PRELIMINARY STUDY ON THE GROWTH OF CULTURED PEARLS

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ABSTRACT

Preliminary study on the growth rate of cultured pearls at Veppalodai, Tuticorin, suggests that the time taken for the production of a pearl of comparable size is considerably less in the Indian waters than in the temperate areas of pearl culture.

The development of a technology for producing cultured pearls in the Indian pearl oyster, *Pinctada fucata*, has been reported earlier (Alagarswami 1974). Alagarswami (1970) indicated that the growth of pearls in the Indian

waters could be expected to be faster than in the Japanese waters. A preliminary study on the growth of pearls produced in the first series of experiments at Veppalodai, near Tuticorin, during 1973-74, which is discussed here, has proved this true.

The techniques and procedures of pearl culture employed at Veppalodai have been reported earlier (Alagarswami and Qasim 1974). The experiments on nucleus implantation in pearl oysters commenced in July 1973. The cultured pearls considered in this study were produced by single-nucleus implantations in the oysters and collected on different dates from October 1973 to February 1974. The pearl oysters used in the experiments ranged 53.7-64.0 mm in dorso-ventral measurement. Shell beads of 3-mm and 4-mm diameter, imported from Japan, formed the nuclei of cultured pearls. In one instance, nucleus of 5.81-mm diameter made indigenously from conch shell was used. The sites of implantation were selected locations in the gonads and digestive glands of the oyster. The diameters of the pearls were measured correct to 0.01 mm with the aid of a precision screw gauge. Their weights were recorded to an accuracy of 0.0001 g, using an electrically operated single-pan balance.

The data on growth of pearls in size and weight, along with the ratios of growth, are presented in Table 1. The figures relate to 30 pearls which were free and spherical. The growth of pearl is represented by the thickness of nacre deposited around the nucleus and the weight of the nacreous layer. It can be seen from the table that there are apparent differences in the growth of pearls

TABLE 1. *Average values of growth of cultured pearls in* Pinctada fucata *in the Gulf of Mannar.*

(The figures on pearls are averages of individual values)

No. of observations	Diameter of nucleus (mm)	Diameter of pearls (mm)	Increase in diameter (mm)	Thickness of nacre (mm)	Ratio of nacreous layer to radius of nucleus	Weight of nucleus (g)	Weight of pearls (g)	Weight of nacreous layer (g)	Ratio of wt. of nacreous layer to nucleus	Site of production	Duration of culture (days)
4	3.00	3.60	0.60	0.30	0.201	0.0459	0.0703	0.0244	0.532	gonad	94-108
3	3.00	3.22	0.22	0.11	0.074	0.0459	0.0564	0.0105	0.229	digestive gland	94- 98
4	3.00	3.52	0.52	0.26	0.173	0.0459	0.0645	0.0186	0.405	gonad	161
6	3.00	3.63	0.63	0.32	0.211	0.0459	0.0705	0.0246	0.537	digestive gland	191
4	4.00	4.49	0.49	0.25	0.122	0.1027	0.1384	0.0337	0.328	gonad	161
8	4.00	4.68	0.68	0.35	0.171	0.1027	0.1516	0.0489	0.476	digestive gland	161
1	5.81	6.32	0.51	0.26	0.088	0.3140	0.3723	0.0583	0.186	gonad	159

in the two sites of implantation, namely the gonad and the digestive glands. This could probably be due to the differences in the physiological condition of the individual pearl oysters during the period of culture. Further experimental evidence is required to elucidate the physiological potential of the different tissues of pearl oysters in promoting the growth of the pearl sac and, consequently, the growth of the pearl itself.

When the data were averaged, irrespective of the sites of implantation, the growth of nacre over the 3-mm nuclei was found to be 0.22 mm, 0.26 mm and 0.32 mm in thickness and 0.0185 g, 0.0186 g and 0.0246 g in weight in 94-108, 161 and 191 days respectively. On the 4-mm nuclei, the growth of nacre was 0.31 mm in thickness and 0.0438 g in weight in 161 days. On the indigenously produced 5.81-mm nucleus, the growth was 0.26 mm in thickness and 0.0583 g in weight in 159 days.

The ratio of average thickness of nacreous layer to the radius of nucleus shows a progressive decrease with the increase in size of the nucleus. The ratios are 0.176, 0.155 and 0.088 for nuclei of 3.00-, 4.00- and 5.81-mm diameter respectively. So also the ratio of average weight of nacreous layer to weight of nucleus decreases with increase in weight of nucleus. The ratios are 0.450, 0.427 and 0.186 for nuclei of 0.0459, 0.1027 and 0.3140 g weight respectively.

It is well known that the metabolic rate of marine organisms is higher in the warmer tropical waters than in the colder temperate waters. The rate of deposition of nacre by the pearl sac in the pearl oyster also follows this general rule. In the Pacific, the rate of production of nacre in the Japanese pearl oyster, *Pinctada martensii*, is very slow in the northern limits of its distribution and it is much faster in the warmer South Pacific waters around Palau and Boetong (Cahn 1949). In the Japanese waters, the secretion of nacre is inhibited at a temperature of about 14°C, and below this limit the pearl ceases to grow (Cahn 1949). According to Kobayashi and Tobota (1949), *P. martensii* hibernates in winter when the water temperature falls below 13°C. Because of the narrow range of temperature in the Gulf of Mannar, which was 27°-31°C during the present experiments, the secretion of nacre in *P. fucata* can be presumed to be never inhibited.

The data on growth of pearl in the Indian and the Japanese waters (Gulf of Mannar and Ago Bay respectively) are given in Table 2. It can be seen from the table that, in the case of 3.00-3.05mm nuclei, the growth obtained in two years in the Japanese waters is achieved in a little over six months in the Indian waters. In the case of 3.95-4.00mm nuclei, the ratio of nacreous layer to radius of nucleus is 0.155 in 161 days in the Indian waters, while it is 0.183 in two-and-half years in the Japanese waters. Similarly, a growth ratio of 0.088 is obtained on a 5.81-mm nucleus in 159 days in the Gulf of Mannar, as against the ratio of 0.146 on 5.80-mm nuclei in three years in the Ago Bay.

According to the present study, the growth of cultured pearls in the Indian waters appears to be faster than in the Japanese waters. Admittedly, more data are needed to draw conclusions on the comparative growth rates; but the trend of faster growth is clear even from the preliminary results presented here. In Japan, the duration of culture of pearls ranges from 6 months to 4 years (Wada 1973). The average increase in diameter of Japanese cultured pearls is about 0.3 mm each year (Cahn 1949). Bolman (1941) also estimated the average yearly growth of nacre to be 0.15 mm in thickness in the case of Japanese cultured pearls.

TABLE 2. *Data on growth of pearls in India (Gulf of Mannar) and in Japan* (Ago Bay).*

Culture area	Diameter of nucleus (mm)	Diameter of pearls (mm)	Thickness of nacre (mm)	Ratio of nacreous layer to radius of nucleus	Weight of nucleus (g)	Weight of pearls (g)	Weight of nacreous layer (g)	Duration of culture
India	3.00	3.65	0.32	0.211	0.0459	0.0705	0.0246	191 days
Japan	3.05	3.7	0.318	0.209	0.041	0.071	0.030	2 years
India	4.00	4.62	0.31	0.155	0.1027	0.1465	0.0438	161 days
Japan	3.95	4.7	0.363	0.183	0.090	0.150	0.060	2½ years
India	5.81	6.32	0.26	0.088	0.3140	0.3723	0.0583	159 days
Japan	5.80	6.6	0.424	0.146	0.289	0.450	0.161	3 years

* Data for the Japanese cultured pearls are extracts from Cahn (1949); only the weights of nacreous layer have been calculated from the weights of pearls and nuclei by the author.

The data obtained in the present experiments show that, as a result of faster growth of pearls in the Indian waters, the duration of culture could be considerably reduced to produce cultured pearls of comparable sizes. This will have significant implications in the economics of pearl culture in India.

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