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PEARL CULTURE

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Pearl, the gem of the sea, is one of the few precious things that have enchanted the hearts of many an eve, from the Queen of Nile, Cleopatra, to the modern fashion loving woman. Though several times costlier, diamonds and other precious stones are counted as priceless possessions, the subtle glow and warmth of pearl brings it dearer to the heart. Man has wondered how the clumsy oyster produces the pearl and many fantastic theories were evolved by the imaginative minds. Some believed that pearl was formed when a rain drop or a drop of dew fell into the shell when it came to the surface. Some others thought that it was the tears of angels that crystallised into pearls. For many centuries the different

theories were debated by the ancient philosophers and scientists. But it was only in the early part of the present century that the mystery was scientifically unravelled when a Japanese scientist, Tokichi Nishikawa, propounded the theory that a pearl is formed when the living pearl-secreting cells of the mantle, migrate into the body of the pearl oyster under the stimulus of a foreign body and the division of these cells produces a 'pearl sac' which covers the foreign body with nacre to form the pearl.

Knowing that it is an external substance which forms the nucleus around which the pearly layer is secreted by the pearl oyster, there were many experiments to artificially induce the



Pearl oyster with two cultured pearls in situ.

oyster to produce pearls by inserting different materials. The Chinese were the earliest to have made such attempts and they produced tiny pearl-coated images of Buddha by introducing the images between the mantle and the shell of a freshwater mollusc. Although several attempts seem to have been

made at various places to produce induced pearls, it was only after Kokichi Mikimoto of Japan came to the scene that it became a commercial possibility although he produced only the semi-spherical pearls in the beginning. Investing his small fortune in this venture he relentlessly strived from 1888 until

he obtained semispherical pearls from the oysters. It was Tokichi Nishikawa of Japan who perfected the technique of producing spherical pearls in 1913 and adopting his technique, cultured pearl production came into existence revolutionising the pearl trade of the world.

Pearls are very much similar in composition to the shells of the pearl oyster. The outer epithelium of the mantle secretes finely crystalline calcium carbonate in the form of aragonite crystals which is known as the nacre or mother-of-pearl and hexagonal calcite crystals which form the prismatic layer of the shell. It also secretes an organic substance, conchiolin, with which the calcareous crystals are cemented. While the above three components form the shell of the oyster, it is only the aragonite crystals and conchiolin which go to form the pearls. In nature when a foreign substance gains entry into the oyster it causes an irritation to the animal. The latter, unable to get itself rid of the unwelcome intruder, attempts to reduce the irritation by coating the foreign substance with its nacre. The process continues and layers after layers of nacre are added which ultimately result in the formation of the beautiful pearl. Depending on the shape and size of the foreign substance, that is the nucleus, the natural pearls vary widely in size and shape. In cultured pearl production, man has substituted the accidental entry of the foreign substance with the wilful implantation of comparatively large spherical nuclei made of shells. Thus the difference between the natural and cultured pearls lies only in the nucleus.

The pearl oysters come under the genus *Pinctada*. Though a number of

species and varieties occur, the commercially important ones are only a few, viz., *Pinctada martensii*, *P. fucata* (= *P. vulgaris*), *P. margaritifera* and *P. maxima*. The first named species is the Japanese pearl oyster, the second the Indian pearl oyster occurring in Ceylon and Persian Gulf, the third found in Persian Gulf, Red Sea, Gulf of Mexico and Japanese waters, and the last the Australian pearl oyster. Though these species have a much wider distribution than mentioned here, only the areas where their commercial importance is high have been given. Besides the pearl oysters, there are other molluscs that produce pearls like the wing shell *Pteria penguin*, the ear shell *Haliotis discus*, freshwater mussels etc. But the pearls are inferior in quality and value to the *Pinctada* pearls.

For well over half a century, the Japanese culture pearl industry has enjoyed monopoly of production and market. Twenty five years back, pearl oysters occurring in the natural beds were collected by women divers, known as 'Ama', and used in pearl culture. But after evolving the technique of collecting the spat of the oysters by providing suitable cultches, the 'Amas' lost their job and took to collecting abalones, seaweeds etc. The spat are collected in natural grounds by hanging cedar sprigs from rafts. When the spat are about the size of the nail of the thumb they are removed from the sprigs and grown in spat cages. When the oyster is about a year and a half old, it is used in pearl culture operations. The oysters are arranged in pearl oyster nets and hung from rafts. After a process of conditioning, the oysters are removed to the laboratory for the nucleus implantation. The nucleus is made from the freshwater mussel shells imported

from U.S. A. The shells are cut, ground and polished into spherical beads of different sizes ranging from 1 to 10 mm diameter or more. With simple tools the shells are opened to get enough clearance for the operation, a small incision is made on the gonad and a piece of mantle and a nucleus are implanted inside the gonad of the oyster. Commonly, two nuclei are introduced in each oyster, but there are cases where as many as 20 tiny beads are implanted in one and the same oyster. After the operation the oysters are left back in the sea in suitable areas which afford ideal conditions for recovery from the 'shock' and for fast growth. The fouling on the shells are scraped once in 3 months to enable healthier growth. The duration of post-operation culture varies from 6 months to 3 years depending upon the size of the pearls desired which is predetermined by the selection of oysters for the operation and the size of the nucleus used. At the end of the culture period, the oysters are taken to the pearl collection centres where the meat is shucked and pulverised without affecting the pearls and the pearls are collected after washing and cleaning. The pearls are then sorted out according to size and shape and sent to the processing section for further assortment into grades and making them into jewellery.

The Japanese pearl culture industry was steadily growing up from the time Mikimoto started exporting pearls to the Western markets in the first decade of the present century. About 80% of the annual production of about 25,000 kan (1 kan — 3.75 kg.) of pearls are exported. The export trade reached a peak in 1966 with \$ 65 million. But since then there has been a decline in

the trade reaching \$ 55 million in 1967 and \$ 46 million in 1968. The reasons attributed to this decline in the export trade are many. With the advent of miniskirts the Western women turned away from the cultured pearls and looked for the plastic beads, coloured stones etc. Another reason is that the pearl farms proliferated from about 100 at the end of World War II to about 4,600, most of which are family operations, crowding the available sea area for pearl culture, thus reducing the conditions much below optimum. The product of six-month culture was inferior in quality. In 1968 the solid base of the industry cracked and many a small farmer abandoned the rafts, cages, pearl-nets etc. and took to growing seaweeds. The Japanese Government stepped in to restore the industry and enacted measures to regulate production. Towards the end of 1969 an upward trend in market prices was noticed.

While Japan has enjoyed the monopoly of the pearl culture industry, it has also helped other countries in developing pearl culture with certain conditions of collaboration. A pearl farm was established in Australia in 1956 and by 1968 there were 18 farms, of which 15 were collaboration projects and the remaining 3 entirely Australian. Collaboration farms also exist in the Philippines, Palau Island and Celebes. In these farms the native entrepreneurs establish the farms and supply the pearl oysters and the Japanese attend to the operation and culture of the oysters and marketing of pearls.

India is blessed with pearl oyster resources and the Oriental Pearls produced by our oysters are among the best in the world market. From time

immemorial the resources were known and the pearls were harvested. Pearls were traded with the ancient Roman and Greek Kingdoms. The Indian pearl oyster *Pinctada fucata* (= *P. vulgaris*) occurs in two widely separated areas, the Gulf of Mannar and the Gulf of Kutch. The pearl oyster beds on the Indian side of Gulf of Mannar exist at a distance of 12 to 20 km. from the shore and at a depth of about 15 to 20 m. This resource has been the object of the famous Indian pearl fisheries conducted from Tuticorin as the base of operations. But this is a highly fluctuating resource with more of 'barren' years than 'productive' years. While we had a successful series of pearl fishery from 1955 to '61 this was preceded by 27 'barren' years and followed by a period of similar nature till date with no prospects of a pearl fishery in the immediate future. The 1958 fishery was the best in the last series which yielded a revenue of Rs. 465,000 to the Tamil Nadu Government.

The Gulf of Kutch stock of the Indian pearl oyster occurs in the intertidal region along the northern coast of Halar District in Gujarat State. The oysters are periodically exposed during the receding tides. Though the fishery is of a regular nature conducted every 3 or 4 years, the pearls obtained are of inferior quality and the revenue from the fishery is also considerably less.

The idea of starting pearl culture in India was there in the mind of late Mr. James Hornell as early as 1908 and

he conducted some experiments to induce the pearl oysters to produce pearls. Considering the highly fluctuating nature of the resource, he was of the opinion that the only way of making the Indian and Ceylon pearl fisheries permanently and regularly remunerative was to concentrate upon inducement of pearls by artificial means in comparatively limited number of pearl oysters. It was at his initiative the Krusadai Island at the head of the Gulf of Mannar became the centre of pearl culture experiments. The experiments were conducted by the scientists of the Fisheries Department of Madras (Tamil Nadu). Pearl oysters were brought from the Tuticorin banks and reared in cages hung from rafts. The oysters were found thriving well. Several techniques were tried by the scientists but success could not be achieved to produce spherical cultured pearls. The years when these experiments were conducted happened to be the 'barren' years at the natural pearl banks and hence the supply of oysters for the experiments was very much limited. An effort was also made to bring pearl oysters from the Persian Gulf to form a breeding reserve to populate the oyster beds in the Gulf of Mannar.

Since 1961 the pearl banks have again become 'barren' and the present indications are that there are no prospects of a pearl fishery in the immediate future. Even so it should be possible to collect oysters for experimental purposes. By concerted efforts, it would

be possible to perfect the technique of spherical pearl production with the indigenous know-how. But commercial production will largely depend on the return of abundance of pearl oysters in the natural beds. Detailed investigations on the various aspects of biology of the pearl oyster and environmental studies are also necessary. The Indian pearl oyster which is similar in so many respects to its Japanese counterpart, perhaps superior with regard to the quality of natural pearls produced, will certainly yield to cultured pearls production. But unfortunately there are

no sheltered bays along the Indian coast which would offer optimum conditions for pearl culture throughout the year. Setting up a farm near Krusadai which has already been accomplished on a small scale, gives an advantage with regard to location.

India is importing Japanese cultured pearls worth over a million U. S. \$ a year. Having a pearl oyster resource in our seas, it is felt necessary that we should make every effort to utilise this resource in the best possible manner.



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