



ZOOPLANKTON IN A MANAGED POND IN RAJSHAHI, BANGLADESH

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Abstract: Twenty one genera of zooplankton were studied based on one year investigation of which 3 genera belonged to Cladocera (19.22%), 5 to Copepoda (36.13%) 12 to Rotifera (44.59%) and 1 to Ostracoda (0.06%).

Key words: Plankton, taxonomy, diversity, growth, development and periodicity

Introduction

The plankton is regarded as major index to compare the relative fertility and the fishery potential of different waters (Prasad, 1969). Islam *et al.* (2007), Begum *et al.* (1996), Chowdhury *et al.* (1989), Ali *et al.* (1985), Bhoyain *et al.* (1983), Ali *et al.* (1982), Das and Bhoyain (1981), Das and Das (1980), Islam and Aziz (1975) and Das and Bhoyain (1974) studied various aspects of zooplankton of Bangladesh. But a total list of zooplankton from diverse habitats of Bangladesh is yet far from complete. The authors made an attempt to study the physical, chemical, soil and biological condition, as well as their inter relationship and effect on the diversity, growth, and periodicity of plankton in a managed pond in Rajshahi, Bangladesh.

Materials and Methods

The study was carried for a year in a rectangular pond. It has an area 3762 M² with an average depth 2.68 M. The pond receives waste water discharged (washing, bathing etc.) from near by dormitory. Retenon (insecticide), Lime, Urea, TSP (75kg/ hac) and light organic manure (Mustered, oil cake, rice bran etc.) were applied in the pond. Dipterex was sprayed to kill insects and other phytoplankton and Aqua-nourish (silica powder) to prevent diseases of fish.

Plankton samples were collected in monthly intervals thrice a day (morning, midday and afternoon) on each sampling date round the year. The plankton was collected by plankton net of no. 20 silk bolting cloth. 75 litres of water was passed through the plankton net with the help of a plastic pan of 5 litre capacity. The water was passed down the net and the plankton was collected

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into a glass test tube fixed firmly at the lower end of the plankton net (Welch 1948). After collection the plankton materials were transferred to glass bottles and preserved permanently in Transeau solution (Transeau 1951). The quantitative enumeration of the zooplankton were carried out with the help of a Sedgwick Rafter counting cell and by drop method (Welch 1948). The abundance was expressed as units per litre (units l⁻¹) and figures of Zooplankton members were drawn by the help of camera lucida.

Results

Zooplankton of the pond constitute the minor bulk of the total plankton population (23.90%) (Table 1). They were mainly composed of the Cladocera, Copepoda, Rotifera. Only one genus of Ostrochoda was found and it was rare in present. The zooplankton population showed the highest peak (264991 units l⁻¹) in October and the lowest in September (24261 units l⁻¹).

Table 1. Seasonal distribution and abundance of zooplankton.

Name of the Genus	% of the Genus	Month of occurrence
<i>Cyclops</i>	9.48	October to February & May to September.
<i>Diaptomus</i>	19.01	October to March & July to September.
<i>Eucyclops</i>	0.80	October, December & January.
<i>Mesocyclops</i>	6.84	October to January & May to August.
<i>Daphnia</i>	6.89	February, March & August.
<i>Diaphanosoma</i>	9.47	November, February to August.
<i>Moina</i>	2.86	November, May & June.
<i>Stenocypris</i>	0.06	December.
<i>Asplanchna</i>	0.88	October to January, April, June to September.
<i>Brachionus</i>	25.58	Round the year.
<i>Cephalodella</i>	1.04	January & April.
<i>Filinia</i>	2.42	November, January, April, & May.
<i>Keratella</i>	1.50	October to March, August & September.
<i>Lecane</i>	0.67	October, January & April.
<i>Notholca</i>	1.13	October to December, February & June.
<i>Platylas</i>	0.06	January.
<i>Polyarthra</i>	6.67	October, November & April to September.
<i>Pomphodyx</i>	0.79	January & September.
<i>Rotaria</i>	2.88	October, January, April & September.
<i>Testudinella</i>	0.13	October.
<i>Trichocerca</i>	0.84	January.

Taxonomic Enumeration

Phylum-Rotifera

Order-Ploima Remane

Family- Brachionidae Ehrenberg

***Brachionus angularis* Gosse (P1. 1, Fig. 10)**

(Battish, 1992, 87, Fig. 72)

Lorica firm, lightly or heavily stippled, divided into dorsal and ventral plates; dorsal plate with pattern of cuticular ridges, moderately compressed dorsoventrally; anterodorsal margin with two median spines flanking a V- shaped notch; lateral and intermediate spine usually obliterated, intermediate spines may be present in some, mental margin rigid, some-what elevated with a shallow median notch; foot opening rather large. Some-what variable in shape; larger foot aperture in ventral plate flanked by cuticular protuberances; posterior spines wanting. Measurements: Length of lorica: 80-89µ, Maximum width of lorical: 76-83µ.

***B. budapestinensis* Daday (P1. 1, Fig. 6)**

(Battish, 1992, 86, Fig. 71)

Lorica firm, oval, divided into dorsal and ventral plates; ornamented with pattern of cuticular ridges on both dorsal and ventral plates, dorsoventral depth about two-thirds width, anterodorsal margin with four spines median pair longer than laterals, their distal end curved ventrally; posterior spines wanting; mental edge nearly straight, with small median unflanked notch; foot with v-shaped aperture dorsally and large oval opening ventrally.

***B. calyciflorus* (P1. 1, Fig. 9)**

(Bhouyain and Asmat, 1992, 110, Fig. 76)

Lorica is rather flexible, oval, not separated into a dorsal and a ventral plate. But body little compressed dorso-ventrally. Anterior dorsal margin with four broad based spines of variable length, medians longer than laterals. Mental margin rather flexible, usually some-what elevated with a shallow V or U shaped notch which is unflanked. Posterior spines present or absent. Posterolateral spines commonly absent, spines flanking.

***B. falcatus* (P1.1, Figs. 3 & 12)**

(Bhouyain and Asmat, 1992, 107, Fig. 73)

Lorica is firm, divided into a dorsal and a ventral plate, quite compressed dorso-ventrally. Anterior dorsal margin with six spines. The intermediates much longer than the other spines, curved ventrally; the laterals and median spines are short and of about equal in size. Mental edge moderately firm, with lateral sinuities, and a some-what undulate raised portion at times with a slight median sinus. Body terminates posteriorly in two long spines, widely separated at their bases, bowed and usually converging toward their free ends. A piece of posterior spines often some-what twisted. Foot opening between bases of posterior spines, a small dorsal aperture present on some specimens. Lorica lightly stippled, extremities of spines some-what serrated.

***B. nilsoni* (P1. 1, Fig. 2)**

(Bhouyain and Asmat, 1992, 112, Fig. 79)

Lorica more or less rounded. Anterior spines are narrow, pointed and short with a short strengthening ridge. Median sinus prominent.

***B. urceolaris* (P1. 1, Fig. 4)**

(Bhouyain and Asmat, 1992, 105, Fig. 71)

Lorica is firm, oval, composed of a dorsal and a ventral plate. The anterior dorsal margin six spines; medians longest, laterals and intermediates about equal in length mental margin rigid, undulate, some-what elevated towards the center, with a central sinus. Posterior spine absent. Foot opening a sub-square to rectangular aperture in the dorsal plate.

***Platyias patulus* (P1. 1, Fig. 5)**

(Edmondson, 1966, 452, Fig. 18.36)

Lorica 49.5 μ long and 36.5 μ broad in mid.

***P. polyacanthus* (P1. 1, Fig. 11)**

(Edmondson, 1966, 451 Fig. 18.30a)

With an even number of spines projecting forward from the dorsal anterior margin of the lorica.

Family -Philodinidae

***Rotaria citrinus* (P1. 1, Fig. 1)**

(Bhouyain and Asmat, 1992, 103, Fig. 68)

Foot with three toes. The body is long and slender, telescopically segmented without spur. Two separate lobes of corona at the anterior end.

Family-Lecanidae

***Lecane luna* (P1. 1, Fig. 17)**

(Bhouyain and Asmat, 1992, 140, Fig. 117)

Lorica broadly pyriform of subcircular. Dorsal and ventral plates with a deep lunate anterior sinus which cuspidate at its external angles. Posterior segment very small and rounded, projecting very little beyond the dorsal plate. Toes parallel sided, about one-third of the total length, terminating in a distinct claw, with a minute basal spicule.

Family- Trichoceridae

***Trichocerca braziliensis* (P1. 1, Fig. 13)**

(Bhouyain and Asmat, 1992, 151, Fig. 134)

Striated kell extending about less than one third of the length of lorica. Main toe longer than the body. The left manubrium smaller than the right and has a small spoon-shaped projection outwards. There is a small spine-like extension from the right side at the rami uncus complex. Length of Lorica 62.7 μ , Width of lorica 26.4 μ .

***T. cylindrica* (P1. 1, Fig. 7)**

(Bhouyain and Asmat, 1992, 150, Fig. 132)

Rotifera with an anterior spine called mucron which is bent but it is not prominent Toe is longer with much longer cylindrical body. Length of lorica 151.8 μ , Width of lorica 46.2 μ .

Family- Synchaetidae

***Polyarthra multiappendiculata* Arora (P1. 1, Fig. 19)**

(Battish, 1992, 107, Fig. 102)

Paddles twelve in number six on each side arranged in four groups, reaching slightly beyond posterior end of the body; two anterior antennae carrying long cillia at their tip present on anterior side, surrounded by ciliary wreath; lateral antennae small and hardly traceable; pair of setiform projections present on ventral side.

Measurements: Length of the body: 99 μ , Width of body: 69.3 μ .

Family -Asplanchnidae

***Asplanchna sieboldi* (P1. 1, Fig. 15)**

(Bhouyain and Asmat, 1992, 156, Fig. 139)

Vitellarium horse shoe shaped. The allulae a ring from the rami and there is single-spine like projection inwards in the middle of the rami.

Order-Flosculariacea

Family- Testudinellidae

***Filinia longiseta* (P1. 1, Figs. 8 & 14)**

(Battish, 1992, 111, Fig.106)

With characters of the genus, with two equal anterior setiform appendages and one posterior ventral or subterminal in position.

***Testudinella patina* (P1. 1, Fig. 16)**

(Bhouyain and Asmat, 1992, 160, Fig. 146)

Body is rounded, with one prominent lobe interiorly. Size variable. Foot opening approximately one-third from the posterior end and circular, ventral plate convex. Long 72.6 μ , 66 μ broad.

***Pomphodyx sulcata* (P1. 1, Fig. 18)**

(Bhouyain and Asmat, 1992, 191, Fig. 147)

Lorica egg shaped, divided into four lobes in cross section. Frontal edge raised into a lobe like projection dorsally, two elevations laterally and a shallow sinus ventrally. Cloacal aperture situated posteriorly. Eggs connected by elastic threads to the posterior end of lorica.

***Cephalodella megalcephalia* (P1. 1, Fig. 20)**

(Bhouyain and Asmat, 1992, 134, Fig. 107)

Body short, slightly constricted behind the neck. Lorica flexible, plates indistinct. Lateral cleft parallel sided. Foot small, below the projecting posterior portion of abdomen. Toes shorth, slightly curved, gradually tapering to acute points. Length of body- 125.4 μ ,Width of body 56.1 μ

Phylum-Arthropoda

Order-Copepoda

Family -Diaptomidae

***Diaptomus gracilis* (P1. 1, Fig. 30)**

(Bhouyain and Asmat, 1992, 45, Fig. 34)

Antennules symmetrical. Antennae biramous and symmetrical. Metasome of female without dorsal process fifth leg of male asymmetrical. Larger right leg 5 joined and shorter left leg 3 jointed. Left fifth leg short reaching almost. Half way upto tip of right leg. First segment Bears a short spine while second segment broader and consists of both eno and endopod. Its enopod bears numerous hairs on its inner margin and an out growth distally which inturn terminates into a curved spine that bears many hair like processes on its conven margin.

Family- Cyclopidae

***Cyclops bicolor* Sars (P1. 1, Fig. 27)**

(Edmondson, 1996, 139, Fig. 29)

Inner of the two middle terminal caudal setage only slightly longer than outer median sets and much shorter abdominal segments and caudal ramus comblind; first antenna of 10, or usually 11 segments.

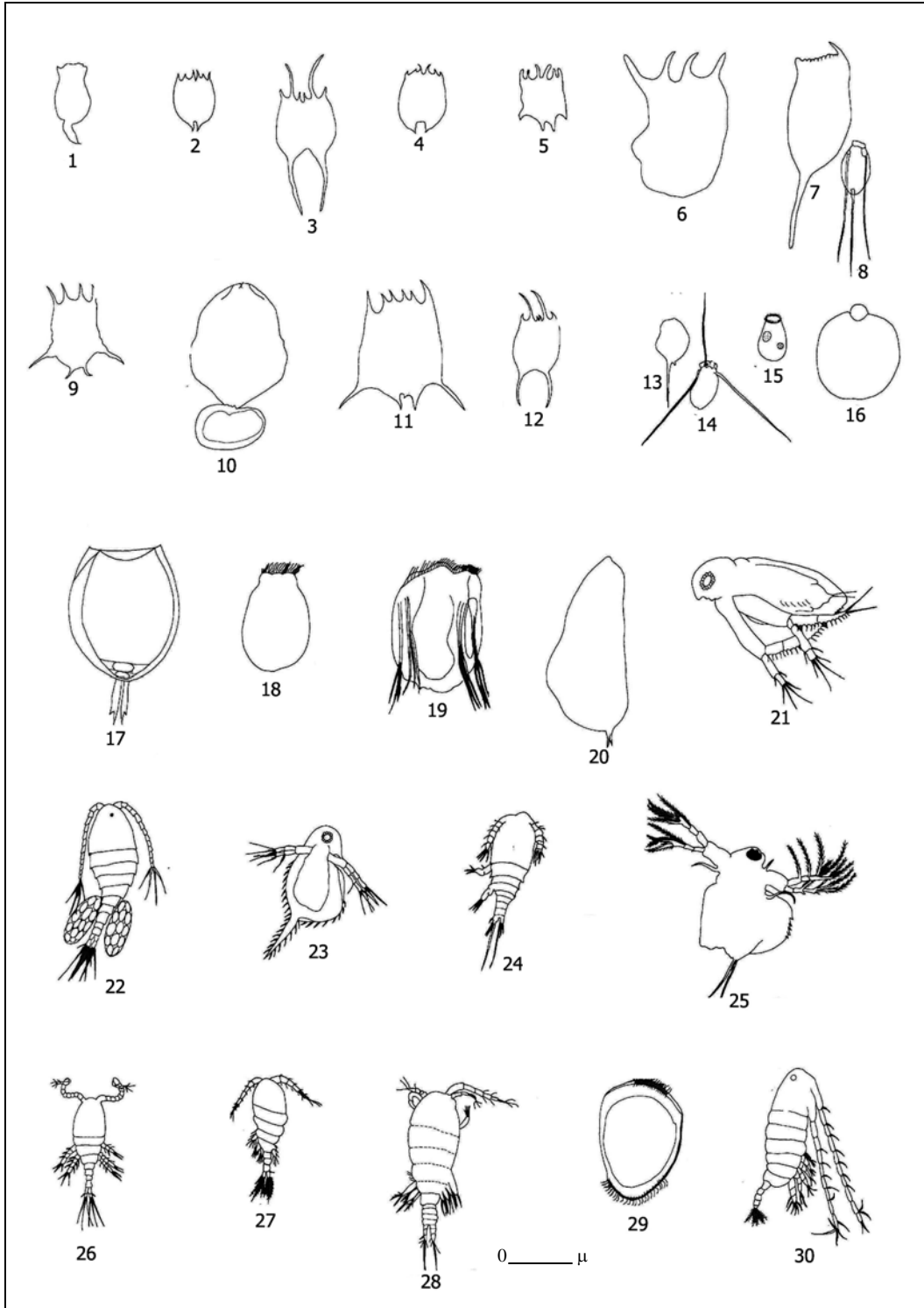


Plate 01

***C. nanus* (P1. 1, Fig. 28)**

(Bhouyain and Asmat, 1992, 59, Fig. 44)

Body slender with a distinct articulation between metasome and urosome, metasome 4 segmented. Second and 4th metasomal segments almost equal in length, while 3rd metasomal segment larger. Metasome 1.4 times longer than urosome including furcal rami. Both right and left antennules geniculated. Antenna uniramous and symmetrical. Each antenna 4 segmented. Antennule consists of less than 13 segments terminal segment of endopod of leg. with long inner spine and shorter outer spine at distal end. Innermost terminal caudal seta shorter than outer. Lateral caudal seta at about middle of ramus. Total length 72 mm; breadth 19mm.

***C. varicans rubellus* (P1. 1, Fig. 22)**

(Bhouyain and Asmat, 1992, 60, Fig. 46)

Body robust rounded at anterior tip and gradually decrease in size at posterior end. Articulation between metasome and urosome is distinct fifth leg with I segment, longer than broad. Without spine or inner side or if present, attached to middle of inner side. Inner of the two middle terminal equadral setae noticeably longer than outer median seta and at least as long as all the abdominal segments and the caudal ramus combined. Antennules consists of 11-12, segments. Total length of the male 0.50-0.65 mm; breadth 0.15-0.25 mm; metasome 0.35-0.45 mm and urosome 0.20-0.30 mm.

***Mescocylops leuckarti* (P1. 1, Fig. 26)**

(Bhouyain and Asmat, 1992, 63, Fig. 47)

Body robust with a distinct articulation between metasome and urosome. Metasome 4 segmented and 1.66 times longer than urosome including furcal rami. Distal segment of 5th leg armed with an apical seta and a long terminal or subterminal inner spine or seta. Inner spine of 5th leg at middle or just beyond middle of second segment. Last segment of antennules bearing hyaline plate with one or more distinct notches. Inner margin of caudal ramus without hair. Inner spine of second segment of 5th leg shorter than terminal seta. Antennules with a hyaline plate at last segment with one deep, rounded notch and sometimes several in distinct notches. Total length of male in 0.80-0.98 mm breadth, 0.23-0.36 mm metasome, and urosome 0.30-0.35mm.

***Eucylops agilis* (P1. 1, Fig. 24)**

(Battish, 1992, 187, Fig. 64)

Spinules at on the outer margin. Comparatively longer on 5 caudal rami. The antennules are 12 segmented leg 5 in comprised. Length of the body 0.39 mm; breadth 0.14 mm.

Order-Ostracoda

Fam.-cypridae

***Stenocypris fontinalis* (P1. 1, Fig. 29)**

(Bhouyain and Asmat, 1992, 84, Fig. 62)

Transparent thin bivalve shell covered the body. The natatory setae extends completely up to the tip of the terminal claw of the second antenna. The margins of the valves without prominent band of pore canals. The length of the body is approximately 92.4µm, width 66µm. Both types of furcal ramus curved. Broader furcal ramus armed with teeth and other smooth. Claw also armed with teeth. Third leg consist of a long reflexed setae.

Order Cladocera Latreille

Family-Moinidae Goulden

***Moina brachiata* (P1. 1, Fig. 25)**

(Battish, 1992, 141, Fig. 127)

Body stout with large and broad carapace. head large and depressed without rostrum and ocellus. Antennule large with olfactory setae. Anterior half of lower margin of valves with stout bristles,

posterior half with minute spinules. Antennules with 4 hooks. Post abdomen with 7-9 denticles. Claw with 1-2 basal spines dorsally placed.

Family -Daphnidae

***Daphnia similis* (P1. 1, Fig. 23)**

(Bhouyain and Asmat, 1992, 29, Fig. 21)

Body large and compressed laterally cervical sinus absent. Valves with posterior spines. No crest on the head. Antennule small and fixed placed behind the rostrum. Head without depression above the eye. Lateral shell well developed. Dorsal margin of postabdomen not sinuate. Anal spines 9 in number.

Family-Sididae

***Diaphanosoma beuchtembergianum* (P1. 1, Fig. 21)**

(Bhouyain and Asmat, 1992, 13, Fig. 3)

Body flattened, covered by transparent valve; ventral margin provided with 6-7 fine stout spines. Reflexed antennae exceeded. Posterior margin of the valves. Setal formula 0-1-3 / 4-8. Head broad, eye lencelate; distinct notch in between head and rest of the body. Ocellus, rostrum and fornix absent. Postabdomen without spine, claw with 3 basal teeth.

Discussion

Zooplankton is very important food for fishes specially the carnivores, which contribute a major role in the food chain in aquatic habitat. So many authors recorded that it is one of the main foods for fish such as Arora (1966), Mollah and Haque (1978), Debeljak *et al.* (1979).

Zooplankton constitute 23.90% of total plankton population of which Rotifers constituted the major portion followed by Copepoda, Cladocera and Ostracoda, Ameen *et al.* (1986), Begum and Alam (1987), and Islam *et al.* (2007) observed the dominance of Rotifers in their studied.

Cladocerans: This group was comprised of *Daphnia*, *Diaphanosoma* and *Moina*. The Cladocerans had their peak in Monsoon and Summer. The Winter population was poor. However, this group showed irregular pluses during the period of study. Das & Srivastava (1965) reported such Cladoceran pulses in Lucknow Tanks. Berg (1929), Smyle (1957), Straskraba (1965) and Islam *et al.* made similar observations in their studies. The diurnal variations and their vertical migration revealed that the Cladocerans were dominantly present in morning. Welch (1952), Pennak (1944) and Krishnamurthi *et al.* (1965) described light is the principal factor for vertical movements of the Cladocerans during the high solar illumination, the organisms naturally avoid light and retreat to deeper regions (Krishnamurthi *et al.* 1965) which supports the above mentioned results for Cladocerans. Hutchinson (1967) stated that the vertical distribution by day or by night varies systematically with the development of thermal stratification in Summer. Further it may be supposed that thermal and chemical gradients as well as differences in illumination, determine the distribution of zooplankton abundance in a water system. In the month of March *Daphnia* sp. showed an abnormal size of growth (lorica 1.5 m.m long) when Diatoms showed highest Peak, Diatoms contribute a major role in the food chain in aquatic habitat. It may be occurred that Diatoms were preferred by the *Daphnia* sp. So, they taken diatoms in a large amount and it was the possible reason of their abnormal growth.

Copepods: The copepods with five genera *Mesocyclops*, *Cyclops*, *Eucyclops*, *Diaptomus* and *Calanus*, constitute the second large zooplankton group in the pond. *Calanus* and *Cyclops* were found to dominant over the other genera. A peak in the copepod populations was observed in October, other peaks, were observed in December and July when P^H values were found 8.4, 8.5, and 7.6 and DO values were recorded 5.52 mg l⁻¹, 5.61 mg l⁻¹ and 5.75 mg l⁻¹.

All the genera of copepods recorded in presence of light. Their abundance increased as the intensity of light and they exhibited a resersed migratin. Worthington (1936) while observing vertical distribution of *Eudiaptomus gracilis* (adult), *Mixodiaptomus* (adult and young), *Cyclops strenuous* (adult and young), also observed similar kind of migration pattern.

Rotifers: Rotifers were represented by 12 genera of which *Brachionus* appeared to be dominant over others and exhibited highest abundance. The other dominant genera of Rotifers were *polyarthra*, *Asplanchna*, *Rotaria*, *Filinia*, *Keratella* and *Notholca*. The Rotifera population prolonged in Summer and decrease in the Monsoon, probably due to water movement and increased again in the Post Monsoon. The abundance of Rotifers was comparatively lower in winter, followed by a sudden rise in the last month of winter. Similar observations were made by Georage (1966) in India. The occurrence of large number of the Rotifers indicated the trophic nature of pond. Arora (1966) observed that the Rotifers occurred in eutrophic water in high abundance, although, they equally appeared in mixotrophic water too. Arora (1966) reported the occurrence of some species of *Brachionus*, *Keratella* and *Filinia* from polluted and eutrophic waters. Pejler (1957) and Bergins (1949) recorded *Asplanchna* and some other Rotifer from eutrophic waters. Pejler (1957) also reported some species of *Brachionus*, *Keratella* and *Filinia* from mixotrophic water. Thunmark (1945), Lillieroth (1950), Berzins (1949) and Arora (1966) designated a large numbers of Rotifer genera including *Brachionus*, *Keratella* and *Filinia* as indicator of eutrophic as well as polluted water, although the level of pollution and the pollutants were not clearly typified by them. Nayer (1965) pointed out that P^H and dissolved organic content of water influence the abundance of Rotifera population, where water temperature played a positive role. Ahlstrom (1940) reported the absence of *Brachionus* from acidic waters, while green (1956) reported the absence of *Brachionus* from water with P^H above 8.5. The pond studied was highly productive and congenial environment for Rotifers. The pond water enriched with nutrients of biological significance, the abundance of Rotifer population may not fit as an index of polluted water in this habitat. The oxygen regime of the pond studied unpolluted nature.

Conclusion

The plankton considered to be the best index of the biological productivity and the nature of aquatic habitat. In fish pond not only the production of plankton but also the right type of plankton production is very much essential for the successful rearing of the fish. To know water quality and to do pisciculture research on plankton is very important. Present study was such an attempt to know the taxonomy, abundance and periodicity of Zooplankton. By Such more study we will be able to make a complete list of zooplankton of Bangladesh as well as their impact on water quality and pisciculture.

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