Brief Communication

Coastal pond farming of Orange spotted grouper (*Epinephelus coioides*): A package of practice for effective technology dissemination

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Introduction

Groupers are classified in 14 genera of the subfamily Epinephelinae, which comprises at least half the approximately 449 species in the family Serranidae. Throughout most warm and temperate marine regions, serranids are highly valued for food in different countries. In the Indo-Pacific and Middle Eastern regions, several grouper species are farmed in cages, ponds, and tanks, but mostly they are raised from wild juveniles and are fed trash fish. Groupers are popular fish in the global Live Reef Food Fish (LRFF) trade in most of the southeast Asian countries. Among different species of groupers, Orange spotted grouper, *Epinephelus coioides* is one of the important farmed grouper species and has the potential to become an important aquaculture species because of high market price and other cultivable characteristics. Captive seed production technology for the species was developed and followed by the coastal pond farming method was developed by the Visakhapatnam Regional centre of ICAR – Central Marine Research Institute. Under the National Fisheries Development Board (NFDB) sponsored project, the coastal pond culture technology was disseminated in Krishna, West Godavari and East Godavari districts of Andhra Pradesh using hatchery-produced seeds. With the result obtained from the technology dissemination in different coastal pond ecosystem, the package of the practice for the coastal farming of the fish is well developed.

Pond preparation and water quality

Existing shrimp/fish pond or newly excavated ponds of rectangular shape with 1-2 m water depth is suggested for the culture. For ease of management, the preferred pond size of 500 m^2 to 1 ha water area is recommended. The pond site should have adequate water sources with salinity ranging from 15 to 35 ppt. After filling the pond with seawater/brackish water, fertilization is to be done by applying either organic or inorganic fertilizers to enhance the growth of natural food in the pond. Organic fertilizers like cow dung or chicken manure are applied at the rate of 1 ton/ha. Inorganic fertilizers like urea and di-ammonium phosphate are applied at the rate of 50 Kg/ha. However, the dose may be increased or decreased depending on the pond's fertility. Stocking of adult tilapia at 2500 to 5000/acre is recommended in the grouper culture pond before stocking the grouper. Once the stocked tilapia starts reproducing; they will serve as natural food or prey for the grouper

Nursery culture in coastal pond-based hapa

The optimum stocking size for the species in the grow-out culture is 25 to 30 g, and if the available size is small (1-2 inches), then nursing of the fry should be done before stocking in the grow-out pond to achieve better survival and reduce the grow-out culture period. Nursery rearing

Nursery rearing of Orange spotted grouper in hapa based nursery in pond

should be in the vicinity of the pond culture site, to reduce the transportation stress fingerlings. Thus, pond-based nursery culture in hapa/cage is recommended in the same grow-out pond or a separate nursery culture pond near the grow-out culture pond. For pond-based nursery, a rectangular hapa made of nylon net is to be used with the support of bamboo or casuarina poles. The sizes of the hapa can vary from 4 x 2 x 1.5 m to x 3 x 1.5 m with mesh sizes of 0.5 mm. The stocking density varies from 200 to 250/m^3. The grading of stocked fry is to be followed every week, to minimize cannibalism.

Feed with higher nutrient content (45% Crude Protein & 10% Crude Fat) is suggested, although chopped or minced trash fish is the most preferred by the fish. The recommended feeding rate in the nursery is 8% to 7% and 15% to 13% for pelleted feed and trash fish, respectively. The fish fry stocked at 2 to 3 g usually takes 60 days to reach 25 to 30 g in size. Adequate aeration should be provided in the nursery pond as the fish fry is stocked at high densities in the hapa. Maintaining a dissolved oxygen level of 4 to 6 ppm is recommended through the use of paddle wheel aerators.

Grow-out culture range spotted grouper in coastal ponds

The grow-out culture phase involves the rearing of grouper juveniles from 25-30 g to a marketable size of 800 to 1500 g in weight. The ideal stocking density for the grouper juveniles is 3500/acre. In grow-out culture system, feeding the fish with the formulated feed and live tilapia perform better growth. Thus, nursery reared grouper fingerlings to be transferred to the grow-out pond, a month after tilapia brooders have been stocked in the grow-out pond. This ensures abundant availability of tilapia seeds when grouper fingerlings are stocked in the pond. Apart from the live tilapia available in the pond, the fingerlings should also be fed with either dead chopped fish at the rate of 5% of biomass or pelleted feed at the rate of 1% of the biomass.

The feeding rate should be 50% of the usual feeding rate for the fish fed with pelleted feed alone (Table.1). If the grow-out pond is stocked with sufficient number of tilapias, then the feeding rate of formulated feed should be reduced 50% than the regular feeding mentioned in the table 1. Whereas, instead of formulated feed, if dead tilapia given as feed, then the feeding rate should be 3-4 times higher than the regular feeding rate given in the table 1. The total feed should be divided and given at the feeding frequency of 2-3 times per day and feeding should be done at the same place to acclimatize the fish for feeding. When chopped fish are provided as feed, adequate care should

Table 1. Growth and feeding of Orange spotted grouper in grow-out farming with formulated feed

Days of Culture (DoC)	Fish size (g)	Feed size (mm)	Feeding rate	Feeding f requency (times/day)
0-60	25-75	1.8 to 3.0	8%	4
60-120	75-150	3.0 to 5.0	6-5%	4
120-180	150-275	5.0 to 6.0	5-4%	3
180-240	275-450	6.0 to 1.0	4%	3
240-300	450-650	1.0 to 1.5	3-2.5%	2
300-360	650-850	1.0 to 1.5	2%	2

(Note: When live tilapia are available in the pond, the feeding could be reduced 50%)

be taken to avoid the deterioration of water quality parameters. Determining the feeding rate depends on the fortnight growth. Based on the weight gain, subsequent feeding should be determined. Though the fish accepts formulated pelleted feed well, it needs a bigger pellet size since the fish has a bigger mouth size. For the fish being demersal, the use of aggregating substratum is recommended during grow-out culture, where the fish can hide and can also be fed at a particular location. However, at times, it may lead to an increase in cannibalism if a size difference exists. The fish growth, feeding frequency, and feed used are given below. While in the sampling, the fish can be collected from the regular feeding site using cast net. It is observed that the size variation in the grow-out culture is more prominent in the fish pond fed with formulated feed than the fish fed with dead tilapia.

Water quality and disease management in coastal ponds

Maintaining good water quality parameters determine healthy culture operation. Use of paddle wheel aerators of 2 numbers/ acre is recommended to maintain required dissolved oxygen content in the pond. Water salinity of 15-30 ppt is recommended for optimum fish growth. Maintaining grow-out pond with small weed fishes/crustacean is highly recommended to enhance the fish growth and reduce the feed cost, and thus frequent pond fertilization with organic or inorganic fertilizer is advisable. Three major disease-causing agents such as parasites, bacteria and virus are mostly responsible for disease in Orange spotted grouper. All diseases are associated with stress and the stressed fish are easily affected by the pathogens. Therefore, stress during culture should be minimized by maintaining good water quality, optimum feeding and stocking density. Among all, the virus infection can occur from hatchery produced larvae itself, so selecting active seed is an important measure to control the infection. Bacterial infection in the grouper culture can be managed by medicated feeds with admissible antibiotics or use of probiotics in the culture. Fish colouration decides market demand for the fish, and the fish with pale white with prominent orange colour spot fetched premium price. The coloration achieved for the fish reared in stress free environment. Thus, maintaining conducive water quality condition by with appropriate management strategy may help to maintain better fish coloration.

Fish harvest and marketing

Orange spotted grouper is demersal fish, and mostly remains in the bottom and thus entire pond should be drained for complete harvest. However, as size variation in the fish is more prominent, phased manned fish harvest would be ideal to achieve better economic returns. If an entire pond is planned for harvest, then the majority are harvested with help of a dragnet and the remaining in the pond bottom, by draining out the entire pond. For phased harvest, hideouts made of PVC pipes or small branches are used. The hideouts are placed usually where feed is given, and the fish congregates in the hideout, then, through the use of cast net or lift net, the fish is harvested. While in the phased harvest, the bigger fishes are collected and smaller fishes are released back for further culture. A type of production net cage of 6 x 3 x 1.5 m size can be installed in the pond, and the bigger fish collected through the cast net can be stocked in the net cage and fed till marketing. To maintain the freshness and quality of harvested fish, washing in clean water and chill killing is suggested. Harvested fishes are stocked in plastic trays or thermocole boxes by adding layers of ice in equal quantities, both below and above the fish. It is suggested to harvest in the morning hours to maintain the freshness of the fish which is highly popular in live and chilled conditions in South East Asian countries and United Arab Emirates, who are the major buyers. The live fish fetches premium price of 3-4 time higher than the dead fish trade, and chilled fish is another major form of export to other countries. All time retail price for the fish in the international live trade ranged between ₹ 1300 to 1600/kg.

Harvesting of Orange spotted grouper cultured in coastal ponds

Economics

The total operational expenditure and profit for culture of the fish in 1 acre water spread area is given in Table 2. Culturing the fish for one year at the stocking density of 3500 numbers per acre will support the farmer with net profit of approximately ₹1.5 lakhs with a price realization of ₹285 per kg. For the calculation, cost of production is calculated with the maximum price and selling price considered for the minimum price based on the earlier experience. Thus, the net profit can be increased by employing appropriate husbandry practices.

Table 2. Economics of coastal pond culture of Orange spotted grouper

Inputs	Cost (₹)
Pond preparation and water treatment	40,000
Seed cost–3500 nos @ ₹15/seed	52,500
Nursery rearing (hapa)	25,000
Expenditure towards live tilapia culture	25,000
Feed @ FCR 1:1 (for 2.4 tonnes of fish, approx. 2.5 tonnes of feed @ ₹ 110/kg is required)	2,75,000
Electricity	50,000
Miscellaneous expenditure (labour for grading)	50,000
Expenditure	517,500
Production: 2400 kg @ 80% survival with selling price @ ₹280/ kg (Average harvest siz: 850 g)	6,72,000
Net profit	1,54, 500

Best Management Practices (BPM) for pond culture of Orange spotted grouper

The following steps are recommended for the coastal pond farming of Orange spotted grouper for better management with economic returns

- Seed transportation in the polythene bag should be avoided if the seed /fingerlings size exceeds more than 10 g. The dorsal spine for the fingerlings at the particular size is strong and prominent, thus, it may damage the polythene bags while in transport.
- Seed stocking during winter season should be avoided: The fish at initial stage (1-2 g) is easily stressed with the low temperature (< 27ºC). Thus, fry staged fish transported at low temperature may stressed easily due to translocation.
- Grading in nursery is essential for reducing cannibalism: The species is highly carnivorous at the initial stage (<50 g). Thus, to enhance the survival, fish to be graded in the nursery phase.
- Use of hide outs: Hide-out should be used in grow-out culture pond for better feeding and ease of harvest
- Mixed feeding (artificial and low value fish) helps for better growth: Use of only trash fish deteriorate water quality and exclusive use of formulated feed increases size variation. Therefore, mixed feeding is recommended.
- Stocking of live tilapia: Stocking of the tilapia brooders before stocking the grouper in grow –out pond is highly recommended to make tilapia larvae readily available for the fish stocked in grow-out ponds. This practice will reduce feed cost in the culture operation.
- Good water quality: Maintaining good water quality with proper water exchange and appropriate fertilization at regular interval is recommended for to increase the natural food in the pond and also to maintain proper coloration of the fish for fetching premium price.