Broodstock and hatchery management techniques of sand lobster Thenus unimaculatus

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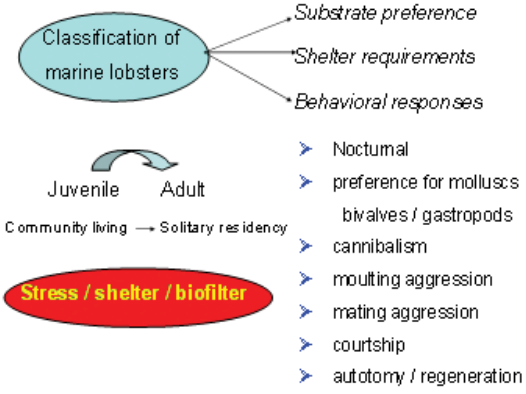
Introduction

Lobsters are the most valued of all seafood delicacies and lobster tails are always in great demand world-wide. Freshwater crayfishes, which are considered a delicacy in many parts of the world, are a favorite aquaculture candidate in North America, Europe and Australia. Crayfish and rock lobster aquaculture practices are initially capital oriented but deliver high production and income turnover in the long run. This industry has already taken off in countries like the U.S.A. and Australia. Lobster culture in India is still in the infancy stage and C.M.F.R.I. has been spearheading research in the development of culture technologies for different species of lobsters.

The spiny lobster Panulirus homarus has been the chief candidate for lobster aquaculture research in India. The sand lobster Thenus unimaculatus which contributes to 8% of the global lobster production, and ranks next to spiny lobsters and tiger shrimp in export value, is one of the most promising candidates for lobster aquaculture in India. Increasing demand for live lobsters in the export market led the farmers and entrepreneurs to collect juvenile lobsters and crabs from the wild and grow to marketable size in ponds and tanks by feeding trash fishes and other discards. In some maritime states juvenile lobsters, pueruli of T. unimaculatus are grown in captivity. Eyestalk ablated lobsters have been found to attain sizes up to 180 – 200 g in 5 – 6 months period. This type of lobster fattening at a stocking density of 10 – 15 young ones per square meter yielded appreciable growth rates with a profit margin of INR.50, 000/- from a pond of 70 m2. Complete larval development of T. unimaculatus was achieved for the first time in India at the Kovalam Field Laboratory of CMFRI. The larval cycle is completed in 26-30 days and juveniles attain a size of 150 g (the minimum legal size for export) in about 300 days. The relatively shorter duration of the larval phase is an advantage in captive rearing of the sand lobster as compared to the spiny lobsters.

As in any aquaculture system, broodstock development and hatchery management are the primary aspects to be tackled while establishing an aquaculture unit for lobsters. Sub-adult and adult lobsters are usually collected from the wild and acclimatized to captive holding. Different techniques for induced maturation and breeding in captivity involve physical handling and provision of favorable influential factors like artificial and natural diets, shelters and hiding places, pathogen-free rearing medium etc. The life history of lobsters shows a transition for a free-swimming planktonic larval phase to a benthic, crawling adult phase. We need to understand the specific requirements of the species before designing the right type of broodstock and hatchery units. The design of an indoor lobster broodstock and hatchery unit is based on the inherent nature of the animals, as depicted below –



Broodstock management techniques

Juvenile and adult lobsters are primarily benthic forms preferring to crawl along the bottom of the sea where light penetration is minimal. To simulate natural conditions to the extent possible, broodstock tanks are usually painted black on the insides and kept covered with dark screens. Lighting in the broodstock unit is kept minimal. The time of light exposure for each species has to be fixed based on experimental studies. Habitat preferences are marked among lobsters. Sand lobsters

are seen predominantly in sandy substrates and spiny amongst rocks. Broodstock tanks for sand lobsters are provided with a layer of sand at the bottom, in which the lobsters remain buried for a major part of the time. Spiny lobster broodstock tanks require no bottom substratum but need to be provided with structures that provide surfaces or crevices for attachment and sheltering. Water quality and photoperiod were found to play a major role and animals reared in larger tanks with increased water depth show more amenability to captive maturation. Broodstock maintenance and development in sand lobsters are done in a Closed Recirculatory System with fluidized bed filter and minimum light exposure (LD 1:23). Juvenile (< 30 mm CL) and sub-adult (30- 40 mm CL) lobsters collected from the wild and reared in recirculatory systems developed into mature adult lobsters (65 - 70 mm CL) in a period of about 6 – 8 months. Regulation of light exposure and feeding @ 5% of body weight in two divided doses daily give good results.

Like all crustaceans growth in lobsters occurs in stages combined with a molt. Molting is controlled by hormones. Growth is faster in the juveniles and slows down as the adult phase progresses. Beyond maturation, growth, particularly in females tends to be slower. Lobsters, like other crustaceans, prepare well in advance to molt and have a short phase of starvation at during and immediately after molting, when they are soft shelled and vulnerable to attack by other lobsters in the broodstock tank. This is particularly seen in the case of spiny lobsters which exhibit tendencies for cannibalism. Therefore, it is necessary to provide shelters and hiding places for these animals in the tank, for seclusion during molting. PVC pipes, asbestos tiles, vertical net screens are some of the commonly used structures for this purpose. Juvenile lobsters coexist in a community living structure while adult lobsters prefer a solitary existence. This also necessitates providing shelters to aid in this transition phase in broodstock development.

Food is a major factor determining the performance of the animals in captivity. Lobsters show a preference for shellfish, particularly mussels. Sand lobsters show good reception to fresh clam meat. Broodstock diets should be combination of natural diet preferred by the species and artificial diets prepared to meet the protein requirements of the broodstock, with additives to promote growth and maturation.

Collection of lobsters from the wild entails the possibility of the animals harboring pathogenic microbes. Quarantine measures and prophylactic treatments form an integral part of the broodstock management unit. This, combined with a strict regime for seawater treatment and disinfection of tanks between stockings, should be good enough to ensure a healthy environment for the lobsters. One of the major problems seen in lobsters, particularly spiny lobsters, is tail injury caused due to aggressive behavior among themselves. Attacks on soft shelled lobsters also induce injuries which tend to get infected. As mentioned earlier, shelters and crevices are essential to avoid such occurrences.

Hatchery management techniques

The larval phase in mostv lobsters is usually complicated, extended and highly dependent on external factors. Like other crustaceans, lobsters begin life as a developing embryo inside an egg which is carried by the female along with hundreds or thousands of other eggs, on the pleopods. These egg-bearing females are called “ovigerous”. Fertilized eggs are dark yellow or orange in color and turn dark brown at the time of hatching. Unfertilized eggs remain cream or pink in colour and are shed off in 3-5 days. After a rigorous incubation phase (early embryo development inside the eggs) when the eggs are fanned with the help of the pleopods, small, transparent, flattened larvae called “phyllosoma” hatch out. The incubation period varies from 26-30 days in tropical spiny lobsters to 30-37 days in sand lobsters. Hatching takes place in batches only during the early morning hours and is usually completed in 1-3 days. Water quality, tank bottom quality and handling stress, particularly during the incubation period, greatly influence the success rate of hatching.

Larvae are usually small when compared to the adult except in clawed lobsters. These larval stages (phyllososma) undergo progressive molts to complete metamorphosis before settling as the post larval stage, called “puerulus” in spiny lobsters and “nisto” in sand lobsters. The hatchery phase is often the crucial stage in lobster aquaculture, since handling of the delicate phyllosoma

is very difficult, and renders the hatchery phase labour intensive. The number of larval stages varies greatly among species, ranging from about 12 stages in spiny lobsters to 4 stages in sand lobsters. Compared to the spiny lobsters, the hatchery phase is of shorter duration in sand lobsters. While larval metamorphoses can extend up to 300 days in spiny lobsters, it is usually completed in 25-30 days in sand lobsters.

The phyllosoma are mostly phototactic and prefer specific zooplankters as live feed .The rearing system should accommodate only minimum numbers per litre, as most of the species are aggressive and cannibalistic; while 10 phyllosoma per litre in tropical spiny lobsters in the initial stages is fine, as stages progress beyond fourth the density has to be thinned further to 5 and 1-2 per litre towards the final stages. The equivalent stages of most species follow almost the same stocking density limits. Larval rearing tanks are usually of shallow depth with upwelling and flow through designs ensuring very less water agitation and reduced photoperiod intensity. Light source is used to pool the larvae to facilitate collection and shifting. Suitable artificial, preferably gel texture, supplementary diets are essential in lobster hatchery feeding regimes. These diets should be floating and stable in water. Water quality in phyllosoma rearing is of utmost importance as delay in molting attracts too fouling microbes on the shell which render the larvae immobile and obstruct their feeding activity. Organic load and ammonia load should be minimal in the system and tank surfaces should be devoid of biofilm formation to reduce bacterial invasions. Proper feed and health management can improve larval survival and growth to a great extent.

The success of any aquaculture enterprise depends on the efficiency of the rearing system design and its management. Simulation of conditions as close as possible to the lobster's natural environment must be attempted at every stage of its progress from juvenile to adult in the broodstock unit and from egg to juvenile in the hatchery unit. The first hurdle being the steady supply of brooders, the primary aim of the enterprise should be to turn out a good number of adult lobsters developed from wild collected juveniles, and to induce repeated maturation and breeding in captivity. The next hurdle would then be to effect successive larval metamorphosis with high survival rates and post-larval settlement to produce healthy juveniles which would then be ready for generation of a new batch of brooders. Both these aspects can be achieved through a rigid and structured set of management practices as described in this note, but perfected best through practical handling and knowledge gained through experience.