PEARL CULTURE AND PEARL OYSTER CULTIVATION

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Few marine animals have yet been tamed and harnessed for man's use. Of these the bivalves have the greatest potential, and of the bivales the pearl oysters are perhaps the most thoroughly exploited. Not only are they eaten and their shell put to use, but their nacre-secreting properties are tapped to produce pearls by design, rather than by accident as in nature.

Pearl oysters belong to the genus *Pinctada* (Hynd, 1955) and are closely related to the mussels. Three species are renowned, either for the excellence of the pearls they produce or for the lustre and quality of their shell ("Mother of Pearl") They are *Pinctada fucata* ("Ceylon pearl oyster" = "Japanese pearl oyster"), *Pinctada maxima* ("Silverlip" = Goldlip" = "Australian pearl oyster"), and *Pinctada margaritifera* ("Blacklip"). Of these, I would think that the Blacklip offers the greatest potential for a lucrative industry in India.

The nacre of pearl oysters is laid down by the living mantle surface and forms the inner layers of the shell. Pearls are formed by the mantle tissue in just the same way. Objects which come between the mantle and the shell are entombed within a nacreous capsule referred to as a "blister". Other objects are surrounded by mantle tissue and encapsuled there free from fusion with the shell. These develop into pearls. Their shape is determined largely by the shape of the foreign object around which the mantle tissue spreads. "Half pearls" are blisters formed around hemispheres cemented to the nacre of the shell.

Beneath the mantle of the oyster lies the gonad which spreads diffusely through a connective tissue matrix. The gonad waxes and wanes seasonally. During the spent stage both germ cells and connective tissue cells alike are relatively undifferentiated. The gonad remnants may even develop the next season as the opposite sex (Tranter, 1958).

The body of the oyster is relatively receptive to foreign objects and tissues at this time. During the early proliferation of the next gonad, a piece of mantle introduced into the underlying connective tissue matrix will continue to grow and

secrete nacre as it would have done in its old position adjacent to the shell. Given a solid object as a shell substitute, the mantle tissue graft will grow completely around it and form what is known as a "pearl sac', This is basis of pearl culture for spherical pearls. The principle is that of tissue grafting, the success of the graft being dependent upon the stage of differentiation of the connective tissue matrix through which the gonad spreads. Although peral culture is a complex biological process, it had its origin in nothing more sophisticated than intelligent animal husbandry.

In this way Japanese technicians perfected a technique during the last 80 years or so which gave rise to an extraordinarily lucrative indusry. With the development of pearl culture techniques there dcveloped also improved practices of collecting spat and growing the treated oysters. Such practices depend on an understanding of elementary boilogy which is the essence of animal husbandry.

The goal was always to produce better and bigger pearls, but there was a limit to the size of pearl which could grow inside a small species of pearl oyster no more than a few inches in length —a limit set less by the capacity of the tissuse, than by the fact that the oyster would be prevented from closing by too large a pearl contained within it.

So the quest for large pearls spread to the south seas where the large "Silverlip" and "Blacklip" grew. The first attempts to tame new species for pearl culture were made before the war. Immediately after the war the first commercial pearl farms for large Pearls were established in Burma. With relaxation of restrictions on Japanese entry into Australia, pearl farms sprang up in North West Australia and in the North East at Thursday Island, the historic centre of Australian pearling.

Australian research had meanwhile shown the feasibility of pearl culture with the Silverlip (Tranter, 1957). There were initial difficulties related to both the different species and the different environment, but soon commercial operations began to thrive. Pearls of half an inch and more became commonplace and pearls up to nearly 1 inch in diameter within reach. The development of this new industry in Australia saved the pearling industry from complete collapse, the vaule of Mother – of – pearl having slumped.

It was a similar slump in the market which put an end to another famous enterprise in pearl oyster husbandry – that of Crossland in the Red Sea. Crossland's work in other fields of marine science is known in India and throughout the world. However, his results with the Blacklip pearl oyster, though carried out nearly 50 years ago, have only recently been published (Crossland,1957). I believe that Crossland's works could form the basis for an active pearling industry in the coral areas of India eg. the Laccadives, Mandapam, and the Andamans.

The Blacklip *(Pinctada margarit,fear)* is amenable to cultivation and has a relatively large size. By contrast the Japanese Pearl oyster (=Ceylon pearl oyster), although easy to cultivate, is veary small; and the Silverlip, although very large, is so far impossible to cultivate. Because the Silverlip does not settle readily on spat collectors, attempts have been made to cultivate the species by artificial fertilization the eggs. The failure of these attempts is in itself an interesting

story, Whereas many species of divalves shed eggs which are cytologically mature or which mature when they reach seawater, the eggs of the Silverlip apparently mature only during the spawning process – and spawning is not easy to induce. Any attempt to cultivate bivalves by artificial fertilization is doomed to failure unless the eggs, howevet ripe they may seem, are ready to be fertilized.

Luckily the Blacklip settles in profusion upon spat collectors placed in the sea immediately after the spawning season; artificial fertilizasion of the eggs is not required. Unlike the Silverlip, the Blacklip retains and renews its byssus (hold – fast) and this property facilitates the cultivation of the species. Crossland's expriments showed that bamboo slats interwoven to form a basketwork provide an excellent settling surface. The species spawns in summer in the Red sea and could very well do the same in Indian waters. If this were so, spat collecting here would be a post – monsoonal operation, and transplantation operations could be carried out, during the calmer months.

The first requirement is to determine whether varieties of Blacklip are endemic to Indian waters as they are in most tropicial and subtropical coral reefs throughout the Indo–Pacific. If not, it would be necessary to transplant the speciee from the Red Sea to, say, the Laccadives to build up a brood stock from which spat could be collected. This is not difficult. Live shell carriers are now well established, — for example in Australian pearling operations (Anon, 1957).

Later development of the industry would depend upon trial – and – error oyster husbandry. The raw materials of the industry, other than brood stock, would be bamboo to make spat collectors, bamboo and drums to make rafts, wire netting to make cages, and tar to protect cages and drums aginst corrosion.

A pearling indusry based upon the Blacklip could have a three fold basis; the Mother–of–Pearl, the "Half pearl" and the Spherical Pearl, in that order of complexity and lucrativeness. In addition, where local artisans are available, secondary industries could develop in Mother–of–Pearl, Half–pearl, and Spherical Pearl jewellery.

A pearl oyster grows to marketable size in about five years. Half pearl and Spherical Pearl operations can be started in the third year while the oyster is still young. Half Pearls take little more than a year to become harvestable, Spherical Pearls about 3 years. Consequently a pearl farm could be well established in five years and yielding considerable profits in ten years. What is required is a little capital, a little science, a little luck, and a lot of common sense animal husbandry.

REFERENCES

Anon. 1967. *Fisheries Newsletter* (Australia), **26**, 4, 15.

Crossland, C. 1957. *Aust J. Mar. Freshw Res.*, **8**, 2, 111.

Hynd J. S. 1955. *Aust. J. Mar. Freshw. Res.*, **6**, 98.

Tranter, D. J. 1957. *Fisheries Newsletter* (Australia), **16**, 9, 11.

Tranter, D. J. 1958. *Aust. J. Mar. Freshw. Res.* **9**, 4, 509.