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Availability of pearl producing marine bivalves in south-eastern coast of Bangladesh and culture potentialities

Md. Ataur Rahman[1] • Mohammed Rashed Parvej[2] • Md. Harunor Rashid[2] • Md. Enamul Hoq[1]

[1] *Marine Fisheries & Technology Station, Bangladesh Fisheries Research Institute, Cox's Bazar 4700, Bangladesh*

[2] *Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh 2201, Bangladesh*

Correspondence: Md. Enamul Hoq, Marine Fisheries & Technology Station, Bangladesh Fisheries Research Institute; Email: hoq_me@yahoo.com

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Abstract

The present study was conducted during September 2014 to July 2015 to identify the pearl bearing bivalves in south-eastern coast of Bangladesh and culture potentialities of marine oyster in captivity based on field investigation. A total of 7 pearl bearing bivalve species were identified in the coast with a salinity of 18-34 ppt, pH 8.1-8.3 and water depth ranged 0.2-2.0 meter in their habitat. From the collected bivalves, most abundant oyster species windowpane oyster, *Placuna placenta* (Linnaeus, 1758) was reared in fiber glass tanks with seawater for a period of 6 months. During rearing highest survival rate of 88% was observed in T_1 with sandy and gravel substratum and lowest survival rate of 78% was found in T_2 with muddy substratum. Average temperature and salinity were varied between 24 °C-25 °C and 21-26 ppt respectively. From the reared oyster, highest 54 nos. small pearls in the month of April and lowest 7 pearls in December from a single *P. placenta* were obtained. The study proved that pearls can be obtained from the marine oysters in captivity in Bangladesh, and this offers large scale culture potentialities in our coast.

Keywords: Pearl, bivalve, windowpane oyster, *Placuna placenta*

INTRODUCTION

Bivalves is the second largest class of mollusks with about 10,000 living species are known throughout the world (Wye 1989) of which there are 6 freshwater and 142 marine and brackishwater species are available in Bangladesh (Siddiqui *et al.* 2007). Bivalves are known to produce pearls. On the other hand, oysters are mainly found in salt water and grow attached to rocks, gravel, tree roots or any hard object in the intertidal zone. The environment of our Bay of Bengal coast is quite suitable for marine pearl production. Small pearls of fairly good luster are produced by the windowpane oyster *Placuna placenta* from the Nauxim Bay of Goa, India (Achuthankutty *et al.* 1979). There are numerous coves, bays and estuaries in Bangladesh coast which can be devoted for oyster culture as well as pearl production. The channel between Sonadia and Moheskhali Islands has a potential farming area of more than 1,500 hectares (Hossain *et al.* 2014). Pearl culture is an attractive business venture because of the high value of the final product. In Bangladesh, still naturally collected freshwater mussel is the main source of pearl culture. Introduction of marine oyster for pearl culture in Bangladesh is a new concept. The present study was an attempt to search pearl producing marine oyster in the south-east coast of Bangladesh and their culture potentialities for pearl culture.

METHODOLOGY

Sampling sites: The study was conducted in the Sonadia, Moheshkhali in Cox's Bazar and Kuakata in Potuakhali (Figure 1). The primary criterion for the selection of this area was suitable geographical coverage for large variety of pearl producing marine oysters and presence of good numbers of bivalve collectors.

Figure 1: Study area for pearl producing oyster collection (Source: Banglapedia, the national encyclopedia of Bangladesh)

Bivalve collection and identification: Bivalves were collected by hand picking, dredging by hand and rake hook from the muddy soft areas especially in Ghotivanga Khal, Moheshkhali and rocky attached bivalves were separated from the rock by using chisel and hammer. The field survey was conducted during September 2014 to June 2015.

Both living and dead oyster shells were put in ice box and carried to the Marine Fisheries and Technology Station, Cox's Bazar. Live oyster individuals were kept in the fiber glass aquarium for rearing with regular monitoring whereas dead shells were kept in the Museum of the MFTS, Cox's Bazar. Collected bivalves were identified on the basis of their shell characteristics after Abbott (1982), Mookherjee (1985), Amhed *et al.* (1990), and Hossain *et al.* (2014). The specimen's length and weight were measured by a steel measurement tape (LAND, JC-379W) to the nearest cm and weight machine (OHAUS, PA213) to the nearest g.

Rearing of collected oysters: Fiber glass tanks (2m×1m×1m) of 2 tons water holding capacity were used for rearing of collected oyster species. Most abundant species windowpane oyster, *Placuna placenta* (Linnaeus, 1758) were collected from the study areas kept into clear fiber glass aquariums with sea water, denoted as T_1, T_2 and T_3. For each of the treatment duplicate aquariums were used. The substratum of T_1 tank was maintained with sand and gravel, T_2 with sand+mud and T_3 with only sand as bottom substratum. Water depth in the aquariums was maintained as 0.5 m with a stoking density of 100 species in each tank. Pearl sampling was done every two-month interval. Fortnightly monitoring of water quality parameter (temperature, salinity, pH, DO) were done and rearing trail was for a period of six months from December 2014 to June 2015.

RESULTS AND DISCUSSION

Availability of marine bivalves: During the study period a total 7 species of marine bivalve were collected from 6 sampling areas of the Sonadia and Moheshkhali, Cox's Bazar, and Kuakata, Patuakhali (Table 1, Figure 2). During the sample collection, water quality parameters were studied to understand the environment of that area. The salinity ranged between 18 to 34 ppt. The pH of water was slightly alkaline and ranged from 8 to 8.5. The water depth was 0.2 to 2.0 meter and the bottom structure was muddy, sandy and rocky.

Figure 2: Bivalve identified during the study period

Water quality parameters during rearing of bivalves: From the field collection most abundant oyster species *P. placenta* locally known as Kortal was selected for rearing with a view to producing pearl in captivity. The *P. placenta* was stocked in December 2014 and reared for 6 months in the fiber glass tanks with aeration. The water quality parameters i.e. temperature, salinity, pH and dissolved oxygen (DO) recorded in 3 treatments are presented in Figure 3.

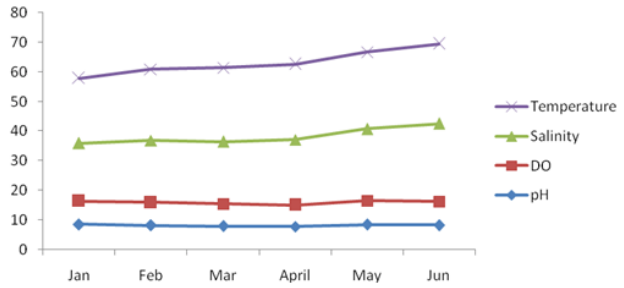

Figure 3: Month-wise average temperature, salinity, pH and dissolve oxygen during rearing of *Placuna placenta* (kortal) in fiber glass tanks

Rearing of windowpane oyster in fiber glass tanks: During the survey period 7 pearl bearing oyster species were identified. Due to more abundance, the windowpane oyster was reared in fiber glass tanks to assess the possibility of pearl production in captivity. During six months rearing period sampling was done at two months interval for pearl production. A total 38 oysters were sampled during the study period among them 68% oysters found to produce pearls (Table 2).

About 35% of the 385 *P. placenta* examined had pearls collected from the Nauxim Bay of Goa, India (Achuthankutty *et al.* 1979). Most of them had only one pearl but quite a few had 2 or 3 and a maximum number of 8 pearls were seen in a single oyster (9-13 cm). The diameter of the pearl recovered was between 0.4-2.0 mm. It was observed that the frequency of occurrence of pearls and size of pearl increased with the increase in size of the oysters (Achuthankutty *et al.* 1979). In our study the size of reared oysters was much higher and 18-54 pearls were recovered from each individual. The diameter of our pearl was 1.5 to 4 mm. During the rearing period, the highest number of pearl (85) was recovered in the month of April and the lowest number of pearl (7) was collected in December.

Table 1: List of bivalve as identified during the study period

Sl. No.	*Order*	*Family*	*Scientific name*	*English name*	*Local name*
1	Pterioida	Anomiidae	*Placuna placenta* (Linnaeus, 1758)	Windowpane shell	Kortal
2	Pterioida	Pteriidae	*Pinctada* sp.	Pearl oyster	Kostura
3	Mytiloida	Mytilidae	*Perna viridis* (Linnaeus, 1758)	Green mussel	Kala zinuk
4	Veneroida	Veneridae	*Meretrix meretrix* (Linnaeus, 1758)	Poker–chip clam	Chilen
5	Pterioida	Pteriidae	*Pinctada margaritifera* (Linnaeus, 1758)	Pearl oyster	-
6	Veneroida	Veneridae	*Meretrix lyrata* (Sowerby, 1851)	Hard clam	Sada chilen
7	Ostreina	Ostreidae	*Crassoostrea* sp.	-	Kostura

Table 2: Status of survival rate and pearl recovery in fiber glass tanks

Rearing tanks with substratum	*Stocking/Tank (0.5 m water depth)*	*Stocking size of oyster (cm, g)*	*Survival rate (%)*	*Sampling nos. of reared oysters*	*Pearl bearing oysters*	*Nos. of pearl obtained from each oyster*
T_1 (Sand+gravels)	100	12.2-17.7, 120-300	88	13	11	30
T_2 (Sand+mud)	100	12.5-17, 100-300	78	13	6	54
T_3 (Sand only)	100	12-17.3, 100-280	85	12	9	18

Although during sampling, examined oysters were sacrificed, the overall survival rate (78-85%) of oyster was satisfactory. In the present study, better survival rate was obtained in sandy gravel substratum. *P. placenta* is naturally found burrowing in muddy or sandy-mud substratum (Rosell 1979). During rearing of oyster in fiber glass tanks, severe algal blooming was observed, which was recovered by regular cleaning and supply of fresh sea water. Moreover, as the rearing tanks (clear fiber glass) were placed in outdoor, sunlight may increase the algal growth. *P. placenta* could be a desirable species for pearl production and rearing is possible in captivity through maintaining proper water quality. Windowpane oyster i.e. "kortal" provides local fishermen an additional income-generating source through the sale of its pearls and shells. The empty shells are used as raw material in making shell

craft products and are used in decorative materials. At present we have no knowledge on grafting of mantle tissue to oyster like freshwater mussels (Hossain *et al.* 2004), the knowledge of pearl production in captivity in marine oyster will open a new avenue of pearl culture in the coastal Bangladesh.

CONCLUSIONS

From the present findings, setting up of *P. placenta* fishery both for the purpose of pearls and shell products appears very promising which can be achieved only through a comprehensive study of this species. Windowpane shell provides coastal population specially women an additional income-generating source through the sale of its pearls and shells. The empty shells are used as raw material in making shell craft products. Toward the conservation of this oyster species, research should focus on the development of seed production, restocking and transplantation techniques.

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