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First Report on Trophic State of Daroji Lake, Ballari, Karnataka

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Abstract The present study objectively conducted to analysis of trophic state and physico-chemical nature of water in Daroji Lake, Ballari, Karnataka. The composite water, plankton and benthic samples were collected from 3 sampling stations from July 2018 to December 2018. The results of the present study showed variation in all the physico-chemical parameters. Mean temperature ranges from 20.4 ^{0}C ± 0.02 to 22.9 ^{0}C ± 0.32, pH varies from 5.7 ± 0.12 to 6.67 ± 0.03, DO form 5.37 ± 0.29 mg/l to 7.52 ± 0.49 mg/l. Alkalinity varied from 4.67 ± 0.67 mg/l to 7.3 ± 0.7 mg/l, Chloride from 19.9 ± 0.61 to 29.11 ± 5.04 mg/l, total hardness from 106.67 ± 1.86 to 142.67 ± 22.98 mg/l, conductivity varied from 165 ± 24.58 to 247 ± 12.01 µs/cm, carbon dioxide range from 7.39 ± 0.95 to 9.86 ± 1.74, nitrate- nitrogen from 0.46 ± 0.28 to 4.9 ± 0.03 and phosphorus values varied from 1.93 ± 0.25 to 4.46 ± 1.28. Among the total biota, the Bacillariophyceae comprises 28.1% followed by Chlorophycea 16.8% and Cyanophyceae (11.3%). The zooplankton, rotifers were found to be more (16.4%) compared to that of Copepod (5.1%) and Cladocera (2.2%). Among the benthic invertebrates Hemiptera was found more (7.7%) followed by Odonata (2.9%), Plecoptera (2.9%), Ephemeroptera (2.2%), Megaloptera (2.2%) and Trichoptera (2.2%). However, the shanon diversity index indicates that Cladocera and Ephemeroptera were found to be highest with H' = 1.79 among the biota. Whereas, Simpson index indicates Bacillariophyceae was found to be more with the index value D = 0.91. During the study period it was also clear that all biotic components shows increasing trends. The correlation among all the parameters and other possible factors influence the development of better trophic state of the lake are discussed.

Keywords Daroji Lake, Plankton, Benthos, Trophic state.

Introduction

The freshwater especially lentic habitat across the globe, supply essential resources for both terrestrial and aquatic organisms. These water bodies are live laboratories by which we can observe the effects of weather change in our own communities. With respect to the geological time, shallow water impoundement of alien property, are short- lived ecological units which become filled up with inorganic, organic and various abiotic factors. Any alteration of these factors can lead cascading consequences like change the living conditions, especially in the number, diversity and distribution of the biota which intern limits the

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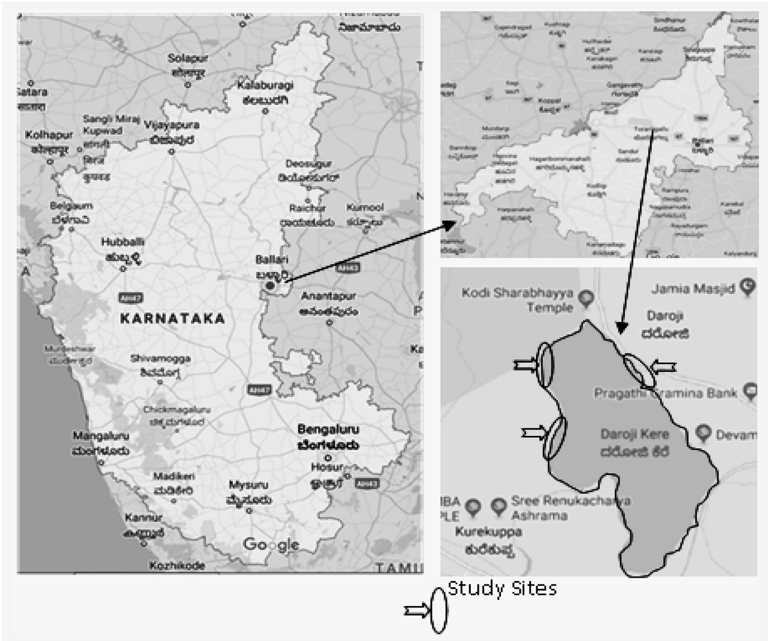

Fig. 1. Map of the study area and location of study sites.

production. The composition, distribution, diversity and abundance of biological system of any aquatic body depend on the water quality (Lei and Li 2000). The importance of plankton in tropical reservoir ecosystems include its use in estimating potential fish yield (Hecky and Kling 1987), productivity (Park et al. 2001), water quality (Walsh et al. 2005), energy flow (Simeiv 2005), trophic status (Reynolds 1999) and management (Beyruth 2000). Phytoplankton are being the primary producers, they act as the main food source for zooplankton and other aquatic biota (Akomeah et al. 2010). They act as biological indicators, where their presence, absence, diversity, abundance and distribution are used to determine the health (nutrient) status or quality of an aquatic environment (Sreenivasa et al. 2017). Anneville et al. (2004) reported that the sedimentation, grazing pressure, light, CO_2 and nutrient concentration act as forces responsible for the species composition of phytoplankton. Therefore, to tap from the potential (benefit) of phytoplankton, it is imperative to study their taxonomy (Atici 2002). Ahmad et al. (2011) reported that rotifers, cladocerans, copepods and ostracods constitute the major zooplankton population in the sewage fed fish ponds and contributed significantly to secondary production of the ponds. Benthic invertebrates are diverse group, play a pivotal role in linking the transfer of energy from producers to aquatic consumers like fishes, crustaceans, mollusks (Sharma et al. 2013). These animals are deferentially sensitive to many biotic and abiotic factors, thus these have been used as indicator of the condition of an aquatic system (Reice and Wohlenberg 1993). According to Daly (1996), Ward (1996) less than 3% of all species of insects begin their life cycle as aquatic larvae before emergence as winged land creatures. Cummins et al. (1995) stated that if sufficient dissolved oxygen and appropriate substrata are available, many species of benthic organisms, especially insects and crustaceans, can accelerate microbial processing of dead organic material. Edward and Ugwumba (2011), Andem et al. (2012), Romero et al. (2013) revealed the loss of some species will likely alter or degrade critical ecosystem processes because of the unavailability of replacement species. With respect to the anthropogenic and antural stress, it is understood that frequent assessment is very much required especially for the lakes and reservoirs which are build for mulpurpose utility. Considering the significance, the proposed research work has been designed to investigate the biotic components and their assemblages with respect to abiotic influences in the Daroji Lake, Karnataka.

Materials and Methods

Daroji Lake is geographically located at latitude 15^0 15´0´´ and longitude 15^0 15´0´´. It is named after the village Daroji, located in the Sandur taluk of Bellary district in Karnataka (Fig.1). The Daroji Lake is located in the Sandur taluk of Bellary district in Karnataka, was built in the 13th century, the lake is now managed by the Watershed Department. The lake is regarded as the second largest water bodies in Karnataka, which can irrigate a total of 4,700 acres of land and serving thousands around Hosa Daroji, Hale Daroji, Madapura, Somalapura, Honnalli, Mavinahalli, Suggenahalli and Gonala villages. Other than its agricultural importance, it is also serving as comfortable habitat for many numbers of flora and fauna.

The composit water samples, plankton and benthos were collected from 3 sampling stations of Lake Daroji for 6 months (July 2018 to December 2018). The benthic samples were collected by using quadrate method. The samples were sieved through 200-500 µm and fixed in 5% for maldehyde for further identification. The qualitative and quantitative analyses were done as described by Arbačiauskas et al. (2008). Water temperature and pH were measured in the field by using digital probes after making standard calibrations. CO_2, alkalinity, hardness, chlorides, dissolved oxygen in the water samples were estimated methods explained in APHA (1995),

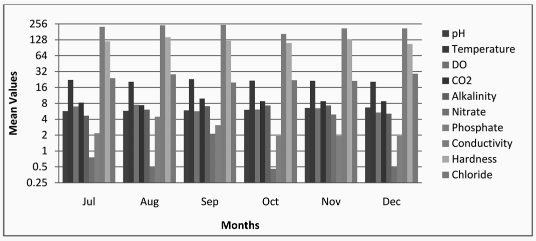

Fig. 2. Physico-chemical parameters of Daroji Lake water.

Strickland and Parsons (1972). The total hardness in the water was determined by EDTA method as described in (Strickland and Parsons 1972). Nitrate in the water were estimated by ascorbic acids the methods (APHA 1995). The total phosphorus was estimated (po4-p) by phenoldisulphonic acids method of Olsen et al. (1954).

Results and Discussion

The results of the present study showed variation in all the physico-chemical parameters. Mean temperature ranges from 20.4 ^{0}C ± 0.02 to 22.9 ^{0}C ± 0.32, pH varies from 5.7 ± 0.12 to 6.67 ± 0.03, DO form 5.37 ± 0.29 mg/l to 7.52 ± 0.49 mg/l, Alkalinity varied from 4.67 ± 0.67 mg/l to 7.3 ± 0.7 mg/l, Chloride from 19.9 ± 0.61 to 29.11 ± 5.04 mg/l, total hardness from 106.67 ± 1.86 to 142.67 ± 22.98 mg/l, conductivity varied from165 ± 24.58 to 247 ± 12.01 µs/cm, carbon dioxide range from 7.39 ± 0.95 to 9.86 ± 1.74, nitrate -nitrogen from 0.46 ± 0.28 to 4.9 ± 0.03 and phosphorus values varied from 1.93 ± 0.25 to 4.46 ± 1.28 (Table 1 and Fig. 2). During the study period the temperature showed variation form onset

Table 1. Physico-chemical parameters of Daroji Lake water.

	Jul	Aug	Sep	Oct	Nov	Dec
pH	5.7 ± 0.12	5.77 ± 0.03	5.87 ± 0.03	6.03 ±0.03	6.53 ± 0.03	6.67 ± 0.03
Temp ^{0}C	22.17 ± 0.6	20.45 ± 0.02	22.93 ± 0.32	21.6 ± 0.31	21.37 ± 0.23	20.51 ± 0.26
DO mg/l,	6.96 ± 0.75	7.52 ± 0.49	5.67 ± 0.09	6.1 ± 0.29	6.47 ± 0.28	5.37 ± 0.29
CO_2 mg/l $CaCO_3$	8.23 ± 1.39	7.39 ± 0.95	9.86 ± 1.74	8.8 ± 2.2	8.8 ± 2.2	8.8 ± 2.2
Alk mg/l $CaCO_3$	4.67 ± 0.67	6.07 ± 0.58	7.07 ± 0.58	7.3 ± 0.7	7.27 ± 0.73	5.1 ± 0.59
Nitrate-nitrogen mg/l	0.76 ± 0.04	0.51 ± 0.04	2.12 ± 1.64	0.46 ± 0.28	4.9 ±0.03	0.5 ± 0.01
Phosphate-phosphorus mg/l	2.17 ± 0.61	4.46 ± 1.28	3.08 ± 0.8	1.93 ± 0.25	1.93 ± 0.25	1.93 ± 0.25
Cond µs/cm	225.67 ± 7.4	240 ± 20.55	247 ± 12.01	165 ± 24.58	211 ± 3.84	211.3 ± 1.86
Hard mg/l $CaCO_3$	119.67 ± 5.0	142.67 ± 22.9	122.67 ± 2.6	111.3 ± 6.2	131.6 ± 1.76	106.6 ± 1.86
Chl mg/l	24 ± 2.52	28.33 ± 1.45	19.9 ± 0.61	22 ± 1.53	21.3 ± 0.91	29.11 ± 5.04

Table 2. Plankton and benthos species diversity in Daroji Lake.

Group	Species	Jul	Aug	Sep	Oct	Nov	Dec
Phytoplankton							
Bacillariophyceae	*Pinnularia* sp.	✓	✓	✓	✓	✓	✓
	Gomphoneis sp.		□	□	□	□	✓
	Navicula sp.	✓	✓	✓	✓	✓	✓
	Nitzschia sp.	□	✓	□	□	✓	✓
	Cyclotella sp.	□	□	□	□	✓	✓
	Asterionella sp.	□	□	□	□	□	✓
	Cymbella sp.	✓	✓	✓	✓	✓	✓
	Diatoma sp.	□	✓	□	□	✓	✓
	Fragilaria sp.	✓	✓	✓	✓	✓	✓
	Gyrosigma sp.	□	□	□	□	□	✓
	Gomphonema sp.	✓	✓	□	✓	✓	✓
	Tabellaria sp.	□	□	□	□	□	✓
	Didymosphenia	□	✓	□	□	✓	✓
	Epithemia	□	□	□	□	□	✓
	Achnanthes	□	□	□	□	✓	✓
	Diatoma hyemalis	✓	✓	✓	✓	✓	✓
	Diatoma vulgaris	□	□	□	□	□	✓
	Didymosphenia	□	□	□	□	□	✓
	Epithemia	□	□	□	□	✓	✓
	Planothidium	□	□	□	□	□	✓
	Synedra	✓	✓	□	✓	✓	✓
	Neidium	✓	□	□	✓	✓	✓
	Caloneis	□	□	□	□	✓	✓
	Brachysira	□	□	□	□	□	✓
	Craticula	□	□	□	□	□	✓
	Micractinium	✓	✓	□	✓	✓	✓
Cyanophyceae	*Anabaena* sp.	✓	✓	✓	✓	✓	✓
	Oscillatoria sp.	✓	✓	✓	✓	✓	✓
	Lyngbya sp.	✓	✓	✓	✓	✓	✓
Chlorophyceae	*Actinastrum* sp.	□	□	□	✓	✓	✓
	Ankistrodesmus sp.	✓	✓	✓	✓	✓	✓
	Cryptophyta sp.	□	□	□	□	✓	✓
	Cosmarium sp.	✓	✓	✓	✓	✓	✓
	Monorophidum sp.	□	□	□	□	□	✓
	Selenastrum	□	✓	□	✓	✓	✓
	Closterium	✓	✓	✓	✓	✓	✓
	Penium	□	□	□	□	□	✓
	Ankistrodesmus	□	□	□	□	□	✓
	Micrasterias	□	□	□	□	□	✓
Zooplankton							
Rotifers	*Asplanchna*	✓	✓	✓	✓	✓	✓
	Conochilus	□	□	□	✓	✓	✓
	Euchlanis	□	□	✓	✓	✓	✓
	Brachionus quadridentatus	✓	✓	✓	✓	✓	✓
	Cephalodella	□	□	✓	✓	✓	✓
	Keratella quadrata	✓	✓	✓	✓	✓	✓
	Philodina	□	□	✓	✓	✓	✓
	Lepadella	□	□	□	✓	✓	✓
	Filinia	□	□	✓	✓	✓	✓
	Rotaria sp.	✓	✓	✓	✓	✓	✓
Copepods	*Cyclops*	□	□	✓	✓	✓	✓
	Nauplius larva	✓	✓	□	✓	✓	✓
	Diaptomus	✓	✓	✓	✓	✓	✓
Cladocerans	*Daphnia*	✓	□	□	✓	✓	✓
	Moina	□	□	□	□	✓	✓

Table 2. Continued

Group	Species	Jul	Aug	Sep	Oct	Nov	Dec
Benthic fauna							
Ephemeroptera (Mayflies and their larvae)	*Epeorus* sp.	□	□	□	✓	□	✓
	Leptophlebia sp.	✓	□	□	✓	✓	✓
Odonata (dragonflies and damselflies and their larvae)	*Lestes*	□	□	□	✓	✓	✓
	Calypteryx	□	□	□	□	□	✓
	Aeshna	□	□	□	□	□	✓
	Epitheca	□	□	□	□	□	✓
	Sympetrum	□	□	□	□	□	✓
	Cordulegaster	□	□	□	□	□	✓
Plecoptera (stoneflies and nymphs)	*Pteronorsis*	□	□	✓	✓	✓	✓
	Capnia	□	□	□	✓	✓	✓
	Perla	□	□	□	□	□	✓
Hemiptera (true bugs)	*Buenoa*	□	✓	✓	✓	✓	✓
	Notonecta	□	□	□	✓	✓	✓
	Nepa	□	□	□	□	✓	✓
	Lethocerus	□	□	□	✓	✓	✓
	Sigara	□	□	□	□	✓	✓
	Gerris	✓	✓	✓	✓	✓	✓
Megaloptera (dobsonflies and alderflies)	*Dysmicohermes disjusctus*	□	□	□	✓	✓	✓
	Sialis sp.	□	□	□	✓	✓	✓
Trichoptera (caddisflies)	*Chimarra,*	□	□	□	✓	✓	✓
	Lepidostoma	□	□	□	✓	✓	✓

of monsoon to post-monsoon. It is true that early monsoon showed maximum temperature followed by slight depletion in any stagnant water (Nainwal et al. 2008). Water pH levels play an important role on the health of bodies of water and their ecosystems. A healthy habitat for aquatic life typically requires 6.5 to 8.0 pH (William and Robert 1992). The pH of the present study also in the permissible limits. The maximum solubility of oxygen in water is around 8 mg/L. at 30^0 (Wetzel 2001). The oxygen and carbon dioxide level in the study lake favors good growth of flora and fauna (Tewari and Mishra 2005, Garg et al. 2006). Based on hardness standard, the Daroji alke water can be categorized into soft water to moderately hard water (Soni et al. 2013). Nitrate-nitrogen and phosphate-phosphorus were also found within the limit of WHO (Ayers and Westcot 1994).

Among the phytoplankton bacillariophyceae comprises 26 species found in December. *Pinnularia* sp., *Navicula* sp., *Cymbella* sp., *Fragilaria* sp. and *Diatoma hyemalis* present throughout the study period. *Gomphonema* sp., *Micractinium* and *Synedra* showed inconsistency in September. Cyanophyceae showed only 3 species, *Anabaena* sp.,*Oscillatoria* sp. and *Lyngbya* sp. found all the time in the present studies. In the chlorophyceae, *Actinastrum* sp. *Cosmarium* sp. and *Closterium* sp. found all the time and *Actinastrum* sp., *Cryptophyta* sp., *Monorophidum* sp., *Selenastrum, Penium, Ankistrodesmus* and *Micrasterias* were found non-frequently. Among zooplankton, rotifers showed maximum number. *Asplanchna, Brachionus quadridentatus, Keratella quadrata* and *Rotaria* sp. were the most frequently seed and other species were present only in few months. From the copepods, diaptomus was found regularly and *Nauplius larva* and *Cyclops* were seen rarely. *Moina* and *Daphnia* developed later stage of the study period (Table 2). In the present study Bacillariophyceae was found more than other groups. This could be due to the presence of more minerals, high temperature, light intensity and rapid multiplication of diatoms. This also might be due alteration of pH by death and decay of water plants (Chindah et al. 2004). The other groups like Chlorophyceae and Cyanophyceae were found lesser in number due the less adherent character and slight water current (Kadiri 1999). The result corroborates the research findings reported by Udoh and Akpan

Table 3. Percentage composition, diversity of plankton and benthos in Daroji Lake.

Individuals	AvG	%	H´ Shanon diversity	D Simpson
Bacillariophyceae	12.8	28.1	1.62	0.91
Cyanphyceae	5.2	11.3	1.71	0.54
Chlorophyceae	4.5	16.8	1.71	0.88
Rotifers	7.5	16.4	1.69	0.60
Copepods	2.3	5.1	1.73	0.53
Cladocerans	1.0	2.2	1.79	0.41
Ephemeroptera	1.0	2.2	1.79	0.41
Odonata	1.3	2.9	0.74	-
Plecoptera	1.3	2.9	1.32	-
Hemiptera	3.5	7.7	1.62	0.22
Megaloptera	1.0	2.2	0.69	-
Trichoptera	1.0	2.2	0.69	-

(2007) and Omonona and Babalola (2007) in the Southern Nigeria, Sreenivasa et al. (2017) in Ethiopian river water.

Among the benthic invertebrates Hemiptera was found more (7.7%) and comprises the larvae and nymphs of *Buenoa, Notonecta, Nepa, Lethocerus, Sigara* and *Gerris*. Among Odonata; *Lestes, Calypteryx, Aeshna, Epitheca, Sympetrum* and *Cordulegaster* comprises 2.9% of the total biotic components. Plecoptera showed 3 species, *Pteronorsis, Capnia* and *Perla* (2.9%), Ephemeroptera with *Epeorus* sp. and *Leptophlebia* sp. (2.2%), under Megaloptera, *Sialis* sp. and *Dysmicohermes disjusctus* (2.2%) and Trichoptera showed *Lepidostoma* and *Chimarra* with 2.2% of total biotic components (Table 2). Among the plankton Bacillariophyceae were to be the dominant species, were found about 28.1% followed by chlorophyceae (16.8%), rotifers (16.4%), cladocera (11.3%), copepods (5.1%) and Cladocera with 2.2% (Fig. 2). The Shanon diversity index indicates that Cladocera and Ephemeroptera were found to be highest with H' = 1.79 among the biota. Whereas, Simpson index indicates Bacillariophyceae was found to be more with the index value D = 0.91 (Table 3). The percentage composition of insect benthos showed that Hemiptera comprises 38% followed by Odonata (15%) and Plecoptera (14%). Whereas, Epimeroptera, Megaploptera and Tricoptera comprises minimum of 1% each of the total benthos population present in the Daroji Lake during the study period (Figs. 3 and 4). Benthic macro invertebrates are an important part of any aquatic ecosystems. These invertebrates respond to changes in the physical and chemical environment. Invertebrates in water are known to be influenced by environmental conditions such as : Hydraulic stress, temperature and water chemistry (Nicola et al. 2010, Rosin et al. 2010). Rainfall distribution pattern have great impact on both the chemistry of water as well as the population dynamics of the fauna (Onyema et al. 2009). It is true in the present study some of the water parameters significantly correlated with Dipterans, Trichoptera, Ephemeroptera and Odonata and water parameters mainly, such as dissolved oxygen, pH and Alkalinity (Cummins et al. 2005). Among the aquatic insects, Ephemeroptera, Plecoptera and Trichoptera (EPT) are considered an important taxonomic groups significantly correlated with Cyanophyceae, Chlorophyceae and rotifers at $p<0.05$. Their abundance and species richness also by represents abundant

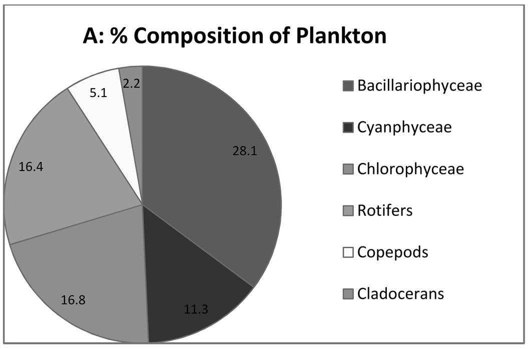

Fig. 3. Percentage composition of plankton in composite sample in Daroji Lake.

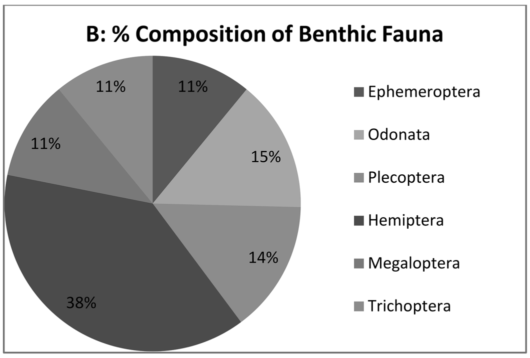

Fig. 4. Percentage composition of benthos in composite sample in Daroji Lake.

Table 4. Pearson correlation between the physico-chemical and biological parameters. **, Correlation in significant at the 0.01 level (2-tailed), *, Correlation is significant at the 0.05 level (2-tailed).

	Correlations										
	pH	Temp	DO	CO_2	Alk	Ni	Phos	Cond	Hard	Chl	Bac
pH	1	-.070	.073	-.184	.432	.932*	-.320	-.099	.333	-.354	.189
Temp		1	-.245	-.489	.278	.230	-.173	.183	-.148	-.844*	-.697
DO			1	-.617	-.142	-.045	.574	.250	.783	.195	-.299
CO_2				1	-.475	-.280	-.324	-.085	-.595	.624	.902*
Alk					1	.529	.021	-.279	.220	-.675	-.373
Nit						1	-.237	.113	.351	-.566	.003
Phos							1	.644	.751	.298	-.331
Cond								1	.551	.119	-141
Hard									1	.013	.342
Chl										1	.645
Bac											1
Cya											
Chl											
Rot											
Cope											
Clad											
Epi											
Odo											
Pleco											
Hemi											
Mega											
Tric											

Table 4. Continued.

	Correlations										
	Cya	Chl	Rot	Cope	Clad	Epi	Odo	Pleco	Hemi	Mega	Tric
pH	.610	.379	.484	.408	-.082	.011	-.055	.283	.576	.457	.457
Temp	-.588	-.304	-.185	-.628	.230	-.298	-.533	-.267	-.468	-.384	-.384
DO	-.364	-.410	-.679	-.124	.261	-.480	-.638	-.786	-.508	-.492	-.492
CO_2	.599	.468	.884	.393	-.083	.548	.978**	.683	.569	.451	.451
Alk	.088	-.045	.348	.023	-.685	-.144	-.355	.221	.255	.294	.294
Nit	.407	.148	.374	.091	-.137	-210	-.192	.189	.413	.256	.256
Phos	-.498	-.877*	-.754	-.589	-.367	-.807	-.439	-.659	.553	-.700	-.700
Cond	-.397	-.781	-.662	-.781	.041	-.848*	-.267	-.569	-.496	-.784	-.784
Hard	-.219	-.623	-.553	-.331	-.199	-.800	-.625	-.635	-.319	-.488	-.488
Chl	.260	.054	-.143	.276	.014	.168	.562	.040	.113	.009	.009
Bac	.843*	.593	.584	.623	-.107	.535	.933**	.704	.764	.604	.604
Cya	1	.761	.839*	.814*	-.253	.577	.726	.823*	.972**	.863*	.863*
Chl		1	.843*	.901*	.184	.926**	.619	.769	.772	.899*	.899*
Rot			1	.744	-.290	741	.639	.958**	.930**	.958**	.958*
Cope				1	-.019	.822*	.560	.673	.791	. 894*	.894*
Clad					1	.164	-.129	-.369	-.374	-.261	-.261
Epi						1	.670	.737	.619	.816*	.816*
Odo							1	.800	.711	.626	.626
Pleco								1	.914*	.904*	.904*
Hemi									1	.925**	.925**
Mega										1	1.00**
Tric											1

resources in the food in the lake. Buss et al. (2004), Sreenivasa et al. (2017) stated that EPT sensitive to environmental perturbations and usually live mainly in clean and well oxygenated waters. Caddis fly

(Trichoptera) and may fly (Ephemeroptera) are less abundant in the river water– soil interface because they tend to prefer specific substratum type in the stream (Harper and Hawksworth 1994). The pH of the water is correlated with Nitrate (r=0.932), carbon dioxide is directly correlated to the presence of Odonata (r=.978), Odonata is correlated with Bacillariophyceae (r=0.933), Plecoptera is stronlgly correlated with cyanophyceae (r = 0.823) and rotifer (r = 0.958). Megaloptera is strongly correlated with rotifer (r=0.958) and Hemiptera (0.926). Tricoptera having positive correlation with Cyanophyceae (r =.863), rotifers (r=0.958), Hemiptera (r=0.926) and Megaloptera (r=1.00) at p<0.01 level significance. Bacillariophyceae with carbon dioxide (r= .902), Cyanophyceae with Bacillariophyceae (r=.843), Chlorophyceae with rotifers (r = 0.843), copepods (r=0.901), Megaloptera (r=0.899) and Tricoptera (r=0.899). Cyanophycea significantly correlated with rotifers (r=0.839), copepods (0.814) Plecoptera (r=0.823), Megaloptera (r=0.863) and Tricoptera (r=0.863) at p<0.05 level. Whereas, chloride negatively significant and correlated to water temperature (r= -.844), phosphate with chloride (r = -.877) and Epimeroptera with conductivity (r= -.848) at p<0.05 (Table 4).

The present study it is therefore can be concluding that the Daroji Lake is slightly mesotrophic with minimum amount of nutrients. This might be due inflow of water from agricultural surrounding areas during rainy season. This is also having conformity with that of the studies carried out by Spence (1964), Vollenwelder (1968). The present results also indicated that the varied physico-chemical characteristics of water, diversity of plankton and benthos, water body which might tern towards eutrophication in the later summer. Further, the trophic condition clearly demands a proper conservation and management strategies.

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