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Limnology, as a distinct field of science has existed less than 40 years. Beginning of knowledge concerning freshwater life arose in the very remote past, probably long before the days of Aristotle (384-322 B.C.). These early beginning often strange mixtures of fact and fancy, little scientific value. As time went on and mans knowledge of his surroundings slowly increased, certain conspicuous freshwater phenomenon observed and recorded in the simple fashion, often with increasing accuracy. However, aside from the historical interest involved, no significant contributions of a strictly limnological nature occurred for at least nineteen hundred years after the time of Aristotle. Although, as pointed out by some writers of biological history, certain facts relating to the habits of fishes, emergence of aquatic insects, aquatic plants and many other similar, easily observable phenomenon had been described.

The invention of the microscope was one of the significant developments in the early history of mans knowledge of aquatic life. Since, it not only opened the door to the whole world of microscopic organisms but also provided a new effective means of studying the various higher types of life in water. Antony Van Leeuwenhock (1632-1723) described for the first time minute organisms in water. After the invent of the microscope, the next aquatic investigation was the discovery of plankton. About 1845, Johannes Muller and several of his students began the study of plankton in Helgoland, using very fine net, so effectively that. Such nets came into use. In 1887, Victor Hensen proposed the term plankton to include all the minute animals, plants and debris which are suspended in natural water. As a result discovery of plankton the part of the nineteenth and first decade of the twentieth century became a very active period in its study.
Then came the first freshwater biological station, a portable laboratory, which was moved about different lakes. Progress in the limnobiological field since about 1910, particularly since 1918, has been rapid and far reaching also, during which period limnology became more completely an integrated, coherent branch of science. For some years, the United States National research council has maintained a committee on hydrobiology and aquaculture.

Further, investigation on the ecology of freshwater bodies includes those of Santisi and Salvatore (1979) on phytoplankton distribution in three lentic waterbodies of Montesirini (Basilica), Italy, who observed the profound effects of phosphorus on the chlorophyll of algae and stated that two fold increase of phosphorus will increase four fold chlorophyll algae. Rai and Hill (1980) made an extensive study on physico-chemical and microbiological parameters of central Amazon lakes and classified them into oligotrophic and eutrophic waterbodies based on the bacterial density, electrical conductivity, pH, dissolved oxygen, silicates and phosphates. Koschel and Rainer (1980) observed that high values of phosphate connected with the plankton limitation in the lake Meckolenburger, Sunplate. Further, Imhoff et al., (1980) investigated the physico-chemical and biological parameters of eutrophic desert lakes of Egypt and pointed out that sulphates, carbonates, chlorides, sodium and other traces like magnesium, calcium and potassium play a significant role in the distribution of algae and bacteria.


Further, Parra et al., (1981) observed the seasonal succession of phytoplankton in some lentic waterbodies and Chile and showed the complex inter relationship between water quality, limnological conditions and planktonic organisms. King and Tyler (1981) studied the limnology of a lake in south-west Tasmania and found that the oxygen of the
hypolimnion declines late in these stratification periods resulting in lower productivity environment. He also studied the seasonal changes of biomes on the lake environment. Beaver et al., (1981) found that the water temperature influences the productivity pattern in the lakes of Florida.


The other important investigations in respects of India include those of Sharma and Pant (1984a) on the species composition of zooplankton in two Kumaun Himalayn lakes (U.P. India). Roy and Verma (1984) on the biological studies of Sitakund. Elmore et al., (1984) studied on the biological communities of subtropical Florida lakes of USA and observed an inverse correlation of meiothos forms with trophic state and oxygen content. Sahmitz and Osborne (1984) studied on zooplankton densities in *Hydrilla*
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The recent investigations on surface waterbodies appeared during 1985 include those of Puttaiah and Somashekar (1985) on the limnological aspects of Mysore city ponds; Kaul and Nirmal Saraf (1985) on the weed composition of Dal lake.

Dokulil and Martin (1985) assessed the components controlling phytoplankton photosynthesis and bacterial plankton production in a shallow, alkaline and turbid lakes of Neusiedlersis, Austria. Blouin et al., (1985) made comparison of phytoplankton and zooplankton distribution in relation to water chemistry in the acidic lake of Novascotia, Canada. A large number of investigators such as Sharma et al., (1986); Chitranshi and Bilgrami (1986) have investigated the Comparative ecological studies on two Ox bow lakes of river Burhi Gandak discussed the importance of physico-chemical characters of water in relation to the distribution pattern of macrophytes. They have considered pH, temperature, potassium, Sodium, dissolved oxygen and phosphate as the chief physico-chemical characters that play a significant role either increasing or decreasing certain phytoplanktonic groups in different waterbodies.

Golachowsaka and Jadwiga (1986) studied on the diurnal fluctuations of phosphorous forms in lake Plusess, Poland. Akhmetova (1986) pointed out seasonal changes do not effect on the composition of diatoms, but the temperature determines the distribution pattern of diatomic population. Similar types of contributions have been made by a number of other workers in the field of aquatic ecology and include those of Basterrechea and Manuel (1986) on limnological characteristics of lake Amatitlan, Guatemala; Jansson et al., (1986) on phosphorous concentration in acidic lakes of
Gardsjon, Sweden; Sahai et al., (1986) investigated effect of fertilizer factory effluent on the distribution pattern of zooplankton in Chilwa lake.

Sarwar and Zutshi (1987) investigated Himalayan lakes for the physico-chemical and biological character and concluded that diatoms dominate the total bulk of plankton. Although, the lakes studied slightly differ with regard to the water quality parameters. Similar observations have been made by Tripathi et al., (1987). Sinha et al., (1987) have also studied the distribution of phytoplankton in the lakes of north India. Later Puttaiah and Somashekar (1987) pointed out that higher carbon dioxide and lower concentration of oxygen significantly contribute for the abundance of euglenoids.

In the water bodies of Mysore city, Singh (1987) who have studied phytoplankton primary production in an Ox-Bow Lake pointed out that high temperature coupled with higher concentration of phosphate trigger the highest rate of production of Microcystis aeruginosa Cyanophyceae algae. Singh Mahajani (1987) discussed the role of temperature, nitrate, nitrogen and phosphorous for phytoplankton variation in the lakes of Himachal Pradesh. Kurata et al., (1987) observed the seasonal changes of temperature, salinity, transparency, nutrients and phytoplankton in the lake Notoro Hokkaido, Japan.

The other researchers like Schelske et al., (1987) observed limnogical aspects such as biogenic silica and bio-geochemistry of silica in lake St. Moritz and lake Zurich, Switzerland. June and Fred (1987) made observation on physico-chemical and biological characteristics of lake Sharpe, South Dakota, USA; Saksena (1987) worked on rotifers as indicators of water quality.

Zutshi and Khan (1988); Anand (1988); Bhattacharya et al., (1988); Saifullah et al., (1988) who have done a considerable work on the chemical composition of Standing
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Waterbodies concluded that both physical and chemical characters of water significantly affect the algal population and they emphasized the importance of pH, total alkalinity and carbon dioxide content of water on the succession of phytoplankton leading to eutrophication.


The other investigation on the water quality and the biological composition of Indian lakes are reflected in the publication of Ahluwalia et al., (1989); Ghosh and George (1989); Parimala Varadaraj and Ayyappan (1989) who have studied the polluted waterbodies and concluded the chloride. Sulphates and organic carbon play a significant role in the formation of algal blooms. They have also opined the phosphate concentration in the water has a direct bearing on the development of algal blooms.


The succeeding contribution to the field of freshwater bodies with special reference to the distribution of phytoplankton and water chemistry have been recorded in the publication of Sarwar and Wazir (1991) on the physico-chemical characters of fresh water ponds near Srinagar. They pointed out that, alkaline water with calcium bicarbonate phosphorous and nitrate in higher concentration trigger the water blooms in the waterbodies and together tend to increase the eutrophic nature. Swarnalatha and Rao (1991) revealed the fact that Cyanophyceae blooms, by and large common in highly polluted lakes and regarded the blooms of Cyanophyceae as indicator of polluted water

Surendrakumar and Sharma (1991) studied the Pichhola lake and Pointed out that the electric conductance, pH, total alkalinity and nitrates at higher concentration increase the productivity status of lake and these parameters could serve as indicators in assessing trophic level of the waterbodies. Sager and Richman 1991 studied the functional interaction between phytoplankton and zooplankton along with the trophic gradient in Green Bay lake, Michigan. Molot and Dillon (1991) discussed about the nitrogen and phosphorous ratios and chlorophyll production in the lakes of Central Ontario.

Distribution and seasonal abundance of algal forms in Chilaka lake was studied by Adhikary and Sahu (1992a). Belsare et al., (1992) have studied numerical and volumetric variation of plankton population in several lakes of Bhopal; Eckartz Nolden (1992) on species composition and seasonal periodicity of phytoplankton of lake Laacher See.

The other noteworthy investigations dealing with the ecology of fresh waterbodies include, those of Chatterjee (1992) who investigated on the lake Nandan Kannan and concluded that, temperature with slightly alkaline pH, conductivity, chlorides, calcium and magnesium do not seem to vary much suggesting the fact that the insignificant influx of organic and inorganic matter from outside to the lake. Vaishya and Adoni (1992) based on their findings on physico-chemical properties in a hyper eutrophic lake. Further,
they (Vaishya and Adoni 1992) pointed out that, whenever the pH of water is alkaline side lake showed less range transparency, Swarnalatha and Narasing Rao (1992) discussed on the occurrence of Cyanophyceae bloom in Hyderabad lake and observed a permanent bloom of *Microcystis aeruginosa* and pointed out that bright sun light coupled with high temperature are the factors responsible for the development of bloom. Borkar *et al.* (1992) from Goa, studied the diurnal variations in physico-chemical parameters of lake near Marmugoa, Goa and concluded that dissolved oxygen, Free carbon dioxide, pH, chloride and total alkalinity in higher concentration could accelerate the lake to become highly polluted. Adhikary and Sahu (1992b.) recorded the occurrence of *Trichodesmium* bloom in the Chilaka lake during summer and attributed that the temperature above 20° C coupled with alkaline pH were responsible for the bloom.

The algal community of the lake Patzewaro, Mexico was studied, as an indicator of trophic status by Rosas *et al.*, (1993); Morgan and Pickup (1993) stated that the greater range of microbial enzyme activity increases the tropic status of the water in the English lake, Cumbraia (U.K.). Nayak (1993) investigated Matyatal lake and recorded the physico-chemical characteristics and associated biological components and noted that the temperature and carbon dioxide are negatively correlated with each other while inverse relationship is noticed between water transparency and bicarbonate content. Parvateesam and Mishra (1993) while working on manmade lake located near temple town pushkar and recorded 88 algal forms belonging to Chlorophyceae, Euglenaceae and Bacillariophyceae. Singh and Verma (1993) while working an Ox-Bow lake near Muzaffpur and pointed out that the lake tended towards hardness as a consequence of accumulation of debris of a macrophyte *Eichhornea* sp. Swarnalatha and Narasinga Rao


The seasonal variations in physico-chemical parameters like dissolved oxygen, chloride, salinity and planktonic composition of Kurichi pond was studied by Arivazhagan et al., (1997). Correlation co-efficient of physico-chemical parameters and other statistical analysis were made by a number of researchers like Boruah et al., (1997), Sarojini et al., (1997) have studied pollution of water resources of Kolleru area. Similar such pollution studies were reported with reference to chemical oxygen demand and total suspended solids by Sahoo et al., (1997). Baruah and Barthakur (1998) worked on the water quality of ponds and assessed the purity of potable water in Chandrapur area of Kamrup district, Assam; Swarnalatha and Narasinga Rao (1998) have studied Banjara lake with reference to water pollution by domestic wastes and highlighted status of eutrophication of this waterbody.

Harikrishnan et al., (1999) investigated the distribution and ecology of phytoplankton in the Kuttanad wetland ecosystem, Kerala and reported that nitrate and phosphate are important nutrients limiting the phytoplankton growth and established a
significant positive correlation with total phytoplankton. Tiwari (1999) investigated the physico-chemical characteristics of upper lake water, Bhopal and emphasized the suitability of water for drinking as well as irrigational purposes based on Kelleys ratio and sodium absorption ratio. Puttaiah and Yogendra (1999) investigated the lentic waterbodies of Shimoga for the dynamics of pH, Dissolved oxygen and Free carbon dioxide but have not established any significant correlation among these parameters. Sanjay Kumar Gambhir (1999) investigated the physico-chemical and biological characteristics of water of Maithon reservoir of D.V.C. and recorded 466 MPN/100 ml of coliform bacteria and called for proper treatment. Islam (1999) worked on the study of certain aquatic Macrophytic vegetation of lentic habitats of Dibrugrah district, Assam.. Further, investigations on the ecology of freshwater bodies include Prakasam and Joseph (2000) who carried out limnological studies in relation to primary productivity and pollution from anthropogenic activities and concluded that the hydro-chemical parameters of the lake were not favorable for productivity and the lake water was not polluted except for fecal contamination. Pandey et al., (2000) investigated the nutrient status and Cyanobacterial diversity in a tropical freshwater lake and concluded the species diversity and the dominance of individual species were affected by the nutrient status of ambient water. He attributed the decrease in Cyanobacterial diversity to the direct inlet of urban industrial effluents. Singh (2000) worked on the evaluation of physico-chemical parameters in an ox bow lake and found that nitrate concentration of 0.2 to 0.5 mg/l is favorable for fish production. He has also observed that lower values of Nitrates and phosphates during the period of maximum macrophytic vegetation. Sharma (2000) investigated on Rotifers from some tropical flood plain lakes of Assam.
Kaur et al., (2000) investigated the physico-chemical status of Kanji wetland and concluded that the water of this wetland is for supporting diverse aquatic life. Yatish and Dhamija (2000) have made limnological investigation on polluted lentic water body of Jabalpur and stated that the dissolved oxygen content in the range of 3.0-8.2 mg/L is optimum for fish growth. He has assessed the condition of the lake as eutrophic. Which is in turn attributed to the growth of Eicchonia crassipes, a floating macrophyte. While, Murugesan and Sukumaran (2000) gave sustained management of nuisance weeds of freshwater habitat by the utilization as viable resource for multi-various application. Harikrishnan and Abdul Aziz (2000) worked on primary production studies in a freshwater temple tank and found that temperature and nutrients had a direct effect on the production potential of the temple tank. Magdy Khalil (2000) worked on the impact of pollution on productivity and fisheries of lake Mariut, Egypt. Chakrabarty (2000) investigated the condition of two high altitude reservoirs of Himalaya and attributed the algal abundance to the increased nutrient concentration.

Further, Shilpa Choudhary and Devendra Kumar Singh (2001) worked on phytoplankton populations of Boosra lake and found that the variation in physico-chemical and meteorological parameters are responsible for the fluctuations in the quality and quantity of the phytoplankton. Malu (2001) worked on phytoplankton diversity in Lonar lake and stated that the lake has reached the state of eutrophy, which was attributed to the presence of phytoplankton like Nitzschia, Euglena and Oscillatioria. Sadguru Prakash (2001) worked on the seasonal dynamics of plankton in a freshwater body at Baralpur and found that, Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae showed significant and positive correlation with various physico-

Furthermore, contributions to the field of limnology of lentic waterbodies include those of Bharathi and Ramanibai (2002) who investigated the hydro biological profile of Kolavi lake. Pushpendra Kumar Khare (2002) investigated the level of organic pollution and water quality of Satri tank, and concluded that Satri tank is highly eutrophic and biologically dead. Pandey et al., (2002) investigated the physico-chemical characteristics of Hamor pond of Kishangarh, Nagarathna and Hosamani (2002) studied the impact of Microcystis bloom on water quality parameters and are opinion that, Microcystis bloom alters the concentration of chemicals in polluted water. Naga Prapurna and Shashikanth (2002) investigated the pollution level in Hussain Sagar lake of Hyderabad and stressed the need for increasing dissolved oxygen content and reducing the turbidity, BOD and total suspended solids of the lake water. Sukumaran (2002) worked on aquatic microflora in a perennial tank in Bangalore, and in the same year he has worked on primary production dynamics of a perennial tank in Bangalore, Karnataka. Dwivedi and Pandey (2002) worked on physico-chemical factors and algal diversity of two ponds of Faizabad


Recently, Raut et al., (2005) who studied diversity of plankton attached to free floating macrophytes in weed infested lake. Dey and Hazra (2005) worked on comparative studies of two ponds of Chandaneshwara temple in Orissa. Kumar Hegde et al., (2005) studied on limnological characteristics of Guruvayanakere pond near Belthangady of Karnataka. Banakar et al., (2005) who worked on Hydrochemical characteristics of Surface water in Chandravalli Pond, near Chitradurga. Similarly, several workers have been also worked on the diversity of macrophytes in lentic waterbodies. Gadag (2005) studied check list of the microphytes and macrophytes in and around Heggeri lake. Kiran and Puttaiah (2005) studied on the diversity of aquatic macrophyte in Hosur tank, near Bhadravathi town, Karnataka. In addition to this, several other general publications on floristic and vegetation have made reference to the aquatic macrophytes in lentic waterbodies. The diversity of aquatic macrophytes in Shimoga district studied by Narayana and Purushothama (2005) under UGC project scheme, in this study documented lentic waterbodies supported by different trophic characteristics with respect to macrophytes diversity.

The review of literature has revealed that, considerable work has been carried out on the hydrophytes and limnological aspects of lentic waterbodies of India and Karnataka. From this review it is evident that, the limnological work on lentic water bodies of Sagar taluk, Shimoga district, has not been taken up so far.

Hence, with this background four lentic waterbodies situated in the Sagar taluk have been selected for the present investigation to explore physico-chemical and biological aspects.