



# A preliminary taxonomic checklist of Zooplankton in the Karnaphuli River Estuary

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## Article History

Received: 04 December 2016

Accepted: 12 January 2017

Published: 1 February 2017

## Citation

Abu Sayeed Muhammad Sharif, Md. Nesarul Hoque. A Preliminary Taxonomic Checklist of Zooplankton in the Karnaphuli River Estuary. *Discovery*, 2017, 53(254), 133-144

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## General Note



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## ABSTRACT

The present study was conducted to identify phytoplankton occurrence in 6 sites (15 No Jetty, Marine Fisheries Academy, Bridge Ghat, Nazirchar, Halda Mouth and Karnaphuli River above Halda's Confluence) from the Karnaphuli River Estuary. In the investigation, a total of 25 major taxa were identified under Arthropoda (19 order), Cnidaria (2 order), Chaetognatha (1 order), Porifera (1 order), Ciliophora (1 order), Mollusca (1 order). Further 6 genus of cladocera were also identified, namely: *Daphnia*, *Bosmina*, *Diaphanosoma*, *Moina*, *Ilyocryptus* and *Penilia*. The highest peak of zooplankton during monsoon and pre-monsoon season were 423.54 indivs/m<sup>3</sup> and 437.39 indivs/m<sup>3</sup> at same site near Karnaphuli River above Halda's confluence. Whereas, during post-monsoon highest 654.40 indivs/m<sup>3</sup> zooplankton were recorded at Nazirchar site between the sites. During monsoon, post-monsoon and pre-monsoon seasons maximum 15, 17 and 19 major taxa were identified from Karnaphuli River above Halda's confluence, near Nazirchar and Marine Fisheries Academy sites respectively.

**Key words:** Preliminary, Taxonomic, Checklist, Zooplankton, Karnaphuli River-Estuary

## 1. INTRODUCTION

Zooplankton is the heterotrophic drifting aquatic fauna in oceans, seas, and other water bodies. Most of them are usually tiny, few are large and some are detectable with the naked eyes (<https://en.wikipedia.org/wiki/Zooplankton>). Zooplankton plays very significant role in the upper stages of the food chain as it is the primary or main food choice of many organisms (Taylor et al. 2002). Most of the zooplankton holds short life cycle and its community structure is capable to reveal real-time scenario as it is less enforced by the constancy of individuals from forgoing years (Richardson, 2008). Many of them are well recognized as the best indicators of environmental changes (Sipkay et al. 2009). Zooplankton is now subjected to the affect by global change phenomenon. The diverse type of long-term result of global changes, events on zooplankton community, might have deep and wide profound impacts.

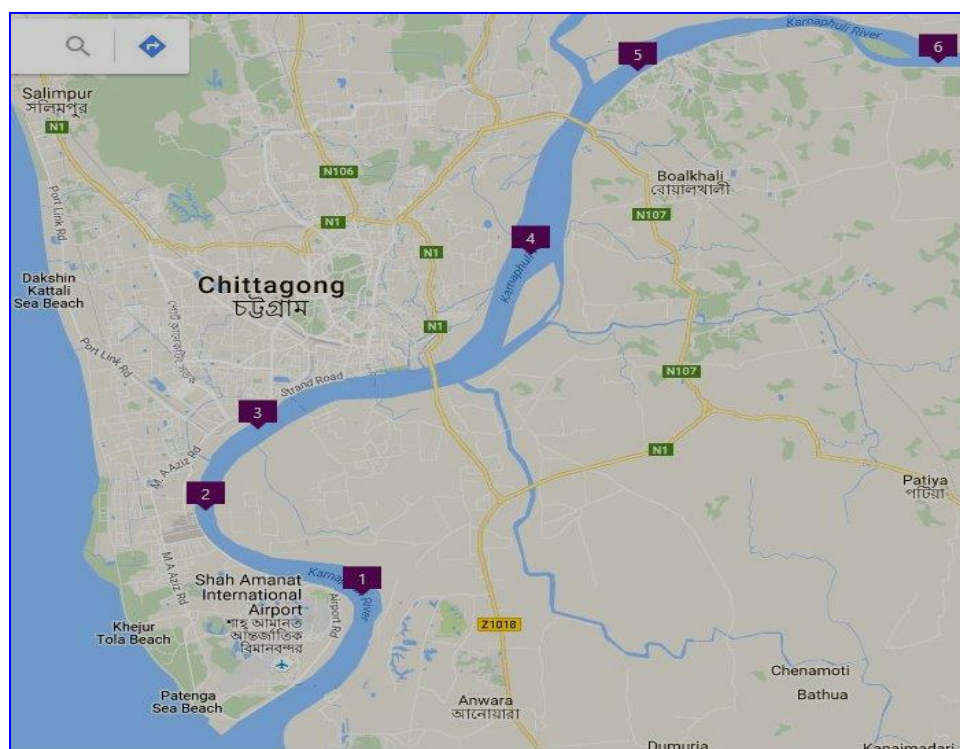
Bagirov (1989) reported almost 200 zooplankton taxa in the northern Caspian Sea with 70 taxa of Protista, 50 taxa of Rotatoria, 30 taxa of Cladocera, and 20 taxa of Copepoda. Hossieni et al. (1998) recorded 36 taxa of zooplankton community including Cladocera (24 taxa), Copepoda (7 taxa), and meroplankton (2 taxa) along the Iranian coastal area of the Caspian Sea while Sabkara et al. (2011) reported over 50 zooplankton taxa.

The taxonomic baseline information is often lacking, so it becomes difficult to forecast how environmental changes affect species, communities and the stability of the affected ecosystems (Danielsen, 1997; Fjeldsa and Lovett, 1997; Gray, 2001; Piraino et al., 2002). This lacking of information about community and species diversity of each geographic area must be filled up that could be vital for designing new scientific programmers' (Agosti and Johnson, 2002; Godfray, 2002). The present study will be a preliminary baseline for zooplankton study in the Karnaphuli River.

## 2. MATERIALS AND METHODS

### Study Area

Zooplankton occurrences and distribution was studied from six sites in the Karnaphuli River. The sampling sites count started from the Karnaphuli River mouth towards upstream. The sampling positions are site-1, site-2, site-3, site-4, site-5 and site-6 are locally named as Jetty No. 15, Marine Fisheries Academy, Bridge Ghat, Nazirchar, Halda Mouth and Karnaphuli River above Halda's Confluence respectively (Map 1). The salinity, temperature, pH, DO, TDS were recorded during the investigation.



**Map 1** The sampling sites in the Karnaphuli River on Google map

### Collection

Zooplankton samples were collected from the subsurface water using a zooplankton net of 300 µm mesh during the monsoon, post-monsoon and pre-monsoon season. A flow meter was attached at the mouth of the net. Weight was attached as required to keep the net at subsurface level while towing. The net was towed for about 15 minutes and the samples were kept in a labeled container for identification. The collected samples were immediately preserved in 70% ethanol and transferred to the laboratory for analysis.

### Staining and sorting

The collected samples were stained with rose Bengal for efficient sorting and left for overnight. All the zooplankton rendered pink color that made the sorting effortless. The stained plankton was sorted out from debris with fine brush, needle, forceps and a magnifying glass. The sorted organisms were preserved in 70% ethanol again for identification.

### Identification and counting

The sorted organisms were brought under microscope and identified following Mizuno (1976); Yamazi (1952, 1955, 1972, 1974); Pennak (1978); Davis (1955); APHA (1975); Santhanam and Srinivasan (1994); Newell and Newell (1973,1979); Sterrer (1986); Parsons et al. (1985); Mahmood (1990); Pinkin et al.(1977); Wickstead (1965); Suess (1982); Rahman (1977); Ahmed (1984); Islam (1982); Elias (1983); Ahmed (1983); Zafar (1986); Mohi (1977) etc.

## 3. RESULTS AND DISCUSSION

The taxonomic checklist of zooplankton along with their occurrence and distribution in the Karnaphuli River was studied. Over-all 25 major taxa of zooplankton were identified belonging from phylum Arthropoda (19 order), Cnidaria (2 order), Chaetognatha (1 order), Porifera (1 order), Ciliophora (1 order) and Mollusca (1 order). Further, 6 genus of cladocera namely *Daphnia*, *Bosmina*, *Diaphanosoma*, *Moina*, *Ilyocryptus* and *Penilia* were also identified. Again 3 Sub-order of copepod namely Calanoida, Cyclopoida and Harpacticoida were record in the investigation. The occurrence and distribution of zooplankton major taxa are shown (Table 1).

**Table 1**

Table showing seasonal (monsoon, post-monsoon and pre-monsoon) zooplankton major taxa (Indivs/m<sup>3</sup>) occurrence at the Karnaphuli River sites

Major taxa (Indivs/m <sup>3</sup> )	Monsoon						Post-monsoon						Pre-monsoon					
	st1	st2	st3	st4	st5	st6	st1	St2	st3	st4	st5	st6	st1	st2	st3	st4	st5	st6
Acetes	0.03	0.03					0.14	0.18	1.23				0.14	0.45				
Amphipoda			0.43	0.34			0.50	2.93	7.09	1.50	1.26		0.35	0.51	0.65	0.14	0.32	0.70
Balanus											0.22							
Bivalve			0.26	0.34				0.22		0.44	2.83			0.08	0.13	0.33	0.43	1.40
Caridean	0.13	0.25	5.83	2.45	4.37	5.28		0.06	0.66	0.44	0.63		0.49	0.08	0.09	0.76	3.93	2.48
Ciliophora					0.36	11.15										0.88		
Cladocera	0.42	0.40	6.96	27.00	66.94	200.92	0.09	0.06	1.51	0.22			3.19	2.41	10.12	29.25	89.20	160.25
Copepoda	12.16	20.19	8.87	25.16	106.96	147.24	17.69	9.87	233.08	584.95	108.02	380.23	5.62	3.36	13.14	15.66	58.15	160.78
Megalopa										3.78	1.26			0.13		0.11		
Crab zoea	0.12	0.23	5.22	5.73	5.82	4.99	0.09		2.65	37.78	21.35	144.53	2.22	0.12	8.71	9.68	34.57	71.38
Cumacea										2.67		3.10						
Diptera			0.35			0.29							1.25	0.30	1.07	0.54	5.12	4.90
Egg			1.48		2.18	10.56	0.14	0.18	1.23	8.00				0.08		0.87	2.99	2.72
Fish larvae	0.03		0.26	1.64	5.09	28.16	0.12	0.10	3.31	0.67		10.54	0.76	0.71	0.18	0.43	2.56	3.50
Gastropoda						4.99				5.45	2.51	57.07			0.76	0.66	2.80	
Hydromedusae	0.07		0.26				0.05	0.10				1.24						
Hydroyda					1.09	0.29		0.18			0.63			0.03		0.11		
Isopoda	0.03	0.04						0.04						0.02				
Lucifer	0.76	1.42					0.19		3.97	2.72			0.35	0.12	3.72			
Mites				0.14	0.73	2.64		0.06		0.44	0.63	1.24	0.07	1.11	0.90	1.52	2.99	0.75
Mysid			0.27				0.05	0.06	0.66		1.88	3.10	0.14	0.03			0.43	
Odonata						0.29												
Oligochaeta			0.09			0.59		0.04	0.47			0.62						
Ostracoda	0.03			0.34							0.31	3.10		0.03	0.02	0.54	0.85	1.40

Penaidae	0.06	0.07	0.17				0.31	4.00	2.27	0.67		0.28	0.06	0.33	2.56	1.25			
Porifera						0.29							0.07						
Sagitta	1.15	1.65					0.50	0.98	4.64	4.22		0.35							
Shrimp zoea			3.74	8.59	7.64	5.87						0.35	2.01	7.07	14.08	23.09			
Un-identified		0.04	0.09					0.04		0.22	0.63	0.02	0.04		0.26				
<b>Total</b>	<b>15.00</b>	<b>24.32</b>	<b>34.01</b>	<b>71.99</b>	<b>201.19</b>	<b>423.54</b>	<b>19.87</b>	<b>19.09</b>	<b>262.78</b>	<b>654.40</b>	<b>141.93</b>	<b>604.78</b>	<b>15.27</b>	<b>9.87</b>	<b>40.92</b>	<b>68.97</b>	<b>219.11</b>	<b>437.3</b>	
																			<b>9</b>

Legend: St1= Jetty No. 15, St2= Marine Fisheries Academy, St3= Bridge Ghat, St4= Nazirchar, St5= Halda Mouth and St6= Karnaphuli River above Halda's Confluence

The highest peak of zooplankton during monsoon and pre-monsoon season were 423.54 indivs/m<sup>3</sup> and 437.39 indivs/m<sup>3</sup> at site 6 (the Karnaphuli River above Halda's Confluence). Whereas, during post-monsoon highest 654.40 indivs/m<sup>3</sup> were recorded at site 4 (beside Nazirchar). During monsoon, post-monsoon and pre-monsoon seasons maximum 15, 17 and 19 major taxa were identified from site 6 (the Karnaphuli River above Halda's confluence), site 4 (near Nazirchar) and site 2 (near Marine Fisheries Academy) respectively.

Copepoda was recorded as dominating in all sites in three sampling seasons. Cladocera, copepoda, crab zoea, Caridean shrimp larvae and fish larvae were most common in the study area round the year. Acetes, Isopoda, Lucifer, Sagitta, Penaidae and Caridean shrimp larvae were identical at site 1 and site 2 near the Karnaphuli River mouth sites. On the other hand site 4, site 5 and site 6 were abundant in compare to other sites. The taxonomic classification of zooplankton is presented with reference to photograph (photographic plates 1, 2, 3 & 4).

### Taxonomic checklist of Zooplankton and photograph in photo plates

Phylum: Arthropoda

Class: Crustacea

Sub-class: Branchiopoda

Order: Cladocera

Family: Daphnidae

Genus: *Daphnia* (PL. 1 & Fig.14)

Family: Bosminidae

Genus: *Bosmina* (PL.1 Fig. 11 & 13)

Family: Moinidae

Genus: *Moina* (PL. 1 Fig. 17)

Family: Holopedidae

Genus: *Diaphanosoma* (PL. 1 Fig. 9, 15)

Family: Macrothricidae

Genus: *Ilyocryptus* (PL. 1 Fig. 16, 18)

Family: Sididae

Genus: *Penilia* (PL. 4 Fig. 12)

Order:Copepoda

Sub-order: Calanoida(PL. 1 Fig. 1, 2, 3, 5 & 8)

Sub-order: Cyclopoida(PL. 1 Fig. 4, 6)

Sub-order: Harpacticoida (PL. 1 Fig. 7, 12)

Order: Isopoda

Sub-order: Anthuridea: (PL. 2 Fig. 7 & 8)

Sub order: Flabellifera: (PL. 4 Fig. 9)

Order: Ostracoda (PL. 4 Fig. 2)

Order: Amphipoda(PL.4 Fig.6, 7, 8)

Order: Mysidacea(PL. 2 Fig. 6)

Order: Cumacea(PL. 3 Fig. 6)

Order: Tanaidacea

Family: Tanaidae (PL. 2 Fig. 13) &(PL. 4 Fig. 11)

Order: Decapoda

Class:Malacostraca

Order:Decapoda

Family:Sergestidae

Genus:*Acetes*(PL.3 Fig. 10)

Sub-order:Dendrobranchiata

Family:Luciferidae

Genus:*Lucifer* (PL. 2 Fig. 1) &(PL. 3 Fig. 11)

Suborder: Dendrobranchiata

Family: Penaeidae(PL. 2 Fig. 2, 3, 4)

Family: Carideans:(PL. 2 Fig. 3)

Order: Stomatopoda

Family: Squillidae

Genus: *Alima*(PL. 4 Fig. 5)

Class:Insecta

Order:Diptera(PL. 3 Fig. 13)

Subclass: Pterygota

Order: Odonata(PL. 1 Fig. 19)

Order: Coleoptera

Family: Carabidae

Genus: *Brachinus*(PL. 2 Fig. 9, 10; PL. 3 Fig. 4; PL. 4 Fig. 10)

Class: Arachnida

Subclass: Acari(PL. 3 Fig. 7& 8)

Class: Maxillopoda

Order: Sessilia

Suborder: Balanomorpha

Family: Balanidae

Genus: *Balanus*(PL. 3 Fig. 3)

Phylum: Cnidaria

*Class: Hydrozoa*

Order: Hydroida(PL. 4 Fig. 3)

Order: Hydromedusae(PL. 3 Fig. 2)

Phylum: Chaetognatha

*Class:Sagittoidea*

Order: Apheroglyphophora

Family: Sagittidae

Genus: *Sagitta*(PL. 2 Fig. 11)

Phylum: Porifera (PL. 3 Fig. 12)

*Phylum: Ciliophora (PL. 4 Fig. 4)*

Phylum: Annelida

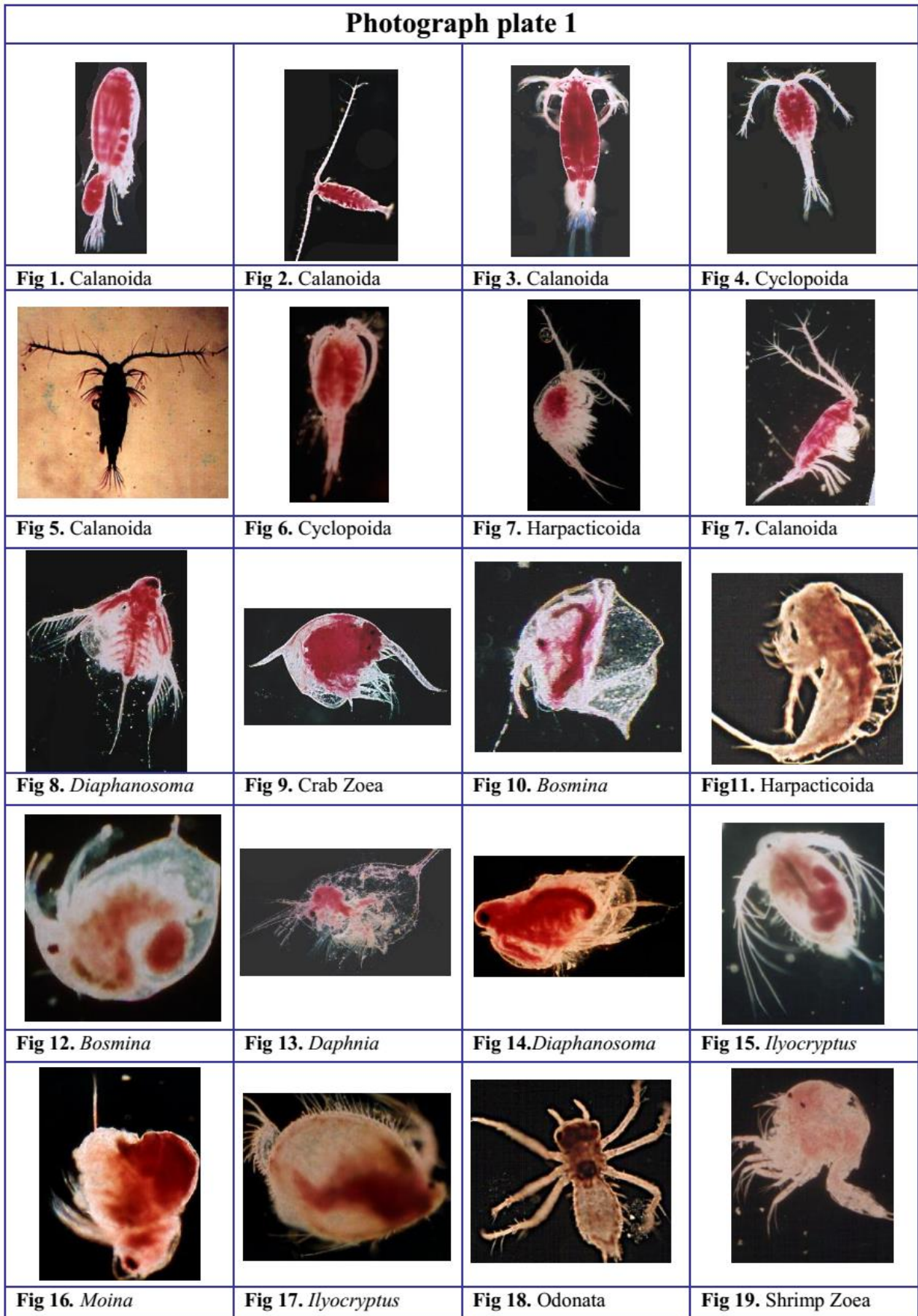
*Class:Clitellata*

Subclass: Oligochaeta(PL. 4 Fig. 10)

Phylum: Mollusca

*Class:GastropodaGastropod larvae(PL. 3 Fig. 14)*

*Class:BivalviaBivalve larvae(PL. 3 Fig. 15)*



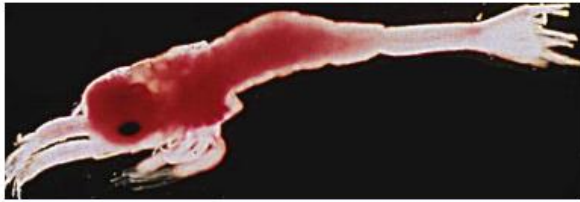
## Photograph plate 2



**Fig 1.** *Lucifer*



**Fig 2.** Penaeid Juvenile



**Fig 3.** Caridean Mysis



**Fig 4.** Penaeid Mysis



**Fig 5.** Penaeid Mysis



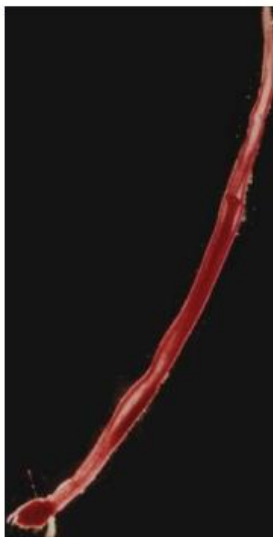
**Fig 6.** Mysidacea



**Fig 7.** Anthuridea



**Fig 8.** Anthuridea



**Fig 11.** *Sagitta*



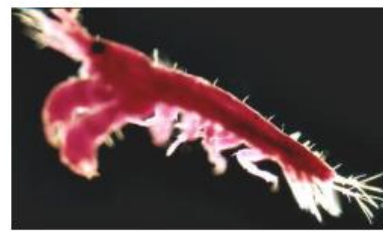
**Fig 12.** Unidentified



**Fig 9.** Crab Juvenile



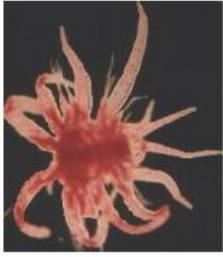
**Fig 10.** Shrimp Zoea



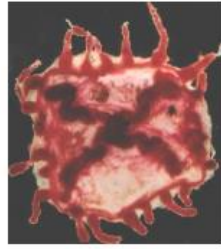
**Fig 13.** Tanaidae



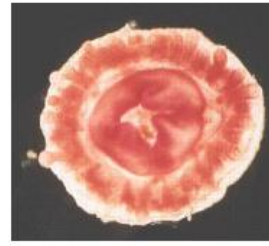
### Photographic plate 3



**Fig 1.** Unidentified



**Fig 2.** Hydromedusae



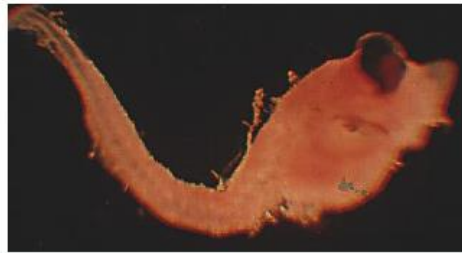
**Fig 3.** *Balanus*



**Fig 6.** Cumacea



**Fig 4.** Crab Zoea



**Fig 5.** Fish Larvae



**Fig 10.** Acetes



**Fig 7.** Acari



**Fig 8.** Acari



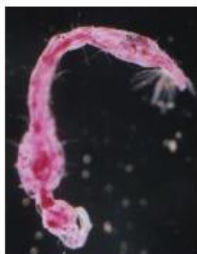
**Fig 9.** Tanaidae



**Fig 11.** *Lucifer*



**Fig 12.** Porifera



**Fig 13.** Diptera

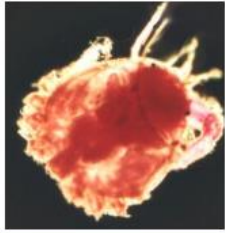


**Fig 14.** Gastropoda



**Fig 15.** Bivalvia

### Photographic plate 4



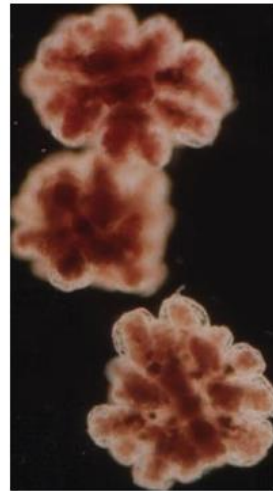
**Fig 1.** Crab juvenile



**Fig 2.** Ostracoda



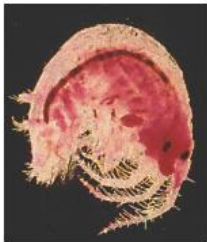
**Fig 3.** Hydroida



**Fig 4.** Ciliophora



**Fig 5.** Squilla larvae (*Alima*)



**Fig 6.** Amphipoda



**Fig 7.** Amphipoda



**Fig 8.** Amphipoda



**Fig 9.** Flabellifera (Isopoda)



**Fig 10.** Oligochaeta



**Fig 11.** Tanaidae



**Fig 12.** *Penilia*



**Fig 13.** Unidentified

#### 4. CONCLUSION

This taxonomic checklist with photographic plates will provide preliminary information and support as baseline for further study of zooplankton in the northern Bay of Bengal and its estuaries.

## REFERENCE

1. Agosti, D. and Johnson, N. F. 2002. Taxonomists need better access to published data. *Nature*, 417: 222. DOI: 10.1038/417222b
2. Ahmed, M. K. 1983. Study on commercially important post larval shrimps of the Karnafully river estuary. M. Sc. Thesis (unpublished) Inst. Mar. Sci. University of Chittagong. 124pp.
3. Ahmed, S. 1984. Zooplankton communities of the estuarine area of Satkhira with special reference to Ichthyoplankton. M. Sc. Thesis (Unpublished). Institute of Marine Sciences, University of Chittagong. Bangladesh. 117pp.
4. APHA-AWWA-WPCF, 1975. Standard Methods for the examination of water and waste water 14th (edi). American public health association American water works association USA. Water pollution control Federation, 1193pp.
5. Bagirov, R. M. 1989. The Azov and Black Sea species introduced to the Caspian benthos and biofouling[Ph.D. thesis], University of Baku.
6. Danielsen, F. 1997. Stable environments and fragile communities: does history determine the resilience of avian rainforest communities to habitat degradation? *Biodiversity & Conservation*, 6: 423-433. DOI: 10.1023/A:1018316825046
7. Davis, C. C. 1955. The marine freshwater plankton Michigan state University Press. Chiago USA. 562pp.
8. Elias, S. M. 1983. Zooplankton of the Mathamuhuri estuary with special reference to shrimp and finfish larvae. M. Sc. Thesis (unpublished) Institute of Marine Sciences, University of Chittagong. 172pp.
9. Fjeldsaa, J., J. C. Lovett. 1997. Biodiversity and environmental stability, *Biodiversity & Conservation*, 6: 315-323. DOI: 10.1023/A:1018304522320
10. Godfray, C. H. J. 2002. Challenges for taxonomy, *Nature*, 417:17-19.doi:10.1038/417017a
11. Gray, J. S. 2001. Marine diversity: the paradigms in patterns of species richness examined, *Scientia Marina*,65: 41-56.
12. Hossieni, A., Roohi, A., Ganjian, K. A. 1998. Hydrology and hydrobiology of the southern Caspian Sea, Registration 96.132, Agricultural Research and Education Organization.
13. Islam, A. K. M. N. 1982. Contribution to the study of Marine Algae of Bangladesh. 253pp.
14. Mahmood, N. 1990. Study on immigration of commercially important penaeid Shrimp post larvae in the Estuarine area of Chakaria, Cox's Bazar, Bangladesh. P. hd. Thesis. Department of Zoology. Rajshahi University. Bangladesh.125pp.
15. Mizuno, T. 1976. Illustrations of the fresh water plankton of Japan. Hoikusha publishing Co., Ltd. Osaka, Japan, (In Japanese 351pp.
16. Mohi, S. A. 1977. Distribution of Ichthyoplankton in the Karnafully River estuary in relation to salinity. M. Sc. Thesis. IMS. CU. 120pp.
17. Newell, G. E. and Newell, R. C. 1979. Marine plankton a practical guide. (5th edi). Hutchinson and Co. (Publishers) Ltd. London. 244pp.
18. Newell, G. E. and Newell, R. C. 1973. Marine Plankton-A practical guide. Hutchinson and Co. Ltd. London. 282pp.
19. Parsons, T. R., Yoshaki, M. and Carol, M. L. 1985. Pergamon Press. Oxford. Newyork Toronto. Sydney. Franlfurt. 173pp.
20. Pennak, R. W. 1978. Fresh water invertibrates of the United States. 2nd (edi). A wiley-interscience publication John Wiley and Sons, Newyork. USA. 803pp.
21. Pipkin, B. W., Donn, S. G, Richard, E. C. and Duglas, E. H. 1977. Laboratory exercise in oceanography. W-H. Freeman and company, Sanfrancisco. USA. 255pp.
22. Piraino S., G. Fanelli, F. Boero. 2002. Variability of species'roles in marine communities: change of paradigms for conservation priorities, *Marine Biology*, 140:1067-1074. DOI: 10.1007/s00227-001-0769-2
23. Rahman, M. 1977. Phytoplankton of the Naf River-estuary during postmonsoon near Teknaf Coast. M.Sc. Project (Unpublished). Univ. Ctg. 24pp.
24. Richardson, A. J. 2008. In hot water: zooplankton and climate change, *ICES Journal of Marine Science*, 65: 279–295.doi: 10.1093/icesjms/fsn028
25. Sabkara, J., Bagheri, S. and Makaremi, M. 2011. Identification of Cladocera in the Caspian Sea, *Journal of Fisheries Sciences*,5: 61–76.
26. Santhanam R. and A. Srinivasan 1994. Manual of marine zooplankton. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi, Bombay, Calcutta, India. 160pp.
27. Sipkay, C., Kiss, K. T., Vadadi-Fulop, C. and Hufnagel, L. 2009. Trends in research on the possible effects of climate change concerning aquatic ecosystems with special emphasis on the modelling approach, *Applied Ecology and Environmental Research*, 17: 171–198.
28. Sterrer, W, 1986. Marine fauna and flora of Bermuda. A systematic guide to the identification of marine organism. A wiley interscience pulication. New York. 742pp.
29. Suess, M, J. 1982. Examination of water for pollution control: A reference hand book. Pergamon Press. 531pp.
30. Taylor, A. H., Allen, J. I. and Clark, P. A. 2002. Extraction of a weak climatic signal by an ecosystem, *Nature*, 416: 629–632.doi:10.1038/416629a
31. Wickstead, J. H. 1965. An Introduction to the study of Tropical Plankton. Hutch inson and Co. Ltd. London. 160pp.
32. Yamaji, I. 1972. Illustrations of the marine plankton of Japan. Hoikusha Publishing Co. Ltd. Osaka, Japan. 369pp.

33. Yamaji, I. 1974. The plankton of Japanese coastal water. Hoikusha publishing co.; Ltd. Osaka. Japan. 238pp.
34. Yamaji, I. 1952. Plankton investigation in inlet waters along the coast of Japan, Publ. Seto Mar. Biol. Lab., 112: 305-318.
35. Zafar, M. 1986. Study on Zooplankton of Satkhira in the vicinity of Aquaculture Farms with special reference to Penaeid post larvae. M.Sc. Thesis. IMS. Univ. Ctg. 238pp.