

Backyard Lobster Fattening Unit Economic Feasibility Analysis

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Lobsters form an important fishery all along the coastline of India. The lobster resource potential of Indian EEZ is 50,000 mt (Vijayakumaran and Radhakrishnan, 2000). Against this, lobster production of India in the year 2000 was 2,387 t, consisting of spiny lobsters, sand lobsters, and deep-sea lobsters. While lobster fishery occurs round the year along the Indian coast and its island territories, there are peak seasons depending on the hydrographic conditions and natural fishery distribution of the regions concerned. Maximum landings of lobster were reported from Gujarat (43.7 per cent), followed by Maharashtra (25.4 per cent), Tamilnadu (14.6 per cent) and Kerala 12.5 per cent. (Sakthivel, 2003). About one fourth of the commercial lobster catches comprises juveniles in the average range of 60-90g in weight each. In some areas hardly 20 per cent of the catch is in about 200g weight range, while upto 80 per cent are juveniles of less than 100g.

Canada is the world's leading live lobster exporter, with an annual export level of 20,400 mt. Export of live lobsters from India increased from 22 mt in 1994 to 97 mt in 1996. Live lobsters were exported to a tune of 22 mt in 1994 and 128 mt in 1997 with foreign exchange earnings equivalent to Rs. 1.55 and 9.3 crores respectively. Further, it is also stated that trade of live lobsters in India increased from 1.3 per cent in 1993-94 to 11.2 per cent during the year 1998-99 and export of live lobsters rose from 44 mt in 1995-96 to 160 mt in 1998-99. The live lobsters fetch an export price that ranges from Rs.800 to 1500/kg. These high export prices for live lobsters have motivated the Indian stakeholders to target lobster fishery which has led to their overexploitation in Indian waters (Remany, 2003).

In recent years, trade figures show that around 400 tonnes of undersized lobster juveniles are being exported

annually in live, chilled & frozen form from India. As baby lobsters of less than 50g have practically no market value, they could be obtained from fishermen at throwaway prices. The price of juvenile lobsters is about Rs 100 - 300/kg. Those that weigh over 200g each will fetch above mentioned price depending on the species and season (especially during December to January). A large number of juveniles caught are exported to Hong Kong in a live condition. From here these are sent to Taiwan and China for fattening. (Charles.M.James and Peter Marian, 2003).

Lobsters have distribution all along the Indian coastline. Three species of lobsters occur in Indian waters, namely *Panulirus homarus*, *Panulirus polyphagus* and *Panulirus ornatus*. They form a fairly good fishery along both east and west coasts of India. The major lobster landing centres (of mechanized boats) on the North West (NW) coast are located at Veraval in Gujarat and Mumbai in Maharashtra.

While lobster juveniles are promising crustacean species mostly for farming, those at pre-adult or advanced juvenile stage of growth are well suited for fattening. The reasons for resorting to lobster farming or fattening are related to their popularity as a delectable seafood item with a high market value.

Capture landings of lobsters from Indian EEZ have been fast declining, mostly because of increasing exploitation of juveniles. This situation emphasises the need for fishery stakeholders engaged in lobster capture and their processing to take the needed measures to target only grown up ones. There has been a focal awareness of the profitability of lobster fattening to marketable size among the stakeholders concerned and this has a remarkable deterring or discouraging effect on the trend of exporting lobster

juveniles. Exporters consider spiny lobster weighing 200g and above as grade-I, 100-199g as grade-II, and below 100g as grade-III (Charles M.James and Peter Marian, 2003). The minimum recommended size (carapace length) for fishing and exports of lobsters are furnished in Table 1

Table.1: Minimum Recommended Carapace Size of Capture Lobsters

Species	Size of Carapace Length
<i>Panulirus homarus</i>	65 mm
<i>Panulirus polyphagus</i>	70 mm
<i>Panulirus ornatus</i>	80 mm
<i>Thenus orientalis</i>	60 mm

(Recommended by Vijayakumaran and Radhakrishnan, 2000)

Fattening can be done for increasing market value of lobsters of less than 50g (Baby lobsters) and also for imparting value addition to bigger lobsters. Lobsters in late or pre-moult stages (soft shell to hard shell) can also be subjected to fattening system. Survival of fattened ones will be higher during transportation, and this contributes to the realization of a higher price.

In the above background, a study on an economically viable backyard lobster fattening system, which can provide additional income to a fisherhold has been conducted.

The objectives of the study were: 1) To work out the economic viability of backyard lobster fattening operation; 2) To find ways of properly utilising low priced juvenile lobsters (Baby lobsters) in the catch; and 3) To create employment opportunities to the local coastal fisher communities and others interested in lobster fattening.

Methodology: The data for the present study were collected from randomly selected fishermen (Trawler deckhands) working in a trawler of

Versova with Mumbai as the base. A structured and pre-tested interview has been conducted to collect primary data.

Lobster Fattening Operation

The different stages in the lobster fattening operation include selection of site and setting up of needed tanks (for fattening lobsters), stocking them with juvenile lobsters, management of tank water parameters, feeding, tracking of moulting, studying growth rate and adopting measures to prevent and control disease incidence in lobsters.

Selection of Site and Locating Tanks:

Fattening facility should be sited in an area where adequate seawater is available with minimal salinity fluctuations, and at a place close to a landing point from where juvenile lobsters could be secured and where needed feeds could be assembled. At this site circular or rectangular masonry tanks to be used for lobsters fattening are to be located. These may have 5 sq m of surface area with a height of about 1.5m. Along the sides adjacent to the bottom small stone projections are to be made to facilitate the lobsters to gain a hold while moving. Tropical spiny lobsters grow faster and they are also highly adaptable to captive conditions. In the middle of the tank an outlet system needs to be provided with a pipe taken out to drain the water out. Filling of the water can be done with inlet pipes taken from a well or from the storage tank, using a pump set.

For backyard operations, it is suggested that a unit having three tanks of the dimensions suggested may be set up, each having a capacity to hold 50 nos of lobster juveniles at a stocking density of 10 nos/sqm.

Quarantine Tank: Live lobsters collected for stocking should be quarantined first in holding tanks (to be set up), for a minimum of 5-6 days before transferring them into the circular or rectangular fattening tanks. These quarantine measures would enable separation of the healthy juveniles from the weaker ones before transference into the fattening tanks. For this quarantine purpose two

masonry holding tanks (as mentioned above) of rectangular or circular size 3x3x1 m of equivalent volume should be provided. (Sakthivel, 2002). As the tanks are for the purpose of holding and for periodic accumulation of baby lobsters, the number to be kept in them has to be regulated suitably.

The important observations on the juveniles to be made during the quarantine period are: 1) Active swimming behaviour; 2) Functioning of appendages; 3) Fungal/ Protozoan infections; 4) Tail or pleopod erosion or black spot occurrence; 5) Mortality rate, and 6) Environmental stress / survival rate.

Stocking: Stocking density in fattening tanks varies from 7-20 nos/m² depending on the size of juvenile lobsters and the type of rearing systems like static or flow through water systems. While an average stocking density of 10 lobsters per sq m are recommended, the number would have to be determined taking into account size of the juvenile lobsters to be fattened. Judicious stocking rate will not only improve growth rate but will also have a major effect on the overall cost of production.

Water Quality Parameters: Lobsters are very much sensitive to sudden changes in water quality parameters. So much so, the source water should be passed through a slow sand filter and a one micron filter bag into the tanks, in order to eliminate the suspended particles. This system of filtering being expensive, it can be adopted only in the case of large farms. For others, a sedimentation tank can be used for the settlement of particles before allowing the water to pass through the inlet into the fattening ponds. Most of the spiny lobsters can adjust themselves to low oxygen conditions. However, they require higher oxygen levels at night as they

normally feed and undergo moulting during this time. *Panulirus homarus* and *Panulirus ornatus* are totally marine, whereas *Panulirus polyphagus* is euryhaline and can grow in lower salinities (20-25 ppt). Less than 3.5 ppm DO₂ may result in mortality of moulting lobsters. NH₃

level in the operation tank should be maintained at less than 1 ppm, Daily water exchange at 80-90 per cent is recommended and this should be done during the early morning hours.

Table.2: Water Quality Parameters

Salinity	28-35 p.c
Temperature	26-33°C
pH	7.5-8.5
Dissolved Oxygen	Not less than 3.5ppm
Total Ammonia Nitrate	1ppm 0.25ppm

Feed and Feeding Strategy: Lobsters are omnivorous. They feed on a variety of bottom dwelling organisms, bivalves, molluscs, barnacles, polychaetes, small fishes and decaying natural animal matter. Daily feeding is necessary for ensuring optimum growth of lobsters. Studies indicate that meat of bivalve molluscs such as mussels, clams, and squid wastes and trash fishes as constituents result in the most suitable feed for fattening lobsters. It is seen that lobsters fed on mussels put on weight of flesh well comparable with other feeds. Feeding rate has been determined to be 5-10 per cent of body weight to be given only once in the evening (Table. 3), in relation to the size of the lobster. In this feeding programme initial feeding may be at 5 per cent of body weight and at end of the fattening month the rate can be increased to 10 per cent of body weight. It can however be altered with reference to the growth and feed intake. Lobsters also accept a wide variety of trash fishes. The feeding rate with mussels or with clams can be almost similar, although mussel-fed lobsters were seen to have a slightly better growth rate than clam-fed ones. Reduction in feeding rate for any reason (such as shortage of feed) may lead to cannibalism among newly moulted animals. Lobsters are nocturnal feeders. Therefore feeding has to be done during the evening hours and any unconsumed feed has to be removed on next day morning before water exchange. Feeding with live mussels is preferable to feeding with frozen or dead animals. Feeding fishes with high fat content may be avoided. Feeding with fatty fish flesh may

Table.3: Feeding Strategy

Months of Culture	Weight at Start of Month (g)	Amount of Feed per day per Animal (g)	For 150 days (in kg)	For 31 days, Amount of Feed (kg)	Cost of Feed (at Rs. 15/kg) Rs.
0	70	3.5	0.525	16.275	244.125
1	100	6.0	0.900	27.900	418.500
2	130	9.1	1.365	42.315	634.725
3	160	12.8	1.920	59.520	892.800
4	190	17.1	2.565	79.515	1192.725
5	220	22.0	3.300	102.300	1534.500
			Total	327.825	4917.375

(Feeding can be increased or decreased based on intake)

Table.4: Economics of Lobster Fattening

Economics of Lobster Fattening (5-6 Months Operations)	Backyard Fattening Model
1.Stocking area 2.Stocking size lobsters of any marketable size. 3.Stocking density / sqm (50-100gm) 4.Survival 5.Harvesting size 6.Fattening period	15 m ² 50-90g and 90-130g, soft shell 10 nos /m ² 80 per cent Above 200-250g 5-6 months operation / Two operations in a year
Capital Cost	Rs.
I.) Open Cement Tanks	
i) Culture tanks 5x 3.3x1.5m (3 nos, circular tanks)	16,000
ii) Quarantine / holding tanks 3x3x2m-(2 nos)	4,000
iii) Bore well / water supply	10,000
iv) Motor / Aerator/ Electrical work	10,000
v) Bucket, Hand net, Plastic turf	1,000
Light roofed shed	5,000
Total	46,000
II.) Operational Cost / Season	Rs.
Cost of seed (150nos Rs/kg) 10.500 kg 1kg = Rs 150	2,500
Cost of feed	4,500
Electricity charges + communication charges (Phone bills)	1,500
Wages to workers	7,500
Maintenance and Management cost	1,000
Total	17,000
Total Capital cost +Operational cost (I + II)	46,000 + 17,000
Rupees	63,000
Harvest / year (kg)	30Kg / operation 60 kg / year
Marketing price (Rs / kg)	Rs. 1000 / kg 30 x 1000 = 30,000 / operation
Total income / year (Rs)	60,000 / year
Net profit/ year (Rs)	63,000 - 30,000 = 33,000

(The input cost may change according to place and seasons)

contaminate the water with the fat in the waste feed leading to deterioration in water quality (Table. 3).

Moulting and Growth Rate:

Lobsters cast their shell during moulting which occurs frequently during the fattening period. The shells that are shed during moulting should be removed daily during morning hours. The moulting rate will be high especially during full moon and new moon days. The moulted animals should not be disturbed as they have very tender flesh and are prone to fatal attack by the other non-moulted lobsters. Under optimal rearing conditions, an average weight increase of 30 - 35g / month could be obtained in *Panulirus ornatus* in a period of 3-4 months (Remay, 2003), and in 5-6 months they attain a weight of 300g to 400g. Under well-managed conditions, the survival rate will be more than 80 per cent. The density of the growing animals may have to be however thinned out in a phased manner to achieve good survival. The average production in a unit of 20 tanks of 5 m² each of a grow out system has been estimated to be 400kg / year (Sakthivel, 2003).

Shelters: In the fattening tank, shelters must be provided for the lobsters to hide during the day time. Shelters not only reduce the cannibalism but will also facilitate newly moulted lobsters to escape from the overtures of hard shelled lobsters to consume them. Provision of shelters like tiles, boulders, etc may help to simulate the natural shelter conditions. Tubular shelters have to be however avoided as lobsters tend to crowd inside the tubes resulting in reduced growth and survival (Srikrishnadhas and Sundararaj, 1989).

Disease Management: Lobsters possess hardy exoskeleton. This reduces the chances for the entry of pathogens into their bodies.



Table.4: Farmers Perception about Lobster Fattening

Respondents (per cent)	Willing to do Lobster Fattening	Need Training and Technical Support	Need basic Knowledge about Lobster Fattening	Need Alternative Business in Closed Season
37 per cent (Mechanized boat fishermen)	Yes	Yes	No	Yes
21 per cent (Traditional fishermen)	Yes	Yes	No	Yes
19 per cent (Mechanized boat fishermen)	No	No	No	No
23 per cent (Traditional fishermen)	No	No	No	No

Yet there are some reports on the occurrence of diseases in lobsters. Cultured lobsters are not generally affected by any major diseases and survival rates are often more than 90 per cent in normal lobsters and 70 per cent in eyestalk-ablated lobsters (Vijaykumaran, and Radha-krishnan, 1986). One of the major diseases is the Moulting Death Syndrome (MDS), which leads to mortality of lobsters soon after moulting. Another important disease is Gaffemia caused by the bacterium *Aerococcus viridans*. Protozoan infection can be controlled by treatment with formalin (20-30ppm) for one hour; Flurozolone (10 ppm for one hr) is effective against bacterial infection. Prior to stocking, the healthy animals should be given bath treatment with methylene blue of 1ppm for one hour on two alternative days. During fattening process, frequency of moulting increases the chances of entry of pathogenic particles. The stress caused at the time of moulting also enhances scope of pathogen entry.. Periodic handling of lobsters especially newly moulted ones should be avoided as this may result in internal injuries to animals, and there is a chance for the depressed growth in the moulted animal before the shell is regenerated.

Result and Discussions

Average production in a unit of 10 tanks of 5 sq m each of a grow-out system has been estimated at 400 kg/year, and the cost of production has

been placed at Rs. 1,47,000 reckoning the net profit at Rs. 93,000 in a year (Srikrishnadhas and Sundararaj, 1989). The estimated capital cost for having a farm with 20 tanks of 5 sqm is Rs. 19.85 lakhs and operational expenses are worked out to be Rs. 5,15,000 per year. The gross profit has been computed at Rs. 6,05,000 with an annual income from sale of lobsters computed at Rs. 11,20,000/year (Selvaraj, 2002). Lazarus *et al* (2004) reported a total production valued at Rs. 6,383 to 6,692 per cycle (3 months), and Rs. 2000-2500 per cycle as additional income per fisherwomen in the experiment conducted in a backyard lobster fattening facility. In the present study, total estimated capital cost for three fattening tanks was Rs. 46,000 and total operational cost was Rs. 17,000 per cycle. The estimated production was 30-35kg per cycle, the result of proper management. The sales price realised per kg of lobsters was Rs. 1000 approximately, and the total sales price was Rs. 32,500 per cycle. These results indicate that through proper fattening management one can get back the total investment within a year. The estimated average monthly income worked out to Rs. 3000-3500.

The survey targeted 50 per cent of the poor and middle class fishermen working as deckhands in a mechanised trawler. They willingly involved themselves in the operations, with the hope of receiving proper guidance and training from the

research institutes or NGOs concerned. They were also seeking an arrangement for loans towards capital investment from the banks for starting lobster fattening activity on similar lines as outlined. In Maharashtra, as ascertained from a respondent during the study, weight of lobster catches per day per fisherman, on an average ranged from 1-15kg, and the weight of each has a range from 20g to 500g. The study has revealed that the fishermen sell lobsters juveniles at marketing places, at a far lower price than those based on graded weight and that in the whole of Maharashtra currently no one is involved in lobster fattening and in any case in a commercial way. This may be the reason that no data on commercial culture production could be collected.

Conclusion

The live lobster export business supports the toiling fisher community to a great extent. Live spiny lobsters fetch good returns for them, several fold more than the dead lobsters. Live lobster fishing and trade should therefore be promoted. Further, regulation of size of lobsters at capture can be controlled as the fishermen can be helped easily to divert the catches to the fattening sector. This kind of diversion provides higher incomes to fishermen and at the same time prevents killing of juveniles. This strategy also enables earning of more of foreign exchange. (Kaleemur Rahman and Srikrishnadhas, 1994). Life Care Trust (NGO) in Tamil Nadu promotes lobster-fattening practices for the uplift of the livelihood of the fisherwomen. The NGO endeavours to spread awareness of negative impacts of fishing of juveniles and egg bearing lobsters for sustaining the lobster fishery. Development of hatchery technology for seed production and sea ranching needs to be given high priority (Radhakrishnan, and Manisseri, 2001) for promoting sustainable lobster fishing in the long run. Tremendous scope exists for transferring the lobster fattening technology to coastal fishing community, especially to unemployed coastal women to earn an additional income during their leisure time by

setting up backyard facilities and utilising them. (Lazarus *et al*, 2004). Survey shows that nearly 50 per cent of the respondents are willing to undertake lobster fattening as an additional business and income source. In this context fishers expect technical support and training from Government Research institutes and NGOs. Now a days, the Government is taking steps for the uplift of fisher communities educationally and socio-economically. Further, bank loan facilities and interventions of cooperatives are in the forefront for the uplift of the status of fishers. In this context, the inspiring news is that NABARD has come forward to refinance commercial banks, which are advancing loans for lobster fattening projects (Sakthivel 2003). Lobster fattening and culture activities could be developed along Maharashtra coast close to the points where catches of young lobsters are more. The study shows possibilities of promoting backyard lobster fattening with all supporting facilities, such as seasonal seed and feed supplies, induction of management techniques, and marketing facilities. The paramount need however is to promote the involvement of the fishermen and fisherwomen in the activity to pave the way for a resounding success of this activity that has immense potential for their professional and socio-economic development and for augmenting exports and foreign exchange earnings.

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