SECTION - 3

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REVIEW OF LITERATURE
Hydrobiology or limnology is the study of water bodies and in the recent past has attracted many workers. The ever increasing rate of pollution and deterioration of water quality is causing concern in the mind of many workers and has attracted wider attention. This has stimulated studies on limnology in various kinds of water bodies, no matter small or big e.g. – Lakes, Rivers, Oceans, Ponds and Reservoirs etc.

In India many workers have contributed to the studies of Hydrobiology. Born (1979), however stated that substantial research in Lake Ecosystem is still needed. Based on Indian publication in Hydrobiologia, Gulati and Wurtz Schulz (1980) has analysed the present status of limnology and have suggested future lines needed for further work. R.G. Michael (1980) has presented a ‘Historical Resume on Indian Limnology’.

Important works on lentic water bodies has been in progress since many years i.e. Iyengar (1940); Gonzalves and Joshi (1946); Ganpati (1943, 1955); Zafar (1959, 1967); Jana (1973, 1974, 1980); Hussain (1976), Das and Pande (1980); Palaniappan etal (1981); Zutshi (1982).

The hydrobiological studies were carried out in India for various water bodies : Ganpati 1955 made hydrobiological investigations of Stanley reservoir and river Cauvery; Krishnamurthy etal 1965 carried out hydrobiological studies on Gandhisagar tank; Dubey and Verma 1966 worked on hydrobiological studies of Budhwari Tank Seoni M.P. Kaushik etal 1988

Hedge and Bharti 1985 have studied trophic status of some ponds at Dharwar which received sewage.

Unni 1984, carried out limnological studies of a sewage polluted tank in Central India. H.M. Saran and A.D. Adoni 1985 carried out studies on 'Diurnal Variation of various parameters in Central Indian Reservoir.

Not only the natural water bodies (like lakes, river work and ponds) have been worked out but work has also been done on Waste Water Stabilization pond ecosystem ie. – P.R. Chaudari, A.V.J. Rao 1985 and many other workers.

The ground water pollution study has also been carried out by various workers like C. Naganna etal 1985 along coastal Karnataka; Banerjee 1983 studied the management plan of ground water in Calcutta. Handa 1983, 1986 studied hydrogeochemical zone in few places in India. Ramchandran etal 1991 revealed influence of agrochemicals on ground water quality. Elango 1992 – groundwater quality in coastal region of South, Mittal etal 1994 in Patiala.


Limnology of manmade reservoir on Westernghats in S. Kerela was studied by Thomas Sabu 1996. Work on estuaries has also been carried out by some workers e.g. K. Kalidasan and A.A. Rahman 1992. Naidu 1990 worked

During limnological studies various physico-chemical parameters have been worked out. The methods of analysis have been given by Welch 1948; Hutchinson 1967; Golterman 1969, 1978; A.P.H.A. 1967, 1980, 1985; Lind 1974; Adoni etal 1985; Das 1989; IS 30251964; I.S.I 1982; Greenberg etal 1975; Schwoerbel 1970 etc.

Detailed work on physico-chemical factors has been done as early as Juday in 1915-1916. This was followed by many more workers, the notable ones among those are as follows:

Correlation between physico-chemical and biological factors had been worked out by Ganpati 1955.

Physico-chemical parameters have been utilized to indicate the pollution level and quality of water. Hantge 1978 studied pollution of Nahe river in Germany. In India Das and Pande 1978a, b, studied lake pollution as induced by physico-chemical and biological parameters. Chandra etal 1984 worked on pollution in Rihand reservoir. Khanka 1983 studied physico-limnological analysis of Naina lake and Bhimtal lake in Kumaon. Shyamsunder 1988 studied the water quality of river Jhelum in Kashmir and concluded river water is becoming more and more alkaline day by day. Abundance of insects in relation to physico-chemical characteristics of pond water at Gwalior (M.P.) was studied by S.S. Kaushik, M.N. Sharma and D.N. Saksena 1990. Kaushik etal 1990 concluded that pollution load during summer months becomes greater in comparison to other months. Khanka 1991 studied
physical limnology of Himalayan lakes. Mishra and Saksena 1991 worked on pollution ecology with reference to physico-chemical characteristics of Morar (Kalpi) river Gwalior M.P.


Krishnamurthy and Bharti 1997 revealed that high value of pH, conductivity, dissolved oxygen, bicarbonate and total hardness influence the occurrence of Euglenophyceae of Kali river around Dandeli, Karnataka.

Physico chemical characteristics and phytoplanktons of Taudah lake Kathmandu were studied by L.R. Bhatt, P. Lacoul, H.D. Lekhak and P.K. Jha. 1999.

Periodicity and interrelationships of physico-chemical factors in ponds was studied by Braj Nandan Prasad and Y.C. Jaitley 1985.

Few workers like Stahl and May 1967, Hartley and Weirs 1970, Merz etal 1957 have studied stratification in stabilisation pond effluents.

Ganpati 1955 also carried out studies on diurnal variation of dissolved gases, pH value and some of the important dissolved substances of biological significance in three temporary pools at Mettur dam.

Studies on diurnal and vertical distribution of phytoplankton in waste water stabilization pond were carried out by P.R. Chaudhary, A.V.J. Rao, J.P. Kotangale and K.P. Krishnamoorthi in 1985. Seasonal, diel and vertical periodicity with reference to phytoplankton production and physico-chemical parameters was studied by A.D. Adoni and A.K. Vaishya 1985.


Diel variation of water quality and zooplankton community in a freshwater pond of Patna was studied by Meena (Swaroop) Singh and R.K. Sinha 1995.

The study of temperature factor is of importance in limnological studies as its variation influence the chemical and biological components of the ecosystem. This factor is usually included during the limnological studies and interpreted in various ways.
Welch 1952, stated that smaller the body of water more quickly it reacts to the changes in the atmospheric temperature.

This factor has been studied in detail by Young and Zimmerman 1956, Zafar 1971, Prasad 1983, Shiv Kumar et al. 1989, Gupta and Mehrotra 1991 and Nalin K. Shastri et al. 1991.

Correlation between temperature and phytoplankton has been done by various workers – Mc Combie 1953 stated that temperature may effect seasonal cycle of phytoplankton in temperate zone; Hutchinson 1957 said that temperature is an important factor which controls both quality and quantity of planktonic flora. Jana 1973 and Chari 1980 observed that temperature is a critical factor for seasonal periodicity of phytoplankton.


Efford 1967 and Moss 1969 from their studies concluded that surface water temperature closely reflected to ambient air temperature. This is particularly true for shallow lakes and ponds.

Thermal stratification in different layers of stabilisation pond was observed by P.R. Chaudhari et al. 1985.

A.D. Adoni and A.K. Vaishya 1985 during their limnological studies of central Indian reservoir observed that surface water temperature was lower than air temperature during day time and reverse trend was noticed during
night hours. A relative decrease with increasing depth during day hours was also evident while during night hours column remained more or less isothermal.

Dodakundi and Rodji (1974) said that temperature and light intensity are the factors which influence the pond dynamics.

Conductivity is a good and rapid method to measure the total dissolved solids and is directly related to total solids (Mishra and Saksena 1993). Many workers worked on this parameter and its effect, like Juday and Birge 1933; Rodhe 1949; Otsuki and Wetzel 1974; Trivedi et al 1985; Rawson 1960; Nalin K. Shastri et al 1991; Dakshini and Soni 1979; Mishra & Saxena 1991; L.R. Bhatt et al 1999.

pH is the important factor depicting the chemical and biological conditions of natural water. Various workers like Atkin 1922, Lund 1934, Shrivastav 1967, Gupta and Mehrotra 1986, Alabi 1971a, studied correlation between pH and water molds.

Pearsall 1930 and Zafar 1966 observed that pH of water appears to be dependent upon relative quantities of calcium, carbonate and bicarbonate.

Gonzalves 1946, Hannan and Young 1975, Zutshi & Vass 1978 while their studies observed seasonal variation in pH and found that maximum pH value was during summer low values were observed during winter and monsoon season.

pH of water also gives an idea to the type and intensity of pollution. Verma et al 1984, Saksena et al 1966 observed pH of Ganga river above 8 in all seasons except rainy. Chandraprakash et al 1978 found alkaline nature of
Jamuna river at Agra, Palhariya and Malviya 1988 recorded maximum pH 11.5 in Narmada river.

Baily 1963, Srinivasan 1963, Moitra and Bhattacharya 1965, Jana 1973 and Chari 1980 observed that high pH value was related to heavy bloom of phytoplanktons. S.K. Chaurasia and A.D. Adoni 1985 while their studies on a shallow eutrophic lake observed that high pH favours the plankton production, higher pH at surface and lower at bottom were associated with the photosynthetic activity.

H.S. Rawat, S.P. Badola and D.R. Khanna 1990 during studies on diurnal variation observed that pH slightly increased in the afternoon and decreased during night.

L.R. Bhatt et al. 1999 while working on physico-chemical characteristics and phytoplanktons of Taudah lake Kathmandu found negative correlation coefficient of pH with Cyanophyceae and Chlorophyceae and positive correlation co-efficient with Bacillariophyceae.

Chloride content of water has been studied by many workers like – Saksena et al. 1966 on river Ganga at Kanpur, Laxminarayan 1965 on river Ganga at Varanasi; Munnawar 1970a and b on fresh water ponds of Hyderabad; Mahadevan and Krishnamchary 1983 on river Vaighi; Somashekhar 1984 on river Cauvery; Ajmal et al. 1985, 1988 on Kalinadi; Brajnandan Prasad et al. 1985 on four ponds in Lucknow; Palhariya and Malviya 1988 on Narmada river; Shah 1988 on river Jhelum; Ghosh and Sharma 1988 on river Ganga at Patna.

According to Thresh et al. 1944 high chloride is generally the indicator of large amount of organic matter in water. Klein 1957 said that there is direct
correlation between chloride and pollution level. Munnawar 1970 stated that higher chloride content is an index of presence of pollutants of animal origin. Goel et al 1980 stated that it increased with the degree of Eutrophication.

Gonzalves and Joshi 1946 and Zafar 1964 and Rao 1971, 1972 reported seasonal variation in chloride contents and stated that high chloride concentration was observed in summer season when water level was low and decrease in its concentration was observed in monsoon season.

Khulbe 1981 found that chloride content had an adverse effect on the fungal occurrence. According to Gupta and Mehrotra 1991 chloride contents of water shows an inverse relationship with temperature and fungi.

Dissolved oxygen is essential to maintain biological life in water. Its value is affected by waste discharges. Wetzel 1983 stated that oxygen content is an important requirement of many organisms. It affects the solubility and availability of many nutrients, therefore determines the productivity of aquatic ecosystem. Some important previous works on tropical waters concerning oxygen distribution were those of Fritsch 1907, Alikunthi et al 1948, 1951; Singh 1955; Chandraprakash et al 1978 on Yamuna; Mahadevan and Krishnamchary 1983 on river Vaigai; Palhariya and Malviya 1988 on Narmada river at Hoshangabad; Shah 1988 on river Jhelum Kashmir etc.

Kudesi 1985 said that low content of DO is a sign of high organic pollution tolerance limit (it is not less than 6 mg/L).

Seasonal variation of oxygen in water depends upon temperature of water which influences oxygen solubility, Zutshi & Vass 1978. Hannan 1979 and Agrawal et al 1976 said that dissolved oxygen depletes due to high temperature in summers. N.C. Datta et al 1985 while studying ecology of
Brackish water impoundment found that the concentration of dissolved oxygen was fairly high due to number of factors as shallowness of Bheri, high precipitation; moderate temperature salinity and photosynthetic activity of phytoplankton. S.K. Chaurasia and A.D. Adoni 1985 while their studies on shallow Eutrophic lake found higher value of dissolved oxygen in winter in comparison to rainy and summer seasons (similar trends had been reported by Hussain 1967 and Adoni 1975). However Unni 1984 while working on sewage polluted tank in Chindwara found that in surface water highest dissolved oxygen was found in summer mainly due to high photosynthetic activity. Choudhary et al 1985 studied diurnal variation in dissolved oxygen at different water levels in waste stabilization ponds along with vertical distribution of plankton. Alabi 1971b, Manoharachary 1978 and Mishra 1991 observed inverse relation between dissolved oxygen and temperature, other workers who had found the same are Welsch 1957, Hussain 1967; Zutshi and Vass 1978; Singh and Mahajan 1987; Gupta and Mehrotra 1986, Yadav et al 1987, H.S. Rawat, S.P. Badola and D.R. Khanna 1990 however found positive correlation between dissolved oxygen and temperature. Ganpati 1940 and Nasar and Munshi 1974 reported that temperature is not always the chief controlling factor of oxygen content but algal blooms and macrophytes play an important role.

Decomposition of organic matter always plays an important role in consumption of dissolved oxygen, which is more vigorous during warm weather- Gonzalves & Joshi 1946; Morissette and Mavinic 1978.

Hannan et al 1978, Hannan 1979 said that water becomes oxygenated during monsoon due to circulation and mixing by inflow after monsoon rains.
L.R. Bhatt et al. 1999 during studies on Taudah lake revealed that the value of dissolved oxygen was below the tolerance limit (6mg/L) during summer due to high trophogenic activities and increased in rainy and winter season. Reoxygenation progressed in winter. Same results had been obtained by Udash 1996 in Tomar lake Kathmandu and Thapa 1994 in Kirtipur pond. However Yadav 1996 observed higher values in June and low in August in the same lake.


Reduction in oxygen during warmer months due to respiration and decomposition of organic matter was also reported by Singh 1995, Patel and Sinha 1998 and Singh and Rai 1999.

Biochemical oxygen demand (BOD) is good indicator of organic pollution and helps in deciding the suitability of water. Notable works on BOD of water has been done by many workers like Zafar 1966, Zutshi and Vass 1982, Shardendu and Ambasth 1988 etc..

Mc Vea and Boyd 1975 during their studies on fish ponds reported lower BOD value due to the presence of aquatic plants.

Agrawal etal 1976 and Rai 1978 found highest value of BOD during summer and lowest value in winter, similar trend was reported by U.S. Bagde and A.K. Verma 1985 during their limnological studies on JNU lake New Delhi. Zutshi & Vass 1982 and Nalin K. Shastri explained that low value in
colder months was due to low quantity of solids and low quantitative values of microbial population.

H.V. Tilwankar, T. Appa Reddy and C.U. Rao 1989 studied the factors affecting BOD kinetics and reported that BOD is affected by dilution, toxic materials pH and temperature.

L. Shrotriya and P.S. Dubey 1991 said that sewage dominated waters have lower BOD load than water bodies receiving industrial effluents.

L.R. Bhatt et al 1999 observed maximum BOD in summer and lowest in winter season. According to them this was due to high rate of organic decomposition during summer. They reported that temperature decline during monsoon and winter retards the microbial activity.

Carbon dioxide is an essential factor of water ecosystem. Free carbon dioxide is suggested to be due to rain, plant roots and decaying vegetation. (A.M. KH. Jarousha 1999).

Welch 1952 reported that high carbon dioxide value in water can be attributed to higher decomposition of organic matter which leads to release of more carbon dioxide. Many workers like Whipple and Parker 1902; Birje and Juday 1911, Pearsall 1930, Ganpati 1943, Gonzalves & Joshi 1946, Raw 1964, Saha et al 1971, Singh 1965, Mandal and Hakim 1975 worked on various physico-chemical parameters of water and observed inverse relationship between carbon dioxide and dissolved oxygen. Manoharachary 1979 and Rao and Manoharachary 1983 showed its correlation with microbial members.

According to Munawar 1970 and Rao 1972 carbon dioxide was usually found to be more during summer with simultaneous low value of dissolved
oxygen. Similar trend was observed in Ramgarh lake of Jaipur by A.M. KH. Jarousha 1999.

According to Gupta and Mehrotra 1991 in Brahma Sarovar tank Kurukshetra free carbondioxide and occurance of water molds showed direct correlation with each other.

Johnson 1996 suggested certain factors like temperature, pH and total alkalinity to be responsible for solubilization of carbon dioxide.

Studies on alkalinity caused by carbonates and bicarbonates were carried out by various workers: Zafar 1966 found higher carbonate concentration in water bodies during summer stagnation period. Munawar 1970 found higher values of bicarbonate during winters in sewage pond. Rao 1972 observed its maximum values in late summer and early winter and minimum values of carbonate/bicarbonate in monsoon season.

Studies on alkalinity caused by carbonates had been carried out by Moss 1973, he concluded that in Eutrophic waters high bicarbonate concentration is found. S.K. Chaurasia and A.D. Adoni 1985 while their studies on shallow Eutrophic lake in Sagar observed that bicarbonate alkalinity and carbondioxide showed positive relation while bicarbonate and carbonate alkalinity showed inverse relation with each other.

Lowest value of carbonate alkalinity was observed by them during rainy season and maximum in summer season while bicarbonate alkalinity was high in rainy and low in summer season. Carbonate content was usually found by them to be higher in surface water as compared to bottom water in contrast to Bicarbonate alkalinity.
Studies on Diurnal and Vertical distribution in waste water stabilisation pond at Nagpur were carried out by P.R. Chaudhary etal 1985. They found that bicarbonate alkalinity was low throughout the depth of pond during afternoon and was very high during night. Carbonate alkalinity show even distribution throughout the depth however low during day and increase during night.

A.D. Adoni and A.K. Vaishya 1985 while working on Central Indian Reservoir found that carbonate alkalinity was maximum during summer and minimum during winter season. No regular diel pattern was observed except that slightly higher during day hours than the night hours. Bicarbonate alkalinity also did not show marked diel variation however it was found to increase with decreasing depth.

A.M.KH. Jarousha 1999 worked on Ramgarh Lake in Jaipur and found maximum value during monsoon. Similar results were recorded by Lakshmannan etal 1996, Singh and Rai 1999 and Bath & Kaur 1999.

Phenolpthalein alkalinity was studied by Nasar 1983, Hegde and Sujata 1996; Suvarna and Somashekhar 1977.

Total alkalinity plays a prominent role in altering the pH value so as to cause a change in flora and fauna according to Nygard 1949, Ganpati 1960, Tandon and Singh 1972; Moss 1973, Rana 1977 etc. Whipple and Parker 1902, Moss 1973 carried out studies on alkalinity caused by dissolved carbondioxide.

Mandal and Hakim 1975 found direct correlation between free carbondioxide and bicarbonate alkalinity in freshwater pond at Bhagalpur.
Previously Pearsall 1930, Howland 1931, Zafar 1964 and Munawar 1970 b had also reported similar correlations.

Gupta and Mehrotra 1986, 1991 observed that total alkalinity and temperature show direct correlative relationship with each other while Total Alkalinity showed inverse correlation with water molds.

According to Reid 1961, Calcium played a significant role in biological productivity. Palmer 1967 recorded higher concentration of Calcium in contaminated waters. M.R. Kundangar and D.P. Zutshi while working on two Himalayan lakes stated that high levels of Calcium in water absorb labile organic substances and limit the plankton growth. The same was also reported by Zutshi and Vass 1973 in Dal Lake, Srinagar.

Braj Nandan Prasad, Yogesh Chandra Jaitley and Yashpal Singh 1985 worked on periodicity and inter relationship of Physico-Chemical factors in Ponds at Lucknow and found that the effect of periodicity did not show and fixed pattern in Calcium content. Two peaks were observed one in summer season and second in winter season.

Kaiser Jamil 1991 said that Calcium content increased in water containing plants mainly hyacinth as Calcium ions are important in regulating a wide variety of biological activities. Gupta and Mehrotra 1991 concluded that Calcium hardness may play an indirect role in the growth and occurrence of water molds.

Close affinity between Magnesium concentration and organic pollution has been suggested by various workers. Zafar 1964, 1966, Munawar 1970 and Rao 1971 found direct correlation between Magnesium content and organic
matter of water bodies. Palharya and Malviya 1988 suggested higher value of Magnesium in river water is an index of pollution.

A.M.KH. Jarousha 1999 while working on Ramgarh Lake found lower magnesium content than calcium content at all sampling stations. Similar observations were reported by Dakshini and Soni 1979, Reddy 1984 and Nirmala Kumari 1994.

Twert etal 1974 classified water having hardness upto 75 mg/L as soft, 76-150 mg/L as moderate 151 to 300 mg/L as hard and more than 300 mg/L as very hard.

Singh 1979 found higher hardness values during summers.

Brajnandan Prasad etal 1985 observed higher hardness values in ponds which were more polluted than those which were less polluted. This observation was in line with that of Moss 1973 who also associated increase in hardness with increased Eutrophication.

U.S. Bagde and A.K.Verma 1985 during Limnological studies of JNU Lake found that Calcium and Magnesium hardness of Lake increased towards winter and summer and this they attributed to the steady state of hardening of water due to evaporation of surface water. Excessive dilution of heavy rains is responsible for lowering the hardness in Monsoon season. This pattern of successional hardness was also reported by Boznaik and Kennedy 1969, Daborn 1976. Kaiser Jamil 1991 found that hardness increased in water in presence of aquatic plants.

A.M. KH. Jarousha while working on Ramgarh Lake Jaipur reported the water to be hard and the hardness ranged between 118 to 255 mg/L. Similar
results have been recorded by Krishnamurthy and Bharti 1995 in river Kali at Karnataka while Pujari & Sinha 1999 gave similar reports from Orissa.

Study of Phytoplanktons is an essential part of hydrobiological analysis of water bodies as their qualitative and quantitative analysis have been correlated with pollution. Several reports on Algae of water bodies have been published from time to time by different workers – Lund 1961, Vyas 1968, Tripathi and Pandey 1990; Parvateesam etal 1991; Parvateesam and Mishra 1993; Shaji and Panikkar 1994; Jain and Shrivastav 1998; Kanhere and Gunale 1977; Tarar etal 1998.

Palmer 1969 listed algae tolerating different kinds of pollution and compared them with clean water algae. Change in species composition was reported by L.Shrotriya 1987. Temperature as a vital factor for growth of algae has been reported by Lund 1949; Rao 1955, Hutchinson 1967; Young etal 1972; Vasishtha & Sharma 1975; Verma and Duttamunshi 1987; Wisharad and Mehrotra 1988 reported proliferation of phytoplankton from winter to summer.

The water bodies receive large quantities of raw sewage and agricultural run off as a result of which high nutrient concentration of water and presence of dense phytoplankton population have been observed by Moss 1972, Prasad etal 1976, Sengupta etal 1988, Brij Mohan etal 1989. Phytoplanktonic composiiton of sewage polluted Morar (Kalpi) river, Gwalior has been studied by S.R. Mishra, D.N. Saksena 1993.

Dominance of blue green algae during rainy season has been attributed to high nitrate values by Mesfin and Belay 1989, Goel etal 1997 and Kaur etal
1997. High number of blue green algae has been assigned to carbon dioxide by Mallik & Base 1987 and to high alkalinity by Rao 1953.

Dominance of diatoms has been reported by Pal Santra 1990 and Mam 1995.

Kumar et al and Zutshi, Pant et al 1980 considered abundant algal growth as indicator of Eutrophication. Raanibai and Ravichandran 1987 attributed occurrence of diatoms in good numbers to healthy unpolluted condition of water body.

Cebacades and Brogueija 1987 emphasised that growth and photosynthesis of algae is mainly influenced by pH and alkalinity of water. Venkateshwarlu et al 1994 used algal species as indicators of pollution gradient.

Hydrology and periodicity of phytoplankton in sewage fed Motia pond Bhopal was studied by Taiyyab Saify, S.A. Chagta, Alis Parveen, I.A. Durrani 1986.

Algal flora has been considered as an indicator of organic pollution, on this basis assessment of water quality of Vishwamitra river, was done by S.N. Nandan and R.J. Patel 1986.

Primary productivity of Phytoplanktons has received due attention since past few decades. According to Westlake 1963 macrophytes are more productive than phytoplankton communities in small water bodies, however in lakes, oceans and rivers macrophytic productivity is less than that of phytoplankton. Some important contributors of past are Lund 1964, Ganpati and Sreenivasan 1968, 1970, 1972; Hussainy 1967, Quasim 1969, Khan and Zutshi 1979, Adoni 1975, Kannan and Job 1980, Awatramani 1980, Saran
1980 etc. Sreenivasan 1965, 1968, 1969, 1970 and 1972 had worked on inland waters, Reservoirs and Tanks of Tamil Nadu. Tundish 1980 had reported that number of factors influence primary productivity Findeneg 1965, Qasim et al 1974, Khan and Zutshi 1979 found that Ultraplankton and Nannoplankton assimilate much more carbon than net phytoplanktons like diatoms or blue green algae. Primary productivity of Indian rivers and streams whether clean or polluted has been studied by Rajyalakshmi and Premswarup 1975, Ramarao et al 1979, Gupta 1982 and Patra 1985. H.M. Saran and A.D. Adoni 1985 while studying seasonal variation in Phytoplanktonic primary productivity in Sagar Lake found that productivity was high during summer. High ratio indicate high NPP and low respiration. N.C. Dutta, B.K. Bandhopadhyay and N. Mandal 1985 while working on ecology of Brackish water impoundment found that Primary Productivity showed bimodal pattern with two peaks one in April and other in November. Productivity is negatively correlated with temperature and dissolved organic matter and directly with dissolved oxygen and salinity. Vijayaraghav 1971 worked on seasonal fluctuations in production of tropical ponds and obtained values ranging from 1.5 to 15.8 gc/m^2/day. S. Ayappan and T.R. Chandra shekhar Gupta 1985 worked on Limnology of Ramsamudra Tank found maximum production during summer, surface water generally recorded higher rates of GPP. Production was generally controlled by several hydrographic factors such as pH, free Carbondioxide, total alkalinity and hardness of water.

A.D. Adoni and A.K. Vaishya worked on seasonal Diel, Vertical variation and periodicity in Phytoplankton production of Central Indian Reservoir and observed higher productivity in summer season coincided with higher air & water temperature and light intensity. This is in accordance with the

Shukla etal 1989 have found that primary productivity of river Ganga at Varanasi is adversely affected by industrial effluents and untreated city sewage released into the river. Verma & Dattamunshi 1989 found that light intensity, photoperiod and rainfall influence primary productivity in flowing waters.

Jhingran and Pathak 1988 have shown that productivity potential of river Ganga was minimum at polluted site at Kanpur, it increased reaching maximum at Allahabad where water quality improved.

Sinha etal 1990 found low primary productivity during winter season. S.R. Mishra and D.N. Saksena 1992 worked on primary productivity in a sewage collecting channel of Morar (Kalpi) Gwalior.

The role of minor nutrients in limiting the productivity of aquatic systems was studied by C.R. Goldman 1972.

Vijay Valeeeha and G.P. Bhatnagar 1989 worked out primary productivity of Phytoplanktons in Eutrophic lower lake of Bhopal and found that primary productivity was quite high without any definete seasonal pattern. Light penetration curtailed due to self shading of planktons which resulted in reduction of productive zone Phytoplankton Productivity in few tropical ponds was studied by R. Bhaskaran, V.S. Namberajan and N. Alagu chamy

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1991. Arvind Kumar, H.P.Gupta and D.K.Singh 1996 studied impact of sewage pollution on primary productivity of two freshwater bodies of Santhal Pargana and observed that high rate of primary production indicates faster rate of Eutrophication.

The dissolved or suspended organic matter in water serves as a substrate for microbial growth. Microbial activities on aquatic organic matter and its effect on biological activities of phytoplankton have been revealed by studies of Basu 1965. Goldreich 1965 and Foster etal 1971 reported that Eutrophic water supported growth of different kinds of organisms. Vijayaraghavan 1971, Shardendu etal 1980, Bagde and Verma 1991 observed that higher temperature favoured the growth and multiplication of Coliform bacteria. Golterman 1976 suggested that increase in temperature may effect growth of organisms positively or negatively depending upon the species.

According to Rheimheimer 1978, high temperature exert a harmful effect upon the survival of some organisms especially those capable of producing disease. Morisette and Mavinic 1978 found that microorganisms need Oxygen to maintain their metabolic process. According to Gonzalves and Joshi 1965, Mannan 1979 there is an inverse relationship between coliform count and dissolved oxygen. Bagde and Verma 1991 studied interaction between coliform bacteria and physico chemical parameters. They observed direct correlation between coliform bacteria, pH and electrical conductivity.

R. Kapur, Archana Sharma and Sajjan Khan 1990 studied bacterial incidents of polluted water and their emerging antibiotic resistance.

Verma and Paul 1996 found that bacteria can survive more successfully under warm conditions. Paniker and Ravindran 1997 stated that Coliform and
other bacteria have ability to survive in various aquatic environment for considerably long period, they reported average survival of S. Typhii for 34 days. Mogal and Dube 1995 worked on heterotrophic bacterial population of waters of Dandi sea coast.

A.M. KH. Jarousha 2000 worked on polluting elements of Ramgarh lake of Jaipur and said higher values of Coliform, faecal Coliform total bacterial counts can be attributed to the run off water during monsoon which carry different kinds of organic matter.
Prevalance of Ipomoea species along with other Angiosperms (28 June 2000).
Spots cleared for collection of sample amidst thick coverage of hydrophytes & grasses.