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A Review on Mariculture in India

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Abstract

According to the FAO's "Global Aquaculture Production" database, the annual global production of aquaculture has increased at an average rate of around 8% over the past three decades, outpacing any other major animal food production sector. This rapid global increase in production is occurring alongside a slow decline in marine fisheries catches. India, with its extensive coastline and abundant marine resources, has immense potential for the development of its fisheries sector. With a record fish production of 175.45 lakh tons in FY 2022-23, India has become the third-largest fish-producing country in the world. Mariculture, including open sea cage farming of finfish and shellfish, assumes great importance in this context. Mariculture involves the cultivation of marine organisms for food and other products in the open ocean, tanks, ponds, or raceways filled with seawater. Species such as sea bass, cobia, and pompano have been identified as suitable candidates for mariculture due to their high commercial value and market demand.

Keywords: Mariculture, Fisheries, Fish, Resources

Introduction

The Food and Agriculture Organization (FAO) of the United Nations defines aquaculture as the cultivation of aquatic organisms such as fish, mollusks, crustaceans, and aquatic plants by individuals or corporations. In aquaculture, interventions are made in the rearing process to enhance production [1]. While aquaculture is a practice with origins dating back more than 3000 years [2], Aquaculture products have only recently been recognized by the United Nations Statistical Commission as distinct global commodities, despite the practice having origins dating back more than 3000 years [3]. According to the FAO's "Global Aquaculture Production" database, the annual global production of aquaculture has increased at an average rate of around 8% over the past three decades (since 1980). Despite a recent slowing in global trends, growth remains higher than any other major animal food production sector. This rapid global increase in production is occurring alongside a slow decline in marine fisheries catches [4]. There is a growing global focus, largely driven by demand from Western countries, on increasing the intensive production of omnivorous and carnivorous

species farmed and harvested in maritime and brackish coastal environments, a practice known as mariculture [5]. The farming of these species, such as salmon, groupers, seabasses, and prawns, typically relies heavily on inputs such as wild post-larvae and juveniles, fishmeal, fish oils, as well as significant amounts of water, land, and energy [6]. As a result, mariculture has faced widespread criticism due to its often-negative impacts on marine and coastal ecosystem health. Negative associations have been drawn between mariculture and its effects on marine capture fisheries and food security [7].

Resources

India, with approximately 8,118 kilometers of coastline, nearly 2 million square kilometers of Exclusive Economic Zone (EEZ), and half a million square kilometers of Continental Shelf, possesses abundant marine resources. From these resources, India has an estimated fisheries potential of 4.41 million tonnes. In this context, the optimum utilization of resources becomes pivotal to achieve the targeted production. It is against this backdrop that we aim to harness all possibilities for the intensive and integrated development of the fisheries sector [8].

Marine Capture Fisheries

Marine capture fisheries are undergoing significant changes due to increasing fishing effort. The catch of almost all commercially important marine finfish and shellfish is on a declining trend, leading to severe resource depletion and unemployment. The decline in marine capture fishery also affects the availability of affordable protein for the public and impacts the GDP growth of the country. It is in this context that mariculture, including open sea cage farming of finfish and shellfish, assumes great importance [9]. With a record fish production of 175.45 lakh tons in FY 2022-23, India has become the third-largest fish-producing country in the world, accounting for 8% of global production. The fisheries sector contributes about 1.09% to the country's Gross Value Added (GVA) and over 6.724% to the agricultural GVA. The sector has immense potential for growth, which calls for focused attention through policy and financial support to ensure sustainable, responsible, inclusive, and equitable development. The overall marine fish landings in the country included 18.72 lakh tonnes of pelagic fishes, 8.74 lakh tonnes of demersal fishes, 2.23 lakh tonnes of molluscs, and 3.73 lakh tonnes of crustaceans. These landings are made by various fishing crafts at 1269 designated locations, which include fifty fishing harbors across the coastal regions of the country[10].

Mariculture

Mariculture is a specialized branch of aquaculture involving the cultivation of marine organisms for food and other products in the open ocean, or in tanks, ponds, or raceways filled with seawater. Examples include the farming of marine fish such as cobia, pompano, and sea bass, as well as shellfish like lobster and oysters, along with seaweed, all in saltwater environments. Non-food products produced by mariculture include fish meal,

nutrient agar, jewelry (e.g., cultured pearls), and cosmetics. Fish raised through mariculture practices are often perceived to be of higher quality than those raised in ponds or tanks, and mariculture offers a more diverse choice of species [11].

Open Sea Cage Culture

Open sea cage farming is eco-friendly and typically conducted in areas of the open sea where wave action is minimal. The fishes cultured in these cages are high-value species, leading to a significant export demand for cage-cultured fishes. A cage, which can be of any shape or size, is an enclosure used for the culture of biotic organisms such as finfish and shellfish in captivity, with a specified objective. The cages are enclosed on all sides, except for an opening at the top for providing feed. The size of a sea cage can vary from 6 to 12 meters in diameter for fish farming in the open sea, where the wave and tidal impact is suitable for farming. A series of cages are typically spaced in a battery for better operation and management [12].

Marine Finfish Culture

[1] Cobia (*Rachycentron canadum*):

Cobia is one of the suitable species for open sea cage farming. It can reach a body weight of about 3-4 kg in one year and 8-10 kg in two years. Brood stock development of cobia was initiated by CMFRI at Mandapam during 2007-08. The technology for cobia seed production and farming was standardized by CMFRI and has been successfully adopted by fish farmers. The successful sea cage farming of cobia by the 'Cobia Farming Association' in the Palk Bay region, Rameswaram, and its subsequent adoption by many fishermen groups in Tamil Nadu, Kerala, Karnataka, and Goa, indicate that the technology is commercially viable. Currently, in the Mandapam-Rameswaram area, more than 50 cages are deployed for cobia farming by fishermen groups. There is a significant demand for seed to deploy further cages for cobia farming [13].

[2] **Sea bass (*Lates calcarifer*) :**

Sea bass is one of the most important candidate species for open sea cage culture and pond culture due to its high commercial value. Seed production technology has been developed and standardized by ICAR Institutes. Protocols for nursery and rearing of sea bass have been developed by CMFRI and CIBA. Several successful cage and pond farming demonstrations have been conducted. CMFRI has perfected cage culture of sea bass at Karwar in Karnataka and has successfully achieved production of about 3 tonnes of fish from a 6-meter diameter cage.Sea bass seeds are produced in the hatcheries of Rajiv Gandhi Centre for Aquaculture (RGCA) and CIBA. However, hatchery production meets less than 40% of the demand. Sea bass is successfully farmed along the coasts of Maharashtra, Goa, Karnataka, Tamil Nadu, Andhra Pradesh, and Kerala [15].

Seabass fingerlings (5.5 cm each) were procured from the Rajiv Gandhi Centre for Aquaculture (RGCA), Tamil Nadu. Each oxygen-filled polythene bag contained 100

juveniles and was transported during October-November. Farmers typically formed procurement groups to share transportation expenses and associated costs. Seed bags were transported in air-conditioned vans for distances up to 1,000 km, incurring an average transportation cost of US$ 671-745 per trip to bring 10,000 juveniles. During transportation, approximately 15-20 percent of the fish died due to stress factors and the acclimation process. Farmers stocked 5,000-6,000 fingerlings per cage, but only 1,000-1,200 survived, largely due to cannibalism during the juvenile stages.Typically, farmers cultured seabass for 18-20 months to achieve a weight of 3-4 kg. Some farmers experimented with stocking stunted fingerlings procured from private hatcheries in Vijayawada. However, due to disease problems, the survival rate was very poor, and one farmer incurred a loss of US$ 7,455 on seed and transportation. Maintaining the quality of seabass fingerlings is crucial to maximize survival during transportation. [15].

[3] **Silver pompano** (***Trachinotus blotchii***):

Silver pompano is also a suitable species for marine aquaculture due to its wide acceptability and medium size, making it suitable for small families. It has the ability to accustom to pellet feeds, wide tolerance to water quality, and high market demand. The Central Marine Fisheries Research Institute (CMFRI) has achieved successful brood stock development, induction of spawning, and larval production of silver pompano. The technology for silver pompano seed production and farming, developed and standardized by CMFRI during 2011-15, has been successfully adopted by fish farmers. The techno-economic viability of coastal pond farming of silver pompano was demonstrated by CMFRI in Andhra Pradesh during 2012. Silver pompano is found to grow faster in low salinities (10-25 ppt), is less cannibalistic, and more resistant to a wide range of diseases. It commands a good price in both domestic and international markets. Pompano seeds have been supplied to many farmers in Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, Goa, Gujarat, and West Bengal for commercial culture[16].

Weight of the fish	Feed Size	Crude Protein %	Crude Fat %	% to be fed as per the biomass	Feeding/day
> 1 gram	800 - 1000 µ	50	10	30	4
1-10 gram	1.0 - 1.5 mm	40	8	20	4
10-100 gram	1.8 mm	35	8	8	3
100-250 gram	3.5 mm	30	6	5	3
250-500 gram	4.5 mm	30	6	3	3

Source (Jayakumar *et al*., 2014)

Conclusion: -

The Practice of Aquaculture, As Defined by The Food and Agriculture Organization (Fao) Of the United Nations, Involves the Cultivation of Aquatic Organisms Such as Fish, Mollusks, Crustaceans, And Aquatic Plants by Individuals or Corporations, With Interventions Made in The Rearing Process to Enhance Production. Mariculture, which involves the intensive production of omnivorous and carnivorous species farmed and harvested in maritime and

brackish coastal environments, has been criticized for its negative impacts on marine and coastal ecosystem health, as well as its implications for marine capture fisheries and food security. Mariculture, as a specialized branch of aquaculture, offers opportunities for the cultivation of marine organisms for food and other products in the open ocean or in tanks, ponds, or raceways filled with seawater. Species such as sea bass, cobia, and pompano have been identified as suitable candidates for mariculture due to their high commercial value and market demand.

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