CHAPTER 6

DISCUSSION AND SUMMARY
DISCUSSION AND SUMMARY

The quality of water resources can be as important as or even more important than water quantity. Water quality affects natural ecosystems, human health, and economic activities. At the same time, human activities directly affect water quality. Concentrated pollutants entering surface waters from specific locations (point-source discharges) and dispersed pollutants generated from local or small-scale activities (non-point source discharges) add large quantities of nutrients, pathogens, and toxins to the nation’s water resources. Global climate changes have the potential to significantly alter water quality by changing temperatures, flows, runoff rates and timing, and the ability of watersheds to assimilate wastes and pollutants. Changes in storm flows will affect urban runoff, which already has adverse water bodies. They could reduce dissolved oxygen concentrations, reduce the dilution of pollutants, and increase zones with high temperatures. For almost everybody or source of water, land use and agricultural practices have a significant impact on water quality. Changes in these practices, together with technical and regulatory actions to protect water quality, can be critical to future water conditions. The net effect on water quality for rivers, lakes, and groundwater in the future therefore depends not just on how climate conditions might change but also on a wide range of other human actions.

Clean and adequate fresh water is critical to the welfare of living beings. It is a fundamental component of the natural ecosystems upon which we all depend, vital for human health and industrial production, used directly and indirectly to generate energy, an important part of our transportation system, the basis for extensive outdoor recreation, and a medium for disposing of wastes. The natural variability of the hydrologic cycle is also important to society: large socioeconomic costs are associated with both too much and too little water. The nation’s water resources, in turn, are dependent on the climate.

Experience with historical climatologically and hydrological conditions plays a major role in determining current water-use patterns and the infrastructure and institutions we have put in place to regulate and allocate supplies. Even today, the design and evaluation of alternative water investments and management strategies assume that future precipitation and runoff can be adequately described by assuming
the future will continue to look like the past. The increasing likelihood that a human-induced greenhouse warming will affect the variability and availability of water quality and supplies as well as the demand for water raises doubts about this assumption and about the most appropriate water policies for the future.

More than two decades of research into the implications of climate change for water resources have improved our understanding of possible impacts and points of vulnerability. Many critical issues and some clear and consistent results have been identified. Taken together, the current state of the science suggests a wide range of concerns that should be addressed by national and local water managers and planners, climatologists, hydrologists, policymakers, and the public. Many climate changes are expected.

This section summarizes more than two decades of research on the effects of Ecological changes on fundamental water-resource variables such as temperature, precipitation, evaporation, runoff, chemical and biological parameter. Any such summary will necessarily be incomplete. Interested readers are strongly encouraged to explore the original citations for more detail about assumptions and methods. The starting point for much of this research is estimating how increasing concentrations of chemicals in the lentic water bodies will affect large scale on biological communities and, particularly, the hydrologic cycle. Many such studies have used scenarios of future aquatic ecosystems. A smaller effort has looked at specific impacts on the operations or management of water systems, or on impacts to ecosystems, navigation, recreation, or other water-related activities. Even fewer studies have considered the complex socioeconomic costs of climate impacts or the costs and benefits of adaptation and coping strategies.

Total precipitation of water is quickly evaporates back into the atmosphere, but the remainder provides a renewable supply of surface water and groundwater that is nearly twenty times larger than current consumptive use. The vast amounts of water stored in lakes, reservoirs, and groundwater aquifers provide reliable, high-quality supplies for much of the nation’s population. The annual average precipitation of Tumkur district is 753.77 mm (Table-1). During these days the fresh water resources have never sustained naturally, the same as they were earlier, as a
consequence of increased anthropogenic activities. It is long established that the increased population, rapid industrialization, fast urbanization and modern agricultural practices are the four major environmental problems that endanger the surface water bodies all over the world. In fact the surface water bodies have been put under severe ecological stress and are being threatened by the increased human interferences. It is very much true in the case of the Kunigal lake of Tumkur district, Karnataka state. It is one of the perennial lakes since it was artificially fed with Hemavathy River. With this background the present work was undertaken from 2007 to 2009 to study the physico-chemical and biological characteristics, pertaining to their quality, inter-relationship between them, Composition seasonal variation and finally to assess the water quality and usefulness for the benefit of human welfare.

During the study course three sampling stations were decided in the light of objectives of environmental monitoring programme. The lake vast in size (1321 Hectares) and harboring huge amount of water, livelihood of Kunigal people and water also served the needs of people for different purpose. The ecological study of this lake revealed that due to enormous anthropogenic activity leads to pollution, that degrade the water quality in for coming generations. So it is the Urgent Need to once again increase its aesthetic and ecological values. The selected sample stations 500 meter away from each other along the stretch of the lake from South West to North West direction. They are as follows,

Station 1:- Organically polluted by sewage water nearby village towards Northern side.
Station 2:- Downstream drainage of the lake, which is sufficiently clean and free draining
Station 3:- Surface drainage of downstream, which is free from vegetation growth and debris certain rain cuts are formed in certain location of the slope.

The water sample were collected from all the three marked stations at a interval of 30 days and analyzed 24 physico-chemical and Biological parameters in field and laboratory by using standard procedures. Further inter relationship between various physic-chemical components of the lake has been statistically evaluated by
standard procedure and software. The occurrence and distribution of different group of phytoplankton in relation to 24 physcio-chemical parameters has been has been studied, correlated, evaluated and discussed. The one time investigation on zooplanktons has been carried out and the result were documented. The conservation strategy of lake was undertaken by P.W.D. (Public Work Deportment). As per our directions. Construction of bunds along the bank of lake, aquaculture and monthly monitoring has given right to private sectors, but still there is lack of ecological knowledge, proper guidance and maintenances. Ecotourism activity generate awareness about conservation of fresh water bodies particularly lake ecosystem because they are the “precious natural bowl”.

**PHYSCIO-CHEMICAL PARAMETERS:**

The temperature is the dynamic in aquatic ecosystem. In the present study both air and water temperature causes on seasonal variation. In general air temperature fluctuating, a minimum of 27.41 c to 28.87 c and water temperature ranges from 24.96c to 26.62 c.

The p<sup>H</sup> of water sample of all the station showed alkalinity in nature, because of filling of river tributaries apart from the natural filling. p<sup>H</sup> and alkalinity go hand in hand and inversely proportional to water and air temperature. Whereas alkalinity and p<sup>H</sup> positively correlated with each other.

Alkalinity and p<sup>H</sup> favored the high amount of D.O while vice versa. It is in respect of alkaline water. Dissolved oxygen by and large was found it be fairly high at statio-1 and 111. While its content reduced to 2.41 to 3.80 mg/L at station-111.

The total dissolved solids varied from minimum of 101.80 to a maximum of 108.5 mg/L. Its concentration should not exceed the permissible level prescribed by ISI or WHO. Fortunately lake water is so safe for potable. In the present investigation there is a clear cut correlation between other physic chemical parameters. The highest TDS recorded during rainy season due to the accumulation of sediments.

Electric conductivity shows minimum of 136.75 mS and maximum of 154.25 mS. overall seasonal behavior of E.C was more during rainy season which is followed
by winter and summer. This is due to deposits of more dissolved solids in to the lake. E.C and T.D.S both were found to be low during summer and winter and become higher during rainy followed by winter and again summer.

The D.O was more during rainy season followed by winter and summer. But during 2008 and 09 showed winter have to be more D.O compared to other two seasons. This is due to fluctuation of air and water temperature, rain fall and microbial decomposition of organic matter.

The B.O.D determines the water quality of any aquatic ecosystem. Present study, the maximum of 2.46mg/ L at station-111 and minimum of 1.76 mg/L in station-1. This is due to the dumping of organic domestic waste. D.O.and B.O.D was highly positively correlated. (r=0.68)

Free co2 and oxygen were directly related to each other, this is due to the high productivity of phytoplankton which utilized for photosynthetic activity.

The content of Fe at all the station was well within the ISI standard fixed for drinking water. But it concentration exceed up to 1.20 mg/L in rainy season at station-1, indicating the lake water unfit for potable. But proper management of water treatment was to be made before drinking purposes.

Silica was found irrespective of all the station through the study, its concentration was high during June because of soil erosion and accumulation of sediments from catchment area and a considerable reduction of its concentration during winter to summer. It ranges from maximum of 6.73mg/L and minimum of 4.86 mg/L. The Pearsall basic ratio of sample station-1 showed highest of 2.21 and lowest of 0.58 during winter season

Total hardness value fluctuated between a maximum of 61.87 mg/L in station-111 and minimum of 54.08 mg/L in station -1. The maximum total hardness was reduced during summer season in all station. Because of excessasive evaporation of water .One interesting observation was made on lake irrespective of year and sampling station, nitrite showed <0.01 mg/L throughout the study. This may be
probably due to the conversion of nitrite to nitrates. Whereas, nitrate year average ranges from the lowest of 1.89 mg/L in station-11 and highest value of 3.36 mg/Lin station-1. Overall occurrence of nitrate was found to be very less in winter season compared to both summer and rainy season.

It is found that the concentration of Ammonical nitrogen and carbonate showed nil in all stations during investigation.

When sulphate and chlorides are taken in to consideration, both the ions show much difference. Chloride comes first in their concentrations followed by sulphate. Overall seasonal variation of both the ions attains higher level during rainy season. This is due to anthropogenic causes and excess of water inflow and addition of organic matter. Even though, the lake water safe for potable because of chloride limit does not cross its limits ISI 1991, prescribed for drinking water.

Turbidity values showed much difference from station to station. Seasonal variations showed fairly fluctuations irrespective of location of the study area, all the stations showed between 26.76 to 28.25 NTU. Overall summer season showed more turbid followed by other two seasons. This is due to evaporation.
PERIODICITY AND DISTRIBUTION OF PHYTOPLANKTON:

The Cyanophycean members are said to be Blue greens. In the present study 26 genera and 38 species of blue-greens have been recorded of which some of the common forms were, which Anabaena arnoldii, Aphanocapsa Crassa, Arthospira Tenuis, Calthrix neberi, Chroococcus targidus, cylindorospermum majus, Dermocarpa Prasina, Gloecapsa calcarea, Gloethece Samoensis Gomphosphaeria aponia, Hapalosiphon lateolus, Hydrocoleum striatum, Lynghbya Spiralis, Merismopedia glauca, Microcystis angulata, Nostoc commune, Nostochopsis labatus and oscillaria irrigua are major.

In aquatic water body a chief factor controlling blue green algae or cyanophyceae are water temperature \( p^H \), dissolved oxygen, bicarbonates, calcium, potassium, total dissolved solids and nitrates. In the present study revealed that \( p^H \) was alkaline at the station- I, II and III. Nevertheless number of blue greens found to be relatively low when compared to station III, which registered a good number of blue greens with slightly alkaline. The behavior of blue greens towards carbon dioxide is quite opposite to that of oxygen were carbon dioxide rich water support luxuriant growths of blue greens. In the present investigation has revealed that average range of temperature was 25.3 C to 26.29 C favors the abundance of blue greens as observed at station-1.

Order chlorophyceae exhibit a fascinating group of organisms belongs to member chlorococcales. A total of 24 genera and 26 species of chlorococcales have been recorded. The form common of these members at all the stations was *Ultrix cylindrocium*. Seasonal average of chlorococcales revels that interestingly irrespective of all the season there is slightly decreasing its occurrence 8225.8/L (table). During summer season 10205/2, 6470/L during rainy and 8992.5/L during winter. Some of the most common species includes, *Oedogonium sp, Pediastrum tetrans, Spirogyra subsalsa, Ulothrix cylindrocium and Botryococcus braunii*, the following were the forms of rare occurrence, *Coleastrum microporum, Crucigenia guadricauda, Kirchineriella lunaris and Micractinium pussillum*. In general, the composition of chlorococcalian population at this station was comparatively increased compared to station II and decreased to station-I.
Desmids are the most beautiful and attractive organisms. 9 genera and 22 species of desmids were found during study period. The forms common forms are Cosmarium spp, Desmidium sp, Euastrum and Micrasterius spp. The desmids can be used for biomonitoring of pollution. The high water temperature, phosphate, nitrate and low D.O and CO2 supported their growth. Seasonally they showed maximum population during rainy and decreased during winter. Except the genera Closterium gracile remaining all genera and species found in station- II. But Clasterium showed it present only in station- I.

Diatoms are a major group of algae. During study period a total of 11 genera and 22 species were registered. Diatoms can be used as indicator of environmental variables. Higher concentration of silica favor the abundance of diatomic population, however silicates cannot be correlated directly with the pattern of distribution of diatoms. Some of the common forms present in all the stations were Amphora ovalis, Cymbella cymbiliformis, Diatoma species Epithemia turgida, Gomphonema andium, Among Gomphonem constrictum occurred in Station- II but in station- I and III it does not occurred during the study period indicate it is slight divergent in polluted stream. The reason could be the pollution factor where in the station- I and III. The absence of this species is fact that species doe not favored contaminated water. Therefore they could be considered as the indicator of organisms of clean fresh water bodies. Elglenoids are controlled by factors such as pH, temperature and bright sunshine. In the present study temperature, pH, D.O and bright sunshine appear to trigger the growth and development of euglenoids.

A total of 5 genera and 16 species of euglenods were recorded during the study period. Interestingly 10 species belonging to all 5 genera were shoed their appearance in station- I. Especially Phacus and Stromonomas species showed their dominance in this station. Euglenoids were occurred in this station were, Englenia elongate, E.proxima, E.acus, Trachelomonas robstua, Phacus caudatus, Stromonomas Spp, Lepoxicilis ovum, T. Bulla, T volvocene Englenia Spirosyra.

While two year seasonal average showed maximum population of euglenoids during rainy season (17010 O/L) and minimum of 7950 O/L during summer season. The overall cluster analysis indicates that the same behavior where were closest relation
existing between chorophyceae.

One time observation was made on zooplankton community. A total of 13 genera and 17 species of zooplankton were recorded during the study period. The group protozoa were represented by 3 genera and 3 species. A protozoan is what we call a eukaryotic organism because it is a cell that contains a true nucleus and is bounded by a nuclear membrane. It consists of only a single cell and is so small that we usually can’t see it without using a microscope. It is observed that relatively higher amount of D.O and low BOD is responsible for their distribution.

Cladocerans represented by 5 genera 6 species. Many zooplankton, particularly the Cladocera, exhibit marked diurnal vertical migrations. The adaptive significance of diurnal migrations is unclear but likely evolved as a mechanism to avoid predation by fish, much of which is a visual process requiring light. Most species migrate upward from deeper strata to more surficial regions as darkness approaches, and return to the deeper areas at dawn. It is observed generally lower amount of BOD, COD and temperature in the range between 25 to 30°C are responsible for their luxuriant growth.

During study period Copepods represented by 3 genera and 4 species. Planktonic copepods are important to global ecology and the carbon cycle. They are usually the dominant members of the zooplankton, and are major food organisms for small fish, whales, seabirds and other crustaceans such as krill in the ocean and in fresh water. Some scientists say they form the largest animal biomass on earth. During the present study a total of 03 genera and 04 species have been recorded of which Cyclops species appear to be dominant, while Heliodiaptomus vidus and Mesocyclops leuckarti appear to be rare forms. Normally copepods exhibit bimodal peaks in any water body under consideration. If the regularity are accounted for, it is observed that high BOD and low DO are important parameters that appear to regulate the population of copepods. The group Rotifers is represented by 2 genera and 4 species. Seasonal variation of rotifers showed highest population (172.5 O/L) during summer season and showed lowest of 123.25 O/L during rainy season.
The lake has rich in vegetation in its surrounding area such in vicinity of protected bunds which helps to prevent soil erosion, wind flow and direct interference of animals as well as anthropogenic activities. As the following common angiospermic plants are documented such as *Acatia arabica, Achyranthues aspera, Barlaria crystata, Casia sophera, Calotropis procera, Canthium indicum, Cassia tora, Duranta plumeria, Ecephorbia splendense, Bambusa arundicum, Ipomea, Justicia simplex, Leucas aspera, Lantana camera, Mimosa pudica, Sida acuta, Plumbago, Tridox procumbance,*
SUGGESTION AND RECOMMENDATION

The data generated clearly reveals that the lake is basically productive and contaminated. Therefore, it suggested that the status of lake should be maintained by enforcing the imitative environmental production act. It is obvious that, to maintain the healthy condition of the lake the catchment area should be protected from the adverse effects of anthropogenic activities. Checking of unplanned growth of human settlement beside the water resources and avoided the indiscriminate discharge of waste and sewage water and ensure a better quality of life for the rural population. The following suggestion and recommendation as given below;

1. As for possible the discharge of domestic waste into the lake should be avoided. It become inevitable the sewage should be treated properly and then it may be a sewage treatment plant should be installed in the side where agricultural sewage and to avoid other domestic waste dumped surrounded the lake.

2. Awareness among the public regard to the impact of water pollution on human health should be broadcasting through mass media programme.

3. Discharge of detergent by washing clothes, automobiles and domestic animals might be avoided.

4. To make rigid bunds along the stretch of lake it should avoided rain cuts, silt accumulation and also use of chemical fertilizer and pesticides in the vicinity of Lake Environment should be minimized in order to avoid their biomagnifications.

5. The public work department, municipality and pollution board should take proper management measures to monitor the lake environment.

6. Lake encroachment should be control by sound land laws of concerned authority.

7. NGO, Scientific club, societies, association and academic should create awareness about environmental problems, about the conservation of fresh water bodies for the wealth of aquatic flora and fauna. so as to maintain the eco friendly life style among the public.
8. In agriculture practice the Biological pest control should be avoided wide use of insecticides, pesticides, fungicides and Biological nitrogen fixation should be adopted.

9. Brick fields should be prohibit by law near agricultural or populated areas.

10. More work is needed to improve the ability of global climate models to provide information on water-resources availability, to evaluate overall hydrologic impacts, and to identify regional impacts.

11. Substantial improvements in methods to downscale climate information are needed to improve our understanding of regional and small-scale processes that affect water resources and water systems.

12. Increased and widespread hydrologic monitoring systems are needed. The current trend in the reduction of monitoring networks is disturbing.

13. There should be a systematic reexamination of engineering design criteria and operating rules of existing dams and reservoirs under conditions of climate change.

14. Information on economic sectors most susceptible to climate change is extremely weak,

There is information on the socioeconomic costs of both impacts and responses in the water sector.