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Limnology: A Critical Review

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ABSTRACT

The word Limnology is derived from Greek limne-marsh, pond and evaluates how physical, chemical and biological environment regulates these relationships. The type of life which is supported by lentic communities will depend greatly on biotic components of the fresh water ecosystems. Phytoplankton's are microscopic plants which obtain their energy via photosynthesis. They are important to the ecosystem because they are part of the primary producing community and assist in recycling of elements such are carbon and sulphur. A biotic factors are essentially non living components that affect the living organisms of fresh water communities. Most biological assessments have dealt with conditions arising out of organic pollution since chemical conditions are rather difficult to monitor. Therefore both biological and chemical parameters are essential to monitor pollution. Curiosity prompted researchers to ascertain facts regarding limnology and hence publications on the ecology of freshwater biota have occurred quite occasionally.233 references are quoted in the present text. The review literature indicates that publications were high during 1980-1989(29.4%) and 1990-1999(26.5%). In the present paper an attempt has been made to give an extensive review of literature related to limnology.

Key words: Limnology, Phytoplankton, Biotic, Abiotic. Review.

INTRODUCTION

The importance of water was realized as far as back as 640-546 B.C. as a means of substance of life, which was expressed in the Greek Philosophers, "Thales of Miletus" Cryptic saying "Water is best". The extensive work of Forel (1901)**(59)** who is regarded as the father of modern limnology gave an impetus to study this subject intensively. Fritsch (1888)**(61)** established the first mobile biological station to study the various lakes, and with the establishment of the Fresh Water Biological station, limnology flourished both in Europe and America (Hosmani 1975)(94).

Limnology is the study of the structural and functional interrelationships of organisms of inland waters as their dynamic physical, chemical, and biotic environments affect them. Freshwater biology is the study of the biological characteristics and interactions of organisms of fresh waters. This study is largely restricted to the organisms themselves, such as their biology, life histories, populations, or communities.

The first use of the term Plankton is widely attributed to the German Biologist Hensen Victor (1887) (80). "Plankton" includes all organic particles, which float freely and involuntarily in open waters, independent of shores and bottom (wandering). Plankton of fresh waters includes representatives of several groups of algae and bacteria. Plankton therefore are microscopic organisms that live suspended in the water environment, and form a very important part of the fresh water community; they move via convection or wind induced currents in almost every habitat of a fresh water ecosystem,

thousands of these organisms can be found, and due to their small size and simplicity, they are capable of occupying large expanse of water and multiplying at an exponential rate.

Abiotic factors are essentially non-living components that affect the living organisms of the fresh water community. When an ecosystem is barren and unoccupied, new organisms colonizing the environment rely on favourable environmental conditions in the area to allow them to successfully live and reproduce. When a variety of species are present in an ecosystem, the consequent action of these species can affect the lives of fellow species in the area, and these factors are deemed biotic factors. The angle of incidence at which sun light strikes the surface of water, the cloud cover, season and location are all important and this sort of variance greatly affects what type of organisms would occupy fresh water ecosystems.

Review

Limnology as it flourished as a different branch of science chiefly concerns with ecology of fresh waters. The factors that govern the algal growth include the physical and chemical conditions and their interrelationship. The discovery of plankton by Victor Hensen(1887)[80]was an outstanding event in the field of limnology and opened up a new vista. Fritsch (1907) [62] was the pioneer worker who studied the algal periodicity of small ponds, Fritsch and Rich (1932) [63] published a series "Studies on the occurrence and reproduction of British Fresh Water Algae in Nature." Other contributions to the study were those of West (1912) [223].West and West (1907) [232], Pearsall (1921) [161],Hodgetts(1921) [86] gave a detailed account of the factors controlling the periodicity of fresh water algae, Rao(1955) [175] reported the distribution of fresh water algae in small ponds.Storm (1924) [203], Howland and Lucy (1931) [111], Hutchinson (1932) [112] and Yoshimura (1932) [235] studied fresh water lakes. Objectionable algae and their control in lakes were dealt by Prescott (1938) [167]; Bailey (1938) [16] studied the ecology of phytoplankton of Lake Michigan, chloride of surface waters were recorded by Thresh *et. al.,* (1944) [213] attributed higher amounts of chloride to pollution. Ecology of temple tanks was extensively studied by Ganapathi (1940) [67], 1943 [64],1955 [69] and 1960 [66] Various aspects such as diurnal variations in certain physico-chemical parameters of biological significance in temporary ponds and temple tanks; ecology of tropical waters with reference to bloom forming algae were done. Gonzalves and Joshi (1946) [76] worked on the seasonal occurrence of algae in a tank at Bandra, Mumbai, Patrick (1948) [159] observed the factors affecting distribution of diatoms, Rao (1955) [175] discussed the distribution of algae in a group of six small ponds of Hyderabad, Krishnamurthy (1954) [126] worked on the diatomic flora of south Indian lake; Gandhi (1955) [69] studied fresh water diatoms of Pratabgad, Rajastan, Philipose (1960) [165] worked on fresh water phytoplankton of inland fisheries, Singh (1960) [198] recorded the phytoplankton ecology of inland waters of Uttar Pradesh. George (1966) [71] made a comparative study of plankton ecology of fish tanks. Similar contributions to the ecology of algae were by Munnawar and Zafar (1967 [144] studied the distribution pattern of phytoplankton of polluted and unpolluted lakes of Hyderabad. They pointed out the importance of chemical parameters and their impact on algal growth. Zaffar (1955) [237]-1967) [236] studied various aspects on the ecology of freshwater ponds of Hyderabad .Munnawar(1970) [145] made an extensive survey the distribution of unicellular and colonial phytoplankton in polluted and unpolluted environments while Muzino and Mori(1970) [146] made a preliminary hydro biological survey of some Asian Inland waters. Verma and Shukla (1968) [227] studied the ecological characteristics of temple tank, in Deoband; Phytoplankton studies were done by Vyas (1968) [228] in Picchola Lake, while Zafar (1969) [238] made and extensive study of algae in ponds of Hyderabad.

Several ecological studies were made during the years 1970 to 1980. Descy(1979) [52] made a novel approach to water quality estimation using diatoms. Water pollution and periodicity of algae were related by Venkateshwarlu (1970) [225] while studying the ecological aspects of river Moosi of Hyderabad. Plankton composition in fresh water lakes was studied by Seenayya (1971) [188] while Munnawar (1972) [143] was the first person to report Euglenophyceae as indicators of organic pollution. Other works on fresh water that followed were those of Bharathi and Hosmani (1973*)* [23] who made an extensive survey of hydrobiology of ponds and lakes of Dharwad. Some of the important observation

was that, heavily polluted ponds showed decreased production during summer, when different species of algae appeared as blooms; further Bharathi and Hosmani (1974) [26] reported that the total algal production increases with increase in the number of species. These ponds were disturbed by animal and human population. Dellon and Rigler (1975) [50] related total nitrogen to phosphorous and indicated that the ratio was important as a growth limiting factor. Further he pointed out that a ratio of 12 indicates that phosphorous becomes a limiting factor, while a ratio of less than 12 indicated that nitrogen becomes a limiting factor. Studies on bloom forming algae especially *Franceia ovalis*, were made by Bharathi and Hosmani (1976) [24]who reported that increased phosphates, calcium, ox disable organic matter, albuminoidal ammonia, low pH and high degree of organic pollution followed by death and decay of Cyanophyceae, accelerated the bloom of *Franceia ovalis*. The ionic composition of sixteen lakes of Hassan and Chitradurga districts were made by Bharathi and Hosmani (1977) [27].Shannon and Brenzoic (1972) [190] developed a trophic state criterion by using multivariate approach and compared it to Sakamato (1966) [181]. This approach was quite significant. According to the values of 0-4 indicated oligotrophic waters; 4-10 indicate mesotrophic and values greater than 10 indicate eutrophic water. According to Dobson (1974) [56] there is a slight variation in the range of these values. 0-4.3 is considered oligotrophic, 4.3 – 8.8 is mesotrophic and greater than 8.8 are considered as eutrophic. However these values are based on the determination of chlorophyll (mg/m^3). While investigating the distribution of phytoplankton in three lentic water bodies of Brasilica (Italy), Santini and Salvatore (1979) [183] reported profound effects of the levels of phosphorous on the Chlorophyll content of algae. Other significant contribution to fresh water ecology were those Singh and Swarup (1979) [196] who studied Lake Surah (Ballia) with special reference to the periodicity of sewage contamination on fresh water ecosystems. Hosmani and Bharathi (1980)[88] reported algae as indicators of pollution using Palmers Pollution Indices, while Hosmani and Bharathi(1977) [96] describe the occurrence of Euglena sanguine in a pond at Dharwad.

Significant research was done during the period from 1981 to 1990. Heinon(1980) [84] made an extensive study on the quantity and composition of phytoplankton of Finish Inland waters. Archibald and Lee (1981) [11] studied the ratio of inorganic nitrogen to orthophosphorous as a limiting factor and Singh (1982) [195] studied the physico-chemical aspects of Nainital Lake. Round (1991) [178] suggested that the information of algal diversity in fresh waters is important to understand the factors influencing the change in algal population. The effect of anthropogenic activity also has an important bearing on the ecosystem. Descy and Costae (1991) [53] developed test methods for assessing water quality based on diatoms. The central Amazon Lakes were classified by Rai and Hill (1982) [170] by using the physico-chemical and microbiological parameters. They were classified as oligotrophic and eutrophic, based on the bacterial density, electrical conductivity, pH, dissolved, oxygen, silica and phosphate content. Lake Lemend (France) was studied by Barroin *et. al.,* (1982) [18] who examined the physico-chemical aspects of the eutrophic lake. Other important works during this period were those of Gurudev *et. al.,* (1983) [79] who reported the Desmid flora of fresh waters of Savandurga (Karnataka), Hosmani and Bharathi (1982) [91] classified water bodies using various algal populations; Prasad and Singh (1982) [166] reported indicator organisms of water pollution; Mohanty (1983) [140] also worked on algal as indicators of pollution. There were many publications related to lentic water bodies during this period. To mention a few, Kaul and Siddarth (1983) [120] worked on Lalpuri Talab (Rajkot); Bharathi and Hegde (1983) [25] on Desmids of Karnataka,Schroeder *et.al.,* (1983) [186] recorded the biogenic calcium carbonate production in an oligotrophic lake at Austria, Forsyth *et. al.,*(1983) [60] studied the limnological aspects of Roangaio Lake (New Zealand); Koschel *et. al.,* (1983) [122] studying lake Breiber (Germany) pointed out that calcite precipitation decreases the phytoplankton population, dissolved oxygen and total phosphate. Raina *et. al.,* (1984) [171] made a detailed study of water quality and pointed out that biological oxygen demand values indicated that the water was not heavily polluted, but it was the nutrient elements that played an important role in determining the trophic status of water bodies. Studies on the sewage pollution and eutrophication of lower lakes of Bhopal were made by Bhatnagar (1984) [29]; Low content of dissolved oxygen in Dal Lake was related to enhance microbial activity Zutshi *et. al.,* (1984) [242], 1988) [241],

further the low content of dissolved oxygen may be related to the increased rate of decomposition in the organic matter and conversion of related carbon dioxide into carbonic acid. Chandra *et. al.,* (1984) [39] reported total absence of plankton which may be due to acute toxicity of the combined effluents having toxic constituents of chlorine and Mercury. Dakshini and Gupta (1984) [48] made an ecological survey of three lakes of Delhi. Chan (1985) [38] studied the effects of water pollution on organisms of a fresh water pond of Aligarh. He reported that members of Chlorophyceae were dependent on nitrates, diatoms were controlled by phosphates, while the excess growth of *Microcystis aeruginosa* stimulated the growth of Euglenophyceae. These organisms indicate eutrophic nature of the pond. Hosmani and Mallesha (1985) [95] reported algal species as indicators of water pollution. Kanugo *et. al.,* (1985) [119] made observations on the physico-chemical characteristics of some ponds of Raipur city. Chaturvedi (1985) [41], Sharma *et. al.,* (1985) [191], Hegde and Bharathi (1986) [83] while studying fresh water ecosystems reported the presence of various species of algae. Sharma *et. al.,* (1986) [192], Chtranshi and Bilgram (1986) [44] investigated lentic ecosystems stressing on the importance of physico-chemical parameters in relation to the distribution pattern on phytoplankton. They stressed upon the physico-chemical parameters that play a significant role in controlling the plank tonic groups in different water bodies..Sladeck(1986) [199] described the use of diatoms as indicators of pollution.

Singh (1987) [194] investigated the primary production in Ox-bow Lake and concluded that high temperature coupled with higher concentrations of phosphorous enhanced the rate of reproduction of *Microcystis aeruginosa*. Puttaiah and Somasheker (1987) [169] pointed out that high concentrations of carbon dioxide and low concentrations of oxygen significantly contributed to the abundance of Euglenoids in fresh waters of Mysore. Some of the other significant studies during this period were those of Singh and Mahajan (1987) [194] studied the role of temperature, nitrate and phosphorous on phytoplankton variations in a Lake of Himachal Pradesh. Similarly Kurata *et. al.,* (1987) [127] studied seasonal changes of various physico-chemical parameters in Lake Notoro Hokkaido, Japan. Some of the common observations made by Zutshi and Khan (1988) [241], Anand (1988) [8] Bhattacharya (1988) [28] and Saifulla *et. al.,* (1988) [180] were that the physico-chemical characters of water significantly affect the algal population. They stressed upon the importance of pH, total alkalinity and carbon dioxide on the succession of phytoplankton leading to eutrophication. Hosmani (1988) [97] studied seasonal changes in phytoplankton community in fresh waters and found that blooms of *Franceia ovalis, Euglena elastica, Euglena gracilis and Trachelomonas charkowensis had* a significant effect in reducing the number of species in ponds.

Tripathy and Pandey (1989) [217] recorded diatom population to be high during summer, Khatavar *et. al.,* (1989) [125] found a close relation between phytoplankton and some nutrients, especially during summer months. The concentration of chloride, sulphate and organic carbon plays a vital role in accelerating blooms; also phosphorous concentration has a profound effect on bloom formations. Such observations were made by Ahluwalia (1989) [5], Srivastava *et. al.,* (1989) [202], Gosh and George (1989) [77] and Varadaraj and Ayyappan (1989) [222]. Gast and George(1989) [70] made an attempt to study the abiotic factors that are causative factors of pollution in urban reservoirs, while Tripathy(1989). [218] Although there were many studies related to fresh water ecosystems during 1991, most of them were diverted mainly towards algal systematics. Few of the reports were those of Naik and Hegde (1990) [149] from the Sharavathi estuary, Tripthi and Pandey (1990) [217], Mathur and Pathak (1990) [138] from rock shelters, Srivastava and Othawani (1990) [201] from semiarid region of Rajastan. Ashok Kumar and Patil (1990) [14] reported Desmids of Gujarath. Some of the ecological studies related to phytoplankton were also made by Singh (1990) [197] who correlated physico-chemical parameters with primary production of plankton, Goviathan (1990) [78] studied seasonal succession of algal flora of waste stabilization ponds; Ibrahim Banat (1990) [113] studied algal productivity in waste water treatment plants. Ikommiko (1990) [114] pointed out the problem of toxic pollution of Ladoge Lake in Russia and suggested that increased discharge of toxic substances into the lake has caused water quality deterioration, changes in species composition and other deleterious effects on the aquatic ecosystem, Trifonova (1990) [216] outlined

the ecology and succession of phytoplankton, His work was related to phytoplankton biomass and chlorophyll levels. Certain inland lakes of Mysore were studied by Naganandini and Hosmani (1990) [147]. They reported that cyanophycean bloom was dominated by *Microcystis aeuruginosa* and the bloom was influenced by dissolved organic matter, carbon dioxide, phosphorous, calcium, dissolved oxygen coupled with the death and decay of *Spirulina nordestedtii*. These observations were supported by Swarnalatha and Narasing Rao (1991) [205] who were of the opinion that Cyanophycean blooms are indicators of water pollution. Surendra Kuamr and Sharma (1991) [204] pointed out that the trophic level of water rises due to high electrical inductance, pH, total alkalinity and nitrates. Lakes of central Ontario were studied by Molot and Dillon (1991) [142] who stressed upon nitrogen and phosphorous ratio related to chlorophyll production in lakes of central Ontario. The distribution of phytoplankton and water chemistry was studied by Sarwar and Wazir (1991) [184], Periodicity of plank tonic algae was studied by Kaushik *et. al.,* (1991) [121]. Sagar and Richman (1991) [179] discussed functional interaction between phytoplankton and zooplankton in Green Bay Lake, Michigan. The seasonal diversity of Desmids were studied by Nygard (1991) [153] in lakes of Denmark. Higler (1991) [85] used diatoms in ecological management.

The conditions controlling the blooms of *Cyclotella* were discussed by Jyothi *et. al.,* (1992) [118] who reported that during the bloom chlorides, phosphates and organic matter were in higher concentrations. Vaisya and Adoni (1992) [221] inferred that lake Sagar had become hyper eutrophic due to unbalanced physical and chemical factors. The lake had lower transparency whenever it turned alkaline. On the contrary Chatterjee (1992) [40] while investigating lake Mandan Kannan reported that the major constituents controlling the lake ecology were organic and inorganic matter from outside the lake. Borker *et. al.,* (1992) [35] investigated the physico-chemical parameters in a lake at Goa. They reported that dissolved oxygen, free carbon dioxide, pH, chloride and total alkanity in higher concentration accelerated the pollution rate in the lake. Adhakari and Sahu (1992) [1] studying Chilka lake concluded that temperature above 20^{0}C along with an alkaline pH was responsible for *Trichodesmium* bloom during summer months. Biswas (1992) [32] recorded phytoplankton periodicity in Ogelube lakes, Nigeria and reported maximum density of Desmids during summer; Besare *et. al.,*(1992) [22] studied the numerical and volumetric variation in a polymictic lake in Bhopal. Dixit *et. al.,* (1992) [55] suggested the use of Diatoms as indicators of biological condition of lakes. They can be used to address a wide variety of environmental issues including lake acidification, eutrophication as well as climate changes. Optimum diversion rates of pH and temperature had a profound influence on Diatoms as stated by Choudary (1991) [45] using the algal bioassay method while Mohaptra and Mohanty (1992) [141] determined water quality of lakes. They found that *Chlorella* was more efficient than *Anabaena* in reducing pollution and nutrient load. Agbeti(1992) [3] made a comparative study of the relationship between diatom assemblages and trophic variables and compared his data to newer approaches. Parvateesan and Mishra (1993) [158] studied algal of Pushker Lake that could be used as indicators of pollution. They recorded various groups of algae that showed a definite correlation between physico-chemical parameters and abundance. Rao *et. al.,* (1993) [177] classified Ooty lake as eutrophic, based on the nutrients status and phytoplankton production. Banjera Lake of Hyderabad was extensively studied by Swarnalatha and Narasingh Rao (1993) [206] who described the various factors responsible for appearance of a bloom of *Microcystis aeruginosa*. Heckey (1993) [82] suggests that nutrient loads to lakes are associated mainly with atmospheric deposition and land run off together accounting for approximately 90% phosphorous and 94% nitrogen input into the lake. Bootsman and Heckey (1993) [33] concluded that domestic inputs are negligible.

Eutrophication usually affects physical and chemical environment and can lead to significant changes in the phytoplankton community structure. Flores and Barone (1994) [58], Uku and Mavuli (1994) [219] opine that generally this process results in zooplankton community dominated by rotifers and small bodied Cladocerous. Lehman *et. al.,* (1994) [128] observed increase in chlorophyll a concentration of algal blooms during rainy season. Shaji and Patel (1994) [189] highlighted phytoplankton ecology of a polluted pond at Anand (Gujarath) and stressed upon the physico-chemical parameters; Khan and

Chowdary (1994) [123] studied physical and chemical limnology of lake Katpal, while Umon and Jireaney (1994) [220] studied basic ecology of a lake of Costa Rica.

Phosphorous inputs in lakes results in frequent blooms of blue green algae that liberates toxins (Bratli, 1994) [37] as observed in lake Froylandswatn (Norway). Mc cormick and Cairns (1994) [132] studying water bodies of Florida reported that algae can respond rapidly and predict the presence of a wide range of pollutants that can be potentially used as early warning signals of water quality determination. Miyajuima *et. al.,* (1994) [139] concluded that the diatom population and biogenic composition of silica were higher in eutrophic lake Biwa, Japan. Swarnalatha and Narasinga Rao (1994) [207] studying two ponds, reported that one experienced a continuous bloom of Cyanophyceae was more polluted than the other pond that supported more Desmids and was less polluted Goel *et al*., (1994) [74] reported that phosphorous nitrogen ratio is dependent on blue green algae dominance. Bairagi and Goswami (1994) [17] made similar observations.

There were a few reports during the year 1995 which included those of Lorson *et. al.,* (1995) [131] and Agbeti and Smol (1995) [4] who studied physico-chemical and biological characteristics of high mountain lakes; Verma and Moanty (1998) [226] reported a direct relation between pH and phytoplankton, while Pandey *et. al.,* (1995) [155] studied the seasonal abundance of phytoplankton in rivers.

Anna-Lisa Holopainen *et. al.,* (1996) [10] studied the trophic level status of lake Ladoga and their relation to phytoplankton. Boris *et. al.,* (1996 [34] reported toxicity of cyan bacteria blooms in the same lake. He reported *Anabaena circinalis, A. flos-aquae, A.lemmemani, Gleotrichia cichimilata and Microcystis aeruginosa*as toxic algal blooms. Algal blooms occurrence was found to be positively related to total nitrogen and phosphorous by James and Hewens (1996) [115] Lenoir and Cste (1996) [129]

The impact of COD and total dissolved solid on the pollution status was demonstrated by Sahu *et.al.,* (1995) [182] while the seasonal variations in physico-chemical parameters and their impact on phytoplankton was studied by Arivazhagan *et. al.,* (1997) [12]. Takans and Hino (1997) [210] opined that high temperature promotes diatom growth in a hypertrophic lake Barato (Japan). Hosmani (1977) [96] studied the occurrence of *Euglena sanguinea* and reported that temperature above 26^{0}C, high pH, carbon dioxide, albuminoidal ammonia, phosphate with low concentrations of carbonates, nitrates and free ammonia accelerated the bloom. Other such reports were those of Swrnalatha and Narisangh Rao(1998) [208], Pandey *et. al.,* (1998) [156] who are of the opinion that inflow of nutrients and consequent algal growth deteriorates the water quality. The importance of phosphorous in eutrophication of fresh waters and production of abundant autotrophs, mainly Cyanophyceae was discussed by Correl (1998) [46]. Pollution tolerant species of algae were reported by Tarar *et. al.,* (1998) [209],Agarkar(1998) [2] assed the water quality of Sakegan Reservoirs, Gandhi revived the freshwater diatoms of central Gujarath and reported many new species. Trophic structure of some phytoplankton communities of trophical wetlands were reported by Pandit(1999) [157].Zandbergon et.al(1998) [240] formulated the British Colombia Water Quality index for watershed management which was an useful index for similar waters elsewhere. Dhanapathi(2000) [54] made notes on the occurrence of Rotifers and their relation to other parameters.. Eloranto and Goiniuen(2002) [57]evaluated the fresh water diatoms of Finnish waters using benthic diatoms. Wani (1998) [229] studied the seasonal dynamics of phytoplankton in Himalaya lakes and reported that diatoms were the most represented species; lakes of Amaravathi district were studied by Seema *et. al.,* (1999) [187] while other works related to coastal aquaculture were these of Chidambaram (1999) [42]. Variations in the correlations of the physico-chemical parameters and phytoplankton were reported by Rajendra Nair(1999) [172] Agarkar(1998) [2] made an assessment. Publications on the ecology, limnology and the phytoplankton communities continued to appear in abundance during the years following 2000.

Borse and Bhave (2000) [36] reported that dissolved carbon dioxide was maximum in summer and minimum in winter and was dependent on carbonates and bicarbonates in water, Carbon

dioxide and pH of water also had an impact. Trophic State Indices for lakes of Mysore were calculated by Hosmani (2006) [93] who inferred that values of 40-50 were considered mesotrophic (moderate pollution), more values than 50 were eutrophic (highly productive) and values less than 40 were considered oligotrophic. Thomas and Deviprasad (2006) [212] studying the lakes of Mysore inferred that sunshine, phosphates, nitrates, oxygen and CO_2 have a significant effect on the growth of Myxophyceae. They reported that members of Chlorococcales had the capacity to tolerate extreme concentrations of nutrients. Mahadev and Hosmani (2004) [135] assessed water quality based on the Langlier's index and concluded one of the lakes had a tendency of hard water with light scale deposition, while the other had a tendency of heavy scale deposition. Hosmani and Vasanth Kumar (1996) [90] made a study on the biochemical aspects of water pollution and inferred that Kukkarahalli lake is highly productive in terms of biochemical products whereas Dalvoi lake is productive in terms of plankton productivity. Nandan *et. al.,* (2001) [151] studied seasonal fluctuation in Hentala lake of Jalgaon and reported abundance of blue green algae was due to higher concentration of dissolved carbon dioxide, carbonates, total alkalinity, phosphates and chlorides, Noor Alam (2001) [152] worked on physico-chemical parameters of a pond at Hatwah, Bihar, and recorded significant variations and suggested measures to prevent deterioration. Seasonal distribution of plankton in a fresh water pond of Pollachi (Tamil Nadu) was studied by Rajkumar (2001) [173] who reported that minimum number of phytoplankton occurred in winter months. Variations in the level of phosphorous and carbon dioxide in Ambegosale lake were studied by Madhuri Pejava *et. al.,*(2002) [133]. Anil Kumar *et. al.,* (2001) [9] studied the important factors of organic pollution on primary productivity in wetlands of Jarkhand, Nagarathna and Hosmani (2002) [148] studied the factors influencing the bloom of *Nitzschia obtusa* in a polluted lake. Correlation matrix and cluster analysis indicated that most of the physico-chemical parameters were inversely proportional to the growth of the Diatom. The appearance of few species of Desmids indicated that the water was polluted; Mamata Rawath and Jakhar (2002) [137] made a limnobiological study of few reservoirs of Jodhpur, Rajasthan and reported that they had low DO and the quality was very poor using advanced monitoring techniques, while Gomez (2001) [75]developed the IDP index for streams and rivers .Many of the researchers during 2001 developed diatom based indices. Gevrey *et.al*.(2001) [73]Mahadev and Hosmani (2005) [136] made an extensive study of Langlier's index and its relation to fresh waters. Their observations were that the phytoplankton growth in saturated waters had a tendency of changing the pH of the water. Further Chlorocaccales and blue green algae dominated waters that had a tendency of light scale deposition. These findings confirmed the levels of organic pollution. Cude (2001) [47] developed an effective water quality index for management of lakes. Bate *et.,al.(*2002) [21]made an extensive study on diatoms as indicators of pollution, Chinmoy and Raziuddin(2002) [43] reported the water quality index of degraded waters of industrial areas. Hosmani and Lingnnaiah (2002) [89] studied the causative factors of fish kills due to algal blooms and Hosmani(2002) [87] also described the interrelationships of phytoplankton and zooplankton.. Mahadev and Hosmani (2002) [134] used the Langlier's index as a factor for the distribution of phytoplankton. Hariprasad and Ramakrishnan(2003) [81]used algal assay for determination of organic pollution. Juttner *et.,al*(2003) [117] used diatoms as indicators of stream water quality. Ahmed 2004) [6] described an innovative index for evaluating water quality of streams. De la Rey *et.,al*.(2004) [49]also applied diatoms as indicators of water quality.

Nandan and Aher (2005) [150] assessed the water quality of Haranbaree dam (Maharastra) using algal communities and recorded pollution tolerant genera of various groups. The most pollution tolerant species were those of *Navicula*, *Oscillatoria* and *Euglena*. The Principal Component Analysis (PCA) was extensively used. Algal biodiversity in fresh waters and the related physico-chemical parameters were studied by Veeresh Kumar and Hosmani (2006) [223]. They concluded that Desmids occurred in fairly good numbers. These observations suggest that the lakes are oligotrophic but are tending to become eutrophic. They were also dependent on high temperature, pH and bicarbonates; Ranjan *et.al*., (2007) [174] studied physico-chemical characters of Ghariyarwara pond (Nepal) and observed dominance of Chlorophyceae throughout the year and seasonal variations in the other phytoplankton. Bhuiyan and Gupta (2007) [31] made hydro biological

study of Barak pond (Assam). They reported that highest dissolved oxygen and neutral pH in them was due to diverse plankton population. Euglenophyceae dominated the ecosystem; Tas and Gorulol (2007) [(211)] observed that lake Cemek (Turkey) supported abundant phytoplankton. Tiwari and Shukla (2007) [(214)] studying temporary water bodies of Kanpur observed high values of alkalinity, phosphates, ammonia and chloride which indicated eutrophic waters. Yogendra and Puttaiah (2007) [(234)] considered that BOD and COD demand decreases with increased nitrogen due to nitrification. The conclusion that was drawn by Venkata Subramani *et. al.,* (2007) [(224)] while studying lakes of Bodham was that chloride indicated pollution and increase in sulfate in water was due to discharge of sewage into it .Dissolved oxygen levels in water constantly changed due to organic matter (Khare *et. al.,* 2007) [(124)]; High sodium levels contribute to salinity problems and can interfere with Mg^{++} and Ca^{++} availability, Smitha *et. al.,* (2007) [(200)].

Hosmani (2008) [(92)] studied the ecology of Euglenophyceae from Dharwad and reported that they responded to high temperature, ox disable organic matter and low concentration of dissolved oxygen; Jayashankara *et. al.*(2010) [(116)] described microbial diversity of temple tanks of Udapi district while earlier Louis-Laclareq(2008) [(130)] developed the diatom index of saprobity. Basavarajappa *et. al.,* (2009) [(19)] studied the water quality parameters of four fresh water lakes of Mysore based on the CCME-WQI. In most cases the quality of water was threatened and its condition often deviated from the normal; Arivind Kumar and Varma (2009) [(13)] studied the spectrum of plankton abundance in certain lotic systems of Jharkhand, India. The quantitative and qualitative information on the seasonal variation of Zooplankton and selected physico-chemical variables based on the nutrient data was indexed. Sawanth *et. al.,* (2010) [(185)] made a limnological study of Atyal pond in Kolhapur, Maharashtra and reported that the pond is rich in nutrients and has become eutrophic. Aijyaz *et. al.,* (2010) [(7)] studied the diversity index of algal flora in Wular lake, Kashmir. They reported that diversity was significantly correlated with physico-chemical parameters. There was a positive correlation with conductivity, carbon dioxide, hardness and nitrate; Shinde *et. al.,* (2010) [(193)] studied seasonal variations in physico-chemical characteristics of Harssooli, Aurangabad and demonstrated that the water was suitable only for fish culture. Hosmani (2010) [(98)] made an extensive study on phytoplankton diversity in lakes of Mysore district and reported that the algal species were uniformly distributed, but diversity within the population was low. Bhosale *et. al.,* (2010) [(30)] dealt with the diversity of plankton in water bodies of Miraj Tashie (Maharashtra). There were great variations in the physico-chemical complexes as well as the phytoplankton population.

During recent years a large number of publications related to limn logical studies appeared, especially in the southern regions of Karnataka. The techniques form normal general descriptions were switched to modern statistical explanations and multivariate analysis were used. Basavarajappa *et.al.*(2011) [(20)] made an attempt to evaluate fresh water diatoms as indicators of water quality in some lakes of Mysore. All the lakes studied were alkaliphic, and nitrogen eutrophic tolerant species were present. The water quality ranged from alpha mesotrophic to polysaprobic. The study suggested that diatoms are an excellent source of ecological indicators.. Hosmani *et.,al* (2011) [(99)]while studying water quality index for protection of aquatic life used the CCME-WQI, and reported that the water quality of many lakes was always endangered and the conditions in it were always deviated from normal situations.. The lake waters were unable to support and protect aquatic life.. The structure and dynamics of biological communities and their relation to biological stress is of importance to develop conservation strategies in lake ecosystems. Nestedness is a measure of the order in ecosystem referring to the order in which the number of species is related to the area or other factors. Hosmani(2011) [(101)] while reporting nestedness patterns of fresh water diatom assemblages in lakes of Mysore found that *Synedra ulna* and *Nitzschia obtusata* to be perfectly nested, while the idiosyncratic species was *Caloneis permagma*. Diatoms of hierarchical range were *Gomphonema sumatranse, Gomphonema baltonis, Gyrosigma kuetzingii, Nitzschia virudla* and *Navicula gracilis*. Hosmani(2011) [(102)] using the National Sanitation Foundation-Water Quality Index rated water quality of lakes as medium to bad. The water quality and oxygen saturation levels had a major impact on the water quality.

Hosmani and Mruthunjaya (2012) [107] applied the one way ANOVA to the data of fresh water ecology. The results indicated that carbon dioxide and dissolved oxygen content were the most significant parameters operating in the lakes. Desmids were at their optimum during certain months, indicating the pristine nature of water. Multivariate analysis for distribution of Euglenophyceae were applied by Hosmani(2012) [106] Hierarchical associations were observed between *Peranema trichosporium* and *Phacus tortus*..Hosmani(2012) [103]also used benthic diatoms in lake water quality monitoring. Many of the plankton species were indicators of anthropogenic pollution which was mainly due to cattle raring in the surroundings of the lakes. The ionic composition of fresh waters and its implication on aquaculture was studied by Hosmani(2012) [104]. Residual Sodium Carbonate and sodium content were high. The Sodium Absorption Ratio could be used for reclamation of lake waters. However the lakes were not suitable for aquaculture. Hosmani and Mruthunjaya(2013) [109] studied the distribution of phytoplankton in lakes of T. Narasipura taluka. Cyanophyceae were the most abundant compared to Bacillariophyceae. Euglenophyceae were less and Cyanophycean blooms were common *(Microcystis aeruginosa*). Hosmani and Mruthunjaya(2013) [109] studied the impact of phytoplankton diversity on the water quality index. Very few plankton species dominated the lakes of T. Narasipura and had no impact on the water quality. Total Nitrogen played a major role while species of *Navicula, Nitzschia* and Gomphonema significantly appeared during the study period.

Hosmani(2013) [110] made a comparative study of various methods of algae as indicators of water quality. The ISDE/5 Index, Palmers Index and ranking of the lakes according to Garrett Ranking were made. Nestedness of species indicated that the matrix fill was low (59.59%) and the system temperature was high (32.22^0). indicating a poor distribution of algal species in the lakes.

CONCLUSION

One of the greatest difficulties in reviewing the amount of work done on a particular type of study is the availability of research journals and the research publications. A vast number of journals are published throughout the country and the world. However based on the records that could be procured through various agencies, as well as referring to various literatures available on the subject, it has been possible to accumulate the present data. It provides sufficiently high percent of references to constitute the review of literature. Avoiding the too early data and taking into account the references available from (1900) to the present day (2013); the review has been prepared.

REFERENCES

1. Adhakari, S.P. and Sahu J.K. Distribution and seasonal abundance of algal forms in Chilka Lake, East Coast of India. *Japanese Journal of Limnology.* **53**(3): 197-205 (1992).
2. Agarkar, S. V. Assessment of water quality of Sakegaon Reservoir. Maharashtra. *Asian Jr. Chem.* **10**(4): 997-998 (1998).
3. Agbeti M. Relationship between Diatom assemblages and trophic variables; a comparison of the old and new approaches *Can J Fish Aqua.t* **49**: 1171-1175 (1992).
4. Agbeti, M.D. and Smol ,J.P. Winter limnology: A comparison of physical, chemical and biological characteristics in two temperate lakes during ice cover. *Hydrobiologia*. **304**(3):221-234 (1995).
5. Ahluwalia, A.S., Kaur, M. and Dua, S. Physico-chemical characteristics and effects of some industrial effluents on the growth of a green algae *Scenedesmus spp. Indian J. Environ. Hlth.* **31** (5): 112-119 (1989).
6. Ahmed S., D. K. Sterans and G. Shelke. An innovative Index for evaluating water quality in streams. *Environmental Management.* **34**(3): 406-414 (2004).
7. Aiyaz R. Mir, A. Wangones, A.R. Yoursef and Wanyanes 2010. Diversity Index of algal flora in Water Lake. Kashmir. *Nature Envi. & Pol Tech.* 9 (2): 293 – 298.
8. Anand, V.K. Limnology of fresh water algae of the Gadigarh Stream. Jammu. *J. Curr. Bio. Sci.* **5**(1): 11-16 (1988).
9. Anilkumar, H.S. Fresh water phytoplankton of Hassan district, Ph.D thesis. University of

Mysore (2001).

10. Anna- Lisa Holopainen, P. Huttenen, E. Galina, Letans Kaya and E.V. Protopova. 1996. Yje trophic state of Lake Ladoga as indicated by lake summer phytoplankton. *Hydrobiologia,* 322; 9-16.
11. Archibald, E.M. and G.F. Lee. Applications of OECD eutrophication modelling approach to Lake Ray. Hubbard, Teres, *J. of Awwa,* **73**(11); 580- 599 (1981).
12. Arivozhagan, P. and Kamalaveni, K. Seasonal variation in physico-chemical parameters and plankton analysis of Kurichi pond. *J. of Environ and Eco*. **15**(2): 272-274 (1997).
13. Arvind Kumar and M.C. Vayma. Spectrum of Plankton abundance in certain lotic systems of Jharkhand, India. *Indian. J. Environ & Ecoplan,* **16** (2-3): 633 – 654 (2009).
14. Ashok Kumar O.K. and R. J. Patel. Desmids of Gujarat -1 Genus *Cosmarium corda*. *Phykos* **29** (1 & 2); 95-101 (1990).
15. Atkins WRG. Seasonal changes in the silica content of natural water in relation to phytoplankton. *Mar. Biol Assl* UK **14**:89-99 (1926).
16. Bailly W A. A Quantitative study of the phytoplankton of Lake Michigan collected in the vicinity of Easton, Illinois Butter *Uni Bot Stud*. 1938; **4**: 65-83
17. Bairagi S. P. and M.M. Goswami. Ecology of water blooms in some ponds of North India. *Env.* Eco/. **12** (93); 568-571 (1994).
18. Barroin, G. P., Blane, Chassing P., Olive and Pelletier G. R. Quality of water in Lake Leman. *France Eauque* **115**(2), 154-157 (1982).
19. Basavarajappa. S.H Raju N.S., Hosmani S.P. and Niranjana S.R. Studies on the water quality parameters of four fresh water lakes of Mysore Karnataka. India. *J. of Envi & Ecoplanning*. **16** (2-3) :413 – 419 (2009).
20. Basavarajappa, S.H, N.S. Raju, S.P. Hosmani and S.R. Niranjana. Freshwater diatoms as indicators of water quality of some important lakes of Mysore. *Indian Hydrobiology*, **14**(1):42-52 (2011).
21. Bate G C; Adams B and Vander Molen,J S. Diatoms as indicators of water Quality in South African River systems. Report No.814/1/02. *Water Research Commission,* Pretoria (2002).
22. Besare, O.K., Gautam, A., Prasad D.Y. and Gupta, S.N. Limn logical studies on Bhopal lakes; numerical and volumetric variation in plankton population of a polymeric tropical lake. *Proc,* of the *Natnl, Sci, Acad. India.* B. **62** (4); 521-533 (1992).
23. Bharathi S.G. and S. P. Hosmani. Hydro biological studies in ponds and lakes of Dharwar (Yemmekeri Pond) I, *Kar, Uni. J. Sci* (**18**); 101-115 (1973).
24. Bharathi S.G. and S. P. Hosmani. Observation on pond life with special reference to the possible causation of a bloom of *Franceia ovalis* (Franci) L. *Phykos;* (**122**); 117-119 (1976).
25. Bharathi S.G. and Hegde. G.R. Desmids of Karnataka-state and Goa, Genus *Euastrum* HER and *Micrasterias agardh*. *J. Indian Bot. Science.* **62**: 170-175 (1983).
26. Bharathi S.G. and S. P. Hosmani. Hydro biological studies in ponds and lakes of Dharwad (Railway Pond) I, *J.A.P. Acad. Sci* (II) 101-105 (1974).
27. Bharathi S.G. and S. P.Hosmani. On the ionic composition of sixteen fresh water lakes of Hassan and Chitradurga districts of Karnataka *K. Uni.. J. Sci.* **22**; 116-121 (1977).
28. Bhattacharya, T. Saha, R.K. and Chakrabarti. T. Dual variation in the water quality, plankton population and primary production in a freshwater pond in Tripura. *Environ Ecol.* **6** (4): 923-932 (1988).
29. Bhatnagar G.P 1984. Limnology of lower lake Bhopal with reference to sewage pollution and eutrophication Technical report of MAB Department of Limnology, Bhopal University, Bhopal pp.77.
30. Bhosale L.J, S.M. Patil, S.N Dhumal and S.S. Sale. Occurrence of phytoplankton in the water bodies of Miraj Tahasil of Maharashtra .*The Ecoscan* **4**: 73-76 (2010).
31. Bhuiyan J.R. and S. Gupta. A comparative hydro biological study of few ponds of Barak valley, Assam and their role on sustainable water resources. *J. Environ Biol* ,2007; **28**(4): 801-805.
32. Biswas, S. Phytoplankton periodicity in Ogelube Lake, Anambra state, Nigeria. *Hydrobiologia*. **246**(2): 169-172 (1992).

33. Bootsman G. A. and R. E. Hecky. Conservation of the African Great Lakes: a Limn logical prospective. *Conservation Biology.* **7**: 644-655 (1993).
34. Boris V, G. Alexey, A. Vepritsky, A. Kira, Mamkaeva and Lyudmila M. Voloshko. A survey of toxicity of cyanobacteria blooms in Lake Ladoga and adjacent water bodies. *Hydrobiologia* **322**; 149-151 (1996).
35. Borker, M.R., Saraswat, K. Quadros, S.V. and Fernandes, .S.V. The cycle of some abiotic and microbial quality of a fresh water reservoir during monsoon at Marmugoa, Goa. *Bioved.* **2**: 133-136 (1992).
36. Borse, S.K. and P.V. Bhave. Seasonal temperature variation and their influence on the level of water. Jalgoan (Maharashtra). *Asian .Jr. of Mrcrobial. Biotech. and Env.Sci*. **2** (3-4): 159-163 (2000).
37. Bratli, J.L. Water quality, phosphorus input reductions, analytical methods and lake internal purification measures. A case study of lake Froylandsvatn, Norway. *Marine pollut Bullet* **29**: 435- 438 (1994).
38. Chan, M.S. Aquatic pollution and its effect in the fauna and flora of the fresh water pond at Aligarh, India. *Geobios* (Sp. vol-1): 49-65 (1985).
39. Chandra, K., R.S. Panwar., D.N. Singh and R.A Gupta. Water pollution in Rihand reservoir. *Indian Assoc. Water Contl. Tech. An XI*. 4-5 (1984).
40. Chatterjee A.K., Water quality of Nanda Kanan Lake. *Indian J. Environ Helth* **34**(4): 329-332 (1992).
41. Chaturvedi U.K. Additions to the algal flora of Rohilkhand division UP India IX. Diatoms from Bareilly district. *Phykos* **245**: 163-169 (1985).
42. Chidambaram Pillai S. Cyanobacteria as indicators of power station hot water effluents. *J. Env. Poll.Q* (2-3): 157-166 (1999).
43. Chinmoy C and M. Raziuddin. Determination of water quality Indices (WQI) of a degraded river in Asansol Industrial area West Bengal. *Nat Envi and Poll Tech* **1** (2): 181 – 189 (2002).
44. Chitranshi, V, R. and Bilgrami., P.A. Comparative ecological studies on two Oxbow lakes of river Burhi Gandak-I Report on macrophysics. *Proc. Natn. Acad. Science India* Sec. **B56** (3): 247-253 (1986).
45. Choudhary T. Studies on the relationship between bicarbonate and chlorophyll- a in lentic and Lotic Systems. *J. Ind. Prot. Soc*. **69**(324): 403-407 (1991).
46. Correl, D.L. The role of phosphorus in the Eutrophication of receiving waters, a review. *J. Environ quality* (USA). **27**(2): 261-266 (1998).
47. Cude C. Oregon water quality index. Tool for evaluating water quality management effectiveness. *Journal of American Water Resources Association*. **37**: 125-137 (2001).
48. Dakshini, K.M. and Gupta, S.K. Physiographic and limnology of three lakes in the environments of the union territory of Delhi, India. *Proc. Indian Natn. Science Acad.* **4**: 417 -430 (1984).
49. De la Rey P.A, J.C. Taylor, Vanceburg L and Vosloo A. Determining the possible application value of Diatoms as indicators of general water Quality. A composition with SASS 5" *water Sa* **30**; 325-332 (2004).
50. Dellon P.J and F.H Reigler, A simple method for predicting the capacity of a lake for development based on Lake Trophic Status. *J. Fish Res. Board. Can*, **32**.1519-1531 (1975).
51. Dell'Umo A. 1996. "Assessment of water quality of an Alpanine River as a pilot study for diatom based Monitoring of Italian water courses" in Whit ton B A and Rott E. (Eds.) Use of Algae for monitoring Rivers II. 64-72: *Innstruck, Intitut fur Botonik*, *Unierssat Insbruck*. ,
52. Descy J. P. A new approach to water quality estimation using diatoms. *Nova Aedurigia*. : 305-323 (1979).
53. Desey J. P and Coste M. A test of methods for assessing water quality based on Diatoms *Verhandlung Interantional Verelngung de Limnologic.* **24**: 2112-2113 (1991).
54. Dhanapati M. V. S. S. S. Taxonomic notes on the Rotifers from India. IAAB (10) pp176 (2000).
55. Dixit S S, P Smol, J C Kingston and D F Charles. Diatoms: Powerful indicators of Environmental change *Env.Sc.Technol* **26**: 23-33 (1992).

56. Dobson HFH, M.Gilbertson, P.G. Sly. A summary and comparison of nutrients and related water quality in Lake Erie. Ontario, Huron and Superior. *J. Fish. Res. Board. Canada* **32**: 731- 738 (1974).
57. Eloranta P. and Goininen J. Ecological status of some Finish Rivers Evaluated using Benthic Diatoms Communities. *Journal of Applied Phyocology.* **14**: 1-7 (2002).
58. Flores L. N. and Barone. Relationship between trophic state and plankton community structure in 21 Sicilian Dam Reservoirs. *Environmental Pollution.* **120**: 207-218 (1994).
59. Forel F.A. Hand Buch den Seckende Allgemeinc Limnologie Stuttgant **3**: 249 (1901).
60. Forseyth, D.T., Downes, M.T Gibbs; M.M., Kemp., L;Maccairum I .Mackenzie, and Payni, D. Aspects of the limnology of Lake Rotongaio (New Zealand). NZ. *J. Mar Fresh Water Res.* **17** (4): 423-436 (1983).
61. Fritsch A.1888. International commission on limnology-in Hutchinson G.1957. A treaties on limnology vol.1 John Wiley and sons. Inc. New York pp 1015.
62. Fritsch, F E. The sub aerial and fresh water algal flora of the tropics *Ann Bot* **21**: 235-275 (1907).
63. Fritsch, F.E and Rich. F, Contributions to our knowledge of the fresh water algae of South Africa 4. *Trans.R.SocAfr.***11**: 207-308 (1932).
64. Ganapathi. S.V. The ecology of a Temple Tank containing a permanent bloom of *Microcystis aeuroginosa* (Kutz) *J. Bom Nat Hist Soc*. **42**: 65-77 (1943).
65. Ganapathi S.V. Diurnal variations of dissolved gases Hydrogen ion concentration and some of the important dissolved substances of biological significances in three temporary lake pools in stream bed at Mettur Dam. *Hydrobiologia* **7**: 283-303 (1955).
66. Ganapathi, S.V. Ecology of tropical waters, *Proc. Symp. Algology* ICAR New Delhi pp. 204-208 (1960).
67. Ganapati, S.V. The Ecology of a temple tank containing a permanent bloom of *Microcystisaerugionosa* (KUETZ) :*J Bombay Nat. Hist Soc*: **42**: 65-77 (1940).
68. Gandhi H P. Fresh water diatoms of Central Gujarat-With a review and some Others. Bishen Singh Mahendra Pal Singh, Dehradun (1998).
69. Gandhi, HP. A contribution to our knowledge of the fresh water Diatoms of Pratapgarh, Rajasthan. *J. Ind. Bot. Soc.* 304 -338 (1955).
70. Gast, A. and George J.P. Studies on the biotic factors and zooplankton in a polluted urban reservoir Hussein Sagar, Hyderabad. Impact on water quality and embryonic development of fishes. *Indian J. Environ Hlth.* **31**(1): 49-59 (1989).
71. George ,M.G. Comparative plankton ecology of five fish tanks in Delhi, India. *Hydrobiologia*. **27**: 81-108 (1966).
72. Gerald Niemi and Michael E McDonald. Application of ecological indicators. *Annual Review of Ecology Evolution and Systematics* **35**: 89-111 (2004).
73. Gevrey, M., Rimet F., Pork Y. S., Giranold J. L., Ector L. and Lell S. Water quality assessment using diatoms assemblages and advanced modelling techniques. *Fresh water Biology*. **49**: 208-220 (2001).
74. Goel P.-K., S.D. Khatvakar, A.Y. Kulkarni, Nitrogen to phosphorus dependentblue green algal dominance in lakes. J. *Env. Poll.* **1** (2): 67-78 (1994).
75. Gomez N and Liuer Si. M. "The Pompeian Diatom Index (IDP) for Assessment of Rivers and Streams in Argentina. *Aquative Ecology* **5**: 173-181 (2001).
76. Gonzalves, E.A. and D.B. Joshi. Fresh water algae near Bombay. J. *Bom. Nat. Hist. Soc.* **46**(1): 154-176 (1946).
77. Gosh A. and George F. P. Studies on the biotic factors and Zooplankton in a polluted urban reservoir, Husain sagar, Hyderabad. Impact on water quality and embryonic development of fishes. *Indian J. Environ. Health* **31**(1): 49-59 (1989).
78. Goviathan, V S. 1990. Seasonal succession of algal flora in waste stabilization ponds. Perspectives in Phycology (Prof. M.O.P. Iyengar, Centenary Celebration Volume, International Symposium on Phycology, Madras 1987. (Edited by Raja RaoV.N,) 195 200. Today and Tomorrows Publishers.
79. Gurudeva, M.R. Govindappa. D.A. and M.K.

Somashekar. Desmids flora of Savanadurga in Karnataka. *Phykos* **22**: 48-56 (1983).

80. Hansen Victor. In limnology by Welch P. MC. Grew Hill Book : 536 (1887).
81. Hariprasad P. and N. Ramakrishnan. Algal assay used for the determination of organic pollution level in fresh water body at Tirurannamalai, India. *J. Ecotoxi. Environment.* **13**(4): 241-248 (2003).
82. Hecky R. E. The Eutrophication of Lake Victoria. *Verhandlungon der International Vercinigung fur Limnologic.* **25**: 856-859 (1993).
83. Hegde, G.R. and Bharathi S. G. Ecological studies in ponds and lakes of Dharwad. Occurrence of Euglenoid blooms. *Phykos.* **25**: 62-67 (1986).
84. Heinonen. Quantity and composition of phytoplankton in Famish Inland water vesihallitus- *National Board of waters, Finland, Helsinki*-91pp (1980).
85. Higler L W G. Ecological water management considerations Proc.Inform CHO *T*ND,45:5-17 Hustedt F 1957 Die Daitomeenflora des Flubsystems der Weser irn Gebiet der Hansetadt *B*remgn *Abhandl Nature Vgr Breman* 34: 181 -440 (1991).
86. Hodgetts, W.J. A study of the factors controlling the periodicity of fresh water algae in nature. *New phytol* **20** :150-64, 195-227 (1921).
87. Hosmani S. P. Phytoplankton-Zooplankton relationship in four fresh water bodies of Dharwad, India. *J. Environ and Ecoplan.* **6**(1): 23-28 (2002).
88. Hosmani S. P. and S. G. Bharathi. Algae used as indicators of organic pollution. *Phykos* **19**(1): 23-26 (1980).
89. Hosmani S. P. and B. Lingannaiah. Mass mortality of fish in Yennehole Lake, Mysore. *Poll. Res.* **21**(4): 435-437 (2002).
90. Hosmani S. P. and L. Vasanth Kumar. Calcium Carbonate Saturation index and its influence on phytoplankton. *Poll. Res.* **15**(3):285-288 (1996).
91. Hosmani S. P. and S. G. Bharathi. Use of algae in classifying water bodies. *Phykos* **21**: 48-51 (1982).
92. Hosmani S.P. Ecology of Euglenaceae from Dharwad, Karnataka. *Indian Hydrobiology* **11** (2) : 303 – 312 (2008).
93. Hosmani S.P. Algal biodiversity in Fresh waters and related Physico-chemical factors. *Nature Env. Poll. Tech.* **5**(1) : 37-40 (2006).
94. Hosmani S.P. and S. G. Bharathi. Hydro biological studies in ponds and lakes of Dharwad, III. Occurrence of two Euglenoid blooms. *Science J.* **30**: 151-156 (1975).
95. Hosmani, S.P and B. B. Mallesha. Observation pond, lakes with special references to algal species diversity indices indicating water pollution. *Plant and Nature* **3**(1): 41-44 (1985).
96. Hosmani, S.P. and Bharati S.G. Notes on the occurrence of '*Euglena sanguinea'* . at Dharwad, *J Karnataka Uni. Sci.* **22**: 122 – 124 (1977).
97. Hosmani. S. P. Seasonal changes in phytoplankton communities of fresh water ponds at Dharwad. Karnataka State, India. *Phykos:* **27**:82-87 (1988).
98. Hosmani. S.P. Phytoplankton diversity in Lakes of Mysore District, Karnataka State, India. *The Ecoscon* **4**(1) : 53-57 (2010).
99. Hosmani,S.P., M.K. Mahesh and Alakananda B. Water Quality Index (WQI) for protection of aquatic life in Lakes of Mysore, Karnataka State, India. *International Journal of Lakes and Rivers*.**5**(1):91-102 (2011).
100. Hosmani S.P. Phytoplankton-Zooplankton relationship in four fresh water bodies of Dharwad, *Indian. J.Environ & Ecoplan* **6**(1): 23-28 (2002).
101. Hosmani,S.P. Nestedness patterns of Freshwater Diatom assemblages in Lakes of Mysore. *Online International Interdisciplinary Journal* **1**(2):7-13 (2011).
102. Hosmani,S.P Assessment of water quality of Hassan Lakes using NSF-Water Quality Index. *Indian Journal of Applied Research*. **1**(3):18-19 (2011)
103. Hosmani, S.P. Fresh water diatoms as indicators of River water quality. *Paripex-Indian Journal of Research* **1**(1):: 36-38 (2012).
104. Hosmani S.P. Ionic omposition of a fresh water lake and its implications on aquaculture *International Journal of Scientific research* **1**(2):1-2 (2012).
105. Hosmani,S.P. Application of Benthic Diatom

Community in lake water quality monitoring. *OIIRJ. I*I(III):21-34 (2012).
106. Hosmani,S.P. Multivariate analysis for distribution of Euglenophyceae in Karanji Lake of Mysore. *Phykos* **42**(2):74-79 (2012).
107. Hosmani,S.P. and T.B. Mruthunjaya. Distribution of phytoplankton in lakes of Tirumalakudal Narasipura of MysoreDistrict *Abhinav* .**1**(7):28-32 (2012).
108. Hosmani S.P. and R.A. Manjunath. Dynamics of algal diversity in Hombargalli Lake of H.D. Kote, Mysore District, Karnataka. *Abhinav* **2**(7):14-18 (2013).
109. Hosmani S.P. and T.B. Mruthunjaya. Impact of plankton diversity on the water quality index in a lake at T. Narasipura, Mysore District .*International Journal of Innovative Research in Science, Engineering and Technology* **2**(5):1434-1441 (2013).
110. Hosmani,S.P. Freshwater algae as indicators of water quality. *Universal Journal of Environmental Research and Technology* **3**(4) 473-482 (2014).
111. Howland, L. and Lucy, J. A four year investigation of the Hertford Shire pond *New Phytol*. **30**: 210-265 (1931).
112. .Hutchinson, G.E. and Pickford, G.E. Limo logical observations on Mountain Lake, Virginia. *Int. Revue. Geo. Hydrobio* (1932).
113. Ibrahim Banat. Waste water treatment and algal productivity in an integrated pond system. *Biol. Wastes* **32**(4): 265-275 (1990).
114. Ikonnikov.'V.V. The problem of toxic'-pollution of Ladoga Lake in Russian In; G.M. Vorapaeva(ed) putisovershentvovanija prorodo-polzvanija V basseinach bolschich. Nauka *Leningard* 34-53 (1990).
115. James, R.T., and Havens, K.E. Algal blooms probability in a large subtropical lake. *Water resources bulletin*.(USA). **32**(5): 995-1006 (1996).
116. Jayashankara, Vijaya, R. Girish and S. P. Hosmani. Microbial Diversity and water Quality Index in Temple ponds of Udupi District, Karnataka, India. *Nature Environment and Pollution Technology.***9** (1): 197-202 (2010).
117. Juttner I, Sharma S, Mani D B ,Ormerod S J, Chimonides J and Cox,E J. Diatoms as indicators of stream quality in the Kathmandu valley and middle Hills of Nepal and India *Freshwater Biology* **48**: 2065-2084 (2003).
118. Jyothi, B., Sudhakar, G and Venkateshwarulu, V. Chlorophycean blooms and their ecological aspects. *Intern. J. Environ Studies.* **40**: 151-164 (1992).
119. Kanungo.V.K, Naik.M. L, and Jain, Y.K. Physico-chemical characteristics of sewage and some ponds of Raipur city.*Geobios.***12** (3-4): 154-156 (1985).
120. Kaul and Siddhartha, Limn logical studies of an aquatic body: Lalpuri. Talab, Rajkot (India). *Indian J. Ecol.* **10**(1): 124-128 (1983).
121. Kaushik, S. Agarkar, M.S. and Saxena, D.N. Water quality and periodicity of phytoplankton algae in Chambal Tal, Gwalior, M.P. *Bio nature.***11**(2): 87-94 (1991).
122. Koschel, R., J. Benndrof, , G. Proft and F. Recknaget. Calcit precipitations as a natural control mechanism of Eutrophication. *Arch. Hydrobiol*.(3): 380 (1983).
123. Khan, M. A. and Chowdary, S.H. Physical and chemical limnology of Lake Katpai; Bangla Desh. *Tropical Ecology.***35** (1): 3551 (1994).
124. Khare, S.L., S.R. Paul and A. Dubey. A study on water quality of Khomp – Miwari lake of Chitrapur. M.P. India .*J. Environ Biol* **6**(2): 539-544 (2007).
125. Khatakar, S.D., A.Y. Kulkarni, and P.K. Goel. Duel cycle of phytoplankton and some nutrients during summer in the surface water of a shallow mesotrophic lake. *Geobios.***16**: 210-214 (1989).
126. Krishnamurthy, V. A contribution to the diatom flora of south India. *Indian Bot. Soc.* **33**: 334-381 (1954).
127. Kurata Mamoru and Yuji Nishihama. Seasonal change of the hydro graphic condition in lake Notoro-Hokkaido (Japan).*Sci. Rep. Hokkaido fish. Exp. Stn*. **29**: 17-24 (1987).
128. Lehman J. T. and D. K. Brans Dator. Nutrient dynamics and turnover rates of phosphates and sulphates in Lake Victoria, East Africa .*Limnology* and *Oceanography* **39**: 227-233 (1994).
129. Lenoir A and Coste M. Development of the practical Diatom Index of overall water quality Applicable to the French National Water Board Network. I Zohiton B A and Rott E. Eds use of algae in monitoring rivers II.29-43. *Institute for Botanic*, *universitat Inusfruk*

(1996).

130. Loeuis – Loclareg. IDSE Diatomic Index of saprobity - Eutrophication Conception (2008).
131. .Lorson, G. L., M. C. Intire, C. D. Kamaugh T. E. and Honokins H. C. Limnology of isolated and connected high mountain lakes in Olympic National Park. Washington State USA. *Archiv fuer Hydrobiologia* **134**(1): 75-92 (1995).
132. M. C. Cornick, P. V. and J. R. Cairns. Algal as indicators of environmental change. *J. of Applied Phycology.* **6**: 509 (1994).
133. Madhuri Pejavar., Vaishali Somani and Mangala Borker. Physico-chemical studies of Lake Ambegosale, Thane, India. *J. Ecobiol.* **14**(4): 277-281 (2002).
134. Mahadev J. and S. P. Hosmani. Langlier's Index and relation to phytoplankton in two lakes of Mysore City. *Env i.& Poll. Tech.* **1**(1): 19-21 (2002).
135. Mahadev. J and S.P.Hosmani. Community structure of cynobacteria in two polluted lakes of Mysore city *Nature Env. Poll. Tech*. **4**(3) : 523-526 (2004).
136. Mahadev. J and S.P.Hosmani. Algae for bio-monitoring of organic pollution in two lakes of Mysore city. *Nature Env. Poll. Tech*. **4**(1) : 97-99 (2005).
137. Mamata Rawat and G.R. Jakhoy. Limno biological studies of few water reservoirs of Jodhpur, Rajasthan, *Indian, J. Environ & Ecoplan*. **6** (2) : 197 – 208 (2002).
138. Mathur M. and N. Pathak. Some chlorococcales new to India *Phykos* **29**: 111-113 (1990).
139. Miyajima, T, Nakanishi, M., Nakana, S.I. and Tezuka, Y. An autumnal bloom of the diatom *Melosira granulate* in a shallow eutrophic lake. *Archiv fuer Hydrobiologia*.**130** (2): 143-162 (1994).
140. Mohanty, R.C. 1983. Algae as indicator of pollution. Proc. *AIAPC* Kanpur, pp: 92-94.
141. Mohapara, P.K. and R. C. Mohanty. Determination of the water quality of two water bodies using algal bioassay method. Utkal River *Phykos.* **31**(1232): 77.84 (1992).
142. Molot, L.A. and Dhillon, PJ. Nitrogen-phosphorus ratios and the production of chlorophyll in phosphorus limited lakes in central Ontario. *Can. J. fish Aquat. Sci.* **48**: 140-145 (1991).
143. Munnawar, M. Ecological studies of Euglenaceae in certain polluted and unpolluted environments. *Hydrobiologia.* **36**: 105-128 (1972).
144. Munnawar, M,.and A.R. Zafar. A preliminary study of vertical movement of *Eudorina elegans* and *Trinema lineare* during a bloom caused by them. *Hydrobiologia.* **29**(1-2): 141-148 (1967).
145. Munnawr. M. Limnoloigcal studies on fresh water ponds of Hyderabad, India. The Bicenose – Distribution of unicellular and colonial phytoplankton in the polluted and unpolluted environments. *Hydrobiologia*, **37**(1) : 105 – 128 (1970).
146. Muzino, T and Mori S. Preliminary Hydro biological Survey of some south East Asian inland waters *Biol J. Limn Soc*, : 77-117 (1970).
147. Naganandini M. N. and S. P. Hosmani. Ecology of certain inland waters of Mysore district. Occurrence of Cyanophycean bloom at Hoskere lake. *Poll. Res* **17**(2)123-125 (1990).
148. Nagarathna and S.P. Hosmani. Factors influencing the bloom *Nitzschia obtuse* in a polluted lake. *Indian .J. Envir. and Eco plan*. **6**(2): 223-227 (2002).
149. Naik P. R. and G. R. Hegde. A systematic account of Diatoms of Sharavathi estuary. Karnataka .*Phykos* **29**(122): 63-71 (1990).
150. Nandan S.N. and N.H. Aher. Algal community used for assessment of water quality of Haranbaree Dam and Mosam river of Maharashtra. *J. Environ. Biol.* **26**(2): 223-27 (2005).
151. Nandan, S.N, Mahajan, S.R., Kumavat, M.R. and Jain, D.S. Limn logical study of Hartala Lake of Jalagaon, Maharashtra .*Proc. 88-^{h} Ind. Sci. Cong. New Delhi. Part III (Advance abstract)* 1-2 (2001).
152. Noor Alam .M. Study on variation in the physico-chemical parameters of pond at Hatwa (Bihar) *J. of Env. Poll.***8** (2): 179-181 (2001).
153. Nygaard, G. Seasonal periodicity of plank tonic Desmids in oligotrophic lake Grane Lang so, Denmark.*Hydrobiologia.***211** (3): 195-226 (1991).
154. Palmer C. M. A composite rating of algae

tolerating organic pollution. *Phycol.* **5**: 78-82 (1969).

155. Pandey, B.N.. A.K. Jha, P.K.L. Dal, P.K. Parky and A.K. Mishra. On the seasonal abundance of phytoplankton in the stretch of Kosi River. *Poll. Res.* **14**(3): 283-293 (1995).
156. Pandey, J., Usha Pandey., Tyagi, H.R.and Rai. N. Algal flora and physico chemical environment of Fateh Sagar lake. *Phykos.* **37** (1 & 2): 29-39 (1998).
157. Pandit, A.K. Trophic structure of plankton community in some typical wetlands of Kashmir, India. 190-224. In S.R.Mishra (eds) *Limnological Research in India,* Daya Publishing House, New Delhi -110035. India (1999).
158. Parvateesham, M. and Mishra, M. Algae of Pushkar Lake including pollution indicating forms. *Phykos.***32** (1 and 2): 27-39 (1993).
159. Patrick, R. Factors affecting distribution of Desmids. *Bot. Rev.* **14**(8): 473-524 (1948).
160. Pearsall W. H. A Suggestion as to the factors influencing the distribution of free floating vegetation. *Ecol.* **8**(3): 163-201 (1923).
161. Pearsall W.H. The development of vegetation of English lake considered in relation to general evolution of glacial and rock basins. *Proc. Roy. Soc.* London. **13**: 259-284 (1921).
162. Pearsall, W.H. A suggestion to Phytoplankton as to the factors influencing the distribution of free floating vegetation. *J. Ecol* **19** :(2): 241 – 262 (1930).
163. Pearsall, W.H. Phytoplankton in the English lake. II the composition of the phytoplankton in relation to dissolved substances. *J Ecol* **20**: 241-262 (1932).
164. Peterson R.A. Infestation of Chytridiaceous Fungi on Phytoplankton in relation to certain Environmental Factors .*J. Ecol.* **41**(2); 416-424 (1946).
165. Philipose, M.T. Fresh water phytoplankton of inland Fisheries .*Proc. Sym. Algal.* ICAR: 272-299 (1960).
166. Prasad B. N. and Y. Singh. On Diatoms as indicator of water pollution. *J. Indian Bot. Soc.* **61**: 326-336 (1982).
167. Prescott, G'.W. Objectionable; algae and their control in lakes and *reservoirs. Louisiana Municipal* Rev!: 2-3 (1938).
168. Prescott, G.W. Some relationships of phytoplankton on limnology and aquatic biology. *American. Adv Sci* **10** : 65-78 (1939).
169. Puttaiah, E.T. and Somashekar, R.K. Distribution of Euglenoids in lakes of Mysore city.*Phykos.* **26**: 39-46 (1987).
170. Rai H. and Hill, G. On the nature of ecological cycle of Lago January: A central Amazonian Ria-Verzea lake.*Top.Ecol.* **23**: 1-49 (1982).
171. Raina, U.S., A.R. Ahmed, R. Shakto. Pollution studies on water quality. *Indian Env.Health.* **26**(3): 187-210 (1984).
172. Rajendra Nair; M.R. Seasonal variation of phytoplankton in relation to physico-chemical factors in a village pond at India (Vidisha) India. *J. Ecotoxicol. Environ. Monit* **3**: 177-182 (1999).
173. Rajkumar, N. 2001. Bio-diversity and quantative analysis of phytoplankton of a polluted fresh water pond (Pollachi), Tamil Nadu.*Proc. 88th Ind. Sci. Cong.*New Delhi. Part III (advance abstracts). 4-5.
174. Ranjani G.N.P. Singh and RB Singh. Physico-chemical characteristics of Ghrigareva pond of Birganji Nepal in relation to growth of phytoplankton's .*Nat. Environ* and *Poll. Tech.***6**(4) : 629-632 (2007).
175. Rao C B. On the distribution of algae in a group of six small ponds. Algal periodicity. *Ecol.* **43**: 291-308 (1955).
176. Rao, C.B. On the distribution of algae in six small ponds. *J Ecol* **41**: 62-71 (1953).
177. Rao, V. N. R., Mohan, R., Hariprasasd,V and Ramasubramanainah, R. Seasonal dynamics of physico-chemical factors in a tropical high altitude lake: an assessment in relation to phytoplankton. *Indian J. Biol.* **14**(1): 63-75 (1993).
178. Round F. E. Diatoms in river water quality monitoring. *Journal of Applied Phycology,* **3**: 129-145 (1991).
179. Sagar P.E. and Richman, S. Function interaction of phytoplankton and zooplankton along the trophic gradient in Green Bay, Lake Michigan. *Can. J. Fish Aquatic. Sci.* **48**: 116-122 (1991).
180. Saifullah, S.M., Mandura, A.S and Khafaji, A.K. A *Platymonas* bloom in coastal wastes of Jeddah, Saudi Arabia .*Pak. J. Bot.* **20**: 285-290 (1988).

181. Sakamoto, H. Shore line displacement in some Japanese lakes and its dependence on lake depth. *Arch. Hydrobiol.* **62**: 1-25 (1966).
182. Sahu B.K.,R.J Rao., S.K.Behera and R.K.Pandit. phytoplankton and primary production in the River Ganga from Rishikesh to Kanpur *Jr.Eco.Bio.* **7**(3): 219-224 (1995)
183. Sanantini and Salvatore. A preliminary account on some mountain lakes of the southern Alpines: phytoplankton investigation on three ponds of the Montesirino Basiliata (Italy). *J. Bot.* **113**(4): 275-286 (1979).
184. Sarwar, S.G. and Wazir, M.A. Physico-chemical characteristics of a fresh water pond of Srinagar (Kashmir): *Pollution Res* **10** (4): 233-237 (1991).
185. Sawanth R.S. AB. Telare, P.D. Desai and J.S. Desai . Variations in Hydro biological characteristics of Atyal pond in Gondhinglaj Tahasil.Dist. Kolhapur, Maharastra. *Nature Env. & Poln Tech* **9**(2) : 273 – 278 (2010).
186. Schroeder, H.G., Windolph, H. and Schneider, J. Balance of the biogenic calcium carbonate production in an oligoprophic lake, Attersee(Salzkammergut, Austria). *Arch. Hydrobiol.* **97**(3*):* 356-372 (1983).
187. Seema, Johari, U.S. Chaudhari and P.R. Chaudhari. Eutrophic status of some lotic and lentic water bodies in Amravati district. *J. Ecotoxil Env. Monitr.* **9**(1): 35-40 (1999).
188. Seenayya G. Ecological Studies in the plankton of certain fresh water ponds of Hyderabad, India. II., The Phytoplankton – I. *Hydrobiologia,* **37** (1): 55-88 (1971).
189. Shaji, C. and Patel, R. J. Phytoplankton ecology of polluted pond at Anand, Gujarat. *Ann. of Bio. (*Ludhiana) **10**(2): 191-197 (1994).
190. Shanon, E.E.and P.L Brenzonik. Eutrophicatin analysis. A multivariate approach .ASCE. Sanitary Engineering Div. **98**: 37-57 (1972).
191. Sharma, J.P., Gupta, V.K. and Srivastava, J. B. Seasonal variations in the primary production and physico-chemical properties of a eutrophic pond. *Bull. Environ. Sci* **3**(3): 3-33 (1985).
192. Sharma, S.K. and R. D. N. Srivastava. Aqua pollution is it a water for growth of chemical process industries. *Chem. Age India*. **36**(5): 513-515 (1986).
193. Shinde S.E., T.S. Patnon, K.S. Rant, P.R. More and D.L. Sonawane. Seasonal variations in Physico – chemical characteristics of Morsool Savangidam, district Aurangabad, India. *The Ecoscon*. **4**(1) : 37 – 49 (2010).
194. Singh and Mahajan, R. Phytoplankton and water chemistry of Rewalsar and Renuka lakes. Himachal Pradesh. *Indian J. Ecol.* **14**(2); 273-277 (1987).
195. Singh N.K and Saha L.C. Diatom of Bhagalpur Ponds-1.Bihar *Phykos* **21**: 128 (1982).
196. Singh, B.N. and K. Swamp. Limn logical studies of Uraha Lake(Ballia). The Periodicity of phytoplankton*. Indian. Bot. Soc.* **58**: 319-329 (1979).
197. Singh, R. Correlation between certain physico-chemical parameters and primary production of phytoplankton at Jamalpur, Munger, India .*Geobios.***17** (5-6): 229-234 (1990).
198. Singh, V.P. Phytoplankton ecology on the inland water of Uttar Pradesh. *Proc. Symp*. *Algol*. ICAR, New Delhi. Pp. 243 – 271 (1960).
199. Sladecek V. Diatoms as indicators of organic pollution *Acta Hydrochirn Hydrobiol* **14**: 555-566 (1986).
200. Smitha. P.G.,K. Byrappa and S.N. Ramaswamy. Physico-chemical characteristics of water samples of Bantwal Taluk, south-western Karnataka, India. *Nat. Environ. and Poll. Tec.* **28**(3): 591-595 (2007).
201. Srivastava P.M. and B. Othawani. *Trachelomonas* 'Ehrenberg .Euglenophyta. from semi arid region of Rajasthan. *Phykos* **29**(122): 121-126 (1990).
202. Srivastava V. S., Rai, A.K. and Mehrotra, R.C. Pollution status of soil beneath sewage disposal pond. *Indian J. Environ. Hlth.* **3**.1(4): 314-320 (1989).
203. Storm. K.M. Studies on the ecology and geographical distribution of fresh water algae and plankton *Rev. Algal.***1**: 1127-155 (1924).
204. Surendra Kumar and Sharma, L. Comparative physico-chemical limnology of lakes Picchola and Fatehsagar, Udaipur,(Rajasthan). *Poll. Res.* **10**(3):173-178 (1991).
205. Swarnalatha N. and A. Narsing Rao. Investigation of Lake Sarror Nagar with reference to water pollution. *J. Phyta. Res.*

4(2): 121-129 (1991).

206. Swarnalatha N. and A. Narsing Rao. Ecological investigation of two lentic environments with reference to Cyanobacteria and water pollution. *Indian.J. Microbial. Ecol.* **3**: 41-48 (1993).
207. Swarnalatha N. and A. Narsing Rao. Assessment of water quality and pollution in lentic environments. *J. Swamy. Bot. Club.* **11**(1) 44-47 (1994).
208. Swarnalatha N. and A. Narsing Rao. Ecological studies of Banjara Lake with reference to water pollution. *J. Environ. Biol* **19**(2)r 179-186 (1998).
209. Taar, J.L., V. Charan and S. Bodkhe. Contributions to the knowledge of Desmids from Nagpur. *Phykos* 379122): 56-69 (1998).
210. Takano, K. and Hino, S. Effect of temperature on the succession of plank tonic algae in hypertonic lake Barato, Hokkaido, Japan. Japanese. J. *Phycology.* **45**(2): 89-93 (1997).
211. Tas ,B and A. Gorualal. An ecological and taxonomic study of phytoplankton of a shallow lake, Turkey. *J. Environ Biol* **28**(20: 439-445 (2007).
212. Thomas M, A.G Deviprasad and S.P.Hosmani. Evaluating the role of physico-chemical parameters in plankton population by application of cluster analysis *Environment and Pollution Technology* **5**(2) : 219-223 (2006).
213. Thresh J. C., Sukling E. V. and J. F. Beale. The examination of water supplies *Ed. By Taylor, E. W.* 1949pp (1944).
214. Tiwari. D. and M. Shukla. Algal biodiversity and trophic status of some temporary water bodies of Kanpur. *Nat. Environ, and Poll. Tech.* **6**(1) 85-90 (2007).
215. Transeau, E.N. The periodicity of fresh water Algae *Amer J. of Botany* **3**(11) ; 121-133 (1916).
216. Trifonova I. S. Ecology and succession of Lake Phyoplankton in Russian Nauka. *Hemigard*. 179 (1990).
217. Tripathi, A.K. and Pandey,S.N. Water pollution: Ashish publishing House, pp. 1-326 (1990).
218. Tripathy, C.K.M. Phytoplankton as indicators of water pollution in rivers Ganga at Varanasi. *Biol. Men*. **15**: 65-72 (1989).
219. Uku, J.N. and Mavuti, K.M. Comparative limnology, species diversity and biomass relationship of zooplankton and phytoplankton in five fresh water lakes in Kenya, *Hydrobiologia* **272**, 251-258 (1994).
220. Uman G. V. Y. and C. Jimeaney. The basic limnology of a low altitude tropical Crater lake; Cerrochato, Costa Rica. *Rev, Biol Trop.* **43**(1-3) 131-138 (1994).
221. .Vaishya, A.K. and Adoni, A.D. Phytoplankton seasonality and their relationships with physico-chemical properties in a hyper eutrophic central Indian lake. *Proc. Indian Sci. Acad.* B(59): 153-160 (1992).
222. Varadaraj P. and S. Ayyapan. Population and distribution of heterotrophic bacterial flora in fresh water bodies of Bangalore. *I. J. Environ Health*. **31**(2): 162-170 (1989).
223. Veeresh Kumar N.S. and S. P.Hosmani. Algal biodiversity in fresh waters and related physico-chemical factors. *Nat. Environ. And Poll. Tec.* **5**(1): 37-40 (2006).
224. Venkatasubramani.R. and T. Meenombal. Ground water quality modeling for Pollachi Taluk of Coimbatore District. *Nat. Environ. And Poll. Tec.* **6**(3): 443-447 (2007).
225. Venkateshwarulu. V. An ecological study of the algae in river Moosi Hyderabad (India) with special reference to water pollution on periodicity of some common species of algae. *Hydrobiologia* **35**: 45-64 (1970).
226. Verma J.P and R C Mohantey. Effect of nutrient environment on *Ankistroderms falcatus(*Canada) Relfs var. *acicularis. Ecol. Env.and Conser*.**4**(3): 151-155 (1998).
227. Verma, S.R. and Shukla, G.R. Hydrobilogical studies of a temple tank "Devikund" in Deobnd (U.P.) India, *Environ Hlth.* **10**: 177-188 (1968).
228. Vyas, L.N. Studies in phytoplankton ecology of Picchola Lake. Udaipur. *Proc. Sym. Adv. Trop. Ecol*. 334-347 (1968).
229. Wani. I.A. Limnology (2na edition) Me Graw Hill Book Co. IVX pp. 536 (1998).
230. Welsh H. A method of cleaning diatoms and the preparation of permanent slides for Ecological survey work. *News l Ximnol. Soc.S. Afr*(l):39-47 (1964).
231. Wieham J. L. and Dorribt. C. Biological

parameters of water quality criteria. *Bioscience*. **18**: 447-481 (1968).

232. West. W. and G.S. West, Freshwater algae from Burma including a few from Bengal and Madras. *Annals of the Royal Botanic Gardens,* Calcutta VI.pp.260 (1907).
233. West W. The freshwater algae of Clare Island. Clare Island Survey. Part 16. *Proceedings of the Royal Irish Academy* **31**::1-62B (1912).
234. Yogendra. K. and E.T. Puttaiah. Water quality assessment of Tunga River using factor analysis. *J. Nat. Environ. And Poll. Tec.* **6**(3) 393- 399 (2007).
235. Yoshamuri S. Seasonal variations in the content of nitrogenous compounds and phosphate in water of Takatsuki pond, Saitama Japan. Arch. *Hydrobiol* **24***:* 155-1761. 27: 25-64 (1932).
236. Zafar A. R. Two years observation on the periodicity of Euglenaceae in two fish breeding ponds. *J.I. Bot. Soc*..**38**(4):549-560 (1967).
237. Zafar, A.R. On the periodicity and distribution an algae in certain fish ponds in the vicinity of Hyderabad, India. Ph.D Thesis (1955).
238. Zafar, A.R. On the ecology of algae in certain fresh water ponds of Hyderabad. India. *Hydrobiologia* **30**(1): 96-112 (1969).
239. Zafar, A.R. On the ecology of algae in certain fresh ponds of Hyderabad – India, III *Physico-chemical complexes*. **24**: 556 – 66 (1964).
240. Zandbergon, P. A. and K. J. Hall. Analysis of the British Columbia water Quality Index for watershed management. A case study of two small water shed. *Water Quality Research Journal of Canada*.**33**: 519-549 (1998).
241. Zutschi D P and A.N Khan. Eutrophic gradient in Dal Lake, Kashmir. *Indian j .Environ Helth*. **30**(4) : 348- 354 (1988).
242. Zutschi, D.P. and Wanganeo, A. The phytoplankton and primary productivity of a high altitude sub-trophic lake. Verh .*Inter. Nat. Verein. Limnol*.**22:** 1168-1172 (1984).