Sindh Univ. Res. Jour. (Sci. Ser.) Vol.44 (1) 119-124 (2012)

SINDH UNIVERSITY RESEARCH JOURNAL (SCIENCE SERIES)

Cultivation of Oyster *Crassostrea gryphoides* (Schlotheim) through rafts at Ambra creek coastal belt of Arabian sea, Sindh Pakistan

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Received 18th October 2011and Revised 29th February 2012

Abstract: Cultivation of edible oyster *Crassostrea gryphoides* on rafts was carried out for the first time in Pakistan during 2009 to 2011. 10 pilot rafts were fixed at Ambra creek an estuarine area of Indus river delta eco-region. Appearance of 8 to 12 tiny spats size average 0.4cm ± 0.158 diameter were evident on submerged old empty shells of oyster in June 2010. The development of crop was studied bi-monthly for size length measurement 2.82±0.526, 4.66±0.364, 6.18±0.465, 7.6±0.291, 9±0.689 and 12.3±0.51cm respectively in period of 13 months. Ideal increment in growth of animal was observed in summer season and leisurely growth in length and width of oyster was recorded during winter months. Physico-chemical parameters vs. temperature of air and water, transparency, pH, alkalinity, hardness, salinity, conductivity, total dissolved solids, dissolved oxygen and depth variation in water of the creek were analyzed and found suitable for oyster farming. Secchi disc reading indicated that water was light green which is a clear indication of phytoplankton productivity. The habitat is rich with natural food items for oyster spats, larvae and juvenile. The growth performance of the oyster was remained quite satisfactory in the ecology of Ambra creek.

Keywords: oyster culture on rafts in Coastal belt of Sindh.

1. INTRODUCTION

The Sindh province has a coastal line of about 352 km, a major part of which comprises the delta of the Indus River crosses districts of Thatta and Badin and talukas (sub-districts) of Ghorabari, Keti Bandar, Jati, Shah Bandar, Kharo Chan and Mirpur Sakro. About 70% community of coastal area are fishermen by their profession as fishing. In this present era of technology our fisherman community is practicing old conservative techniques of fishing. Under the umbrella of the project (Sindh Coastal Community Development Project) the rafts were installed at creeks for cultivation of oyster. Oysters belong to family Oysteridae having 3 genera, *Crassostrea*, *Saccostrea* and *Ostrea*. 9 species of oysters are reported from Pakistan (Siddiqui and Ahmed, 2002). Few research works have been carried out on the oyster species in Pakistan by Ahmed (1971 and 1973), Asif (1975), Ahmed *et al*., (1982) and Siddiqui and Ahmed (2002). Initial investigation on the oyster beds was carried out by Kazmi (1953). Work on the oyster fishing resources of Pakistan published by Hasan (1960). Scientific data regarding the reproductive biology seasonal gonadal changes, hermaphroditism and sex reversal, histological basis of population structure and gametogenic pattern and spawning season in different species of oysters documented by Ansari and Ahmed (1972), Asif (1979a, 1979b), Asif (1980), Siddiqui and Ahmed (2002), and Siddiqui and Ahmed (2003) respectively.

Since no concrete information is so far available on cultivation of edible oysters at coastal belt of Sindh and Balochistan provinces of Pakistan. The objective of the project is to develop the skills regarding oyster and mussels cultivation. It will certainly be conducive to generate income for the community as well as remain beneficial for conservation of the species.

2. MATERIALS AND METHODS

Ambra creek is located about 4-5 kilometers from Garho town in deh U.C. Garho, Taluka Ghorabari near Pilot Shrimp Farm Garho at longitude N- 24º 2011 and latitude E- 67º35.20. Installation of 10 pilot rafts was completed in the end of 2009 at Ambra creek at (Garho) Ghorabari by Livestock and

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Fisheries Department, Government of Sindh. The site was free from hazards of environmental pollution such as domestic and industrial wastes. The rafts were constructed using 40 wooden bamboos size length 22 feet setup in square shape (20x20) like roof. This structure was fixed in soil with help of another set of 16 heavy wooden bamboos functioning as beam; the size length was 18 feet each. These bamboos were placed parallel to each another at about 1.5 to 2 feet distance. About 400 number of nylon ropes usually12 feet long were hanged with bamboos in a parallel series. Six pairs of local old oyster shells size about 20-33 cm lengths were setup in rope at spaces 6-8 cm.

Physico-chemical parameters of the creek water were also recorded to find out the suitability of the environment for the culture. Temperature of air and water was noted with mercury thermometer. Transparency of water, rate of suspended solids and light penetration in water was measured with the help of a metal black & white disc that was lowered in water; result was recorded at the point of appearance and disappearance. The chemical parameters of water such as, total dissolved solids (TDS), salinity, pH and dissolved oxygen of water were noted with WTW 320 conductivity meter, Orion 5 Star pH-ISE-Cond-DO Bench top Thermo Scientific digital meter, and Oxy. 315i/SET meter respectively. Alkalinity ($CaCO_3$) and hardness were determined by titration with standard HCl 0.01N with methyl orange and phenolphthalein as indicators, ethylenediaminetetra acetic acid with indicator buffer solution and erichrom black-T. Both the parameters were determined according to the recommended methods of APHA (1992) the size length of oyster was recorded on spot with the help of plastic foot scale tape. Photography was done with the help of digital camera (Sonny DSC-W120). The weight was recorded with electronic kitchen scale Model: 14225-206. The culture was carried out during 2010.

Marketable oysters were analyzed for quality controlled such as microbiological, chemical and bio-chemical analysis was carried out at quality control laboratory of Marine Fisheries Department, Government of Pakistan.

3. RESULTS AND DISCUSSION

The spats (larvae of oyster) gradually attached on submerged substrates through tidal actions. The appearances and attachment of colourless transparent spats size 0.2 to 0.6 cm (0.4±0.158) were observed during June on submerged substrate (empty old shell hanged on rafts). Siddiqui and Ahmed (2003) reported *Crassostrea gryphoides* as major edible oyster species found in Pakistan. In August 8 to12 living spats viewed attached on submerged substrate on empty old oyster-shells in rafts, the growth was recorded from 2.1 to 3.4 cm (2.82±0.526) in diameter. Siddiqui and Ahmed (2003) described the oyster spawning takes place throughout the year. The size, length and the width of spats indicate that this crop is the result of April, May and June spawning period because of oyster larvae are free swimming and drifting during initial weeks of their life. Siddiqui and Ahmed (2003) discussed the December and January is the declined period for breeding of *C. gryphoides*. When the size of larvae increases above 1-2mm, then attaches on submerged substrates till the grown up stage. After interval of 60 days, in October the size was inspected of white transparent spats/ 4.2 to 5.1 cm length and width was 1.7 to 2.9 cm (4.66±0.364). During December spats were scrutinized having the size from 5.6 to 6.7 cm in diameter (6.18±0.465) were found attached in colonial form on a single empty shell. The crop was studied for measurement growth rate of spats during February 2011 ranging from 7.2 to 7.9cm (7.6±0.291) was found satisfactory it may be suitability of the environmental conditions of the area. In April the growth rate of oyster spats was recorded from 8.2 to 10 cm in diameter (9±0.689). By the gradual changes of temperature, salinity and planktonic productivity of the Ambra creek the growth rate of the animal was observed in optimum rate 11.7 to 13 cm (12.3±0.50) in June during the summer season **(Table 1)**. The largest size of *C. gryphoides* 50.8 cm reported by Ahmed (1971). Fast growth performances were observed during summer periods and slow average was recorded in winter period **(Table 1 and Fig. 12)**. Ahmed (1971) reported low percentage of oyster growth and dispersal in winter.

Water quality parameters of Ambra creek at raft area were analyzed vs; temperature of air 22 to 36°C and water temperature was 18 to 30°C. Male and females of *C. gryphoides*, its spawning clearly coincides with the temperature profile of the area and enhance spawning activity observed during the months of summer season Siddiqui and Ahmed (2003). Transparency was observed as 32 to 52cm (water turned light green by the natural productivity and presence of phytoplankton, unicellular algal forms and zooplankton); pH, alkalinity and hardness were 7.3 to 7.98, 220 to 298 mg/l respectively which is ideal for oyster cultivation; salinity, and TDS 6.9 to 34.7 ppt, and 7750 to 95731 mg/l respectively. Siddiqui and Ahmed (2003) reported tropical waters

temperature generally remains above the critical levels but fluctuate in salinity do occurred due to flood and rainfall which cases rapid change in salinity. Similar observations were found in the present study. In India spawning of oyster species chiefly controlled by temperature and salinity fluctuations (Siddiqui and Ahmed, 2003). Dissolved oxygen was about 4.69 to 8.74 mg/l. Depth of water was noted ranging between 7-13fts. The habitat condition of Ambra creek, Garho for oyster farming was ideal i-e sandy- cum-muddy platform; therefore, the high quantities of oyster spats were attached on the empty old shells in the rafts. Water quality parameters of the area were analyzed and found suitable for substantial growth of larvae and seed of estuarine shellfish forms. After hatching, the larvae and juveniles move to low saline areas, creeks and shallow areas where any submerged substrates may be available. About 4 to 9 number of seeds/spats on artificial substrate was recorded at Ambra creek and 18-24 spats on a single old shell indicated the fertility of the site. Secchi disc reading indicated that water was light green which is a clear indication of phytoplankton productivity. The habitat is rich with natural food items for oyster spats, larvae and juvenile. Hassan (1960; 1963) carried out studies on Oyster Culture. The oyster seeds were allowed to settle on the bricks for culture purposes. These bricks were placed on the bottom but the results were not encouraging. In this regard an Oyster Park at Ibrahim Hydri in Korangi Creek was developed By Marine Fisheries Department. Wherein oysters were brought here from other creeks and kept till sold (Moazzam and Rizvi, 1983). Present study reveals that the culture of oysters through raft method was found satisfactory and oysters were successfully grown to market size at Ambra Creek in estuarine area of coastal belt of Sindh province. Biochemical, chemical and micro-biological results of culturable oyster were quite satisfactory according to recommended methods of ISO and EC (2005) (fit for human consumption and export).

4. ACKNOWLEDGEMENT

Authors are greatly acknowledging the Department of Fresh Water Biology and Fisheries, University of Sindh Jamshoro, Sindh Coastal Community Development Project (funded by ADB), Planning & Development Department, and Livestock & Fisheries Department, Government of Sindh for financial assistance and moral support. Technical support provided by Professor Dr. Ghazala Siddiqui of CEMB, University of Karachi is highly appreciated. Thanks to Ms. Shazia Naz for quality control analysis of cultivated oyster samples.

Table 1. Measurement of size length (in cm) growth rate of oyster (*Crassostrea gryphoides*) during 2010 to 2011 at Ambra creek.

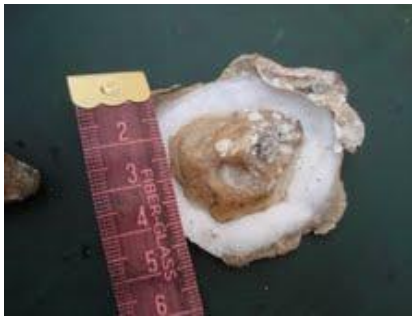
S. No.	June	August	October	December	February	April	June
1	0.2	2.1	4.2	5.6	7.2	8.2	11.7
2	0.3	2.5	4.4	5.8	7.4	8.6	12
3	0.4	2.9	4.7	6.3	7.7	8.9	12.2
4	0.5	3.2	4.9	6.5	7.8	9.3	12.6
5	0.6	3.4	5.1	6.7	7.9	10	13
Mean	0.4	2.82	4.66	6.18	7.6	9	12.3
Stdv (±)	0.15811388	0.52631	0.36469	0.46583	0.29155	0.6892	0.51
Increment	**0.4**	**2.8**	**1.7**	**1.6**	**1.2**	**2.1**	**3**



A



B



C



D



E



F



G



H

Plate-1
Fig. A and B shows installation of rafts and C to H different sizes of cultivated oyster.

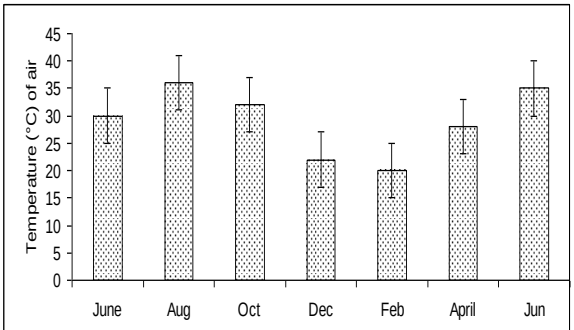


Fig. 1 Seasonal variation of temperature at Ambra creek during 2010-2011

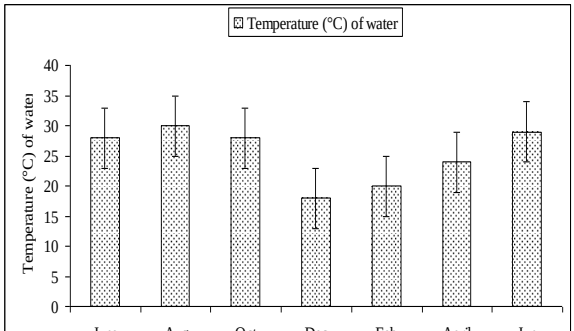


Fig. 2 Seasonal variation of temperature at Ambra creek during 2010-2011

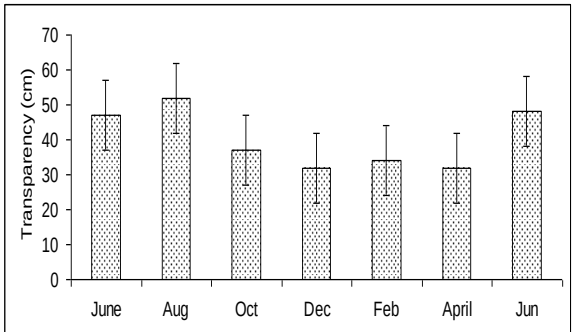


Fig. 3 Seasonal variation in transparency of water at Ambra creek during 2010 -2011.

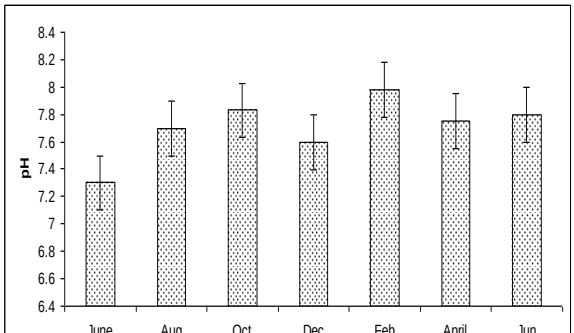


Fig. 4 seasonal variation of pH in Ambra creek during 2010-2011.

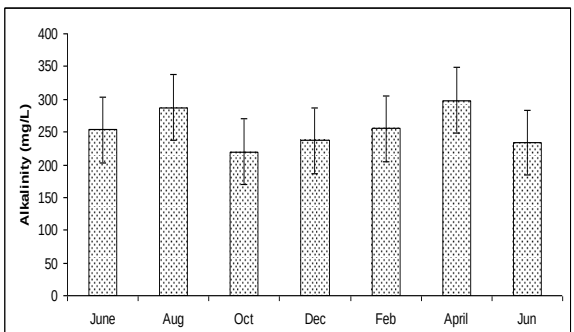


Fig. 5 Seasonal variation of alkalinity in Ambra creek during 2010-2011.

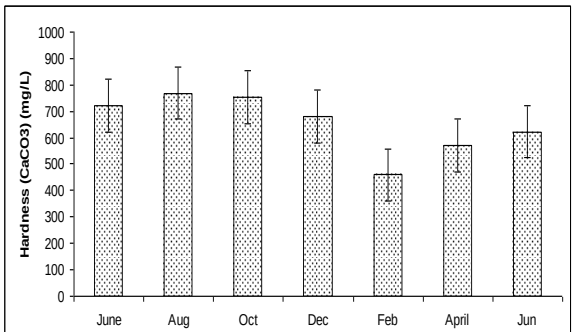


Fig. 6. Seasonal variation of hardness in Ambra creek during 2010-2011.

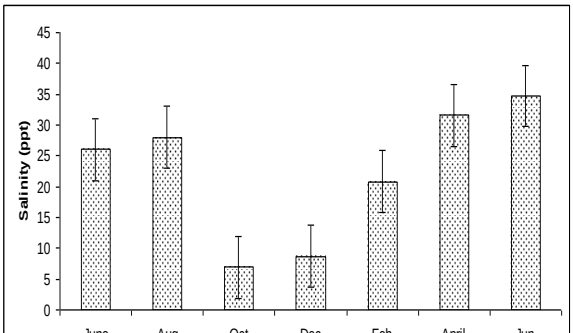


Fig. 7. Seasonal variation of salinity in Ambra creek during 2010-2011.

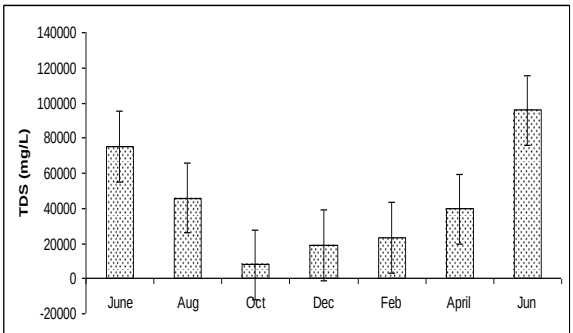


Fig.8. Seasonal variation of total dissolved solids in Ambra creek during 2010-2011.

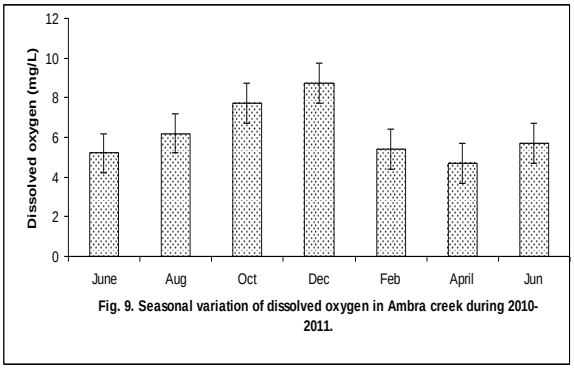


Fig. 9. Seasonal variation of dissolved oxygen in Ambra creek during 2010-2011.

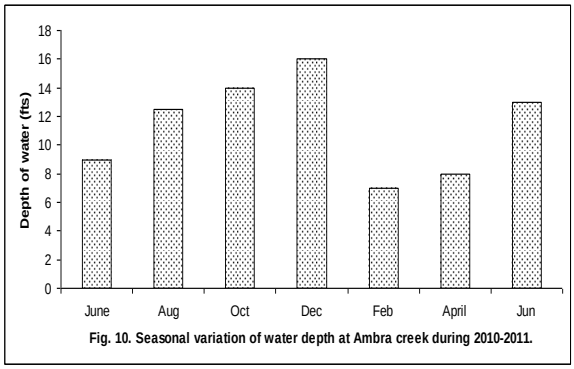


Fig. 10. Seasonal variation of water depth at Ambra creek during 2010-2011.

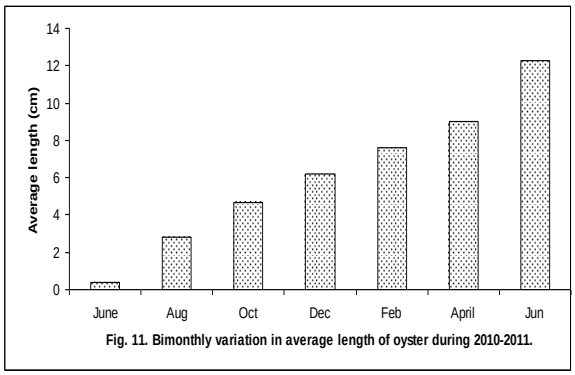


Fig. 11. Bimonthly variation in average length of oyster during 2010-2011.

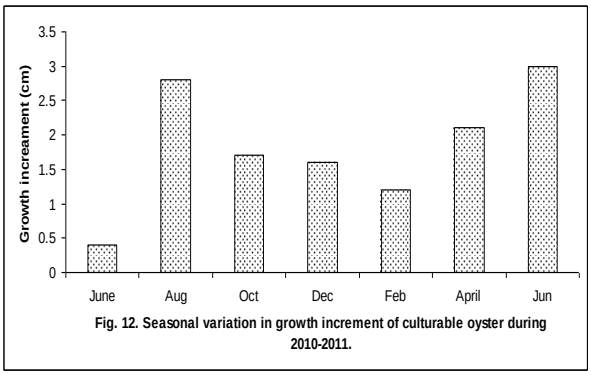


Fig. 12. Seasonal variation in growth increment of culturable oyster during 2010-2011.

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