

CMFRI bulletin 42

Part Two

DECEMBER 1988



NATIONAL SEMINAR ON SHELLFISH RESOURCES AND FARMING

TUTICORIN

19-21 January, 1987

Sessions II-VI

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

53. ON SOME EXPERIMENTS ON PEARL PRODUCTION AT OKHA AND SIKKA IN THE GULF OF KUTCH

I. R. Khan, M. I. Patel and S. N. Nariya
Gujarat Fisheries Aquatic Sciences Research Station, Department of
Fisheries, Govt. of Gujarat, Sikka-361 140

ABSTRACT

Considerable progress has been made since 1956 in the field of pearl culture by the Gujarat State Fisheries Department at Okha and Sikka in the Gulf of Kutch. Earlier attempts on pearl production did not yield desired results. Refinement in this field was achieved on receiving the technology on pearl culture perfected by the Central Marine Fisheries Research Institute. Of the various materials tested as nuclei, the Japanese nuclei was found to give quality pearls. The pearls produced by agate beads, though reflected the colour of beads, experienced problem in uniform drilling while making strings. Analysis of structure of pearl by X-ray method revealed no distinction between the core material and nacre coating. Use of artery forceps and electrocautry in sealing the site of incision was tested. Straining of nucleus and pearls were attempted.

INTRODUCTION

Gulf of Kutch is one of the areas in India where the pearl oyster (*Pinctada fucata*) is available in the intertidal zone extending upto 5 km from coastline. Based on the pearl oyster resources the work was initiated to produce cultured pearls since 1956. Hornell (1909) laid foundation for the work by establishing a pearl oyster farm with stone enclosures near Sikka. Easwaran (1972) reported that a pearl was produced in Sikka Station. In the subsequent years several attempts were made to produce cultured pearls using different materials as nucleus (Desai et al 1977; Pathak et al 1981 and Anon 1983). This paper reviews the earlier attempts on pearl production and the latest techniques developed in various aspects of pearl production both in *P. fucata* and freshwater mussel.

MATERIAL AND METHODS

Before nucleus implantation, *P. fucata* brought from the pool owned by Gujarat State Electricity Board were conditioned for 12 h. The pearl culture techniques perfected at the Tuticorin Research Centre of Central Marine Fisheries Research Institute were followed here (Alagarwami and Dharmaraj 1984). Different sizes of surgical artery forceps were procured for the experiments in sealing the incision after nucleus implantation. The lips of incision

was held together by the artery forceps till the incision was closed. A mild electric shock was given to incision in order to coagulate the muscles at the site by means of electrocautry. The battery used for the purpose has 3-6 volts of current.

The plastic experimented here were blue, purple, green and yellow in colour having the diameter of 2-3 mm. The agate and akik beads were obtained from M/s. Mutual Industrial Corporation, Sabli Pole, Cambay 388,620, Gujarat State. The colour of the beads were grey, green jet, amethis, blue jet, carmelian, rose quartz, blood stone and light jet. The diameter of the beads varied from 4 to 6 mm.

The structure of pearl was examined by X-ray photography at the Civil Hospital, Ahmedabad and at District Health Centre, Jamnagar. Straining of nucleus and pearl was done in the medium containing 0.5 gm eosin, 20 ml of edible oil and 50 ml of absolute alcohol. To ensure nucleus rejection by individual oyster the bottom of aquarium tank was partitioned into compartments.

The live freshwater mussels, the species of which not confirmed, were collected from the down streams of Sinhan River, 33 km away from Sikka on Jamnagar-Sikka highway and from the water logging areas around Lingda fish farm, 19 km away from Nadiad near

Ahmedabad. The size of mussels was 90-99 mm in length and 45-50 mm in breadth. They were transported in wet gunny bag by road and kept in natural environment near Sikka. 50 mussels of the batch were implanted with 2 mm Japanese nucleus. The surgical instruments meant for pearl oyster surgery work were used here except the oyster clamp. Instead of oyster clamp a wooden box was prepared for holding mussels during operation. The mussels were implanted fresh without narcotizing.

RESUME OF EARLIER WORKS ON PEARL PRODUCTION IN GULF OF KUTCH

Experiments on pearl production in *P. fucata* were commenced in 1956 by implanting 60 pearl oysters with imported nuclei. The technique employed at that time during the operation was to drill a hole from outer side of the shell just to reach the mantle and place nucleus in the hole and seal it. The portion of nucleus touching mantle was found to have received a thin coating of nacre (Pandya 1974). During 1972, various materials like plaster of paris, glass beads, freshwater mussel bead and plastic bead were tried as nuclei in a few oysters. Of these materials the freshwater mussel bead received a partial coating of nacre. According to Easwaran (1972) out of 200 oysters operated an oyster yielded a pearl. Desai et al (1977) reported that preliminary work on implantation was done during January 1975 using Japanese nuclei, which they found at that time, was not suitable for pearl production in *P. fucata*.

EXPERIMENTS ON PEARL PRODUCTION AT OKHA AND SIKKA

According to Pathak et al (1981) nucleus implantation in *P. fucata* at Okha during February 1979 yielded 172 free spherical pearls. Of this 115 were single pearls 38 twin, 2 triplet and 17 plastic pearls. The colour of pearls by Japanese nuclei were silver white, ivory and golden yellow. The pearls produced by plastic beads were not as good as the pearls of Japanese nuclei. In another set of experiment 6 plastic pearls, 6 twin pearls and 2 triplet pearls were produced.

The results of nucleus implantation carried out at Sikka from the year 1979-80 to 1984-85 were reported by Anon (1983) (Table 1). Jani (1981) gave his results of nuclei implantation done during the year 1979-80, 80-81 and 81-82. According to him percentage of pearl formation was 24.8%, 30.5% and 21.9% in the respective years. The mortality was found to increase 17.9%, 28.1% and 43.6% whereas the percentage of nucleus rejection decreased from 43.3% to 23.9%. The colour of pearls produced here at Sikka was similar to that of pearls at Okha.

TABLE 1. Results of nucleus implantation as reported by Anon (1983).

Year	Pearl No. of oysters operated	No. of nuclei implanted	No. of pearls harvested
1979-80	507	1027	255
1980 81	442	799	244
1981 82	1412	2593	569
1982-83	982	1507	314
1983-84	3809	8178	1715
1984-85	745	863	98

IMPROVEMENTS IN POST-OPERATIVE CULTURE

Some improvements were made during post-operative culture by keeping individual oyster in a compartment made at the bottom of tank to ensure nucleus rejection. Farm rearing of seeded oysters was done in cages covered with velon screen to prevent the loss of pearl and nucleus.

STAINING OF NUCLEUS AND PEARL

Japanese nuclei were stained in the medium prepared by dissolving 0.5 gm eosin 20 ml edible oil and 50 ml absolute alcohol (modified after Cahn 1949). The pearls obtained from these nuclei were pink in colour. In the same way cultured pearls were also stained at different durations namely 12 h, 24 h, 36 h upto 72 h. Depending upon the duration the pearls were stained light pink to dark pink colour.

USE OF COLOUR PLASTIC BEADS AND AGATE/AKIK BEADS IN PEARL PRODUCTION

Plastic beads of different colours namely blue, purple, green, yellow were used as nuclei. A total of 181 *P. fucata* were implanted with 253 plastic beads. 13 numbers of plastic pearls were recovered which reflected the colour of beads. The quality of these pearls were not comparable to the pearls of shell bead nucleus. The study indicated 5.1% of pearl production, 70.2% mortality and 20.2% nucleus rejection.

The use of agate or akik beads were tested in pearl production during the year 1981-82 and 82-83. The source of availability of these beads was already mentioned elsewhere in the text. The beads resulted in 38.2% of pearl formation with a mortality of 24.3% and 21.9% nucleus rejection. The pearls obtained by these beads were lustrous in nature and reflected the colour of beads.

USE OF ARTERY FORCEPS AND ELECTROCAUTRY IN NUCLEUS REJECTION

A new device was employed in sealing the incision point after nucleus implantation. An artery forceps was used to hold the lips of incision together. This facilitated the closure of incision thus preventing the slipping of nucleus. A method of electrocautry was also employed to coagulate the muscles at the site of incision after nucleus implantation. It gives a mild electric shock of 3-6 volts. The oysters treated with electrocautry showed no rejection of nucleus both in the laboratory and farm.

X-RAY PHOTOGRAPHY OF CULTURED PEARLS

An attempt was made to examine the structure of cultured pearls by means of X-ray photography. The study showed no distinction between the core material and nacre coating.

PEARL PRODUCTION IN FRESHWATER MUSSEL

A total of 50 freshwater mussels were implanted, each with 2mm size Japanese nucleus. Two white pinkish colour pearls were produced

after 177 days of culture. It indicated only 4% pearl production; mortality of seeded mussels was as high as 88%.

DISCUSSION

Experimental pearl production started in the year 1956 in the Gulf of Kutch which was considered to be the second important place in India with respect to the availability of pearl oyster resources. Panda (1974) reported that by adopting an old method of drilling the shell of a live oyster from outside and keeping the nucleus in touch with the mantle inside and finally sealing the hole, a thin coating of nacre was noticed on a portion of nucleus during 1956. Desai et al (1977) expressed that no pearl was produced due to high mortality of seeded oysters. Till then the progress was rather slow. By this time the Central Marine Fisheries Research Institute developed the technology of pearl production and imparted the technique to personnel of different maritime states through training courses. The active participation of Gujarat State Fisheries Department in acquiring the technology resulted in the production of more pearls. According to Pathak et al (1981) a total 58 pearls were produced, of which 39 pearls were by Japanese nuclei, 7 by 'Patharia moti' and 12 by plastic beads during the year 1979-80 and the production rate obtained was 21.4% 38.9% and 60.0% respectively. Anon (1983) reported that 3195 pearls were harvested between 1978-80 and 1984-85 with a maximum of 30.5% production during 1980-81.

Experimentation of various materials as nuclei revealed their suitability in pearl production. Though the coloured pearls produced by agate beads have reflected the colour of nucleus, the problem of drilling the pearls was experienced. The use of plastic beads as nuclei resulted in poor quality pearls. The results indicated that the Japanese nuclei are more suitable for pearl production. Similarly the suitability of indigenously made chank beads in pearl production was reported by Alagarswami (1987).

The study on the structure of pearl through X-ray might be useful to assess the size of

pearl *in situ* in the seeded oysters and accordingly by noting initial size of nucleus the schedule time for harvesting of pearl might be fixed.

A method of sealing the site of incision by artery forceps and electrocautry has decreased the percentage of rejection of nucleus from 43.3% to 23.7%. But it has increased the mortality rate considerably from 17.9 to 43.6% during the years 1979-80, 80-81 and 81-82. The percentage pearl production was 24.8, 30.5 and 21.9 in the respective years. It clearly indicated that the method is effective in the retention of nucleus rather than the production of pearl and mortality.

A pearl was produced in freshwater mussel by Tamil Nadu Fisheries Department at Tuticorin and the mortality reported here was 30% (Nazarene and Dev/1984). Freshwater pearl production was attempted in Bangladesh using eyeball of small fishes and a piece of mantle as core material. The data showed 90% mortality (Masud Ahmed 1982). In the present study a pearl produced out of 50 freshwater mussels operated. The percentage of mortality was 80%. Japanese nucleus was used for this work.

ACKNOWLEDGMENTS

The authors wish to express their sincere thanks to Mr. A. K. Luke, Former Commissioner of Fisheries, Mr. Ajit Magodia, Joint Commissioner, Prof. N.D. Chhaya, Deputy Commissioner of Fisheries for the facilities extended during the work and for encouragement. Our thanks are also due to Mr. M. M. Jani for his data and H. A. Ravel for typing.

REFERENCES

- ALAGARSWAMI, K. 1987. Pearl culture. *Bull. Cent. Mar. Fish. Res. Inst.*, 39, pp, 119.
- ALAGARSWAMI, K. AND S. DHARMARAJ. 1984. Manual on pearl culture techniques. *Cent. Mar. Fish. Res. Inst., Cochin*, 20: 1-42.
- ANON. 1983. Review on pearl culture project, *Gujarat Fisheries Aquatic Science Research Station*, pp. 1-50.

- CAHN, A. R. 1949. Pearl culture in Japan. *Fish. Leaflet. U. S. Fish. Wildl. Ser.*, 357 : 1-91.
- DESAI, K., D NIMAVAT AND J. A. PANDYA. 1977. Studies on the pearl oyster *Pinctada fucata* (Gould) of the Gulf of Kutch. III Preliminary investigation on pearl culture. *Curr. Sci.*, 46 (21) : 748-749.
- EASWARAN, C. R. 1972. Pearl culture. *Fish. Res. Symp. Mar. Biol. Res. Station, Port Okha*, 25-26, August 1972.
- HORNELL, J. 1909. Report to the Government of Baroda on the prospects of establishing a pearl fishery and other marine industries on the coast of Okhamandal. *Report to the Government Baroda on the Marine Zoology of Okhamandal in Kathiawar*, Pt. I. 34 pp. Williams and Norgate, London:
- JANI, M. M. 1981. Experiments on pearl culture at Sikka, Gujarat. *Ind All India Symp. on Exptl. Zoology*, Dept. of Zoology, M. S. University, Baroda, 29-31, January, 1981.
- MASUD AHMED. 1982. Bivalves and Bivalves Fisheries in Bangladesh. *Proc. Workshop on Bivalve Culture in Asia and the Pacific, Singapore*, 16-19, February, 1982. F. Brian Davy and Michael Graham, 20.
- NAZARENE, C. Z. AND D. S. DEV. 1984. Culture of pearls from Freshwater mussel, Tamil Nadu's Achievement, *Fish. chimes*, 4 (6): 26-27.
- PANDYA, J. A. 1974. Pearl oyster resources and culture experiments in Gujarat. *Proc. Group discussion on pearl culture C. M. F. R. I., Cochin* 25-27.
- PATHAK, R.R., M.A.VARGHESE, S.G.RUPARELIA AND M. BHASKRAN. 1981. Pearl culture experiments at Port Okha in the Gulf of Kutch. *Ind All India Symp. on Exptl. Zoology*, Dept. of Zoology, M. S. University, Baroda, 27-31, January, 1981.