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Grazing Impact of Common Carp (*Cyprinus carpio*) on the Bottom Fauna of *Halia beel* and *Noli beel* in the Karimganj Upazila under Kishoreganj District of Bangladesh

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Abstract: The present investigation was carried out to access the grazing impact of common carp (*Cyprinus carpio*) on the bottom fauna of *Halia beel* (not stocked with *Cyprinus carpio*) and *Noli beel* (stocked with *Cyprinus carpio*) in Karimganj upazila under Kishoregonj district during January to May, 2012. The observed groups of benthos (individual/m^2) in *Halia beel* were Hemiptera 2018.75 (76%), Oligochaeta 218.75 (8%), Chironomidae 148.44 (6%), Tipulidae 135.42 (5%), Gastropoda 62.5 (3%), Trichoptera 31.25 (1%) and Megaloptera 31.25 (1%). At the same time the groups of benthos (individual/m^2) in *Noli beel* were Hemiptera 725 (64%), Tipulidae 166.67 (15%), Coleoptera 52.08 (5%), Oligochaeta 52.08 (4%), Chironomidae 39 (3%), Gastropoda 31.25 (3%), Trichoptera 31.25 (3%) and Isopoda 31.25 (3%). The possible of significance differences of benthos in two *beels* might be the feeding of benthos by *Cyprinus carpio*. Depth distribution of benthos in *Halia beel* and *Noli beel* showed significant differences. Shallow region showed greater density of benthos than deep region in both *beel*. In *Halia beel* the density of benthos in shallow and deep region were 80% and 20% respectively. In *Noli beel* the density of benthos in shallow and deep region was 76% and 24% respectively. Distribution of benthos in shelter place and away from shelter place in *Halia beel* and *Noli beel* also showed significant differences. Place away from shelter showed greater density of benthos than shelter place in both *beel.* In *Halia beel* the density of benthos in shelter place and away from shelter place were 38% and 62%, respectively. In case of *Noli beel* the density of benthos in shelter place and away from shelter place were 27% and 73%, respectively.

Key words: Common Carp · Macrobenthos · Effects · *Halia beel* · *Noli beel*

INTRODUCTION

Water resource of Bangladesh is a natural capital. Fisheries and aquatic resources are economically, ecologically, culturally and aesthetically important to the nation. In Bangladesh fisheries is one of the major sub sectors of agriculture, which play a dominant role in nutrition, employment, earning foreign currency and other areas of economy. Low-valued exotic species for aquaculture is becoming an increasingly important food production process in many Asian countries [1]. With rising population and demand, expansion of fish supplies to maintain food security has emerged as a priority concern for Bangladesh. In order to meet the soaring demand for food, there is a growing tendency of low-valued fish farming in Bangladesh. Common carp is foreign origin and introduced to Bangladesh during the last few decades to supplement fish production [2]. This species, is fast growing, reaches 5-7 kg within six months of stocking in the *beel* of Kishorgonj.

Macrobenthos are an important and integral component of all aquatic ecosystems which lives on, in or near the bottom of water bodies [3]. Although globally macrobenthos has been much studied but in Bangladesh the published information on macrobenthos of is scanty [4]. All organisms, microscopic to macroscopic, play important role in balancing the ecosystem. Loss or extinction of any group organisms hampers the functioning of this ecosystem [5]. The term *beel* is defined as billabong or a lake-like wetland with static water [6]. Macro-invertebrates are part of the food supply for many fishes and other vertebrates of lakes and streams [7].

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Whether as it is subjected to native fish species to new competitors, predators, habitat and water quality alterations, hybridization, the importation of parasites and diseases or other agents that they are unable to withstand. It is a matter of great concern that, there is almost no scientific research about this issue. Considering the above stated facts the present study was undertaken to evaluate the impact of stocking common carp (*Cyprinus carpio*) in the beel of Kishorgonj especially on the benthic sedentary composition. The specific objectives are: identify the impact of grazing of common carp (*Cyprinus carpio*) on the bottom and also identify different groups of benthos.

MATERIALS AND METHODS

Study Area: The experiment was carried out for a period of five months from January to May 2012 in the Karimganj upazila under Kishoreganj district Bangladesh. *Halia beel* (not stocked with *Cyprinus carpio*) and *Noli beel* (stocked with *Cyprinus carpio*) were selected for the evaluation of grazing effects of *Cyprinus carpio* on the bottom fauna.

Experimental Design: *Halia beel* and *Noli beel* were selected as treatment I and II respectively, five samples were collected from each *beel* in such a way that 2 samples from shallow (30-50 cm) area and 3 samples from deep (90-110 cm) area of which 2 from the shelter place and 1 away from shelter place to observe the depth distribution and effects of shelter on the distribution of benthos.

Sample Collection: Benthic sample were collected from five stations with an Ekman Dredge at around 10:00 am from the *beels* on each sampling days. Then fine mesh screen net was placed beneath the Ekman Dredge to collect the sediment. After collection the bottom materials and organism were passed through a 0.2 mm mesh sieve for preliminary separation of benthos and large particles from mud and water. The sieved organism samples were preserved with other residue in the plastic container with 10% formalin and labeled and then transferred to laboratory for further analysis.

Identification and Counting of Benthos: Benthic samples were kept in laboratory for 48 hours to allow the organism to be hardened. The preserved organisms were then transferred to Petri dish and washed with tap water to remove the remaining washable detritus and mud. For identification, the samples were placed in a white paper background for the easy contrast of vision. Organisms were sorted by using small brush or forceps. Identification was done by magnifying glass and microscope and the benthos under major groups were enumerated. Identification was done up to possible taxonomic groups. Finally the results were tabulated.

Statistical Analysis: All data obtained during the present study were statistically analyzed with Microsoft Excel 2007. Data were presented as mean.

RESULTS

Quantitative distribution of benthos in *Halia beel* (not stocked with *Cyprinus carpio*) and *Noli beel* (stocked with *Cyprinus carpio*) are documented below in table (Table 1) and Figures (1 & 2).

Hemiptera: Hemiptera was found to be the most dominant group in both *Halia beel* and *Noli beel*. The mean abundance of Hemiptera was 2018.75 (76%) individual/m^2 in *Halia beel*, whereas in *Noli beel* the abundance was 725 (64%) individual/m^2.

Table 1: Mean density of benthos in *Halia beel* and *Noli beel*.

Groups	*Halia beel* (individual/m^2)	*Noli beel* (individual/m^2)
Oligochaeta	218.75	52.08
Gastropoda	62.50	31.25
Chironomidae	148.44	39.00
Tipulidae	135.42	166.67
Hemiptera	2018.75	725.00
Megaloptera	31.25	-
Trichoptera	31.25	31.25
Coleoptera	-	52.08
Isopoda	-	31.25

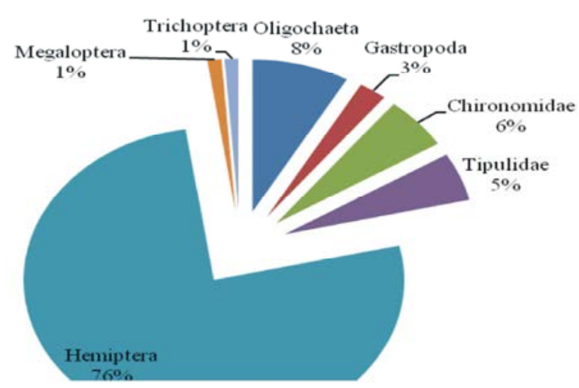

Fig. 1: Percentage composion of benthos in *Halia beel*

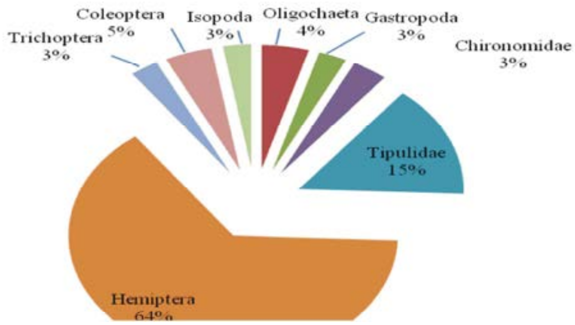

Fig. 2: Percentage composion of benthos in *Noli beel*

Oligochaetea: Oligochaeta was found as the second dominant group in *Halia beel*. The mean abundance of Oligochaeta was 218.75 (8%) individual/m^2 in *Halia beel*, however in *Noli beel* the mean abundance was 52.08 (4%) individual/m^2.

Chironomidae: Chironomidae was found as the third dominant group in *Halia beel*. The mean abundance of Chironomidae was 148.44 (6%) individual/m^2 in *Halia beel*, at the same time in *Noli beel* the mean abundance was 39 (3%) individual/m^2.

Tipulidae: Tipulidae was found as the second dominant group in *Noli beel* also dominant in *Halia beel*. The mean abundance of Tipulidae was 166.67 (15%) individual/m^2 in *Noli beel*, whereas in *Halia beel* the mean abundance was 135.42 (5%) individual/m^2.

Gastropoda: Gastropoda was found in both *Halia beel* and *Noli beel*. The mean abundance of Gastropoda was 62.50 (3%) individual/m^2 in *Halia beel*, at the same time in *Noli beel* the mean abundance was 31.25 (3%) individual/m^2.

Trichoptera: Trichoptera was found same in both *Halia beel* and *Noli beel*. The mean abundance of Trichoptera was 31.25 (3%) individual/m^2 in the both *beel*.

Megaloptera: Megaloptera was found in only *Halia beel*. The mean abundance of Megaloptera was 31.25 (1%) individual/m^2 in *Halia beel*.

Coleoptera: Coleoptera was only found in *Noli beel*. The mean abundance of Coleoptera was 52.08 (5%) individual/m^2 in *Noli beel*.

Isopoda: Isopoda was only found in *Noli beel*. The mean abundance of Isopoda was 31.25 (3%) individual/m^2 in *Noli beel*.

Table 2: Depth distribution of benthos in *Halia beel* and *Noli beel*

	Shallow (individual/m^2)		Deep (individual/m^2)	
Groups	*Halia beel*	*Noli beel*	*Halia beel*	*Noli beel*
Oligochaeta	156	93	343	31
Gastropoda	78	31	31	31
Chironomidae	156	47	203	31
Tipulidae	312	203	31	-
Hemiptera	3516	1156	328	422
Megaloptera	31	-	31	-
Trichoptera	31	31	31	-
Coleoptera	-	62	-	-
Isopoda	-	31	-	-
Total	4280	1654	998	515

Table 3: Density of benthos in shelter place and away from shelter place in *Halia beel* and *Noli beel*

	Shelter place (individual/m^2)		Place away from shelter (individual/m^2)	
Groups	*Halia beel*	*Noli beel*	*Halia beel*	*Noli beel*
Oligochaeta	93	-	156	93
Gastropoda	-	-	78	31
Chironomidae	31	31	156	47
Tipulidae	62	93	312	203
Hemiptera	2406	468	3516	1156
Megaloptera	-	-	31	-
Trichoptera	-	-	31	31
Coleoptera	-	31	-	62
Isopoda	-	-	-	31
Total	2592	623	4280	1654

Depth Distribution of Benthos: Depth distribution of benthos in *Halia beel* and *Noli beel* also showed significant differences. Shallow regions showed greater density of benthos than deep region in both *beel*. In *Halia beel* the density of benthos in shallow and deep region were 4280 (80%) individual/m^2 and 998 (20%) individual/m^2 respectively. In *Noli beel* the density of benthos in shallow and deep region were 1654 (76%) individual/m^2 and 515 (24%) individual/m^2 respectively. Hemiptera was found to be most dominant group of benthos in shallow and deep region in both *Halia* and *Noli beel*. Tipulidae, Trichoptera, Coleoptera and Isopoda were absent in deep region but present in shallow region of *Noli beel*. Depth distribution of benthos of *Halia beel* and *Noli beel* are documented in Table (2).

Distribution of Benthos in Shelter Place and Away from Shelter Place: Distribution of benthos in shelter place and away from shelter place in *Halia beel* and *Noli beel* also showed significant differences. Place away from shelter showed greater density of benthos than shelter place in both *beel*. In *Halia beel* the density of benthos in shelter place and away from shelter place was 2592 (38%) individual/m^2 and 4280 (62%) individual/m^2 respectively. In *Noli beel* the density of benthos in shelter place and away from shelter place was 623 (27%) individual/m^2 and 1654 (73%) individual/m^2 respectively. In *Halia* and *Noli beel* Hemiptera was found to be most dominant group of benthos in shelter place and away from shelter place. Oligochaeta, Gastropoda, Trichoptera, Isopoda were absent in shelter place but present in away from shelter place of *Noli beel*. Distribution of benthos in shelter place and away from shelter place of *Halia beel* and *Noli beel* are documented in Table (3).

DISCUSSION

Investigations on the distribution of benthic faunal food and fisheries of benthophagic fishes are imperative to understand the condition of benthos component and their utility for the fish. The common carp also accounts for the world's second highest farmed fish production, mainly from polyculture in Asia [8]. Hemiptera was found to be the most dominant group in both *Halia beel* and *Noli beel*. The mean abundance of Hemiptera was 2018.75 individual/m^2 in *Halia beel*, whereas in *Noli beel* the abundance was 725 individual/m^2. The probable cause of this difference might be due to feeding of Hemiptera by carp. Insects also showed positive selectivity by *Cyprinus carpio* during March-May with E value (selectivity value) of 0.04 to 0.92 [9].

Oligochaeta was found to be the second dominant group in Halia beel. The mean abundance of Oligochaeta was 218.75 individual/m^2 in Halia beel, but in Noli beel the abundance was 52.08 individual/m^2. It might be due to feeding of young carp on Oligochaeta, because carp <100 mm mainly fed upon microcrustaceans, the proportion of dietary chironomids and oligochaetes increased with body length >100 mm [10].

Chironomidae was found to be the third dominant group in *Halia beel*. The mean abundance of Chironomidae was 148.44 individual/m^2 in Halia beel, at the same time in *Noli beel* the abundance was 39 individual/m^2. The possible cause of this difference might be due to active selection of Chironomidae by carp. Active selection of chironomids by carp has also been observed [11]. Tipulidae was found to be the second dominant group in *Noli beel* also dominant in *Halia beel*. The probable cause might be due to feeding of Tipulidae by carp. The relative selectivity of *Cyprinus carpio* for dipterans (Tipulidae) and insects was highly positive throughout the year [9].

Gastropoda was found in both *Halia beel* and *Noli beel*. Gastropoda might be feed by carp. Molluscs, mainly pelecypods indicate slightly positive selectivity in case of *Cyprinus carpio* [9]. Trichoptera was found same in both *Halia beel* and Noli beel. Trichoptera might be feed by carp. Insects are preferred by carp from April to July and E value (selectivity value) ranges between 0.34 to 0.82 [9]. Megaloptera was found in only *Halia beel*. Megaloptera might be negatively selected by *Cyprinus carpio*. Coleoptera was only found in *Noli beel*. The carp might be ingesting Coleoptera non-selectively.

Isopoda was only found in *Noli beel*. Isopoda might be feed by carp. Micro-crustaceans are known to be a major dietary component of invasive small carp and benthic macro-invertebrates become increasingly important in carp diet with increased body lengths [12, 13]. In contrast, amphipods and phantom midge larvae were by far the most consumed invertebrates, due to their higher availability in the lake [15].

Depth distribution of benthos in *Halia beel* and *Noli beel* showed significant differences. Shallow regions showed greater density of benthos than deep region in both beel. The probable cause of less abundance of benthos in the deeper region might be due to greater feeding in deep region than shallow region by carp and other fishes. Tipulidae, Trichoptera, Coleoptera and Isopoda were absent in deep region but present in shallow region of *Noli beel*. This might be due to high feeding pressure in the deep region than shallow region.

CONCLUSION

Distribution of benthos in shelter place and away from shelter place in *Halia beel* and *Noli beel* also showed significant differences. Place away from shelter showed greater density of benthos than shelter place in both beels. This was possibly due to the greater aggregation of fish in the shelter place and successive greater feeding pressure. Oligochaeta, Gastropoda, Trichoptera, Isopoda were absent in shelter place but present in away from shelter place of *Noli beel*. This might be due to high feeding pressure in the shelter place than away from shelter place. The possible cause of significance differences of benthos in two *beels* was the feeding of benthos by *Cyprinus carpio*. The probable cause of less abundance of benthos in the deeper region was greater feeding in deep region than shallow region by carp and other fishes. This was possibly the greater aggregation of fish in the shelter place and successive greater feeding was happened.

REFERENCES

1. De Silva, S.S., T.T.T. Nguyen, G.M. Turchini, U.S. Amarasinghe and N.W. Abery, 2009. Alien species in aquaculture and biodiversity: a paradox in food production. Ambio., 38(1): 24-28.
2. Banglapedia, 2009. Exotic fish in Bangladesh. Banglapedia – An Encyclopedia of Bangladesh, Dhaka.
3. Hossain, M.B., 2011. Macrobenthos Community Structure of a Tropical Estuary, LAP Publishing Company, Germany, ISBN10: 3843385343, pp: 84.
4. Asadujjaman, M., M. Belal Hossain, M. Shamsuddin, M.A. Amin and A.K.M. Azam, 2012. Occurrence and Abundance of Macrobenthos of Hatiya and Nijhum Dweep Islands, Bangladesh.
5. Hossain, M.B., S.M.N. Amin, M. Asadujjaman and Sharmeen Rahman, 2012. Analyses of Macrobenthos of Hatiya and Nijhum Dweep Islands at Higher Taxonomic Resolution. Journal of Fisheries and Aquatic Science, 2: 48-73.
6. http://en.wikipedia.org/wiki/Beel [accessed, 13 May, 2015]
7. Barham, E.G.N.J., Jr. Ayer and R.E. Boyce, 1967. Macrobenthos of the San Diego Trough photographic census and observations from the bathyscaph, terieste. Deep-see, pp: 773-784.
8. Milstein, A., 1992. Ecological aspects of fish species interactions in polyculture ponds. *Hydrobiologia,* 231: 177-186.
9. Kaushal, D.K., 2000. Interrelationship of bottom fauna, fish and fisheries of Gobindsagar Reservoir, Himachal Pradesh. Indian J. Fish, 47(1): 13-19.
10. Britton, J.R., R.R. Boar, J. Grey, J. Fosterk, J. Lugonzo and D.M. Harper, 2007. From introduction to fishery dominance: the initial impacts of the invasive carp *Cyprinus carpio* in Lake Naivasha, Kenya, 1999 to 2006. Journal of Fish Biology, 71(Supplement D): 239-257.
11. Lammens, E.H.R.R. and W. Hoogenboezem, 1991. *Diets and feeding behaviour. In Cyprinid Fishes: Systematics, Biology and Exploitation* (Win?eld, I. J. & Nelson, J. S., eds). London: Chapman & Hall, pp: 353-376.
12. Vilizzi, L., 1998. Observations on the ontogenetic shifts in the diet of carp, *Cyprinus carpio* L., from the River Murray Australia. Folia Zoologica, 47: 225-229.
13. Khan, T.A., 2003. Dietary studies on exotic carp (*Cyprinus carpio* L.) from two lakes of western Victoria, Australia. Aquatic Sciences, 65: 272-286.
14. Chapman, G. and C.H. Fernando, 1994. The diets and related aspects of feeding of Nile tilapia (*Oreochromis niloticus* L.) and common carp (*Cyprinus carpio* L.) in lowland rice fields in northeast Thailand. Aquaculture. 123: 281-307.
15. Rieradevall, M., 1991. Ecologia i producció del bentos del llac de Banyoles, Ph.D. dissertation, Univ. of Barcelona, Barcelona, Spain, pp: 223.