LOBSTER CULTURE AND LIVE TRANSPORT

M. VIJAYAKUMARAN[1] AND E.V. RADHAKRISHNAN[2]

Central Marine Fisheries Research Institute,
Cochin 682 014.

INTRODUCTION

Eight species of spiny lobsters, six shallow water and two deep sea species, and two species of slipper or sand lobsters constitute the lobster fishery of India. Spiny or rock lobsters have a subcylindrical body with long cylindrical antenna with whip like flagellum. The carapace is covered with numerous spines and tubercles. The slipper or sand lobsters are with a dorsoventrally flattened body and short scalelike antenna without whip like flagellum.

RESOURCES

Lobster catch in India is around 2000-3000 tonnes per annum and most of it is exported frozen, whole cooked or live. Export of whole lobsters since late 80's and live lobsters since 1993 and the ever increasing demand for Indian lobsters have resulted in their regular and organised exploitation. Maharashtra and Gujarat are the main lobster fishing states followed by Tamil Nadu. While lobsters are landed as a by-catch in fish/shrimp trawls in the north-west coast, they are caught by gillnets, traps and occasionally by trawls in the south-east and south-west coasts (Table 1.)

Lobsters weighing 200 to 300g are best suited for whole cooked product while those weighing over 300g (greens) and 500g (tiger) are in demand for live lobster export. High demand for live lobsters, which is Rs.600-1500/kg depending on size, has recently generated considerable interest in culture/fattening of spiny lobsters.

SCOPE FOR CULTURE/FATTENING OF INDIAN SPINY LOBSTERS SEED

Seed

All commercially important species of shallow water spiny lobsters in India have been bred in captivity, but their whole larval cycle is yet to be completed. Scientists at the Central Marine Fishers Research Institute (CMFRI) were successful in rearing lobster larvae to more than half way stage and efforts are on to complete the larval rearing process. Success has been achieved recently in Japan in completing the life cycle of a few temperate and sub-tropical species of spiny lobsters, but hatchery produced lobster seed is yet a distant dream.

Many successful devices have been developed for collection of postlarvae or puerulii, but large scale collection is not possible in India to initiate lobster culture, since it

Present Address : 1 Madras Research Centre of CMFRI, Chennai - 600 006.
2 Calicut Research Centre of CMFRI, Calicut - 673 005.

will be difficult to collect large numbers from a particular region. Hence, any lobster culture venture in India, at present, has to start with collection of lobster juveniles from nature and growing them to the required size. As there are no size regulation in our country, about a third of our commercial catch are undersized juveniles. These juveniles can be utilized for lobster culture/fattening.

Another strategy that can be adopted by prospective lobster farmers is fattening of big size lobsters for 2 to 3 months to increase their "grade" in the live export trade.

Growth Rate

Under sub-optimal rearing conditions, the Indian spiny lobsters, *Panulirus homarus* and *P. polyphagus* were grown from puerulii to 80g size in 12-16 months and then to 30g in another 12 months. In the tiger lobster, *P. ornatus,* 380g size was obtained in 20 months. Fattening of juveniles of 100g and above to required commercial size is more promising than rearing puerullii to marketable size. The tiger, *P. ornatus* is the ideal species due to its faster growth rate and maximum value in live export. *P. ornatus* of 100-150g size can be grown to 500g in about 8 months in indoor culture systems under ideal rearing conditions. Since they attain maturity only at larger size (700-800g), juveniles of this species are more suited for farming to the target size of 500g and above. Fattening of larger size (300-350g to 500; 750-800g to 1000g) can be done in shorter period of 3 to 4 months. The greens, *P. homarus* and *P. polyphagus* mature at about 175 to 200 g and it will be economical to grow them to this size and sell for whole - cooking purpose. Recently greens of this size are exported live to Hong Kong. Lobster farmers of Saurashtra in Gujarat (commercial rearing of lobsters is prevalent only in Saurashtra) grow *P. polyphagus* from 32-35g size to 100-125g in about 80 days and sell them for whole cooking. Alternatively, monosex culture of greens can be undertaken to grow them to bigger size, to prevent loss of energy towards reproduction when males and females are grown together.

Growth enhancement by eyestalk ablation

Three to seven fold growth enhancement was achieved in four species of Indian spiny lobsters by bilateral eyestalk ablation (removal of both the eyes). The tiger has been grown from 100g to 1500 g in 8 months by this technique. The ethics of enhancing growth by removal of eyes and the consumer acceptance of eyeless lobsters are the points to be considered before applying this technique. Research is on to find out whether the same result can be achieved by inactivating the eyestalk hormones by laser or other modern techniques, rather than by eyestalk ablation.

Factors influencing growth of lobsters

Salinity, dissolved oxygen (DO), pH, temperature and nitrogenous metabolic wastes, especially, ammonia, are the major water quality parameters regulating lobster growth. Stocking density, provision of shelter, handling stress and intensity of light also influence growth in captivity. Quality of feed plays a major role in obtaining optimum growth and body colouration (Table 2).

Drastic changes in salinity should be avoided. Moulting and survival of lobsters are affected when DO levels fall below 60-70% of saturation level. Hence DO level should be maintained above 4ml/l and at still higher concentration when the stocking density is high. Ammonia concentration in water reduces growth rate and it is important to keep it below 0.1 ppm for optimum growth. Stocking density varies from 7 to 20/m^2 depending on the culture system and size of lobsters. It may be possible to increase the stocking density in raceway culture with good water turnover. Spiny lobsters hide in crevices in their habitat and appropriate shelters in growout system should be provided. Excessive light and handling should be avoided.

In nature, spiny lobsters feed predominantly on mussels, barnacles, small crabs, echinoderms, polychaete worms etc. In captivity, it prefers molluscs to fish. No compounded dry pellet has yet been developed for spiny lobsters and it has to be fed on bivalve molluscs preferably. FCR of 1.79 to 5.2 has been obtained (on dry matter basis) for normal *P. ornatus* and *P. homarus* while in eyestalk ablated lobsters, the FCR was around 1.

Prospects of commercial lobster culture/fattening

Culture of spiny lobsters in dugout pits in intertidal areas of Gujarat has yielded excellent results. It would be worthwhile to improve this culture scientifically and explore the possibility of adoption of this method in other identical areas There is scope for spiny lobster culture in salt water lagoons and shallow enclosed bays using tray culture method. The trays can be attached to fixed stakes in parallel rows. *P. polyphagus* can tolerate wider range of salinity and can live in muddy habitat also. Possibility of rearing this species along with prawns in earthen ponds, with salinity above 20 ppt can be explored.

The most promising method of lobster farming/fattening appears to be intensive culture in indoor tanks and flow through systems. It can be either a semi-closed system with biological filters or an open system. In such systems, high density stocking can be made if optimum water quality and feed are maintained. Management of this system is easier.

Site selection is very important for intensive lobster culture. Good quality seawater should be available and the site should be located away from areas of wide salinity fluctuations and industrial and domestic sewerage pollution. Uninterrupted power supply and availability of feed in nearby places are other factors to be considered. It would be ideal if the site is well connected by road and has an easy access to air transport so that live lobster can be airlifted directly rather than sending them to another holding facility.

Under optimal environmental conditions with good water and feed management, 90% survival can be expected. *P. ornatus* is the ideal species for intensive culture/fattening. A production of 1100 kg/year can be obtained, with lobsters weighing 500g each from a fattening unit of 100 sq.m. The sale price of 500 g live *P. ornatus* is about Rs.800 per

kg and the total sale price would be Rs.8,00,000. The operational cost would be around Rs. 5,00,000 per year and the gross profit works out to Rs.3,80,000. The capital investment for construction of a 100 square meter indoor fattening is about Rs.6,00,000.

Disease management

Lobsters are reasonably sturdy and no serious diseases have been reported in experimental rearing. Moult Death Syndrome (MDS), leading to death after moulting and failure of hardening of shell are reported, but good water management and feeding can control such diseases. However, it is essential to take precautions to prevent entry of pathogens to the system through water or through lobster juveniles. The water can be disinfected, if necessary, with chlorine and the juveniles can be quarantined and disinfected before they are released to the rearing tanks.

Live export of lobsters

Live lobster export, started in 1993, touched 24 tonnes in 1994 and is on the upward trend reaching 99 tonnes in 1996. Madras is the main city for live lobster export with a share of more than 90%. Bombay and Thiruvananthapuram are the other cities from where lobsters are exported live.

Lobsters are kept alive at the landing centres for two or three days, before they are transported to the city of export. In that place they are again held for two or three days prior to airlifting to foreign destinations. Thus, in a matter of seven days, the lobsters are exposed to netting stress, transport stress (twice - each time keeping them out of water for more than 20 hours) and holding stress (at high density at two places). This may result in mortalities exceeding 10% if proper care is not taken at each step. Since live lobsters cost 3 to 5 times more, mortality in excess of 10% during live transport will make it uneconomical. Proper conditions at holding facilities and efficient means of live packing are necessary to avoid such situations.

Holding facilities

In door tanks and raceways can be used for holding lobsters. Quality sea water is a prerequisite for good holding facility. Closed recirculation system with efficient biological filter can be used to hold 20 to 30kg/m^2 for few days. More stocking can be done in raceways and flow through systems. All species of spiny lobsters can be held together and no feeding is required if lobsters are to be held for 2 to 3 days. If feeding is done, exchange of water is necessary to remove metabolic wastes. The facility should have uninterrupted power supply and aeration. The DO level should be maintained above 6ml/l and ammonia level should not be allowed to exceed more than 0.1ppm. Since lobsters are to be kept only for a few days, artificial shelters are not required, but provision of shelters in two or three tiers will increase floor space for the lobsters to rest. Care should be taken to keep the temperature in the holding tanks below 30°C.

Since lobsters are brought to the holding facility from different places daily, it is better to quarantine the new arrivals for a day before releasing them to the holding tanks. Only healthy lobsters should be transferred to these tanks. It would be better to have provision, especially at the first holding centre, to hold lobsters which are in advanced moulting stage and those just moulted for two to three weeks. This helps the shell to harden after moulting. Such lobsters have to be fed during fattening.

Live transport

The metabolism of lobsters is to be reduced to the minimum level, if they are to be kept out of water for longer periods of live transport. This can be done by reducing the temperature.. The temperature in the live pack should be proportional to the time of exposure and has to be reduced - but not below 4°C depending upon the duration of transport. Cooling down to 13°C is enough if lobsters are to be kept alive for 24 hours. Still lower temperature is required if the transportation period is longer. Before packing, the lobsters may be cooled either gradually to the packing temperature or suddenly, which might give an anaesthetic effect.

Materials for packing

Many materials like moist beach sand, sea weeds, bamboo and palmyrah leaf baskets, gunny bag materials, hay, saw dust, wood shavings, waste paper, bolting paper, thermocol boxes, polypropylene bottle, polythene bags, frozen sea water and dry ice are used for live transport of lobsters. While any of these materials can be used for internal transport by road or rail, air transport requires strict adherence to IATA live animals transport regulations.

The materials for air transport are thermocol boxes, polypropylene bottles with frozen sea water, waste paper, gunny or blotting paper, wood shavings/saw dust and adhesive tapes. Dry ice is no longer used for transport of Indian spiny lobsters. The container should be leakproof.

The dimension of the thermocol box normally used for air transport is 60x37x23cm and 8.5kg of lobsters can be packed in one box. Gunny piece or blotting paper has to be spread at the bottom and a layer of lobster, with folded abdomen, each covered by paper, has to be kept in a row. A bottle of frozen sea water should be kept at the centre between the lobsters. Depending on the size of the lobster packed, one more layer of lobsters can be kept above this layer with another bottle of frozen water at the centre. Precooled wood shavings or saw dust can be spread at the top, if necessary. The box has to be tightly sealed with adhesive tape and labelled properly before it is booked for air freight.

Packing of lobsters can be started few hours before booking depending on the quantity to be packed. The air traffic regulation might require opening of few boxes at the air port for inspection. The type of packing used for air freight is increasingly being used for internal transport also. The thermocol boxes, which are the most expensive

among the packing materials and polypropylene bottles can be used several times for internal transport, reducing the packaging cost.

Table 1: Commercially Important Lobsters of India

Lobster groups	Species	Trade name	Area of Exploitation	Level of Exploitation	Peak season	Gears used
Shallow water Spiny lobsters	*Panulirus polyphagus**	Green Lobster	west & east coasts	high	December to February	trawl net
	*Panulirus homarus**	Green Lobster	west & east coasts	high	December to March	gill net, traps
	Panulirus versicolor	Green Lobster	south & east coasts	Moderate	December to February	gill net, traps
	Panulirus ornatus	Tiger Lobster	south & east coasts	High	December to March	gill net, traps
	Panulirus longpipes	Red Lobster	south & east coasts	Low	December to March	gill net traps
	Panulirus penicillatus	Black Lobster	south & east coasts	Low	December to March	gill net, traps
Deep Sea lobster	*Puerulus sewelli*	Deep sea Lobster	west & east coasts & Andamans	High	December to April	trawl net
	Linuparus somniosus	Deep sea Lobster	west & east coasts	Low	December to April	trawl net
Sand/Slipper lobster	*Thenus orientalis*	Sand.slipper lobster	west & east coasts	High	December to January	trawl net
	Scyllarus sordidus	Sand/slipper lobster	west & east coasts	Low	December to January	trawl net

*Cultivable Species

Table 2 : Optimum Water Quality Parameters for Lobster Culture

Parameter	Optimum level
Salinity (ppt)	28-35
pH	7.5-8.5
Dissolved oxygen (ml/l)	4 (higher for intensive culture)
Total Ammonium nitrogen (ppm)	<0.1
Temperature °C	26-33