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Variation in the Plankton Abundance, Biomass and Diversity of Municipal Pond and Bukvora Baor at Jashore District, Bangladesh

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Abstract

This is the first approach to identification, abundance calculation; biomass analysis and diversity evaluation in two water bodies namely, Municipal pond and Bukvora baor at Jashore district, Bangladesh. The present study was conducted to find out the abundance and species diversity of plankton, water quality parameters in pond and baor environment. However, Municipal pond that is located at the central point of Jashore town and Bukvora baor that is located at sadar upazila in Jashore district. Study also concentrated on the comparison about abundance, species diversity and water quality parameters between pond and baor. Water samples were collected in each month throughout the study period from May, 2016 to August, 2016. Different water quality parameters such as air temperature, water temperature, dissolve oxygen; pH and transparency were measured in every month. The mean water parameters such as air temperature, water temperature, dissolve oxygen; pH and transparency were 30.4±2.30°C, 32.25 ± 2.6°C, 5.7±0.35 mg/l, 7.05 ± 0.39 and 19.9 ± 2.6 cm, respectively in pond. In baor, the mean water parameters such as air temperature, water temperature, dissolve oxygen, pH and transparency were 33.45 ± 1.19°C, 33.15 ± 1.49°C, 5.03 ± 0.15 mg/l, 8.45 ± 0.36 and 24.95 ± 2.6 cm, respectively. A total of 30 phytoplankton species have been found in the study area of which species under four groups; namely Cyanophyta (5), Heterokontophyta (3), Chlorophyta (11), Euglenophyta (2) have been identified and nine species were unidentified. Phytoplankton species distribution was not uniform. Chlorophyta species was most dominant group in both environments. Major four groups of zooplankton identified in study area both pond and baor; namely Cladocera (10%), Copepoda (55%), Ostracoda (3%), Rotifera (15%). In addition Nauplius (2%), Tunicata (4%), Insect larve (5%) fish eggs (6%) were also identified. Copepoda species was most dominant group in both environments. Plankton diversity was highest in June occurred in both environments.

Keywords: *Plankton abundance, biomass, diversity, municipal pond, Bukvora baor, Jashore, Bangladesh*

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INTRODUCTION

Ponds are relatively shallow bodies of standing water and are generally rich in biodiversity [34]. The plankton community is comprised of the primary producers or phytoplankton and the secondary producers or zooplankton [9]. Phytoplankton is the major primary producers in many aquatic systems and is important food source for other organisms [22]. Phytoplankton not only serves as food for aquatic animal but also play an important role in maintaining the biological balance and quality of water [10]. Zooplankton constitutes important food item of many fishes. The larva of carps feed mostly on zooplankton [25]. Zooplankton also plays an important role in the food chain, as they are

second in trophic level as primary consumers and also contributes to the next trophic level [1]. The pH, dissolved oxygen, alkalinity, hardness, turbidity and the dissolved nutrients are important for the plankton production [7]. On the other hand, zooplankton makes bridge in food chain between the primary producers and nektonic as well as benthonic animals in apex trophic levels. The abundance of plankton in a water body is regarded as an indicator of productivity. Growth and abundance of plankton varies with season and depth and depends upon meteorological and water properties. The availability of plankton in both measures as, qualitative and quantitatively a fish pond has the enormous values and impacts in maintaining the fruitful aquaculture practices, as they differ from place to place as well as water body to water body within the similar location even within adjacent ecological situations [14]. Some of the works which have been done in Bangladesh include those of Bhuiyan and Nessa [12] and Bhuiyan et al. [13]. Although scientists worked on plankton population over the world, but there are a small or no work has been done on the abundance of plankton population, its diversity, biomass analysis in aspect of physico-chemical conditions of water bodies of Jashore, Bangladesh. Therefore, the current study has purposed to achieve attention to the occurrence and abundance of plankton population, its diversity, and biomass analysis in well recognized two water bodies in aspect of physico-chemical conditions of Jashore, Bangladesh. Scientifically, plankton is miniature organisms that contribute the base of food chains and food webs in all aquatic ecosystems. Zooplankton takes phytoplankton as their feed and straightly involved with the growth of fish especially prawn and shrimp. That's why the plankton study carries enormous significance. Though, majority forms of plankton are motile, and the distributions of either phytoplankton or zooplankton are both vertically and horizontally may be quite variable. Different plankton serves vital food item of omnivorous and carnivorous fishes [4]. The plankton contributes about 23% of the food item of shrimp [4], 32% of the *Notopterus notopterus*, 47% of the *Catla catla* and 6.37% of the *Labeo rohita*. Their abundance and diversity greatly influence the culture system through maintaining oxygen concentration in water, ensuring the balance between O_2 and CO_2, enhancing the decomposition of organic matters accumulated in the pond, preventing the development of demersal microalgae and pests, stabilizing water temperature in the pond, regulating pH value and the ecosystem of the pond and also minimizing the variation of water quality parameters. The relationship among the physico-chemical parameters, plankton production as well as plankton abundance in water bodies and their relation with year round changes in diversity and biomass has great importance and basically has tremendous essentiality in case of aquaculture and fisheries management. Although in aquaculture fishes are severely relies on physical factors like, temperature of water, dissolve oxygen, pH, alkalinity, free CO_2 and in case of coastal aquaculture; salts for their growth, nourishment, healthiness and developments. Any fluctuation of these mentioned parameters can cause affect the growth; development, healthiness and maturity of fish [25]. As above mention parameters are also involved with the growth, nourishment and development of plankton population. Plankton abundance and species may vary from one water source to another because of variation of physic-chemical parameters. They may also vary from season to season due to fluctuation of physic-chemical parameters. The physico-chemical parameters like water temperature dissolve oxygen, pH, alkalinity, hardness, presence of concentration of nitrogen; and plankton communities together form a comprehensive ecosystem and in such ecosystem, there are interactions between plankton and physic-chemical parameters. These interactions are directly or indirectly subjected to the complex influences some of which results in quantitative changes e.g., the size of the population increases or decreases. So it is needed to study with plankton abundance and diversity. In order to fisheries development and to increase the present fisheries production; proper and scientific research conduction is essential for every part of the world. To conduct such research and development; plankton identification, abundance, species composition and diversity is one of the most important topics. Although a few researches have been carried out their research about plankton population but those are not satisfactory enough

and in case of this study it is the first approach to investigate the plankton population and abundance in this region; so, further study can be carried out for more specific investigation. The present study has been undertaken to know about plankton abundance and biodiversity in two different water bodies. The result of this study will be helpful to provide baseline information for future studies on this topic. The main objective of this present study is to identify abundance and year round diversity of plankton and the levels of water quality parameters in Municipal pond and Bukvora baorin in Jashore district, Bangladesh.

MATERIALS AND METHODS

Study Area

The study area was selected in two different water bodies. a) Municipal pond that is located at the central point of Jashore town b). Bukvora baor that is located at Jashore Sadar Upazila in Jashore district. Study period- The experiment was conducted during May, 2016 to August, 2016 (Figure 1).

Sample Collection

Samples were collected in each month from May, 2016 to August, 2016. Random sampling method used for collecting water sample. Samples were collected by passing water throw plankton net. Approximately 40 liters of water was passed throw the plankton net and the concentrated sample value became 50 ml plankton net, glass jar were used for sample collection. After collecting sample they were preserved with lugol solution (20 g Potassium iodide (Ki) and 10 g iodine crystals dissolved in 200 ml distilled water containing 20 ml glacial acetic acid). Lugol solution was added in an amount of 0.7 ml per 100 ml of sample. After preservation the plankton samples were carried our laboratory for further analysis.

Measurement of Physicochemical Parameters

In this study physicochemical parameters including air and water temperature, transparency, pH and DO measured (Table 1).

Water and Air Temperature

Temperature was measured in the field immediately. Water and air temperature was measured with a mercury filled Celsius thermometer ranging 0 to 150°C to measure water temperature, the thermometer was dipped into the water for one minute and reading from the thermometer was recorded.

Transparency

Transparency was measured at the time of sample collection. A sec chi disc was used to measure the transparency. First the sec chi disk lowered into the water until it has just disappeared and the depth was recorded from its elongated scale. Then the sec chi disk was raised until it has repaired. In this time the depth was not noted. The average of two depths gave the transparency value in centimeter unit.

pH

pH of the water also measured in the field. Water pH measured directly from water by using digital pH meter (model No 7200, ezdo, made in Taiwan). Before using instrument it was calibrated with pH 7 and pH 10 buffer solutions. Before taking each pH reading, the electrode was washed well by the distilled water.

Dissolved oxygen (DO)

Dissolved oxygen of water was measured directly by using digital DO meter (model YK 22DO, Made in Taiwan).

Measurement of Biological Parameters

Phytoplankton Abundance

Abundance of phytoplankton was measured with the help of glass slide and photographic microscope. Plankton was counted by Rafter cell S50 (Microliter).

Plankton Identification

Then small amount of sample was taken by dropper and putted on the slide glass and observed under photographic microscope to identify plankton (phytoplankton and zooplankton).

Counting

To count zooplankton, microscope observation was done and counted each species group from of 1 ml sample. The same way was followed and counted total 15 ml concentrated sample. Then accounted average individuals in each 1 ml sample and then counted the total number by multiplying with 50 ml.

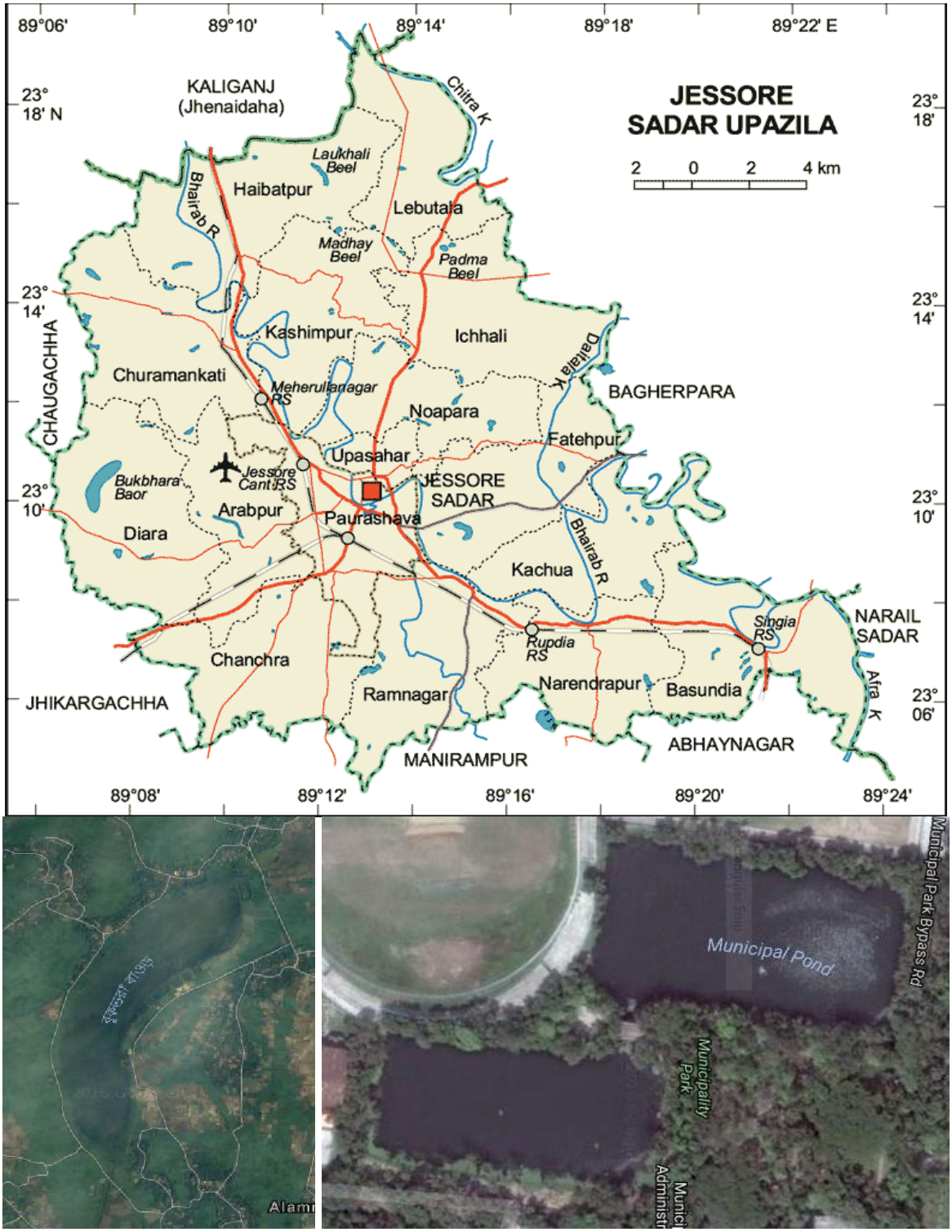

Fig. 1: *Map of showing the Study Area.*

Table 1: *Methods or Instruments used for the Determination of Water Quality Parameters.*

Category of parameters	Parameters	Units	Methods/ Instrument
Physical parameters	Temperature	°C	Mercury Filled Celsius Thermometers
	Transparency	Cm	Secchi disk
Chemical parameters	PH	N/A	Digital pH meter (model no 7200, ezdo, made in Taiwan)
	DO	Mg/L	Digital DO meter (YK22DO, made in Taiwan)
Biological parameters	Plankton abundance	Units/L	Glass slide and microscope
	Species composition	N/A	Zooplankton were identified by using checklist of different scientists

The cells/ liter of original water can be calculated by the following formula:

$$N = \frac{A \times 1000 \times C}{L}$$

Here, N is the No. of plankton cells/ liter of original water, A is the Average number of plankton cells in 1cubic mm, C is the Volume of final concentrate in ml, L is the Volume of original water expressed in liters.

Data Analysis

The collected data were put down in to tables and Microsoft excels 2010. Once the data were inputted, then analysis was done according to research presentation. The column and bar are the most preferable figure in case of this study so the team preferred to choose them as the way of presentation of data.

RESULTS

Physiochemical Parameters

Air Temperature

Range of air temperature of Municipal pond and Bukvora baor was found to vary from 27.7 to 33.4°C and 30 to 38°C.

Water Temperature

Range of water temperature of Municipal pond and Bukvora baor was found to vary from 31 to 34°C and 30.8 to 36°C. Water temperature distribution at different months in Municipal pond and Bukvora baor is shown in Figure 2.

Dissolved Oxygen (DO)

Range of water temperature of Municipal pond and Bukvora baor was found to vary from 5.0 mg/l to 6.6 mg/l and 4.3 mg/l to 5.5 mg/l. Variation of dissolved oxygen at different months in Municipal pond and Bukvora baor is shown in Figure 3.

P^H

pH of pond water ranged from 6.33 to 7.8 and baor water ranged from 8.0 to 8.8. Variation of pH at different months in Municipal pond and Bukvora baor is shown in Figure 4.

Transparency

Transparency of the Municipal pond and Bukvora baor also found to be variable. It was changed from 18.3 to 22.0 cm and 23.6 to 26.3 cm. Variation of Transparency at different months in Municipal pond and Bukvora baor is shown in Figure 5.

Plankton Diversity

Diversity of Phytoplankton in Pond and Baor

Phytoplankton abundance varied from 5 to 85 units/L. Four groups of phytoplankton were found namely Cyanophyta (5), Heterokontophyta (3), Chlorophyta (11), Euglenophyta (2) have been identified and nine species were unidentified. Phytoplankton species distribution was not uniform. Chlorophyta species was most dominant group in both environments (Figure 6, 7, 8, 9 and 10).

Diversity of Zooplankton in Pond and Baor

Zooplankton abundance varied from 30 to 75 units/L. Four groups of zooplankton were found namely Cladocera (10%), Copepoda (55%), Ostracoda (3%), Rotifera (15%). In addition Nauplius (2%), Tunicata (4%), Insect larve (5%) fish eggs (6%) were also identified. Copepoda species was most dominant group in both environments (Figures 11, 12, 13, 14, 15, 16 and 17).

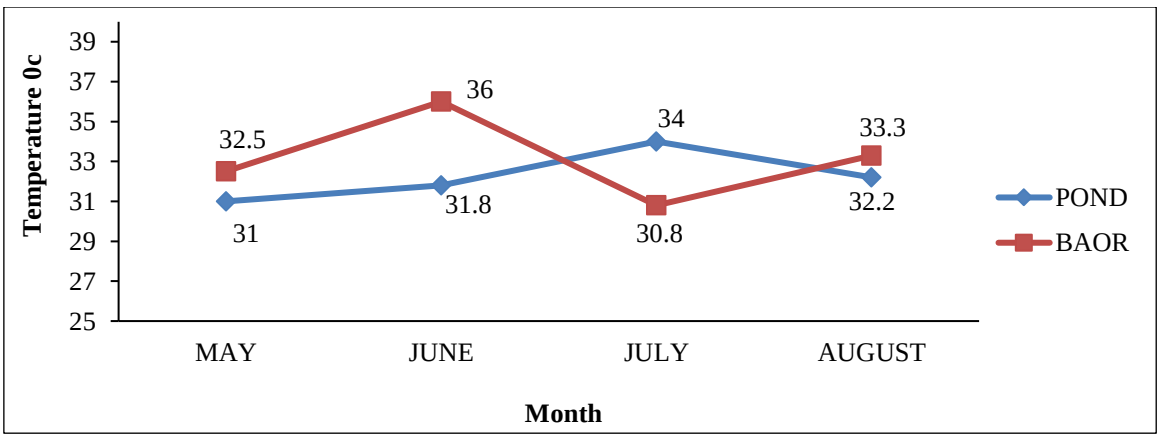

Fig. 2: *Water Temperature Distribution at Pond and Baor.*

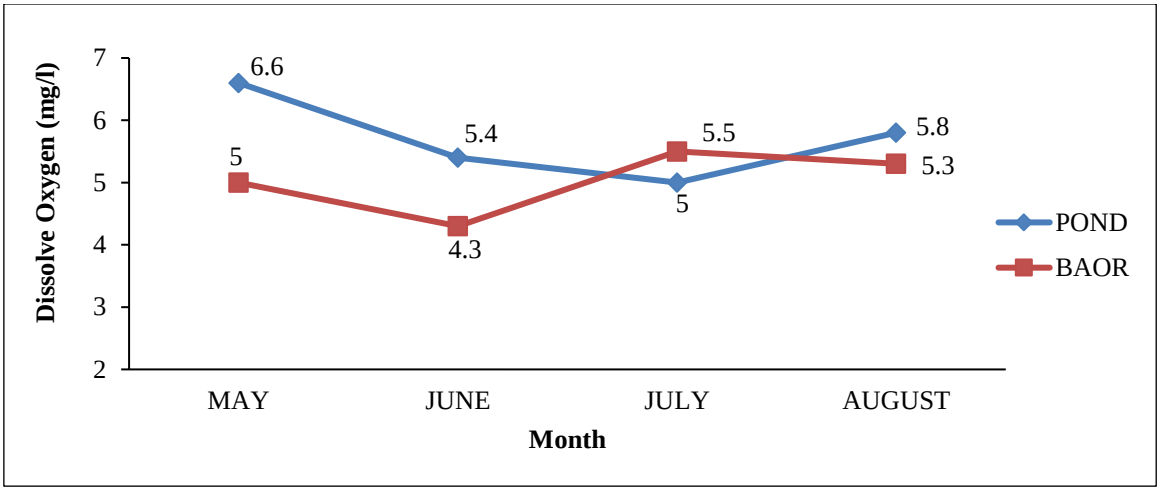

Fig. 3: *Dissolve Oxygen Distribution at Pond and Baor.*

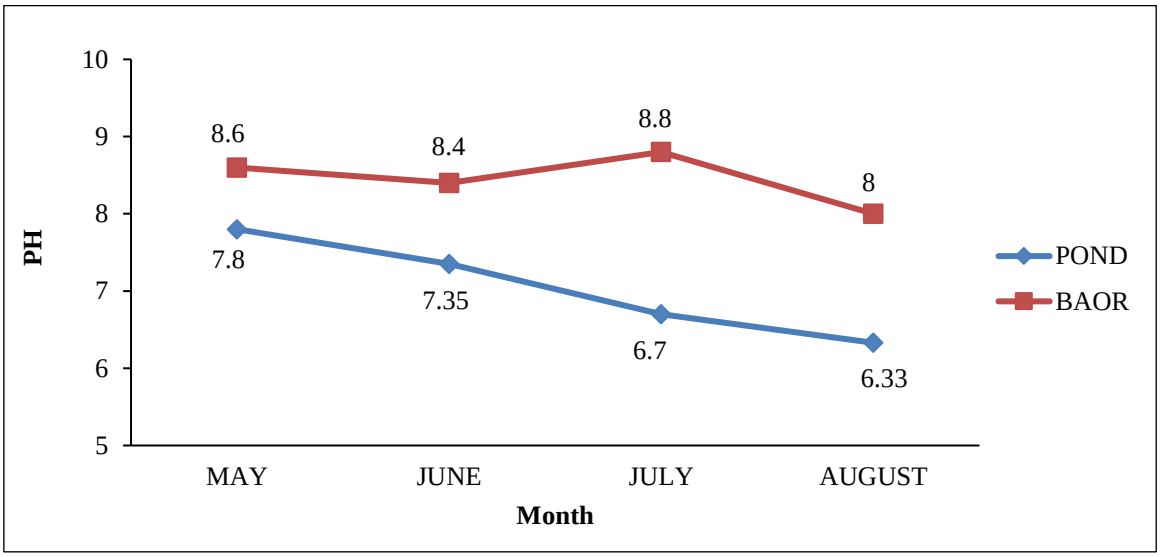

Fig. 4: *pH Distribution at Pond and Baor.*

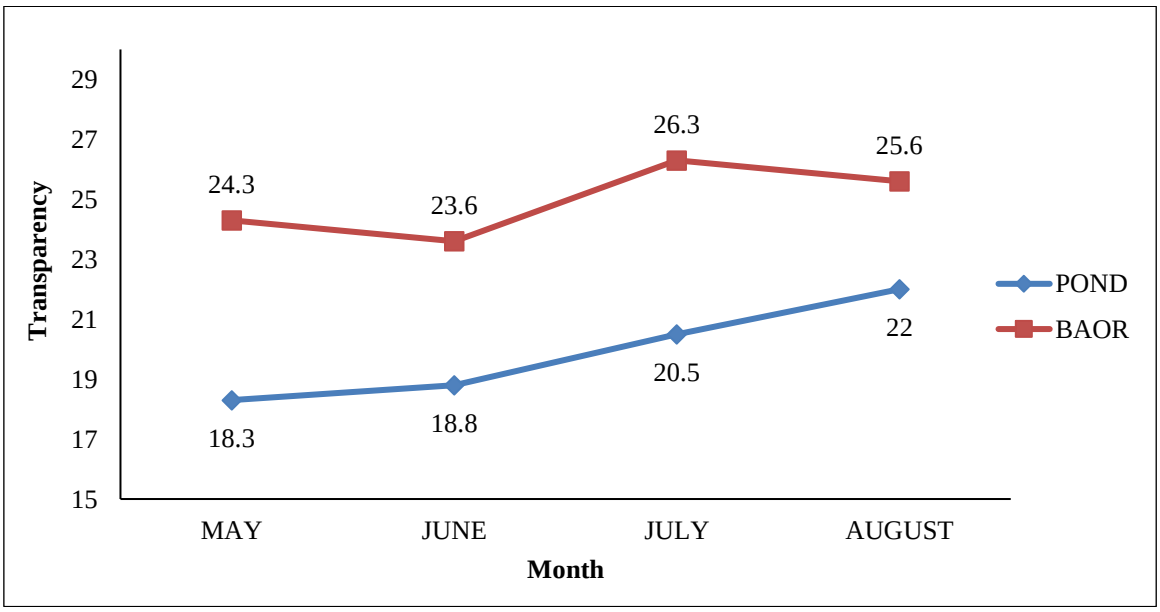

Fig. 5: *Transparency Distribution at Pond and Baor.*

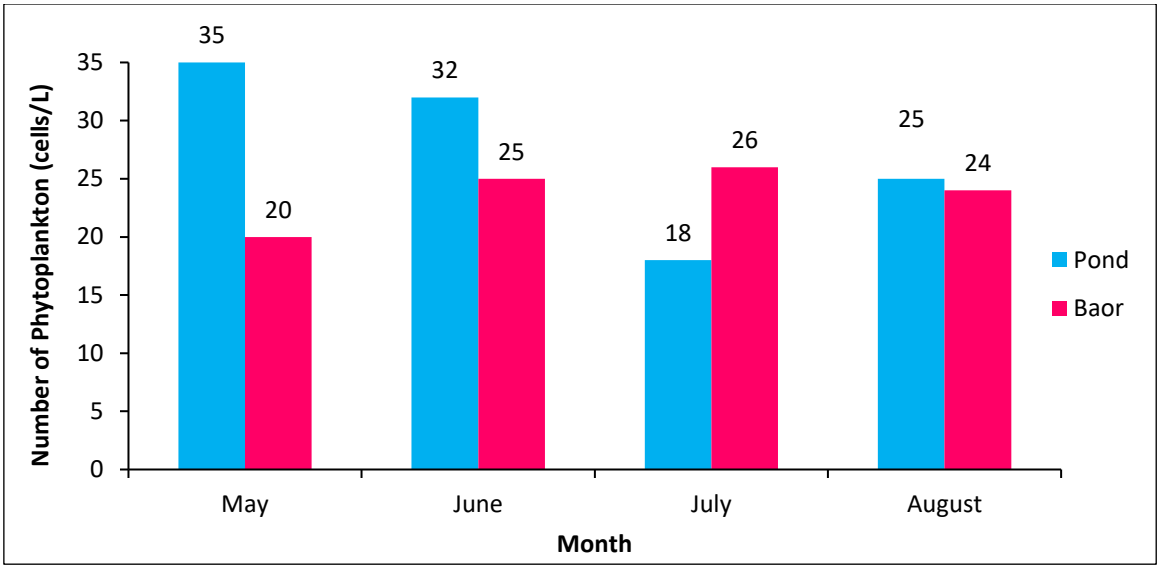

Fig. 6: *Variation of Phytoplankton Abundance in Pond and Baor.*

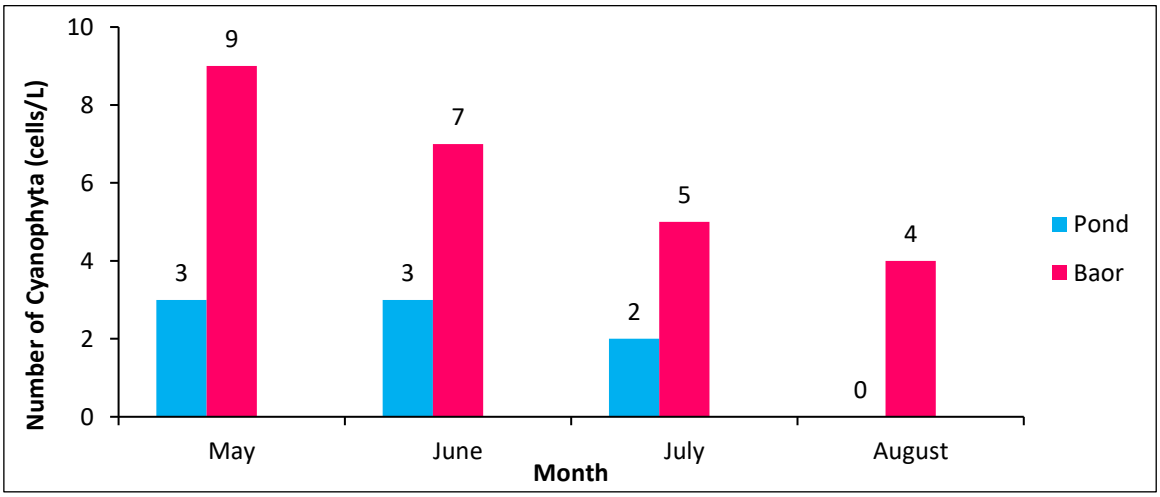

Fig. 7: *Variation of Cyanophyta Abundance in Pond and Baor.*

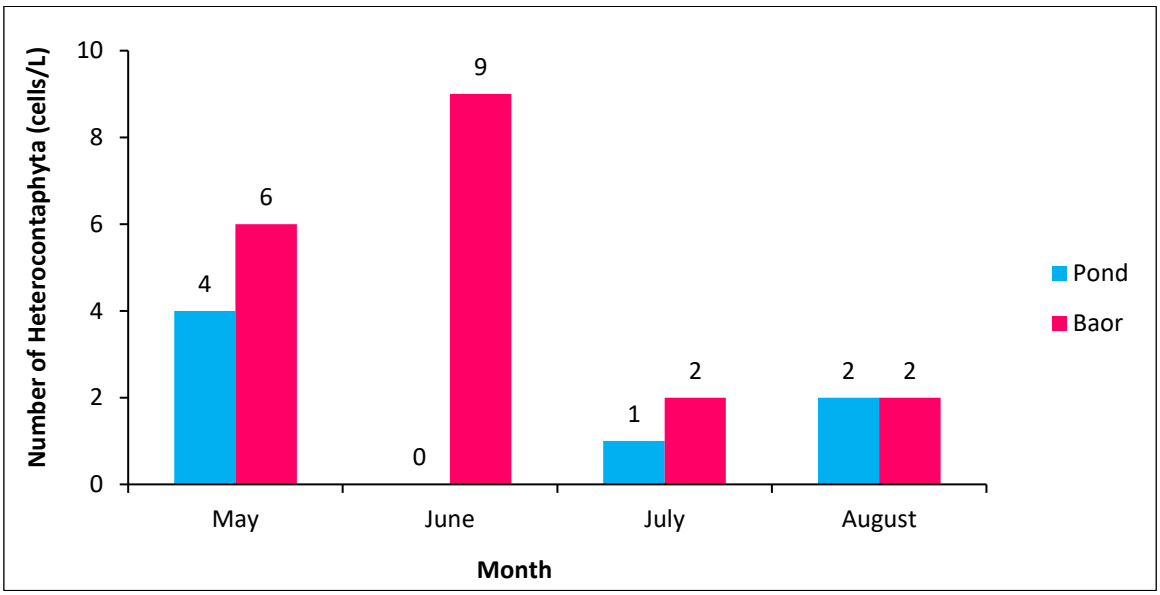

Fig. 8: *Variation of Heterocontaphyta Abundance in Pond and Baor.*

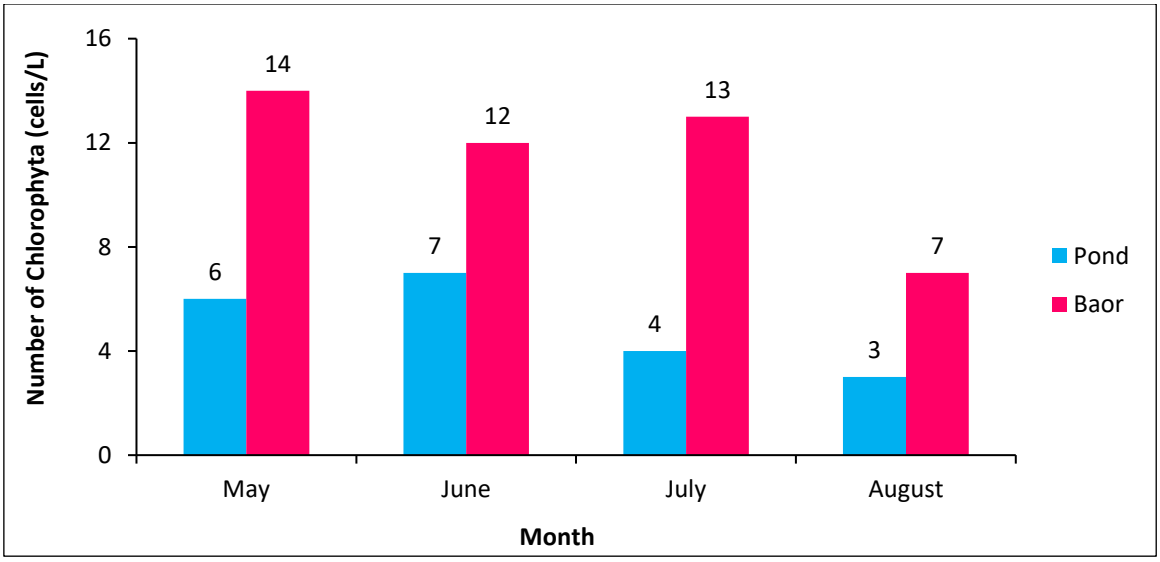

Fig. 9: *Variation of Chlorophyta Abundance in Pond and Baor.*

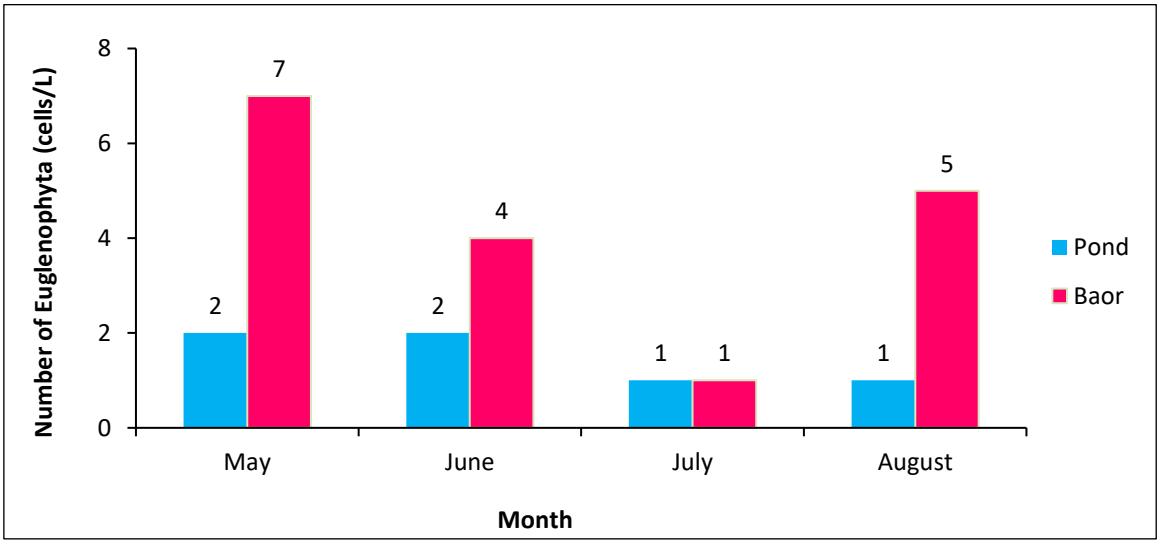

Fig. 10: *Variation of Euglenophyta Abundance in Pond and Baor.*

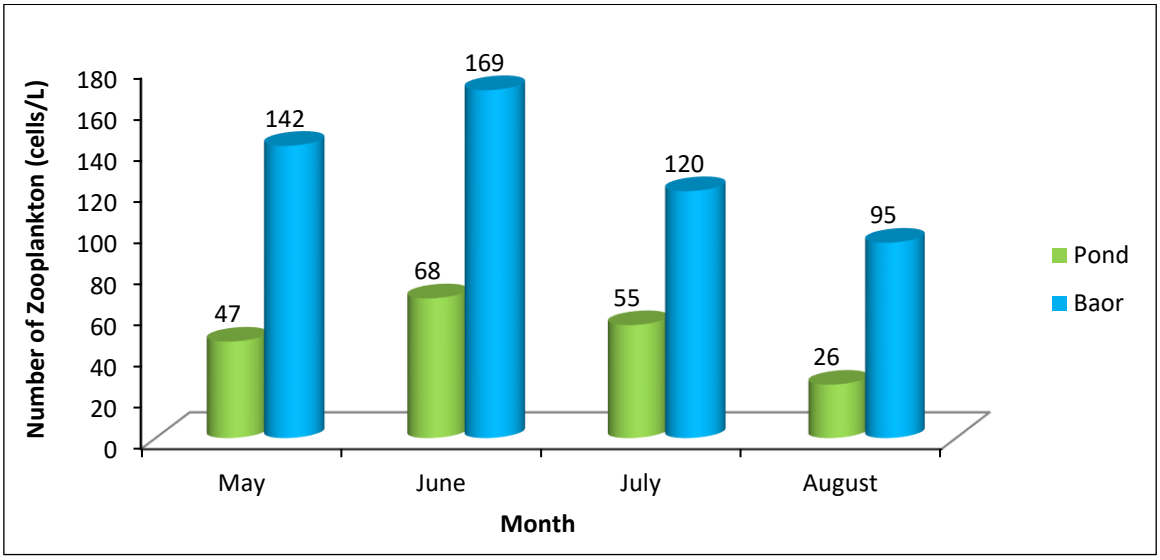

Fig. 11: *Variation of Zooplankton Abundance in Pond and Baor.*

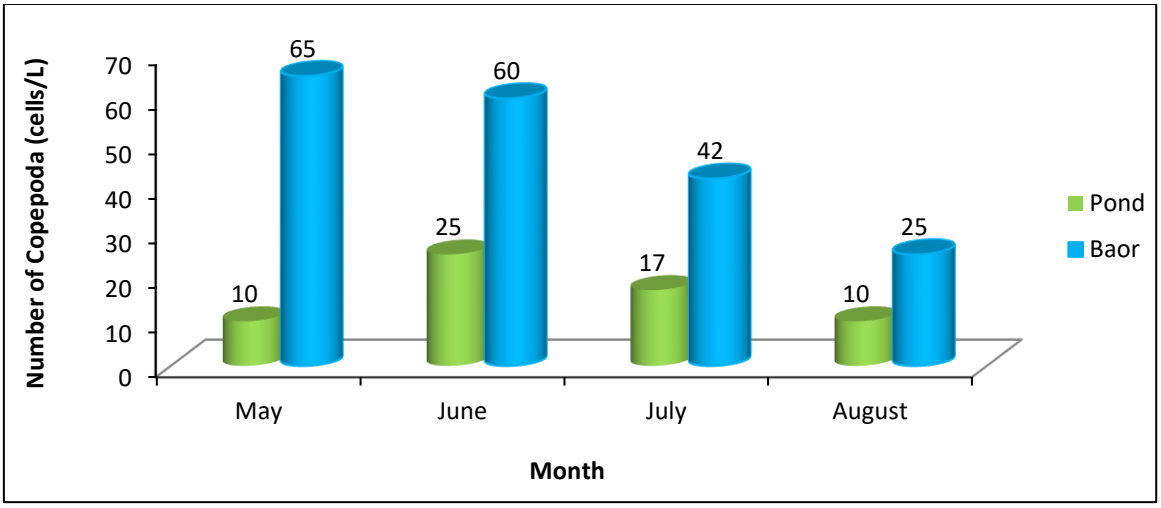

Fig. 12: *Variation of Copepoda Abundance in Pond and Baor.*

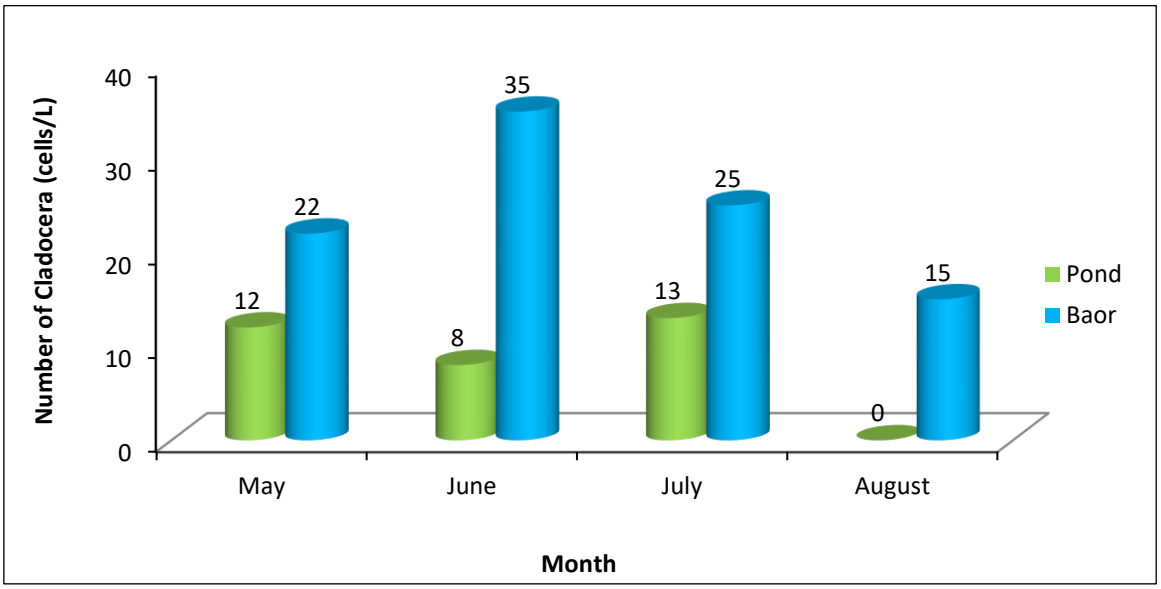

Fig. 13: *Variation of Cladocera Abundance in Pond and Baor.*

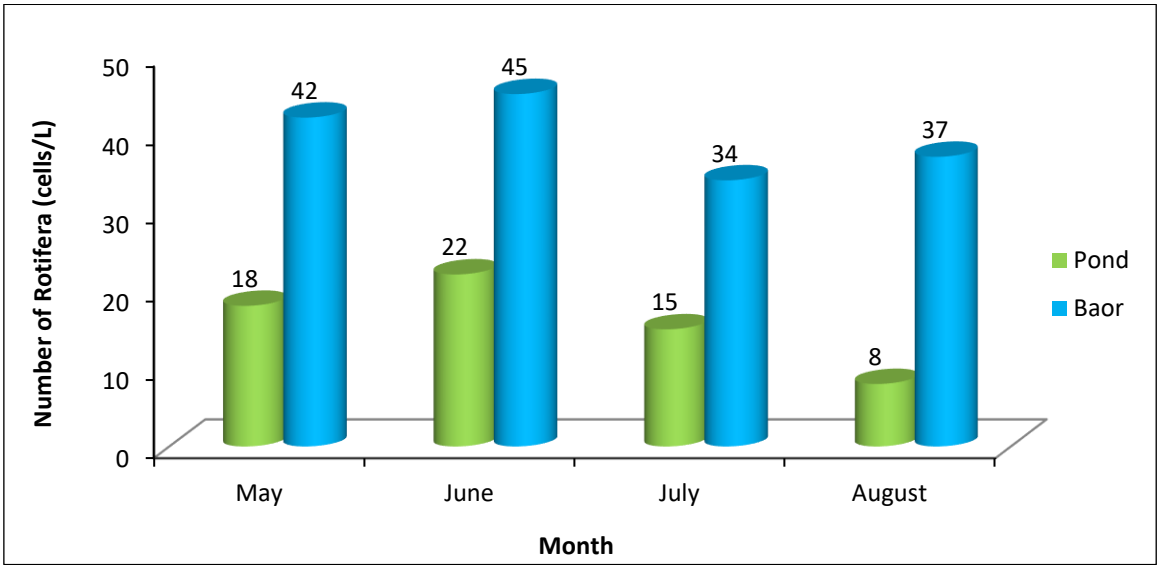

Fig. 14: *Variation of Rotifera Abundance in Pond and Baor.*

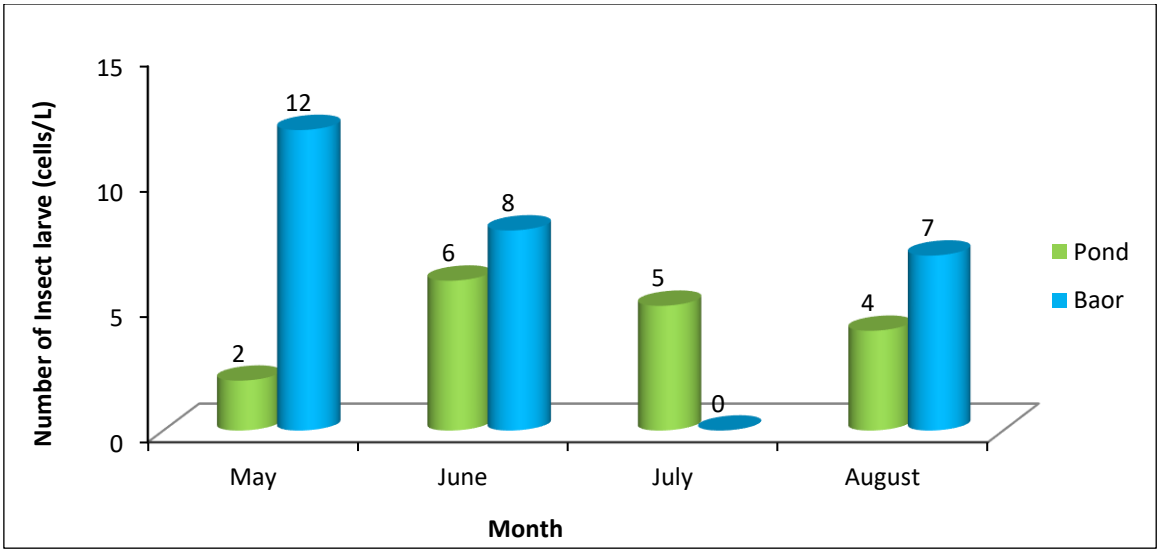

Fig. 15: *Variation of Insect Larve Abundance in Pond and Baor.*

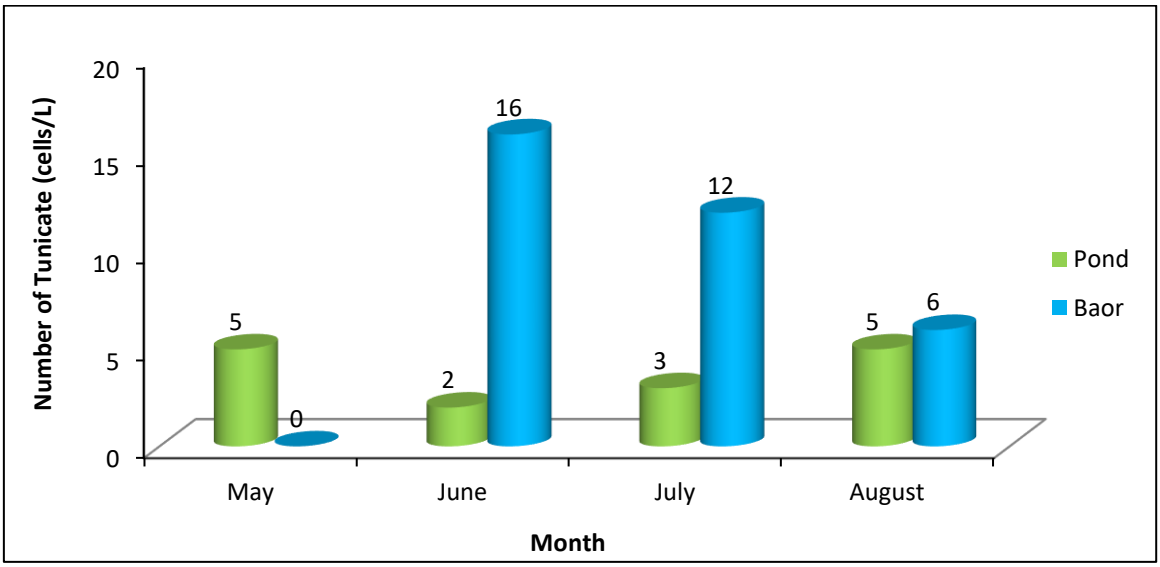

Fig. 16: *Variation of Tunicate Abundance in Pond and Baor.*

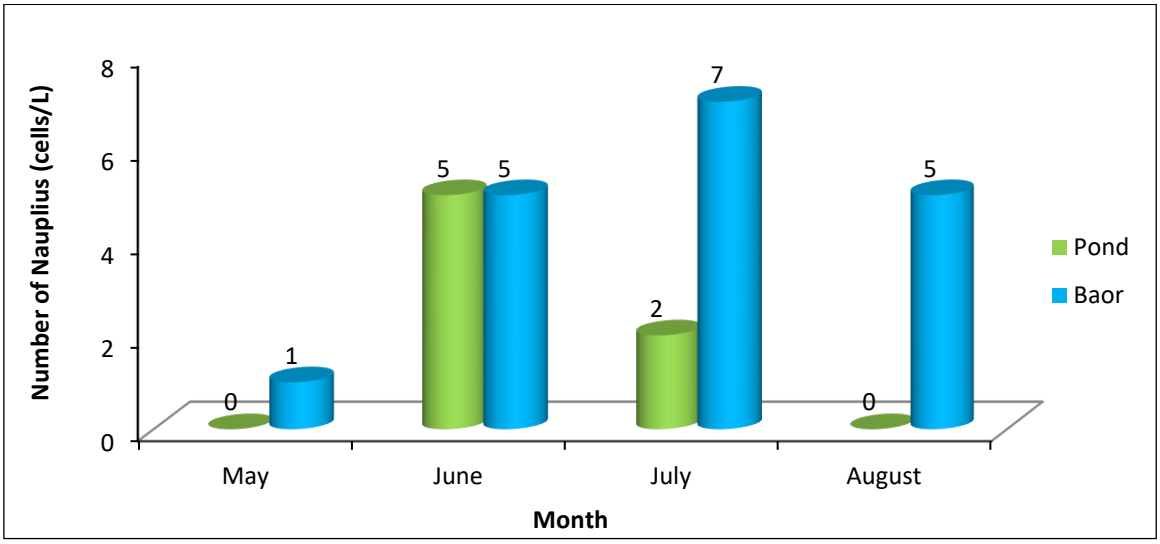

Fig. 17: *Variation of Nauplius Abundance in Pond and Baor.*

DISCUSSIONS

Monthly records of different 11 physic-chemical factors showed fluctuations in different months in pond and baor. The maximum water temperature (34 and 36°C) in June and air temperature (33.4 and 38°C) recorded in July and the minimum water temperature (31 and 30.8°C) in August and air temperature (27.7 and 30.3°C) recorded in May. The similar water quality and parameter study were conducted by the several researcher and found 23°C to 32°C [35, 36,37,38 and 39] During the study the lowest pH was in 6.33 and 8.0 (August) and the highest was in 7.8 and 8.8 (May). A study conducted which found 6.3 to 8.9 [39]. The maximum concentration of dissolved O_2 was 6.6 and 5.5 mg/l (June) and the minimum 5.0 and 4.3 mg/l (July) was recorded in pond and baor. Higher values of dissolve oxygen were observed at the surface water might be due to the wind action and also due to the active photosynthesis process. Similar trend had also been put forward by [39]. A study in BAU (Bangladesh Agricultural University) and found the parameters were, Water temperature 27.20 ±3.13; Air temperature 27.50±2.88; DO 7.86 ± 0.24; pH 7.03±0.13 and Transparency (cm) 32.30±0.91[30]. A study Found Water temperature ranged 27–30; DO values were 3.7–5; pH were 6.9–8.9 and Transparency ranged 25–35 [29]. A different investigation revealed surface water temperature ranged from 18.4 to 33.8°C and pH values fluctuated widely from 7.00 to 9.85 [2]. The range of different parameter as, dissolved oxygen (mg/l) 0.7–1.8; pH 7.3–8.4; air temperature (°C) 22–23.5; water temperature (°C) 24–26.5 and transparency (m) was 0.2–0.4 [32]. A rigorous study found the 11 physic-chemical variables of Lake Çali ranged from 7.62 to 8.08 for p^H, from 14.6 to 21.6°C for temperature, from 5.96 to 7.46 mg/L for DO [23]. Another researcher found in their research the water temperature were 26.4–32.5, while DO 2.61–10.7 and pH ranges 5.31–7.24 [6]. Other study revealed dissolved oxygen (mg/l) 3.2–8.2; pH 7.4–9.2; air temperature (°C) 22.3–34.8; water temperature (°C) 23–33.4 [28].Two researcher stated that, experiment pond's water temperature (°C) was 27.06 ± 0.03; air temperature (°C) 28.50 ±1.84; dissolved oxygen (mgL^{-1}) 7.4 ± 0.10; transparency (m) 0.48± 0.05 and pH was 7.09 ± 0.25 [16]. Another research showed dissolved oxygen (mg/l) 3.05–3.3; pH 5.72–6.13; temperature (°C) 29.55-30.65 and transparency (cm) 18.23–27.65 [21]. The experimental temperature (°C) was 23.5–24; pH 6.10–6.71 and dissolved oxygen (mgL-1) was 50.05–54.29 [33]. Water temperature (°C) was 26.30±2.8; air temperature (°C) 30.67±2.05; dissolved oxygen (mgL-1) 8.23±0.05; transparency (m) 62.70±2.87 and pH was 7.53±0.03. Plankton populations in the studied pond and baor were represented by 42 genera [3]. Phytoplankton 30 genera of which species under four groups; namely Cyanophyta (5), Heterokontophyta (3), Chlorophyta (11), Euglenophyta (2) have been identified and nine species were unidentified. The zooplankton population was composed of 12 genera belonging to two major groups: Crustacea and Rotifera- each was represented by six genera. The maximum abundance of total plankton was recorded in the month of June and minimum values were recorded in the month of August. The total abundance of phytoplankton varied from 5 to 85 units/L. Four groups of phytoplankton were founds namely Cyanophyta (5), Heterokontophyta (3), Chlorophyta (11), Euglenophyta (2) have been identified and nine species were unidentified. Phytoplankton species distribution was not uniform. At large margin of this study, the abundance of phytoplankton in pond in May is higher than any other month, whereas June is the most abundant month in case of baor's phytoplankton analysis. Chlorophyta and Cyanophyta species was most dominant group in both environments in the present study peak of phytoplankton in the month of May. In baor Heterocontaphyta abundance was noticeable in the month of June whereas there is no Heterocontaphyta group in pond population. In case of Euglenophyta May and August is the peak abundant month in baor population but in pond May and June is the most abundant month of the study period. Similarly another research reported primary peak of phytoplankton in the month of September-October in Uttar Pradesh in India [15]. The similar study were conducted by [16, 21, 28, 32, 6, 31, 2, 29, 33, 27, 23, 26, 3, 30, 24, 5,8,

11,15,17,18,19 and 20] these researches are more or less similar with the present phytoplankton abundance from May to August in different part of the world. Zooplankton abundance varied from 30 to 75 units/L. Four groups of zooplankton were founds namely Cladocera (10%), Copepoda (55%), Ostracoda (3%), Rotifera (15%). In addition Nauplius (2%), Tunicata (4%), Insect larve (5%) fish eggs (6%) were also identified. In the present study Copepoda species was most dominant group in both environments. Zooplankton growth cycle was noticeably less than the phytoplankton abundance almost throughout the study period. This statement is more or less similar with the study of [23, 26, 3, 30, 24, 5, 8, and 11].

CONCLUSIONS

The present study showed that thirty genera of phytoplankton species under four groups; namely Cyanophyta, Heterokontophyta, Chlorophyta, Euglenophyta have been identified and nine species were unidentified. There are twelve genera of zooplankton species under four groups were found namely Cladocera, Copepoda, Ostracoda, Rotifera. In addition Nauplius, Tunicata, insect larve, fish eggs were also identified. This study also showed the monthly variation of phytoplankton and zooplankton abundance in two water bodies. This study is the first approach to identify, abundance analysis, biomass analysis and diversity study in these public (government owned and managed) water bodies. Further study can reveal other specific situation in these water bodies.

REFERENCES

1. Aarti D, Sharma KK, Sharma A, *et al.* Zooplankton diversity and physico-chemical conditions of a temple pond in Birpur (JandK, India). *Int Res J Env Sci.* 2013; 2(5): 25–30p.
2. Abu A, Abu SJ, Mahfuzul H, *et al.* Seasonal cycle of phytoplankton in aquaculture ponds in Bangladesh. *Algae.* 2005; 20(1): 43–52p.
3. Alam MF, Nusrat J. Physico-Chemical Characteristics and Phytoplankton Diversity of Marjad Baor of Kaliganj Upazilla, Jhenaidah, Bangladesh. *ARPN J Sci Tech.* 2014; 4(2): 91–98p.
4. Alam MJ, Begum ZNT. Plankton abundance in relation to physico-chemical variables in two ponds in Maijdee court, Noakhali. *J Asi at. Soc Bangladesh, Sci.* 1987; 13: 55–63p.
5. Alvarez-Cobelas M, Rojo C. Ecological goal functions and plankton communities in lakes. *J Plankton Res.* 2000; 22: 729–748p.
6. Asha MS Nair, Reshma JK, Anu M, *et al.* Effect of water quality on phytoplankton abundance in selected ponds of Nedumangad block Panchayat, Kerala. *Emer Life Sci Res.* 2015; 1(2): 35–40p.
7. Banerjea SM. Water quality and soil condition of fish ponds in some states of India in relation to fish production. *Indian J Fish.* 1967; 14: 115–144p.
8. Basu KB, Pick FR. Factors regulating phytoplankton and zooplankton biomass in temperate rivers. *Limnol Oceanogr.* 1996; 41(7): 1572–1577p.
9. Battish SK. *Freshwater Zooplankton of India.* Published by oxford and IBH publishing Co. Pvt. Ltd. New Delhi. 1992.
10. Benarjee G, Narasimha RK. Physico-chemical factors influenced plankton biodiversity and fish abundance- a case study of Nagaram tank of Warangal, Andhra Pradesh. *Int J Life Sci Biotech Ph Res.* 2013; 2(2): 248–260p.
11. Benson-Evans K, Furet JE. An evaluation of the sedimentation technique for concentrating phytoplankton. Aqua. *Ecol Poll Bull.* 1979; 6: 1–9p.
12. Bhuiyan AS, Nessa Q. A quantitative study on zooplankton in relation to the physico-chemical conditions of a fresh water fish pond of Rajshahi. *Univ. j. zool.* Rajshahi. Univ. 1998a,b; 17: 29–37p.
13. Bhuiyan NIMAS, Nahar Q, Islam MN. Physico-chemical condition in relation to meteorogical condition of a fish pond in Rajshahi. *Univ. j. zool.* Rajshahi Univ. 1997; 16: 85-88p.
14. Boyd CE, Turker CS. *Pond Water Quality Management.* Kluwer Academic Publishers, Boston, MA., USA. 1998.
15. Casamatta DA, Beaver JR, Fleischman DJ. A Survey of Phytoplankton Taxa from

Three Types of Wetlands in Ohio. *Ohio J Sci.* 1999; 99: 53–56p.
16. Chukwu MN, Afolabi ES. Phytoplankton abundance and distribution of fish earthen ponds in Lagos, Nigeria. *J Appl Sci Environ Manage.* 2017; 21(7): 1245–1249p.
17. Cory N, Buffam I, Laudon H, *et al.* Landscape control of stream water aluminum in a boreal catchment during spring flood. *Environ Sci Technol.* 2006; 40 (11): 3494–3500p.
18. Cushing CE. Plankton and water chemistry in Montreal River lake-stream system, Saskatchwan. *Ecology.* 1964; 45: 306–13p.
19. Dorris TC, Copeland BJ, Lauer GL. Limnology of the middle Mississippi River. Physical and chemical limnology of river and chute. *Limnol Oceanogr.* 1963; 8: 79–88p.
20. Ekman-Ekebom M, Kauppi K, Sivonen M, *et al.* Toxic cyanobacteria in some Finnish lakes. *Envir Toxicol Wat Qual.* 1992; 7: 201–213p.
21. Evi V, Amin SL, Soemarno, *et al.* Effect of water quality on phytoplankton abundance in Hampalam river and fish pond of Batanjung village. *IOSR J Env Sci Toxic Food Tech.* 2014; 8(1): 15–21p.
22. Gupta T, Dey M. Hydro biological Characteristics of Some Semi-intensive fish culture ponds of Lumding town of Nagaon district, Assam. *Cur W Envir.* 2012; 8(1): 107-115p.
23. Hanife Ö. Composition and abundance of phytoplankton in boggy freshwater lake, Turkey: In relation to physical and chemical variables. *Ecologia Balkanica.* 2016; 8(1): 29–40p.
24. Islam MD, Rahmatullah SM, Ahmed M, *et al.* Aquatic weeds diversity of Bangladesh Agricultural University Campus, Mymensingh, Bangladesh. Asian-Austra. *J Biosci Biotech.* 2017a; 2(2): 181–192p.
25. Jhingran VG. *Fish and Fisheries of India*. Hindustan Publishing Corporation (India), Delhi. 1985.
26. Lúcia HST, Rodrigo NM, Atanásio AA. Influence of management on plankton community of fishponds during the dry and rainy seasons. *Acta Limnologica Brasiliensia.* 2010; 22(1): 70–79p. doi: 10.4322/actalb.02201009
27. Pereira, Anne I, Fidalgo ML, *et al.* Phytoplankton and nutrient dynamics in two ponds of the Esmoriz wastewater treatment plant (Northern Portugal). *Limnetica.* 2001; 20(2): 245–254p.
28. Pronob KM, Naser MN, Ahmed ATA. Abundance of zooplankton and physico-chemical parameters of a polyculture fish pond of Manikganj, Bangladesh. *Bangladesh J Zool.* 2014; 42(1): 67–76p.
29. Sharmin A, Rahman MM, Masuma A. Composition and abundance of phytoplankton population in fish ponds of Noakhali district, Bangladesh. *Am-Eurasian J Agric. Environ Sci.* 2015; 15(11): 2143–2148p. doi: 10.5829/idosi.aejaes.2015.15.11.95317
30. Siddika F, Shahjahan M, Rahman MS. Abundance of plankton population densities in relation to bottom soil textural types in aquaculture ponds. *Int J Agril Res Innov Tech.* 2012; 2 (1): 56–61p.
31. Sipaúba-Tavares LH, Donadon ARV, Milan RN. Water quality and plankton populations in an earthen polyculture pond. *Braz J Biol.* 2011; 71(4): 845–855p.
32. Sunder S. Analysis of plankton diversity and density with physico-chemical parameters of open pond in town Deeg (Bhratpur) Rajasthan, India. *Int Res J Biological Sci.* 2015; 4(11): 61–69p.
33. Tesfaye K, Eba A. Phytoplankton fauna abundance and diversity in aquaculture pond, Jimma town, Jimma zone south west Ethiopia. *ARPN J Agric Biolo Sci.* 2014; 9(7): 246–249p.
34. Williams P, Biggs M. Comparative biodiversity of rivers, streams, ditches and ponds in an agricultural landscape. *Biol Conserv.* 2004; 115: 329–341p.
35. Asif AA, Samad MA, Rahman BMS, *et al.* A. Study on Management of Fish Fry and Fingerling Marketing of Jessore in Bangladesh. *Int J Bus Soc Sci Res.* 2014; 2: 127-135p.
36. Islam MA, Asif AA, Samad MA *et al.* A comparative study on fish biodiversity with conservation measures of the Bhairabriver, Jessore, Bangladesh. *Asian J Med Biolo Res.* 2017b; 3: 357-367p.

37. Shajib MSH, Sarker B, Asif AA *et al.* Effects of stocking density on the growth rate of gold fish fry reared in hapa. *Asian J Med Biolo Res.* 2017; 3: 504-515p.
38. Neowajh MS, Rashid MM, Asif AA *et al.* Effects of chemotherapeutics against experimentally injured stinging catfish *Heteropneustes fossilis*. *Asian J Med Biol Res.* 2017; 3 (4): 476-487p.
39. Akter S, Rahman MM, Faruk A *et al.* Qualitative and quantitative analysis of phytoplankton in culture pond of Noakhali district, Bangladesh. *Int J Fish Aqua Stud.* 2018; 6(4): 371-375p.

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