CHAPTER – TWO

REVIEW OF LITERATURE

Limnology is the science of inland water with all factors that influenced living organisms within this water (Kumar, 2005). All the aspects on limnology made by Hutchinson (1957, 1967 and 1975) were included in his three volume treatise.

PHYSICO-CHEMICAL ANALYSIS OF WATER

Throughout the world several researchers have studied on limnological aspects of water in different wetlands. Sreenivasan (1964) had made a study on the hydrobiology of Bhavani Sagar Reservoir with the observation that the productivity of water body had been affected by the flushing of inflow and outflow of water. Hussainy (1967) studied on Lake Vihar in India and observed that the water temperature of the lake was high in turbid but low in transparent condition. Mathew (1975) studied the physico-chemical factors along with high rate of precipitation with an impact on the plankton in Govindagarh Lake of Madhya Pradesh. Gopal *et al.* (1981) reported that the absence of free CO_2 and the presence of significant phosphorous content in the fresh water Ramgarh reservoir of Jaipur due to the high degree of rainfall.

Sarwar and Wazir (1991) studied a fresh water pond of Srinagar and reported relatively low content of nitrate-nitrogen during the periods of luxuriant growth of macrophytes. Singh and Pandey (1991) worked on stagnant water bodies of North Bihar and reported that high water temperature range (24 -30˚ C) affect on the dissolved oxygen concentration and alkalinity in the water bodies.

Ashutosh *et al.* (1993) worked on physico-chemical characteristics of sewage and its impact on water quality of Alaknanda at Srinagar (Garhwal). Dave *et al.* (1999) analyse the abiotic factors of a lentic habitat (Kalika pond) at Dhar (MP). The study revealed that the abiotic factors like temperature, transparency, pH, DO, carbonates, bicarbonates, alkalinity, Ca, Cl, nitrate, phosphate and silicate showed marked

seasonal variation in the habitat. Hudson *et al.* (2000) reported that phosphate was an important nutrient that restricts microbial production in many freshwater and marine environments.

Johnson (2005) deals with the ionic composition such as Ca^{++}, Mg^{++}, Na^{+}, K^{+}, CO_3^{--}, HCO_3^{--}, Cl^{+} and SO_4^{--} of two fresh water lakes Banjara and Nadimi situated in Hyderabad, Andhra Pradesh. He observed dominance of Mg over Ca might be indicator of saline nature of water in both the reservoirs.

Narayan *et al.* (2007) worked on Taxi Temple pond in district Etawah, UP and analyse a total 18 nos. of water quality parameters along with their seasonal variations. They reported maximum CO_2 value (37.0 mg/l) during summer where as lowest concentration of CO_2 (5.5 mg/l) was recorded during monsoon season. The phosphate concentration was also found higher during summer and lower in winter season.

Bhuyan and Gupta (2007) worked on hydrobiological study in nine different ponds of rural area of Barak Valley, Assam. They found that the parameters like DO, Free CO_2, p^H, conductivity, alkalinity, nitrate, phosphate, Ca, Mg, Cu and Zn were within the permissible level of drinking water quality but iron content was found higher in most of the ponds which suggested an indirect relationships between iron concentration and Euglenoides including that these ponds could be a very good source of water for drinking, domestic use and fishery.

Shyamala *et al.* (2008) analyse the physico-chemical quality of ground water in Telungupalayam village in Coimbatore city, Tamil Nadu, India. It was observed that the p^H, Cl, TH, Ca and COD values were within the permissible limit. It is concluded that the ground water of Telungupalayam though it is fit for domestic and drinking purpose yet need treatment to minimise the contamination especially the alkalinity.

Lashari *et al.* (2009) worked on limnological studies on Keenjhar Lake of Pakistan. The seasonal variation in the physico-chemical parameters such as temperature p^H, alkalinity, Cl, conductivity, total dissolved solid, turbidity, DO, Ca and Mg was assessed and concluded that the variation existed in parameters due to rain and flow of river water.

Patra *et al.* (2010) investigated on seasonal limnological investigation related to physico-chemical characteristics of water of the Santragachi and Joypur Jheel, West Bengal, India. The higher nutrient content (nitrate, phosphate) in Santragachi Jheel and showed distinct seasonal variations of water parameters in both the Jheel might signify eutrophication which suggests the poor water quality of the Jheel.

Garg *et al.* (2010) studied the seasonal variation in water quality of Ramsagar reservoir, MP, India and found that the nutrients including silicates, sulphate, phosphate, nitrates and potassium are in insufficient quantities for the growth of aquatic organisms in the reservoir. It has been concluded that Ramsagar Reservoir is under the category of mesotrophic water body which is slightly inclined towards eutrophication.

Chandrasekhar and Rao (2010) studied the limnology of Pocharam lake of Hydarabad, Andhra Pradesh and found the values of carbonates and bi-carbonates maximum in summer and no specific pattern were noticed in case of Cl, TH, Ca and Mg during the study period of the lake.

Sharma and Capoor (2010) worked on water quality assessment with special reference to biotic and abiotic factors of the lake of Patna Bird Sanctuary, Bihar. They observed the water quality of the beel as highly alkaline (131 – 428 mg/l) and higher BOD level (18 – 44.07 mg/l). Maximum numbers of Rotifers and Cladocera were observed in the month of May and June. However, Copepods and Ostracods were found as the highest during the month of December. In conclusion, they indicated that the lake water was poor in quality and not suitable for drinking purposes.

Sharma *et al.* (2010) deals with Water Quality Status and zooplankton composition of Gundolav Lake at Kishangarh, Rajasthan. They observed high BOD (49.42 mg/l), COD (74.18 mg/l), chloride (282.75 mg/l), sulphate (277.20 mg/l), nitrate (4.32 mg/l), phosphate (12.27 mg/l) and low DO content (3.68 mg/l) which in turn signify nutrient enriched status of the lake, might be an indication of eutrophic condition of the lake. Presence of pollution-indicator species, viz. Protozoans (*Paramoecium caudatum, Xytricha ovalis, O. oblongatus, Holophyra simplex* and

Cyclidium glaucoma) Rotifers (*Brachionus calcyflorus, B. forficula, Keratella tropica* and *K. procurva*) and Copepods (*Neodiaptomus schmackari, Mesocyclops leuckarti* and *M. hyalinus*) indicates deterioration of of water quality of the lake.

Ehiagbonare and Ogunrinde (2010) worked on Physico-chemical analysis of fish pond water in Okada and its environs, Nigeria. Twenty-one different physico-chemical parameters were analyzed. The values of the parameters were found within the permissible limit. Heavy metals copper (0.01 -0.07 ppm) and zinc (0.01 - 0.07 ppm) were reported in very small quantities and cadmium and lead were not detected in the samples. This quality assurance process had been made to ensure that there are no toxic substances in ponds leading to possible bio-accumulation and magnification. In this way they guaranteed the good health of aquaculture, humans and the environment.

Bhat *et al.* (2010) carry on the limnological study of three freshwater springs of Pulwama District of Kashmir Valley. They investigated on the quality and hygienic conditions of spring water. The result showed that these springs were hard water type with slightly lower values to higher values of DO (1.6-12mg/L). The ionic composition of the spring waters revealed the predominance of bicarbonate and calcium over the other ions with usual ionic progression as $HCO3^{-} > Ca^{++} > Mg^{++} > Na^{+} > K^{+.}$ The water of all the three springs is used for multipurpose including drinking, irrigation, washing, bathing etc.

Venkatesharaju *et al.* (2010) studied seasonal and spatial variation in surface water quality of Cauvery River in Karnataka. They observed the seasonal and spatial variations in river water quality and cluster analyses had been applied for water quality data set, monitored in pre- and post- monsoon season. The variables were mainly divided into two categories viz., non-conservative like DO, BOD, COD, nitrates and phosphates and conservative parameters like TDS, conductivity, alkalinity, hardness, calcium, magnesium, sodium, potassium and sulphates. Trivial elevated values of all non conservative characteristics in pre-monsoon and some conservative parameters (SO_4, Cl) in post-monsoon period reflected contribution on temporal effect on surface water. Results of principal component analysis evinced that all the parameters equally

and significantly contribute to water quality variations in the river basin for both the seasons.

Manjare *et al.* (2010) studied on analysis of water quality using physico-chemical parameters Tamdalge tank in Kolhapur District, Maharashtra. They observed monthly changes in the studied physico-chemical parameters namely water temperature, transparency, turbidity, TDS, p^H, DO, Free CO_2, and Total Hardness, Chlorides, Alkalinity, Phosphate and Nitrates and found all the studied parameters within the permissible limits. The results indicate that the tank was non-polluted and can be used for domestic, irrigation and pisciculture.

Offem *et al.* (2011) studied the influence of seasons on water quality, abundance of fish and plankton species of Ikwori Lake, South-Eastern Nigeria. Here the results showed that the water parameters except dissolved oxygen, total dissolved solids, acidity, color and p^H showed significant seasonal variation. The highest values of the parameters occur during dry season (February and March) and lowest in wet season (May to August). The phytoplankton population were significantly more during the dry season than the wet. The seasonal variation in the richness and diversity indices of all species sampled revealed higher values for the dry season than the wet.

Thirupathaiah *et al.* (2012) observed the status of physico-chemical characteristics of Lower Manair Reservoir at Karimnagar District, Andhra Pradesh. They observed the monthly changes of the parameters and found all the parameters within the permissible level and could be used for domestic, irrigation and pisciculture.

Islam *et al.* (2012) carried out investigation on the hydro-chemistry of Kulsi River, a tributary of the Brahmaputra, NE India. They studied the temporal and spatial distribution of certain physico-chemical parameters of Kulsi River which harbour a small population of Gangetic dolphin. The water quality was found within the permissible limit for biological components and therefore, the river health can be said as satisfactory for freshwater biota including Gangetic dolphin. Slight seasonal variation in Dissolve oxygen values with a higher range is signifying the healthy water

environment for the aquatic biota. All these physicochemical properties of water exhibit the healthy status of the river.

Chandrsekhar *et al.* (2013) worked on physico-chemical analysis of water in Wyra Lake, Hyderabad, Andhra Pradesh. They observed that Wyra lake water is characterised as alkaline with a pH range of 7.0 – 8.7. They also observed the maximum values of carbonates, bi-carbonates, TH, Ca and Mg in summer season and the lowest values of Cl and DO in winter.

Mishra *et al.* (2013) assessed the physicochemical Characteristics of Bhamka pond, Hanumana, Rewa District, MP (India). The parameters like temperature, p^H, dissolved oxygen, nitrate, phosphate, biological oxygen demand, chemical oxygen demand, total alkalinity, were analyzed per month. They reported that the pond water was included under very hard category.

Khanna *et al*. (2013) worked on fish diversity and the limnological status of Ganga River system in foothills of Garhwal Himalaya, Uttarakhand, India. They reported a total of 53 species belonging to 11 families of fishes. The physico-chemical parameters such as temperature, velocity, turbidity, conductivity, total dissolved solids, p^H and alkalinity, free CO_2, DO, BOD, chlorides, calcium and magnesium were also analyzed. They concluded that fishes of various rivers of Ganga river system of Garhwal Himalaya totally depends upon the physico-chemical factors. Although all the parameters were found favourable for fish survival, however, certain parameters such as turbidity increases in monsoon season results in increased number of fish mortality.

Bera *et al.* (2014) examined the physico-chemical analysis of the water of Kangsabati reservoir, West Bengal, India. They observed values of physico-chemical parameters were in desirable, permissible, acceptable range – recommended by WHO, FAO, BIS, NRAC, SRAC, ICAR guideline. They also had done the statistical analyses by calculating correlation coefficients among several parameters. They found the strong positive correlation among air and water temperature; dissolved oxygen and transparency; hardness with Calcium, Magnesium and phosphate; salinity and

chloride; free CO_2 and conductivity. And highly negative correlation was found among water temperature with dissolved oxygen and phosphate; total inorganic nitrogen and PH; phosphate and transparency. And they concluded that all the physico-chemical parameters of Kangsabati Reservoir are within the acceptable limit, except conductivity value which was recorded to be low and the water was properly applicable for the purpose of irrigation, pisciculture and drinking.

Barman *et al.* (2015) deals with the seasonal variation of physico-chemical characteristics of wetlands in the West Garo Hill, Meghalaya, India. Eleven physico – chemical parameters of wetlands were recorded in different seasons to assess the quality status of water. The parameters were water temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solid (TSS), total dissolved solid (TDS), total hardness, nitrate (NO_3) and phosphate (PO_4). The water showed slightly alkalinity. DO was found normal as prescribed by WHO. COD and TSS were found beyond the permissible limit. The BOD was slightly higher than permissible limit indicates that though the water of wetlands was not polluted at present but it was going to be polluted. It may be due to addition of sewage or other agricultural residues. The current status of wetlands lies below the level of pollution.

Deshmukh (2015) worked on the Physico - chemical characteristic of Pravara River, tributaries of Godavari river of Maharashtra. The studied parameters like water temperature, p^H, Free CO_2, Dissolved Oxygen, BOD, TDS, Total Hardness, Chlorides, Phosphate, Sulphate, Nitrate, Calcium and Magnesium and found that p^H of water slightly alkaline in nature (6.49 - 7.87). The maximum concentration of TDS was recorded during summer, which decreases during rainy season. DO showed significant inverse relationship with temperature. The wide range CO_2 concentration, increased nitrate, phosphate and chloride concentration was due to increase in sewage contamination in river basin. The minimum nitrate was observed during summer, probably due to heavy growth of phytoplankton.

Hussain *et al*. (2015) studied on the limnological and Ichthyofaunal diversity of Dhir Beel at Dhubri, Assam .They recorded 71 numbers of species of fishes. The

studied limnological parameters did not show much abrupt fluctuation in the beel. Their experimental studies indicate that the wetland has a fairly high production potential.

Sharma *et al*. (2016) had done a case study on Baldi water stream of Garhwal Himalayas, India. They observed the relationship between physico-chemical parameters and phytoplankton assemblages of Baldi stream .They noted that increased concentration in physico-chemical parameters (turbidity, total dissolved solids, nitrates and phosphates) has an adverse impact on the density of phytoplankton during monsoon season where maximum disturbances were recorded. They had done correlation coefficient between physicochemical parameters and density of phytoplankton. Their correlation results concluded that as sediment load increases in the stream, the growth of phytoplankton decreases. They had also done the Canonical Correspondence Analysis (CCA) between environmental variables and dominant taxa of phytoplankton to indicate the influence of physico-chemical parameters on phytoplankton distribution in freshwater ecosystem of Baldi stream.

PHYTOPLANKTON DIVERSITY

Arhonditsis *et al.*(2004) investigated the patterns and mechanisms of phytoplankton variability in Lake Washington (USA). He found that phytoplankton dynamics in the lake were characterized by four seasonal modes, each of which was associated with different ecological processes.

Jena and Adhikary (2007) studied on Chlorococcales (Chlorophyceae) from different water bodies of eastern and north-eastern states of India. They recorded fifty-six taxa of chlorococcales belong to 21 genera, such as *Chlorococcum, Truebaria, Pediastrum, Hydrodictyon, Botrycoccus, Coenochloris, Radiococcus, Coenocystis, Oocystis, Glaucocystis, Chlorella, Kirchneria, Kirchnereilla, Ankistrodesmus, Coelastrum, Actinastrum, Tetrastrum, Crucigenia, Crucigeniella, Desmodesmus* and *Scenedesmus* and concluded that out of 56 species 16 species were reported first time from India and all of these species were recorded first time from eastern and north-eastern states of India.

Pradhan *et al*. (2008) worked on the phytoplankton diversity as indicator of water quality for fish cultivation of East Calcutta Wetland. They indicated that plankton growth could be an important factor responsible for greater fish production. They reported some useful plankton include *Chlorella, Crucigenia, Spirulina, Nitzchia, Scenedesmas, Cyclotella, Microcystis, Coelastrum, Melosira, Navicula, Anabaena, Chlamydomonas, Tetraedron, Euglena, Endorina, Ankistrodesmus, Cosmarium, Fragilaria, Pediastrum and Synderaw* which perform a major role in bioremediation.

Choudhury *et al.* (2009) studied on status of phytoplankton in chaurs of Begusarai of North Bihar. They observed Chlorophycean taxa like *Spirogyra, Oedogonim, Closterium, Chlorella and Cosmerium* observed as dominant genera throughout the study period. The maximum numbers of Cyanophyceae were in summer and minimum numbers were in winter season. The dominant species were *Anabaena* sp.; *Microcystis* sp. and *Oscillatoria* sp. Bacillariophyceae were found maximum in summer and minimum during winter season. The most dominant species were *Fragilaria* sp. and *Navicula* sp.

Laskar and Gupta (2009) observed the phytoplankton diversity and dynamics in different seasons and their correlations with physico-chemical properties of Chatla floodplain lake, Barak Valley, Assam. It was reported a total of 34 phytoplankton taxa belonging to Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae. Highest number of species was present in pre-monsoon (29) and lowest in winter (23). They had also done the correlation analysis between the phytoplankton groups and the physico-chemical parameters. From the correlation analysis the total phytoplankton density showed highly significant positive correlation with transparency ($p < 0.01$) and significant positive correlation with total suspended solids, total hardness and calcium ($p < 0.05$). Thus it was concluded that the growth of phytoplankton was governed by transparency, total suspended solids, calcium and total hardness.

Rout and Borah (2009) studied the algal diversity in Chatla wetland in Cachar district of Assam. They reported a total of 39 algal species belonging to 25 genera. Diatom showed maximum population with 23 species and 13 genera. Other groups of

algae viz. Chlorophyceae, Cyanophyceae, Euglenophyceae were observed. They also analysed some physical factors such as $p^{H,}$ DO, Alkalinity, Free $CO_{2,}$ Conductivity, light and water temperature. They noted that abundance of algae was more in higher p^{H}.

Gonulol *et al.* (2009) studied taxonomical and numerical comparison of epipelic algae from Balik and Uzun lagoon, Turkey. They recorded 106 species of phytoplankton out of which 85 were from Balik lagoon and 78 were from in Uzun lagoon and analysed the physico-chemical characteristics of water from the Lagoons. Cluster analysis had been applied to show the distributional pattern of epipelic algal flora of the two Lagoons of Turkey.

Sharma (2009) described the composition, abundance and ecology of phytoplankton communities of Loktak Lake (Ramsar site), Manipur, India. He documented seventy-five species of phytoplankton belonging to six groups from the lake and Chlorophyta was found the dominant group followed by Dinophyta > Bacillariophyta were sub-dominant groups and Euglenophyta > Cyanophyta > Chrysophyta showed very low densities group. Chlorophyta, the dominant quantitative group, showed winter peaks; *Closterium* > *Staurastrum* > *Gonatozygon* > *Micrasterias* species contribute significantly to their abundance.

Santiago *et al.* (2010) studied phytoplankton dynamics in a highly eutrophic estuary the port of Recife in North eastern Brazil. High level of eutrophication were found in the study area due to metropolitian degradation They reported a total of 129 species among which 53 were observed in the dry season and 97 were recorded in rainy season. They observed diatoms were the most diverse group and comprised 75.47% of the phytoplankton collected in the dry season and 60.82% of those collected in the rainy season. The dry season was characterized by *Coscinodiscus* sp. and *Helicotheca tamesis*; the rainy season by *Oscillatoria* sp. and *Coscinodiscus centralis* in the estuary.

Onuoha *et al.* (2010) investigated about the phytoplankton diversity of the Ologe lagoon, Lagos South western Nigeria. They recorded the five algal groups such

as Bacillariophyta, Cyanophyta, Euglenophyta, Pyrrhophyta and Chlorophyta. 119 species were observed belonging to 49 genera in which diatoms formed the most abundant group with 48 species from 18 genera. This was followed by green algae, with thirty-two species from fourteen genera, Cyanobacteria, with twenty-three species from eleven genera, Euglenoids with seventeen species from five genera, while the Dinoflagelates had only one species and recorded a higher number of species in the dry season than in the wet season. They reported 9 phytoplankton species were to be potentially toxic bloom species and 57species were bio-indicator during the period of study. They recorded 10 new species and stated to be the first reports for Lagos lagoon complex, south-western Nigeria.

Sharma (2010) studied phytoplankton diversity of Utra and Waithou pats, two floodplain lakes of Manipur, north-eastern India and revealed 62 and 61 species respectively. It had been shown Chlorophyta as the dominant quantitative component followed Bacillariophyta formed sub-dominant group, and Dinophyta > Euglenophyta > Chrysophyta showed very low densities in both the pats. They analysed fifteen abiotic factors which exert higher cumulative influence (R12= 0.822, R22 = 0.805) on the diatom densities in the two pats. Phytoplankton richness and abundance showed significant monthly variations and insignificant temporal variations between two lakes. He noted that phytoplankton communities of both the pats were characterized by higher species diversity, higher evenness and lower dominance.

Rajagopal *et al.* (2010) worked on diversity of phytoplankton in relation to physico-chemical parameters with respect to pollution status of two perennial ponds in Sattur area, Tamil Nadu. They identified fifty species, belonging to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. They recorded high value of physico-chemical parameters and low phytoplankton diversity in the Chinnapperkovil pond and low value of physico-chemical parameters and high phytoplankton diversity were recorded in the Nallanchettipatti pond. They found class Chlorophyceae qualitatively and quantitatively dominated in both the ponds. They reported the abundance of certain species such as *Closterium acerosum, C. dianae, C. lineatum, Anabaena aequalis, Oscillatoria angusta* and *Navicula membranacea* in the

Chinnapperkovil pond and species *Merismopedia glauca* and in Nallanchettipatti ponds were considered as pollution indicators. They concluded that the diversity of phytoplankton species and physico-chemical parameter profiles indicate the Chinnapperkovil pond to be meso-eutrophic whereas the Nallanchettipatti pond was oligo-eutrophic.

Kumar and Oommen (2011) investigated on phytoplankton composition in relation to hydro-chemical properties of tropical community wetland, Kanewal, Gujarat, India. In the result a total of 45 species were identified belonging to Cyanophyceae, Chlorophyceae and Bacillariophyceae. From the correlation coefficient analysis they found both sulphate and nitrate that showed a positive correlation with phosphate; dissolved oxygen showed a negative correlation with phosphate, sulphate and nitrate. The species of Bacillariophyceae was recorded to be the most abundant group compared to others which indicated relatively unpolluted nature of the wetland.

Mahadev *et al.* (2011) investigated on Species richness and diversity of Chlorophyceae and Bacillariophyceae in Cauvery River, Mysore, India. They reported 21 species from both the group of Chlorophyceae and Bacillariophyceae respectively.

They observed the decreased diversity of Chlorophyceae and Bacillariophyceae due to receiving urban waste and agricultural effluents and noted that higher p^H, Turbidity, COD, chloride, Iron and heavy metals favours growth of Chlorophyceae and Bacillariophyceae.

Pareek *et al*. (2011) studied some fresh water diatoms of Galta kund, Jaipur, India. They identified 24 species of diatoms that belong to eleven genera such as *Cyclotella* (2), *Melosira* (2), *Navicula* (4), *Achnanthes* (2), *Amphora* (1), *Synedra* (2), *Nitzschia* (5), *Gomphonema* (3), *Hantzschia* (1), *Pinnularia* (1) and *Fragillaria* (1) and suggested that the diatoms attains maximum growth during the winter and gradually declines in summer to reach its minimum during the rainy season.

Yasmin *et al.* (2011) studied the planktonic desmid flora of South of the Eastern Himalayas and recorded a total 38 taxa of desmids including the genera

Closterium (8), *Cosmarium* (10), *Euastrum* (5), *Micrasterias* (5), *Netrium* (1), *Tortitaenia* (2), *Gonatozygon* (2), *Pleurotaenium* (5), and *Staurastrum* (5) which were the new records from the South of the Eastern Himalayas. They concluded that the more abundance of *Closterium* and *Cosmarium* indicating the oligotrophic nature of the water bodies.

Shukla and Shukla (2013) worked on phytoplankton productivity of Marhani Lake, Basti (UP) in relation to physico-chemical parameters and observed the increase of certain parameters such as total alkalinity, BOD, Free CO_2, COD and PO_4 in the lake due to inflow of domestic sewage and detergents used by washer men. The increases of these parameters become responsible for the algal bloom.

Wang *et al.* (2013) dealt with on phytoplankton community structure and assessed the Eutrophication degree of Baiyangdian Lake in China and identified the total 133 species including Cyanophyta, Chlorophyta, and Bacillariophyta dominated the phytoplankton community. They reported that Chlorophyta and Bacillariophyta were the dominant phyla, and the dominant species included *Chlorella* sp., *Chroomonas acuta* and *Microcystis incerta* in spring season. In summer Chlorophyta and Cyanophyta became the dominant phyla and the dominant species were *Chlorella* sp., *Leptolyngbya valderiana* and *Nephrocytium agardhianum*.

Sayeswara (2014) studied the diversity of phytoplankton species diversity in Chikkamalappanakere Tank, Shivamogga, Karnataka, India as recorded 45 species of phytoplankton representing five taxonomic groups such Chlorophyceae, Cyanophyceae, Euglenophyceae, Bacillariophyceae and Desmids. They calculated the relative abundance of phytoplankton in Chikkamalappanakere tank showed maximum of Cyanophyceae (31.1%), followed by Bacillariophyceae (24.4%), Chlorophyceae (20%), Euglenophyceae (13.3%) and *Desmids* (11.1%). Presence of *Scenedesmus quadricauda* and *Merismopedia glauca* was the common pollution indicators which were found in the Tank water.

Water Quality and Phytoplankton Community was studied by Bhat *et al.,* (2015) in Bhoj wetland, a Ramsarsite, Bhopal, India and revealed that Chlorophyceae constituted dominant group followed by Bacillariophyceae, Cyanophyceae, Euglenophyceae and the lowest abundant groups were Pyrophyceae and Chrysophyceae and suggested that the higher abundance of (*Closterium, Pediastrum, Scenedesmus, Navicula, Anabaena, Microcystis* and *Phacus*) and nutrient concentration (nitrate-nitrogen and phosphorus) during the dry and wet periods reflect higher organic pollution in the Bhoj wetland.

The phytoplankton abundance and species diversity in Ranjit Sagar wetland, Punjab was studied by Brraich and Saini (2015) and revealed that Bacillariophyceae constituted (12 genera) the dominant group, whereas Chlorophyceae (11 genera) and Cyanophyceae (3 genera) formed sub dominant groups besides the phytoplankton and observed that Cyanophyceae appeared with least number of species throughout the year, but they show their maximum abundance during monsoon and summer seasons. They concluded that low temperature and reduced photoperiod during winter season may be responsible for their minimum appearance in this period.

Brraich and Kaur (2015) studied on phytoplankton community structure and species diversity of Nangal wetland, Punjab, India and reported 49 genera belonging to three major classes i.e., dominated by Chlorophyceae (21 genera) followed by Bacillariophyceae (19 genera) and Cyanophyceae (13 genera). Their observation for the highest numerical abundance in summer and lowest during winter season forwarded for large population of phytoplankton was present in the Nangal wetland which enhances the wetland's productivity.

Murulidhar and Murthy (2015) studied the seasonal dynamics of phytoplankton and physico-chemical parameters of Gulur weland, Karnataka, India and reported 66 species of phytoplankton under 37 genera belonging to 5 different classes. The phytoplankton classes showed the following order of dominance: Diatoms (41.67%) > Blue-greens (27.78%) > Chloroccales (13.89 %) > Euglenoids and

Desmids (8.33%). The physico-chemical parameters showed the significant positive correlation with the groups of phytoplankton.

Devi *et al.* (2016) had done an ecological study on Phytoplankton community of Lake Baskandi anua, Cachar district of Assam. They estimated the Chlorophyll content and biomass of phytoplankton along with the physico-chemical conditions of the lake water. They reported that of 41genera of phytoplankton, belonging to 5 groups were such as Chlorophyceae, Cyanobacteria, Bacillariophyceae, Euglenophyceae and Dinophyceae. The group Chlorophyceae was found to be highest in winter, Cyanobacteria and Euglena in monsoon and Bacillariophyceae in pre monsoon season. Their ANOVA analysis revealed the significant seasonal variation in physico-chemical parameters of water like Water temperature, p^H, Conductivity, Dissolved oxygen, Free CO_2, Total alkalinity, Calcium, Chloride, Nitrate and Ammonia. They also used the CCA (Canonical Correspondence Analysis) method to explore the relationship between phytoplankton group and environmental variables. They also reported that the lake was covered with *Hydrilla* and other macrophytes like *Eichhornia*, *Trapa*, *Altrnenthera*, *Polygonum*, *Ludwizia* sp. etc. They observed the lake Baskandi anua as eutrophic.

Mercurio *et al*. (2016) worked on phytoplankton communities between the aquaculture and non-aquaculture sites of Taal Lake in Batangas, Philippines. They reported 39 phytoplankton genera under division Chlorophyta, Cyanophyta, Chrysophyta and Pyrrophyta out of which 36 genera were observed from the aquaculture sites and only 30 genera from the non-aquaculture sites. They noted that the availability of phytoplankton was significantly higher in the aquaculture than the non-aquaculture sites and observed the highest density of phytoplankton in the summer months and lowest in the winter months due to sulphur upwelling. They also reported that most dominant phytoplankton was *Microcystis* followed by *Merismopedia* in aquaculture sites and *Oscillatoria* in non-aquaculture sites under the group of Cyanophyta which indicating the organic pollution and eutrophication of Taal Lake.

ZOOPLANKTON DIVERSITY

Sharma *et al.* (2000) studied on the composition of zooplankton in a tropical Floodplain lake of Assam, North East India and concluded that 53 species of zooplankton belonging to Rotifera, Cladocera, Rhizopoda and Copepoda. They also recorded Rotifera as the most dominant group followed by Cladocera, Rhizopoda and Copepoda respectively.

Sharma (2000) studied on Rotifers from some tropical flood-plain lakes of Assam, N.E. India. He observed 64 species of Rotifers belonging to 15 families and 26 genera from five flood-plain lakes of the Brahmaputra river basin, Upper Assam. He reported that the rotifer communities of the different lakes registered 37.3 - 68.9% similarities and their individual species richness ranged between 24 - 35 species.

Chandrasekhar and Chatterjee (2003) worked on Cladocera from Dimna and Jublee Park lakes, Jamshedpur, Jharkhand, India. They reported 9 Cladoceran species belonging to 5 genera and 3 families. The species *Ceriodaphnia cornuta, Simocephalus exspinosus, Chydorus hermanii* and *Alona rectangula* were found both of the lakes. *Moinodaphnia macleayi, Chydorus sphaericus* and *C. parvus* were observed only from Dimna Lake. They concluded that the presence of *Chydorus sphaericus* and *Simocephalus* sp. and *Ceriodaphnia* sp indicate that the water body of both the lakes were oligotrophic and eutrophication in nature.

Turner (2004) investigated the importance of small planktonic Copepods and their roles in Pelagic Marine food webs and found that small copepods exhibit various reproductive and feeding strategies which help to maximize population size, in order to counter heavy losses due to predation and concluded that small copepods are abundant and have important links in marine food webs.

Sivakumar and Altaff (2004) studied the ecological indices of freshwater copepods and Cladocerans from Dharmapuri district, Tamil Nadu. They reported four Copepods and seven Cladoceran species from the zooplankton group from fifty freshwater bodies, in and around the Dharmapuri District.

Mukhopadhyay *et al.* (2007) worked on the variations in zooplankton diversity in East Calcutta wetlands, a Ramsar site of Kolkata city, India with heavily contaminated by industrial and municipal wastewaters. They recorded 22 species of zooplankton that consist 3 species of Cladocera, 2 species of Copepoda, 15 species of Rotifera, and 2 species of Ostracoda.

Ganesan and Khan (2008) were studied the physico-chemical conditions and the abundance of zooplankton species in a flood plain wetland of West Bengal, India. The study reveals that the lake water was alkaline in nature with the p^H varying from 7.5 – 8.4. The water was moderately hard and the nutrients were present only in trace amounts. 70 species of zooplankton belonging to Rotifera, Cladocera, Copepoda and Ostracoda were recorded. Rotifers were found to dominate the zooplankton community in terms of species richness.

Ahmad *et al.* (2011) studied the zooplankton diversity in relation to physico-chemical factors of a sewage fed pond of Aligarh (UP), India. In the observation they found high values of nutrients such as phosphate (0.435 mg/l to 1.02 mg/l); Nitrate (0.106 mg/l to 0.198 mg/l) and high range of p^H (8.3 to 9.1). They reported 20 zooplankton species belonging to 4 groups (Cladocera - 4 species, Copepoda - 3 species, Rotifera - 11 species and Ostracoda - 2 species). The water body of this investigation was receiving domestic discharge leading to large amount of phosphate and nitrate in the water body indicates that water was eutrophic in nature and presence of zooplankton species like *Asplanchna, Brachionus, Keratella, Fillinia, Cyclops* and *Diaptomus* were the indicator of organic pollution.

Joshi (2011) studied on zooplanktons of Dhanora (Hattipaul) Lake of Buldhana district, Maharashtra and recorded four major groups of zooplankton (Rotifera, Cladocera, Copepod and Ostracoda) with 22 genera .It has been suggested least density of Zooplankton in monsoon season and it may be due to the dilution effect, high turbidity and less photosynthetic activity by the primary producers. Rotifera's maximum density was observed in winter season and Ostracoda did not show any seasonal remarkable fluctuations.

Ghantaloo *et al*. (2011) evaluated the zooplankton diversity of Nira left bank canal Shardanagar Tal Baramati District of Pune with reference to physico- chemical parameters. They also analysed the physico-chemical parameters such as atmospheric temperature, water temperature, p^H and dissolved oxygen and minimum Dissolved oxygen was recorded during summer and maximum during monsoon. 25 species had been reported of which Rotifer 10 species, Cladocera 8 species, Copepoda 5 species and Ostracoda 2 species.

Sharma (2011) reported 171 and 160 species of zooplankton in two different sites of the Deepor Beel (a Ramsar site) of Assam. He observed that Rotifera and Cladocera were dominated by Copepoda and Rhizopoda and Ostracoda and Conchostraca were found in very low densities in the beel. From the analysis of physico-chemical parameters he observed that richness and abundance were inversely correlated with water temperature and rainfall, and positively with specific conductivity and dissolved oxygen of the beel. He also noted the winter peak of the zooplankton species in the Deepor Beel.

Koli and Muley (2012) studied on zooplankton diversity and seasonal variation with special reference to physico-chemical parameters of Tulshi reservoir of Kolhapur district (MS) India and records 39 species of zooplanktons out of which 15 species of Rotifer, 12 species of Copepod, 10 species of Cladocera and 2 species of Ostracoda and seasonal variations of zooplanktons were noted in the reservoir. They analysed that zooplankton population showed positive significant co-relation with physico-chemical parameters like temperature, alkalinity, phosphate, hardness and BOD whereas negatively correlated with rainfall and salinity. They concluded that the physico-chemical parameters of Tulshi reservoir were suitable for the growth of aquatic biota and for pisciculture practices.

Raina *et al*. (2013) had done the limnological investigation with special reference to zooplankton diversity on Samrat Ashok Sagar reservoir of Madhya Pradesh. They reported 105 zooplankton species including the group Rotifera 43 species (41%), Cladocera 25 species (24%), Protozoa 20 species (19%), Copepoda 12 species (11%) and Ostracoda 5 species (5%) and Rotifera found to be the most

dominant group and recorded maximum zooplankton population was noted during summer season at the macrophytic sites. From their investigation on physico-chemical characteristics it could be revealed the alkaline nature of the reservoir.

Manickam *et al.* (2014) recorded a total of 55 species of zooplankton from Perennial Reservoir at Thoppaiyar, Dharmapuri district, South India, which includes 19 species of Rotifera, 13 species of Cladocera, 15 species of Copepoda and 8 species of Ostracoda. The population abundance of zooplankton was in the following order: Rotifera > Copepoda > Cladocera > Ostracoda.

Sharma and Sharma (2014) investigated the planktonic rotifers of floodplain lakes of Northeast India including 30 floodplain lakes of Assam and 15 floodplain lakes of Manipur. They found 238 species belonging to 50 genera and 23 families. They recorded highest richness of zooplankton diversity in Assam (>50.0% of the Indian species) amongst all states of India.

Kulkarni and Mukadam (2015) reported that zooplankton species like *Acrocalanus* species, *Eucalanus pileatus, Lucicatia flavicornis, Mesocyclops* species and *Pontellina plumata were* dominated in the estuarine region of Ratnagiri, Maharashtra.

Kar and Kar (2016) investigated the zooplankton diversity of Madhura anua, oxbow lake in Cachar, district Assam and they found a good diversity of zooplankton in the lake. Three major groups of zooplankton were reported namely, Cladocera, Copepoda and Rotifera. A total of 37 taxa were reported out of which 20 were from Rotifera followed by Cladocera with 13 taxa and copepod with 4 taxa. The quantitative analysis of zooplankton in the wetland shows higher abundance percentage of 58% by Rotifera. The higher presence of Rotifera is an indication of its pollution leading to eutrophication in near future.

Akter *et al.* (2016) worked on influence of physico-chemical factors on the zooplankton population of Bostami pond of Chittagong city. They observed 19 species of zooplankton where 16 Rotifera were the dominant followed by two Copepods and one Cladoceran. They concluded that abundance of phytoplankton and zooplankton

indicated that the nutrient quality of the pond water was good. Plankton abundance and physico-chemical characteristics of the Bostami pond indicate that the pond was eutrophic in nature.

Abujam *et al.* (2011) had studied the plankton diversity of an oxbow lake in Dibrugarh district of Assam. They reported 31 species of phytoplankton and 61 species of zooplankton among these; Chlorophyceae was the most dominant class in phytoplankton (54.84%) followed by Cyanophyceae (25.81%) and Bacillariophyceae (19.35%) while zooplankton Rotifera constituted (75.41%) followed by Copepoda (11.48%) and Cladocera (13.11%). Their observation suggested for seasonal abundance of plankton communities in relation to certain physico-chemical parameters of the lake.

Roy (2013) examined the plankton diversity of a Managed fish farm pond and an unmanaged village pond in Arang district of Chhattisgarh, South Central India. He reported seven classes of phytoplankton including 21 species and three classes of zooplankton including 19 species and drew a inverse relationship between phytoplankton and zooplankton abundance.

Jagadeeshappa and Kumara (2013) studied the influence of physico-chemical parameters on the diversity of plankton species in wetlands of Tiptur taluk, Tumkur District, Karnataka, India. They studied the water quality parameters like temperature, p^H, EC, DO, BOD, COD, free carbon dioxide, total alkalinity, total hardness, calcium and magnesium hardness, chloride, phosphate, sulphate and nitrate and the plankton composition of the wetland. The increased concentration in physico-chemical parameters and plankton diversity was more in pre monsoon compared to post monsoon and monsoon season indicating the fluctuation in the physico-chemical parameters of the water perhaps due to entry of rain water and change in the temperature and salinity as season changes.

Sarma *et al.* (2013) made an ecological investigation of two riverine wetlands namely Urpod beel and Hasila beel of Goalpara district. They analyzed the physico-chemical parameters, plankton diversity of the beels and observed that both the beels

were dominated by Chlorophyceae. They recorded that phytoplankton community of Urpod beel constituted 58.82% to 65.52%, while zooplankton community constituted 34.48% to 41.18% of the total plankton.

Bhanja (2014) studied on of plankton community in two unmanaged ponds of West Bengal, India and 14 taxa of zooplankton viz. Copepoda 5, Cladocera 3 and Ostracoda 1 and 15 taxa of phytoplankton - Chlorophyceae 6, Cyanophyceae 5, Bacillariophyceae 3 and Euglenophyceae 1 were recorded. He concluded that the presence of rotifers like *Keratella* and *Brachionus* was the indicative of eutrophic status of the pond.

Pradhan *et al*. (2014) worked on the status of the largest Eastern belt River Mahanadi in Cuttack with the help of planktons. It is analysed that the water quality parameters like p^H, Dissolved oxygen, Carbon dioxide, Total Hardness, Phosphate and Orthophosphate are the major attributing factors. They recorded Rotifera as a dominant group from zooplanktons and Bacillariophyta from phytoplankton.

Pavan *et al.* (2016) studied on zooplankton diversity of Lake Bhandam, Warangal, TS and India and reported 4 major groups of zooplankton belonging 12 species of Rotifers, 6 species of Copepods, 7 species of Cladoceran and 4 species of Ostracodes. The dominant species like *Brachinous* sp, *Keratella tropica*, *Mesocyclops leuckarti* indicated clearly that the lake waters were nutrient enriched and hence eutrophicated.

Macrophytic Diversity

Pompeo and Moschini-Carlos (1996) studied the seasonal variation and density of the macrophyte in the Lagoa do Inferngo, a lake of Brazil.

Mcfarland and Rogers (1998) worked on the aquatic macrophytes in lake Onalaska, Wisconsin. They recorded 15 aquatic plant species among which 10 species were submersed aquatic (*V. americana, N. flexilis, H. dubia, P. foliosus, P .crispus, M. spicatum, P. richardsonii, C. demersum, Chara* sp. and *Nitella* sp.) and 3 were

emergent aquatic (*Sagittaria latifolia*, *Lindernia dubia* and *Sparganium eurycarpum*) and 2 were free-floating aquatic plants (*Lemna minor* and *Spirodela polyrhiza*).

Khan (2002a) carried out investigation on diversity of freshwater macro-invertebrate communities associated with macrophytes in some lakes and ponds of southern West Bengal and reported 49 macro-invertebrate fauna and 17 macrophytic species in the lakes. The result indicated that the lower species diversity of macrophytes in the pond was mainly due to dense growth of the water hyacinth, *Eichhornea sp.,* which covered the pond and not allowed the other macrophytes to grow and the water hyacinths are the indicator of eutrophicated waters.

Rolon and Maltchik (2006) studied the variation of macrophyte richness and composition, altitude, water conductivity, nitrate and total phosphorus concentrations in wetlands in southern Brazil. They recorded 153 species of macrophytes in the wetlands and the mean number of macrophyte species per site was 8.7 (range 1–23). CCA analysis suggested that two first axis explained only 4.4% of the variation in the aquatic macrophytes distribution.

Ali *et al*. (2007) dealt with the importance of submerged aquatic macrophyte for invertebrate diversity and their relation to water properties in large subtropical reservoir, Lake Nasser. They measured the water quality parameters such as temperature, p^H, dissolved oxygen, total dissolved solids, electrical conductivity, turbidity, total suspended solids, carbonate, bicarbonate, nitrate, nitrite, phosphate, sulphate, silica, potassium, total hardness, calcium and magnesium. After the examination they recorded five macrophyte species like *Myriopyllum spicatum, Najas horrida, Potamogeton schweinfurthii, Potamogeton pectinatus* and *Vallisneria spiralis* and sixty seven invertebrate species. They concluded that the TSS, TH and NO_2 were the most important water parameters on the distribution of the aquatic macrophytes and their invertebrate communities. P, NO_3, K, Na, Mg, Cl and DO were the most influential water parameters for the distribution of invertebrate groups. They noted that water temperature, electric conductivity, p^H, NO_2, SO_4, SiO_3, CO_3 and turbidity had a lesser influence on the invertebrates.

Padial *et al.* (2008) studied the aquatic macrophytes in Neotropics, Brazil and dealt with the influences of aquatic macrophytes on organisms and abiotic features of the water body.

Harkal *et al.* (2011) studied on micro-invertebrates associated with littoral macrophytes in Kagzipura Lake of Aurangabad, India. Report of 28 species of micro-invertebrates belonging to five groups were represented by species of Protozoa, Rotifera, Copepoda, Cladocera and Ostracoda along with sponges, bryozoa; nematodes and insect larvae were also recorded. The colonies of Protozoa like *Stentor, Verticella* were on edges of dissected leaves of macrophytes while the colonies of rotifera on branching region of the macrophytes and they had drawn an inference that study will be helpful to understand the real picture of community structure of limnetic ecosystem.

Bordoloi (2014) made a comparative study of aquatic macrophytes and its primary productivity in the closed and open type wetlands of upper reaches of the Brahmaputra river basin**.** In the closed wetland the dominant macrophytes were *Eichhornia crassipes* and *Monochoria vaginalis* followed by *Chara*. Aquatic plants such as *Alternanthera sessilis, A. phylloxeroides* and *Paspalum scorbiculatum* were absent in the wetland. In the Open wetland the species like *Trapa natans var. bispinosa* was absent and there were different types of marginal amphibious plants such as *Ipomoea crassicaulis, Ipomoea aquatic*. *Alternanthera sessilis*, *Alternanthera philox, Ipomoea carnea, Alternanthera phyllxeroides* and *Paspalum scorbiculatum* were present. Dominant macrophytes were *Eichhornia crassipes, Monochoria vaginalis* followed by *Chara* and *Ipomoea fistulosa*.

Dar *et al*. (2014) in their study dealt with the factors affecting the distribution patterns of aquatic macrophytes and concluded that sediment compositions markedly affect the growth rates and distribution of aquatic macrophytes. They examined both biotic and abiotic factors that influence the structural attributes like species composition, distribution, abundance and diversity of macrophytes. Water quality changes and nutrient enrichment can cause considerable variations in the species

richness, composition, and density of aquatic vegetation. The availability of light and temperature appears to be the most important factors in determining the macrophyte distribution there by influencing the productivity as well as species composition of submerged macrophytes.

Dutta *et al.* (2014) worked on the diversity of aquatic macrophytes of Kapla wetland of Barpeta district, Assam, India and found reported 68 plant species belonging to 49 genera and 28 families. Here the dominant family was Cyperaceae with12 species. Different diversity indices like Shannon-Weaver diversity index, Simpson diversity index, Menhinick diversity index and Concentration of dominance were calculated to show the plant communities structure of the wetland. Maximum values of Shannon- Weaver diversity index, Simpson diversity index and Menhinick diversity index were found during the summer season as it is active growth period of macrophytes whereas maximum concentration of dominance during the summer season reflects the dominance of few species due to high diversity of the macrophytes.

Deka and Sarma (2014) worked on aquatic macrophytes of the four wetlands viz. Batua kamakhya beel, Borbilla beel, Borali beel and Ghoga beel of Nalbari district of Assam, India. All the four wetlands are perennial in nature and cover a total area of more than 200 hectares. They reported 137 macrophytic species belonging to 114 genera and 53 families. Poaceae was the most dominant families with 15 species followed by Asteraceae (13 species), Cyperaceae (11 species), Nympheaceae (7species), and Araceae (6 species).Twenty eight families were represented by one species each. They observed that the wetlands were gradually degrading due to various natural and manmade activities like recurring flood that causes heavy siltation, construction of dykes, development of commercial fisheries which resulted the excessive growth of invasive aquatic weeds mainly *Eichhornia crassipes* , *Leersia hexandra* , and *Hymenachne acutigluma* which are suppressing the growth of other associated species.

Sarma and Deka (2014) conducted the quantitative analysis of macrophytes and water parameters of Batua kamakhya beel and Ghoga beel of Nalbari district of

Assam, India and recorded 82 species of macrophytes from both the beels. Though the number of free floating rooted with floating leaved and submerged species were almost same in both the wetlands, the numbers of emergent species vary in both the wetlands i.e. 57 and 41 in summer followed by 20 and 9 in winter in Batua kamakhya beel and Ghoga beel respectively. Based on Importance Value Index (IVI), *Eichhornia crassipes, Hygroryza aristata, Hydrilla verticillata* and *Hymenachne acutigluma* were dominant species in both the wetlands in summer, whereas *Eichhornia crassipes, Ceratophyllum demersum* and *Kyllinga monocephella, Lemna minor* were dominant in winter in both the wetlands. Diversity indices were found to be the highest in Batua kamakhya beel in both summer and winter season. Water quality of both the wetlands shows differences in their qualities and accordingly in the species composition of the two wetlands.

Ahmad *et al.* (2015) investigated the diversity of aquatic macrophytes of Aligarh, U.P. India and concluded that the diversity of aquatic macrophytes had grouped into three categories like Submerged - plants that grow completely below the water surface; Emergent - are rooted in the sediments and protrude up at the water surface; Floating - can be rooted to the bottom but have leaves floating on the water surface or free floating. They recorded 13 species of macrophytes. The ANOVA analysis indicated significant difference in density of Submerged macrophytes between ponds ($F=13.44$; $P<0.05$) and insignificant between months ($F=1.98$; $P>0.05$).

Choi *et al*. (2015) investigated zooplankton density and diversity, macrophyte characteristics (dry weight and species number), and environmental parameters in 40 shallow wetlands in South Korea. They used self-organizing map (SOM), to analyse the data (SOM), which extracts information through competitive and adaptive properties. It was found that zooplankton assemblages were positively related to macrophyte characteristics (i.e., dry weight and species number) particularly epiphytic species (i.e., epiphytic Rotifers and Cladocerans) exhibited a clear relationship with macrophyte characteristics.

Deka and Sarma (2015) made an ecological study of macrophytes of Borali beel and Borbilla beel of Nalbari district of Assam, India. They reported 92 macrophytic species belonging to 77 genera and 34 families from these two wetlands. Monocotyledons were represented by 43 species under 37 genera and 15 families while dicotyledons were represented by 49 species under 40 genera and 19 families. Maximum values of species richness, diversity and dominance index, and evenness of the macrophytic communities were noted at Borbilla beel during the summer season and similarity index was also found maximum during the summer season between the two wetlands and reasonably argued that the two wetlands had the similarities in their plant species composition.