

Grouper Culture - A New Venture for Indian Aqua Farmers

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Introduction

Groupers are carnivorous reef fishes; belonging to the subfamily Epinephelinae with 15 genera and 159 species. They are available globally but are predominant in the tropical and sub-tropical waters including the Indo-Pacific region (110 species), the East Atlantic and Mediterranean regions (14 species) and the inter-tropical American zone (35 species) (Pierre *et al.*, 2007). They mainly inhabit coral reefs, rocky areas, sea grass bed and estuaries. Groupers are popular carnivorous fishes with a high market demand in many parts of the world and form the mainstay in the world Live Reef Food Fish (LRFF) trade (Koesshendran & Hartono, 2006). In coral reef ecosystems, a diversity of species is harvested worldwide and the major groups of fishes traded include snappers, surgeon fishes, unicorn fishes, parrot fishes, emperor breams and groupers. Among all, grouper is the highest prized fish group, often heavily exploited, and is highly regarded for the quality of their flesh (Chiappone *et al.*, 2000). According to Food and Agricultural Organisation, groupers contributed more than 2.75 lakh tonnes to the global marine fin fish production in 2009. In addition to the fishery from wild, contribution from the cultured grouper has also been adding to the world total grouper production. Culture of some grouper species is being carried out around the world and they have the potential to become an important aquaculture species because of high market price, high consumer demand, desirable taste, fast growth, efficient feed conversion and hardiness. (Millamena, 2002; Sim *et al.*, 2005). These positive attributes make groupers a potential candidate fish for aquaculture development.

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Grouper aquaculture: World scenario

World aquaculture production in 2012 was around 66.6 million tonnes with two-third (44.2 million tonnes) being contributed by finfish species. Of the total production from mariculture which is 66% of the total aquaculture production (24.69 million tonnes), the contribution of finfish is around 5.6 million tonnes (which is 22.68% of mariculture). The increased value is attributed to the large proportion of maricultured carnivorous finfish species *viz.*, Atlantic salmon, trouts and groupers, which possesses higher unit value than most freshwater-farmed finfishes (FAO, 2014).

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Grouper is a high-value species like tiger shrimp and with best aquaculture management practices, it is easier to culture the fish without much operational difficulties, especially disease related issues. Disease out-breaks and frequent price fluctuations in shrimp culture have led to the shrimp farmers looking for an alternative species and grouper is the most appropriate. Presently, the fish has become an alternative for shrimp in most parts of the world. The farming methodology is mostly similar to that of milkfish and shrimp. Grouper culture was first introduced in the early 1970s in Singapore, Malaysia, Hong Kong, Thailand and Taiwan and is now practiced throughout Southeast Asia (Seng, 1998). Mariculture of this fish is most developed in Asia, mainly because of high commercial value in the markets of Hong Kong, Singapore and Taiwan, in particular. Among the groupers, around 20 species are cultured in the world, and the dominating species vary depending upon the country of origin (Sadovy, 2001). Some of the most frequently encountered species in the culture are orange spotted grouper/green grouper (*E. coioides*), greasy grouper (*E. tauvina*), Malabar grouper (*E. malabaricus*), brown-marbled/tiger grouper (*E. fuscoguttatus*), giant grouper (*E. lanceolatus*), humpback grouper (*Cromileptes altivelis*),

white grouper (*E. aeneus*), yellow/banded grouper (*E. awoara*), honeycomb grouper (*E. merra*), red grouper (*E. morio*), red spotted grouper, (*E. akaara*), dusky grouper (*E. marginatus*), leopard grouper (*Mycteroperca rosacea*), Nassau grouper (*E. striatus*), and potato grouper (*E. tukula*). They are being commercially cultured in China, Indonesia, Malaysia, Hong Kong, Taiwan, Philippines and Thailand in Southeast Asia and in other parts of the tropics, in South-eastern USA and Caribbean (Tucker, 1999). Apart from this, farming has also been reported from other parts of the world *viz.*, Srilanka, Saudi Arabia, Republic of Korea and Australia and grouper aquaculture is growing rapidly in these countries. Culture of grouper is mainly practiced in floating net cages in open seas, fixed net cages in ponds and directly in earthen ponds. Initially, the fishes were farmed using wild caught seeds (fry and fingerlings). Later, seed production of grouper started and by 1990s seed production technology was developed for most groupers, but only few are produced in hatcheries to any significant extent. Seed production of *Cromileptes altivelis*, *E. fuscoguttatus*, *E. coioides*, *E. malabaricus*, *E. akaara*, *E. lanceolatus*, *E. tukula*, *E. areolatus*, *E. tauvina* and *E. polyphkadion* are reported (Rimmer *et. al.*, 2000; Rimmer *et. al.*, 2004) from hatcheries of Southeast Asia and are expected to form the mainstay for cultured grouper production. The establishment of hatchery has helped in increasing grouper aquaculture production and according to FAO, global production of cultured groupers in 2009 was 75,520 tonnes, valued at 310 million USD.

Grouper in live fish trade

As mentioned earlier, groupers form the mainstay of multimillion-dollar Live Reef Food Fish (LRFF) trade around the world, especially in Southeast Asia. In Asia, Hong Kong is the largest importer of live food fish. The major suppliers of grouper to the live fish trade are Taiwan and Malaysia, followed by Indonesia, Philippines, Vietnam and Thailand. In Asia-Pacific, around 20 countries are involved in supplying Live Reef Food Fish and 60% of the international trade is to Hong Kong. Hong Kong is the largest consumer of LRFF worldwide. The import of LRFF has been considerably increasing in the recent years, and the overall imports of live marine food fish in 2013 was 11,795 tonnes valued at USD 136 million; in which the contribution of grouper alone was 9,085.3 tonnes valued at USD 112 million (Ferdouse, 2014). The contribution of grouper in Hong Kong live fish trade market is around 77.02%. Live groupers fetch higher price than any other group of fish species in the trade, and live specimens between 400-1000g body weight fetches 3-5 times more than the normal price of the fish (Guerrero, 2014). The source of fish in live grouper trade is from wild caught as well as aquaculture produced fish and the increase in live fish trade in the recent decades has led to increase in the production of groupers from aquaculture.

Status of grouper farming in India

In India, the expected fish requirement would be around 16 million tonnes by 2025, of which aquaculture is expected to provide 10 million tonnes (<http://www.icar.org.in/node/3456>). Indian aquafarmers are

diversifying their culture systems as well as fish species to enhance fish production. Over the last two decades, interest has been generated in India for developing mariculture in coastal areas and off late, coastal aquaculture has been turning towards fin fishes from shrimps, where environmental and pond deterioration has led to abandonment of shrimp farming. Moreover, India has vast resources for mariculture including 8129 km of coastline, 0.5 million km² of Exclusive Economic Zone (EEZ) with 2.2 million km² of continental shelf, 1.2 million ha of brackish water area, 8.5 million ha of inland saline area and 20 million ha for sea farming, etc. These available resources could be used efficiently for enhancing the production of marine finfishes. But, in spite of having huge mariculture resources, India still is in its infancy in mariculture production when compared to the global scenario.

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India is one of the major fish farming countries, but the farming operations rely mostly on inland finfish aquaculture and mariculture production remains largely untapped. In 2012, fish production from mariculture was around 84,164 tonnes, which was 1.2% & 2.2% of India's total farmed fish production and farmed finfish production (FAO, 2014). At present, in India, only 13% of total available potential area is under mariculture and produces around one lakh tonnes annually, mainly from shrimp culture. The other organisms which contribute to production from mariculture include mussels, edible oysters and to a lesser extent, marine finfishes. Several potential cultivable candidate species of marine finfishes are available for culture, which includes rabbitfish (*Siganus spp*), seabass (*Lates calcarifer*), groupers (*Epinephelus spp*), snappers (*Lutjanus spp*), pompano (*Trachinotus spp*), cobia (*Rachycentron canadum*) and sea bream (*Lethrinus spp*). Among them, groupers represent the most important and the most valued fishes, for their excellent texture and flavour, and for its great potential in aquaculture.

Groupers are distributed all around the Indian coast and 69 species are reported from Indian waters, among which *E. coioides*, *E. malabaricus* and *E. dicanthus* are considered as potential species for aquaculture. The LRFF in India, started in 1990s and 10 tonnes of groupers were exported to Hong Kong. However, at present, published data on grouper culture and live grouper trade in India is lacking.

Understanding the importance of grouper, several initiatives have taken place in India for developing seed production and culture technology. Accordingly, experimental culture of groupers was initiated in 1992 (Hamsa and Kasim, 1992) and *E. tauvina*, *E. merra* and *E. malabaricus* emerged as major species for culture in experimental level at Mandapam, Tuticorin and Vizhinjam Centres of Central Marine Fisheries Research Institute. Experimental culture of these species was carried out in coastal ponds and fixed cages in shallow water areas using wild collected seeds. Initially, grouper culture was thought of an avenue for increasing mariculture production from underutilised coastal ponds, estuarine and brackish water areas. But, this technology failed to bring massive changes in the state of grouper production through mariculture. Non-availability of sufficient quantity of seeds at the right time from the wild and improper culture technology in confined water bodies has constrained the advancement of grouper mariculture. Later, importance of hatchery produced seeds for grouper was realised by the researchers and development of hatchery seed production technology was initiated. Broodstock development, sex inversion and captive spawning of *E. tauvina*, *E. malabaricus*, *E. merra* and *E. coioides* were standardised by CMFRI after several trials (Pillai *et. al.*, 2002; Jagadis *et. al.*, 2010; Ranjan *et al.*, 2012). Though the technology was standardised, it remained confined to the laboratory and could not be disseminated to the farmers because of difficulties in obtaining natural male from wild, problems in sex reversal and difficulties in larval rearing due to its small mouth size. Due to these problems associated with culture and seed production technologies, Indian farmers were not enticed to venture into grouper culture, even though the fishes fetched high price in international market.

In India, as part of Research and Development activities, open sea cage culture was initiated in 2007 and the first cage was launched off Visakhapatnam coast. Successful cage culture was demonstrated to fish farmers in most Indian maritime states (Rao, 2012). Experimental culture of several finfishes *viz.*, seabass, mullet, pearl spot and cobia were carried out at various centres of CMFRI with varying degrees of success. Significant progress in cage culture by CMFRI has convinced several government organisations, entrepreneurs and farmers to come forward and commercialise cage farming. At several locations, cage culture of groupers was initiated and encouraging results were obtained. In the coastal waters of Palk Bay, near Mandapam in Tamil Nadu (Badhul Haq *et. al.*, 2011), *E. malabaricus* exhibited growth gain of 750g in six months in cages. In India, success in large scale production of fingerlings of tiger grouper by Rajiv Gandhi Centre for Aquaculture (RGCA) at Andaman and Nicobar Island and orange spotted grouper by CMFRI at Visakhapatnam were achieved under controlled condition. This breakthrough in culture and seed production technology of grouper has opened up new avenues for the Indian entrepreneurs for exploiting the species and enhancing its production.

Constraints and scope for live grouper culture & export from India

India is bestowed with 69 species of groupers and the

estimated landing was around 44,487 tonnes in 2013 (CMFRI, 2014). However, live fish export is lacking since several years. The major constraints in live grouper marketing are 1) Barotrauma 2) Insufficient quantity of live fish for export and 3) Improper technical dissemination to farmers. Groupers are mainly caught by hook and lines, and the fishes suffer barotrauma on lifting and become bloated. The affected fishes may die immediately, if not treated properly. Therefore, fishermen need to be trained and made aware of barotrauma. (In general, for live fish export/marketing, live fish trading vessel is used. However for exporting through trading vessel, one has to have a minimum of 50-60 tonnes of live fishes, and getting these huge quantities of grouper is difficult at present, unless a network venture is involved in live fish trade). Further, awareness needs to be created among small scale entrepreneurs and fishermen on the importance and scope of live fish trading. If the above mentioned problems are addressed, then live grouper export using wild seeds would be possible in near future. Moreover, in recent years, cage culture has proved to be an important technique for culturing marine finfishes. Indian fishfarmers have the option of farming grouper in open sea floating cages either using hatchery produced seeds or seeds caught from wild termed capture based aquaculture. Farming groupers in large quantities in cages would contribute considerably to live fish trade in near future. In conclusion, seed production technology and mariculture production of grouper in cages will present enormous aquaculture business opportunity in near future for the Indian fishfarmers/exporters.

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