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PEARL CULTURE

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INTRODUCTION

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India is endowed with a pearl oyster resource which has been exploited for the natural pearls from time immemorial and, in the historical past, pearls have been one of the precious objects, along with spices, exported from the ports in the South. The Gulf of Mannar and Gulf of Kutch are the well known haunts of this resource and pearl fisheries had been organised in the past from Tuticorin and Jamnagar respectively. The 'paars' of Gulf of Mannar have yielded to very valuable fisheries in the past, the most successful of which has been the fishery series of 1955-1961. Since then the beds have gone back into a recessive phase without much of pearl oyster stock as has been the typical situation in the past. The 'khaddas' of the Gulf of Kutch, after yielding to a moderate fishery in 1966-67 season, have likewise, been unproductive since then.

The Central Marine Fisheries Research Institute, has been involved in the survey of the pearl banks, along with the chank beds, in the Gulf of Mannar since 1959 and the pearl oyster beds were chartered. The ecology of these beds has been studied in detail. The Institute started an experimental project in pearl culture in 1972 at Tuticorin with a field laboratory at Veppalodai. This project laid the foundation for multidisciplinary research in pearl culture which is being implemented with adequate infrastructure facilities. This chapter briefly reviews the developments in pearl culture research in India, the results of which are presented in the following chapters of this Bulletin.

Early attempts in Tamil Nadu and Gujarat

Late James Hornell who took the responsibility of investigating the prospects of the Gulf of Mannar pearl fisheries along the Indian as well as Ceylon coasts in

the nearly part of the present century for the purpose of improving the pearl oyster resources and conditions of fishing grounds came to the conclusion that 'the only economically sound way of making the Indian and Ceylon pearl fisheries permanently and regularly remunerative is to concentrate upon the inducement of pearls by artificial means in comparatively limited numbers of cultivated pearl oysters....' Following this recommendation, the erstwhile Madras Fisheries Department commenced experiments on pearl culture at Krusadai island at the head of the Gulf of Mannar in 1938. This work continued intermittently over a period of about three decades and resulted in giving valuable information on some aspects of the biology of the Indian pearl oyster, farming and ecological conditions. However, success in respect of pearl culture technology was limited to obtaining 'two imperfect pearls' away from the site of implantation and 'mother-of-pearl ball' attached to the shell and coated with nacre.

Similar early attempts have been made in Gujarat. Presumably based on the advice of late James Hornell, stone enclosures with sluices were constructed near Sikka for farming pearl oysters. Experiments on pearl culture which commenced in 1956 did not result in developing the technology.

Breakthrough in technology

Against this background, the Central Marine Fisheries Research Institute started a research project on pearl culture in 1972 at Tuticorin with a field laboratory at Veppalodai. An early breakthrough was achieved and the first spherical cultured pearl was produced on 25 July 1973, heralding the development of pearl culture technology in India. The technology

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for farming of pearl oyster in the open sea adopting raft culture and production of cultured pearls has been developed.

Scheme on pearl culture

In the immediately following period, directed pearl culture research was organised by the CMFRI in collaboration with the Department of Fisheries, Government of Tamil Nadu under an *ad hoc* scheme on pearl culture of the Indian Council of Agricultural Research which was implemented from October 1973 to September 1978. During this period multiple production of cultured pearls was achieved; surgical equipments for nucleus implantation were developed indigenously; the growth of cultured pearls was studied; the problems of biofouling and boring organisms in the farm were elucidated; pearl oyster resource of the Gulf of Mannar was studied with reference to insurgence of non-*fucata* component in the paars and inshore areas; growth of pearl oyster in the farm was observed; the ecological conditions of Veppalodai farm were investigated; and certain physiological experiments were carried out. Concurrently, the Department of Fisheries, Government of Tamil Nadu gained expertise in the field of pearl culture and re-established a pearl oyster farm at Krusadai island.

Experimental work at Vizhinjam

Chance occurrence of pearl oyster spat on the ropes used in mussel culture in Vizhinjam Bay enabled the Institute to build up a pearl oyster stock through farming and subsequently trial production of cultured pearls. The Department of Fisheries, Government of Kerala subsequently executed a pilot project on pearl culture for a period. Monitoring the spat fall in the bay was continued and it was noticed that as the bay was being developed as a fishing harbour, the spat fall became reduced year after year as also the *fucata* component of pearl oyster. Increase in suspended silt made it more and more difficult to raise oyster stock. However, the programme gave valuable data on the biology and farming of pearl oyster.

Further research on pearl culture

The ecological conditions of the experimental farm at Veppalodai were found to deteriorate with the commencement of operation of fishing trawlers in the area resulting in poor growth, weakening and higher rate of mortality of pearl oysters. Farming was shifted to the Tuticortn harbour basin and better results in terms of growth and survival of oyster were obtained. Continued monitoring of pearl oyster beds showed that some of the northern shoreward paars had moderate populations but the age composition was

static in any given season. An interesting feature observed in the beds was the heavy mortality caused by predatory gastropods. Emphasis was given to control of fouling and boring organisms for which simple methods were evolved. The pearl oyster resource potential of Andaman and Nicobar Islands was surveyed in 1978.

Development of hatchery technology

Having realised that all the success achieved in pearl culture will be of no avail in establishing an industry unless steady supplies of pearl oysters are assured, top priority was given from 1978 to the project on development of hatchery technology for production of pearl oyster spat. Techniques for induced spawning of pearl oyster were developed and the early developmental stages of pearl oyster larvae were described. The progress was at standstill at the straight-hinge larval stage for a considerable period until the flagellate *Isochrysts galbana* became available for culture as food of the pearl oyster larvae. The breakthrough came in 1981 when the first batch of pearl oyster spat was produced in the laboratory. This signified yet another important development leading to the establishment of a moderate hatchery for large-scale production of pearl oyster spat.

Juvenile rearing

At this stage, rearing the spat from about 0.3 mm to the minimum size of about 45 mm when the oyster can be used in surgery for pearl production had to be accomplished. This needs a period of a little more than a year. Considering the space, volume of sea water and the food requirements, it is not practicable to rear the pearl oyster in the hatchery for more than the absolute minimum period. The spat can be transplanted at about 3 mm and reared in the farm in special rearing baskets to ensure that they do not drop out through the meshes, a free flow of water is maintained and that they are protected against predation. Growth and survival are two important factors in juvenile rearing. Pearl oysters produced in the hatchery have been grown over a period of three years, employed in surgery for pearl production and used as brood-stock for raising further generations.

Sea-ranching

With the above technology, it has become possible to reverse the flow of pearl oyster from land to the sea for certain investigations. Commencing from the end of 1985 a sea-ranching programme was taken up to study the possibility of replenishing the natural stock on the beds and to understand the factors responsible for the fluctuations of the wild populations. Moni-

toring is a major technical and logistic problem in this effort. If successful, revival of pearl fishery may become possible. It can also supply grown oysters suitable for cultured pearl production.

Commercial pearl culture

The developments in pearl culture research have led to the establishment of a commercial pearl culture project in the country. The Tamil Nadu Fisheries Development Corporation Ltd and Southern Petrochemical Industries Corporation Ltd started a joint venture project in 1983 with a collection base at Tuticorin, farm at Kursadai and surgery at Mandapam. This is a laudable pioneering effort on the part of the Government and Industry.

Technology transfer

In an effort to transfer the technology of pearl culture and pearl oyster hatchery, the CMFRI has organised training courses for the benefit of the fisheries departments in the maritime States and Union Territories. This has been taken advantage of by Gujarat, Karnataka, Kerala, Tamil Nadu, West Bengal, Andaman & Nicobar Islands and Lakshadweep, besides Konkan Krishi Vidyapeeth. In order to instil confidence in the technology, consignments of pearl oyster spat produced in the hatchery have been presented to some of the programmes in the States/UTs.

Thrust areas

As the dictum goes, research should aim either at improving the frontiers of knowledge or at increasing

the frontiers of production, ideally both. The CMFRI has so far had a good measure of success in both the frontiers in the field of pearl culture. However, there are several areas of research which need to be taken up. Some of the major priority areas in pearl culture would be identification of sites, site-specific farming technology, critical ecology of pearl culture grounds, identification and control of disease, species-specific technology for *Pinctada margaritifera* and possibly *P. maxima*. Andaman & Nicobars and Lakshadweep as special areas for pearl culture, shell-bead technology which is an engineering problem, improvement of oyster quality through genetic studies, increase in production, improvement of quality of cultured pearls through selective breeding and mantle tissue culture. On the hatchery front the thrusts would be on control of reproduction enhanced larval survival, synchronous larval growth and spat setting, economic nursery rearing and higher assured survival of spat in mother-oyster culture. Besides, an area which is totally open for future is freshwater pearl culture though this will not be within the mandate of CMFRI.

The Bulletin on Pearl Culture has been designed to present information on the several aspects of pearl culture briefly outlined above. Primarily, the results of research carried out at CMFRI since 1972 have been incorporated under different chapters. This includes results already published and those which are given for the first time. The chapters have also reviewed the relevant literature from outside India, particularly the publications from Japan.