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Experiments on grow out culture of groupers, *Epinephelus malabaricus* (Schneider) and *Epinephelus tauvina* (Forskal)

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ABSTRACT

The results of the experiments conducted on the grow-out culture of the Malabar grouper *Epinephelus malabaricus* and Greasy grouper *Epinephelus tauvina* in three different culture systems such as brackish water earthern ponds, silpaulin lined ponds and FRP tanks during 1996-1998 are presented. In the earthern pond, from a mean size of 183 mm SE 21.67 and 137.9 g SE 4.78 in May 1997 *E. tauvina* attained 442 mm 4.25 and 1780 g SE 4.79 in March 1998 at the end of eleven months showing a daily growth increment of 0.78 mm and 4.97 g. In the silpaulin lined pond, *E. malabaricus* grew from an average size of 163.2 mm SE 2.96 (74.2 g SE 2.09) in April 1997 to 425.7 mm SE 3.65 (1170 g SE 4.67) in March 1998 registering a mean growth of 0.72 mm (3.04 g) per day. The average daily growth increment for *E. tauvina* in the FRP tank during the culture period was only 0.51 mm (1.53 g). The present investigations have shown the prospect of culturing groupers in the presently unutilised/under-utilised estuarine and brackish water ponds.

Introduction

Groupers are large sized marine fishes belonging to the family Epinephelidae. They are relatively high priced and widely accepted. They are commercially cultivated in Thailand, Malayasia, Taiwan, Singapore, Philippines and Kuwait (Yaman, 1982; Pinij, 1995; Thobaity and James, 1996; Trai and Hambrey, 1998 and James *et al.*, 1999). However in India sufficient attention has not been paid to the development of appropriate technologies for the seed production and grow-out of these fishes. The work done so far is confined to the preliminary studies on *Epinephelus tauvina* in net cages at Mandapam in the Gulf of Mannar (Hamsa and Kasim, 1992). With the recent thrust given for aquaculture development to increase fish production, serious attempts are being made by the Central Marine Fisheries Research Institute to develop suitable technologies for culture of these fishes. The present paper deals with the results of the studies carried out on the Greasy grouper *Epinephelus tauvina* and Malabar grouper *E. malabaricus* in different culture systems, stocking densities and feeding regimes at Narakkal during 1996-98.

Materials and methods

Juveniles of the Greasy grouper

Fig. 1 Monthly average temperature, salinity, dissolved oxygen and pH in earthen pond at Narakkal from May "97 to March '98

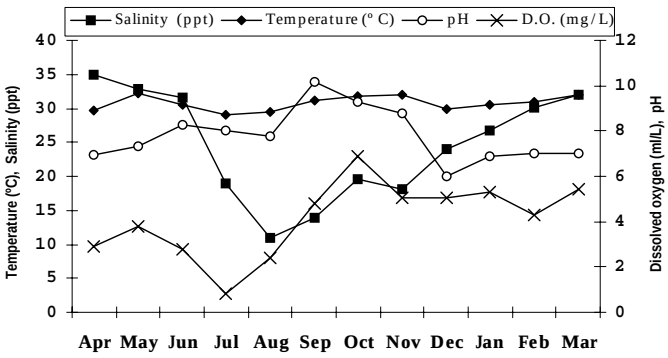

Fig. 2 Monthly average temperature, salinity, dissolved oxygen and pH in silpaulin-lined pond at Narakkal from April "97 to March '98

Fig. 3 Monthly average temperature, salinity, dissolved oxygen and ph in FRP tank at Narakkal from April '96 to January '97

Epinephelus tauvina (18 numbers) and Malabar grouper *E. malabaricus* (30 nos.) were collected locally by using drag nets and fish traps from the nearby estuarine and backwater areas. Since sufficient number of juveniles could not be collected locally, they (45 nos.) were transported from Tuticorin in polythene bags filled with sea water and oxygen and kept in ice (Peer Mohamed and Devaraj, 1997). The studies were conducted in three different culture systems: brackish water earthern ponds, silpaulin lined ponds and FRP tanks at the Field Mariculture Centre of CMFRI, Narakkal. Hydrographical parameters such as water temperature, pH, salinity and dissolved oxygen were monitored at weekly intervals following standard analytical procedures, the mean monthly values of which are presented in Figs. 1, 2 and 3. Live groupers were sampled (all specimens in the FRP tanks and silpaulin lined tanks and 50% in earthern ponds) at monthly intervals and the body length (total length in mm) and weight (in g) of each fish were recorded for comparing the growth rates in different culture systems.

Results

Earthern pond

An earthern pond of the size 25x 20x 1.5 m (approximately 0.05 hectare area) was selected for the present investigation. Water exchange was maintained through a traditional wooden sluice gate of 120 x 90 cm fixed at the northern side of the pond. The sluice gate was provided with wooden shutters to regulate the inflow and outflow of water and nylon nettings to prevent the entry of undesirable species. The bottom of the pond was muddy. The water depth ranged from 0.30 to 0.90 cm. There was no supplementary aeration during January and March.

Forty five numbers of grouper fingerlings (*E. tauvina*) collected from Tuticorin by drag nets were stocked in earthern ponds. At the time of stocking the size ranged from 171 to 232 mm with a mean size of 183 mm SE 3.23 and the weight ranged from 120 to 190 g with a mean weight of 137.9 g SE 4.78. The mean size increased from 183 mm and 137.9 g in May 1997 to 442 mm SE 4.25 and 1780g SE 4.79 in March 1998. Thus an average daily increment of 0.78 mm and 4.97 g was obtained for the species. The production rate was estimated at 781 kg/hectare with a survival rate of 48.8% (Table. 1.).

The groupers were fed mainly with juveniles of *Oreochromis mossambicus* , *Etroplus suratensis* and *E. maculatus* and prawns available in the natural pond at the time of

TABLE. 1. *Results of the experiments conducted on grouper culture in different culture systems at Narakkal*

Type of culture systems	Date of stocking	Pond size	Numbers stocked	Stocking density No/ha	Duration of experiment and date of harvest	Initial size mm/g	Final harvest size mm/g	Mean growth rate per month	Numbers harvested	Production rate Kg/ha	Survival rate (%)
Earthern pond (*E. tauvina*)	May 1997	0.05 ha 25x20x 1.5m	45	900	11 months March 1998	183 mm SE 3.23 138 g SE 4.78	442 mm SE 4.25 1780 g SE 4.79	23.5 mm 149.2 g	22	781	48.8
Silpaulin lined pond (*E. malabaricus*)	April 1997	10x5x 1.5 m	30	6000	12 months March 1998	163 mm SE 2.96 74 g SE 2.09	426 mm SE 3.65 1170 g SE 4.67	21.8 mm 91.3 g	16	3740	53.3
FRP tanks (*E. tauvina*)	April 1996	10 t 8.3 sq. m.	18	7200	10 months January 1997	161 mm 67 g	314 mm SE 9.79 526 g SE 12.38	15.3 mm 45.9 g	15	3154	83.3

SE = Standard Error

stocking. In addition to this, they were also fed with very small fishes and prawns that enter the pond through the sluice gate during high tide. As the groupers were feeding on the food items available in the pond at the time of stocking and also which enter through the sluice gate during high tide, feeding rate could not be estimated. Supplementary feeding was also done by stocking the pond with low cost fish caught by cast nets and fish traps from the nearby brackish water area.

Silpaulin lined ponds

Preliminary experiments conducted on the culture of pearl spot, grey mullets and milk fish revealed the possibility of using the polythene lined ponds for mariculture in sandy beaches which at present remain mostly unutilised (Lal Mohan and Nandakumaran, 1980; Lazarus and Nandakumaran, 1987). About 30 numbers of *E.malabaricus* were stocked in silpaulin lined ponds of 10 x 5 x 1.5 m size. Sea water was pumped into the ponds by a 3.5 HP electric pump with 2.5" suction and 2" delivery pipe from a bore well sunk on the beach very near the coast line. About 1.5 m depth of water was maintained in the pond. To maintain the water quality, about 30% exchange of water was carried out daily.

Sharp decline of salinity values was avoided by exchanging water as far as possible from the bore well and draining of the surface rain water. There was a heavy algal bloom which resulted in sudden depletion of dissolved oxygen resulting in the mortality of 14 specimens in the size range of 75 to 480 mm in July and August 1997. Application of lime at 20g/tonne was not effective in controlling the algal bloom.

The fishes were provided with shelter devices in the ponds to protect them from sun light. The fish grew from an average size of 163.2 mm SE 2.96 (74.16 g SE 2.09) in April 1997 to 425.7 mm SE 3.65 (1170 g SE 4.67) in March 1998 registering a mean growth of 0.72 mm (3.04 g) per day. The survival rate was 53.3% and the production was 3740 kg/ha (Table 1).

The fishes were fed with live juveniles of *O. mossambicus, E. maculatus* and prawns at the rate of 10% of the body weight. Feeding was done once a day during morning hours.

FRP tanks

As part of the broodstock development programme of groupers, eighteen juveniles of *E. tauvina* collected locally were reared in three FRP tanks. The FRP tanks were of 10 tonne capacity with a diameter of 2.6 m and a surface area of 8.32 sq. meters. Sea water was pumped into the tank by a 3 HP diesel pump. Sea water was pumped directly from the sea and stored in 100 tonne capacity concrete sumps. To maintain water quality in the culture system, 100% water exchange was carried out every fortnight.

Aeration was provided by a 3 HP single phase air compressor and dissolved oxygen values were maintained between 3.2 and 4.0 ml/L. However, optimum water quality conditions could not be maintained due to the low capacity of the air compressor and frequent power breakdowns. Eighteen numbers of *E. tauvina* of 140 to 180 mm (mean length 161 mm SE 5.87) and weight ranging from 50 to 90 g (mean weight 66.5 g SE 3.48) were stocked in April 1996. Shelter devices were provided in the tanks using granite stones, roof tiles, polythene sheets, asbestos sheets etc. The fishes reared in

the FRP tanks have grown from an initial mean stocking size of 161 mm SE (66.5 g) in April to 183.3 mm (115 g) in June, 233.3 mm (230 g) in September, 253.3 mm (305.8 g) in October, 284.2 (435 g) in November, 300 mm (481.5 g) in December 1996 and 314.5 mm SE 9.79 (525.5 g SE 12.38) in January 1997. The average daily growth increment during the culture period was 0.51 mm and 1.53 g. The production was estimated at 3154 kg per hectare with a survival rate of 83.3% (Table.1).

The fish was fed mainly with small sized live *Tilapia (O. mossambicus), E. maculatus* and small shrimps. The daily feeding was adjusted to 5% of body weight and feeding was done once in a day in the morning. From November onwards, the feeding rate was increased to 10% of the body weight. In addition to low cost fish and shrimps, clam meat was also incorporated in the diet. The growth in length and weight of groupers was found to be relatively higher when the feeding rate was increased. The overall food conversion efficiency was 0.107. Groupers with body weight of 500 g and above were given commercial cod liver oil capsules (150 mg) twice in a week inserted into the body of the trash fish. The fish fed with cod liver capsules had relatively higher growth rate.

Discussion

Groupers are emerging as a preferred species as an alternate for commercial production in farms where/ when intensive shrimp production has been restricted due to environmental degradation. Though commercial grouper culture is carried out in Malayasia, Singapore, Hongkong, Thailand and other Southeast Asian countries, not much progress has been achieved in India (Bensam, 1993, Nammalwar *et al.,* 1998).

The results of the present investigations have shown that growth and growth rate of *E. tauvina* and *E. malabaricus* in the different culture systems is comparable to those of identical species cultured elsewhere. Lanjumin (1982) reported a growth of 600-700 g per fish from 150-200 g in 5-6 months in *E. tauvina* cultured in net cages in Indonesia. Lee (1982) also recorded an almost similar growth pattern for the species from Singapore. Yaman (1982) reported a growth of 600g/ fish in 10-12 months in groupers fed with trash fish. In India, Hamsa and Kasim (1992) recorded a mean monthly growth rate of 16.3 mm (47.5 g) for *E. tauvina* reared in net cages at Mandapam in the Gulf of Mannar.

Low cost fish is the most common feed used in the culture of groupers in India. However, most of the commonly available small sized fishes presently used for human consumption in the country are relatively high priced. Feeding cost forms one of the major inputs (often 30-40% of the total expenditure) in the culture of carnivorous fishes such as groupers and sea bass. In the present investigation, the cost has been considerably reduced as feeding was mainly based on *Tilapia* and other trash fishes as well as clam meat collected from nearby brackish water areas. It is also envisaged to rear *Tilapia* in one of the brackish water

ponds at Narakkal so that it can be used as feed in the grow-out experiments. In Philippines, groupers are fed with *Tilapia* fingerlings by broadcasting usually 45 kg of *Tilapia* per one hectare pond every fortnight. Polyculture of groupers and *Tilapia* at a ratio of 1:20 is also practiced in Philippines. The importance of developing a balanced feed formulation for use in large scale culture of groupers is now well recognised and presently a slow sinking commercial extruded feed is available in some Asian countries. The level of dietary protein which provides maximum weight gain for *E. colloides* is estimated to be about 50% (Thobaity and James, 1996).

The studies conducted on the grow out culture of groupers showed that the mean growth rate was the maximum in earthen ponds compared to that in silpaulin lined ponds and FRP tanks. Considering an increase in the stocking density to 5,000 nos. per hectare and the growth rate obtained it works out to an average annual production of 4,340 kg from the earthern ponds. However, survival rate for groupers was the lowest in earthern ponds due to lesser control in maintaining the water quality. The investigations have shown the prospects of culturing groupers in the presently unutilised/underutilised estuarine and brackish water ponds.

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