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 beds 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 Fish (LRFF) trade (Koehnvedrjan & 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 priced fish group, often heavily exploited, and is highly regarded for the quality of their flesh (Chiapanne et al., 2008). According to Food and Agricultural Organisation, groupers contributed more than 2.75 lakh tonnes to the global marine fish production in 2019. In addition to the fishery from wild, contribution from the farmed groupers 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 food conversion and hardness. (Neillams, 2002; Sim et al., 2005). These positive attributes make groupers a potential candidate fish for aquaculture development.

Groupers are 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 as they interbreed and out-breeds and frequent price fluctuations in shrimp culture have lead 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 practised 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), greyish grouper (E. taurus). Malabar grouper (E. malabaricus), brown-marbled/tiger grouper (E. fuscoocellatus), giant grouper (E. lanceolatus), humpback grouper (Cromileptes altivelis), white grouper (E. taurus), yellow/banded grouper (E. murdjan), honeycomb grouper (E. niger), red grouper (E. menton), red spotted grouper (E. alutacea) grouper (E. merra), and potato grouper (E. itap. 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, 1986). Apart from this, farming has also been reported from other parts of the world, like Sri Lanka, South 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 (rye and flingers). Later, seed production of groupers 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 C. altivelis, E. fuscoguttatus, E. coioides, E. malabaricus, E. australis, E. lanceolatus, E. teksu, E. areolatus, E. taurina and E. polyphekadion are reported (Branmer et al., 2008; 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 USD 28.2 million.

Groupers in live fish trade

As mentioned earlier, groupers form the mainstay of multi-million-dollar Live Reef Food Fish (LRFF) trade around the world, especially in Southeast Asia. In Asia, Hong Kong is the largest importer of live fish. The major suppliers of groupers to the live fish trade are Taiwan and Malaysia, followed by Indonesia, Philippines, Vietnam and Thailand. The 20 countries are involved in supplying Live Reef Fish and 60% of the international trade in Hong Kong. Hong Kong is the largest consumer of LRFF. The export of LRFF has been considerably increasing in the recent years, and the overall imports of live marine fish in 2013 was 11,795 tonnes valued at USD 136 million; in which contribution of grouper alone was 9,853 tonnes valued at USD 112 million. The contribution of grouper in Hong Kong live fish trade market is around 77.02%.

In India, the expected fish requirement would be around 16 million tonnes/year and the expected aquaculture is expected to provide 10 million tonnes (http://www.lcar.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 groupers in both coastal and offshore aquaculture. However, in recent years, groupers have been reared in the state of Tamil Nadu in coastal areas, and farmed as part of Integrated Multi-trophic Aquaculture (IMA) system in coastal areas and off coast, coastal aquaculture has been turning towards fin fishes from shrimp farms, wherein 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 continental shelf, 1.2 million ha of brackish water area, 8.5 million ha of inland waters, 20 million ha of inland lakes and ponds. These available resources could be used efficiently for enhancing the production of marine finfishes. But, in spite of having huge aquaculture resources, India is still 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 fresh water aquaculture and mariculture production remains largely unexplored. In 2012, fish production from mariculture was around 84,164 tonnes, which was 1.2% and 2.2% of India's total farmed fish production and farmed fish 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, eel, prawns and to a lesser extent, marine finfish. Several potential cultivable candidate species of marine finfishes are available for culture, which includes rabbitfish (Siganus rivulatus), sea bass (Lates calcarifer), groupers (Epinephelus spp), snappers (Lutjanus spp), pompano (Trachynotus spp), cobia (Rachycentron canadum) and sea bream (Lithognathus spp). Among them, groupers represent the most important and the most valued fishes, for their excellent texture and flavor, 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. australis are considered as potential species for aquaculture. The LRFF in India, started in 1990 and 10 tonnes of fish were reported to the world. However, at present, published data on grouper culture and live fish trade in India is lacking.
Grouper Culture - A New Venture for Indian Aquafarmers

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 beds 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 Fish (LRFF) trade (Koestwandjoro & 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., 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., 2006). According to Food and Agricultural Organisation, groupers contributed more than 2.75 lakh tonnes to the global marine fin fish production in 2008. In addition to the fishery from wild, contribution from the farmed groupers 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, saleable taste, fast growth, efficient feed conversion and hardness. (Nillamala, 2002; Sim et al., 2005). These positive attributes make groupers a potential candidate fish for aquaculture development.

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Among the groupers, around 20 species are traded in the world and the dominating species vary depending upon the country of origin.

Grouper aquaculture: World scenario

World aquaculture production in 2012 was around 66.6 million tonnes with two-thirds (44.2 million tonnes) being contributed by finfish species. Of the total production from mariculture which is 66% of the total aquaculture production (26.69 million tonnes), the contribution of fish is around 5.6 million tonnes (which is 22.6% of mariculture). The increased value is attributed to the large proportion of maricultured carnivorous finfish species viz., Atlantic salmon, trout and groupers, which possesses highest unit value than most freshwater-farmed fishes (FAO, 2014).

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 in the final out-brakes 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 groupers is being carried out around the world, and they have the potential to become an important aquaculture because of high market price, high consumer demand, saleable taste, fast growth, efficient feed conversion and hardness. (Nillamala, 2002; Sim et al., 2005). These positive attributes make groupers a potential candidate fish for aquaculture development.

Among the groupers, around 20 species are traded in the world and the dominating species vary depending upon the country of origin.

Status of grouper farming in India

In India, the expected fish requirement would be around 20 million tonnes and the 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. Some 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 (Trachynotus 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. dhumnades are considered as potential species for aquaculture. The LRFF in India, started in 1990 and 10 tonnes of grouper were exported to Hong Kong. However, at present, published data on grouper culture and live fish 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. maculata, E. niger and E. coioides emerged as major species for culture in experimental level at Mandapam, Tulicorin and Vizhinjam Centre of Central Marine Fisheries Research Institute. Experimental culture of these three species was carried out in coastal ponds and fixed cages in shallow water areas using wild captured seeds. Initially, groupers were thought of as an avenue for increasing mariculture production from utilised coastal ponds, estuarine and brackish water areas. However, this technology failed to bring massive change 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. maculata, E. niger and E. coioides were standardised by CMFRI after several trials (Pillai et al., 2002; Jagad 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 entitled 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 Vishakhapatnam coast. Successful cage culture was demonstrated to fish farmers in most Indian maritime states (Rao, 2012). Experimental culture of several fish species, viz., seabass, mullus, 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 Pen Bay, near Mandapam in Tamil Nadu (Badhi et al., 2011), E. longirostris 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 (RCGA) at Andaman and Nicobar Island and orange spotted groupers by CMFRI at Vishakhapatnam were achieved under controlled conditions. 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 groupers 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 groupers is difficult at present, unless a network vessel is involved in live fish trade. Further, awareness needs to be created among small scale estuarine farmers 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 fish farmers have the option of farming groupers in open sea (floating cages either using hatchery produced seeds or seeds caught from wild term care captured 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 groupers in cages will present enormous aquaculture business opportunity in near future for the Indian fish farmers/exporters.

References


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