Chapter - 5

SUMMARY AND CONCLUSION

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5.1 SUMMARY

Hydobiological study on Almatti reservoir located in Bijapur district in northern part of Karnataka state was carried out for a period of two years from February 2003 to January 2005 to assess the limnological conditions, the planktonic life and macrofauna like insects, molluscs and fishes as indicators of progressive trophic reservoir were determined. The results of the present study are summarized and conclusions are drawn as follows.

1. Almatti reservoir is one of the major perennial reservoirs situated near B. Bagewadi taluk, Bijapur district, Karnataka state. The climate of this region is moderate (tending to hot). Maximum water spread area is 487.87 Sq.km. The maximum depth of water is 30.42 mts. The catchment area of the reservoir is about 35.926 Sq.km. Water depths around the edges of the reservoir are less. The reservoir shows vast litoral zone, which sustains profuse growth of aquatic macrophytes.

2. The physical parameters such as rainfall, humidity, air and water temperature, pH and electrical conductivity, which govern the hydrodynamics of the reservoir. Rainfall is mostly restricted to the south-west monsoon season which extends from June to September, overlapping and extension beyond the specific period. Variation in rainfall has greater influence on the hydrobiological features of the reservoir. The relative humidity was maximum
in monsoon and minimum in summer seasons of both the years of study. Ambient temperature was generally followed a seasonal trend, found always higher than the water temperature. The amplitude of variation between ambient and water temperatures was minimum.

The pH was generally alkaline at all the five stations of the reservoir throughout the study period. pH showed negative correlation with chlorophyceae and bacillariophyceae. The electrical conductivity was high during summer followed by monsoon and low during winter season throughout the investigation period. The range of electrical conductivity indicates the productivity of the reservoir. Electrical conductivity values were positively correlated with total alkalinity, total hardness, calcium, magnesium, chloride, sulphate, bicarbonate, total dissolved solids and dinophytes but inverse correlation showed with dissolved oxygen and cyanophyceae, cladocerans and ostracods.

3. The concentration of chemical substances of the reservoir is well under the prescribed limits of inland surface waters. In general the chemical substances of the reservoir are favourable for aquacultural and agricultural use. The optimum level of dissolved oxygen is recorded in the reservoir. Seasonal fluctuation in DO was observed in the study period and it was positively correlated with nitrates, cyanophytes and ostracods, but negatively correlated with total alkalinity, total hardness, calcium, chloride and sulphate. A peculiar characteristic feature of the reservoir is that CO$_2$ was absent throughout the investigation period. The total alkalinity was maximum during summer.
followed by winter. The range of total alkalinity observed in the reservoir indicates their productive potential. In the present study, total alkalinity values were positively correlated with total hardness, calcium, magnesium, sulphate, bicarbonate, total dissolved solids, diatoms, dinophyceae, rotifers and with molluscs while inverse correlation showed with phosphate, cyanophytes, cladocera and ostracods. The total hardness in the reservoir was found to be maximum in summer during both the years of study. The hardness of reservoir water is moderate, indicating its suitability for domestic use. The hardness values were positively correlated with calcium, magnesium, chloride, sulphate, bicarbonate, total dissolved solids, diatoms, dinophytes and with molluscs, but negatively correlated with cyanophytes, cladocerans and ostracods. The calcium and magnesium values observed in the present investigation, showed a definite pattern of seasonal variation being higher mg/l in summer and lower mg/l in monsoon. The low concentration of calcium in Almatti reservoir were observed and it was positively correlated with phosphate, sulphate, bicarbonate, total dissolved solids, dinophytes, rotifers and molluscs, while inverse correlation with cyanophytes. Magnesium concentration was also very less in the reservoir and found maximum in summer, while minimum in winter. Magnesium was positively correlated with chloride, sulphate, bicarbonate, diatoms, dinophytes and molluscs but negative correlation showed with cyanophytes, cladocerans and ostracods. Seasonal fluctuations of chloride concentration was occurred in the reservoir. Chloride values showed inverse correlation with nitrates, chlorophyceae, desmids, copepods and with ostracods. The low concentration
of nitrates and phosphates in reservoir indicate the rapid utilization of nutrients by autotrophs. Seasonally nitrate value was maximum during winter and minimum during monsoon and the value of nitrate showed positive correlation with dissolved oxygen, pH, cyanophytes, desmids, ostracods but negative correlation showed only with chloride. Seasonally fluctuation of phosphate was observed in the reservoir. The phosphate content was positively correlated with rainfall, humidity, calcium, TDS, cyanophytes and cladocerans, but inversely correlated with sulphate, bicarbonate, diatoms, dinophytes, rotifers and with molluscs. The sulphate concentration in the reservoir was found to be maximum during summer and minimum during monsoon months of both the years of study period. The values were positively correlated with air and water temperature, electrical conductivity, total alkalinity, calcium, magnesium, bicarbonates, total dissolved solids and molluscs. While negatively correlated with dissolved oxygen, phosphate, cyanophytes and ostracods. Bicarbonate values were also found to be maximum during summer in both the years of the study and the values were positively correlated with air temperature, electrical conductivity, total alkalinity, total hardness, calcium, magnesium, sulphate, total dissolved solids, diatoms, dinophytes and with molluscan group, but inversely correlated with phosphate, cyanophytes, cladocerans and with ostracods. Total dissolved solids was found maximum during summer and minimum during monsoon season. Statistically the values were positively correlated with electrical conductivity, calcium, phosphate, total alkalinity, total hardness, sulphate, bicarbonate, diatoms, dinophytes and with molluscs.
While negative correlation showed with humidity, cyanophytes, cladocerans and with ostracods.

4. Bottom sediments were analysed for a period of two consecutive years. The physical parameters such as pH and electrical conductivity were determined. The pH of the sediment was neutral to alkaline in all the stations throughout the study period. pH showed negative correlation with available potassium in the study and the seasonal fluctuations in the pH value was observed. Electrical conductivity values were found to be maximum in summer followed by winter. The electrical conductivity values were positively correlated with organic carbon, sodium, potassium and available potassium. The organic carbon in the sediment of reservoir noticed maximum in summer and declining trend towards monsoon and again increasing trend of the organic carbon was observed during the winter months. Organic carbon showed positive correlation with sodium and potassium. Sodium and potassium distributed fairly well and showed seasonal fluctuations with relatively high concentration in summer and winter seasons. Sodium was positively correlated with potassium and available potassium but potassium showed positive correlation with total nitrogen, available phosphorus and available potassium. The available phosphorus and potassium contents showed distinct seasonal variations and are found to be maximum in summer and minimum in rainy season of both the years of study period. The available phosphorus values showed positive correlation with potassium while available
potassium values showed positive correlation with electrical conductivity, sodium, potassium and showed negative correlation with pH.

5. The phytoplankton community in the reservoir was represented by cyanophyceae, chlorophyceae, bacillariophyceae, desmids and dinophyceae among these bacillariophyceae contributed 30.19 and 30.94 percent of the total phytoplankton in 2003 and 2004 respectively. There was no distinct differences between summer and winter densities during both the years, however, they exhibited peak during summer and low in monsoon periods. The higher density of phytoplankton in reservoir indicates the trophic status. Cyanophytes accounted only 6.92 and 7.7 percent of the total phytoplankton in the reservoir and found maximum in winter season. This group was represented by Oscillatoria, Microcystis aeruginosa, Lingbya limnetica and Anabaena circindalis, however, these species exhibit very less in number.

Cyanophytes were positively correlated with dissolved oxygen, nitrate, phosphate, ostracods, copepods and inversely correlated with total hardness, total alkalinity, electrical conductivity, calcium, magnesium, sulphate, bicarbonate, total dissolved solids. Chlorophytes contributed 30.98 and 30.05 percent of the total phytoplankton in the Almatti reservoir. Seasonally the maximum density was recorded in winter followed by summer and less in monsoon months. This group was represented by Ankistrodesmus falcatus, Pediastrum simplex, P. duplex, P. calthratum and Coelastrum cambricum. In the present study Pediastrum species were dominant among all species. Chlorophytes population was positively correlated with bacillariophytes, desmids, dinophytes, copepods and with rotifers, but inversely correlated with
rainfall, humidity, pH and with chloride. Bacillariophyceae contributed 30.19 and 30.94 percent of the total phytoplankton and found the dominant group. This group was represented by Cyclotella sps., Cymbella cymbiformis, Gomphonema sps., Pinnularia viridis, Melosira granulata, Nitzschia sps., Navicula sps. Synedra ulna and Rhizosolenia longiseta. All these species found throughout the study period and recorded maximum density in summer followed by winter and minimum in monsoon months. Bacillariophytes were correlated positively with total hardness, total alkalinity, bicarbonate, magnesium, total dissolved solids, desmids, copepods and with rotifers. Whereas inverse correlation was found with rainfall, humidity, pH, phosphate and with cladocerans.

Among five groups of phytoplanktons identified in the reservoir the diatom was the dominant group followed by dinophytes, chlorophytes, cyanophytes and desmids. Cymbella cymbiformis, Pinnularia viridis, Navicula and Synedra ulna were the dominant forms among the diatom Ceratium and Peridinium among dinophytes, Oscillatoria sps. and Lyngbya limnetica from cyanophytes, Pediastrum sps. and Ankistrodesmus falcatus from chlorophytes, Closterium setaceum, Cosmarium bicalatum from desmids. The optimum DO temperature and low phosphate level appears to influence desmid growth, colder months stimulated the growth of chlorophyceae. Temperature influences the growth of diatoms. Desmids grow in the waters which are generally free from pollution. This group contributed 3.18 and 3.43 percent of the total phytoplankton. Seasonally maximum abundance of desmids recorded in winter followed by summer and minimum in monsoon.
In the present study, desmids were represented by 4 species viz., *Cosmarium biculatum*, *Closterium setaceum*, *Staurstrum cingulum* and *Arthrodesmus convergens*. In this group, *Cosmarium sps.* found maximum density throughout the study which indicate clean water fit for human consumption. Desmids were correlated positively with nitrate and negatively with rainfall and humidity. Dinophytes were also abundantly seen in Almatti reservoir and they were contributed 30.98 and 30.05 percent of total phytoplankton population during 2003 and 2004 respectively. The maximum density of this group was found in summer and minimum in monsoon season. Dinofyhts represented by 3 species viz., *Ceratium sps.*, *Tintinnid joricas* and *Peridinium*. Dinophytes were positively correlated with total alkalinity, total hardness, calcium, electrical conductivity, bicarbonate, total dissolved solids, magnesium, rotifers and negatively correlated with rainfall and humidity.

6. Zooplankton community represented by four groups viz., cladocera, copepoda, ostracoda and rotifera. The rotifera and cladocera formed the dominant groups besides copepoda and ostracoda. Rotifera in the reservoir accounted 49.18 and 49.36 percent of the total zooplankton. *Brachionus* and *Karatella* were dominant among the rotifera, *Daphnia* sp amongst the cladocera, *Paracyclops fimbriatus* and *Nauplius larvae* from copepods and ostracods was poorly represented by *Cypris* sps. Cladocerans were the subdominant group of zooplankton and contributed 25.32 and 26.40 percent of total zooplankton in 2003 and 2004 respectively. Cladocerans were found maximum in monsoon and minimum in summer season. This group was represented by *Alona rectangula*, *Diaphanosoma excisum*, *Daphnia carinata*, *...*
Bosminia longirostris, Moina brachiata and M. micrura. Cladocerans were positively correlated with rainfall, humidity and phosphate, but negatively correlated with total alkalinity, bicarbonate, total dissolved solids, electrical conductivity, bacillariophyceae and with dinofytes. Copepods contributed 17.83 and 17.50 percent of total zooplankton in 2003 and 2004 respectively. Seasonally copepods were found maximum in winter and minimum in monsoon period. This group was represented by Mesocyclops hyalinus, Tropocyclops prasinus, Paracyclops fimbriatus and Nauplius larva. Statistically copepods were positively correlated with phosphate and chlorophyceae. While negatively correlated with chloride, rainfall and humidity were recorded. Ostracods contributed less to the zooplankton community and it accounted 7.66 and 6.71 percent of the total zooplankton in 2003 and 2004 respectively. Ostracods were found maximum numbers during winter. This group was represented by only Cypris sps. Ostracods showed positive correlation with dissolved oxygen, nitrate and cyanophytes. Whereas negative correlation showed with air temperature, total alkalinity, total hardness, magnesium, chloride, sulphate, bicarbonate, total dissolved solids and electrical conductivity. Rotifers formed the dominant group of zooplankton community and contributed 49.18 and 49.36 percent of total zooplankton in 2003 and 2004 respectively. Seasonally rotifers were abundantly found in summer season during both the years of study. Rotifers were represented by Brachionus diversicornis, B. caudatus, B. calyciflorus, B. rubens, Asplanchana priodonta, Tricocera cylinderica, Lecane ploenensis, Keratella tropica, K. cochlearis and Notholca sps. Statistically rotifer group
showed positive correlation with total alkalinity, calcium, chlorophytes, diatoms, desmids and with dinophytes while inverse correlation was showed with rainfall, humidity and phosphate.

7. Macrophytes serve as suitable substrate. Macrofauna such as insects, molluscs and fishes were studied from the reservoir. Gastropods and insects were supplementary food for fish life in reservoir. The distribution and diversity of molluscs remain close association with macrophytes, water and sediments quality for their normal life. Most of the gastropods and bivalves were confined to shallow water zones are the reservoir. Molluscs were showed positive correlation with total alkalinity, calcium, magnesium, sulphate, bicarbonate, electrical conductivity and with total dissolved solids, while negative correlation showed with rainfall and humidity. The reservoir sustain great diversity of fauna. Thus the reservoir plays a very important role in maintaining the biodiversity.

8. Statistical analysis was carried out to correlate the interrelationships among the abiotic and biotic factors. It revealed that their exists significant relations between the biological and non-biological factors.

5.2 CONCLUSION

The present investigation deals with limnobiotic status, water and sediment quality, micro and macroorganisms and ecological equilibrium in the reservoir. The study revealed that there exists a seasonal fluctuations of the factor and from data it was also apparent that various correlations between the factors could be seen. However, it is obvious that the absence of significant difference between sampling
stations for all these parameters in the Almatti reservoir indicated fairly homogeneous conditions and the water quality is also found to be homogeneous.

The distribution and population density of phyto and zooplankton species depend upon the physico-chemical factors of the environment. The benthic fauna constituting the food of fish, can be utilized for extensive culture operation so that the nutrient in the reservoir is not only properly cycled but also serve as a check on further eutrophication.

Studies on the water and sediment interaction for nutrients and productivity status and need detailed investigations stratification of various organisms in relation to selected physical and chemical factors are necessary in future. The detailed diurnal studies on the estimation of micro plants and their density along with zooplankton need to be investigated. The density and distribution of macrophytes aquatic insects, fish and fish production are required. In addition data generated in the form of a memoir are essential, so that this information may be used as decision makers for conservation and effective utilization of water bodies particularly reservoirs. The present study revealed that Almatti reservoir is of the better quality, although there is need in continuous monitoring to maintain the quality of drinking water. However, government should take necessary steps to beautify the water of the reservoir before reaching eutrophic condition. The results showed that Almatti reservoir water is suitable source for supply of water for drinking, irrigation and also useful for fish culture.