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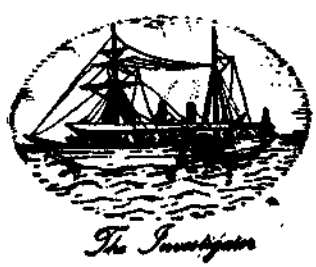

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SOME PROBLEMS IN COMMERCIAL CULTURE OF MARINE PRAWNS IN INDIA

P. BENSAM

Central Marine Fisheries Research Institute, Cochin-682 018

ABSTRACT

Although experimental work is being carried out on commercial cultivation of marine prawns at a few centres in India, intensive culture technology to suit the varying ecological and hydrobiological conditions in different parts of the country is yet to be developed and perfected. One of the constraints for increasing stocking density of prawns for obtaining maximum production per unit area is in adequate water replenishment on which depend the vital factors affecting the well-being of the stock. As prawns usually like to consume natural food items like algae rather than artificial food supplied such as pellets, an attempt to enhance their growth and fatten them by the latter is beset with difficulties, unless they are equally nutritious and well balanced. Another constraint in intensive culture of marine prawns is the havoc caused by predators, particularly carnivorous fishes. The present paper examines these problems and suggests ways and means of overcoming or reducing them.

INTRODUCTION

AMONG the two general kinds of prawn cultivation being practised in different parts of the world, ' extensive culture ' involves operations in more or less natural amenities available, rather indiscriminate stocking allowing entry of even undesirable organisms inside the culture system and is devoid of proper management procedures. The more scientific and systematic method of cultivation called ' intensive culture ' involves elaborate construction of culture ponds, selective stocking with the most desirable species and implementation of management procedures. In the former method, production is rather low but in the latter it is quite high. In India, where there are vast scope and potentialities for commercial culture of marine prawns, only extensive culture is being practised in the ' Pokkali ' fields of Kerala, 'bheris' of West Bengal and ' Khazan ' lands of Goa. However, in the wake of increasing demand for marine prawns both for internal consumption as well as for export purposes, attempts are being made at present for their intensive culture ; and experimental work and/or pilot projects are being undertaken at a few centres by research organisations as well as commercial firms. An intensive culture technology has been developed in countries like Japan (Shigueno, 1975). Unlike Japan, India is a vast country with an extensive coastline of about 6,100 km with various agro-climatic and soil conditions, and localized ecology and hydrobiology. As such, the intensive culture technology being evolved in various regions is bound to differ from one another. However, there are a few general problems which are likely to be faced in intensive culture operations wherever it is practised in relation to the prevailing conditions and in the context of the principal aim of enhancing production in intensive culture. The present paper examines some of these problems faced by the author in Tuticorin and Porto Novo during 1975-79 and suggests ways and means of overcoming or reducing them.

Water replenishment

One of the constraints for increasing stocking density of prawns in intensive culture systems for obtaining maximum production per unit area is in adequate water replenishment. It is well realized at present that the vital factors affecting the well-being of culture stocks such as amount of oxygen available, temperature of pond water, calcium content present, etc. are closely linked up with water management. In intensive culture in Japan it was found (Shigueno, 1975) that no simple stocking formula could be prescribed without taking into consideration the quantity of dissolved oxygen present and the rate of circulation of pond water. Experience has shown that if water temperature is 28°C, dissolved oxygen content is at 80% of saturation (6.3 ppm) and if 10% of the amount of water could be replaced every hour, then the stocking density could be made at a level to yield 0.11 kg/sq. m, allowing a mortality of 30%. On the other hand, if 33% of water could be replaced every hour under the same conditions, the stocking density could be increased to a level to yield 0.5 kg/sq. m, which in terms of a hectare would amount to 5,000 kg. From these facts it is obvious that for increasing prawn production by intensive culture, it is imperative to ensure effective water management in culture ponds.

The most inexpensive method of water replenishment for culture ponds is by making use of the tidal amplitude prevailing in the locality. In India, tidal amplitudes are usually more during the second half of the year than during the first. Also, south of about 14° latitude, the amplitudes are usually in the range of 1 to 1.5 metres, while north of this latitude the amplitudes are more. Besides, the topography of the site selected for culture in relation to prevailing tidal amplitudes throughout the year should be carefully examined for ensuring effective water exchange. Taking these aspects into consideration it appears that for constructing culture ponds in a state like Tamil Nadu the ponds should be deep enough for holding adequate quantity of water. Also, fool-proof provisions should be effected for sufficient renewal of water, such as a separate outlet, installation of inexpensive wind-mills, etc. Cases have come to notice where seepage has been taking place even in clayey areas, resulting in quick loss of water. In such areas, the ponds should be excavated in such a manner that the pond bottom is at a level lower than the substratum of the source from which water is drawn for culture. Alternatively, durable liners such as made of synthetic material and inexpensive sealents could be used to make the culture ponds free from seepage and rapid loss of water.

In addition to effecting adequate water replenishment in the above lines, the amount of oxygen present in the pond water may be kept at optimum levels by operating artificial contraptions also. Aerating water in commercial culture ponds is commonly practised in intesive cultivation of prawns, eels, etc. in countries like Japan. Development of indigenous contrivances for aerating pond water would go a long way for solving the problem of oxygen availability in ponds and lead to higher production.

It was observed that ponds constructed in areas which enjoy strong winds have the advantage of some quantity of atmospheric oxygen diffusing into the water. Therfore, while preparing layout of culture ponds it is essential to bear in mind the direction of winds in different seasons of the year and plan the layout in such a manner that the pond water is, exposed to maximum wind action. However, on days with windless weather, lack of adequate diffusion of atmospheric oxygen was found to result in deoxygenation of pond water and distress for cultre stocks. On such

occasions, it is essential to exchange the water immediately or aerate it artificially.

Feeding culture stocks

In temperate regions of the world there is rather less natural productivity in embanked areas and estuarine regions. On the other hand, in tropical zones under blessings of enough sunlight and natural and man-made fertility available, productivity of water masses is rather high (Bardach *et al.*, 1972), leading to algal and diatom blooms which in their turn result in zooplankton production. This natural productivity is a factor of great advantage in extensive culture of prawns, as there is lesser need for providing supplementary food. On the other hand, in intensive culture operations, the aim is to enhance growth and production of culture stocks by providing artificial well-balanced food. And, since prawns are observed to prefer natural food items present in culture ponds to artificial food pellets supplied, the presence of the former in large quantities is likely to prejudice the success of intensive culture operations. It may be noted in this connection that it is rather impractical to prevent the growth of algae and diatoms, since natural fertility factors as well as the nutrients added to the system in the form of left-overs from artificial food supplied serve to increase the production of algae, diatoms, etc.

One way of reducing natural algal growth is to strike a balance at which the artificial food supplied is just sufficient for the growth of the culture stock, without allowing any residue to get into the pond ecosystem. In this connection, it is essential to ensure that the artificial food supplied remains intact in the bound condition till it is consumed completely by the prawns. For this purpose, an effective binding agent such as gluten or agar-agar or even some synthetic binder in adequate concentrations is an essential prerequisite. The pelletted food could be compounded in such a way that its taste should be made equally acceptable for the prawns as natural food available. In this case, some amount of fundamental research appears to be necessary. Besides, periodical estimation of the stock present in the ponds may be made for broadcasting only the amount of food required by the stock.

Environmental conditions

Unlike *Penaeus indicus* and *P. monodon* which have a wide range of tolerance to such environmental factors like salinity, species such as *P. semisulcatus* is less euryhaline and will not be able to tolerate low saline conditions ranging from 15 to 20‰. Also, sudden lowering of salinity accompanying heavy rains or influx of fresh water was found to affect culture stocks of *P. semisulcatus* at Tuticorin and Porto Novo. When pens or ponds constructed in areas which are prone to such adverse factors are stocked with *P. semisulcatus* the results are most likely to be disastrous. Therefore, it is an essential prerequisite that culture of such species is carried out in localities and during seasons which are free from sudden changes in salinity values.

Similarly, high values of temperature were observed to cause distress to culture stocks, especially during summer months (April-June), when temperature in the afternoon hours rises to 35-40°C. If the culture ponds, are deep enough or provided with trenches for the shelter of the stock, it would serve to protect the population and reduce mortality. In addition, to this, shelters may be provided in the form of tree branches, bamboo twigs, coconut leaves, palmyrah leaves, etc. for prawns to get shelter. Also, jets or fountains of water could be provided for cooling the ponds on days of excessive heat.

Prawns which were cultured in ponds having a slushy substratum were observed to register much less growth than those stocked in ponds with a firm substratum such as hard clay and sand. It was also found out that quite

often prawns cultured in ponds of the former category had failed to harden the shells, pointing out that the amount of calcium present in such an environment is not sufficient for their growth, moulting and normal hardening of the shell. Therefore, it is advisable to avoid such areas for prawn culture operations, but, if such areas could not be avoided, steps to improve the environment should be resorted to such as conversion of the slushy substratum into one of hard clay or sand. Alternatively, adequate amount of calcium may be provided in the supplementary food supplied to the culture stocks or calcium compounds may be applied to the ponds from time to time, without adversely affecting the hydrology of the pond. Some amount of basic research on calcium requirements of the important species at various levels of their growth stages and assimilation under various hydrobiological conditions in the culture site is essential in this regard.

Fish Predators

Predatory animals, particularly carnivorous fishes, usually cause considerable alarm in intensive culture of marine prawns. Even in countries like Japan, fish predators have been posing serious problems and many a venture is stated (Shigueno, 1975) to have met with disastrous ends due to the failure to solve this one problem. In India, the predatory fishes usually found in prawn culture ponds are *Lates calcarifer, Elops saurus, Epinephelus, Therapon,* etc. In addition to these, crab predators *Scylla serrata* and *Portunus pelagicus* have been observed, particularly the former in large numbers. Even after killing predators by chemical fish poisons or organic fish toxicants well before stocking the ponds, these harmful organisms were observed to find their way into the culture ponds by penetrating mesh screens in their early developmental stages and grow rapidly. For instance, *Elops saurus* was found to grow to a size of 12-15 cm total length within 45 days.

One way of preventing the entrance of predatory fishes into culture ponds is to mechanically obstruct their penetration by providing a series of fine-meshed nets across the passage of water. In this connection, care should be taken to ensure that the meshes of the net screens are smaller than the sizes of the eggs, larvae, etc. of predatory fishes. Experience has shown that this is an effective method. Another way of solving the problem of predatory fishes after they have found access into the ponds is the application of agents containing such toxicants which when applied in certain concentrations are lethal only to bony fishes but do not have any bad effect on prawns. These toxicants are rotenone, saponin contained in derris powder, teaseed oilcake and mahua oilcake. In this connection, the approximate age of the predator at which it becomes actively predaceous should be known in order to determine the periodicity of application of the toxicant.

The only method of eradicating crab predators is to trap them by using simple trap-bait devices, such as the one used for capturing *Scylla serrata* in certain areas (Shanmugam and Bensam, MS).

Remarks

Shigueno (1975) has rightly pointed out that 'for development of shrimp culture into a stabilized industry, three factors must not be excluded from serious attention, namely, the breeding of fry, the control of natural enemies and the problem of feeding which includes the management of pond water'. Among these three factors, production of prawn seeds by artificial propagation has already been achieved in India through the recent researches of the Central Marine Fisheries Research Institute (CMFRI, 1978); and some agencies are on the way of commercialisation of prawn seed production at present. But, the prob-

lems of controlling natural enemies and feeding culture stocks in the context of natural productivity and management of water replenishment in various ecosystems still remain as important problems to be investigated and solved successfully.

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