

Chapter-6

Summary and conclusion

The present work deals with the comparative study on the freshwater algal diversity of Bahrathapuzha river and Bhavani river. Bharathapuzha or 'Nila' is the second longest river in Kerala, with a prolonged outstanding contribution to the cultural, social and commercial developments of the state. It originates from Anamalai hills and flows through three districts in Kerala namely Palakkad, Malappuram and Thrissur. The Bhavani river begins in Tamil Nadu and flows through Kerala's Silent Valley before entering western Tamil Nadu after a few kilometres in Palakkad district. Silent Valley is the most ecologically diverse area on Western Ghats. A severe ongoing consequence of anthropogenic interferences are escalating in this river especially sand mining and the associated activities, which gradually reveals the current study area's ecological health. Freshwater phytoplankton are ecologically significant because they are the major resource in aquatic ecosystem with their capacity of producing organic matter. The freshwater river bodies in Palakkad district is the source of drinking water to thousands of people living on its banks. The river's ability to self-purify is being harmed by polluted river water, low or no river flow, sand mining, and deteriorating catchment area. Presence of check dams and construction activities in this river also restricted the flow of water and are projected as one of the reason for the presence of pollution.

The present study is the first attempt to elucidate the algal diversity from the river ecosystem in Palakkad district. Ten stations were surveyed for qualitative and quantitative distribution of phytoplankton for a period of one year from October 2018 to September 2019. The physico chemical parameters analyzed were temperature, pH, TDS, EC, dissolved oxygen, nitrate, phosphate and silicate. The study has brought out the spatiotemporal variation of the above parameters and identified all the parameters except DO was higher in pre monsoon compared with other seasons. Spatial variation

in parameters revealed that higher values observed in stations Malampuzha, Kalpathy, and Kannadi respectively. All the parameters showed a decreasing trend with increase in altitude.

Analysis of water samples reveal the presence of total of 257 taxa belonging to 70 genera, 26 families, 9 order and 6 classes namely Chlorophyceae, Xanthophyceae, Bacillariophyceae, Euglenophyceae, Cyanophyceae and Dinophyceae were identified from the 10 stations. The chlorophyceae, bacillariophyceae and euglenophyceae were the major group in the present study. *Micrasterias laticeps* var. *acuminata* is a new species to India and 11 species are new to Kerala. Out of the 257 taxa, 88 species to chlorophyceae, 1 species to xanthophyceae, 74 species to bacillariophyceae, 69 species to euglenophyceae, 24 species to cyanophyceae and 1 species to dinophyceae. Due to similar environmental conditions such as climate, rainfall and physico chemical characteristics, the majority of the recorded taxa were common to all of the studied river sites. The most frequent taxa belong to the class bacillariophyceae are *Synedra ulna*, *Aulacoseira granulata*, *Navicula cuspidata* and *Fragilaria intermedia*. pH and temperature maximum at Malampuzha station and during the month of May, which supported the maximum growth of bacillariophyceae. Quantitative analysis of phytoplankton also showed maximum at Malampuzha during May and least occurrence at stations Mukkali and Seenkara during the month of June. During the pre monsoon season, there was a greater diversity of algae, and it is thought that this is the best season for algal proliferation. The current study shows that the algal flora in freshwater river ecosystem is properly correlated to different environmental factors.

Irrespective of the monthly variation, chlorophyceae were recorded in high number throughout the study period, but highest proliferation seen in pre monsoon. Most dominant species include *Cosmarium quadrum*, *C. blyttii*, *Scenedesmus*

quadricauda, *S.acuminatus* and *S.perforatus*. Presence of appropriate amount of organic matter and low DO in pre monsoon favours the proliferation of euglenophyceae and cyanophyceae. The dominant species are *Euglena acus*, *E.proxima*, *E.splendens*, *Trachelomonas volvocina* and *T.hispida*. The dominant species under cyanophyceae are *Microcystis aeruginosa*, *Oscillatoria limosa* and *Chroococcus turgidus*.

Highest Shannon index value was obtained from Malampuzha during May and least at Mukkali station during June. The same result is observed in Simpson diversity index and species richness. SIMPER analysis of the data confirmed that major station wise contributing percentage at station 7 (Malampuzha) and monthly variations maximum in May. The analysis of similarity (ANOSYM) within stations and months can be used to determine statistical significance. The multivariate similarity analysis (Bray-Curtis) based on phytoplankton abundance and composition in different stations formed, stations from Bhavani river (Mukkali and Seenakara) differed from that of the other stations during the monsoon and post monsoon months.

CCA ordination plot has unveiled statistically significant influence of physico chemical characteristics on phytoplankton abundance. The axial plot explained temperature, pH and TDS have significant influence on abundance and composition of organisms during months in pre monsoon and have effect on the abundance of only bacillariophyceae and euglenophyceae. In monsoon season, temperature, nitrate and silicate have strong effect on the algal growth. Temperature, pH, nitrate and phosphate have strong correlation on the abundance of chlorophyceae and bacillariophyceae. These findings show that temperature and pH are the most important variables in determining algae diversity, regardless of other factors. In total, the algal species diversity in the rivers of Palakkad district determined by the

temperature and alkalinity level. The presence of algal species *Pandorina morum*, *Cosmarium obsoletum*, *Fragilaria construens* var. *venter*, *Euglena deses* fo. *intermedia*, *Trachelomonas armata*, *Phacus lefevrei*, *Phacus splendens* and *Lepocinclis playfairiana* are the regularly reported taxa in all the seasons.

Palmer's pollution index revealed that high organic pollution recorded in the stations Malampuzha, Kalpathy, Kannai and Chulliyar because of the presence of pollution tolerant algal genus such as *Euglena*, *Oscillatoria*, *Scenedesmus*, *Navicula* and *Nitzschia* has been considered as indicative of water bodies. Only light organic pollution observed in stations Mukkali and Seenkara. These stations are located at high altitude and flow through Silent valley. Human intrusions as well as all other external activities are strictly restricted in that area. This improves the quality of water good while among the other stations.

Malampuzha is the most polluted area on the Bharathapuzha river. The urban sewage canals are directly open through that area. A paper mill is working very close to that station, wastes from there also directs the river. The Shannon and Wiener's diversity index value revealed that present study area is highly polluted ecosystem based on the distribution of species. According to Boyd's diversity index value, moderate level of pollution persists in that area throughout the year, except during the months in monsoon season.

The taxonomy and ecology of freshwater algae revealed that the river ecosystem of Palakkad district is moderately polluted and high organic pollution occurs in some regions such as Malampuzha, Kalpathy and Kannadi. Hydrology of river displayed statistically significant spatiotemporal variations in physico chemical characteristics. Fertilizers, nutrients and wastes that are dumped into the river cause deterioration of the water quality to some extent. The river now faces serious threats

to its existence. The river's course is expected to change due to the obstruction of tall grasses and bushes that have grown in the river. Excessive sand mining from the river has resulted in the degradation of the river bottom in certain regions. The comparative study of the algal community from undisturbed areas of the Bhavani river with that of Bharathapuzha river aids in distinguishing the human impact on the freshwater ecosystem. Proper conservation measures must be adopted to protect the river from anthropogenic interferences. Appropriate afforestation packages along the river basins, renovation of river margin vegetation, controlled mining of the sand, sustainable use of the resources of the river are crucial to conserve this freshwater body. The study of fresh water algal diversity in rivers of Palakkad district would serve as a valuable reference for the monitoring and management of freshwater river ecosystem.