RESULTS OF MULTIPLE IMPLANTATION OF NUCLEI IN PRODUCTION OF CULTURED PEARLS

K. ALAGARSWAMI

Scheme on Pearl Culture, Central Marine Fisheries Research Institute, Tuticorin 628001.

ABSTRACT

Multiple implantation of shell-bead nuclei in the pearl oyster *Pinctada fucata* enhances the rate of production of cultured pearls. From two to five pearls have been produced in individual oysters in experiments carried out at Tuticorin. The rate of retention of nuclei is comparable with single implantations. While the average production with reference to the number of oysters employed is 62.8% in single implantations, it is 180.6% in multiple implantations. Besides single pearls, clusters (twins and triplet) have been obtained. The growth of pearls is as good in multiple-pearl production as in single-pearl production.

An effective way of increasing the rate of production of cultured pearls in a given number of pearl oysters is to employ the technique of multiple implantation of nuclei. This practice helps in economising the essential raw material — the pearl oyster. While the Australian species, *Pinctada maxima*, renders itself for reuse at least once more because of its large size (18-19 mm in shell height when used in operation), as reported by Hancock (1973), the Japanese oyster, *Pinctada fucata* (= *P. martensii*), because of its comparatively smaller size, is generally used only once for producing cultured pearls. Hence in the latter species two or more pearls are produced in individual oysters through multiple implantation by highly skilled technicians (Cahn 1949). In the freshwater mussel, *Hyriopsis schlegeli*, multiple pearl production without any organic nuclei is the common practice (Alagarswami 1970). Experiments on multiple implantation were carried out on the Indian pearl oyster, *P. fucata* (Gould), at Tuticorin and encouraging results were obtained.

A batch of 34 pearl oysters was used in the experimental work on multiple implantation of nuclei. The oysters, ranging 41.0-56.6 mm in dorso-ventral measurement and 11.5-28.5 g in weight, were operated in December 1975. Each oyster was seeded with two to five spherical shell-bead nuclei of 3-mm and 4-mm diameter class. The mean diameter and weight of 3-mm class nuclei were 3.19 mm and 0.0463 g and those of 4-mm class were 4.12 mm and

0.1028 g. The nucleus-load was decided based on the size of oyster, the phase of reproduction and general condition of the visceral mass. Thus, i) two oysters were seeded with 5 nuclei each of 3-mm diameter class, ii) one was seeded with 4 nuclei of 3-mm class, iii) fourteen were seeded with 3 nuclei each of 3-mm class and iv) seventeen were seeded with 2 nuclei each of 4-mm class. The oysters were beached in June 1976 after a period of 192 days in the sea.

Thirty-one oysters which were alive were examined for pearls. Full success was obtained in one oyster with 5 pearls, six oysters had 3 pearls each and seven oysters had two pearls each in the first, third and fourth categories of seeding, respectively. In others, partial success was obtained with one or two pearls each and only three oysters were blank. In all, 56 pearls were collected. Out of a total of 82 nuclei seeded among the 31 oysters, 21 had been ejected and in 5 cases the graft tissue had failed to form a pearl-sac.

The rate of deposition of nacre over the nucleus was found to be good. In the 3-mm diameter class nuclei, among 26 pearls, the smallest pearl measured 3.28 mm in diameter and 0.0532 g in weight and the largest measured 4.80 mm and 0.1440 g, with an average diameter of 4.12 mm and weight of 0.1029 g. In the 4-mm diameter class nuclei, among 21 pearls, the smallest measured 4.46 mm and 0.1261 g and the largest measured 5.70 mm and 0.2716 g, with an average diameter of 5.01 mm and weight of 0.1830 g.

An interesting feature noticed in multiple implantation was the formation of clusters of pearls due to the closeness of the sites of seeding. Four clusters were obtained, of which three were of two pearls each and one was of three pearls (Fig. 1). Such formations have been referred to as Siamese-twin pearls

FIG. 1. Cluster Of Pearls (3 twins and a triplet) produced through multiple implantation of nuclei in the pearl oyster.

and triplets (Cahn 1949). It is probable that when the growing edges of closely placed graft pieces meet, they unite and form a single pearl-sac surrounding the nuclei and the nacre secreted binds the nuclei together resulting in clusters of

pearls. It is also likely that when pearl-sacs of two or more free pearls are very closely situated, they might unite as the pearls grow larger, thereby linking the pearls too. The growth of pearls in clusters was observed to be as good as in single pearls. All clusters obtained were from 3-mm class nuclei. In the case of twin pearls, one was always slightly larger than the other and the diameters of pairs were (in mm) 4.64 and 4.36, 4.52 and 4.24, and 4.56 and 4.32, all being above the average diameter of 4.12 mm observed in free pearls. The weights of the three twin pearls were 0.2432 g, 0.2354 g and 0.2442 g. The pearls forming the triplet were comparatively smaller and also slightly flat from side to side; its weight was 0.2710 g.

The results of multiple implantations obtained here are compared with those of single implantations obtained earlier from 183 oysters (unpublished data) in Table 1.

TABLE 1. *Results of single and multiple implantations of nuclei in pearl oyster.*

		Single implantation	Multiple implantation
i	Retention of nuclei	79.8%	74.4%
ii	Pearl production with ref. to no. of nuclei seeded	62.8%	68.3%
iii	Pearl production with ref. to no. of oysters used	62.8%	180.6%

The advantages of multiple implantation are clear from the table. The rate of retention of nuclei and the rate of pearl production with reference to the number of nuclei used are generally comparable. But with reference to the number of pearl oysters the rate of production is nearly three times in multiple implantation as compared to single implantation. This factor is of great significance in the economic use of pearl oysters in pearl culture. The size of oysters used in the experiments are comparatively small with an average dorso-ventral measurement of 50.3 mm and weight of 20.8 g. It would be possible to increase the per-oyster pearl production rate and to employ nuclei of larger diameter in bigger oysters.

It has also been seen that multiple implantations do not inhibit the growth of pearls. The average deposition of nacre has been found to be 0.465 mm on the radius of nucleus (0.93 mm on the diameter) and 0.0566 g in weight in the case of 3-mm diameter class nuclei, and 0.445 mm on the radius (0.89 mm on the diameter) and 0.0802 g in weight in the case of 4-mm diameter class nuclei in a period of 192 days. In single implantations, Alagarswami (MS) has observed nacre deposit of 0.32 mm on the radius and 0.0246 g in weight in the case of 3-mm diameter class nuclei in 191 days and 0.31 mm on the radius and

0.0438 g in weight in the case of 4-mm diameter class nuclei in 161 days. These data apparently show even better growth in multiple implantations of the present study. This may, to a large extent, be due to the fact that the post-operative culture of this batch of oysters was done in the harbour basin where the sea is calmer, depth is greater and clarity is better throughout the year, as compared to the conditions in the open-sea farm off Veppalodai. While the results of a comparative study of the merits of the above two environments in respect of pearl culture will be reported elsewhere, the present experiment does indicate that the growth of pearls is as good in multiple-pearl production as in single-pearl production when the nucleus-load is adjusted to the size of the pearl oyster and its physiological condition.

The author expresses his gratitude to his director, Dr E. G. Silas, for the encouragement received throughout the work.

ALAGARSWAMI, K. 1970. Pearl culture in Japan and its lessons for India. *Proc. Symp. Mollusca*, III: 975-993. Mar. biol. Ass. India.

CAHN, A. R. 1949. Pearl culture in Japan. *U.S. Fish Wildl. Serv., Fish. Leafl.*, **357**: 1-91.

HANCOCK, D. A. 1973. Kuri Bay pearls — some of the finest in the world. *Austr. Fish.*, **32** (4): 11-12.