



## EFFECT OF COMMERCIAL INORGANIC FERTILIZER ON ABUNDANCE OF PLANKTON IN POND POLYCULTURE SYSTEM

Md. Ripon Hossen, Shamima Sultana\* and Manash Kabiraj

*Fisberies and Marine Resource Technology Discipline, Khulna University, Khulna 9208, Bangladesh*

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**Abstract:** The experiment was conducted to assess and compare the effect of micronutrient rich commercial inorganic fertilizer and macronutrient rich traditional inorganic fertilizer on plankton abundance in the manmade earthen ponds of Khulna University pond complex II for a period of three months from August to October 2017. There were three treatments each with three replications. Macro fertilizers (Urea 2.45 g m<sup>-1</sup> week<sup>-1</sup>, TSP 2.45 g m<sup>-1</sup> week<sup>-1</sup> and molasses–yeast mixture 3.09 g m<sup>-1</sup> week<sup>-1</sup>) were applied in treatment-1 (T<sub>1</sub>) while commercial inorganic fertilizer (4.5 g m<sup>-1</sup> week<sup>-1</sup>) was applied in treatment-2 (T<sub>2</sub>) while no fertilizer was applied in treatment-3 (T<sub>3</sub>). Four different classes of phytoplankton namely Chlorophyceae, Cyanophyceae, Bacillariophyceae, and Euglenophyceae were found in this experiment in which Chlorophyceae (5304.25±223.78 cells L<sup>-1</sup>) was the dominant class in respect of abundance and number of genera. Additionally, four classes of zooplankton such as Copepoda, Cladocera, Rotifera, Ostracoda were observed in which Copepoda (1559.84±70.48 cells L<sup>-1</sup>) was the most dominant class in treatment T<sub>2</sub> than other treatments. Mean abundance of different phytoplanktons were 8864.77±52.78, 11489.04±295.76, 5983.04±272.88 (cells L<sup>-1</sup>) in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> and mean abundance of zooplankton under treatments T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were 3997.65±126.78, 4621.64±45.67, 3017.66 ±137.67 (cells L<sup>-1</sup>) respectively. The results indicated that mean abundance of phytoplankton and zooplankton were significantly higher (P<0.05) in treatment T<sub>2</sub> compared to other treatments. The total mean abundance of plankton was observed significantly higher (P<0.05) in treatment T<sub>2</sub> than other treatments. Therefore, it is concluded that micro nutrient rich commercial inorganic fertilizer Bluemix was more effective on the primary production in polyculture ponds as well as increase the production of fish than traditional inorganic fertilizer.

**Keywords:** Inorganic fertilizer, phytoplankton, zooplankton, polyculture

### Introduction

The major people of rural and urban areas in Bangladesh are facing acute problem of protein deficiency. Fish is one of the major and cheapest sources of protein in Bangladesh. Aquaculture development especially the fish culture has appeared as an important source of protein and economic activity in Bangladesh. It contributes about 63% animal proteins to our daily routine (DoF, 2015). The demand of fish has increased due to the increase in population and our per capital fish demand is 18.00 kg but we are getting only 13.5 kg (DoF, 2013).

\*Corresponding author: <shamimasultana87@gmail.com>

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Phytoplankton plays a vital role in maintaining water quality by effectively maintaining oxygen levels, light regimes, bacterial numbers as well as zooplankton biomass and assimilates ammonia which is generated by fish excretion (Lorenzen *et al.* 1997). Zooplanktons are microscopic organisms that play important roles in energy and material transfer in water bodies as the consumers of phytoplankton (Welch, 2000). So, the phytoplankton population represents a vital link in the food chain and zooplankton forms the principal source of food for the cultured species (Prasad and Singh, 2003). Zooplankton provides the necessary amount of protein for the rapid growth and gonad development of fish (Dewan *et al.* 1977). Devi *et al.* (2004) reported that micro algae species, *Artemia* and rotifers play a vital role in larval growth and survival of prawn and fishes. The carrying capacity of aquatic habitat is essentially connected with the qualitative and quantitative aspects of plankton biomass. The greater the plankton biomass the larger the standing crop (Hasmatar, 1998).

Fertilizer is helpful for the increase of natural food of fish i.e. plankton, benthos and periphyton (Boyd, 1982). The objective of both inorganic and organic fertilizer application is to increase the productivity of the fish pond. Inorganic fertilizers are more effective than organic fertilizers and inorganic fertilizers are more readily soluble and have immediate effect on plankton growth. Fertilizers are known to supply the required nutrients for the primary productivity of phytoplankton as well as found to increase 3–4 times higher yield of fish (Moses, 1983; Westly, 1984). Nutrients level in a pond water plays a major role in determining the structure of planktonic community, amount and quality of plankton growth (Pearson *et al.*, 1984; (Harris, 1986). The inorganic fertilizer was applied while the water was cold, it fell to the bottom and dissolved and diffused slowly, thus giving the filamentous forms of algae a better opportunity to become established (Swingle, 1957).

Ponds or tanks with fertilized water will turn a rich green or reddish color when the plankton becomes abundant and food will be available for the fish in the poly culture system. The extensive fish cultures are dependent upon the natural or inherent pond productivity, while the semi-intensive fish culture system makes more optimum use of various inputs such as manures, fertilizers and supplementary feed. In freshwater fish ponds, total primary fish production; mainly depend upon the availability of nutrients, nutrient recycling and primary nutrients in the form of organic and inorganic fertilization (Mahboob and Al-Ghanim, 2014).

In order to fisheries development and to increase the present fish production level, the knowledge of abundance of plankton plays an important role. Therefore, this study was conducted to determine the effect of as well as to compare between macro nutrient rich inorganic fertilizers, micro nutrient rich commercial inorganic fertilizers and no fertilizer on the abundance of phytoplankton and zooplankton in the polyculture system.

## **Materials and Methods**

**Study area and period:** The study was carried out in nine experimental research pond complex and Fish Biology Laboratory of Fisheries and Marine Resources Technology

(FMRT) Discipline, Khulna University during August to October 2017. The area of each pond was about 100 m<sup>2</sup> with an average depth of about 1.5 m.

**Experimental design:** The experiment was conducted using three treatments of fertilizer application. Each treatment was three times replicated. Nursery reared PL of prawn (*Macrobrachium rosenbergii*), rohu fingerling (*Labeo rohita*) and brood mola (*Amblypharyngodon mola*) were stocked same in all treatments shown in Table 1. In treatment T<sub>1</sub>, fertilizers like urea, triple super phosphate and molasses-yeast mixture were applied at 2.45, 2.45, 3.09 g m<sup>-2</sup>week<sup>-1</sup> and in treatment T<sub>2</sub> commercial fertilizer containing Dicalcium Phosphate, Cobalt, Copper, Choline, Folic Acid, Manganese, Selenium, Zinc, Iron, Pantothenic Acid, vitamin A, D, E, K3, B1, B2, and B6 was applied at the rate of 4.5 g m<sup>-2</sup>. week<sup>-1</sup>, and no fertilizer was applied in T<sub>3</sub>.

Table 1: Experimental design

Parameter/Stocking Density	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
PL of Prawn ( <i>M. rosenbergii</i> )	2/m <sup>2</sup>	2/m <sup>2</sup>	2/m <sup>2</sup>
Fingerlings of Rohu ( <i>L. rohita</i> )	1/ m <sup>2</sup>	1/ m <sup>2</sup>	1/m <sup>2</sup>
Brood Mola ( <i>A. mola</i> )	2/m <sup>2</sup>	2/m <sup>2</sup>	2/m <sup>2</sup>
Fertilizer	Traditional inorganic fertilizer	Commercial inorganic fertilizer	No
Composition	Urea 2.45, TSP 2.45, Molasses-yeast mixture 3.09 (g m <sup>-2</sup> week <sup>-1</sup> )	4.5g m <sup>-2</sup> week <sup>-1</sup>	No
Replication	3	3	3

**Pond preparation:** The main source of water of these ponds was rainfall, but there was a provision for water supply from a deep tube-well whenever needed to maintain water level at 1 m throughout the study period.

The ponds were well exposed to sunlight, pond embankments were well protected and covered with grasses. Ponds were renovated and cleaned of aquatic vegetation. Ponds were fenced by 1 m high nylon net to prevent the entry of fishes, snakes and other predators, and escape of prawn. All unwanted fishes and other aquatic organisms were eradicated by dewatering and sun drying. The ponds were then treated with lime at the rate of 250 kg ha<sup>-1</sup> and filled with underground water at a depth of 1 m after five days of liming and allowed to stabilize for one week. Finally, the experiment was started with the described treatments. The ponds were fertilized two weeks before the fish stocked into ponds to ensure occurrence of plankton production.

**Fertilization:** Commercial inorganic fertilizer and traditional inorganic fertilizer such as Urea, TSP and molasses-yeast mixture were used for the experiment. Fertilizers were applied at seven days interval. Ponds of treatment 1 (T<sub>1</sub>) were fertilized with urea, TSP and molasses-yeast mixture at a rate of 2.45, 2.45 and 3.09 g m<sup>-2</sup>week<sup>-1</sup>. In the ponds of treatment 2 (T<sub>2</sub>) only commercial inorganic fertilizers was applied at the rate of 4.5 g m<sup>-2</sup>

week<sup>-1</sup>. In the ponds of treatment 3 (T3) no fertilizer was applied. After the first fertilization and before fish stocking, the ponds were left 10 days to allow plankton development.

**Fingerling collection and stocking:** The fingerling of Rohu (*Labeo rohita*) and brood Mola (*Amblybryngodon mola*) were collected from local sellers of Khulna while PL of prawn (*Macrobrachium rosenbergii*) was collected from a commercial hatchery in Cox's bazar hatchery. The mean initial weight of Prawn, Rohu and Mola was 3 g, 83 g and 0.99 g respectively. They were acclimatized for a period of several days before starting the experiment and the fingerlings of Rohu, Mola and prawn PL in each pond were stocked at stocking density of 1 fingerling m<sup>-2</sup>, 2 fingerling m<sup>-2</sup> and 2 fingerling m<sup>-2</sup> respectively.

**Sample collection and preservation:** Plankton samples were collected fortnightly by the deep of a conical shaped plankton net with 90 µm mesh size and 30 cm diameter. A bucket (10 liters) was used to collect samples and 20 liters of water were passed through plankton net where the concentrated sample volume became 30 ml. The concentrated sample was kept in 100 ml beaker. Water was collected from different parts of each pond for the collection of concentrated sample at sampling date. After collection, it was preserved with Lugol's solution (20 g potassium iodide and 10 g iodine crystals dissolved in 200 ml distilled water containing 20 ml glacial acetic acid) in plastic bottles at the sampling site. Then the samplings were carried out to the Fish Biology Laboratory of Fisheries and Marine Resources Technology (FMRT) Discipline, Khulna University for further investigation.

**Plankton identification and counting:** The quantitative enumeration of the plankton (phytoplankton and zooplankton) was carried out with the help of a Sedgwick-Rafter (S-R) cell which is 50 mm long, 20 mm wide and 1 mm deep. The cover glasses were diagonally placed across the cell before filling the S-R cell with sample and then samples were transferred with a dropper so that no air bubbles in the cell covers were formed. Then plankton on the bottom of the S-R cell was enumerated by compound microscope. From quantitative analysis, the number of phytoplankton and zooplankton was counted in 20 cells randomly and the number of phytoplankton and zooplankton in S-R cells was calculated using the following formula of (APHA, 1976)-

$$No. ml^{-1} = \frac{C \times 1000 mm^3}{L \times D \times W \times S}$$

Where,  $C$  = number of organisms counted;  $L$  = length of each strip (S-R cell length) in mm;  $D$  = depth of a strip (whipple grid image width) in mm;  $W$  = width of each stripe (mm) and  $S$  = number of strips counted.

**Data analysis:** At first all the recorded data on sampling was tabulated. Then those data were analyzed by using SPSS (Statistical Package for Social Science version 20.00) software. One-way Analysis of Variance (ANOVA) was performed at 5% level of significance to determine the significance difference while then Tukey test was applied to determine the variation among means of different treatments.

**Results**

**Plankton Population:** A total of four diversified classes namely Bacillariophyceae, Chlorophyceae, Cyanophyceae, Euglenophyceae different phytoplankton are found in this experiment. It also contained 21 genera. . Five genera of four diverse groups of zooplankton namely, Copepoda, Rotifera, Cladocera and Ostracoda were identified to be abundant (Table 2).

Phytoplankton abundance was higher in T<sub>2</sub> followed by T<sub>1</sub> applied with traditional fertilizer and least in T<sub>3</sub>. All identified groups of zooplankton individually had higher abundance in treatment T<sub>2</sub>.

Table 2: List of abundant planktons

Group	Class	Genera
Phytoplankton	Bacillariophyceae	<i>Cyclotella, Mellosira, Tabellaria, Navicula, Synedra</i>
	Chlorophyceae	<i>Ankistrodesmus, Botryococcus, Chlorella, Characium, Cladophora, Closterium, Gonatozygon, Oocystis, Tetrabedron, Ulothrix, Zygnema</i>
	Cyanophyceae	<i>Anabaena, Oscillatoria, Microcystis, Nostoc</i>
	Euglenophyceae	<i>Phacus, Trachelomonas</i>
Zooplankton	Copepoda	<i>Cyclops, Mesocyclops, Diaptomus, Helidiaptomus, Calanus, Acrocalanus</i>
	Rotifera	<i>Braciomus, Filinia</i>
	Cladocera	<i>Diaphanosoma, Daphnia</i>
	Ostracoda	<i>Cypris</i>

**Abundance of Phytoplankton:** The phytoplankton of the experimental ponds was found to consist of four groups such as Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae. Variation in the abundance (cells L<sup>-1</sup>) of phytoplankton group made the different treatments is shown in Table 3.

Table 3: Mean ±SD of phytoplankton abundance (cells L<sup>-1</sup>) in ponds under three different treatments

Treatment	Groups of Phytoplankton			
	Bacillariophyceae	Chlorophyceae	Cyanophyceae	Euglenophyceae
T <sub>1</sub>	1703.85± 93.11 <sup>a</sup>	3930.73±119.83 <sup>a</sup>	2331.95 ±74.18 <sup>a</sup>	898.24 ±5.32 <sup>a</sup>
T <sub>2</sub>	1956 ±89.09 <sup>a</sup>	5304.25±223.78 <sup>b</sup>	3039.67±195.63 <sup>b</sup>	1189.95 ±234.84 <sup>b</sup>
T <sub>3</sub>	821.58±101.10 <sup>b</sup>	3093.75 ±194.1 <sup>c</sup>	1744.23 ±71.03 <sup>c</sup>	323.5 ±48.79 <sup>a</sup>

\* Difference in superscript represents significantly different at 5% level of significance

**Bacillariophyceae:** The mean abundance (cells L<sup>-1</sup>) of Bacillariophyceae in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 1703.85 ± 93.11, 1956 ± 89.09 and 821.57 ± 101.01 respectively. Bacillariophyceae was the third ranked group in respect of both abundance and number of genera. The abundance of Bacillariophyceae was significantly (p < 0.05) different between T<sub>1</sub> and T<sub>3</sub> and between T<sub>2</sub> and T<sub>3</sub> and no difference between T<sub>1</sub> and T<sub>2</sub>.

**Chlorophyceae:** The mean abundance (cells L<sup>-1</sup>) of Chlorophyceae in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 3930.73 ± 119.83, 5304.25 ± 223.78 and 3093.75 ± 194.1 respectively. Chlorophyceae was the dominant group of phytoplankton with a large number of genera in all treatment ponds. The abundance of this group of phytoplankton were significantly different (p < 0.05) between T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>.

**Cyanophyceae:** The mean abundance (cells L<sup>-1</sup>) of Cyanophyceae in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 2331.95 ± 74.18, 3039.67 ± 195.63 and 1744.23 ± 71.03 respectively. Cyanophyceae was the second dominant group among all group phytoplankton in respect of abundance and number of genera. The abundance of this group of phytoplankton were significantly different (p < 0.05) between T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>.

**Euglenophyceae:** The mean abundance (cells L<sup>-1</sup>) of Euglenophyceae in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 898.24 ± 5.32, 1189.95 ± 234.84 and 323.5 ± 48.79 respectively. Euglenophyceae ranked fourth in respect of both abundance and number of genera. The abundance of Euglenophyceae was the highest in treatment T<sub>2</sub> rather than other treatments. The significant difference (p < 0.05) in abundance of this group of phytoplankton was found only between T<sub>2</sub> and T<sub>3</sub>.

**Total phytoplankton:** The mean abundances (cells L<sup>-1</sup>) of total phytoplankton in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 8864.77 ± 52.78, 11489.04 ± 295.76 and 5983.04 ± 272.88 respectively. The mean abundance of phytoplankton was significantly different (p < 0.05) among T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> when compared. Chlorophyceae was found as the most dominant group and that of Euglenophyceae was the least abundant group during the period of study.

**Abundance of zooplankton:** The zooplankton of the experimental ponds composed of four groups such as Copepoda, Rotifera, Cladocera and Ostracoda. Variation in the abundance (cells L<sup>-1</sup>) of zooplankton groups of the experimental ponds was observed during the study period presented in Table 4.

Table: 4 Mean ± SD of zooplankton abundance (cells L<sup>-1</sup>) in ponds under three different treatment)

Treatment	Different Groups of Zooplankton			
	Copepoda	Rotifera	Cladocera	Ostracoda
T <sub>1</sub>	1330 ± 103.24 <sup>a</sup>	948.09 ± 50.74 <sup>a</sup>	1000.73 ± 25.84 <sup>a</sup>	718.83 ± 100.16 <sup>a</sup>
T <sub>2</sub>	1559.84 ± 70.48 <sup>a</sup>	1084.17 ± 117.14 <sup>a</sup>	1245.45 ± 73.70 <sup>b</sup>	732.175 ± 18.63 <sup>a</sup>
T <sub>3</sub>	1076.86 ± 37.98 <sup>b</sup>	604.18 ± 43.59 <sup>b</sup>	825.11 ± 49.33 <sup>a</sup>	511.5 ± 82.73 <sup>a</sup>

\* Difference in superscript represents significantly different at 5% level of significance

**Copepoda:** The mean abundances (cells L<sup>-1</sup>) of copepoda in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 1330±103.24, 1559.84±70.48, and 1076.86±37.98 respectively and which was the most dominant group among the all zooplanktonic groups in T<sub>2</sub> rather than T<sub>1</sub> and T<sub>3</sub> during the whole study period. The significant difference (p<0.05) of the mean abundance of copepoda was found only between T<sub>2</sub> and T<sub>3</sub>.

**Rotifera:** The mean abundances (cells L<sup>-1</sup>) of Rotifera in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 948.09±50.74, 1084.17±117.14 and 604.18±43.59 respectively which was the third ranked among the all zooplanktonic groups during the whole study period found in T<sub>2</sub>. The significant difference (p<0.05) of the mean abundance of Copepoda were found between T<sub>1</sub> and T<sub>3</sub>, T<sub>2</sub> and T<sub>3</sub> but no significant difference was not found between T<sub>1</sub> and T<sub>2</sub>.

**Cladocera:** Cladocera was the second dominant group among all zooplanktonic groups which was found in treatment T<sub>2</sub> than those of treatment T<sub>1</sub> and T<sub>3</sub>. The mean abundance (cells L<sup>-1</sup>) of Cladocera was in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> 1000.73±25.84, 1245.45±73.70 and 825.11±49.33 respectively. The significant difference (p<0.05) of the mean abundance of Cladocera were found between T<sub>1</sub> and T<sub>2</sub> and T<sub>3</sub> while T<sub>1</sub> and T<sub>3</sub> did not show any difference.

**Ostracoda:** Among the zooplanktonic group, the mean abundance (cells L<sup>-1</sup>) of Cladocera in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 718.83±100.16, 732.175±18.63 and 511.5±82.73 respectively. No significant difference (p<0.05) of the mean abundance of Ostracoda was observed among treatments.

**Total zooplankton:** Mean abundance (cells L<sup>-1</sup>) of different group of zooplankton throughout the study period in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 3997.65±126.78, 4621.64±45.67 and 3017.66 ±137.67 respectively. The mean abundance of zooplankton was significantly different (p<0.05) between T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. Among zooplankton groups, Copepoda was the most dominant group and Ostracoda was the least abundant planktonic group during the study period.

**Total plankton:** The average abundance (cells L<sup>-1</sup>) of plankton in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was 12862.41±189.56, 16111.5±341.43 and 9000.7±410.55 respectively throughout the study period (Fig. 1). The treatment means were observed significantly different (p<0.05) among three treatments.

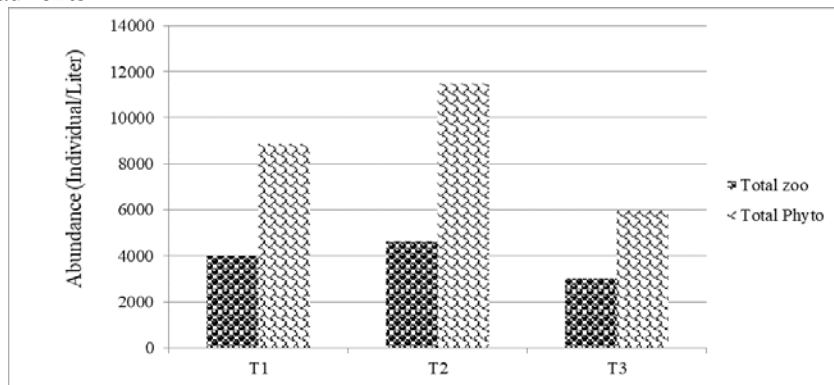


Fig. 1: Difference of abundance of phytoplankton and zooplankton under three treatments

## Discussion

The present study was conducted to evaluate the effects of inorganic fertilization on abundance of phytoplankton and zooplankton in polyculture of *L. rohita*, *A. mola* and *M. rosenbergii*. The results indicated that the addition of commercial inorganic fertilizer to the fish ponds increase more abundance of phytoplankton than unfertilized pond. Several researchers (Lin *et al.*, 1998; Dang and Dalsgaard, 2012; Saad *et al.*, 2014) reported that addition of manures and fertilizers to the fish pond found to improve the level of phytoplankton that was responsible for growth of fish. This was supported by Silva and Anderson (1995) who reported that phytoplankton and zooplankton were rich source of protein often containing 40-60% protein on a dry matter basis and was sufficient to support excellent growth of fish. However, nitrogenous and phosphorus rich fertilizer compounds found to improve the growth of phytoplankton and zooplankton that in turn improved growth performance of the fish (Saad *et al.*, 2014). According to Boyd (1982) the abundance of phytoplankton in fertilized ponds may be found more than 10 times higher than in unfertilized ponds.

In this present study, four groups of phytoplankton such as Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae and four groups of Zooplankton such as Copepoda, Rotifera, Cladocera and Ostracoda were observed. The observed highest number of phytoplankters in treatment T<sub>2</sub> treated with inorganic commercial fertilizer showed that micronutrients are very essential for the growth of phytoplankton as has previously been observed by (Boyd, 1982; Boney, 1983). The highest mean abundance (11489.04±295.76 cells L<sup>-1</sup>) of all groups of phytoplankton during the study period was found in treatment T<sub>2</sub> than those of treatments T<sub>1</sub> and T<sub>3</sub>.

The significantly higher abundance and diversity of phytoplankton was likely due to easily available nutrients to the water. Boyd and Massaut (1999) reported that inorganic fertilizers had much higher concentrations of nutrients such as nitrogenous compounds than manures. In this study among the different groups of phytoplankton, Chlorophyceae (5304.25±223.78 cell L<sup>-1</sup>) was the highest in abundance in treatment T<sub>2</sub> and the lowest value of the abundance of Euglenophyceae (323.5 ±48.79 cell L<sup>-1</sup>) in treatment T<sub>3</sub>. Hossain *et al.* (2006) also reported that almost similar order of dominance in different groups of phytoplankton in ponds treated with poultry and cow manure and iso nutrient phosphorous. But there was no significant difference (p<0.05) in mean abundance of Bacillariophyceae and Euglenophyceae between treatment T<sub>1</sub> and T<sub>2</sub>. Silicon is a major limiting nutrient for diatom growth and hence is a controlling factor in primary productivity. It is assumed that silicon is responsible for the better growth of diatom by the many researchers. So, for the absence of silicon in commercial fertilizer it may be less abundance between treatments T<sub>1</sub> and T<sub>2</sub> (Martin-Jezequel *et al.*, 2000). The significant difference (p<0.05) in mean abundance of phytoplankton was found among the treatments T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. Rotifera, Copepoda and Cladocera and Ostracoda showed a higher abundance as phytoplankton trend. The Copepoda was observed as the most dominant group in treatment T<sub>2</sub> fertilized with commercial inorganic fertilizer and Ostracoda the least dominant group in the T<sub>3</sub> which was not fertilized. On the contrary, Shil *et al.* (2013) and

Kumar *et al.* (2014) reported rotifers to be the common and dominant zooplankton group in fertilized ponds. In addition, Mischke and Zimba (2004) reported that Copepod, Nauplii and Cladocerans were significantly higher in ponds fertilized with inorganic fertilizer (Urea + Super phosphate) than in control ponds and organically fertilized ponds. The highest mean abundance of all the groups of zooplankton during study period was observed in treatment T<sub>2</sub>. Haq *et al.* (1993) and Kohinoor *et al.* (1998) observed the best result in case of zooplankton production in ponds fertilized with inorganic fertilizers.

The results indicated that the total abundance ( $16111.5 \pm 341.43$  cell L<sup>-1</sup>) of plankton was higher in treatment T<sub>2</sub> fertilized with inorganic commercial fertilizer than in traditional fertilizer and the control. The concentration of total plankton was observed significantly different ( $p < 0.05$ ) among three treatments. Similar results have been reported by Hussain *et al.* (2011) reporting significant the difference between treated and control pond for the production of planktonic biomass.

### Conclusion

Finding of this study can be concluded that the application of commercial inorganic fertilizer boosted up the phytoplankton population specially Chlorophyceae and Cyanophyceae as well as zooplankton population like Copepoda, Cladocera, Rotifera and so on by providing more nutrients than traditional inorganic fertilizer application.

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