

## **PRESENT STATUS AND PROBLEMS OF MUSSEL FARMERS IN KERALA-A CASE STUDY OF KOLLAM DISTRICT**

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### **Abstract**

Aquaculture simply means the production of aquatic organisms as well as fishes, molluscs crustaceans, and aquatic plants. This form of cultivation originated in China about 4000 years back. Kautilya's Arthashastra- one of the oldest Indian epics indicates that fish culture activity in India dates back to 2000 years. Mussels are included in the molluscan species. Open sea and estuaries are most suitable for mussel farming. Farming of Mussel is most important due to their advantages like they feed directly on the primary producers like the phytoplankton and it can be farmed three dimensionally in the water column at the farm site. Aquaculture is the fast growing food production sector with an average of 4.8 % annual growth during 2011-17. In 2017 the total production reached 80 Million Tones and total sale value to 238 Billion. In 2017 among the top producers of Aqua products (excluding aquatic plants and non food products) china is the first position with 46.8 M.T and India standing second with 6.2 M.T. Green Mussel (*Perna Viridis*) and Brown Mussel (*Perna Indica*) are most available mussels along the Indian coast. Total mussel production in 2017 was 2.16 MT through aquaculture and 86,000 t in capture fisheries all over the world. Annual bivalve production in India during the year was 84483 t. Among this Clams dominated the fishery contributing 72.9% to the annual bivalve production followed by oysters 20.5% and mussels 6.5%. Major share of the bivalve production of the country was reported from the State of Kerala (75.8%). Total inland and marine fish productions of Kerala in 2013-14 was 186337 t and 522308 t respectively. But in 2017-18 inland fish production has increased to 189081 t and marine fish production decreased to 483686 t. Total mussel production during 2013-14 was 23969 t in Kerala and 680 t in kollam district. In 2017-18 total mussel production in Kerala is decreased to 2541 t and in kollam district the same is 195 t. The present statistics shows that there are some serious issues related to the farming of mussels in kerala.

## INTRODUCTION

Aquaculture simply means the production of aquatic organisms as well as fishes, molluscs crustaceans, and aquatic plants. This form of cultivation originated in China about 4000 years back. Farming means there are some interventions in the culturing process to increase production like regular stocking, feeding and protection from predators.(FAO Year book 2017). Aquaculture originated in China over 4000 years ago. Egyptian tombs dating from 2500 BC depicted tilapia culture and by 2000 BC Japan was rearing oyster. Aquaculture productions are mainly done in three culture environment like Freshwater,Brackishwater,and Marine.The distinction among these culture environments is mainly based on the salinity of water. In freshwater salinity is consistently negligible, but in brackish water rate of salinity is comparatively high and will be changed with the influx of fresh water and marine water. Marine water is full with salinity and there are no significant changes in salinity level. What type of species is culturing is decided on the basis of culture environment. Mussels are included in the molluscspecies.Open sea and estuaries are most suitable for mussel farming.Farming of Musselis most important due to their advantages like they feed directly on the primary producers like the phytoplankton and it can be farmed three dimensionally in the water column at the farm site. In western countries mussel is considered as poor man's oyster. But in India mussel is considered as a tool for the empowerment of the poor people living in the coastal areas.

### **Aquaculture Global Scenario**

Aquaculture is the fast growing food production sector with an average of 4.8 % annual growth during 2011-17. In 2017 the total production reached 80 Million Tones and total sale value to 238 Billion. In 2017 among the top producers of Aqua products (excluding aquatic plants and non food products) china is the first position with 46.8 M.T and India standing second with 6.2 M.T (FAO Year book 2017). Among the Asian countries India ranked second in aquaculture production and third in capture fisheries. World aquaculture production includes Finfish 53.4 M.T (66.6%), Molluscs 17.4 M.T (21.7%), Crustaceans 8.4 M.T (10.5%) and other aquatic animal 0.9 M.T (1.1%) in 2017. Among the crustaceans species, mussel production in 2017 was 2.16 MT through aquaculture and 86,000 t in capture fisheries. The total world production of aquatic plants mostly from marine macroalgae (seaweeds) reached 32.9 M.T in 2017 of which 31.8 M.T (96.6%) was harvested from aquaculture.(FAO Year book 2017). Many millions of people around the world find source of income and livelihood in the fisheries and aquaculture sector. 40

Million people were directly engaged in capture fisheries and 20 Million people were directly engaged in aquaculture (FAO 2018). The total engagement of women both in fisheries and aquaculture was around 13 % of the primary work force.

### **Aquaculture in India**

Kautilya's Arthashastra- one of the oldest Indian epics indicates that fish culture activity in India dates back to 2000 years (De & D.K Pandey-2014). In India fish in the diet is the most important in the east and south India. Fish is a nutrient dense food. Since India has predominantly an agricultural economy, about 80% of India's population live in villages and 90% of its rural population depends on agricultural and allied activities for their livelihood (Sudipto Sarkar & Bimal Chanra Mal-2005). India is blessed with huge inland water resources (29,000 Kms of rivers, 0.3 million ha of estuaries, 0.19 million ha of back waters and lagoons, 3.15 million ha of reservoirs, 0.2 million ha of flood plain wetlands and 0.72 million ha of upland lakes (S. Ayyappan). India is the second largest producer of fish and fresh water fish in the world (Annual report-2017-18, Department of Animal Husbandry, Dairying and fisheries GOI). India has wide area of coast line about 8129 Km. Annual bivalve production in India during the year was 84483 t. Among this Clams dominated the fishery contributing 72.9% of the annual bivalve production followed by oysters 20.5% and mussels 6.5%. Major share of the bivalve production of the country was reported from the State of Kerala (75.8%). Karnataka (11.8%), Tamil Nadu (4.3%), Andhra Pradesh (2.5%), Odisha (2.4%), Maharashtra (1.7%), West Bengal (1.4%) and Goa (0.2%) contributed nearly 24.2% to the total bivalve production. (CMFRI Annual report 2016-17). There are mainly two categories of mussels are found in India namely Green mussel (*Perna viridis*) and Brown mussel (*Perna indica*). Green mussels are widely distributed and found extensively around Kollam, Alappuzha, Kozhikode, Kannur and Kasargod in Kerala and in small beds in Chilka lake, Visakhapatnam, Kakinada, Chennai, Poduchery, Cuddalore, Mangalore, Karwar, Goa, Ratnagiri and in Gulf of Kutch. But Brown mussels are restricted distribution and is found along the south west coast from Varkala to Kanyakumari and south east coast from Kanyakumari to Thiruchendur (ICAR & CMFRI Technical bulletin).

## **Aquaculture in Kerala**

Total fish production in Kerala was 6.73 lakh tones out of it 4.84 lakh tones from marine landings and 1.89 lakh tones from inland (Economic Review 2018- State Planning Board). The population of Kerala is 334 lakh as per the census 2011 and the population of fisherfolk is estimated around 3.1% of the census population, ie 10.34 lakh. Out of it 7.96 lakh from marine and 2.38 lakh from inland. District wise fish production shows that Kollam, Thiruvananthapuram and Ernakulam are the first three districts in marine fishing whereas in inland production of fish Kasaragod, Kottayam and Alappuzha are standing highest three positions. In total fish production Kollam district is ranked first followed by Ernakulam and Thiruvananthapuram. (Economic Review 2018- State Planning Board) . Kerala has a vast line of coastal area of 590 km and rich in other water resources, ie, 44 rivers, 1620 ha of fresh water lakes, 65213ha of brackish water area, 1486.69 ha of panchayath ponds, 479.37 ha of holy ponds and streams, 495.49 ha of village ponds and other water holds and 2834.38 ha of irrigation tanks (Fisheries Hand Book 2019, Dept. of fisheries GoK). Annual bivalve production in India during the year was 84483 t. Among this Clams dominated the fishery contributing 72.9% to the annual bivalve production followed by oysters 20.5% and mussels 6.5%. Major share of the bivalve production of the country was reported from the State of Kerala (75.8%).

## **OBJECTIVES OF THE STUDY**

1. To ascertain the present status of Mussel culture in Kerala.
2. To analyse the production and marketing problems of mussel farmers in Kerala with special

reference to Kollam District.

## **Mussel Farming**

Mussel farming has a great history since thirteenth century. Farming of molluscan species are most important in relation to the increasing protein demands among human population. The main mussel production countries are China, Korea, Spain, Netherlands, Denmark, France and New Zealand. Among the Molluscan species, Mussel, Oyster, Clams are the most demanded. Among this mussels have high acceptance in the nutritional food

sector. Mussel farming was in practice from thirteenth century. As per the 2017 Year book of FAO indicates that out of the world aquaculture production 21.7% (17.4 M.T) from molluscan culture. This report showing the importance of molluscan culture in aqua farming..Annual bivalve production in India during the year was 84483 t. Among this Clams dominated the fishery contributing 72.9% to the annual bivalve production followed by oysters 20.5% and mussels 6.5%. Major share of the bivalve production of the country was reported from the State of Kerala (75.8%). Karnataka (11.8%), Tamil Nadu (4.3%), Andhra Pradesh (2.5%), Odisha (2.4%), Maharashtra (1.7%), West Bengal (1.4%) and Goa (0.2%) contributed nearly 24.2% to the total bivalve production.(CMFRI Annual report 2016-17)Central Marine Fisheries Research Institute (CMFRI) is the prominent institute in giving special training and practices in mussel farming. CMFRI has developed a number of eco friendly culturing techniques for mussel farming in India since early seventies. For mussels are grown only in marine water and brackish water. In fresh water mussels cannot grow well since the rate of salinity is negligible. In estuaries there is a chance for the influx of fresh water during the monsoon causes mortality of the mussels.

### **Mussel farming in Kerala**

Kerala is endowed with rich mussel resources and has a vastline of coastal area of 590 km and 65213ha of brackish water area. Major share of the bivalve production of the country was reported from the State of Kerala (75.8%). Clams formed 85.3% of bivalve production in the State followed by edible oysters (11.1%) and mussels (3.6%) (CMFRI Annual report 2016-17). Open sea and estuarine areas free from strong wave actions are most suitable for mussel farming. Open sea mussel culture was initiated by CMFRI off Vizhinjam and off Calicut during 1970's (K.S Mohammed, et al-2015). During 1996-97, mussel culture was done on a large scale at padanna with the involvement of a group of twenty five fisher women. Financial support was given by the DWCRA. This programme proved the scope of mussel culture and was profitable utilizing available brackish water resources in the estuaries of north Kerala. Mussel is popularly known as "Kallumekai/Kadukka/Chippi" in Malayalam language. Green Mussel (*Perna Viridis*) and Brown Mussel (*Perna Indica*) are most available mussels along the Indian coast. Along the Kerala coast major locations are Koduvally, Mahe, Chombala, Moodadi, Thikkodi, Elathur, chaliyam and South beach, Anchangadi, Ethai, Narakkal, Chellanam, Andakaranazhi, Azhikkal, Paimanam, Port Kollam and Neendakara (K.S. Mohammed et al 2015). In mussel farming adoption of technology was easy since it was simple, low cost, no additional feed required, eco friendly, short

culture period and good market demand are the main advantages. The growth of mussel is influenced by a number of environmental factors such as water quality, food availability, settling density, water current, and tidal exposure. The farmed mussels give better meat yield when compared to mussels from natural bed. The average edible portion of the meat in cultured mussels ranges from 34.5% to 40.5%, whereas in the natural bed the meat yield is ranges only from 27.2% to 33.3% (K.S.Mohammes et.al 2015). During post monsoon period there is heavy settlement of mussel spat along the entire Kerala coast. This seed can be used for farming. Mussels reach harvestable size (55-70 mm) within 4-5 months when culture. Many experiments show that culturing of mussels conducted from November to May will be much advantageous for good growth and survival especially in most estuaries of Kerala.

There are different methods are following for mussel farming all over the world. They are Bouchot or Intertidal pole culture, Stake Culture, On bottom culture, Long line culture, Raft culture, Rack culture. Among the above said culture practices Raft culture is most widely used in Kerala due to their adoption advantages. Raft culture technique has its origin in Spain in the Galician Bay. The basic principle behind the raft culture is that mussels are suspended from the raft. The raft itself is anchored to the sea bed removing the need for several anchoring system. Raft culture is most suited to areas of dense phytoplankton and to smaller operations, as there is less scope for mechanical harvesting. Floating rafts of 5X5 m or 6X6m or 8X8m fabricated out of teak pole and Bamboo poles duly buoyed and anchored firmly are used for suspending culture ropes in the coastal seas at depth ranging from 5-15 m. Mussel farming has two distinct stages, first one is spat collection and next is grow-out. Mostly seeds are collected from natural beds are used in farming. Hatchery technologies are also being used for commercially developing seeds. Seed collected from submerged (subtidal) places are more healthier. Ideal size of seed is 20-25 mm. Around 500 to 750 g of seed is required for seeding on one meter length of rope. The length of the rope is decided after considering the depth where raft/rack is positioned. Nylon rope of 12-14 mm or 15-20 mm coir rope can be used for seeding. Here old cotton net, cotton mosquito net or cheap cotton cloth etc. may be used for covering the seeds around the rope. To avoid slipping of the mussels due to growth a 4 mm nylon rope is wound around the 12-14 mm seeded rope with knots at a distance of 25 cm before seeding. The seed with secrete byssus threads and will attach itself to the rope. A mesh netting is used to cover the mussels to prevent them from detached and lost. And also a barrier will be placed at the bottom of the pole to prevent predators reaching the mussel.

Harvest will be done when mussel reaches marketable size and condition index is high, normally harvest season is from April to June. Mussel ropes are collected manually and undergo the depuration process for purification. The peculiar feeding habit results in the retention of a lot of foreign particles like mud, sand bacteria etc. in the intestine. To ensure the safety of mussel meat, the mussel have to be depurated first. A simple depuration can be achieved by starving the mussels in clean and filtered sea water/brackish water for a certain period of time. The mussel meat can be removed by two methods, one is meat can be shucked out with a clean knife from the live shell on mussels, the second is the shell on mussels can be steamed/cooked to open out the shell and the meat taken out.

### **Mussel Farming in Kollam**

Kollam district is situated in the southern part of Kerala with vast area of sea water, brackish water and fresh water resources. In kollam there are 273.7 ha of fresh water resources including 62.93 ha of panchayath ponds, 24.96 ha of holy ponds and streams, 35.55 ha of village ponds and other water holds and 150.26 ha of irrigation tanks. And also includes 440 ha of fresh water lakes and 8604 ha of brackish water area. The total area of rivers in kollam district is 7227.19 ha. Total inland and marine fish productions of Kerala in 2013-14 was 186337 t and 522308 t respectively. But in 2017-18 inland fish production has increased to 189081 t and marine fish production decreased to 483686 t. Total mussel production during 2013-14 was 23969 t in Kerala and 680 t in kollam district. In 2017-18 total mussel production in Kerala is decreased to 2541 t and in kollam district the same is 195 t. (Fisheries Hand Book 2019, Dept. of fisheries GoK). The present statistics shows that there are some serious issues related to the farming of mussels in Kerala.

### **Marketing of mussels**

A variety of products have been developed in India from mussel meat. The proximate composition of mussel meat includes moisture (80%), protein (13%), glycogen (3.50%), fat (1.50%) and minerals (1.5%). Mussels are exporting to different countries in the frozen and dried condition. The main drawback of mussel marketing is the lack of appropriate price structure and assured market for the product. The product can only be exported if it meets the quality and sanitation standards prescribed like, Bureau of Indian Standards (BIS), Hazard Analysis Critical Control Point (HACCP), International Organisation of Standards (ISO 9002) and European Economic Community norms. A



number of variety of mussel products are being developed from mussel meat, ie, dried and smoked mussel meat, marinated mussel meat, mussel meat pickle, mussel meat chutney powder, canned mussel meat, ready to serve mussel meat etc. The mussel shells are composed with calcium carbonate and so it can be commercially used to make lime.

### **Problems of mussel Farmers**

Molluscs from valuable fisheries in various parts of the coasts of India providing shell fish as food and as source of lime, pearls, and decorative shells, as constituents of medical preparations, etc. (K. Nagappan Nayar et al 1985). The high productivity, the presence of huge quantities of unexploited seed in natural bed, high rate of yield in a short period when cultured and pollution free water are some of the favorable factors for large scale farming of mussels in Indian waters (K. K. Appukkuttan 1996). Clear sea water with rich plankton production (17-40 mg chlorophyll 11/1) is considered ideal for mussel farming. Problems of mussel farmers include Production problems and Marketing problems.

The important variables identified in production problems are,

Selection of Land and type of water, Siltation of back water, Availability and quality of Seed and seeding, Harvesting methods and post harvest technology, Adoption of new technology in processing, Agency support, Training to farmers and Problems related to natural disturbances,

The important variables identified in marketing problems are,

Influence of middlemen, Price fixation of the product, Structure of market, Transportation cost, Distribution channel, Storage facilities, Advertisement/Other promotional activities, Structure of domestic market, Quality standards for export market, Low popularity among people, Production of more value added products, Perishability of the product and cost of marketing.

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