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Spatial Distribution and Temporal Variance of Fish Juvenile Communities in the Hooghly-Matla Estuarine Complex of West Bengal, India

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Abstract

A survey was made in three stations of Hooghly-Matla estuarine complex, starting from its mouth at Sagar Island to Haldia during January 2005 to December 2007 to evaluate spatial distribution and temporal variance of fish juvenile communities in the estuary. Twenty families comprising 60 finfish juveniles taxa were available from these three sampling stations. The most diversified family found in the estuary was Engraulidae followed by Clupeidae, Mugilidae and Gobiidae. Six families such as Scianidae, Ariidae, Bothidae, Syngnathidae, Serranidae and Ophichthidae were represented by single taxa. Thirty seven taxa were found to be stenohaline of which 27 were restricted to the mouth of the estuary and ten at the upstream. Twenty three species were found to be euryhaline and were distributed all through the study areas. Composition of species, total catch per sampling, and the diversity index showed spatial and temporal variations. Station close to sea showed more varieties and abundance of fish juvenile taxa than the other two sampling stations. The most abundant species in the estuary was *Sardinella gibbosa* (Family Clupeidae), which was found restricted towards the mouth of the estuary.
Key words : Biodiversity, Fish juvenile, Engraulidae, Estuary, Sundarbans.

Estuaries are known to be prime spawning and nursery areas for many important forage, commercial, and recreational fish species (Pearcy and Richards 1962, Mc Hugh 1985, Powles et al. 1984, Day et al. 1985). Estuaries and coastal lagoons with shallow areas and habitats offer suitable food supply, shelter and eco-physiological conditions for eggs, embryos, larvae and juveniles of fish for development. It is well documented that many populations of coastal fish depend on such critical areas, at least during part of their life cycle (Weinstein 1979, Mc Hugh 1967, Yanez-Arancibia and Sanchez-Gil 1988). In general, two distinct groups of fish utilize estuaries : those that are year-round residents or migrate into the estuary to spawn and those that spawn offshore but their eggs, larvae or juveniles enter the system (Boehlert and Mundy 1988).

The Hooghly-Matla estuarine complex encompasses numerous large and small deltas with mangrove vegetation supporting the world's most magnificient mangrove block-the Sundarban (Choudhury et al. 1980). Total areas of Sundarban is vast covering two countries, Bangladesh and India. The Indian part, lying between $21^0 31'$ N to $22^0 30'$ N latitude and $88^0 10'$E to $88^0 51'$E longitude, spreads over 4,226 sq km. Large number of marine and riverine species of finfish and shellfish come to breed in these creeks and channels, and the larvae and juveniles stay back to exploit its rich nutrient resources. Hooghly-Matla estuarine complex is biologically most productive, taxonomically diverse and aesthetically celebrated ecotone of the country (Sasmal et al. 1998).

Methods

The present program involved monthly collection of fish juveniles from each sampling station. Samples were collected by shoot and drift net, using the mesh size (0.04–0.06 mm) suitable to haul the drifting community of estuary irrespective of high and low tides. In the present investigation the fish juveniles were collected and preserved in 4% formaldehyde in sea water buffered with sodium borate. From the total collection of fish juvenile a 10 g sample was taken out after random mixing. The sample was them subjected to analysis of composition of species, total catch and Shannon-Weaver species diversity index. The biodiversity of fish juvenile was calculated by

Table 1. Fin fish juvenile taxa obtained exclusively from sampling stations with family and mean catch ± SD during the entire investigation period.

	Taxa	Family	Mean catch ± SD
	Station-1		
1.	*Cynoglossus lida* (Bleeker 1851)	Cynoglossidae	9 ± 16
2.	*Cynoglossus* sp. (Hamilton-Buchanan 1822)	Cynoglossidae	41 ± 23
3.	*Paraplagusia bilineata* (Bloch 1928)	Cynoglossidae	20 ± 17
4.	*Gastrophysus lunaris* (Bloch 1917)	Tetraodontidae	28 ± 5
5.	*Tetraodon* sp. (Linnaeus 1758)	Tetraodontidae	10 ± 17
6.	*Odontamblyopus rubicundus* (Hamilton–Buchanan 1876)	Eleotrididae	5 ± 9
7.	*Odontamblyopus* sp. (Bleeker 1874)	Eleotrididae	28 ± 12
8.	*Polynemus paradiseus* (Linnaeus 1758)	Polynemidae	15 ± 25
9.	*Polynemus* sp. (Linnaeus 1758)	Polynemidae	16 ± 28
10.	*Hemiramphus* sp. (Celvier 1817)	Hemiramphidae	31 ± 29
11.	*Coilia* sp. (Gray 1831)	Engraulidae	15 ± 25
12.	*Stolephorus malabaricus* (Linnaeus 1758)	Engraulidae	113 ± 47
13.	*Platycephalus* sp. (Bloch 1795)	Platycephalidae	5 ± 8
14.	*Eleutheronema tetradactylum* (Shaw 1862)	Polynemidae	46 ± 12
15.	*Trachyrhamphus serratus* (Schlegel 1832)	Syngnathidae	9 ± 16
	Station-2		
1.	*Glossogobius* sp. (Gill 1862)	Gobiidae	40 ± 14
2.	*Setipinna* sp. (Swainson 1839)	Engraulidae	6 ± 10
	Station-3		
1.	*Pisodonophis boro* (Hamilton-Buchanan 1822)	Ophichthidae	14 ± 9
2.	*Thryssa malabarica* (Bloch 1795)	Engraulidae	8 ± 14
3.	*Coilia ramcarati* (Haminton-Bachanan 1822)	Engraulidae	15 ± 25
4.	*Sillaginopsis* sp. (Gill 1861)	Sillaginidae	23 ± 26
5.	*Sillago* sp. (Cuvier 1817)	Sillaginidae	23 ± 21
6.	*Leiognathus* sp. (Lacepede 1803)	Leiognathidae	9 ± 8
7.	*Pseudorhombus* sp. (Bleeker 1862)	Bothidae	8 ± 12
8.	*Pseudupocryptes* sp. (Bleeker 1874)	Gobiidae	34 ± 36
9.	*Rhinomugil* sp. (Gill 1863)	Mugilidae	13 ± 23
10.	*Eleutheronema* sp. (Bleeker 1804)	Polynemidae	2 ± 5

Shannon-Weaver species diversity index (Shannon and Weaver 1963). Samples were sorted, counted and were identified to the lowest taxonomic level possible. The spatial and temporal variation of fish juvenile was evaluated from the monthly variation of fish juvenile.

Results and Discussion

Twenty families and 35 genera of fish juvenile taxa were available from the three sampling stations during January 2005 to December 2007 (Table 1). Of these 35 genera 34 species were identified distinctly while 26 fish juvenile could be identified upto genus level but could not be identified upto species level. Most dominant family was the Engraulidae which included (11 species ; 18.33%) followed by Clupeidae (8 species ; 11.67%), Mugilidae (6 species ; 10%) and Gobiidae (5 species ; 8.33%). Six families such as Scianidae, Ariidae, Bothidae, Syngnathidae, Serranidae and Ophichthidae were represented by single species (Figs. 1 and 2). Composition of species, total catch per sampling, and the diversity indices showed spatial and temporal variations (Tables 2 and 3).

Spatial Variation

Fifteen taxa were found exclusively from sta-

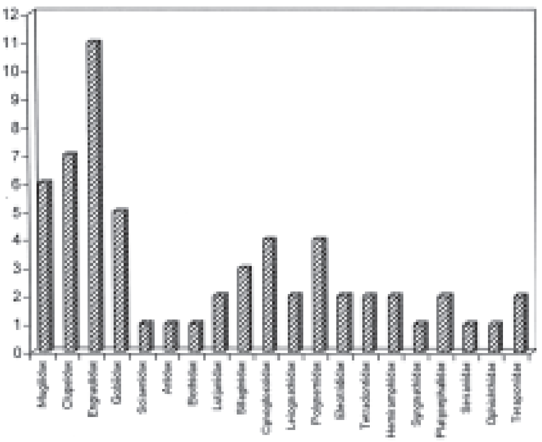

Figure 1. Total number of fish juveniles under 20 families recorded in the sampling stations during the investigation period.

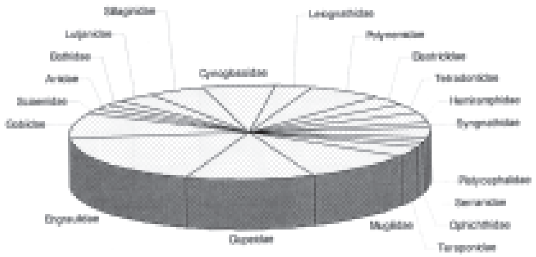

Figure 2. Distribution and abundance of different families recorded in the three sampling stations during the study period.

tion-1 and ten taxa from station-3 while only two taxa were found exclusively from station-2 (Table 1). Station-1 showed more variety of fish juvenile taxa than the other two sampling stations ((Table 3). Maximum catch per sample was also recorded from the station 1. Depending upon distribution and average catch per sample twelve taxa were found dominant. Most dominant was *Sardinella gibbosa* (family Clupeidae) followed by *Stolephorus bagenensis* (family Engraulidae), *Boleopthalmus boddarti* (family Gobiidae), *Liza parsia* (family Mugilidae), *Coilia neglecta* (Family Engraulidae). *Thryssa hamiltonii* (family : Engraulidae), *Mugil cephalus* (family : Mugilidae), *Liza tade* (family : Mugilidae), *Lutjanus malabaricus* (family : Lutjanidae), *Tenualosa toli* (family : Clupeidae), *Tenualosa ilisha* (family : Clupeidae) and *Epinephalus* sp. (family : Serranidae) (Figs. 3 and 4).

Temporal Variation

All the stations showed seasonal fluctuations in the number of taxa recorded with a trend of gradual decline in number of taxa from the beginning to the end of study period. The decline was most conspicuous in station-3 (Table 3). In all the stations maximum number of fish juvenile was available during pre-monsoon and minimum during monsoon. Highest numerical values of fish juvenile taxa was recorded during March to April, 2006 in station-1 and lowest numerical values of fish juvenile taxa was recorded during November to December 2007 in station-3 (Table 2). The fish juvenile catch also varied seasonally and there was a marked tendency of decline in catch from the beginning to the end of the investigation. A drastic reduction was found in total catch from station-3 at the end of 2007 (Table 3).

Shannon-Weaver species dioversity index showed a wide temporal variation and maximum values in all the sampling stations during March to May which is the peak period of finfish breeding in the

Table 2. Shannon-Weaver species diversity index values (mean ± SD) for the whole year, peak period and lean period in the three sampling stations.

Study sites	Annual average			Peak period (Mar to May)			Lean period (Jul to Sep)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Station-1	2.58 ± 0.6	2.34 ± 0.6	1.91 ± 0.6	3.26 ± 0.1	2.92 ± 0.0	2.56 ± 0.3	1.62 ± 0.2	1.35 ± 0.1	1.00 ± 0.2
Station-2	2.64 ± 0.4	2.39 ± 0.1	2.42 ± 0.6	3.03 ± 0.2	2.82 ± 0.2	2.72 ± 0.1	1.91 ± 0.2	1.62 ± 0.2	2.54 ± 0.7
Station-3	2.52 ± 0.4	2.27 ± 0.4	1.52 ± 0.5	3.09 ± 0.3	2.72 ± 0.2	2.32 ± 0.3	2.00 ± 0.1	1.70 ± 0.2	1.69 ± 0.3

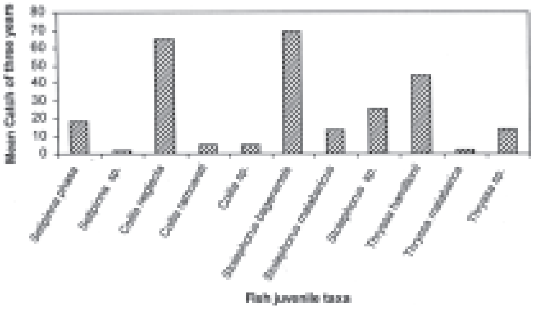

Figure 3. Composition and distribution of fish juveniles taxa under family Engraulidae.

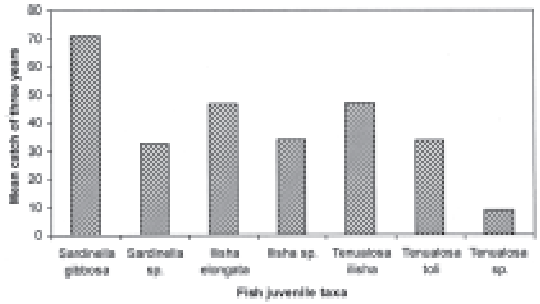

Figure 4. Composition and distribution of fish juveniles taxa under family Clupeidae.

Table 3. Summary of fish juvenile community variables (mean ± SD) during the entire investigation period.

Community variables	Station – 1 Study period 2005	2006	2007	Station – 2 Study period 2005	2006	2007	Station – 3 Study period 2005	2006	2007
Number of species	20.83 ± 5.91	16.00 ± 6.00	15.00 ± 4.00	20.42 ± 4.74	15.00 ± 5.00	12.00 ± 5.00	17.00 ± 3.93	13.00 ± 5.00	6.00 ± 4.00
Total catch/sample	125 ± 68	117 ± 83	117 ± 83	148 ± 67	67 ± 43	67 ± 45	79 ± 39	18 ± 17	18 ± 17
Species diversity index	2.58 ± 0.65	2.34 ± 2.65	1.92 ± 0.65	2.64 ± 0.40	2.39 ± 0.32	2.42 ± 0.63	2.52 ± 0.48	2.38 ± 0.44	1.53 ± 2.85

Hooghly estuary. This index values dropped during July to September, the lean period of breeding of fin fish, indicating a decline in the variety of species (Table 2). The occurrence of early life history stages of different species in Hooghly-Matla estuarine complex suggests that this estuary is an important spawning and nursery grounds for several species of finfish. It is essential to keep this spawning and nursery grounds free from any stress so as to maintain a sustainable fishery in the estuary. The drifting community of fish juvenile has been found to play an important role in the structure and functioning of estuarine ecosystem. Anthropogenic inputs and other pollutants not only result in the loss of fish juvenile biodiversity but also jeopardize the sustainability of the Hooghly-Matla estuarine ecosystem.

References

Boehlert G. W. and B. C. Mundy. 1988. Roles of behavioral and physical factors in larval and juvenile fish recruitment to estuarine nursery areas. *Am. Fish. Soc. Symp.* 3 : 51—67.

Choudhury A., A. Das, S. Bhattacharya and A. B. Bhunia. 1980. A quantitative assessment of benthic macrofauna in the intertidal mudflats of Sagar Island, Sundarbans. *Asian Symp. On mangrove environ : Research and management.* Aug 1980. Kuala Lumpur.

Day J. W. J. R. L., A. Deegan, J. G. Gosselink, A. J. R. Yanezarancibia, G. P. Soberon-Chavez and P. Sanchez-Gil. 1985. Relationships among primary productivity, fisheries yield, and physical characteristics of the Gulf of Mexico estuaries. *Estuaries* 8 : 3A.

Mc Hugh J. L. 1985. The estuarine ecosystem integrated. Foreword. Pp. 9—16. *In* A. Yanez Arancibia (ed). *Fish community ecology in estuarine and coastal lagoons : Towards an ecosystem.* Integration Universidad Nacional Autonoma de Mexico PAUL-ICML. Editorial Universitaria. Mexico.

Mc Hugh J. C. 1967. Estuarine nekton. Am. Assoc. for the Advan. of Sci. Publ. 83 : 581—620.

Pearcy W. G. and S. W. Richards. 1962. Distribution and ecology of fishes of the Mystic river estuary, Connecticut. *Ecol.* 43 : 248—259.

Powles H., F. Auger and G. J. Fitzgrald. 1984. Nearshore ichthoyplankton of a north temperature estuary. *Can. J. Fish. and Aquat. Sci.* 41 : 1653—1663.

Sasmal S. K., A. Kaviraj, A. Choudhury and A. Mitra. 1998. Community structure of ichthyoplankton in the coastal zone of West Bengal, India *J. Riv. Res.* 25 :

80—83.

Shannon C. E. and W. Weaver. 1963. Pp. 117—125. The mathematical theory of communication. Univ. of Illinois, Urbana.

Weinstein M. P. 1979. Shallow marsh habitats as primary nurseries for fishes and shallfish. Cape Fear River, North Carolina US. *Fish Bull.* 77 : 339—357.

Yanez-Arancibia A. and P. Sanchez-Gil. 1988. *Ecologia de los recursos demersales marines.* Fundamentos en costas tropicales. AGT Editor. Mexico. 238. pp.