquaculture as aquaculture is the scientific rearing and management of all aquatic animals.

Fishery is further divided into:

- Inland Fishery
- Marine Fishery

#### **Inland Fishery**

- In this, fishing is done in freshwater bodies, such as lakes, ponds, rivers, and tanks. Reservoirs where freshwater bodies and seawater bodies join also form inland fisheries.
- The method incorporated here is generally pisciculture, as the yield of capture fishery is not very high.
- 5-6 species are reared in one water body. This selection of species is such that they have different food habits yet there is no competition for food.
- Common varieties reared are Rohu, Catla, Grass Carp, Common Carp, etc.

#### **Marine Fishery**

- With the Indian landmass being a peninsula, we have been blessed with a coastline of 7517 km. Thus, fishing is a source of livelihood for 14 million people. These 14 million people cast their fishing nets in marine fisheries, i.e. in marine waters- the sea and the ocean.



- These are further divided into coastal fisheries that are near the shore and off-shore or deep-sea fisheries that are deeper in the sea.
- Sardines, mackerel, hilsa, tuna, Pomfret, mussels, prawns, oysters, etc. are some common types.
- The use of echo-sounders and satellites for the location of large fish to increases the yield.

### **Culture Fishery**

Culture fishery is also known as fish farming. Let us have a detailed look at the process of fish production by fish farming, and its advantages.

### **Fish Production & Fish Farming**

Pisciculture or fish farming is a process of breeding, raising, and transporting of fishes for domestic and commercial purposes. Fishes top the list when it comes to healthy and nutritional food options as they are a rich source of proteins and other minerals.

**There are mainly three types of pisciculture and different available. These are**

- **Monoculture** – This system allows farming a single species of fish. It offers high production and quality. These fishes are popular among consumers. Usually, in India, an example of monoculture fish is shrimp.
- **Polyculture** – It is also called composite or mixed fish farming. Polyculture lets rearing different species of compatible fishes in a shared pond. However, their feeding habits have to be different so that each of the species can survive on different food from a common resource. It is a beneficial kind of pisciculture.
- **Monosex Culture** – Generally, this culture allows growing either female or male fishes of a species. This is how fishes are obtained through this culture. One example of such fish is Tilapia.

Now that you know what fish culture is. Let's proceed with other details.

### **Fish Production**

Fish production refers to raising fish commercially for consumption. The Fish production process includes

- Capturing of fishes from their natural habitat. (capture fisheries)

### **Controlled farming or cultivating fish. It includes Pisciculture. (culture Fish Farming**

About half the fish consumed today is raised globally through fish farming. Some of the common fish species that are farmed include tuna, salmon, halibut, cod, and trout. The aquafarms can be in the form of mesh cages submerged in water or concrete enclosures on land. However, the fish farms can damage the ecosystem by introducing diseases, pollutants and invasive species.

### **Composite Fish Culture**

The composite fish culture framework is an innovation created in India by the Indian Council of Agricultural Research during the 1970s. In this framework, of both neighbourhood and imported fish, a blend of five or six fish species is utilised in a solitary fish lake. These species are chosen so they don't vie for food among them by having various sorts of food in their natural surroundings. Subsequently, the food accessible in every one of the pieces of the lake is utilised. Fish utilised in this framework incorporate catla and silver carp which are surface feeders, rohu, a section feeder, and marigal and normal carp, which are bottom dwellers. Other fish additionally feed on the excreta of the normal carp,



and this adds to the proficiency of the framework which in ideal conditions produces 3000-6000 kg of fish for every hectare each year.

One issue with such composite fish culture is that a large number of these fish breed just during rainstorms. Regardless of whether fish are gathered from the wild, they can be blended in with different species, also. In this way, a significant issue in fish cultivating is the absence of accessibility of good-quality stock. To conquer this issue, ways have now been worked out to raise these fish in lakes utilising hormonal excitement. This has guaranteed the inventory of unadulterated fish stock in wanted amounts.

### **Methods of Fish Farming**

Fish farming involves the following methods:

#### **Extensive Fish Farming**

In this type of farming, economic and labour inputs are low. The natural food production plays a major role in this type of farming. Fertilizers may be added to increase the fertility and hence, the production of fish.

#### **Semi-intensive Fish Farming**

This method implies moderate levels of economic and labour inputs. The production can be increased by supplementary feeding or addition of fertilizers. Thus, the production of fish is higher.

#### **Intensive Fish Farming**

In this method, the fish are stocked with as many fish as possible. The fish are fed with supplementary feed.

- fisheries)

### **Fish Farming Methods**

Different fish farms use different methods. Some of them are discussed below.

- **Cage System** – Metal cages are submersed into water that contains fish. This off-shore mode of farming allows feeding the fishes artificially.
- **Pond System** – In this system, people need a small pond or tank where fishes grow. It is one of the most beneficial fish farming techniques because the water containing fish waste is used to fertilise the agricultural field.
- **Integrated Recycling System** – This method makes use of large plastic tanks containing fish, placed in a greenhouse. Besides, there lies a hydroponic bed next to the tanks. Using the water from the fish tanks, people cultivate several herbs like basil, parsley, etc.
- **Classic Fry Farming** –Using this technique, the fishes are reared from eggs to fingerlings. Then they are released in stream water.

**These methods are essential when you write the answer to what is pisciculture.**

### **Recirculation System in Fish Farming**

The water recirculation system in aquaculture has aroused great interest worldwide. However, its production in a commercial scale has not yet been achieved, even with the advances that research has provided in the past few decades. Energy costs, associated with intensive fish production, are the main obstacles to expanding investments in this technology. Biological filtration, aeration, water circulation, and temperature control are necessary for obtaining good results. Therefore, the use of motors, pumps, heaters, and ventilation devices make energy a fundamental element in the entire process. Although, in



parts, it is not yet possible to confirm the economic viability of this system, as it largely depends on the balance between the high capital to be invested and operating costs.

If the water recirculation system intends to compete directly with other forms of production, such as excavated ponds and cages, the need to reduce costs cannot interfere with the quality of the water that must be supplied for long periods, because the fattening process only becomes profitable if repeated constantly. At high densities, the possibility of reusing water is an important alternative to conventional systems that normally impose environmental restrictions and generate conflicts over the availability of land and water. According to Blancheton [15], this system allows for the rapid growth of fish and the adequate use of natural resources, advantages that can undoubtedly favor its economic viability.

Feeding fish in captivity is processed differently from what happens in a natural environment, where decisive factors, such as the nutritional contribution of natural aquatic organisms in the farming ponds, as well as the effect of food on water quality and loss of nutrients, if the food is not consumed immediately, interfere with the zoo technical performance. The adoption of more effective cultivation technologies, which allow for good growth rates, reaching industrial production is only possible with food that meets the nutritional requirements of the species. Thus, in highly modified environments, such as floating cages, “raceways”, or ponds stocked with high densities, successful fish farming depends on nutritionally balanced foods.

### **Technological Evolution in Fish Farming**

Industry 4.0 is associated with engineering and computer science knowledge, coupled with multisensory schemes for aquaculture systems associated with online servers and/or workstations with the most appropriate software to manage and control the system, thereby contributing to improved aquaculture productivity and efficiency, while lowering the overall costs. Aquaculture 4.0 technologies are a long-term solution for increasing production (quantity and quality), while decreasing expenses and pollution in aquaculture. Because aquaculture can be offshore or onshore, abiotic and biotic factors influence the aquaculture system, which has a high influence on aquaculture productivity. The 4.0 technologies and methods must be developed to deal with the environmental demand from the aquaculture location and species cultivated.

Numerous technologies are now being used in different domains that can be included in aquaculture 4.0: recirculation aquaculture systems (RAS), smart aquacultures (offshore and onshore), and real-time water quality.

Aquaculture 4.0 programs provide farmers with real-time monitoring of water quality and aquaculture conditions. These systems can provide a large amount of information at intervals of seconds or minutes, allowing for the more accurate planning of aquaculture activities and the possibility of prompting alarms, in case of unsafe water conditions/quality or weather alerts (e.g., allowing the offshore systems to descend the fish cages to deep sea weight, reducing the negative effects of sea waves and bad weather in the aquaculture system). Additionally, the creation of a comprehensive database will aid in precise and specialised research to improve the efficiency of aquaculture over the medium- and long-term, minimising risks and elevating fish farming productivity.



## **Benefits of Fish Farming**

Following is the list containing the advantages of fish farming:

- Fish farming does not require a lot of resources; a small concrete tank is enough to start with.
- The farmed fishes grow under supervision to increase their nutritional value. Therefore, the quality of these fishes is superior to the wild ones.
- There are a wide variety of fishes suitable for farming. Thus, the owners of the fisheries can select the best kind of fish that will be profitable for them.
- People can transform any poor and infertile piece of land into a fish pond and earn money.
- Demand for fishery fish is increasing with passing days. Therefore, people can start fish farming by allocating some space to their existing farms. It will increase their income substantially.
- Fish farming has low-risk factors as the fishes are under confinement. This makes sure that the outsiders cannot access the place and catch fish.
- Since the fish are safe in the fish tanks, people do not need to catch wild fish on a large scale. It helps in restoring natural ecosystems.
- Another importance of fish farming is that it provides employment.

## **Advantages of Fish Farming**

1. The farmed fish provides high quality protein for human consumption.
2. Fish farming can be integrated into the existing farm to create additional income and improve its water management.
3. The farmers can select the fish species with desired characteristics to raise.
4. Fish in a pond are not accessible to everyone. Thus, they are secured and are harvested at will.

## **Challenges**

India must address some challenges to further develop its fish farming sector, including the following technical challenges

1. The country's sector is based and operates on a few fish species – carps, pacu and pangasius – and increasing this base will increase fish production.
2. Overproduction based on fewer species leads to oversupply of particular varieties of fish and this eventually leads to price drops and variability.
3. Lack of other potential aqua feed-consuming species or high-value fish in India, and this should be a consideration for new introductions. For example, tilapia farming is yet to take off in the country.
4. Lack of hatchery technology for the introduction of new species, which could include freshwater, brackish and marine species.
5. Species diversification will help stabilize prices and increase demand for formulated aqua feeds.
6. Freshwater fish farming is still based on traditional methods – large ponds, no water exchange, no draining, and no bottom sediment removal – that often lead to conditions that promote disease.
7. Use of modern culture systems that use less land and water will greatly benefit the sector and should be given more importance and prioritized.
8. The availability of water and unpredictable monsoons have a direct bearing on the country's aquaculture production. And some market challenges include:



9. The inferior quality of fish produced in inadequately managed production systems affects customers' acceptance and preferences.
10. The lack of adequate cold chain and distribution systems for fish as a perishable product affects availability and marketing.
11. The low farm-gate prices for low-value species does not support their economic performance. India should aim at adopting fish species and marketing systems that generate farm-gate prices of INR 120/140 per kg (U.S. \$1.72 to 2.00 per kg) at the lower scale, to INR 250/300 per kg (\$3.60 to 4.30 per kg) farm-gate prices for high-value, premium fish. This should include freshwater, brackish as well as marine fish species.

### Conclusions

The fisheries and aquaculture sector in the country is poised to play a major role in the lives of people in the coming decades, with increasing population pressure on land and alternate food production system being increasingly projected from the aquatic resources. The research and development activities as indicated above in the frontier areas of fisheries sector are urgently required on priority basis to meet the new challenges in fisheries sector and to make the whole system sustainable and eco-friendly. Such research and development support through various organizations will not only boost fish production and productivity but also ensure nutritional and food security, employment opportunities and socio-economic upliftment of the poorest of the poor. Thus, this review demonstrates that fish farming is evolving to be more neutral to the surrounding environment; it is also a hypothesis for being a good food source for humanity, due to being used aquatic systems and not arable land. The increase of coastal aquaculture can contribute to the production of much-needed extra food for the world's rising population. Increasing fish output, through the growth of coastal aquaculture, using ecologically friendly techniques and suitable adaptation measures for the physical cultivation methods used nowadays, is important.

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