Recent Advances in Coastal Aquaculture

Imelda Joseph
Central Marine Fisheries Research Institute
Post Box No. 1603, Ernakulam North P.O, Cochin, Kerala, India
imeldajoseph@gmail.com

Introduction

The world fish production is around 152 million tonnes supporting the nutritional security of the growing population of the world. Out of the total fish production, aquaculture contributes around 42%. The capture fisheries, though intensive efforts are made for exploitation in many cases is static or declining. In some areas through continuous unregulated over exploitation it has often exceeded the maximum sustainable yield (MSY) and aquaculture has to necessarily support the fish production. Aquaculture is considered as one of the potential growth sectors showing annual growth rate between 8 and 10%. and is dominated by Asian countries. The importance of coastal aquaculture in the context of augmenting fish production, improving rural economy and productive utilisation of water resources is well-established. The development of coastal aquaculture received attention since certain fish stocks in the marine capture fishery indicated optimum level of exploitation, and their catch returns, despite increased efforts, showed declining trend. Following this, national Institutes concerned with research and development of marine and brackishwater fisheries, initiated investigations on coastal aquaculture such suitable organisms.

Resources

The potential coastal water area available in India includes about 8.9 million ha of inshore waters for open-sea farming, and 1.7 million ha of estuaries, backwaters, brackishwater lakes and swamps. A variety of high valued fishes, crustaceans, molluscs, seaweeds and other marine organisms, possessing high reproductive capacity, short larval development, fast rate of growth, and physiological features to adjust to wide changes in the environment are available in our coastal waters. For mariculture, adequate seed resources of the cultivable species are also available, if all local prioritized species are taken into account. There are also a large number of unemployed and under employed fishermen who could advantageously take up coastal aquaculture.

Recent advances

The marine fish production and the bulk of the brackishwater fish catch of our country are realised through the capture fisheries, the main emphasis of research and developmental activities has so for been in this field. Except for a few isolated studies and experimental and pilot-scale projects taken up by the Fisheries Departments of certain maritime states, there have been no detailed investigations or concerted efforts to develop coastal aquaculture. However, following the recognition of the potentials in the field, its Importance and the high

priority assigned to its development, several intensive research programmes have been taken up during the last five decades. Most of these investigations are centred on the culture of prawns, lobsters, crabs, mussels, pearl oyster and pearls, edible oysters, clams, fin fishes and seaweeds because of their commercial importance.

Crustaceans

Researches on the culture of prawns were mainly carried out at the Central Marine Fisheries Research Institute, the Central Inland Fisheries Research Institute, the National Institute of Oceanography, the Central Institute of Fisheries Education, the Konkan Krishi Vidyapeeth, certain Universities and by the All India Coordinated Research Project on "Brackishwater prawn and fish culture". The investigations were mainly directed towards developing an indigenous technology of large-scale culture of prawns on scientific lines. The techniques of breeding and rearing of larvae of the commercial penaeid prawns, namely, *Penaeus monodon, F. indlcus, P. semisuicatus, P. merguiensis, Metapenaeus dobsoni, M. monoceros, M. affinis M. brevicornis* and *Parapenaeopsis stylifera* under controlled conditions have been developed. In India, shrimp farming developed at an annual growth rate of nearly 15% during 1990 to 1995. Since 2009, after the introduction of SPF *L. vannamei* in the country, the shrimp production levels have increased from 1 lakh tonnes to 4.34 lakh tonnes in 2014 -15 with *L. vannamei* contributing nearly 83%.

Although isolated experiments on the breeding of the spiny lobsters (*Panulirus* spp.) and rearing of phyllosoma larvae were conducted earlier in our country, directed research on lobster culture, particularly on *Panulirus homarus* was taken up at the Field Laboratory of the Central Marine Fisheries Research Institute at Kovalam, near Chennai and later at Kochi. Techniques of collection of pueruli that migrate into the coastal waters, by special collectors were developed. The young ones of lobsters thus collected were reared in the laboratory. The results of these experiments have indicated that the young lobsters of 35 mm carapace length grow to a size of 57-58 mm carapace length in about 15 months and reach marketable size in 18 months. At present farming of lobsters is only fattening in cages and the species are *Panulirus homarus* and *P. polyphagus*.

Among the edible crabs occurring in our country, the most suitable species for culture is the mud crab, *Scylla serrata,* and *S. tranquebarica.* These are fast growing and can withstand wide ranges of salinity from almost freshwater to that of sea the species involve collection of seed crabs from the wild and growing them either individually in cages or baskets. Seed production is carried out by MPEDA and ICAR-CIBA.

Molluscs

Culture of brown mussel *Perna indica* and the green mussel *P. viridls* have been initiated since 1971 by CMFRI. Mussels can be cultured by raft culture method using ropes in 10-20 m depth zone, or on poles in shallow areas. The current production is around 20,000 tonnes in the country. One of the remarkable contributions made to promote mariculture in our country, is the successful development of an expertise on the techniques of production of pearls under controlled conditions. Researches leading to this achievement were started in 1972 at CMFRI. Culture of edible oysters, particularly *C. madrasensis*, was initiated at Tuticorin and techniques of collection of spat from the wild on different kinds of material such as lime coated tiles, oyster shells and empty coconut shells and growing them by rack and long line culture methods, on poles as well as in trays were standardized.

Finfish

Most of the species which can be commercially farmed are suitable for farming in marine and freshwater also. Some of the candidate species identified suitable for commercial aquaculture are seabass (*Lates calcarifer*), groupers (*Epinephelus* sp.), cobia (*Rachycentron canadum*), Pearl spot (*Etroplus suratensis*), milk mish (*Chanos chanos*) and grey mullet (*Mugil cephalus*). For the development and expansion of aquaculture, the most important pre-requisites are the seed and feed. Seed production technologies have been developed for some species like seabass, cobia, pampano and pearl spot and for other species like groupers, snappers, grey mullet and milk fish, efforts are made by different R & D Institutions in India to develop and standardize seed production technology. Technology for controlled breeding of seabass was developed in by CIBA in 1997 and since then the technology has been further refined and commercialized by RGCA. The technology includes captive broodstock development, induced maturation, water quality, health and feed management, induction of spawning through hormonal administration and spawning in the Recirculating Aquaculture System (RAS). In the farming front, Sea bass is considered as the best species for cage farming due to its fast growth, market demand and price. For pond culture also seabass is found good.

Groupers are another species which attain maturity after 2 years and are around 2-3 kg in size. They are protogynous, where many are females in the early period and reverse to male when they are larger in size. In hatchery operations, for obtaining male sometimes require intervention through exogenous hormone administration. Successful breeding of orange spotted grouper *Epinephelus coioides* has been achieved by CMFRI. Considering its high potentiality for farming along with other fishes and shell fishes with low cost inputs, the good market demand in some parts of India like Kerala, West Bengal Grey Mullet *Mugil cephalus* is farmed in cages as well as in coastal ponds. However, breeding of grey mullet under controlled conditions, though being attempted for some years, is yet to be taken off. Milk fish *Chanos chanos* breeding and seed production has become a house hold activity in countries like Philippines, Indonesia and Taiwan. However in Indian context, breeding of milk fish under captivity is yet to make a beginning. Captive broodstock of milk fish developed after feeding them with formulated feed @ 2-3% body weight after 5 years of holding under captive conditions have shown male maturation and the female fishes have not attained gonadal maturity preliminary success in seed production in India. It is a suitable species for cage and pen farming, and for Polyculture in coastal ponds.Pearl spot *Etroplus suratensis* is also a candidate species suitable for cage farming as well as coastal pond farming in Indian waters. CMFRI has developed seed production technology for the species by cost- effective methods.

Technology for seed production Silver pompano *Trachynotus blochii* and Indian pompano *Trachinotus mookalee* has also been developed by CMFRI. Pompano is a suitable species for coastal pond farming.

Benefits of Coastal aquaculture

Generally, the socio-economic benefits arising from aquaculture expansion include the provision of food, contributing to improved nutrition and health, the generation of income and employment, the diversification of primary production, and, increasingly important for developing countries, foreign exchange earnings through export of high-value products (UNDP/Norway/FAO, 1987; Schmidt, 1982). Aquaculture is also being promoted for its potential to compensate for the low growth rate of capture fisheries. Stocking and release of hatchery-reared organisms into inland and coastal waters support culture-based fisheries (Larkin, 1991). Sustainable development of aquaculture can contribute to the prevention and control of aquatic pollution since it relies essentially on good-quality water resources. Culture of molluscs and seaweeds may in certain cases counteract

processes of nutrient and organic enrichment in eutrophic waters, which is popularized as integrated multi-trophic Aquaculture (IMTA) Conversely, productivity of oligotrophic waters may be enhanced due to the nutrient and organic wastes released from aquaculture farms.