

BIODIVERSITY OF MESOZOOPLANKTON AND MACROFAUNA IN MARINE FISH PONDS AT GHARO, THATTA

Riaz-ud-Din Qureshi¹ and Zakia Khatoon²

¹Centre of Excellence in Marine Biology, University of Karachi

²Pakistan Council of Scientific & Industrial Research, Karachi Lab. Complex, Karachi, Pakistan

*Corresponding author's e-mail: zakia_khatoon@hotmail.com

ABSTRACT

The biodiversity of mesozooplankton and macrofauna abundance was studied from the grouper culture ponds, Gharo, district Thatta, Pakistan during April 2006 to March 2007. A total of 6 mesozooplankton taxa and 19 macrofauna taxa were recorded from the four fish ponds. The zooplankton community in the fish ponds was representative of marine and freshwater crustaceans including copepods, euphausiids and larval stages of stomatopods, bathynellids, isopods and barnacles, while macrofauna organisms were characterized by crabs and shrimps larval forms of decapod crustaceans, as well as juvenile ray-finned fishes in dominance.

KEYWORDS: Fish ponds, Mesozooplankton, Macrofauna.

INTRODUCTION

Gharo Creek is a tidal creek with associated mangrove and mudflats ecosystems that are linked with a network of creeks in the Indus Delta. Gharo Creek is connected at the North-Eastern end to the Phitti Creek at the South-Western end and located about 22.3 km from Karachi. The land area of the ecosystem has the drainage basin of the Ghaggar and Dhabeji Nalas (freshwater channels) and also of the Rann Pethani River, both system discharges into the Gharo Creek. The filtration plant along Gharo also provides some spills into the Gharo Creek. This creek system is about 28 km long and its width ranges from 250 to 2,500 m (Beg, 2012; Amjad and Khan, 2011).

Gharo City (Latitude: 24°45'27"N; Longitude: 67°31'44"E), district Thatta situated at the Southeast of Karachi, Pakistan. In one pilot project along Gharo Creek, grouper fish was cultured in tidal fed brackish water ponds during the period from March 2006 to October 2008. The tidal feed ponds along creek area bring organisms associated with water, ultimately increase productivity in the fish ponds and provide variety of live feed which in turn is utilized by the cultured fish species. The present study is a part of the project conducted during April 2006 to March 2007 for one year to evaluate the diversity and abundance of mesozooplankton and macrofauna present in the fish culture ponds.

MATERIALS AND METHODS

The study was carried out during the period April 2006 to March 2007 at the grouper culture experimental ponds located along Gharo Creek. Four earthen ponds (two experimental and two control, respectively) having dimension of 165 x 85 x 7 feet respectively were selected for the experiment, organic fertilizer was added in the ponds to improve the fertility of water. These ponds were tidal fed and water enters the ponds by tidal flow from Gharo Creek main channel. The control grouper ponds only receive water during tidal forth and back exchange with no extra feed whereas experimental ponds were also provided supplementary feed at every alternate day. The inlets of both ponds were properly screened with iron frame, loaded with gauze of fine mesh to avoid the entry of any intruders into or exit of fish from the ponds. The ponds were allowed to enter water up to 1.5 meter depth and the water level was maintained throughout the study by monk valve or gate. For this study, the ponds fauna were checked every month by 53 micron mesh size Nytax nylon plankton tow net and by 3.8 cm monofilament nylon drag net. The samples were preserved immediately in 4% formaldehyde solution, and brought to the laboratory where mesozooplankton and macrofauna organisms were examined, identified and counted under the microscope to the lowest possible taxon. Identification of the organisms was made with the help of Smith (1977), Newell and Newell (1979), Tirmizi *et al.* (1994), Conway *et al.* (2003), Froese and Pauly (2014) etc. The percentage composition of each organism was calculated by the number of individuals in the sample over the total number of all individuals x 100. Physical parameters like water temperature, pH, salinity and dissolved oxygen were also recorded during the study; they will be presented separately along with the data of grouper culture in ponds.

RESULTS AND DISCUSSION

A total of 6 mesozooplankton taxa and 19 macrofauna taxa were identified from the four fish ponds. The zooplankton community in the fish ponds was representative of crustaceans including copepods, euphausiids, larval stages of bathynellids, isopods, stomatopods and barnacles (Table 1), while macrofauna organisms were characterized by decapod crustacean juveniles of crabs and shrimps, as well as larvae and juveniles of ray-finned fishes (Table 2), which were found in dominance.

Table 1. Monthly percentage composition of zooplankton collected from fish ponds during the period from April 2006 to March 2007.

Pond No. Months	<i>Oratosquilla interrupta</i>				<i>Habrobathynella indica</i>				<i>Ligia exotica</i>				<i>Euphausia sp.</i>				<i>Cypris sp.</i>				Copepods			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
April	21	24	17	12	17	19	9	07	08	6	16	12	18	16	21	18	22	19	16	12	14	16	21	39
May	8	16	14	9	6	31	32	19	12	9	10	06	12	14	08	06	18	11	12	19	44	19	24	41
Jun	17	15	13	10	18	12	15	12	13	16	14	09	23	21	20	14	14	14	15	16	15	22	23	39
July	13	16	17	12	14	18	14	10	11	12	15	17	24	19	19	13	04	09	10	12	34	26	25	36
Aug	14	12	16	16	11	10	15	12	12	19	14	21	16	20	16	14	19	15	17	13	28	24	22	24
Sep	12	14	17	18	19	13	16	15	18	15	18	17	16	18	19	13	12	18	08	12	23	22	22	25
Oct	22	21	16	17	11	14	19	15	13	12	9	14	14	11	16	15	16	19	21	16	24	23	19	23
Nov	12	12	19	12	22	29	21	14	10	11	15	17	19	17	13	16	13	12	12	13	24	19	20	28
Dec	14	16	18	14	13	21	22	18	11	12	10	10	22	07	18	9	09	10	14	13	31	34	18	36
Jan	23	9	14	16	14	12	16	12	09	06	12	14	18	15	13	11	12	14	16	18	24	44	29	29
Feb	18	11	16	12	12	18	10	8	11	18	10	11	22	11	14	15	18	15	11	14	19	33	38	40
Mar	15	15	12	11	18	14	19	16	13	9	14	15	16	24	12	14	15	18	16	12	23	20	27	32

Experimental ponds: 1, 3, Control ponds: 2, 4

Table 2. Macrofauna collected from the fish ponds during the period from April 2006 to March 2007.

Macrofauna	April 2006	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. 2007	Feb.	Mar.
Various crabs	++			++	+++				+			
<i>Scylla serrata</i> (mud crab)				++	++	+				+	++	
<i>Parapenaeopsis stylifera</i> (Kiddi shrimp)	++						+++	+++	++	++	+++	++
<i>Metapenaeus monoceros</i> (Pink shrimp)		+						+++				
<i>Penaeus monodon</i> (Giant tiger prawn)			+++	+++	++	+				+		
<i>Fenneropenaeus indicus</i> (Banana prawn)						++				++		
<i>Sardinella</i> sp. (Herrings, shads, sardines)	++	++	+	+	+++	+	+	+++	++	+++	++	+++
<i>Tenualosa ilisha</i> (Hilsa shad)					+						+	
<i>Thryssa</i> sp. (Anchovies)	++	+	+	+		++	++	++	++	++	++	++
<i>Arius</i> sp. (Sea catfish)				+								+
<i>Rachycentron canadum</i> (Cobia)	+				+	+	+	++	++	+		
<i>Liza</i> sp. (Grey mullet)	+			+	++	++	+	+++	++	+	++	++
<i>Mugil cephalus</i> (Mugil)						++	+	+	+	+	+	
<i>Tilapia</i> sp.	++		++		++		+++	++	++	+		+
<i>Sillago sihama</i> (Lady fish)		+								+	+	
<i>Boleophthalmus</i> sp. (Gobies)	++	++	++	++	++	+++	++	+++	++	++	+++	+++
<i>Pomadasys kaakan</i> (Grunts)					+							+
<i>Parastromateus niger</i> (Black pomfret)					+	+	+					
<i>Channa striata</i> (Snakehead murrel)						+						

Zooplankton fauna: Table 1 collectively shows the abundance of mesozooplankton in four fish ponds, following are the list of species.

***Oratosquilla interrupta* (Kemp, 1911):** The marine planktonic crustacean larvae of stomatopod squilla or mantis shrimp were found in maximum percentage in the months of April (ranged from 12-24%) and October 2006 (range 16-22%) whereas minimum percentage was seen in May 2006 (range 8-16%).

The occurrence of many larvae of commercially important mantis shrimp in the fish ponds suggests that Ghara channel may be the spawning ground of this species and later they metamorphose to benthic juveniles.

***Habrobathynella indica* Reddy & Schminke, 2005:** It is a little known freshwater crustacean of the order bathynellacea, which mostly lead subterranean life. In India, to date only seven species of this order are described, inhabiting certain rivers and bore-wells in the State of Andhra Pradesh, Southeastern India, none of the bathynellacean taxa hitherto reported from other parts of Asia (Reddy and Totakura, 2010). This species is first time reported in the present study.

The highest abundance was seen in the months of May (range 6-32%) and November (range 14-29%) 2006, respectively whereas minimum number was observed in the months of August 2006 (range 10-15%) and February 2007 (range 8-18%), respectively.

***Ligia exotica* Roux, 1828:** Isopods are unusual among the crustaceans. They are the most diverse in form. They are common inhabitants of nearly all environments, including the gill chamber of crustaceans or buccal cavity of fish (Kazmi and Yousuf, 2013).

Maximum number of *Ligia exotica* were seen in the months of August (range 12-21%) and September (range 15-18%) 2006, respectively whereas minimum number was seen in the months of May 2006 (range 6-12%) and January 2007 (range 6-14%).

Euphausia species: A fairly large portion of the euphausiids crustacean larvae were observed in the plankton samples throughout the study period with several species including *Pseudeuphausia latifrom*, *Euphausia diomedea*, *E. sibogae*, etc. The planktonic stages of krill in the pond water provide rich source of live feed to carnivore fishes like grouper.

Abundance of euphausiids was seen maximum in the months of April (range 16-21%), June (range 14-23%) and July (range 13-24%) 2006, respectively whereas minimum abundance was seen in the month of May 2006 (range 6-14%).

Cypris species: The cyprid larvae of crustacean barnacles are planktonic in nature; they play an important role in the ecological study.

Maximum percentage of *Cypris* species was observed in the month of October (range 16-21%) whereas minimum abundance was seen in the month of July (range 4-12%) 2006.

Copepods: These planktonic crustaceans are ubiquitous in freshwater as well as marine environment and play important role in the food chain.

Copepods of diversified group were found maximum in number in the months of April (range 14-39%), May (range 19-44%), June (range 15-39%), July (range 15-36%), December 2006 (range 18-36%), January (range 24-44%) and February 2007 (range 19-40%) whereas minimum in number were seen in the months of August (range 22-28%), September (range 22-25%), October (range 19-24%) and November (range 19-28%), respectively.

Macrofauna: Table 2 shows the list of macrofauna found in the fish ponds at Gharo during the study period. The juveniles of various commercial crabs like mud-crab (*Scylla serrata*) etc. and shrimps like tiger (*Penaeus monodon*), banana (*Fenneropenaeus indicus*), pink (*Metapenaeus monoceros*) and kiddi (*Parapenaeopsis stylifera*) were found abundant in the grouper ponds in different months. Among the fishes, juveniles of various species of *Sardinella* found almost throughout the year whereas juveniles of *Tenualosa ilisha* (palla) found in the months of August 2006 and February 2007; juveniles of engraulids (*Thryssa* sp.) were also found in abundance in the fish culture ponds; catfish are demersal in nature, may be the reason their juveniles were caught seldom by the drag net. From the perciformes fishes, the larvae of *Rachycentron canadum* (cobia) were found in April, August to December 2006 and January 2007 in the ponds; grey mullet and mugil juveniles were found in enormous quantity in different months; tilapia is very hardy species, their juveniles were found abundant throughout the study months. The juveniles of lady fish (*Sillago sihama*), grunts (*Pomadasyss kaakan*) and Black pomfret (*Parastromateus niger*) were found only in few months. Gobies (*Boleophthalmus* sp.) were resident of the area and found abundant in the soft mud of ponds. Snakehead murrel (*Channa striata*) is a common freshwater fish which usually burrow in the mud; it was also caught once in September from the ponds.

As the study was conducted along the Gharo Greek coastal area and all the ponds were tidal fed, the study shows that water in the ponds come by the flow from the small freshwater streams (nallas) and Gharo salt water creek with the diverse forms of mesozooplankton and macrofauna, they may also be utilized as feed by the experimental fish, both in control and treated ponds. The presence of larvae and juveniles of freshwater (*H. indica*, *C. striata* and *Tilapia* sp.), anadromous (*T. ilisha*) as well as marine organisms (crabs, shrimps, fishes) shows the unique variety of mixed fauna found in the water of fish ponds. The composition of commercially important larval forms of mesozooplankton and macrofauna also showed the importance of the area in the region and can be suggested as breeding, shelter and rearing grounds for the aquatic organisms. It can also be recommended by this study that fish culture along the coastal area may have potential and will hopefully contribute a lot in the economy of Pakistan.

REFERENCES

- Amjad, S. and M.U.A. Khan. (2011). Marine Ecological Assessment for LNG Terminal at Port Qasim. *Pakistan Journal of Engineering & Technology Science*, 1: 74-85.
- Beg, M.A.A. (2012). Environmental Impact Assessment (EIA Report). *Environmental and social baseline of coastal region of Thatta district. Part I: Dhabeji-Gharo-Rann Pethani Ecosystem*, 50 pp.
- Conway, D.V.P., R.G. White, J. Hugues-Dit-Ciles, C.P. Gallienne and D.B. Robins. (2003). Guide to the coastal and surface zooplankton of the South-Western Indian Ocean. *Marine Biological Association*, U.K. and Plymouth, UK. Occasional Publication, No. 5: 1-354.
- Froese, R. and D. Pauly Editors. (2014). Fishbase. World Wide Web, electronic publication. www.fishbase.org, version (10/2014).
- Kazmi, Q.B. and F. Yousuf. (2013). Checklist of Peracarida of Pakistan A-marine and terrestrial Isopoda. B-Marine Tanadaicea. *Faust Journal of Biology*, 3: 121-139.
- Newell, G.E. and R.C., Newell. (1979). *Marine Plankton, a practical guide*. Hutchinson of London: 1-244.
- Reddy, Y.R. and V.R. Totakura. (2010). A taxonomic revision of the genus *Habrobathynella* Schminke, 1973, with the description of four new species from southeastern India (Crustacea, Malacostraca, Bathynellacea). *Zootaxa*, 2532: 1-54.
- Smith, D.L. (1977). *A guide to the marine coastal plankton and marine invertebrate larvae*. Kendall/Hunt Publishing Co., Iowa, 1-161.
- Tirmizi, N.M., Q.B. Kazmi and R.B. Manning. (1994). An illustrated key to the malacostraca (crustacea) of the Northern Arabian Sea. Part II. Stomatopoda. *Pakistan Journal of Marine Sciences*, 3: 125-169.