Culture of Spiny Lobsters in Small Cages along Saurashtra Coast, Gujarat

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Introduction

The state of Gujarat with about 20% of the country's coastline, 33% of the continental shelf area and over 2,00,000 sq. km of EEZ ranks second only to Kerala among the maritime states in marine fish production. The annual marine fishery potential of the state is estimated at 0.57 million tonnes, which is about 17% of the all India potential. The width of the Indian continental shelf is greatest off Gujarat offering scope for exploitation of several finfish and shellfish resources by both traditional and mechanized fishing. However, the intensive and uncontrolled fishing pressure in the coastal waters of the state fishing has resulted in major shifts in the marine ecosystem adjoining the state. The bulk of the fish catch of the state in recent times is composed of low value species, which are sun dried, or block frozen and exported to China and Southeast Asian countries. The production of large sciaenids, large perches, pomfrets, threadfins, penaeid prawns, lobsters, eels, clupeids and mullets have been declining very fast and have reached a critical level. Some of the valuable fishes like larger sharks and whitefish had completely vanished from the fishery of the state. The fishery at present is dominated by low value finfishes and shellfishes like small sized croakers, carangids, Bombay duck, ribbonfishes, threadfin breams, lizardfishes, flatfishes and non-penaeid shrimps. It was therefore felt a necessity to revitalize the dwindling fishery of the state. Capture based aquaculture (CBA) is one of the alternative to augment the low catches and low economic returns in recent times. In this context, open sea cage culture offers much promise and allows the fishermen to maximize their economic returns.

Site selection

Site selection is one of the most important factors determining the success of cage culture. The water quality, currents, tides, depth and pollution load are some of the important factors to be considered while setting up of a cage. In addition, navigational routes, property rights, ease of approach, proximity to market, availability of feed and communication are the other factors that determines the success of cage farming.

Katpar fishing harbour located 10 km away from Mahuva in Bhavnagar district (Fig. 1) offers excellent scope for culture of spiny lobsters as juveniles are available in plenty during the post monsoon months of August, September and October. There are other potential sites of juvenile availability as well along the coast of Mahuva. The most promising among them are Doliya followed by Khera, Gujarda, Dayal, Kotada, Kalasar, Koliyak, Kuda, Mahuva Bander, Setarda, Chanch and Visaliya. However, due to excellent availability of juvenile lobsters coupled with easy accessibility and transportation and good communication facility, Katpar fishing harbour (near lighthouse) was selected as the site for installing small cages designed for artisanal fishers. A survey of the bottom by underwater survey revealed rocky substratum and an analysis of water quality parameters from the area suggested that water quality is optimum for lobster culture. The water current is not too strong at this area and the tidal fluctuation is favourable which further supports its selection for cage farming.

Availability of seed

Juveniles of spiny lobsters are available in abundance and are stocked in pits from mid October. The catching of lobster juveniles is a highly skilled job and the fishermen from this area specialize in it. Juveniles are best caught during low tide using encircling net locally known as "wada" (Fig. 2). Such nets are costly and last only for a month or so but the cost is usually recovered in a day itself as marketable lobsters are also caught along with juveniles. The total cost of the net is around Rs. 2000/-. The nets are easily available and purchased from Rajula market in Bhavnagar.

Traditional pit culture for fattening of spiny lobsters

The size of pit varies but, in general, two sizes have been found to be popular. The "virdas" or smaller pits measure 2.4 m in length, 1.8 m in breadth and 0.9 m in depth (Fig. 3). The "virdas" must be spaced by about 1.5 m to allow enough space for movement between them. The

Fig. 1: A view of the Katpar fishing harbour where the cage was installed

Fig. 2: Juveniles of lobsters are caught during low tide using encircling net

Fig. 3: Traditional pit culture of spiny lobsters for fattening purposes

Fig. 4: Circular cages designed by CMFRI for lobster culture

large pits measure 6 m in length, 9 m in breadth and 1.5 m in depth. The borders of these tanks are made firm with a cemented stonewall about 0.3 m in height. The "virdas" must be located at lower levels where flushing with tidal waters occurs twice a day. In the larger pits, an outlet with valve is located at the lower end from where the lower muddy water can be drained out. A provision for pumping in fresh seawater is also made and the pump is protected from tidal water. Pits are dug with hand tools as the bottom rock is soft in nature. In the sides of the pits, small holes of 0.15 m are made so as to provide hiding spot for the moulting lobster. The pits are covered with nylon nets to prevent the lobsters from being washed away by tidal waters. The nets are fastened in such a way that the force of water does not easily displace them. Displacement of netting may cause loss of fattened lobsters and also entry of the predators into the culture pit.

Juveniles of spiny lobsters are stocked to achieve a stocking density of 27 per m^2 of floor space of the pit. The seeds are stocked for the entire year. About half the seed are used in the first fattening cycle of 4–5 months and the remaining half are fattened in the next cycle for grow out.

Cage culture of lobster fattening

Culture of lobsters using small cages was introduced by Veraval Regional Centre of CMFRI, in Saurashtra, Gujarat. Four small circular cages made from HDPE material having a circular base of 3.5 m dia at bottom, 3 m dia at the top and covered with birds net to prevent predators were fabricated and installed at Katpar fishing harbour (near lighthouse) (Fig. 4). The nets were made up of nylon material and ballast was attached at the bottom. A small round feeding gate was provided at the top end of the cage by cutting the net. The cages were fastened to four casuarina poles placed in the four sides of the cages and were fixed to the sea bottom and held in position by PVC ballasts. Culture of lobsters in the cages was cost effective and less labour intensive for fish farmers of this area than the traditional pit culture. The cages were submerged three-fourth in water and floated 2 m above the sea bottom. Juveniles weighing on an average 43.3 g were stocked @ 30 numbers per m^2 in the cages. Uniform sized juveniles free from injury and free from damage were stocked to prevent cannibalism among juveniles.

Trash fishes fetching very less market value were fed to lobsters @ 10% of the body weight distributed evenly between morning and evening hours. The growth rate was frequently observed by sampling with cast net and their daily feeding ration was adjusted, if required. The nets were frequently cleaned as there was clogging with silt and fouling with barnacles. Clogging and fouling of net material restricts water flow and also adds to the weight in due course. The environmental parameters in the vicinity of the cage were monitored weekly and were found to be well within the optimum limits for lobster culture.

The growth rate of lobsters in small cages was found to be very promising. The survival rate of juveniles in artisanal cages was found to be excellent and nearly 100%. Feed Conversion Ratio (3.24) and Specific Growth Rate (0.68) were also favourable. The average weight increment was 0.96 g per day. The results of the present study are in full agreement to Syda Rao *et al.* (2010), who recorded a survival of 75%, weight increment of 0.82 g per day and SGR of 0.50 in cage reared spiny lobsters *Panulirus homarus* at Vizhinjam Bay. Vijayakumaran *et al.* (2009) reported that sub-adults of *P. homarus* with an average weight of 123.61 g reached 341.25 g in 225 days at a stocking density of 21 nos.m^{-2} with a survival of 73% in floating sea cages along the southeast coast of India. Their growth rate was 0.97 g.day^{-1} with a SGR of 0.43, which are comparable to the results obtained in the present study. Sreekrishnadas *et al.* (1983) recorded 0.6 g growth per day with survival rate of 57.5% for *P. homarus*

from open sea net cage at Tuticorin Harbour. Indeed the highest reported growth rate obtained in indoor culture of *P. homarus* juveniles so far was 0.75-0.76 g.day^{-1} (Radhakrishnan and Vijayakumaran, 1990; Kaleemur *et al.*, 1997). The survival rates recorded was similar to 70-95% recorded for *P. homarus* by lobster growers in Vietnam (Tuan *et al.*, 2000).

Other advantages of cage farming

Seaweed culture was integrated profitably with cage culture and *Kappaphycus alvarezii* farmed in bags associated with cage and thirteen-fold increases in weight of *Kappaphycus alvarezii* was observed after 90 days of culture. Small cages in sea functions effectively as Fish Aggregating Devices and attracts pelagic fishes which move in shoals. This facilitates fishing in the vicinity of cages and saves fuel costs.

Conclusion

The success attained in culture of lobsters in small cages could spur the popularity of cage culture in Saurashtra, Gujarat and enhance prosperity of fishers by boosting spiny lobster production.

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