International Journal of Advancements in Research & Technology, Volume 2, Issue 1, January-2013
ISSN 2278-7763

Food and feeding habit of the critically endangered catfish *Rita rita* (Hamilton) from the Padda river in the north-western region of Bangladesh

Syeda Mushahida-Al-Noor[1*], Md. Abdus Samad[1] and N.I.M. Abdus Salam Bhuiyan[2]

[1]Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi 6205, Bangladesh.
[2]Department of Zoology, Faculty of Life and Earth, University of Rajshahi, Rajshahi 6205, Bangladesh.
*E-mail: munianoor@gmail.com

ABSTRACT

Food and feeding habits of *Rita rita* collected from the Padda river in the north-western region of Bangladesh were investigated by examining the gastro-intestine contents of 744 specimens collected from May, 2010 to April, 2011. Their diet consisted of a broad spectrum of food types but crustaceans were dominant, with copepodes constituting 20.73%, other non-copepode crustaceans constituted 12.01%. The next major food group was insect (15.97%), followed by mollusks (14.76%), teleosts (12.98%) and fish eggs (8.608%). Food items like Teleosts, mollusks, insects and shrimps tended to occur in the stomachs in higher frequencies with an increase in *R. rita* size (up to 30.5 - 40.5cm), while fish eggs, copepods and non-copepode crustaceans tended to increase in stomachs at sizes between 10.5-20.5cm. Analysis of monthly variations in stomach fullness indicated that feeding intensity fluctuated throughout the year with a low during June and August corresponding to the spawning period.

Keywords: Rithe, food items, feeding frequency, Ganges, Rajshahi.

1 INTRODUCTION

Rita rita (Hamilton) is a freshwater fish and commonly known as catfish. It is locally called as "Rithe" in Bangladesh. *R. rita* is endemic in oriental zoogeographical region (Mirza and Omer, 1984), found in large rivers throughout the Indian subcontinent (Shaji, 1995). This freshwater species also found in estuary, streams, rivers, canals and ponds, occurs mainly in shallow waters (Mirza, 1982; Talwar and Jhingran, 1991; Rahman, 2005 and Yashpal *et al.*, 2006). Young fishes are greenish brown above and flunk, sometimes silvery brown on back and dull white below. *Rita. rita* is a bottom and column feeder, carnivorous and mainly feeds on insects, shrimps, mollusks, fishes and rotifers in adult stage (Bhuiyan, 1964 and Rahman, 2005) but takes insects and aquatic plants in earlier stage of life (Bhuiyan, 1964). It is extremely slimy when captured (Rahman, 1989). Talwar and Jhingran (1991), considered *R. rita* as food fish and stated that the species contributes a good fishery in northern India. Khan *et al.* (1988) has documented *R. rita* in the 56 vulnerable fish species in freshwater. *R. rita* is critically endangered in Bangladesh due to loss of habitats (IUCN Bangladesh, 2000) and due to over exploitation (Mishra *et. al.,* 2009). This Bagrid catfish is also included in IUCN red book enlisted species in the world due to rare availability (Ng *et al.*, 2010). Practically, there is no

published information is available on the food and feeding habits of this commercially important fish from Bangladesh. Few isolated studies like Sandhu and Lone (2003) and Devi *et al*., (1992) studied food and feeding habit of *R. rita* from India. The results of the food and feeding study would be useful in future for stocking, successful farming and management of this species in impounded water bodies.

2 MATERIALS AND METHODS

2.1 Study site

The specimens of *R. rita* were obtained from the Padda river in the north-western part of Bangladesh (Latitude 24° 22' N; Longitude 88° 35' E) by commercial gill net. The Padda river is believed to be an important spawning and feeding ground for riverine fish species of north-western Bangladesh. *R. rita* specimens were collected monthly from the sampling site (Rajshahi area) in the Padda river during daytime (10:00–17:00 hours) from May, 2010 to April,2011 by means of traditional gill nets. Specimens were preserved in 10% buffered formalin, packed in wooden boxes and transported to the laboratory.

2.2 Data analysis

A total of 1050 specimens measuring 10.2-35.2 cm standard length (SL) and weighing 75.25-385.21g were examined. Standard length (SL) were measured with a slide caliper to the nearest 0.01 cm, while body weight (BW) was determined with a digital balance to the nearest 0.01 g. Fish were opened and the degree of stomach fullness was assessed according to the subjective scale described by Lebedev (1946) as empty, 1/4 full, 1/2 full, 3/4 full or full. The data were then used to calculate the monthly Fullness Index (FI).

$$\text{FI}\,(\%) = \frac{\text{Number of stomachs with the same degree of fullness}}{\text{Total number of stomachs examined}} \times 100$$

The gut was then exercised, weighed (g) together with its contents and preserved in 70% alcohol. Subsequently, stomach contents were suspended in water in Petri dishes and undigested food items were identified to the possible taxon using the identication keys of Pennak (1953), Ward & Whipple (1959), Prescott (1962) and Needham & Needham (1962). The gastro-somatic index (GaSI) was calculated to investigate monthly variations in feeding intensity using the equation:

$$\text{GaSI} = \frac{\text{Fresh weight of stomach}}{\text{Total fresh weight of fish}} \times 100$$

The contribution of each food type to the diet and the frequency of occurrence were determined according to Hynes (1950). The proportion of total food items contributed by each items for the entire year was determined according to the numerical method (Bowen, 1985). Variation in diet by length was investigated by regrouping the samples into six size classes at 5 cm intervals and assessing the gut content based on the major food groups using the percentage occurrence data. Finally monthly variation of food abundance in the stomach content was investigated to determine the seasonal changes in the diet of the species using the frequency of occurrence method.

3 RESULTS

3.1 Food compositions

The proportion of total prey types contributed to each prey group for the entire year (Fig.1) shows that the major component of the diet was Copepodes contributing 20.73% of the major food types eaten by *R. rita.* Teleosts and their body parts, insects and Mollusks accounted for 25.87%, 15.97% and 14.76% respectively. Mud-sands were the least common items accounting 4.26% for of the major food types. Figure. 3 depicts the percentage frequency of occurrence of different food items in the gastro-intestine of *R. rita* for the entire year. Of the non-copepode crustaceans, rotifers (8.07%) and cladocerans (3.94%). Of the teleosts, Cyprinoides (6.5%) represented the major food item followed by Clupeioides (3.03%) and

Gobiioides (2.38%). Among the mollusks, decapodes (6.64%), isopodes (3.03%) and amphipodes (3.21%).

3.2 Seasonal changes in diet composition

Seasonal changes in diet composition is shown in the Table.1. The maximum percentage of fish scale was recorded in January (6.4%) and minimum in August (2.3%). The maximum percentage of fish eggs was recorded in January (12.8%) and minimum in August (4.6%). The maximum percentage of Cyprinoides was recorded in February (10.5%) and minimum in July (3.0%). The maximum percentage of Clupeioides was recorded in January (5.1%) and minimum in July (1.8%). The maximum percentage of Gobiioides was recorded in January (4.2%) and minimum in July (1.2%). The crustacean consists of three major groups such as copepodes, rotifers and cladocerans. The maximum percentage of copepodes was recorded in July (30.7%) and minimum in Febuary (13.3%). The maximum percentage of cladocerans was recorded in May (7.6%) and minimum in April (1.4%). The maximum percentage of rotifers was recorded in May (12.1%) and minimum in January (4.9%). The highest percentage of mysids in the stomachs was recorded in August (7.7%) and the lowest percentage in the stomach was recorded in March (4.9%). The highest percentage of insects in the stomachs was recorded in November (22.8%) and the lowest percentage of insects in the stomach was recorded in May (10.2%). The maximum prevalence of isopodes was recorded in March (10.5%) and minimum proportions were found in July (2.7%). The maximum prevalence of amphipodes was recorded in July (5.8%) and minimum proportions were found in September (3.0%). The maximum prevalence of decapodes was recorded in March (12.5%) and minimum proportions were found in May (3.5%). Sand, silt and clay particles together was found in stomachs was recorded in larger amount in August (9.0%) and minimum prevalence was recorded in October (2.0%).

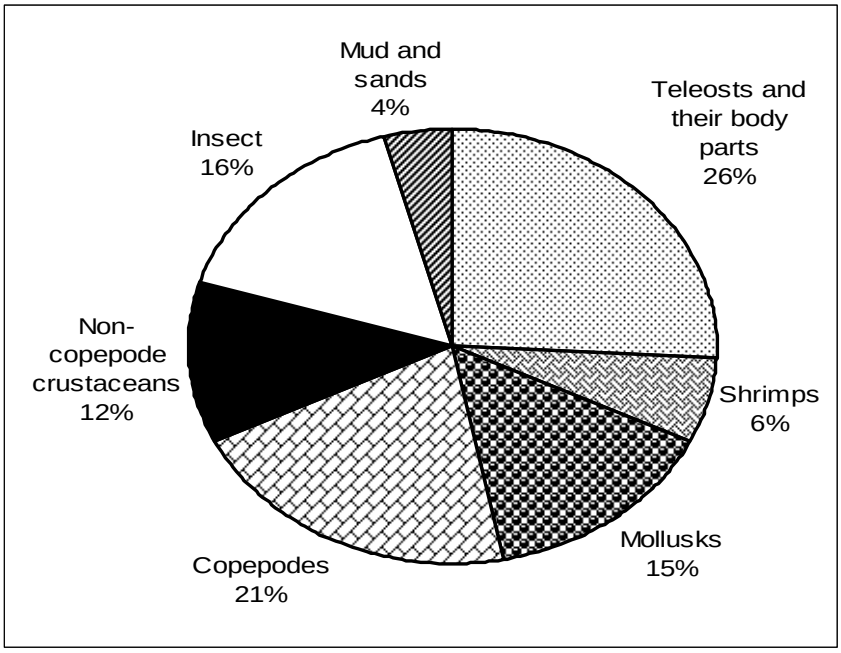


Fig-1. Proportion of food items in the gastro-intestine of *Rita rita* (May, 2010 to April, 2011)

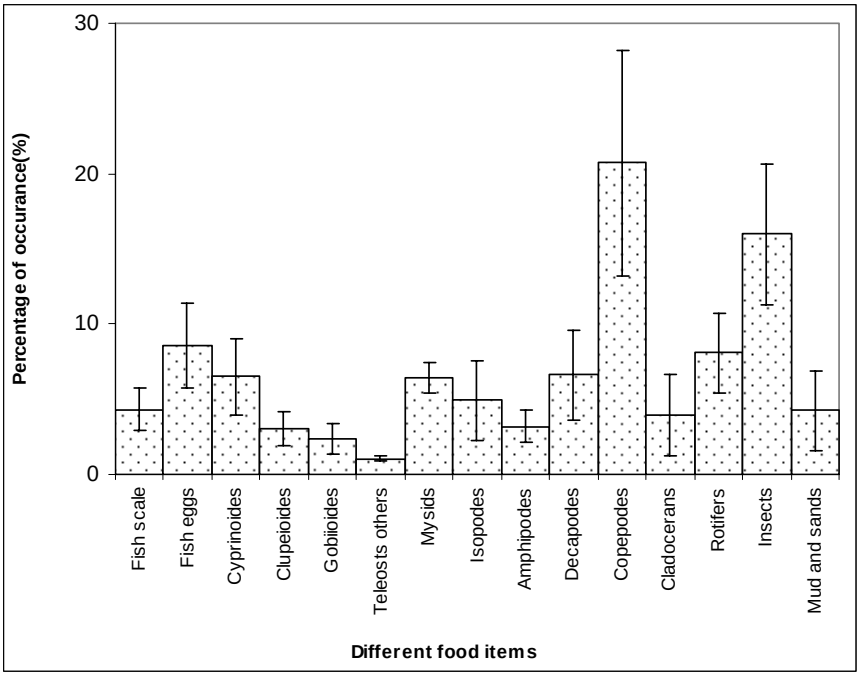


Fig-2. Percentage frequency of occurrence of different food items in the diet of the gastro-intestine of *R. rita* during the study periods (Vertical bars indicates standard deviations)

3.3 Food in relationship to fish size

Higher frequency of crustacean was found in of *R. rita* having standard length between 10.5-20.5cm, which decreased to lower frequency in 30.5-40.5cm size group. Higher frequency of rotifers (32.1%) and fish eggs (21.2%) and the lowest frequency of insect (1.2%) is found in the gut of *R. rita* having standard lengths between 10.5-20.5cm. Higher frequency of fishes, mollusks and insect is found in of *R. rita* having in 30.5-40.5cm size group. The highest frequency of Mollusks (33.2%), insects (27.1%) and teleosts (31.5%) and lower frequency of copepodes (9.1%) is found in the gut of *R. rita* in 35.5-40.5 cm size group. Higher frequency of mollusks (29.2%), insects (24.8%) and teleosts (28.2%) and the lowest frequency of copepodes (9.1%) is found in the gut of *R. rita* in 30.5-35.5 cm size group. *R. rita* takes different food items at a average frequency in 20.5-25.5cm size group such as teleosts (19.6%), rotifers (14.4%), mollusks (15.3%), insects (10.2%) and copepods (8.1%).

3.4 Feeding intensity

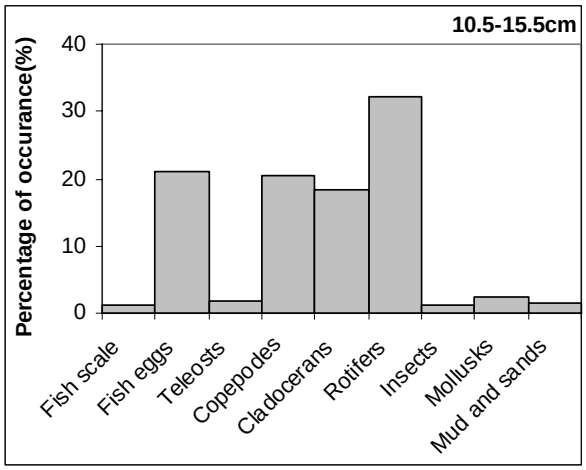
The gastrosomatic index of *Rita rita* fluctuated throughout the year (Fig.4). After a relatively low GaSI of 2.38 in July an increase up to 7.21 and 9.31 was recorded in both September and October relatively. An increase was observed during March (4.51) and April (4.74) due to pre-monsoon feeding before spawning period.

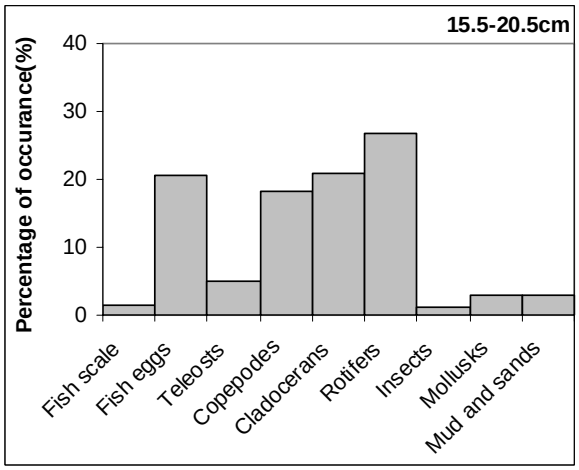
Monthly fluctuations were also witnessed in the percentage occurrence of stomachs with different degrees of fullness. It is evident that higher percentage of fullness of the stomach was recorded in October to November due to post spawning fattening process. The highest percentage of fullness (88%) was recorded in November. Higher percentage of emptiness of the stomach was recorded in June to August, due to starvation during reproduction. The highest percentage of emptiness (56%) was recorded in August. From September to November most of the fish contained full (average 28%), ¾

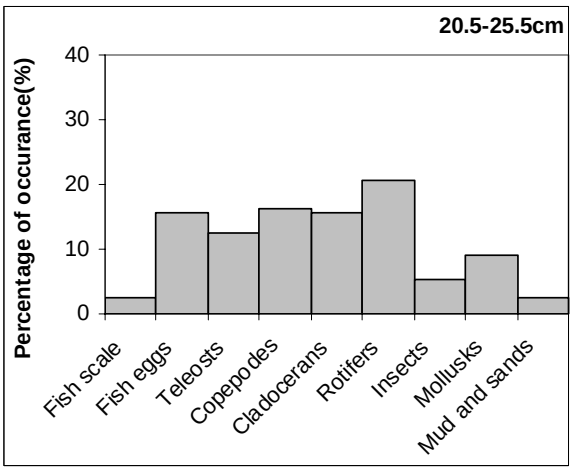
full (average 31%) and ½ full (average 22.3%)stomach where from June to August most of the fish contain ¼ full (average 22.6%) and empty (average 29.7%) stomach. In January, majority of the stomach is ¾ full(42%) and in August majority of the stomach was empty (34%).

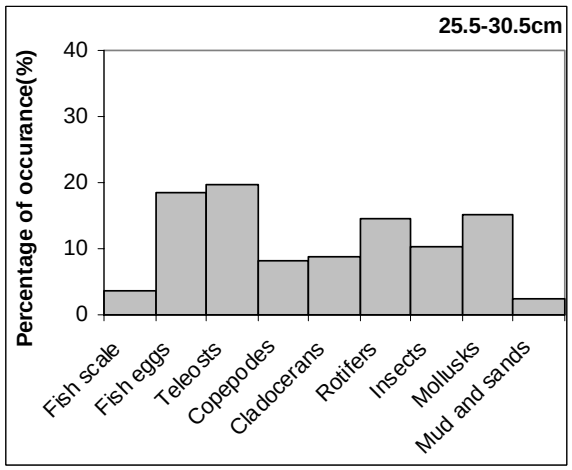
4 DISCUSSION

Rita rita is a carnivorous fish and they eat small fishes, crustaceans, and insects in the main food of the fish. The condition of feed was also related to maturity of fish. The adult fishes were found to be poorly fed in the breeding period while the immature fishes were found to actively feed in all the months. Frost (1945) reported that may fish change their food as they grow up. Bhuiyan and Islam (1991) recorded that the most important food item of the carnivorous *Ompok pabda* in adults was the fishes, crustaceans, protozoans and insects. The food groups such as copepods and cladocerans were recorded mostly in the gut contents of immature and juvenile fishes in *Mystus gulio* (Begum *et. al.,* 2008). Similar observation was found in *Notopterus notopterus* (Hossain *et al.,* 1990), *Heteropneustes fossilis* (Pal *et al.,* 1996), *Wallago attu* (Kumer and Roy, 2009) and *Mystus gulio* (Begum *et al.*, 2008) also made similar observations. Bapat and Bal (1950) concluded that *Herengula punctata* and *Nematolosa nasus* among the bottom feeders, mud and sand were found in large quantities in their stomachs. Das and Moitra (1955) noted that the surface feeders were both omnivorous and carnivorous which feed









ISSN 2278-7763

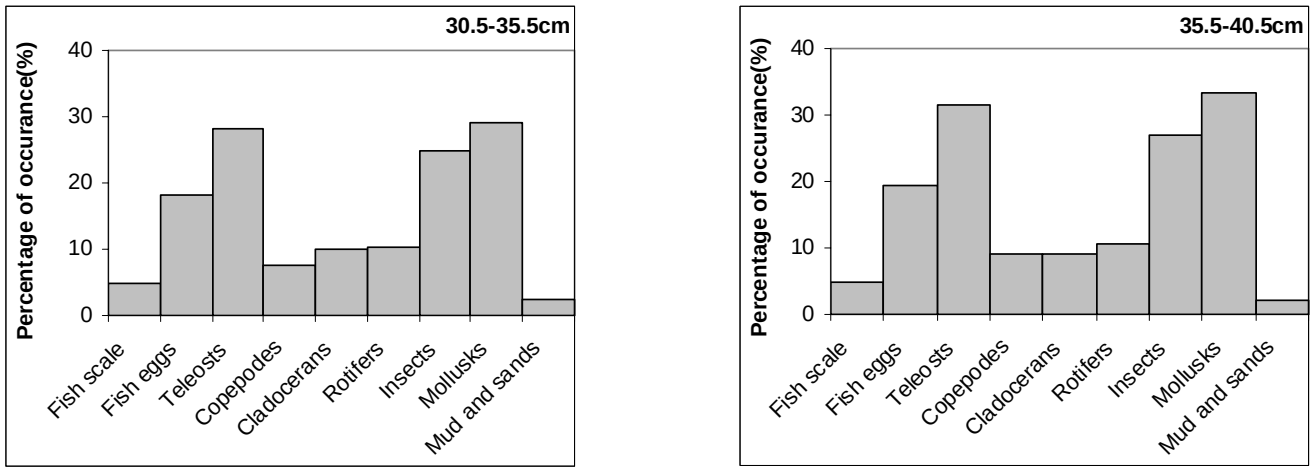


Fig- 3. Mean percentage frequency of occurrence of different food groups in different size classes of the gastro-intestine of *Rita rita* (May, 2010 to April, 2011)

TABLE-1.

MONTHLY PERCENTAGE FREQUENCY OF DIFFERENT PREY TYPES IN THE GASTRO-INTESTINE OF *RITA RITA* DURING THE STUDY PERIODS

Food items	Frequency of occurance (%)											
	2010								2011			
	May	June	July	Aug	Sept	Oct	Nov	Dec	Janu	Feb	Mar	Apr
Fish scale	2.8	2.7	2.4	2.3	4.8	5.1	4.8	5.6	6.4	5.6	4.8	4.5
Fish eggs	5.6	5.4	4.8	4.6	9.5	9.9	9.5	11.2	12.8	11.7	9.2	8.8
Cyprinoides	3.6	3.5	3.0	3.6	9.5	7.9	5.7	7.4	8.6	10.5	7.5	7.5
Clupeioides	2.1	2	1.8	1.5	2.1	3.4	4.2	4.4	5.1	3.6	3.2	2.9
Gobiioides	1.6	1.4	1.2	1.2	1.8	2.6	3.1	3.8	4.2	3.2	2.6	1.8
Other Teleosts	1.1	1.2	1.2	0.5	0.9	1.1	1.2	1.2	1.3	1.0	0.9	1.1
Mysids	7.2	7.4	7.5	7.7	6.9	6.8	6.4	5.8	5.3	5.0	4.9	6.0
Isopodes	2.2	2.5	2.7	2.9	3.1	3.8	4.9	5.1	5.8	7.9	10.5	7.5
Amphipodes	3.5	3.1	3	2.2	5.8	3.1	4	2.9	1.4	2.7	3.3	3.6
Decapodes	3.2	3.6	3.9	4.3	4.7	5.1	7.1	7.5	7.9	9.8	12.5	10.1
Copepodes	30.3	30.5	30.7	31	17.1	16.4	15.1	14.8	14.1	13.3	15.1	20.4
Cladocerans	7.6	7.3	7.2	7.1	3.0	2.8	2.4	2.3	2.1	1.7	1.5	1.4
Rotifers	12.1	11.8	11.2	10.3	8.1	7.6	6.7	5.5	4.9	5.2	6.5	6.9
Insects	10.2	10.6	11.1	11.2	20.6	22.4	22.8	19.5	17.4	16.5	15.8	13.5
mud and sands	6.9	7.0	7.9	9.0	2.1	2.0	2.1	3.29	2.7	2.4	1.6	4.0

ISSN 2278-7763

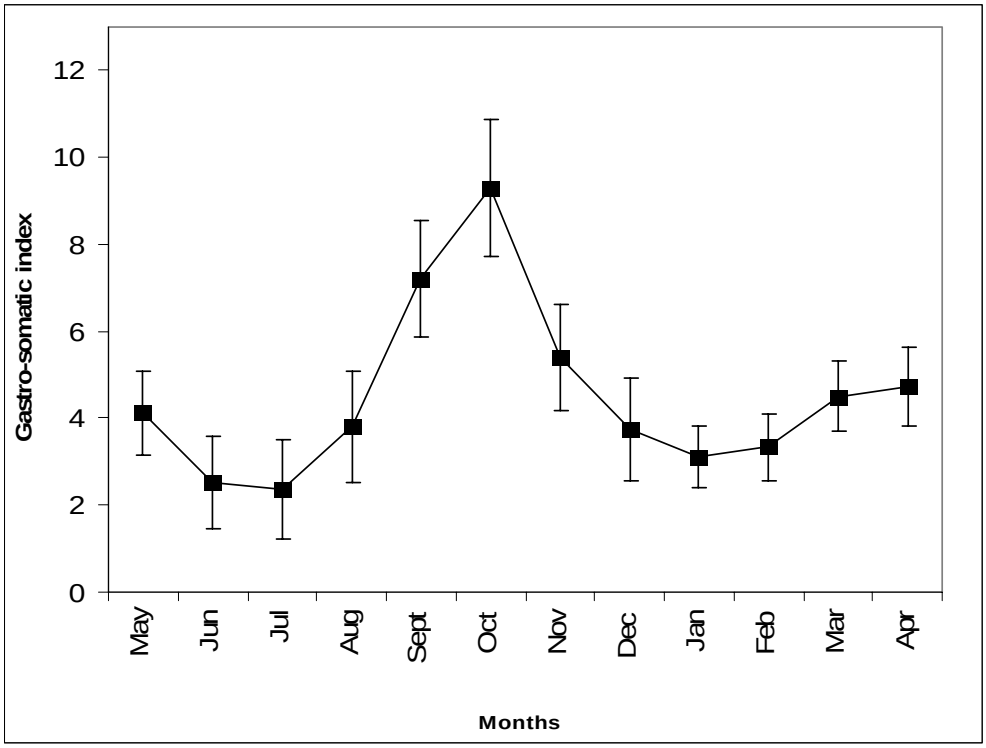
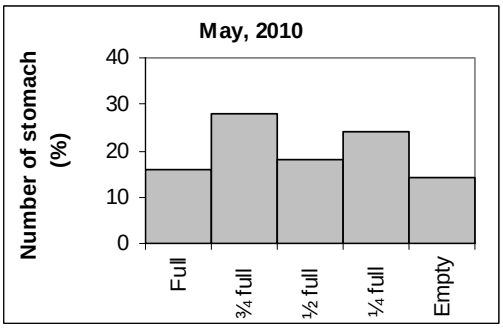
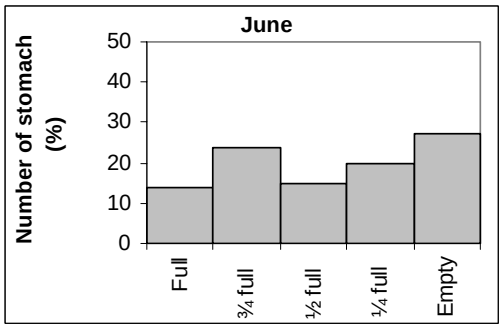
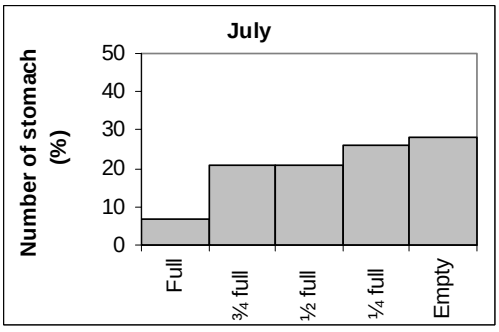
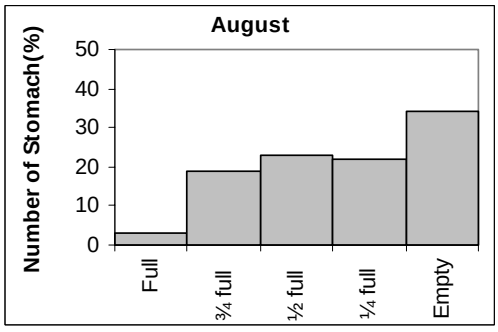


Fig-4. Monthly variations in the gastro-somatic index of *Rita rita* (Vertical bars indicate standard deviation)

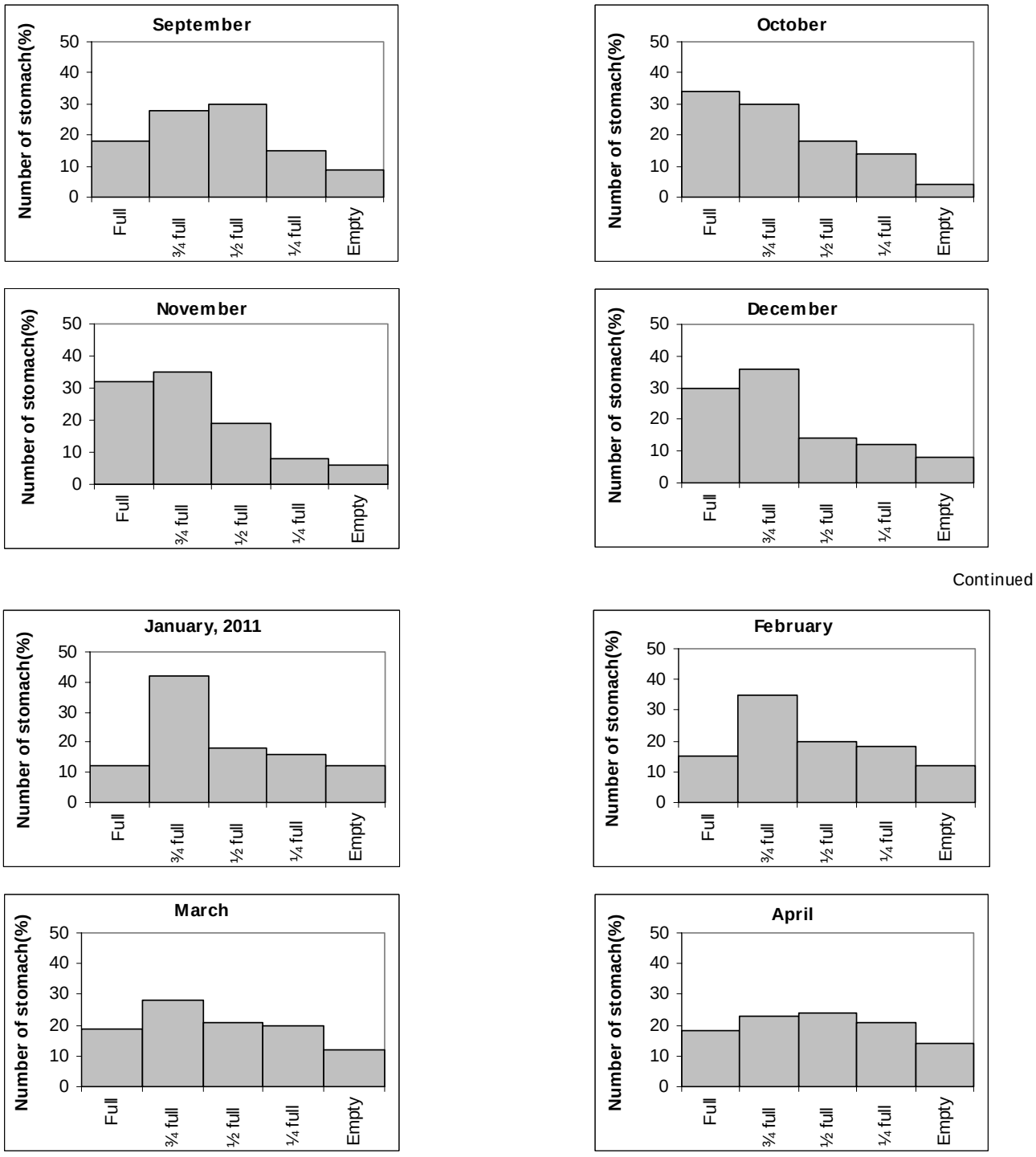








ISSN 2278-7763



Continued

Fig- 6. Monthly variation of stomach fullness of *Rita rita* during the study periods.

.

on algae, rotifers, micro crustaceans and their larvae, the mid or column feeders were herbivorous and carnivorous which feed on algae, aquatic plants, adults crustaceans, insects, fish, mud and sands, and the bottom feeders are herbivorous, omnivorous and carnivorous which fed ort decomposed aquatic vegetation, bryozoans, insects, crustaceans, mollusks, fishes, sand, mud etc. From the above finding, it may be concluded that *R. rita* in the Padda river of northwestern

Bangladesh feed throughout the year. The continuous feeding behaviour may be due to the prolonged favourable environmental conditions and productivity leading to intensive feeding throughout the year. However, variations were observed in feeding activity which correlated negatively with spawning in *Rita rita*. The GaSI in post-spawning period was higher, followed by pre-monsoon period before spawning. The lower values of GaSI was found in spawning periods of *Rita rita*. The findings are quite similar to the previous studies on *Channa punctatus* (Islam *et al.,* 2004), *Macrognathus pancalus* and *M. aral* (Abujam and Biswas, 2010), *Chitala chitala* (Sarker *et al.,* 2009), *Eutropiichthys vacha* (Abbas, 2010), *Pampus argentius* (Dadzie *et al.,* 2000), *Arius arius* (Kohli *et al.,*1996) and *Heteropneustes fossilis* (Karodt *et al.,* 2010). The feeding intensity in mature fishes was found to be very poor during the months of June to August. These periods of poor feeding activities in case of mature fish coincides with the peak spawning season of this fish and suggest a decline in feeding during spawning season. It was also observed that the maximum numbers of empty stomachs were recorded during the spawning season (June to August). The mature fishes showed active feeding intensities in other months. Similar type of results were also reported for *Notopterus notopterus* (Hossain *et al.,* 1990), *Eutropiichthys vacha* (Abbas, 2010), *Mystus numerous* (Khan *et al*.,1988), *Mastacembelus armatus* (Serajuddin *et al.,*1998), *Ompok pabda* (Bhuiyan and Islam, 1991). An inverse relationship between feeding and breeding cycles has been reported by many workers (Homans & Vladykov, 1954; Pandian, 1966; Desai, 1970; Bhatnagar and Karamchandani, 1979; Serajuddin *et al*., 1988; Fatima and Khan, 1993 and Jhingaran, 1997). Pantulu (1961) also reported a similar observation from his studies on the feeding intensity of *Mystus gulio* in the Hooghly estuary of India. He mentioned that, about 50-100% of the investigated *M. gulio* had 'empty' stomachs during the pre-spawning months to May and June respectively. After spawning in July, the fish fed intensively, more than 60% of the investigated fishes had either full or 'gorged' stomach. This high feeding intensity steadily decreased during the subsequent months, about 30% of the investigated fishes had hardly any food in their stomachs during December-January. These findings agree with the findings of Pandian (1966), who reported that analyses of the stomachs of the fishes collected in April revealed that more than 80% were starving, and the rest had only tracer quantities of food in the stomachs. Reddy and Rao (1987) studied the food of *Mystus vittatus* and observed seasonal variation in the rate of feeding. They recorded no uniform pattern in the two years of study. However, in general, the maximum rate of active feeding is during December to February as was observed by Bhatt (1971) in *Mystus vittatus* from Aligarh. Afsar (1990) reported high feeding intensity during September to October in the closely related fish *Clupisoma garua,* similar to the present study. Thomas (1966) stated that the low feeding activity may not be due to the shortage of food items but due to the spawning season of the fish. He also observed that the fishes in advanced stage of maturity had their abdominal cavities fully occupied by the voluminous ripe gonads and the stomachs were always empty. The determination of food habit was also reported by Mustafa *et al*. (1980) for *Nandus nandus*, Bisht and Das (1981) for *Tor tor* and *Nemaechilus rupicola,* Bhuiyan and Rahman (1983) for *Channa gachua*, Reddy & Rao (1987) for *M. vittatus*, Khan e*t. al.* (1988) for *M. nemurus*; Bais *et al.,* (1994) for *Channa punctatus* and Ali *et al*., (2003) for several species Mastacembelidae. They categorized these fishes either as carnivore or omnivore. From the above findings it can be concluded that the different food groups varied monthly in their abundance in the gut contents of the fish where it

showed some seasonal preference to certain food groups. The adult *R.rita* preferred to feed insects and crustaceans where the immature and juvenile fish preferred to feed on diatoms, copepodes, cladocerans and rotifers.

5 CONCLUSION

This study provides an important baseline study on *R. rita* from the Padda river of Bangladesh. The results of the study would be an effective tool for fishery biologists, managers and conservationists to initiate early management strategies and regulations for the sustainable conservation of the remaining stocks of these economically important species in the Padda River ecosystem. Moreover, information on the feeding habits of *R. rita* from the north-western part of Bangladesh is clearing lacking from literature and data bases. Therefore, the results of this study provide invaluable information for the online database, as well as providing an important baseline for future studies within the Padda River of Bangladesh.

ACKNOWLEDGEMENTS

The authors are grateful to the Department of Fisheries of University of Rajshahi for providing technical support. We also wish to thank Dr. Yeamin Hossain, Laboratory of Aquatic Resource Science, Faculty of Fisheries, Kagoshima University, Japan, for technical assistance and scholastic guidance during the study.

REFERENCES

[1] Abbas, A., 2010: Food and feeding habit of freshwater catfish, *Eutropiichthys vacha* (Bleeker). *Indian J.Sci.Res.* 1(2):83-86.

[2] Afsar M.R.,1990. Food and feeding habits of a teleostean fish *Clupisoma garua* (Ham.) in the Ganga river system. *J. Freshwater. Biol.*, 2:159-167.

[3] Ali, M.S., Rahman, M.M., Hossain, L. and Mollah, M.F.A., 2003: Studies on the food habits of three species of Mastacembelidae. *Bangladesh J. Fish. Res.* 7 (1): 43-52.

[4] Bais, V., Thakur, S. and Agarwal, S.S., 1994: Food and feeding activity of *Channa punctatus* (Bloch). *Freshwater Biol*. 6: 247-251.

[5] Bapat, S. V. and Bal, D. V., 1950: The food of some young clupeids. *Proc. Indian. Acad. Sci.,* 32, Sec. B, 39-58.

[6] Begum, M., Alam, M. J., Islam, M. A. and Pal, H. K., 2009: On the food and feeding habit of an estuarine catfish, *Mystus gulio* (Hamilton) in the south-west coast of Bangladesh. *Univ. J. Zool. Rajshahi Univ.* 27: 91-94.

[7] Bhatt, V.S. , 1971: Studies on the biology of some freshwater fishes. Part V. *Mystus vittatus* (Bloch). *J. Bombay Nat. Hist. Soc*. 68 (3): 556-572.

[8] Bhuiyan A.L.1964: Fishes of Dacca, Asiat. Soc. Pakistan, Pub. 1, No. 13, Dacca, pp. 68-69.

[9] Bhuiyan, A.S. and Haque, M.S., 1985 : The food and feeding habit of the fry of *Glossogobius guiris* (Ham-Buchanon) Gobidae: Perciforms from the river Padma. *Bangladesh. J. Aquaculture*. 6-7 (1): 31-34.

[10] Bhuiyan, A. S. and Islam, M. N., 1991 Obs: ervation on the food and feeding habit of Ompok pabda (Ham.) from the river Padma (Siluridae : Cypriniformes). *Pakistan J. Zool.* 23 (1): 75-77.

[11] Bhuiyan, A.S. and Rahman, K., 1983: Food and seasonal pattern of feeding of the freshwater snake headed fish C*hanna gachua* (Hamilton). BASS Proceeding of the 8th Bangladesh Science conference, Dhaka.

[12] Bisht, R.S. & Das, S.M., 1981: Observation on aquatic insects as food of fishes and the predatory action of some aquatic insects on fish and fish food. *J. Inland. Fish. Soc.*13 (2): 80-86

[13] Bowen, S. H. ,1985: Quantitative description of the diet. L.A.Nielson,D.L. Jhonson and S. Lampton (Eds.) Blacksburg fisheries Techniques, pp. 325-336.

[14] Dadzie, S., Abou-Seedo,F. and Al-Qattan, E.,2000: The food and feeding habits of the silver pomfret Pampus argenteus (Euphrasen) in Kuwait waters. *J. Appl. Ichthyol.* 16:61-67.

[15] Das, S.M. and Moitra, S.K. , 1955: Studies on the food of some fishes of Uttar Pradesh,Part I: The surface feeder, the mid feeder and the bottom feeder. *Proc. Nat. Acad. Sci. India,* 25B(I-2) : 1-6.

[16] Desai, V. R. , 1970: Studies on the fishery and biology of *Tor tor* (Ham.) from River Narmada. *J. Inland Fish. Soc. India,* 2: 101- 112.

[17] Devi, N. T., M. S. Siddique and Anwar. , 1992: On the food of catfish, *Rita rita* (Ham) from the river Yamuna in North. *J. Inland. Fish. Soc.India.* 20: 34-39.

[18] Dutta, S.P.S. 1994 : Food and feeding of *Channa punctatus* inhabiting Gadigarh Stream, Jammu, *Freshwater Biol*. 69: 333-336.

[19] Fatima M. and Khan A.A. , 1993: Cyclic changes in the gonads of *Rhingomugil corsula* (Ham) from river Yamuna, India. *Asian fish Sci.,* 6:23-29.

[20] Frost, W. E. , 1945: The age and growth of eels *(Anguilla anguilla)* from the Windermere catchment area, Part I. J. *Anim. Ecol.,* 14(1}:26-36.

[21] Homans, R.E.S. & Vladykov, V.D. , 1954 : Relation between feeding and sexual cycle of the haddock. *J. Fish. Res.Bd. Canada.* II: 535-542.

[22] Hossain, M. A., Parween, S., Taleb, A. & Rahman, M. H. ,1990 : Food and Feeding Habit of *Notopterus notopterus* (Pallas). *Univ. J. Zool., Rajshahi Univ*., 9: 1-6.

[23] Hynes, H. B. N. , 1950: The Food of Fresh Water Sticklebacks (*Gasterosteus aculeatus and Pygosteus pungitius*), with a Review of Methods used in Studies of the Food of Fishes. *J. Anim. Ecol.,* 19: 26-58.

[24] Hynes, H.B.N.,1990: The food of freshwater stickleback with a review of the methods used in studies of fishes. *J. Anim. Ecol*. 19: 41-57.

[25] Islam, M. N., Parvin, S., Hyder, F., Flowra, F. A. & Masud, A. A. , 2004: Food and Feeding Habit of Juvenile *Channa punctatus* (Bloch) from a Semi Closed Water Body in Chalan Beel Floodplain, *Bangladesh J. Biol. Sci.,* 4(3): 352-356.

[26] IUCN, Bangladesh. 2000: Red book of threatened fishes of Bangladesh, IUCN- The world conservation union. xii+116 pp.

[27] Jhingran, V.G. 1997: Fish and Fishes of India. Hindustan Publishing Corporation (India). 3rd edition. pp.xxiii+727.

[28] Karodt, S.A. and Radhakrishnan, C.K., 2010: Food and feeding habits of *Heteropneustes fossilis* (Bloch) from the Brahmaputra river system, Assam. *Indian J. Fish.* 43(1):97-101.

[29] Khan, M. S., Ambak, M. A. and Mohsin, A. K. M. ,1988:. Food and feeding biology of a tropical catfish *Mystus nemurus* (C&V) with reference to its functional morphology. *Indian.J. Fish*., 35(2): 78-74.

[30] Kohli, M.P.S. and Goswami, U.C.,1996: Seasonal variation in the gut content of *Arius arius* (Hamilton) from Coochin backwater. *Indian J. Fish.* 57(1):93-96.

[31] Kumer, D and Roy, S. P. ,2009: Food and feeding habits of some representative fishes of different trophic guilds of Kharagpur lake with a note of their role in energy harvest. *The Ecoscan*. 3 (1&2): 169-176

[32] Mirza, M. R. ,1982: A Contribution to the Fishes of Lahore. Polymer Publications, Urdu Bazar, Lahore. 48pp.

[33] Mirza, M.R. ,2002: Checklist of freshwater fishes of Pakistan. Department of Zoology, Government College University, Lahore, Pakistan.

[34] Mirza, M.R. and T. Omer, 1984: A key to the identification of the freshwater fishes of Baluchistan. Biologia. 30(1):73-91.

[35] Mishra, S. S., Acherjee, S. K. and Chakraborty, S. K. ,2009: Development of tools for assessing conservation categories of siluroid fishes of fresh water and brackish water wetlands of South West Bengal, India. *Environmental Biology of Fishes.* 84(4): 395–407.

[36] Mustafa, G., Ahmed A.T.M. & Islam, K.R. ,1980 : Food and feeding habit and fecundity of a freshwater perch, meni fish. *Bangladesh J. Agril. Sci*. 5 (4): 205-210

[37] Needham, J.G. & Needham, P.R. 1962: Guide to the Study of Freshwater Biology. 5th edition. Holden day Inc. San Francisco. 108 pp.

[38] Ng, H.H., 2010: *Rita rita*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. <*www.iucnredlist.org*>. Downloaded on 21 September 2012.

[39] Pandian, T.J. ,1966: Feeding and reproductive cycle of the fish *Mystus gulio* in the cooum backwaters, Madras. *Indian J.Fish*. 13 (182) XIII (1-2): 322-333.

[40] Pantulu, V.R. , 1961 : Determination of age and growth of *Mystus gulio* (Ham.) by the use of pectoral spines, with observations on its biology and fishery in the Hooghly estuary. *Proc. nat. Inst. Sci. India*. 27: 198-225.

[41] Pennak, R.W. ,1953: Freshwater Invertebrates of the United States. Ronald Press, New York. 769 pp.

[42] Prescott, G.W. ,1962 : Algae of the Western Great Lakes Area. Wm. C. Brown Co., Pub., Dubuque, Lowa. 946 pp.

[43] Rahman A.K.A. ,1989: Freshwater Fishes of Bangladesh, 1st edition, Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000, pp. 190-191.

[45] Rahman A.K.A. ,2005: Freshwater Fishes of Bangladesh, 2nd edition, Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000, pp. 210-211.

[46] Reddy, Y.S. & Rao, M.B. ,1987: A note on the food of *Mystus vittatus*(Bloch) from the highly polluted Hussain Sagar lake, Hyderabad. *Indian J. Fish*. 34 (4): 484-487.

[47] Sandhu, A. A. and Lone, K.P., 2003: Food and feeding habits of some catfishes of Pakistan, *Pakistan J. Zool.* 35 (4): 353-356.

[48] Serajuddin M.A. Khan, A. and Mustafa S., 1998 : Food and feeding habits of the spiny eel *Mastacembelus armatus.* Asian fish, Sci. 11:271-278.

[49] Shaji, A. I. ,1995: Freshwater fish diversity in Arlam Wildlife Sanctuary, Kerala, South India. *J. Bombay Nat. Hist, Soc.* 92:360-364.

[50] Smith,B.L. ,1977 : A guide to marine coastal plankton and marine invertebrate larva. Hunt Publishing Company. California.161 pp.

[51] Talwar, P.K. & Jhinagran, A.G. ,1991: In:Inland Fishes of India and Adjacent Countries. Vols. I & II. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India.

[52] Thomas, J.D. ,1966. On the biology of the catfish *Clarias senegalensis* in a man-made lake in the Gahnian Savanna with Particular reference to its feeding habits. *J. Zool*. 148: 476-514.

[53] Todd,C.D., Lavarack, M.S.,1991: Coastal Marine Zooplankton: A practical manual for student. Cambridge Uni. Press, Cambridge. 106pp.

[54] Ward, H.B. & Whipple, G.C. , 1959: Freshwater Biology. John Wiley and Sons, Inc., New York. 124 pp.

[55] Yashpal, M., Kumari, U., Mittal, S. and Kumar, A. , 2006: Surface architecture of the mouth cavity of a carnivorous fish *Rita rita* (Hamilton, 1822) (Siluriformes, Bagridae)". *Belg. J. Zool.* 136 (2): 155–162.