

## Limnological study of Hosahalli Pond in Shivamogga district, Karnataka

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### Abstract

The present study deals with the physico-chemical parameters and biotic communities of Hosahalli pond of Shivamogga district, Karnataka during January to June 2021. In this study, 64 species of phytoplankton, 11 species of zooplankton, 07 species of hydrophytes, 04 species of aquatic insects/ beetles, 03 species of molluscans and 01 species each of annelid worm, rhizopoda and parasitic ciliates are recorded. The water temperature ranged from 22 to 28°C and the pH of the Hosahalli pond water was slightly acidic to slightly alkaline in nature. DO values varied from 2.4 to 4.6 mg/l. While, BOD level fluctuated between 7.0 and 8.8 mg/l. Carbon dioxide value varied 10.9-28 mg/l. However, chloride content of the water deviated from 90.2 to 112.6mg/l. The total hardness ranged from 90 to 116 mg/l. The results have revealed that the Hosahalli pond is contaminated due to human conflict, entry of domestic waste and agricultural runoff from the nearby area.

**Keywords:** Hosahalli Pond, biotic communities, water quality, contamination

### Introduction

Limnology is the learning of fresh water habitat. The biotic components may be heterotrophic, autotrophic or decomposers, the aquatic ecosystem is further divided into fresh water and marine water ecosystem. Fresh water ecosystem is further sub-divided into lotic and lentic ecosystem. Lentic ecosystem that includes lakes, ponds, tanks, reservoirs, beels, jheels etc.

The physico-chemical study of water help in understanding the structure and function in relation to its habitats. Abundance of particular element might suggest the type of organism that may be found as well as indication of ecologically unfavorable ecosystem which can have negative or positive impact on the population i.e. high concentration of nitrate or phosphate is indicative of eutrophication (Patil Shilpa *et al.*, 2012; Sayeswara and Ashashree, 2018) [14, 16].

Abiotic compounds are the number of inorganic substances like carbon, hydrogen, nitrogen, sulphur, phosphorous, carbon dioxide and water, organic compounds like proteins, carbohydrates, lipids, amino acids etc. Biotic components are the living components, it includes producers. Phytoplankton are the microscopic autotrophs, which fix solar energy. Phytoplankton play an important role in the biosynthesis of organic matter (primary production) in aquatic ecosystems, which directly or indirectly serve all the living organisms of a water body as food.

Consumers are the heterotrophic living creatures, which burn-through makers as their food. Primary consumers are the herbivorous creatures rely on autotrophs organic entities like infinitesimal plant eaters or zooplankton, molluscans, bugs, Cyclops and daphnia and so forth secondary consumers are the essential flesh eating, which relies on herbivorous creatures for food. Eg: creepy crawlies, fishes, frogs, crabs etc. Tertiary consumers are 2nd grade of savage. They feed upon plants or animals (secondary consumers) in this way they are called omnivorous. Top

consumers are 3rd grade of rapacious, which feed upon essential, auxiliary and tertiary shoppers. Decomposers incorporates heterotrophic microorganisms like microbes, parasites, what separate the natural complex food from dead makers and buyers into basic inorganic mixtures made accessible to the producers.

The main objectives of the current study is to know the physico-chemical parameters of the studied pond and also to know the biotic components of the Hosahalli pond.

### Materials and Methods

#### Study area

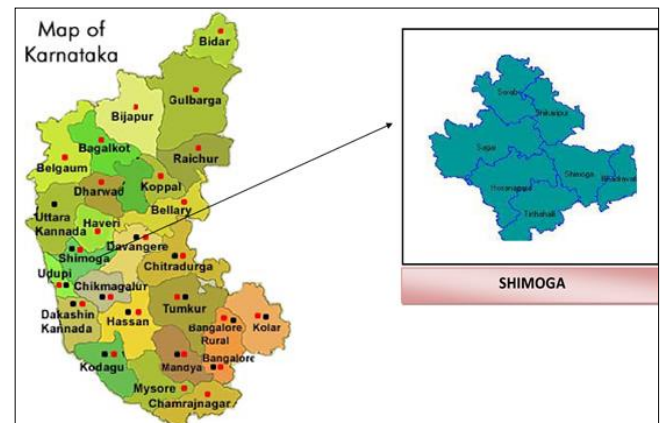


Fig 1: Study area map

Hosahalli pond is an perennial one and is located between 13° 52' N latitude and 75° 34' inches E longitudinal and is situated 5.3 km away from Shivamogga. The gross area of the Hosahalli pond is about 95 acres but the water spread area is about 70 acres. The depth of this pond is around 6 feet. This water body is located in Hosahalli area of Shivamogga district. The water is used for domestic purposes like washing clothes, vehicles and domestic

animals etc. It is surrounded by paddy, sugarcane field and nut garden in all the directions. The water has undergone moderate changes in its physico-chemical properties due to ecological degradation, overflowing of water from adjacent paddy fields and other exclusive human activities.

**Methodology**

The study was carried out during January to June months of 2021. During the study period the surface water samples were collected in clean plastic bottles between 7 AM to 9 AM in each month. Water temperature and pH were recorded immediately on the field. For estimation of dissolved oxygen samples were fixed on the field itself. The parameters were analysed as per the standard methods of APHA (1995) [2]. Phytoplankton samples were collected by using plankton net by filtering 4 litre of water preserved in 4% formaldehyde. identifications of Phytoplankton and zooplankton were made with the help of standard references (Welch,1952;Desikachary,1959;Goudar and Joseph,1961; Gandhi,1961; Prescott,1982; Sinha and Sinha,1983; Anjana et al.,1998; Goswami,2004; Sayeswara et al,2011; Jose Sanal Kmar,2012; Maria Alexandra and Barbosa,2020) [23, 4, 6, 15, 18, 1, 7, 17, 11, 13]. Biotic communities were recorded by referring monographs, books and field guides (Khan and Ghosh,2001; Subba Rao,1989; Fasseit,1957 ; Gupta 1979) [12, 19, 5, 9]. The materials used in this study were, plankton net, plastic bottles, 4% formaldehyde, compound microscope, binocular microscope, dropper, slides, and coverslips.

**Statistical analysis**

Oneway-ANOVA with Tukey HSD test is calculated for physico-chemical parameters by using www.socscistatistics.com software.

**Results and Discussion**

The abiotic components comprise water, oxygen, nitrogen, phosphorous, calcium, amino acids, humic acid etc. Producers take them in a small amount in soluble for most

of them remain inside the bodies of animals.

The physico chemical parameters of Hosahalli pond has shown in Figure 3 and the biotic communities are depicted in Table 1. Percentage composition of biotic communities are shown in Figure 4.

In this study, 64 species of phytoplankton, 11 species of zooplankton,07 species of hydrophytes, 04 species of aquatic insects/ beetles, 03 species of molluscans and 01 species each of annelid worm, rhizopoda and parasitic ciliates are recorded.

The water temperature ranged from 22 to 28°C during the experimental period. pH of the Hosahalli pond water was slightly acidic to slightly alkaline. (Figure 2).

Dissolved oxygen values varied from 2.4 to 4.6 mg/l. The variations of DO depends on the primary production and respiration of aquatic organism. Amount of oxygen required to carry out the biological decomposition of dissolved solids in sewage under aerobic conditions at standard temperature is known as the biological oxygen demand (BOD). BOD and other microbial activities generally increased by the introduction of sewage. The BOD level fluctuated between 7.0 and 8.8 mg/l.

Carbon dioxide value varied 10.9-28 mg/l. The variation of carbon dioxide was due to the absorption by plants for photosynthesis and activity of other living organisms. the abundance of carbon dioxide exerts certain specific effects on aquatic biota.

Water quality can be given assisted by its chloride content. Low chloride content indicates pure water. In the present analysis, the chloride content of the water deviated from 90.2 to 112.6mg/l. Chloride present in sewage and form drainage, control the salinity of water and osmotic stress on biotic communities. Chlorides increase the degree of eutrophication.

Total hardness of water is not a pollution parameter but indicates water quality mainly in terms of Ca<sup>2+</sup> and Mg<sup>2+</sup> contents. In the present study, total hardness values ranged from 90 to 116 mg/l.



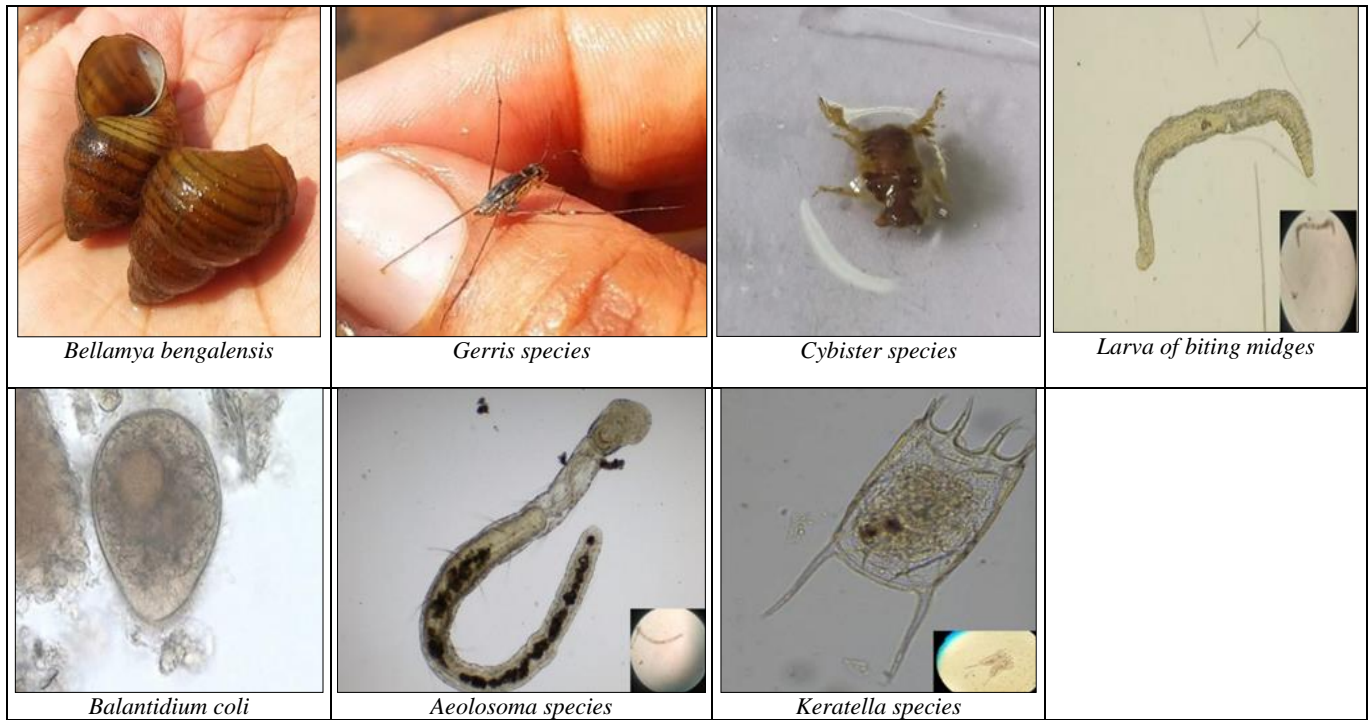


Fig 2: Biotic communities of Hosahalli pond, Shivamogga district

Table 1: List of Biotic communities in Hosahalli pond

Organisms	Species
Chlorophycean algae	<i>Ankistrodesmus falcatus</i> , <i>Arthrodesmus</i> sp., <i>Coelastrum microporum</i> , <i>Coelastrum reticulatum</i> , <i>Crucigenia rectangularis</i> , <i>Eudorina ielgans</i> , <i>Kirshikoviella limnetica</i> , <i>Oocystis gigas</i> , <i>Pediastrum simplex</i> , <i>Pediastrum duplex</i> , <i>Scenedesmus dimorphos</i> , <i>Scenedesmus quadricauda</i> , <i>Selanastrum abundance</i> , <i>Selanastrum acuminatus</i> , <i>Tetraedon</i> sp, <i>Tetraedon caudatum</i> , <i>Closterium gracile</i> , <i>Desmodesmus seratus</i> , <i>Ulothrix</i> sp., <i>Cosmarium</i> sp., <i>Staurastrum artiscon</i> , <i>Eudorina elegans</i> . (Sayeswara et al.,2011) <sup>[17]</sup>
Blue green algae	<i>Anacystis</i> sp., <i>Anabaena</i> sp., <i>Arthospora</i> sp., <i>Gloecapsa</i> sp., <i>Merismopedia glauca</i> , <i>Merismopedia tenuissima</i> , <i>Microcystis aeruginosa</i> , <i>Nostoc microscopium</i> , <i>Oscillatoria formosa</i> , <i>Phormidium</i> sp., <i>Rivuliera</i> sp., <i>Spirulina</i> sp., <i>Synechocystis</i> sp.
Euglenoids	<i>Euglena acus</i> , <i>Euglena gracile</i> , <i>Euglena elongata</i> , <i>Euglena oxyalis</i> , <i>Phacus longicauda</i> , <i>Phacus pleuronectes</i> , <i>Phacus curvicauda</i> , <i>Strombomonas gibberosa</i> , <i>Trachelomonas robusta</i> .
Diatoms	<i>Anomoeonies sphaeophora</i> , <i>Colonies pulchra</i> , <i>Cymbella tumida</i> , <i>Cymbella affinis</i> , <i>Diatoma vulgare</i> , <i>Fragillaria intermedia</i> , <i>Gomphonema abbreviatum</i> , <i>Gomphonema lanceolatum</i> , <i>Gyrosigma elongaa</i> , <i>Melosira granulata</i> , <i>Navicula pupula</i> , <i>Navicula pigmea</i> , <i>Navicula radiosa</i> , <i>Nitzschia amphibia</i> , <i>Pinnularia major</i> , <i>Pinnularia microstauron</i> , <i>Surirella capronii</i> , <i>Synedra ulna</i> , <i>Taballaria</i> sp., <i>Navicula palea</i> .
Zooplankton	<i>Brachionus</i> sp., <i>Colpoda</i> sp., <i>Cyclops</i> sp., <i>Daphnia</i> sp., <i>Sida</i> sp., <i>Moina daphnia</i> sp., <i>Keratella tropica</i> ., <i>Paramoecium caudata</i> , <i>Paramoecium</i> sp., <i>Para cyclops</i> , <i>Uronema</i> sp.
Hydrophytes	<i>Nymphaea</i> sp, <i>Jussiaea repens</i> , <i>Salvinia minima</i> , <i>Hydrilla verticillata</i> , <i>Typha</i> sp, <i>Cyperus</i> sp, <i>Myriophyllum spicatum</i>
Aquatic insects and beetles	<i>Notonectids</i> , <i>Larva of biting midges</i> , <i>Gerris</i> sp, <i>Cybister</i> sp..
Molluscans	<i>Pila globosa</i> , <i>Lymnaea</i> sp, <i>Bellamya bengalensis</i>
Parasitic ciliate	<i>Balantidium coli</i>
Annelid worm	<i>Aeolosoma</i> sp.
Rhizopods	<i>Pontigulasia compressa</i>

**One Way Anova and post hoc Tukey hsd test**

Table 2 depicts one-way-ANOVA data for physico-chemical parameters of Hosahalli pond. Nevertheless, Table 3 shows Post Hoc Tukey HSD statistics for physico-chemical parameters. The Tukey's HSD facilitates pair wise

comparisons within ANOVA data. The F statistic value (above) tells whether there is an difference between the means. Tukey's HSD test allows to determine if any pairs there is a significant difference.

Table 2: One-Way-ANOVA data for physico-chemical parameters of Hosahalli pond

	WT (T1)	DO (T2)	BOD (T3)	TH (T4)	CI (T5)	Total
N	6	6	6	6	6	30
ΣX	150	22.7	47.4	536	607.3	1363.4
Mean	25	3.7833	7.9	89.3333	101.2167	45.447
ΣX <sup>2</sup>	3778	88.59	378.34	55904	61990.37	122139.3

Std.Dev.	2.3664	0.736	0.8809	40.0533	10.2126	45.553
Result details						
Source	SS		df	MS		
Between-parameters	51599.9047		4	12899.9762		F = 37.59869
Within-parameters	8577.41		25	343.0964		
Total	60177.3147		29			

The f-ratio = 37.59869. p-value <.00001. The result is significant at p <.05.

**Table 3:** Post Hoc Tukey HSD data for physico-chemical parameters of Hosahalli pond

Pair wise comparisons	HSD <sub>.05</sub> = 31.4077 HSD <sub>.01</sub> = 38.8978	Q <sub>.05</sub> = 4.1534 Q <sub>.01</sub> = 5.1439
T <sub>1</sub> :T <sub>2</sub> M <sub>1</sub> = 25.00 M <sub>2</sub> = 3.78	21.22	Q = 2.81 (p = .30243)
T <sub>1</sub> :T <sub>3</sub> M <sub>1</sub> = 25.00 M <sub>3</sub> = 7.90	17.10	Q = 2.26 (p = .51167)
T <sub>1</sub> :T <sub>4</sub> M <sub>1</sub> = 25.00 M <sub>4</sub> = 89.33	64.33	Q = 8.51 (p = .00003)
T <sub>1</sub> :T <sub>5</sub> M <sub>1</sub> = 25.00 M <sub>5</sub> = 101.22	76.22	Q = 10.08 (p = .00000)
T <sub>2</sub> :T <sub>3</sub> M <sub>2</sub> = 3.78 M <sub>3</sub> = 7.90	4.12	Q = 0.54 (p = .99504)
T <sub>2</sub> :T <sub>4</sub> M <sub>2</sub> = 3.78 M <sub>4</sub> = 89.33	85.55	Q = 11.31 (p = .00000)
T <sub>2</sub> :T <sub>5</sub> M <sub>2</sub> = 3.78 M <sub>5</sub> = 101.22	97.43	Q = 12.88 (p = .00000)
T <sub>3</sub> :T <sub>4</sub> M <sub>3</sub> = 7.90 M <sub>4</sub> = 89.33	81.43	Q = 10.77 (p = .00000)
T <sub>3</sub> :T <sub>5</sub> M <sub>3</sub> = 7.90 M <sub>5</sub> = 101.22	93.32	Q = 12.34 (p = .00000)
T <sub>4</sub> :T <sub>5</sub> M <sub>4</sub> = 89.33 M <sub>5</sub> = 101.22	11.88	Q = 1.57 (p = .79912)

deficiency of the oxygen which leads anaerobic respiration causing elimination of most of plant and animals the organic compounds like carbohydrates proteins lipids also play an important role in abiotic cycle.

Phytoplankton require carbon dioxide for photosynthesis. The CO<sub>2</sub> concentration is also major factor in controlling the pH of water. Dissolved oxygen is dissolves in water at very low connections during day lights hours plants normally produce oxygen then they consume, thus providing oxygen for the fish and other organism in the pond.

Hardness of water due to alkaline earth elements and cations like calcium and magnesium are essential for metabolic reactions in fishes and very much needed for bone and scale formation.

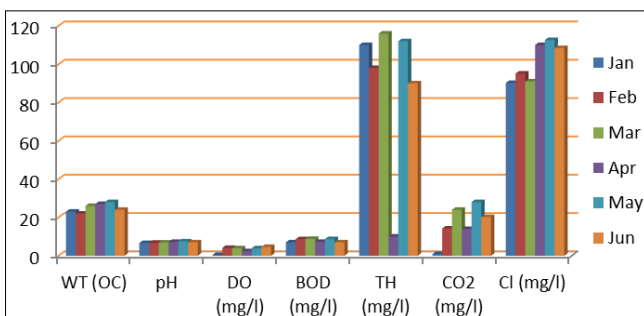
The level of DO in a pond can determined by the temperature. BOD can affect the oxygen cycle and thus, the oxygen equilibrium plays vital role in the productivity of waste water fish ponds, it indicates the number of organic pollutions in aquatic ecosystems.

Sayeswara *et al* (2011) [17] have studied the physico-chemical characteristics and phyto-zooplanktonic composition of Hosahalli pond. Their water quality parameters were compared with BIS and WHO standards and they concluded that the water is polluted. They recorded a total of 60 species and 43 genera of phytoplankton of which chlorophycean algae and diatoms were found to be dominant. 11 zooplanktons were identified by them.

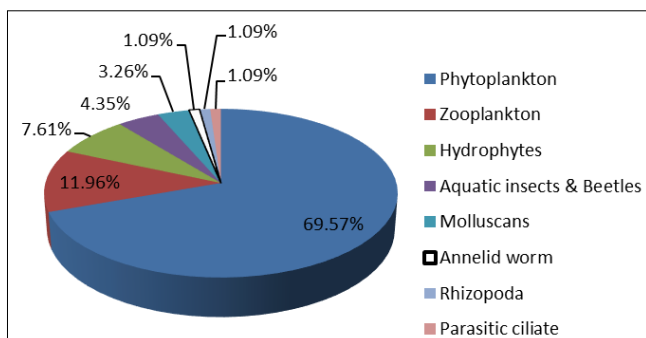
Sayeswara and Ashashree (2018) [16] have designed to studied the water quality of Nidige tank of Shivamogga. Their results depicted that the Nidige tank water was used for human consumption after proper treatment.

Harish Kumar *et al* (2020) [10] have studied the seasonal variations in the ionic levels in the surface water samples of Kundavada lake of Davangere district (Karnataka) caused by natural and human anthropogenic activities. Their results showed that the lake is included under mesotrophic group. However, Thirumala *et al* (2006) [21] worked on diurnal variations in the water of Ayyanakere lake of Chikmagalur district of Karnataka.

Thirumala and Kiran (2020) [22] have reported the phytoplankton populations and water quality in Bathi lake of Davangere district, Karnataka. They recorded 13 genera and 26 species of Chlorococcales & Desmids, 12 genera and 22 species of Diatoms, 10 genera and 17 species of Blue greens and 02 genera and 10 species of Euglenoids in Bathi lake. Their study indicated that Bathi lake is eutrophic in nature. Thirumala *et al* (2020) [21] have recorded a sum of 203 insects with 04 orders and 07 families in five fish culture ponds of Bhadra fish farm of Karnataka. The pond skater and water bug were adversely associated with the nitrogen and temperature of the water bodies. In view of these fish ponds were decently contaminated predominantly from dumping of poultry/cowdung waste and fish food.



**Fig 3:** Monthly variations in physico-chemical parameters of Hosahalli pond



**Fig 4:** Percentage composition of biotic communities in Hosahalli pond

**Discussion**

The water quality decide the species composition, in a pond when light is sufficient the photosynthesis exceeds respiration which increases the rate of growth of producers if the pond is polluted with organic matter there will be led

**Conclusion**

The results of physical and chemical analysis have revealed

that the Hosahalli pond is contaminated due to human disturbances, influx of domestic waste and agricultural runoff from the adjacent area of pond.

The presence of bioindicators of pollution (Phytoplankton and zooplankton) indicates the occurrence of organic pollution. In the light of standard water quality recommended by BIS (1993) [3], the pond water should not be used by human beings especially for drinking and cooking. It is recommended that the domestic waste has to be properly treated before discharged into the pond. The anthropogenic activities should be prevented by organizing awareness programs. Appropriate scientific development is needed to use this pond water efficiently.

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