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Additions to the Zooplankton and Filamentous blue Greens Flora of Marathwada Region, Maharashtra

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Abstract: *While working on Zooplankton diversity of Karsa-Pohregaon barrage, the author came across some interesting members of blue green algae. The barrage is constructed on Manjra River at Pohregaon in Renapur tehsil of Latur district in the Marathwada region of Maharashtra. The present investigation was carried out during June 2018 to May 2019 to study Zooplankton diversity along with blue greens.The present paper deals with 15 genera belonging to five major groups of zooplanktons i.e. Protozoa (three genera), Cladocera (three genera), Copepoda (four genera), Ostracoda (two genera) and Rotifera (three genera) were present, and a total of 27 taxa under 05 genera belonged to blue greens were encountered. The present paper deals with the systematic enumeration of filamentouscyanobacterial forms like Oscillatoria (7), Schizothrix (1), Microcoleus (2), Phormidium (9) and Lyngbya (08).)*

Keywords: Karsa-Pohregaon barrage, Zooplanktons, Blue green algae, Renapur, Maharashtra

I. INTRODUCTION

Zooplanktons are the animals of the planktonic community that lives in the water column of oceans, lakes and ponds. Zooplankton community is cosmopolitan in nature and they inhabit all freshwater habitats of the world. Zooplankton is the intermediate link between phytoplankton and fish. They are good indicators of the changes in water quality because they are strongly affected by environmental conditions & respond quickly to changes in water quality. Zooplankton diversity reflects the quality of water hence constitutes the important ecological parameter to assess it. These are not only useful as bio indicators, but are also helpful for ameliorating polluted waters. Hence qualitative and quantitative studies of zooplankton are of great importance. Zooplankton are microscopic, free floating organisms occurred in all natural water bodies. They are a major mode of energy source betweenphytoplankton and other aquatic animals. They occupy an intermediate position in the aquatic food web (Altaff, 2004). Zooplanktons constitute the food source of organisms at higher trophic levels (Gajbhiye, 2002). According to Dadhick and Saxena (1999) the zooplankton plays an integral role and serves as bio- indicators. It is a well suited tool for understanding water pollution status (Contreras *et al*., 2009). Due to their large density, shorter lifespan,drifting nature, high species diversity and different tolerance to the stress, they are being used as indicator organisms for the physical, chemical and biological processes in the aquatic ecosystem. A number of studies has been carried out on the condition of ecology and freshwater bodies in various parts of India (Smitha *et al.*, 2007) but in some parts of Vidarbha region (M.S), the ecological studies of freshwater bodies especially zooplankton studies is very scanty. So the present study was undertaken to investigate the zooplankton diversity in Karsa-Pohregaon barrage during the period April 2017 to March 2018 in order to assess the species composition, population density and seasonal fluctuation of this faunal group.

II. MATERIAL AND METHODS

Study Area:

The Karsa-Pohregaon barrage is constructed on Manjara River at Pohregaon village in 2008, creating10.67 Mcum storage and high irrigation potential and also benefitted for the 9 villages from the Latur Tehsil and 7 villages from Renapur Tehsil to meet the requirement of drinking water and domestic purposes. The Pohregaon village is located in

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Renapur Tehsil of Latur district in the Marathwada region of Maharashtra. It is situated 15km away from sub-district headquarters Renapur and 25 km away from district headquarter Latur.

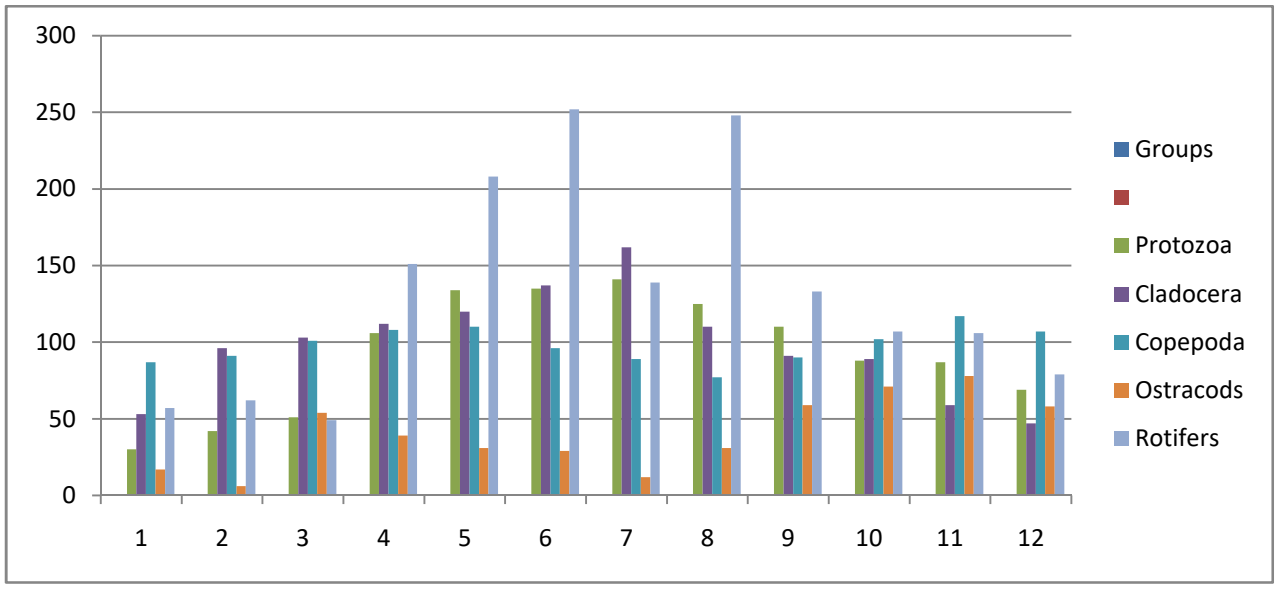
Collection of Sample:

Water samples were collected from lake every month during June 2018 to May 2019 in the morning between 6 AM to 9 AM. For collection of zooplanktons sample 50 liters of surface water passed through standard plankton net of bolting silk No. 25 and blue greens were collected by using acid washed collection bottles .The collected samples were preserved in 4% formalin solution.The systematic identification ofZooplankton was made by using standard keys of Dhanapathi (2000) and Altaff (2004).The quantitative analysis of planktonic organisms was carried out using Sedgwick Rafter's plankton counting chamber and identifications of blue greens were made by using Monograph by Desikachary (1959), Gomont (1892), Geitler (1932), Tiffany and Britton (1952), Prescott (1952) and available literature and research papers.

III. RESULT AND DISCUSSION

Table. 1: Monthly population density (No. / lit) of different zooplanktons.

Month	Monsoon season				Winter season				Summer season				Total
Groups	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
Protozoa	30	42	51	106	134	135	141	125	110	88	87	69	1118
Cladocera	53	96	103	112	120	137	162	110	91	89	59	47	1179
Copepoda	87	91	101	108	110	96	89	77	90	102	117	107	1175
Ostracods	17	06	54	39	31	29	12	31	59	71	78	58	485
Rotifers	57	62	49	151	208	252	139	248	133	107	106	79	1642



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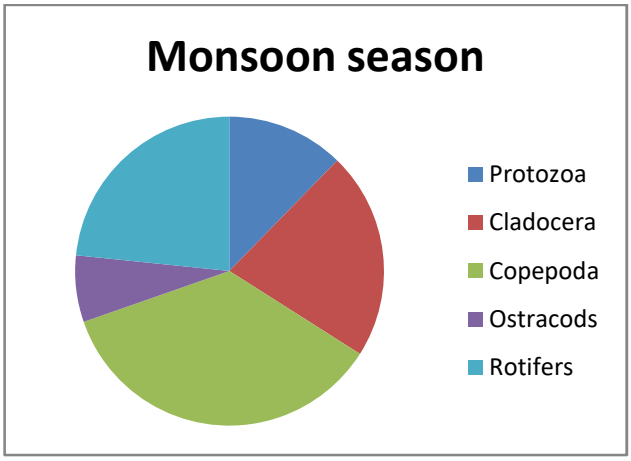

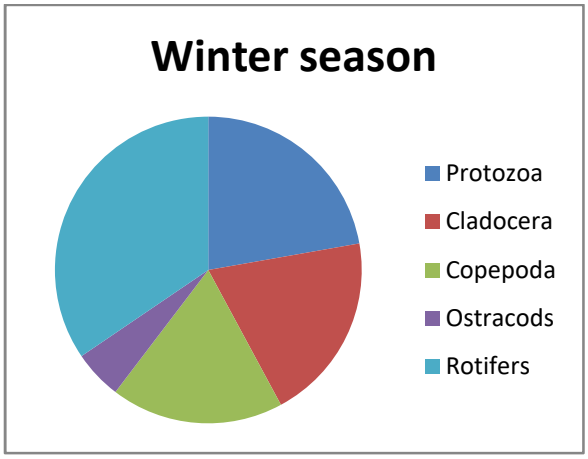

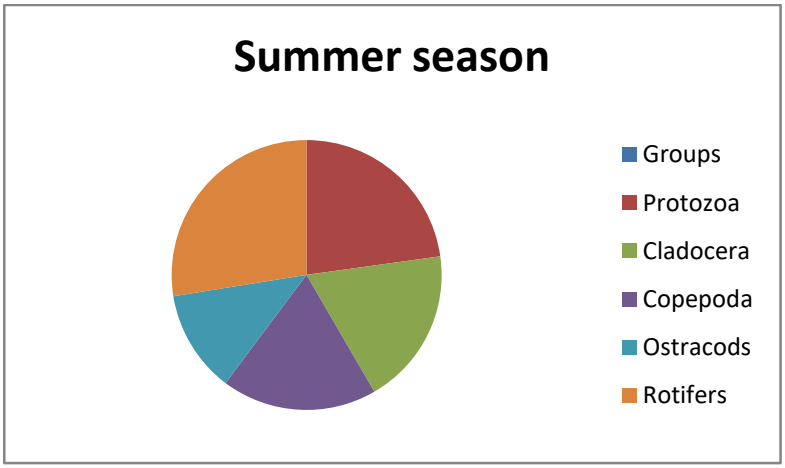

Part A: Zooplanktons:

As shown in Table 1 for month wise population density (No. /lit) of different zooplankton groups from June 2018 to May 2019.

Protozoa:

Protozoa are an important food source for micro invertebrates. They are both herbivores and consumers in the decomposer link of the food chain. They also control bacteria populations and biomass to some extent (Alcamo *et al*, 2009). All the three species had been reported from the Chulod Lake where density was maximum in winter, i.e. 157/lit in December, while it was minimum in monsoon, i.e. 24/lit in June.

Cladocera:

They play key role in food chain and energy transformation (Uttangi,2001). In this study three species out of 110 species recorded in India (Patil*et.al.*, 1989) were recorded. The Cladoceran population showed minimum in monsoon, i.e. in June 50/lit and maximum in winter, i.e. in December 174/lit.This variation in population was due to favorable temperature and availability

of food, while in monsoon the factors like temperature, turbidity, and transparency play an important role in controlling the diversity and density of Cladocera (Edmondson, 1965).

Copepods:

They serve as food to several fishes and play a major role in ecological pyramids. In the present investigation, they were found to be maximum during summer, i.e. 120 in April and minimum during winter, 80/lit in October. Similar trend was observed in Renukalake, Himachal Pradesh (Chauhan, 1993).

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Ostracods:

They occur in all kinds of freshwater and marine environments. The abundance of these provides a good food for aquatic organisms. In the present investigation two species of ostracods were recorded. Maximum ostracods population was recorded in summer, 79/lit in March month while minimum in monsoon, i.e. 02/lit in July. Similar observations were also made in Fort Lake of Belgaum, Karnataka (Sunkad *et al.*, 2004).

Rotifers:

The rotifers are being considered as the most important soft bodied invertebrates (Hutchinson, 1991). The dominance of rotifers was reported in several water bodies. In this study population density of rotifers was maximumin winter, 270/lit in December and minimum in monsoon, 45/lit in June.

Part B: Blue greens: Systematic Enumeration:

OSCILLATORIA Vaucher, 1803

***Oscillatoriaanimalis*Agardh ex Gomont:**

Thallus blue-green; trichomes straight, curved or bent at the ends, slightly constricted at the cross walls, not granulated at the cross walls, briefly attenuated at the ends; cells slightly shorter than broad, seldom longer, 3-4.8µ in diameter 2-4.5µ long; end cell conical, without a cap or a calyptra.

***Oscillatoriaamphibia* Ag. exGomont:**

Thallus blue-green; trichomes straight or coiled, not constricted at the cross walls, not attenuated at the ends; cells 2 times longer than broad. 2-2.5µ in diameter, 3.8-5.5µ long, with two granules at the septa; end cell rounded, without a cap or calyptra.

***Oscillatoriachalybea* (Mertens) Gomont:**

Thallus dark blue-green; trichomes usually bent at the ends, slightly constricted at the cross walls, very slightly tapering at the ends; cells shorter than broad, 5-7.2µ in diameter, 3-4.8µ long; end cell conical, without a cap or a calyptra.

***Oscillatoriamargaritifera* (Kuetzing) Gomont:**

Thallus blue-green to olive green; trichome straight, fragile, constricted at the cross walls, slightly attenuated at the ends; cells 1/3 – 1/7 as long as broad, 10.5-11.5µ in diameter, 2.8-4µ long, cross walls granulated; end cells capitate, with slightly convex calyptra.

***Oscillatoriamartini* Fremy:**

Thallus blue-green; trichome loosely, irregulary spirally coiled, not constricted at the cross-walls, not granulated at the cros walls, attenuated at the ends, ends slightly curved; cells ½ - 1/3 as long as broad; 3.2-4.5µ in diameter, 1.5-2.5µ ling; end cell with flat, convex, distinctly thick, broad outer membrane.

***Oscillatoria princeps* Vaucher ex Gomont:**

Thallus blue-green; trichomes long, curved, not constrited at the cross walls, slightly tapering at the ends; cells (much shorter than broad) ¼ as long as broad, 15-16.5µ in diameter, 2.2-4.2µ long; not granulated at the cross walls, end cells capitate without a calyptra.

***Oscilatoriasubbrevis* Schmidle:**

Trichomes blue-green, single, nearly straight, not constricted at the cross walls, not attenuated at the ends; cells 6.5-7.2µ in diameter, 1.5-2µ long; not granulated at the cross walls; end cell rounded, without a cap or a calyptra.

***SCHIZOTHRIX* Kuetzing, 1843.**

***Schizothrixfriesii* (Agardh) Gomont:**

Thallus blue-green; filaments in lower parts contorted, above rarely straight; sheath hyaline, lamellated, acuminate at the ends, coloured violet by chlor-zinc-iodide, with few trichomes or single trichomes; trichomes distinctly constricted at the cross walls; cells nearly quadratic or 2 times as long as broad, 2.5-3µ in diameter, 3.8-6.2µ long; end cell obtuse, conical.

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***MICROCOLEUS* Desmazieres, 1823**

***Microcleuslacustris* (Rabenh.) Farlow:**

Thallus blue-green; filaments 32-36µ in diameter, contorted, seldom branched; sheath colourless, slimy, not coloured violet by chlor-zinc-iodide; trichomes distinctly constricted of the cross walls, cells 4-5.2µ in diameter, 6.5-8.5µ long, slightly attenuated at the ends; not granulated at the cross walls; end cell more or less rounded, conical, without a cap or a calyptra.

***Microcoleusvaginatus* (Vaucher) Gomont**

Thallus dark green; filaments 25-27.5µ in diameter, sometimes sparsely branched, sometimes coiled; sheath hyaline, watery, uneven not coloured by chlor-zinc-iodide, often agglutinated with one another; trichomes blue-green or dirty green, not constricted at the cross walls, aften granulated at the cross walls, attenuated at the ends; cells subquadrate or ½-2 times as long as broad, 3.2-4.8 µ in diameter, 2-4.7 µ long; end cell capitate, with a flat, conical calyptra.

***PHORMIDIUM Kuetzing*, 1843**

***Phormidiumambiguum* Gomont:**

Thallus blue-green; filaments flexuous, entangled, 5.4-6µ in diameter; sheath thin, firm, coloured violet by chlor-zinc-iodide; trichomes slightly constricted at the cross walls, not attenuated at the ends; cells shorter than broad, 4.5-4.8µ in diameter 1.5-2.5µ long; end cell rounded, without a cap or a calyptra.

***Phormidiumanomala* Rao, C.B.:**

Thallus expanded, soft, mucilaginous, dark blue green; filaments 9.5-10.1µ in diameter; sheath, thin, hyaline, not stained by chlor-zinc-iodide; persistant or dissolved; trichomes not constricted at the cross walls; cells disc shaped, much broader than long, 7-7.5µ in diameter, 1-1.2µ long; end cells bluntly rounded, without a cap or a calyptra.

***Phormidium corium* (Agardh) Gomont**

Thallus expanded, membranous, leathery, brownish green; filaments long, more or less flexuous, entangled, 5.8-6.5µ in diameter; sheath thin, gelatinizing, coloured violet by chlor-zinc-iodide; trichomes not constricted at the cross walls, briefly attenuated at the ends; cells nearly quadrate, up to twice as long as broad, 4.5-4.8µ in diameter, 5-8.5µ long; not granulated at the cross walls; end cell obtuse, conical, without a cap or a calyptra.

***Phormidiumcalcicola* Gardner:**

Thallus blue-green, thick, firm, entangled; sheath thick, colourless, unlamellated; trichomes not constricted at the cross walls, not attenuated at the ends; cells slightly longer than broad, 6-6.5µ in diameter, 6.2-7.5µ long; not granulated at the cross walls; ends cell truncated, rounded, with a thickened outer membrane.

***Phormidiumjenkelianum*Schmid G.:**

Thallus brownish black, slimy, filaments 3.5-3.8µ in diameter, flexuous, not attenuated at the ends; not coloured violet by chlor-zinc-iodide; trichomes brownish blue green, distinctly constricted at the cross walls, not granulated at the cross walls; cells ½ as long as broad, 3-3.8µ in diameter, 1.5-1.8µ long; end cell rounded, truncated, without a cap or a calyptra.

***Phormidiummicrotomum*Skuja:**

Thallus expanded, lamellose, light blue-green; filaments more or less straight, 6.7-7.5µ in diameter; sheath thin, colourless later diffluent; trichome end briefly attenuated, not constricted at the cross walls; cells 5.2-6.5µ in diameter, 1-1.5µ long; end cell rounded with a hyaline calyptra.

***Phormidiummolle* (Kuetzing) Gomont:**

Thallus light blue-green, thin; sheath more or less diffluent, colourless, not coloured by chlor-zinc-iodide; trichomes 2.5-3µ in diameter, nearly straight, distinctly constricted at the cross walls, not attenuated at the ends, not granulated at the cross walls; cells quadrate, to longer than broad, 2.2-2.5µ in diameter, 4.8-6µ long; end cell rounded, without a cap or a calyptra.

***Phormidiumpachydermaticum* Fremy**

Thallus blue-green; filaments 6-6.5µ in diameter; sheath thick, lamellated, trichomes not constricted at the cross walls, not granulated at the cross walls, not attenuated at the ends; cells not quadrate, ½ as long as broad, 4.8-5.1µ diameter, 1.8-2.2µ long; end cell slightly convex or obtuse, conical, with a thickened membra

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***Phormidiumretzii* (Agardh) Gomont:**

Thallus blue-green; filaments more or less straight, 6-6.8µ in diameter, sheath thin, diffluent, trichomes constricted at the cross walls, not granulated at the cross walls, not attenuated at the ends; cells 5-5.2µ in diameter, 4.5-5.2µ long; end cell rounded, without a cap or a calyptra.

***LYNGBYA* Agardh, 1824**

***Lyngbyaaestuarii* Liebm.ex Gomont:**

Thallus blue-green; filaments nearly straight, 13-13.5µ in diameter; sheath thin, lamellated, not coloured violetby chlor-zinc-iodide, trichomes not constricted at the cross walls, cross walls often granulated; cells 10.5-12.8µ in diameter, 2.5-3.5µ long; end cell flat with thickened membrane, slightly attenuated.

***Lyngbyabirgei* Smith, G.M.:**

Filaments blue-green, straight, 16.5-17.2µ in diameter; sheath firm, colourless, unlamellated, seldom lamellated; trichomes not constricted at the cross walls, not attenuated at the ends; cells shorter than broad, 15-16µ in diameter, 2-3µ long, gas vacuoles not observed.

***Lyngbyadendrobia* Bruhlet Biswas:**

Thallus blue green, more or less expanded, compact, thin; filaments long, flexible, more or less straight 7-7.5µ in diameter; sheath thin, smooth, hyaline; trichomes vary slightly constricted at the cross walls, uniformly, densely granular; cells 2 times shorter than broad (as broad as long), 6-6.8µ in diameter 2.5-3.2µ long; end cell rounded, without a cap or a calyptra.

***Lyngbyalagerheimii* (Moebius) Gomont:**

Filaments blue-green, 2.5-3µ in diameter, single or entangled with one another, irregularly spirally coiled; sheath thin, hyaline; trichomes not constricted at the cross walls, not granulated at the cross walls, not attenuated at the ends; cells longer, end cell rounded, without a cap or a calyptra.

***Lyngbya major* Meneghini ex Gomont:**

Filaments dark blue-green, long, straight, 15-16.5µ in diameter; sheath thick, colourless, lamellated, not coloured violet by chlor-zinc-iodide; trichomes not constricted at the cross walls, granulated at the cross walls, not attenuated at the ends; cells 1/4-1/8 as long as broad, 10-12.2µ in diameter, 2.5-3.2µ long; end cell rounded, with slightly thickened membrane.

***Lyngbyamajuscula* Harvey ex Gomont:**

Thallus blue-green, expanded; filaments very long, curved or seldom, 14-15.1µ in diameter; sheath colourless, lamellated, colourlesslamellated, not coloured violet by chlor-zinc-iodide; trichomes blue-green; not constricted at the cross walls, not attenuated at the ends, cells shorter than broad, 1/6-1/5 times as long as broad 11.7-12.5µ diameter, 2.8-3.5µ long; cross walls not granulated, end cell rotund, without a cap or a calyptra.

***Lyngbya semiplena* (C. Agardh) J. Agardh ex Gomont:**

Thalluscaespitose, dark yellowish-green; filaments 7.5-8µ in diameter, entangled, curved or straight; sheath hyaline, thick, unlamellated, not coloured violet by chlor-zinc-iodide; trichomes not constricted at the cross walls, often granulated at the cross walls, slightly attenuated at the ends; cells 1/3-1/2 times as long as broad, 6.2-6.5µ in diameter, 2.5-4.2µ long; end cell capitate, without a calyptra.

***Lyngbyaspiralis* Geitler:**

Thallus blue green; filaments 8.5-9.4µ in diameter; spirals 6.8-9.4µ broad, the distance between two consecutive spirals 25.2-32.5µ; sheath hyaline, firm, not lamellated, not coloured violet by chlor-zinc-iodide; trichomes not constricted at the cross walls, not attenuated at the ends; cells shorter than broad, ½ times as long as broad, 6-6.5µ diameter, 2.5-3.2µ long; end cell broadly rounded, without a cap or a calyptra.

***Discussion:* Part A: Zooplanktons :**

In the present investigation, total 15 species of zooplanktons were recorded. Three species of Protozoa were found as follows; *Vorticella, Paramecium* and *Amoeba*. Three species belonging to Cladocerans were recorded as *Alonapulchella*, *Ceriodaphniacornuta*, *Moinamicrura*. Four species of Copepods were recorded as *Cyclops strenuus*, *Diaptomuspallidus*, *Heliodiaptomusviduus* and *Mesocyclopsleuckarti*. Belonging to Ostracods two species *Cyclocyprisglobosa*and *Cyprissubglobosa* were recorded. In Rotiferathree species such as *Asplanchna*, *Brachionusdurgae*and *Keratellavalga* were recorded. The physiochemical parameters such as temperature, light, pH,

organic and inorganic constituents and the interrelationship with theirorganisms play an important role in determining the nature and pattern of fluctuation of population densities of zooplanktons. Maximum species richness was observed during winter season and minimum was during monsoon. The maximum species richness was observed in group Rotifera and minimum in group Ostracods. The total number of zooplanktons was recorded maximum in the month of December and minimum number observed in month of June (Table 1).Zooplanktons are good indicators of changes in water quality, becausethey are strongly affected by environmental conditions and responds quickly tochanges in environmental quality. Hence, qualitative and quantitative studies of zooplanktons are of great importance. The monthly and seasonal variations of zooplankton are tabulated (Table 1).

Discussion part B : Blue greens :

The present investigation was carried out during June 2018 to May 2019 and a total of 27 taxa under 05 genera belonged to blue greens were encountered like *Oscillatoria*(7), *Schizothrix*(1), *Microcoleus*(2), *Phormidium*(9) and *Lyngbya*(08),the results are agreed with Ashtekar,(1979c),Bhogeet.al (2007),Chaporkar,(1984), Kolte,(1985).Yadav(2018).

IV. CONCLUSION

The zooplankton analysis showed that, the total zooplankton density was more in winter season due to low temperature, favorable for phytoplanktonic growth as an abundance of food.

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