CHAPTER - 1

INTRODUCTION

Limnology is the science of inland water bodies particularly rivers, ponds and lakes, including their biological, physical, chemical and hydrobiological aspects. The main aspect of Limnology is the biogenic material balance of natural waters. Water maintains an ecological balance between various group of living organism and their environment. Limnology has come a long way since the time Forel (1892) in understanding the dynamic of a standing water bodies subsequently, Limnology was studied with reference to the organism specially plankton Hensen (1887) and Fritsch (1907).

Fresh water bodies are specialized ecosystems which perform important ecological functions and have many ecological, socio-economic and cultural values. One of the very important functions of the fresh water bodies is to provide suitable habitat for the breeding of local birds as well as a wintering ground for short and long distance migratory water birds. Fresh water bodies are generally rich in their floristic and faunal diversity which is often much higher than that in many other ecosystems. Fresh water bodies occur extensively throughout the world in all climatic zones. In India the large seasonal and spatial variability in the rainfall enhances the diversity of fresh water bodies ranging from flood plain to coastal area, natural to man made fresh water bodies in Himalayas and arid and semiarid area of the country. There are more man made fresh water bodies than natural ones in India particularly arid region of Rajasthan created to cater the needs of water for drinking, domestic and agricultural uses.

Water is not only an economic good but also a social good. Safe water supply and appropriate sanitation are the most essential components for a healthy and prosperous life. The provision of safe drinking water and adequate sanitation facilities. Water is the elixir of life, it is the source of energy and
governs the evolution and functions of the universe on the earth. It is a medium of life and necessary component of protoplasmic system and raw material of photosynthetic process. Due to increasing urbanization and industrialization, natural quality of water has changed and deteriorated to a great extent. This has totally disturbed the hydrological cycle, as sufficient time is not available for the nature to regenerate the water from the waste water. Although water is abundant, covering nearly three quarters of the earth; yet is a scarce resource. The total amount of water on the earth is about 1.35 billion cubic meter (Ananthakrishnan, 1982).

Water is considered as one of the most basic and important material for all living organism. Our dependence on fresh water resources has accelerated in the last century due to rapid world population growth and economic development. As a result, fresh water resources have deteriorated both in quantity and quality in many areas of the world.

Water is a major natural resource, an essential human need and a valuable national asset and hence its use needs proper planning, development and management. The trophic status of a water body depends on the locality and its topography. Of all renewable resources of planet, water has the unique place. It is essential for sustaining all forms of life, food production, economic development and for general well being. Due to tremendous development of industry and agriculture, the water ecosystem has become perceptibly altered in several respects in recent years and as such they are exposed to all local disturbances regardless of where they occur (Venkatesan, 2007).

The increasing industrialization, urbanization and developmental activities, to cope up the population explosion have brought inevitable water crisis. The health of lakes and their biological diversity are directly related to health of almost every component of the ecosystem (Ramesh et al., 2007). In freshwater bodies, nutrients play a most important role as their excesses causes eutrophication. Too much macrophytic vegetation is analytical of the
eutrophication status of any water body. Regular inspection of water quality is the first step that can lead to management and conservation of aquatic ecosystems. It is also true that the management of any aquatic ecosystem is aimed to the conservation of its habitat by suitably maintaining the physico-chemical quality of water within acceptable levels (Garg et al., 2010).

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Lakes, rivers, ponds and other fresh water bodies have poorly withstood the blessings of human civilization. Almost everywhere man has leaned upon these waters not only as the great life givers, but also as cleansers. They have served as recipients for a major part of human wastes both directly and indirectly, wastes which frequently became excessive wherever people concentrated in cities and densely populated areas. Water of varying degrees of purity is required by every form of life. This distinctive characteristic of water have been a boon to modern man.

The aquatic environment can generally be characterised as a dilute aquous solution, containing a large variety of organic and inorganic chemical substances dissolved and in suspension and including a variety of plant and animal life. A knowledge of the qualitative and quantitative composition of this
system is the first approach towards revealing the nature of the particular environmental problem.

The significant role played by different water resources in almost all the developmental programmes of the country hardly need any elaboration. These resources not only serve the purpose of water supply for domestic and industrial use, but also for the development of agriculture, fisheries, power etc.

In the natural fresh water bodies, nutrients of the catchment area get transported through run-off water. These nutrients are used by the inhabiting biota for their growth and reproduction. Some nutrients get trapped in the sediment; the rest remains in solution in water. This nutrient input-utilization activity continues in a regular manner in nature, subject to non interference by man. In man made reservoirs, some nutrients may get drained out through waste weirs, sluices or such other means.

Rajasthan which is well known as the desert and xerophytic environment, but it has many water resources because the rulers of this state were aware of the water scarcity, therefore constructed a numbers of lakes, ponds and dams. The main purpose behind construction of these water bodies was irrigation, drinking water and recreation. Due to low rainfall in the state, it is important to develop appropriate technology for conserving the rain water which may enrich our gournd water resources and form the basis for supporting appropriate aquaculture. Probably because of erratic monsoon in Rajasthan there has been a rich tradition to conserve water especially in the arid area.

In most parts of the state the water table is very low and dependable sources of water are limited. But vast number of small pond and tanks existing in the state which receive rain water during monsoon period and this water is retained for about 10 to 11 months. These water bodies are known as seasonal ponds.
Temporary ponds (aestival ponds) or Johra present in arid region like CHURU are chief source for drinking water for cattle as well as human beings. These are filled up with rain water and get dry with the arrival of the dry period of the year. In other words the aquatic ecosystem of temporary ponds present an interesting study of wet and dry cycles.

**REVIEW OF LITERATURE**

The study of aquatic ecosystem has been overlooked since long back. There is absolutely no literature available on the socio – economically important water lands and the ponds. Any authentic data on the physicochemical properties and phytoplankton population of the water bodies is also lacking. The main reason for this may be that these water bodies are temporary ponds and remain dry for major part of year.

The studies of aquatic flora of Rajasthan were initiated by Goyal (1964), Gupta and Kumar (1968), Yadav & Bhardwaj (1977). First time Soni and Bhardwaj (1980) has reported few members of chlorophyceae and cyanophyceae from ponds of Western Rajasthan.

Several workers have engaged themselves in the limnological studies of lakes and ponds. The data available on the physico-chemical characteristics of water in the largest provinces of India and abounds in lakes and ponds are quite insufficient. Lakshminarayana (1965) studied physico-chemical characteristics and phytoplankton population of river Ganga. George (1966) studied comparative plankton ecology of five fish tanks in Delhi. Kaul & Zutshi (1967) studied aquatic and marsh lands vegetation of Srinagar. Singh (1968) observed seasonal fluctuations of the main groups of phytoplankton periodicity in a small lake near Delhi. Verma (1969) studied hydrobiology of a tropical impoundment, Tekanpur Reservoir, Gwalior.

Limnological studies on fresh water ponds of Hyderabad was undertaken by Munawar (1970). Saha *et al.* (1971) studied seasonal and diurnal variations


Limnological studies of two ponds in Jammu was under taken by Shashikant and Raina (1990). Limnological survey of water bodies of the Sikkim Himalayas was undertaken by Venu et al. (1990). Singh and Ahmad (1990) studied a comparative study of the phytoplankton of the river Ganga and Pond of Patna (Bihar). Shukla and Anjum (1991) studied biological aspects of Ganga river ecosystem. Limnological studies on Bhopal lakes was


Limnological study of Papnash pond, Bidar (Karnataka) done by Angadi et al. (2005). Narayana et al. (2005) studied drinking water quality of Basavanahole tank and concluded that the tank water is very soft and might be recommended for drinking purpose. Hegde et al. (2005) reported 69 species of phytoplanktons belonging to 37 genera from Guruvayanakere pond, Karnataka.

Tiwari and Chauhan (2006) reported 73 algal species from Kitham Lake, Agra. Usha et al. (2006) Studied Peruman Lake, Cuddalore, Tamil Nadu and estimated values of net and gross productivity. Sachidanandamurthy and
Yajurvedi (2006) studied many physico-chemical parameters of Bilikere Lake, Mysore city and noticed dense algal growth. Nautiyan et al. (2007) reported 16 and 25 diatom species from the river Bhagirathi and the tributary Kherg Gad respectively. Muthukumar et al. (2007) studied cyanobacterial biodiversity of 5 different fresh water ponds in and around Thanjavur, Tamil Nadu and observed 39 species of 20 genera of cyanobacteria. Narayan et al. (2007) studied the limnological aspects of Texi temple pond, Etawah (UP) and 18 parameters were analysed. They observed many of the parameters were found below the permissible limits for drinking water as suggested by WHO. Kamal et al. (2007) studied physico-chemical properties of water of Mouri River, Khulna, Bangladesh.

Tas and Gonulol (2007) reported 104 taxa belonging to cyanobacteria, Bacillariophyta Chlorophyta, Euglenophyta and Xanthophyta division from Lake Cerneke, Turkey. Chaurasia and Pandey (2007) studied some water ponds of Ayodhya, Faizabad and concluded that some parameters like TDS, BOD, alkalinity, total hardness and total phosphate were found to be beyond the permissible limit. Smitha et al. (2007) studied physico-chemical characteristics of water samples of Bantwal Taluk, South-west Karnataka and reported that some parameters like pH, Sodium, Calcium, Magnesium, Chloride and nitrates were well within the permissible limits for drinking water recommended by WHO.

Bhuiyan and Gupta (2007) studied few ponds of Barak Valley, Assam and concluded that water quality of these ponds is suitable for drinking and domestic use. Lohar (2008) studied seasonal Variations in physico-chemical parameters of Mehroon, Nakane and Yashwant Lakes in Maharashtra and observed that most of the parameters were in the normal range, nevertheless the water of Mehroon lake is not used for drinking water supply while the lakes Nakane and Yashwant had better quality of water and they were used by local public for drinking and irrigation.
Senthikumar and Sivakumar (2008) observed 160 species of phytoplankton from Veeranam lake, Tamil Nadu. Among these 74 species belong to Bacillariophyceae, 43 species to Chlorophyceae, 38 species to Cyanophyceae and 5 species to Euglenophyceae. They also reported high phytoplankton density during summer season and low during the winter season. Dondajewska et al. (2008) studied phytoplankton abundance and biomass from Antoninek reservoir, Western Poland.


Laskar and Gupta (2009) reported 34 phytoplankton taxa belonging to Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae from Chatla floodplain lake, Barak Valley, Assam. Ingole et al. (2010) observed 33 genera of phytoplankton belonging to Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae from fresh water reservoir at Majalgaon on Sindphana River, Beed (M.S.). Patra et al. (2010) studied physico-chemical characteristics of water of santragachi and Joypur Jheel, WB.

Mullar et al. (2010) studied seasonal variation in physico-chemical parameters of Hirahalla reservoir, Koppal district, Karnataka. Kanagasabapathi and Rajan (2010) reported 26 different species of phytoplankton belonging to Cyanophyceae, Chlorophyceae, Charophyceae and Bacillariophyceae classes. Rajagopal et al. (2010) observed 50 species of phytoplankton from two perennial ponds in Sattur area, Tamil Nadu. Out of these 50 species 24 belonged to Chlorophyceae, 14 to Cyanophyceae, 11 to Bacillariophyceae and one to Euglenophyceae. Soylu and Gonulol (2010) reported 130 phytoplankton taxa belonging to Chlorophyta, Cyanophyta, Euglenophyta, Bacillariophyta and Xanthophyta from Liman Lake, Turkey. Rajagopal et al. (2010) studied
physico-chemical parameters in three perennial ponds of Virudhunagar district, Tamil Nadu.

Garg et al. (2010) studied seasonal variations in water quality of Ramsagar reservoir, Datia (MP). Jadhav et al. (2011) studied Coefficient correlation between pH and alkalinity of Sangmeshwar reservoir in Osmanabad district, Maharashtra. Shiddamallayya and Pratima (2011) studied seasonal changes in phytoplankton community in Papnash pond Bidar, Karnataka along with physico-chemical characteristics of water.


The data available on the ecology of phytoplankton and other algae in the state of Rajasthan which is geographically being the the largest provinces of India and abounds in lakes and ponds are quite insufficient. In this context the important contribution was of Ratnam and Joshi (1952) who contributed themselves by an ecological study of the vegetation near about a temporary pond in Pilani (Jhunjhunu). Further in 1958, Sarup studied hydrophytes of Jodhpur. Vyas (1968) studied on phytoplankton ecology of Pichhola lake, Udaipur. Whereas Mishra et al. (1975) contributed by studying diurnal variation in physico-chemical factors at Padam Sagar reservoir, Jodhpur during premonsoon period. In this row Bohra (1977) studied comparative limnology and primary productivity of two adjacent lakes Padam Sagar and Rani Sagar, Jodhpur. Later the study of observations on the primary productivity and energetics of the macrophytic vegetation of Goradhan Vilas tank, Udaipur was undertaken by Jain (1978). Mahajan (1979) studied aquatic ecosystems of Ghana bird sanctuary, Bharatpur and Ramgarh lake, Jaipur. In the same year Dhakar studied in some aspects of the hydrobiology of Indra Sagar tank, Udaipur. Whereas Vyas and Jain (1979) studied observations on the hydrobiology of Gordhan Vilas lake, Udaipur.


Kumar et al. (2008) reported 42 species of diatom from Kishore Sagar, Kota. Paulose and Maheshwari (2008) studied physico-chemical parameters of Ramgarh lake, Jaipur. Srivastava et al. (2009) studied physico-chemical characteristics of Jalmahal, Amer, Nevta and Ramgarh lakes, Jaipur. Kumar et al. (2009) studied physico-chemical characteristics and diatom diversity of
Jawahar Sagar lake, Bundi. They reported 35 diatom species from this lake. Vikal (2009) analysed drinking water quality parameters of lake Pichhola, Udaipur. Singh et al. (2010) studied seasonal diatom variations and physico-chemical properties of Mansagar lake, Jaipur. They observed 35 diatom species from this lake. Koli and Ranga (2011) studied physico-chemical status and primary productivity of Ana Sagar lake, Ajmer. Gautam et al. (2011) studied fluoride content in ground water of Nawa Tehsil in Nagaur.

In view of the importance of the studies on phytoplankton population as discussed, as well as because of the paucity of data as evident from the review of literature, the present study “Limnological studies related to physico-chemical characteristics of water of Sethani Johara, Churu (Rajasthan)” is of importance in the national interest.

The main objectives of the present study are as under:

1. To study monthly variations in the physico-chemical characteristics of water.
2. To study monthly variations in the species composition and density of phytoplankton population.
3. To study monthly variation in primary productivity of phytoplankton population in terms of biomass, chlorophyll content and gas exchange.
4. Temporary ponds present in arid region like CHURU are chief source for drinking water for cattle as well as human being. These temporary ponds are filled up with rain water and get dry with the arrival of the dry period of the year. In other words the aquatic ecosystem of temporary ponds presents an interesting study of wet and dry cycle. Hence, in the present investigation, an attempt has been made to evaluate the physico-chemical characteristics and phytoplankton population of Sethani Johara situated in Churu city.
IMPORTANCE OF PROPOSED RESEARCH WORK

Rajasthan inspite of being recognized as a state of arid conditions is characterized by large numbers of water bodies both natural and man made. These water bodies of arid and semi arid region are characterized by very low precipitation largely confined to the rainy season and extremely scorching sunlight and high temperature. Sethani Johara is an important fresh water body of Churu city (Rajasthan). This pond is under constant threat due to scanty rains and increased human and grazing animal activities. It is therefore essential to manage scientifically this water body to tap it maximum potentiality.

Thus in the present study phytoplankton has been studied quantitatively and qualitatively and the results are correlated with physico-chemical factors to get a better understanding of the structure and function of this important fresh water ecosystem.