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CAGE FARMING OF FINFISHES IN ESTUARIES

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The importance and popularity of culture of food fishes is increasing rapidly in coastal states of India. The support and expanse of marketing network and advancement of preservation technologies solved long standing problems marketing in domestic as well as international market. In view of its high demand in internal and international market, more and more entrepreneurs are getting interested in the farming of food fishes. Innovations in cage culture technology and its success has drawn the attention of policy makers into giving thrust on food fish culture. Those who have invested huge amount in shrimp culture installations along the coastal areas are also showing interest in switching over to food fish farming following these developments and setback in shrimp culture. In estuaries cage culture is the most viable technique to rear fin fishes. The indigenous technology is developed in cage culture of food fishes in India. There are two general types of cages, floating and stationary. A floating cage is made up of a floating unit from which a single or a series of netcages are suspended. Some of them are mobile and can be easily towed away. A stationary cage, on the other hand, is tied to fixed poles at their corners. In Asia, finfish like grouper (*Epinephelus tauvina*), seabass (*Lates calcarifer*), snapper (*Lutjanus* spp.) and siganid (*Siganus* spp.) are cultured in commercial scales in tropical countries such as Singapore, Thailand, Malaysia, Philippines, Indonesia and Hong Kong.

Fishing and aquaculture are in the past have tended to be treated as distinct and isolated sectors. 'capture-based aquaculture' is form of overlap between fisheries and aquaculture which is being propagated in many parts of the world successfully. The fishing is put at the service of aquaculture or aquaculture is practiced to avoid the loss of fishery due to juvenile exploitation. Capture-based aquaculture is the practice of collecting "seed" material – from early life stages to adults - from the wild, and its subsequent on-growing in captivity to marketable size, using aquaculture techniques.

Capture Based Aquaculture (CBA) is a global activity but has specific characteristics that depend on geographical location and the species being cultured. The species groups used in capture-based aquaculture include molluscs (e.g. oysters, mussels, scallops), crustaceans (e.g. shrimps, crabs) and finfish (e.g. eels, grey mullets, milkfish, yellowtails, groupers, rabbitfish, tunas). In world wide CBA is practiced in many species following are some of the species, with the countries where it is practiced.

- Shrimp (*Penaeidae*) in South America and South-East Asia;
- Milkfish (*Chanos chanos*) in the Philippines, Sri Lanka, Pacific Islands and Indonesia;
- Eels (*Anguilla* spp.) in Asia, Europe, Australia and North America, mainly in China, Japan, Taiwan Province of China, The Netherlands, Denmark and Italy;

- Yellowtails (*Seriola* spp.), mainly in Japan, Taiwan Province of China, Viet Nam, Hong Kong, Italy, Spain, Australia and New Zealand;
- Tunas (*Thunnus* spp.) in Australia, Japan, Canada, Spain, Mexico, Croatia, Italy, Malta, Morocco and Turkey
- Groupers (*Epinephelus* spp.), which is now widespread in Indonesia, Malaysia,Philippines, Taiwan Province of China, Thailand, Hong Kong, People's Republic of China, and Viet Nam, and in other parts of the tropics, for example in southeasternUSA and Caribbean. Grouper culture is also on-going in India, Sri Lanka, Saudi Arabia, Republic of Korea and Australia.

These species are caught and farmed using various techniques and systems, depending on different cultural, economic and ethnical traditions. In some areas this is typically artisanal, rather than industrial in nature. Economic considerations are the key drivers for capture-based aquaculture. The selection of species for culture reflects their acceptability and demand in local or international markets. Market requirements are determined primarily by people's tastes and customs. As capture-based aquaculture potentially generates higher profits than other aquaculture systems, the market demand for the products and species cultured is high and it is likely that efforts to promote this activity will significantly increase. This development will be capable of causing a number of very important and diverse effects, not all of them beneficial.

Cage based aquaculture is getting adopted rapidly in many parts of the country. When it is being practiced in high intensity some of the scientific factors has to be taken care.

The number of cages should be according to the carrying capacity of the water body and the number of cages exceeds its carrying capacity, it will effect fish growth and survival.

There is a strong need for better data on the biology and fisheries of the species. Accumulation of uneaten feed and fish excreta under the cage can become an environmental problem, but this can be avoided by selecting a site with good water exchange to install the cage. Capture-based aquaculture provides significant positive returns in areas with depressed and marginal economies, and an alternative livelihood for coastal communities. However, the difficulties of marketing fresh fish and supplying markets that demand live fish (e.g. groupers), and the need to expand markets limit its potential. Skill gaps are evident in the sector, including specific knowledge on economics and management, the suitability of individual (new) species for culture, information on their biology and dietary requirements, and marketing. Capture-based aquaculture is labour intensive in its farming and processing operations, and can contribute to poverty alleviation in developing countries.

Legal and security issues

We will have to envisage some difficulties in future development of capture based aquaculture. Security of the cages is the major issue. For leasing the inland waters and estuaries, the provisions were made in the 73rd and 74th amendments to the Constitution of India empower the panchayats to perform functions mentioned in the eleventh schedule of the Constitution in 29 subjects including fisheries. However, due to lack of legal clarity this has not been implemented in any panchayat. Leases policies should be guided by a set of rules and principles relevant to public trust responsibilities and should specify the size of farm, duration of farming and other terms of lease. Rents thus collected should be used for development of coastal areas.

Food safety issues

The success of cage culture depends on maintaining good water quality around the fish cages and so it is in the farmer's best interests to minimize environmental impacts. Size and intensity of the process should fit to the size of the water body and water exchange rate. It may facilitate to overcome adverse impacts on water and sediment quality. In common with other types of aquaculture, careful choice of aquafeed ingredients and on-growing sites, in addition to good management practices, are necessary to avoid the accumulation of chemical and antibiotic residues, in order to ensure the continued safety of farmed products. Capture-based aquaculture provides other opportunities to reduce the risks associated with food safety.

Demonstration experiments by Central Marine Fisheries Research Institute

Central Marine Fisheries Research Institute is one of the pioneer Research Centres in transferring mariculture technologies in the State of Karnataka. The participatory approach gave exposure to the local fishers on the finfish rearing aspects besides creating awareness on this lucrative farming technique. Encouraged by this success many fishermen group evinced interest in rearing finfish in suitable farming areas near their backyard.

Karnataka state has 8,000 hectares of unpolluted brackish waters and estuarine areas, which are highly suitable for capture based aquaculture. The local fishermen use dragnets, castnets and gillnets in estuarine and coastal waters, which harvest juveniles of commercially important cultivable finfishes. These juveniles fishes though live at harvest are invariably discarded due to low market demand. The juvenile of commercially important species such as redsnapper, pearlspot, mullets, seabass etc are available in the inshore waters of Karnataka for CBA.

Seed survey for cultivable finfishes

Detailed survey of the estuaries and coastal waters were done from Mangalore Research centre to study the availability of fish seed along the coast. The gears operated during the monsoon season were hand trawls, cast nets and gillnets. It was observed that during the monsoon season lots of juveniles of economically important species are also caught along with the market size fishes. *Etroplus* and *Gerres* juveniles are caught in large quantity in Netravathi and Gangoli estuary. Usually these are discarded and efforts are made to collect these fishes and grow them in the cages as a part of CBA programme. Cages of netlon material was designed with inner nylon net to grow the juveniles discarded in fishery. Specially designed netlon cages fabricated locally with the participation of the fishermen were used for farming. The dimensions of the cages 2.5x2.5 m with a depth of 1.5 m Provisons were made to withstand water level changes during high tide and low tide.

Demonstration experiments in Karnataka

The concept of CBA was introduced in this village by collection of *Lutjanus argentimaculatus, Etroplus suratensis* and *Lates calcarifer* fingerlings and stocking in floating cages of 2.5 m x 2.5 m x 2 m, made of Netlon (mesh of 30 mm) lined with nylon net. It was envisaged to use local seeds for culture, in addition to assure good production seeds for *Lates calcarifer* was supplemented by CMFRI. The netlon cages was designed and fabricated by CMFRI with the participation of local fishermen. Five cages were provided to the fishermen for stocking the fingerlings.

The technology envisages the utilization of juveniles which were otherwise discarded due to small size, but if there is a high demand for the seeds for cage culture, this exploitation may lead to stock reduction in estuaries and also lead to social conflict between capture fisheries and culture fisheries. The development of seed production in hatcheries on an economically viable commercial scale, and the refinement of grow-out technology to ensure that the fattening phase is environmentally acceptable are the critical issues for the future. Failure to address these matters successfully would have severe consequences for both aquaculture and capture fisheries. So attempts are being made to complement the CBA cages with hatchery reared finishes which may be a viable option in the future.

Husbandry:

The red snapper and pearlspot fingerlings were continuously stocked by fishermen and the fishermen community was engaged in the cage setting, cage cleaning, feed sourcing, feed preparation and feeding. Feeding was done with locally available trash fish and also fish waste from fish processing areas/plants.

Production and Harvest:

Altogether five cages were installed and three of the cages were partially harvested as and when the fishes were grown to marketable size, to meet day to day needs of the fishermen. Two cages were spared for final harvest to demonstrate total production possible from these cages.

Theses cages were harvested during July, 2011, when the mechanized fishing is banned. The Lutjanus sps attained an average weight of 755 ± 415 g ranging from 105 to 1,914 g. The pearlspot ranged from 37-222 g (96 ± 35g). About 255 numbers of seabass of average weight 1819 ± 540 g was harvested. The total production from the cages including seabass, red snapper and pearlspot was around ~400 kg realizing a farm gate price of ~ Rs 75,000 per cage.

Table 1.Harvest details (2 cages)

Species	Mean size	Mean weight	Numbers	Harvest wt.(kg)	Amount (Rs)
Red snapper	350 ± 70 mm (190-500 mm)	755 ± 415g (105-1914g)	105	150	27,000
Pearlspot	158 ± 17 mm (115-205 mm)	96 ± 35g (37-222g)	988	150	22,500
Seabass	510 ± 50 mm (310-620 mm)	1819 ± 540g (262-3049g)	255	450	99,000
		Total	1348	750	1,48,500
Production per cage				**375**	**74,250**

The fishermen view this as an alternative source of fish when adverse climatic conditions prevent them from venturing into the sea. This concept could be popularized along the coast of Karnataka and sustainable use of the finfish resources to augment the fish production could be done. Demonstration of this methodology encouraged the fishermen to install cages of similar type in the estuary and at present many cages stocked with fingerlings of *L. argentimaculatus*, *E. suratensis* and *L. calcarifer* are found in the village. Thus this concept of CBA was adopted by the fishermen and the diffusion of the technology in this village has been phenomenal. This concept could be popularized along the coastal Karnataka and sustainable use of the finfish resources to augment the fish production could be done. The popularization and adoption of the concept of CBA by the fishermen would generate alternate livelihood, income and contribute to fish production of the region. ■