Diyawanna lake

Phytoplankton diversity in the Diyawannawa wetland

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Phytoplankton play a significant role as primary producers in marine and freshwater food webs and contribute to nearly half the global primary production (Boyce et al., 2010). In addition, they are important components in the ocean's ultra-long-term carbon cycle since they have the ability to lock CO_2 which is dissolved in water. When they die, this CO_2 trapped material sinks as organic matter to the bottom of the ocean and is prevented from being released back into the atmosphere (Nellemann and Corcoran, 2009). Phytoplankton are very sensitive to environmental changes. There are many factors that affect their growth such as the temperature of the water column, light and availability of nutrients. In addition to the major factors, phytoplankton can be lost in lentic waters through their suspension due to mortality caused by resources or other physiological limitations, by infected diseases, by grazing, or when they are attacked by parasites such as bacteria, virus or fungi (Silva, 2007).

According to the Water Framework Directive (WFD), European Union 2000, phytoplankton posses several characteristics which make them favorable for use as a biological assemblage to evaluate ecological status of water bodies. In comparison to other aquatic species, phytoplankton are more sensitive to the combined effects of environmental stressors and can show early responses to various environmental influences (Vinebrooke, et al., 2004). These environmental influences can be either natural variabilities or anthropogenic influences (Cabecinha et al., 2009).

Among all the water bodies that exist on Earth, receiving water bodies such as lakes and rivers are the most essential resources available for human existence and settlement. Therefore, the quality of water in receiving water bodies is important. However, rapid population growth and an increase in urban activities significantly influence the water quality of receiving water bodies (Goonetilleke et al., 2005). This is mainly due to the deterioration of water quality because of the higher pollutant loads in surface water.

Water pollution occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds. Sources of surface water pollution are generally grouped into two categories based on their origin as point source pollution and non-point source pollution. Water quality can be described by the physical, chemical, and biological status of water. Water quality parameters provide important information about the health of a water body. These parameters are used to determine whether the quality of water is good enough for drinking, bathing, recreation, irrigation, and aquatic life.

The present study was conducted in the Diyawannawa wetland system. The Colombo metropolitan city was declared a Ramsar wetland city according to the International Ramsar Convention 2018. Among the eighteen wetland systems located in the Colombo wetland city, the Diyawannawa wetland is a very important ecosystem in terms of social, environment and economic aspects. In this study phytoplankton diversity in relation to water quality in different sites in the Diyawannawa wetland system was analyzed.

According to the result, there was no significant spatial variation of water temperature and pH levels among study sites. However, total phosphorous, dissolved phosphorous, chlorophyll- a concentration, conductivity and salinity were significantly high in sampling sites located near the input streams flowing through the human settlements, compared to those near the pristine ecological areas. Nitrate concentration was significantly high in areas receiving runoff from the surrounding paddy fields.

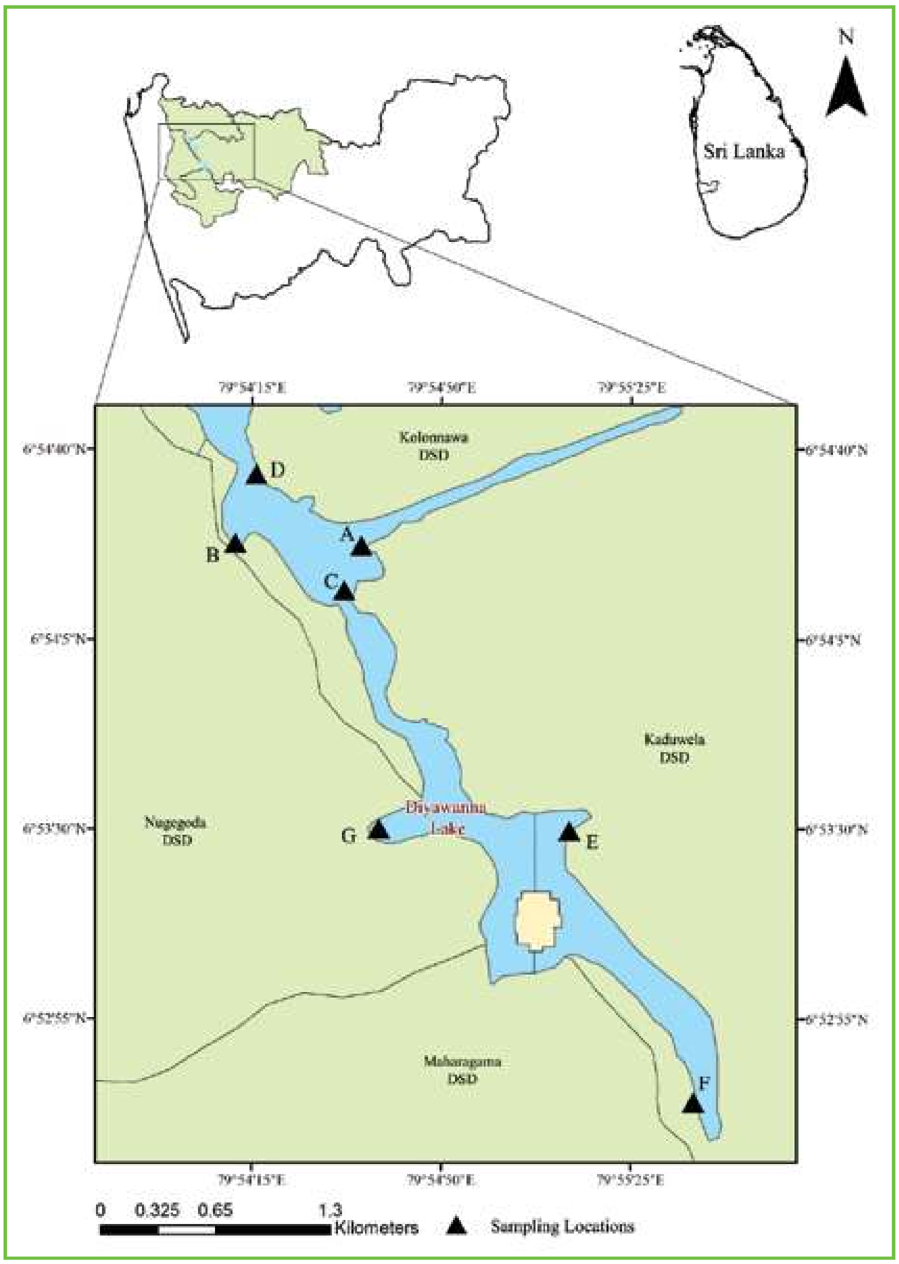

Figure 02 – Locations of selected sites in Diyawanna lake

Seven sampling sites were selected covering main input streams to the lake. In each site water temperature, pH levels, Dissolved Oxygen (DO), conductivity, salinity, Total Dissolved Solids (TDS), total dissolved phosphate, total phosphate, nitrate concentration, chlorophyll-a concentration and Biochemical Oxygen Demand (BOD) were measured and phytoplankton samples were identified using the relevant keys (Abeywickrama and Abeywickrama, 1979) to the lowest possible taxonomic level.

Recommended water quality and phytoplankton management programs are conducted as awareness programs for people and businessmen in the area. Continuous water quality monitoring is very important as are rules and regulations to control point and non-point sources.

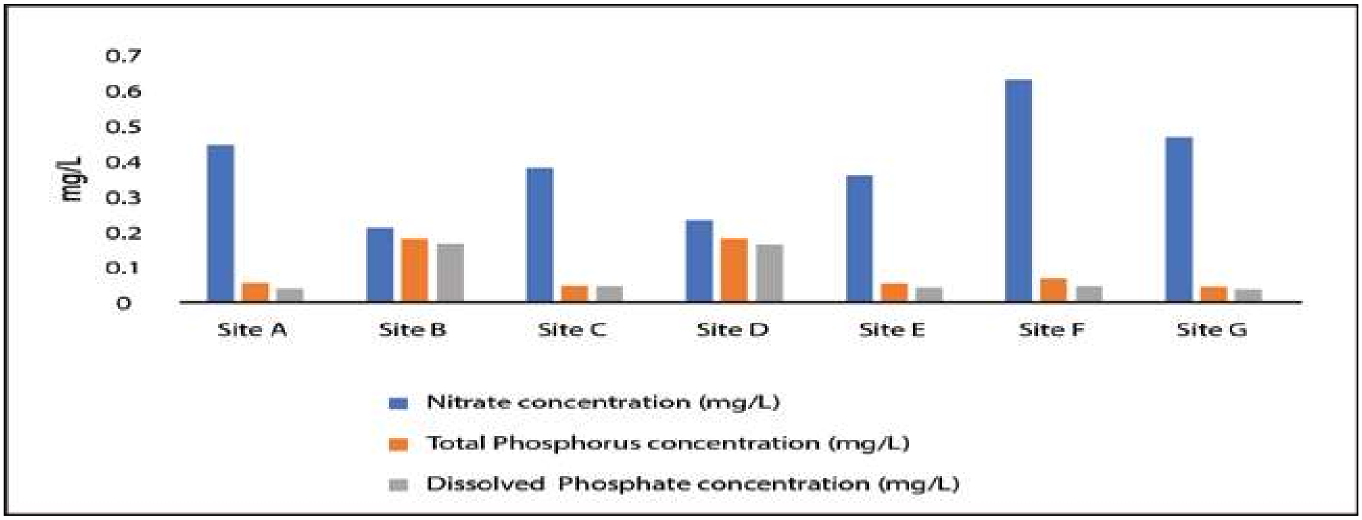

Figure 03 – Illustration of spatial variation on selected water quality parameters

From this study, 50 phytoplankton species were identified and categorized into five different classes. They are Cyanophyceae, Chlorophyceae, Zygnematophycae, Euglenophyceae and Bacillorphyceae. According to the results the most abundant species was *Spirulina sp.* and the subdominant species was *Melosira* sp. The abundance of these abundant phytoplankton species correlated with the eutrophication indicating water quality parameters.

Table 1 – List of identified phytoplankton species

Class Chlorophycea	Class Cyanophycea	Class Bacilliriophycea	Class Zygnematophycea	Class Euglenophycea
Ankistrodesmus sp.	*Anabaena sp.*	*Cymbella sp.*	*Arthrodesmus subulatus*	*Euglena sp*
Chlamydomonas sp.	*Chroococcus limneticus*	*Cyclotella sp.*	*Closterium sp.*	*Phacus sp*
Coelastrum microporum	*Chroococcus turgidus*	*Fragilaria sp.*	*Closterium kuetzingii*	*Trachelomonas sp.*
Crucigenia sp.	*Coelasphaerium sp.*	*Melosira sp*	*Closterium ehrenbergii*	
Kirchneriella sp.	*Gloeocapsa sp*	*Navicula sp*	*Cosmarium sp.*	
Oocystis sp.	*Merismopedia glauca*	*Synedra sp.*	*Staurodesmus sp.*	
Pediastrum biradiatum	*Merismopedia sp.*		*Penium sp.*	
Pediastrum boryanum	*Microcystis aeruginosa*		*Pleurotaenium sp.*	
Pediastrum clathratum	*Microcystis incerta*		*Micrasterias sp.*	
Pediastrum duplex	*Oscillatoria sp*		*Onychonema filiforme*	
Pediastrum simplex	*Rivularia sp.*			
Pediastrum tetras	*Spirulina sp*			

Class Chlorophycea	Class Cyanophycea	Class Bacilliriophycea	Class Zygnematophycea	Class Euglenophycea
Scenedesmus sp.	*Nostoc sp.*			
Selenastrum bibraianum				
Tetrastrum sp.				
Tetraerdron sp.				
Tetrallantos lagerheimii				
Volvox sp.				

The present study reveals that the areas with human settlements are prone to eutrophication. The results of the study also indicate that there is a possibility to use dominant phytoplankton species as indicators of eutrophication in the Diyawannawa wetland. However further research covering both monsoon and inter-monsoon periods are needed to confirm the findings.

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