

PROSPECTS OF GROUPER CULTURE IN INDIA

P. NAMMALWAR¹, R. MARICHAMY², A. REGUNATHAN¹ AND K. KANDASAMY³

Central Marine Fisheries Research Institute, Kochi - 682014

INTRODUCTION

The "Groupers" of the genus *Epinephelus* are excellent marine food fishes in the Indo-Pacific and Caribbean regions and have assumed importance for commercial culture in recent years. About 40 species of this genus have been reported from the seas around India. Most of them inhabit coral reefs and rocky habitats, while others sea grass beds, muddy and sandy bottoms. Juveniles of some species occur in lower reaches of estuaries, occasionally ascending upper reaches also. Most species are solitary and all are predators on fishes and invertebrates. The estuarine groupers, *Epinephelus tauvina* and *E. malabaricus* are most important for aquaculture. Groupers are hardy species which can tolerate wide fluctuations of salinity and spawn throughout the year probably with a peak in monsoon seasons. The major constraint for large scale commercial production of groupers is the shortage of fingerlings either from the hatchery or from the wild. The shortage of seed, high market value and scarcity of groupers from the wild have encouraged many countries in Asia to initiate research and development programmes on grouper breeding and seed production.

Groupers are extensively cultured in floating and fixed net cages and coastal ponds in many Southeast Asian countries since more than 15 years. Groupers of the species *E. tauvina* and *E. malabaricus* are cultured in Malaysia, Thailand, Singapore and Hongkong from mid seventies. *E. suillus* and *E. amblycephalus* in Taiwan, red grouper, *E. akkar* in Hongkong and Japan, *E. mexicanus* and *E. morio* in Mexico; *E. tauvina* and *E. malabaricus* in Indonesia, Kuwait and India are cultured. In Philippines, *E. tauvina*, *E. malabaricus*, *E. sexfasciatus* and *E. bleekeri* are cultured at present. The recent annual production of groupers from these ventures are: Thailand 450 t, Hong Kong 365 t; Singapore 153 t and Malaysia 143 t.

Until recently, the majority of the culturists had to depend only upon natural seed resources although induced breeding could be achieved in a few species of groupers, in many Southeast Asian countries. In Malaysia, the seeds of groupers are collected by using seine nets in the coastal waters. The fingerlings are stocked in small nursery ponds and cages before selling to the farmers.

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- Present address :
1. Madras Research Centre of CMFRI, Chennai - 600 006.
 2. Tuticorin Research Centre of CMFRI, Tuticorin - 628001.
 3. Regional Centre of CMFRI, Mandapam Camp - 623520.

INDUCED BREEDING AND SEED PRODUCTION

Most groupers are hermaphrodites, the fish maturing at first as a female, and becoming a male with advancing age and size. In the case of *E.tauvina*, the fish of 45-50 cm/ 2.5 - 3.0 kg in size (3 years) mature as females. while fish more than 74 cm/10-11kg in size (6-8 years) become males having ripe testes. In specimens of 65-72 cm/4.5-5.5 kg in size (5-7 years) an intersex condition was observed with transitional gonads containing male and female gonadal tissues. Mature spawners of *E.tauvina* caught from the wild have spawned in captivity in Kuwait. Successful rearing of fingerlings to more than 3 cm in length was achieved in Kuwait. In Singapore, induced spawning of 3 year old females of *E.tauvina* and sex reversal to males have been achieved by injecting human chorionic gonadotropin (HGG) and pituitary gland extract from chum salmon or white snapper. It is reported that induced spawning of *E.tauvina* can be carried out throughout the year, depending upon the stage of gonadal development. Ovulation was achieved by a single injection of 5000 I.U. of HCG. By oral administration of alpha methyl testosterone over a period of 2 months, 2-3 year old fish were made to yield milt. The fertilized eggs of *E.tauvina* were hatched in tanks within 23-25 hours at a temperature of 27°C. The larvae metamorphose into juveniles of about 2.5 cm. In Taiwan, advanced sex reversal at an earlier age and size in *E.tauvina* has been achieved through oral administration of male sex hormone androgen. In Taiwan, the males of *E.malabaricus* are injected with HCG for stripping and the females are induced to ovulate by hypophysation. Of about 0.2 millions eggs spawned, 78% were fertilised and 69% hatched with an ultimate survival of 38,400 seed. The 96 hours old postlarvae were fed with oyster trochophore larvae and later with rotifers, copepods, *Artemia* nauplii, eel meat and frozen mysids. In about a month's time, the postlarvae reach a length about 1.5 cm and in 3 months time these reach about 8 cm with an average survival of 14%. In Hong Kong, the red grouper *E.akaar* has also been induced to spawn.

Nursery rearing

The early fingerlings are first stocked either in small nursery ponds or in small floating net cages. In Taiwan, the nursery concrete ponds are about 100 m² in area and 1m depth. Fingerlings of 5-8 cm are stocked at a rate of 100/m² and fed on a diet of frozen fish. The fingerlings grow to 9-12 cm in 2-4 weeks with maximum of 90% survival, when they are ready for stocking in production ponds or cages. Floating nursery net cages (1-2m³) called 'Happa' with mesh size of about 1.5 to 2.5 cm are made of polyethylene netting supported by a wooden frame work. These are kept afloat with metal or plastic drums, anchored with concrete blocks and are stocked with 200 - 600 numbers of fry or fingerlings. In the beginning, they are fed with mysids and small shrimps and later with minced trash fish or shrimps. Gradually, the above food may be replaced by fish meal, chicken feed, vitamins, minerals and wheat flour as the binder, at about 10% of body weight. When the fingerlings reach 15-20 cm in total length they are ready for transfer to production ponds or net cages.

GROW-OUT SYSTEMS

a. Pond Culture

In Taiwan, the culture ponds situated in the intertidal zone receive tidal flushing. The ponds vary from 0.2 to 0.3 ha in area and have vertical concrete dikes to hold a height of about 1.5 m, of water and about 0.5 m of free board. For every hectare of water surface, eight aerators are provided. A continuous flow of clear water supply is maintained, with a salinity of 33‰, and temperature 16-32 °C. If filamentous green algae grow in the ponds, these are removed regularly. A pipe system is also provided for daily removal of waste and excreta accumulating at the bottom. The ponds are stocked with 9-12 cm long fingerlings at a density of upto 40,000/ha. Feeding with fresh trash fish is done twice a day at 8% of the body weight. Under optimum management condition, the fingerlings grow to 30 cm in length and 600-800 gm in weight in 8 months with a survival of 80-90% and yield more than 20t/ha.

b. Net Cage Culture

In Singapore, Malaysia, Thailand and Indonesia and few neighbouring countries, intensive net cage culture of groupers is being carried out in floating and fixed net cages. The water temperature for farming should range from 27-31° C, dissolved oxygen content at 5ml/l or more; salinity between 26-31‰ pH 7.8-8.3 and chemical oxygen demand at 3 mg/l or less.

In Singapore, grouper fingerlings of 12-15 cm size are stocked in production net cages at a rate of 40-50/m² and are fed with trash fish. Feeding is done once or twice a day at a rate of 3-5% of the body weight. The groupers grow fast at a rate of 80-100 g/month and attain a market size of 600-800 g in about 6-8 months, from an initial weight of 80-100g. Based on the estimate of 600g weight for the fish at harvest, a net cage of 5 mLx5mWx3mH has been yielding 600 kg in about 6-7 months of culture. a raft unit of 32 such cages, occupying an area of 5,000 m² has been yielding 19.2 tonnes per harvest and 38.4 t/yr. After taking into account the expenses, the net profit has been Rs. 4,50,00/- per year. In Thailand, Indonesia, Singapore, Philippines and Japan, artificial production of seeds of groupers has been achieved followed by culture in floating net cages. The broodstock of groupers for seed production is obtained either by collection from the sea or by raising from young stages in floating net cages in the sea.

In Saudi Arabia, grow out production trials of groupers are carried out using land based as well as off-shore culture facilities. Hatchery produced grouper fingerlings are stocked in floating net cages to investigate the growth of groupers. In the land based production of groupers earthen ponds and circular tanks of various capacities are used. The preliminary results showed that a growth of upto 800g for *E.polyphkadion* and 600g size for *E.fuscoguttatus* was achieved in 15 and 10 months, respectively. However, growout production of groupers is in its early stage of development. In Indonesia, *E.tauvina* is cultured to 200g size in 5-6 months.

TECHNOLOGY TRANSFER AND UTILIZATION IN INDIA

The results of net cage culture and seed production of groupers carried out in many Southeast Asian countries are encouraging. There is also possibility of developing export markets due to the high price and market demand for groupers in other countries. Hence it is high time that technology developed in other countries is transferred to suit local conditions for utilization in our country. Induced breeding and seed production of groupers have already been achieved in Malaysia, Singapore and Kuwait. With the knowledge of techniques already available, it is possible to develop induced breeding and seed production of commercially important species of groupers such as *E.tauvina* and *E.malabaricus* as these species are available in India.

PROSPECTS IN INDIA

In India, grouper culture practices are entirely supported by the supply of seed collected from the natural environment which is the only major source at present. Juveniles of 13-25 cm are caught from the wild by drag nets and traps. Recently, Tuticorin Research Centre of CMFRI has identified a few resourceful natural grounds in the inshore coastal waters and the peak season for collection. Young ones of *E.tauvina* and *E.malabaricus* occur in the eel grass beds at 10m depth line during the northeast monsoon period. Fishermen operate mini shore seine mainly to catch green tiger prawn *Penaeus semisulcatus*. In the same gear, groupers locally known as "Moonjan" are also caught and they do not fetch any attractive price in the local market. Fishermen, who normally go to fish in this traditional ground, are entrusted to bring the catches alive, without any damage. Grouper seeds in the size ranging from 60 to 200 mm are collected and transported for culture in coastal ponds at Tuticorin and in cement tanks at Mandapam Camp and in FRP tanks at Cochin. Techniques for transportation of the live seed and broodstock are also perfected. Efforts are in progress at the CMRI to evolve a viable technology for the mass production of seed by induced breeding for culture.

In India, coastal ponds in a muddy inter-tidal zone at Tuticorin, were developed suitably for farming groupers. Two ponds 0.2 and 0.3 ha were stocked with *E.tauvina*, with seed collected from nursery grounds. Artificial shelter devices such as concrete rings, cement pipes, used tyres, tiles and wooden stumps are placed at scattered location in the pond and invariably it was noticed that the groupers assemble in these hideouts. Both monoculture and polyculture methods are followed in coastal ponds at Tuticorin. They are stocked at the rate of 5000/ha and fed at 10% of body weight with chopped fresh trash fish and occasionally with live *Tilapia* fingerlings. *Tilapia* may be stocked well in advance to the stocking of grouper, leaving enough time for *Tilapia* to spawn and to produce young ones that become the live feed of grouper. This technique is followed in a number of countries. Stocking should be of uniform size to avoid cannibalism. The groupers stocked at 95-245 mm/10-200 g size have grown to 180-360 mm/160-630 g in 6 months when maintained in cement tanks at Mandapam. Similarly, the broodstock 2-10 kg have reached 4.0-15.5 kg in 3 months period.

In India, both the species viz *E.tauvina* and *E.malabaricus* which are cultured in neighbouring Southeast Asian countries are available besides *E.bleekeri* and *E.faveatus*. Since groupers are valuable and some species could be artificially induced to breed and successfully cultured in Malaysia, Singapore and Philippines, it is high time that in India also the groupers are brought into the list of priority species for breeding and culture. It may not be out of place in this connection to point out that an experimental work on the culture of *E.tauvina* was carried at Mandapam during 1984. In a 5 x 5 x 2 m fixed net cage, 4 experimental culture of groupers *E.tauvina* was conducted, for a period of 5 to 11 months and the mean growth rate was 16.3 mm / 47.5 g per month. The method is simple and economically viable and can be easily adopted by fish farmers, in our country. Although, this experiment is not comparable to the practices in Malaysia and Singapore, it gives some indication on the possibility of developing grouper culture on a viable basis in India also. Further, from the recent findings, it is evident that *E.tauvina* is highly suitable for cage culture as its growth and survival rates are good. The availability of grouper seeds also indicates the possibility of planning and developing cage culture into a viable commercial farming in the coastal waters where seeds of groupers occur in fairly good numbers.