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Growth performance of green mussels (*Perna viridis* Linnaeus, 1758) culturing artificially on rafts at Ambra creek coastal belt of Arabian Sea in Sindh, Pakistan

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Abstract: *Perna viridis* is a fast growing native mussel species occurring in beaches and creeks at the coastal belt of Sindh in Pakistan. 10 pilot rafts were installed for artificial cultivation of green mussel in which growth performance was examined and found satisfactory. Initial size of juveniles at the time of stocking during April was 1.2 to 2.0 cm length and weight 0.179 to 0.232g. After interval of 3 to 4 months the growth size length and weight was measured as 2.5 to 3.2cm and 0.638 to 1.555g, subsequently the growth of the crop was observed 3.9 to 5.1 cm and 2.239 to 2.589g in December, then in March, length of the shells were in ranging from 6.6 to 7.8cm and 24.735 to 26.324g, afterward the growth rates in size between 8.8 to 10.1cm and weight 39.762 to 44.83g of culturable green mussels were found satisfactory in July that may be due to high temperature ranges at the Ambra creek and finally at the time of harvesting the size length and weight were recorded between 11.0 to 12.2 cm and 50.21 to 53.358g respectively. Results of pilot rafts indicated that green mussel can be cultured commonly in the creeks through the rafts method.

Keywords: green mussel *Perna viridis* cultivation.

1. INTRODUCTION

Perna viridis commonly known as green mussel, it is marketable bivalve occurring at beaches and creeks along the coastal belt of Sindh. In Pakistan a few species of edible mussels are present in the market due to lack of local consumption, however large mass of undersize mussels being used for preparation of poultry feed. Cultivation of mussels on commercial scale is practiced in many countries like India, Singapore, Malaysia and Philippine (Qasim *et al*, 1977; 1982; Davy and Grabam, 1982; Mason, 1991).

In Pakistan, the work on *Perna viridis* has been carried out by (Fatima *et al*, 1985; Barkati and Choudhry, 1988). The edible mussel species have gradually been declining due to pollution and scarcity of freshwater in the estuarine areas of Sindh for a couple of decades. In order to promote sustainable development of edible mussel species, the Sindh Coastal Community Development Project (SCCDP) and Livestock and Fisheries Department, Government of Sindh carried out an initiate for the culture of green mussels through rafts method in the creeks at coastal belt of Sindh. This technology would be transferred to coastal communities which ultimately result in widespread adoption of mussel farming as an alternate livelihood option.

2. MATERIALS AND METHODS

Ambra creek is located about 4 to 5 kilometers from Garho town in U.C. Garho, Taluka Ghorabari at latitude 24º 20'07.68" N and longitude 67º35'04.86"E. The creek having permanent supply of water and free from pollution such as industrial, agriculture and domestic wastes therefore suitable for mariculture, hence the Livestock and Fisheries Department, Government of Sindh, had established a Pilot Shrimp Farm Garho especially for shrimp farming **(Fig. 1).** The rafts were constructed using wooden bamboos setup in square shape (20x20) like roof, which fixed in soil with help of another set of heavy wooden bamboos functioning as pillars; the size length was 18 feet each. Juveniles of *Perna viridis* of size 1.2 to 2.0 cm were collected from the natural bed of the Ambra creek during low tidal action in April.

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The individuals were collected by hand picking with great care avoiding any damage to the animal and were placed in special hanging cultch material made up of coconut rope one meter and 1.5 meter nylon rope. 50-60 numbers of green mussel of size 1-1.2 cm placed in between coconut rope and fabric cloth and wrapped in cloth, stitch each cultch individually **(Fig. 2-7)** and placed under water for 2-3 days till animal fix its root in coconut rope than it was hung along the sides of rafts. All individual cultch remained submerged all the time irrespective of the low or high tides. These special clutches were taken out of water and the shell lengths were measured with plastic foot scale. Photography was done with the help of digital camera (Sonny DSC-W120). The weight of green mussels was recorded with electronic kitchen scale Model: 14225-206.

Fig 1. Rafts in Ambra creek an experimental site for cultivation of mussels.

3. RESULTS AND DISCUSSION

Perna viridis is a fast growing native mussel species occurring in the wild environment at beaches and creeks of coastal belt of Sindh province Pakistan. Its farming and cultivation through rafts have been carried out for the first time in Pakistan. Cultivation of mussels on commercial scale through various methods is practiced in many countries like India, Singapore, Malaysia and Philippine (Qasim *et al*, 1977; 1982; Davy and Grabam, 1982; Mason, 1991). 40 to50 numbers of juveniles having size 1.2 to 2.0 cm length and weight 0.179 to 0.232g were placed in soft and fine cotton cloth pouch. After interval of 3 to 4 months the growth size length and weight was measured in August and found 2.5 to 3.2cm and 0.638 to 1.555g, subsequently the growth of the crop was observed 3.9 to 5.1 cm length and weight 2.239 to 2.589g in December, then in March, length of the shells were in ranging from 6.6 to 7.8cm and 24.735 to 26.324g, afterward the growth rates in size between 8.8 to 10.1cm and weight 39.762 to 44.83g of culturable green mussels were found satisfactory in July, this may be due to high temperature ranges at the Ambra creek and finally at the time of harvesting during September, the size length and weight were recorded between 11.0 to 12.2 cm and 50.21 to 53.358g respectively **(Table 1)**. The growth rates of *P. viridis* on different substrates and rafts as floating forms (ropes and strip) have been studies by different workers (Kuriakose and Appukuttan, 1980; Mohamed *et al*., 1998; Parulekar *et al*, 1982, Rivonker *et al*, 1993; Rajagopal *et al*, 1998; Vakily, 1989; Velayudhan *et al*, 2000) in tropical areas. Ambra creek is major creek of Arabian Sea in Sindh coastal belt that is a subtropical area of cultivated site for green mussel. In Goa, India, green mussels were reported to grow faster on ropes compared to those on natural beds (Qasim *et al*, 1977). Similarly, Rivonker *et al*, (1993) mentioned high growth rate in controlled harvested population of mussels compared to the mussels from natural bed. In the present study satisfactory growth rate of mussel was observed in the period of 17 months. *Perna viridis* is referred as filter feeder and one of the most efficient converters of food in to flesh. Planktons are favorite food for most of the mussel species. A number of workers have given the attention on the effects of various environmental factors on growth of mussels such as temperature (Lutz, 1980; Mason, 1991), salinity (Ahmed *et al*, 1982; Bardach *et al*, 1972), food supply (Hickman, 1992). Water quality parameters of experimental site were recorded and found suitable especially for growth and survival of mussels **(Table 2).** Ambra creek was selected for culture of *P. viridis* due to continues flow of water, interconnection with sea and rich with natural productivity and also the colour of water was observed greenish. The farming of mussels still not practiced artificially in Pakistan; however this step of farming through this project revealed the artificial culture of green mussels as alternate livelihood of poor fishermen community settled around the coastal belt of the province. Through this project the culture technology of green mussels is transferred at gross root level and the coastal community be trained on culture side. Results of pilot rafts indicated that green mussel can successfully be cultured commonly in the creeks through rafts. Local consumption of the mussel is not satisfactory; however it is income generating crop especially from export point of view.

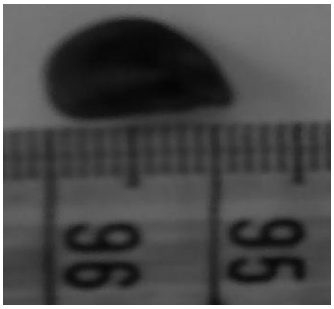

Fig.1. Crop in April 2010

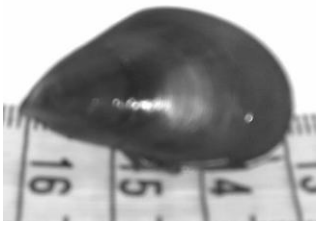

Fig.2. Crop in August 2010

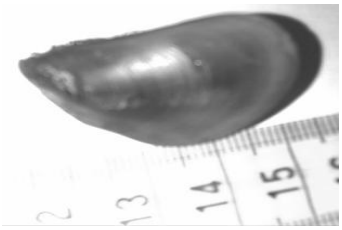

Fig.3. Crop in December 2010

Fig.4. Crop in March 2011

Fig.5. Crop in July 2011

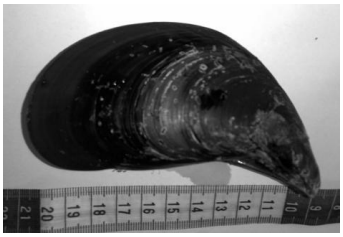

Fig.6. Crop in September 2011

Fig.7. Mature crop in cloth pouch

Fig. 8. Bulk yield ready for market

Table 1. Growth rate Length (cm) and Weight (g) of *Perna viridis* cultivated in rafts at Ambra creek coastal belt of Sindh from April 2010 to September 2011.

S. No.	Apr		Aug		Dec		Mar		Jul		Sep	
	L	W	L	W	L	W	L	W	L	W	L	W
1	1.2	0.179	2.5	0.638	3.9	2.239	6.6	24.74	8.8	39.76	11.0	50.52
2	1.4	0.192	2.7	0.712	4.3	2.589	6.8	25.01	9.0	40.23	11.3	51.07
3	1.6	0.206	2.8	0.828	4.5	3.172	7.3	25.48	9.2	41.71	11.5	51.83
4	1.8	0.224	3.0	1.217	4.7	3.492	7.6	25.72	9.5	42.04	11.7	52.41
5	2.0	0.233	3.2	1.555	5.1	3.841	7.8	26.33	10.1	44.83	12.2	53.36
Mean	1.6	0.21	2.84	0.99	4.5	3.1	7.22	25.46	9.32	41.71	11.54	51.84
Stdv (±)	0.32	0.1	0.3	0.4	0.5	0.7	0.51	0.62	0.51	1.99	0.45	1.11
Growth Increment	0.8	0.054	1.2	2.967	1.7	2.286	2.72	22.49	2.1	18.5	2.22	8.53

Table 2. Water quality parameters of Ambra creek an experimental site for mussel cultivation during April 2010 to September 2011.

Parameters	April	Aug	Dec	Mar	Jul	Sep
Temperature (°C) of water	28	30	18	20	24	29
Transparency (cm)	47	52	32	34	32	48
pH	7.3	7.7	7.6	7.98	7.75	7.8
Alkalinity (mg/L)	253	287	237	255	298	234
Hardness ($CaCO_3$) (mg/L)	723	769	679	459	569	623
Salinity (ppt)	26	28	8.7	20.8	31.6	34.7
TDS (mg/L)	75182	45862	18970	23200	39552	95731
Dissolved oxygen (mg/L)	5.2	6.2	8.74	5.4	4.69	5.7
Depth of water (ft)	9	12.5	16	7	8	13

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