2. REVIEW OF LITERATURE

2.1. ABIOTIC COMPONENTS

2.1.1. Hydrochemical Properties

2.1.1.1. International Status

Jeppesen et al., (2011) evaluated the climate change effects on nitrogen loading from cultivated landscape as well as on N transport in streams and the eutrophication of European Wetlands. Li et al., (2010) evaluated the chemical characteristics of drinking groundwater and its distribution patterns in Pengyang Country and discovered the hydrochemical evolution laws of groundwater. Lee et al., (2010) studied the cumulative effects of human development on freshwater wetlands and adopt several new approaches to quantify wetland hydrologic characteristics of 10 isolated freshwater marsh and cypress wetlands in the mantled karst landscape of Central Florida.

Yufeng et al., (2010) carried out an ecological survey to determine the water body concentrations of nutrients and its factors in Xixi National Wetland Park, China to the intensities of human activities; water body was classified into natural ponds, ornamental ponds, natural creeks and sight-seeing creeks. The comparative lake studies of 19 prairie saline wetlands in the Northern Great Plains (USA) with seasonal changes in freshwater phytoplankton communities and limnological parameters were investigated by Salm et al., (2009).

Muvanga and Barifaijo (2006) studied Uganda wetlands to assess the impacts of industrial activities on the hydrochemical characteristics. Slawomir (2010) investigated the factors affect the load of water ecosystems with mineral nitrogen compounds (N-NH$_4$ and N-NO$_3$) conducted in the Olsztyn Lake District. Scientific problems to be solved in order to increase the understanding and the protection of ponds, to highlight those aspects of pond ecology that are relevant to freshwater science, and to bring out research areas (Cereghino et al., 2008). Torres et.al., (2007) estimated the essential nutrients (carbon, nitrogen and phosphorus) retention capacity and total suspended solids in an urban traffic Pampulha reservoir in Brazil. Data from more than 70 restoration projects conducted...
mainly in shallow eutrophic wetlands in Denmark and the Netherlands focused on the removal of zooplanktivorous and benthivorous fish by Martin et al., (2007).

The comparative study conducted in various created and natural wetlands in Pennsylvania, USA to suggest that created wetlands do not look, or function, like the natural systems they are intended to replace (Deborah et al., 2002). Kim et al., (2001) surveyed thirteen of the major reservoirs for the general assessment of the eutrophication patterns, including nutrient runoff from agriculture, animal farms, fish aquaculture, and urban areas, of South Korean reservoirs.

2.1.1.2. Indian Status

Jagadeeshappa et al., (2011) evaluated the significant variations of the physical chemical parameters and monthly comparisons were made as monsoons, pre-monsoon and post-monsoon of Sugar and Bajagur wetlands, located at Tiptur Taluk, in Tumkur district, Karnataka. The water quality indicator of the Dalvoy Lake of Mysore that deteriorates due to the anthropogenic activities was assessed by Mahesha and Balasubramanian, (2010). Sanjay et al., (2010) evaluated the temporal changes in water quality parameters for analyzing the variations with time in different zones of the study area of Alandi, Dehu and Chikali near Pune city of Maharashtra state of India. Patra et al., (2010) studied the 16 physical chemical parameters of water the Santragachi and Joypur Jheel, West Bengal, India. Ilika, (2009) presented a background on the ecological, cultural, socio-economic, impact of human activities on the ecological and cultural aspects of Lonar. Drastic water quality improvement in Upper Lake at Sheetal das kibagia after shifting of idol immersion site was noticed by Vyas et al.,(2008). Mustafa et al.,(2007) compared both benthic macro-invertebrates and physicochemical parameters for evaluating water quality of the stream Cekerek (Tokat, Turkey).

Tiwari et al., (2004) studied the Shahpura Lake compared to acceptable limits of very high phosphate content to examine the trophic status of the lake. Pani and Misra (2000) examined the hypolimnion zone and impact of hydraulic detention on the water quality characteristics of a tropical wetland (Lower Lake) of Bhopal.
2.1.1.3 Regional status

Nirmal Kumar et al., (2011, a, b) assessed of hydro-chemical characteristics of a tropical wetland system using Principal Component Analysis and the influence of water quality of composition, seasonal abundance of phytoplankton communities in Thol wetland. An analysis of dissolved methane fluctuations in relation to hydro-chemical parameters in Tapi Estuary, Gulf of Cambay were carried out by Nirmal Kumar et al., (2010). Variations in hydro-chemical characters of two distinct wetlands of Central Gujarat were assessed for heavy metals distribution at lower reaches of three permanent estuaries of the Gulf of Kambhat (Nirmal Kumar and Cini 2009, b. and c.). Nirmal Kumar et al., (2008 a. and b.) explained the influence of hydro-Geo chemistry on methane emission from two contrasting tropical wetlands of central Gujarat and temporal and spatial variations in hydrochemical properties of a sewage-fed wetland, Khodiyar. Hydrobiological investigations in the village fish-culture ponds in Gujarat, a composite rating of trophic status of certain ponds of Gujarat, trophic status of lentic waters in Kheda district Gujarat, ecology of polluted waters in Gujarat were carried out by Nirmal Kumar and Rana (1994), Nirmal Kumar (1992).

2.1.2 Geochemical Properties

2.1.2.1 International Status

Manuel (2006) examined sediment cores to quantify sediment organic carbon (OC), nitrogen (N) and phosphorous (P) accumulation and to examine historic changes and spatial variability in the sedimentation pattern in Lake Kariba. The results of the study depicted sediment characteristics (concentrations of OC, N, P; C and N; wet bulk density) showed large variability both with sediment depth and between cores. Hill and Bolgrien (2011) studied the nitrogen removal by streams and rivers of the Upper Mississippi river basin. Kool et al., (2011) evaluated the denitrification as a distinct and significant source of nitrous oxide from soil. Physico-chemical properties of soil of four soil series in Malacca, Rasau, Bungor and Gong Chenak were studied by Muhammad et al., (2011). The organic carbon, nitrogen and total phosphorus in sediment to assess the eutrophication of a reservoir in central Texas was examined by Scott et al., (2005).
Patrick et al. (2010) identified amides involved in nitrogen sequestration in dissolved organic matter and sediment by ESI-FTICR-MS.

Kosten et al. (2009) studied the nitrogen (N) and phosphorus (P) limit primary production in shallow Wetlands, to know variations of these nutrients in time and space in the sediment of Lake Myall, NSW, Australia. Hupfer et al. (2009) was assessed using a sequential extraction technique the total phosphorus (TP) content and chemically extractable phosphorus in both fine and coarse sediment fractions from the deep sites of the lake.

Robert (2006) studied the Lilloet lake sediment deposition due to the floods from the river, which is related to the lacustrine processes, especially turbid underflow, that distributed the sediment through the lake. Li et al. (2005) measured the growing season surface-layer fluxes of CO$_2$ in a Deyeuxia angustifolia dominated wetland on the Sanjiang Plain in Northeastern China.

The inorganic fraction greater than the organic fraction, below the thermocline in eutrophic lake in Georgia was explored by Haberyan and Porter (2003). He described that the thermocline acts as a barrier to sedimentation and allows microscopic heterotrophs to consume detritus that paused during its descent. Koschorreck and Darwich (2003) analyzed nitrogen dynamics in seasonally flooded soils in the Amazon floodplain by comparing the effect of vegetation on soil nitrogen dynamics at three sites with different vegetation (forest, aquatic macrophyte stand and bare sediment with annual herbs). It was concluded that both the soil physical and chemical changes directly caused by the flood pulse and the vegetation have a great impact on microbial nitrogen turnover in the soils.

2.1.2.2. Indian Status

The ecosystem level attributes of a freshwater tropical lake in relation to microbial biomass at the land water interface studied by Pandey and Verma (2008). Prusty et al. (2009) investigated the spatial variation of carbon (C), nitrogen (N), phosphorus (P), and sulphur (S) and associated basic soil parameters along the depth profile for three years, in Keoladeo National Park (KNP), a Ramsar site in India. The
sediment characteristics such as pH, organic matter, calcium carbonate and phosphate of Madhurantakam Lake, Tamil Nadu was assessed by Ramachandra et al., (2005). The pH, clay, cation exchange capacity, $\text{Al}_2\text{O}_3$ and $\text{Fe}_2\text{O}_3$ levels exhibited minimum variation between the disturbed and undisturbed sites. Shanthi et al., (2003) studied the temporal variation of Geo-chemical characteristics of Singanalluar wetland in Coimbatore, Tamil Nadu, India while, Anand and Sharma (2000) investigated the physical–chemical characteristics of the bottom sediments of lacustrine habitats of Jammu. Deka (1999) examined the physical-chemical characteristics of the soil of Kapla Beel a freshwater perennial wetland in the Barpeta district of Assam. The study revealed that the soil of the wetland was acidic in nature and showed the presence of a high amount of organic carbon and low phosphorus content.

2.1.2.3. Regional Status

EDAX- analysis of mud of four ponds from Central Gujarat, seasonal distribution of nutrients in sediments of two ponds around Anand district, the influence of hydro-geochemistry on methane emission from two contrasting tropical wetlands of Central Gujarat, short term diurnal and temporal measurement of methane emission in relation to organic carbon, sulphate, phosphate contents of two rice fields of central Gujarat were carried out by Nirmal Kumar et al., (1989), Nirmal Kumar and Rana (1994), Nirmal Kumar and Viyol (2008), Nirmal Kumar and Viyol (2009).

2.2. BIOTIC COMPONENTS

2.2.1. Phytoplankton

2.2.1.1. International status

Akoma and Imoobe (2010) investigated the limnological and phytoplankton survey of the Bahir Dar Gulf of lake Tana, Ethiopia. Soylu and Gonulol (2010) studied the seasonal succession and diversity of phytoplankton in a eutrophic lagoon (Liman lake). The results that obtained explained the seasonal succession of phytoplankton. The spatio-temporal variations of phytoplankton by morphological observation and photosynthetic pigment analyses at Lake Taihu were studied by Tan (2009). The results showed as chlorophytes dominated phytoplankton community initially and were replaced
by cyanobacteria especially microcystis *sp.*, which underwent a colony-enlargement process and evolved from colonies with a few cells to those with dozens or hundreds of cells before blooming in late June. Mahar et al., (2009) investigated the seasonal fluctuations of 16 dominant genera of phytoplankton found in Manchar lake.

The potentially harmful and indicative planktons with pollution stress in surface waters in three man-made Wetlands (reservoirs) in Ibadan, Nigeria were studied by Oben et al.,(2008). Mc. Cartney et al., (2010) worked out on the seasonal dynamics of phytoplankton in relation to physical-chemical factors in Lake Bishoftu, Ethiopia. The results showed that mean vertical extinction coefficient varied temporally with higher values coincident with high algal biomass and abiogenic turbidity following rainy periods. Tavernini et al., (2009) analyzed over three years the seasonal and inter-annual dynamics of phytoplankton in two Italian sand-pit lake.

The physiochemical parameters and periphyton composition of Onah Lake, Nigeria observed seasonally in the concentration of the various nutrients in the lake by Olele et al., (2008). Kai et al., (2008) investigated the temporal and spatial patterns of phytoplankton in a temperate lowland river (Emajogi, Estonia) by applying the principal component analysis methods and correlated the different parameters. Luciana and David (2007) analyzed hydrodynamics of a shallow coastal Itapeva lake, southern Brazil, responsible for the spatial and temporal gradients of biotic and abiotic variables. The phytoplankton taxa, seasonal variations of densities and correlations with the hydrochemical properties of Maltanski reservoir were described by Kozak (2005). Saadet and Bulent (2007) analyzed the composition of phytoplankton community and physical factors of Karagol Lake. Tas and Gonulol (2007) described the biodiversity of phytoplankton consisting of 104 taxa that are responsible of water blooms in Middle Black sea region. Algal community and its important species were grouped in terms of bray Curtis similarity index, by taking into consideration the phytoplankton dynamics and months. Onyema (2007) described the strong positive correlation between physical-chemical characteristics of the creek in Lagos with phytoplankton taxa. The results showed that the physical-chemical characteristics and phytoplankton indicator species reflect a polluted and rapidly deteriorating estuarine environment.
Phytoplankton composition within two distinct surface and sub-surface strata were examined and compared from a cypress swamp, and four Wetlands of various trophic status in Poland and the southeastern United States were studied by Harold et al. (2007). The study revealed the differences in algal abundance between the two strata and the surface dwelling flora originated from sub-surface assemblages occupying adjacent regions of the water column. Kalytyte (2007) recorded the summer phytoplankton of nine deep Lithuanian Wetlands and applied the trophic state index characterizing the Wetlands as mesotrophic. The agricultural runoff fuels large phytoplankton blooms in vulnerable areas of the ocean, Gulf of California was analyzed by Michael et al., (2005).

2.2.1.2 Indian status

In India, Shaon et al., (2008) studied the reason behind the efficiency of the Bheris in fish production compared to other water bodies like rain water ponds or sewage fed fish ponds and proposed that planktons can act as a biomarker for water quality assessment in fish production. Mohamad et al., (2009) investigated the epiphytic algae and macro-invertebrates communities of *Myriophyllum spicatum Lemm* and their cascade in the littoral food web of lake Nasser, Egypt. Laskar and Gupta (2009) carried out an investigation in Chatla Flood plain Lake, Barak Valley, Assam, North East India on phytoplankton diversity, density and distribution in different seasons and their correlations with physicochemical properties of water. Temporal changes in phytoplankton diversity in response to abiotic factors were investigated by Senthil Kumar and Sivakumar (2008) in Veeranam lakes in the Cuddalore district of Tamil Nadu. Hujare (2008) studied monthly variation in diversity and density of phytoplankton in a fresh water tank of Talsande, Maharashtra for 2 years. Tiwari and Chauhan (2006) studied the seasonal phytoplankton diversity of Kitham Lake, Agra. The study revealed the presence of 73 algal species.

Pawar et al., (2006) studied phytoplankton of Pethwadaj Dam, Taluka Kandhar, district Nanded, Maharashtra. Pethwadaj dam is across the confluence of three nalas, namely, Wartala nala, Digrus nala and Anamand nala near the village Kallali. During the study, the Chlorophyceae was found to be dominant. Systematic and ecological studies on the algal flora of fresh water environment of three different agroclimatic zones of Uttar Pradesh.
Pradesh revealed one hundred eighty two species represented by fifty-two genera inhabiting freshwater bodies having different physical-chemical properties (Dwivedi et al., 2005). In both the regions members of order Conjugales were dominant and represented by ninety nine species belonging to fourteen genera. Pulle and Khan (2003) analysed the qualitative and quantitative concepts of phytoplankton and recorded 43 species, of which 18 were Chlorophyceae, 10 Bacillariophyceae, 10 Cyanophyceae and 5 Euglenophyceae. The nutrient status and cyanobacterial diversity of tropical freshwater wetlands of Udaisagar and clearly indicated the elimination of sensitive cyanobacterial species from the substations receiving urban industrial effluents (Dwivedi et al., 2005).

2.2.1.3 Regional status

The relationships between phytoplankton community and physical (temperature, pH), chemical (dissolved oxygen, phosphate, sulphate and nitrate) parameters were analysed for the year September 2007 to August 2008 in a seasonally inundated, isolated wetland – Malwar, Gujarat, India by Nirmal Kumar and Oommen (2009, a). The studies on plankton were carried out by Nirmal Kumar et al., (2009b) where short term assessment of hydro-geochemical properties in relation to phytoplankton occurrence in the tropical estuary – Narmada of Gujarat was performed. Mali and Gajaria (2004) have also assessed the planktonic assemblage of a fish culture pond in Gujarat. Nirmal et al (2009, b) studied the biosorption of heavy metals from aqueous solution by green marine macro algae from Okha port, Gulf of Kutch. Nirmal Kumar et al., (2009, c) analysed the removal of cadmium, mercury and lead from aqueous solution using marine macro algae as low cost adsorbents. Rana et al., (1995) investigated the phytoplankton ecology of certain water bodies of Gujarat. Nirmal Kumar (1991) studied the seasonal primary productivity of phytoplankton of the temple tank Vadtal, Gujarat. Nirmal Kumar et al., (1989) analyzed the variation in primary productivity of phytoplankton of Tarapur pond, Gujarat. Nandanand Patel (1983) studied the algal flora of polluted waters and Jose (1990) evaluated the algae as pollution indicators in running waters of Gujarat.
2.2.2 Zooplankton

2.2.2.1 International status


Adel, (2006) analyzed the spatial-temporal variations of the zooplankton community in the hyper saline lagoon of Bardawil, North Sinai-Egypt. The study revealed that the community composition was highly changed with time series. Takano et al., (2001) investigated the densities and growth rates of dominant phytoplankton in Lake Oshima- Ohnuma to clarify the mechanism of change from spring-dominant to summer-dominant phytoplankton species, examining the influence of zooplankton grazing and nutrient limitation. Islam et al., (2000) studied the ecology and seasonal abundance of some zooplankton of a pond in Rajshahi.

2.2.2.2 Indian Status

of rotifers and water quality index in the four Wetlands of Mysore was carried out temporally by Padmanabha and Belagali (2006). Sharma and Sharma (2001) examined the species composition, distribution and ecology of the rotifer communities in 15 floodplain Wetlands (locally called Beels) of the lower Assam region of the Brahmaputra basin.

2.2.2.3. Regional status

Saravanakumar et al., (2008) assessed the quantitative and qualitative in regard to their abundance in the creek waters at three sites along the western mangrove of Kachchh, west coast of India. The other studies were carried out by Soni (2007) to investigate the temporal and spatial variations with reference to community composition of zooplankton for two community reservoirs (Pariyej and Kanewal), Central Gujarat for a year long study period.

2.2.3. Waterbirds

2.2.3.1. International status

Milinki et al., (2008) studied the limnological conditions of Egerszalok reservoir and functional feeding Guilds of aquatic birds of Lasko stream. The reservoir is an essential feeding and resting location for groups of geese, mallards, and shorebirds and the study revealed that the ratio of nesting species within each guild is lower when compared to the avifauna of other reservoirs that were established earlier. Moreno-Ostos et al., (2008) studied the response of waterbirds to alternating clear and turbid water phases in two shallow Mediterranean Wetlands- Lake Honda and Lake Nueva. Guadagninand Maltchik (2007) evaluated wetland fragments for the richness, abundance and presence of waterbird species.

Mark, (2006) compared the aquatic birds of Wetlands and coastal rivers in Florida. The study also determined the river systems support the densities, biomass and species similar to those found in Florida Wetlands. Baldi, (2005) investigated the distribution of five passerine bird species across the reed bed (Phragmites australis) edges during large-scale construction work in the Kis-Balaton marsh land, Hungary. The spatial and temporal composition and abundance patterns in 42 wetland fragments in Rio
Grande do Sul, South Brazil was described by Guadagnin et al., (2005). Besides, spatial and temporal patterns of a waterfowl community in a reservoir system of the Central plateau, Mexico had been studied by Severo et al., (2002).

2.2.3.2. Indian Status


2.2.3.3. Regional status