ANALYSIS OF NUTRIENTS IN KURUNEGALA LAKE, SRI LANKA.

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ABSTRACT

Eutrophication which results with the nutrient enrichment of water bodies such as rivers and lakes have become a major environment issue as it deteriorates the water quality as well as the esthetic appearance of water bodies. In this context the regulatory authorities strive to mitigate the nutrient enrichment in water bodies and hence to safeguard the fresh water system for the benefit of the human. This study is focused on understanding the extent of nutrients loading and influential parameters for nutrient loading in Kurunegala Lake, Sri Lanka which has already been faced to the threat of eutrophication. The research confirmed that the more than 80% of the total nitrogen is attributed to the nitrate and the extent of loading depends on surrounding land use characteristics of the catchment. The study also found that the nitrate content of the surface lake water is in the range 1.401 ppm to 5.037 ppm the phosphate content of the lake water studies was found in the range of 0.05 ppm to 4.56 ppm.

Key words: Eutrophication, Nutrients, Water Quality

1. INTODUCTION

Eutrophication of water bodies such as rivers and lakes results with the enrichment of nutrients which mainly includes Nitrogen (N) and Phosphorus (P) has become one of the most significant and widespread water quality issues in the global environment [3,4]. Excess nutrients have been identified as the leading cause of impairment in lakes and coastal water and the second leading cause of impairment to rivers and streams [5].

Form the water quality perspective, the most important forms of N and P are nitrate (NO_3^-), Nitrite (NO_2^-) or ammonia (NH_3^+), Organic nitrogen and phosphate (PO_4^{3-}). Several researchers have recognized human activities as a major source of nutrients to water bodies [2,4]. However, the sources and extent of contribution of nutrient loading to water bodies is highly varying with the surrounding catchment characteristics such as land use.

In order to mitigate the adverse impact of eutrophication of water bodies the long term water quality objectives must be developed and established. In this context, the understanding of the extent and variability of nutrient contribution to the water bodies which are already been subjected to the eutrophication and has faced to the threat of eutrophication is in crucial importance. This study was mainly focused on investigating the extent of nutrient loading and its variability with catchment characteristics in Kurunegala Lake which is one of the most beautiful and well known lake in Sri Lanka.

2. METHODOLOGY

Kurunegala Lake which is situated at North Western Province in Sri Lanka was selected for this study. Most importantly this lake is used as one of the main intakes to supply drinking water to the Kurunegala town area. This lake has been identified as a regional water body which has been subjected to occasional eutrophication during recent past. According to the National Water Supply and Drainage Board (NWSDB), Kurunegala, Sri Lanka, this Lake had been cleaned two times from 2003 and 2010 due to the algae growth.

Five sample locations from the lake were selected to collect the samples. They are Intake, Mouth of North channel, Mouth of mode ale, Law level and Mouth of Wawegala inflow. (See Figure 1) These locations were selected in order to cover the whole region of the lake considering the geographical maps and the contour maps of the catchment.

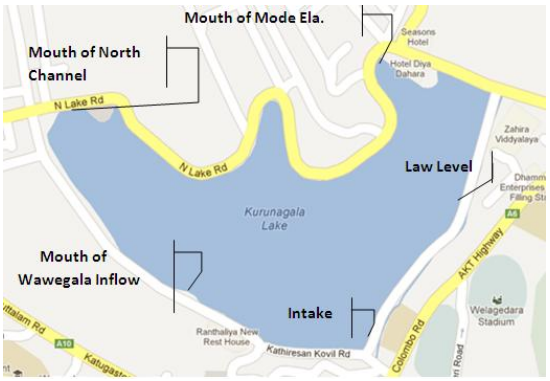

Figure 1 : Kurunegala Lake and sampling points

Intake is the place where the water is taken from the lake to the water treatment plant. "Mode ale" is the cannel which brings all the drained water from the paddy fields to the lake. Both "Wawegala Inflow" and "North cannel" are two streams which bring drained water from the rest of catchment. Law level is the location where the deepest part of the lake is located.

Samples were collected in every month for the period of July, 2010 to August 2011 from the selected sample locations. The collected samples were tested for total N, total P, Colour, pH, Turbidity, Electrical Conductivity, Chloride, Alkalinity, Fluoride, and etc. All the testing was done by the Chemical Laboratory, NWSDB, Kurunegala according to the APHA, (2001).

The collected data was analyzed using Ms Office Excel 2007 software package.

3. RESULTS.

The analysis revealed that the highest total nitrogen content is at the Intake (See Figure 2). This can be attributed to the relatively higher depth in the intake and the sedimentation which could leads to accumulate considerable load on nitrogen [6]

From the analysis it is also reveal that the second highest nitrogen concentration is at the Mouth of Mode Ela. In addition to the data analysis, according to the geographical map of the catchment and the surrounding areas of the lake it is clear that Mode Ela brings huge amount of water from the paddy fields which consists with fertilizers, pesticides and weed killers. Moreover, as more than 70% of the surrounding of the lake consists with hotels and residential areas during the rainy seasons runoff could carry significant amount of nutrient loads generated due to the residential and commercial activities.

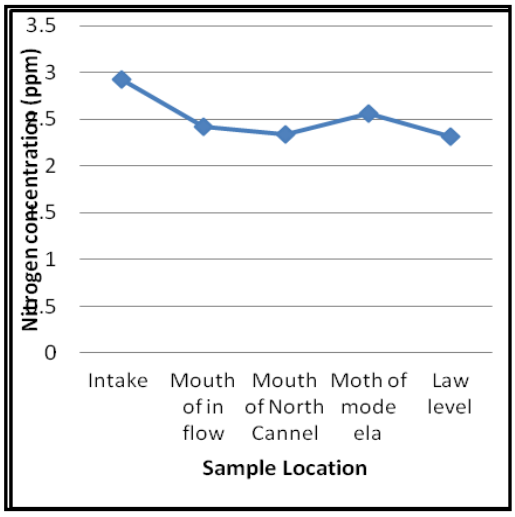

Figure 2: Variation of Total Nitrogen Concentration

Furthermore, as shown in the Figure 3 more than 80% of total nitrogen amount is attributed to nitrate compare to the nitrate and ammonia (See Figure 3). This can be mainly attributed to the runoff from the agricultural lands which could carry considerable amount of nitrates due to the use of fertilizers in the surrounding paddy fields and other cultivated lands. Furthermore, domestic sewerage discharges and washing clothes using detergents especially close to Wawegala area where about 25 families live unauthorizedly can also be major sources of nitrate and total nitrogen to the lake water.

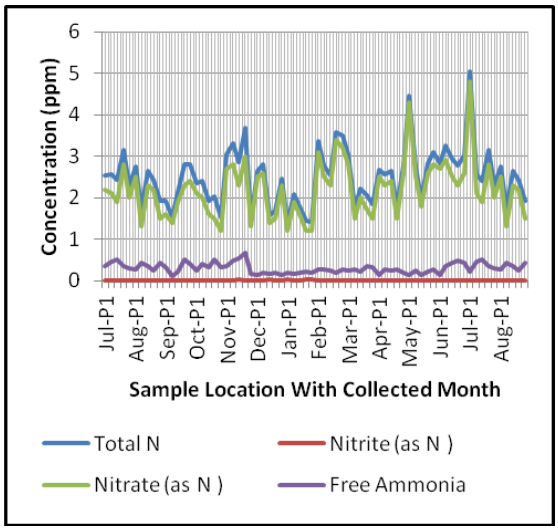

Figure 3: Variation of Nitrogen Component with Collected Month

Highest amount of Phosphorous concentration found at the Mouth of North cannel (See Figure 4). Geographical map shows that this catchment area is consist with the coconut estates where the highest amount of phosphorous concentration can be due to the fertilizer.

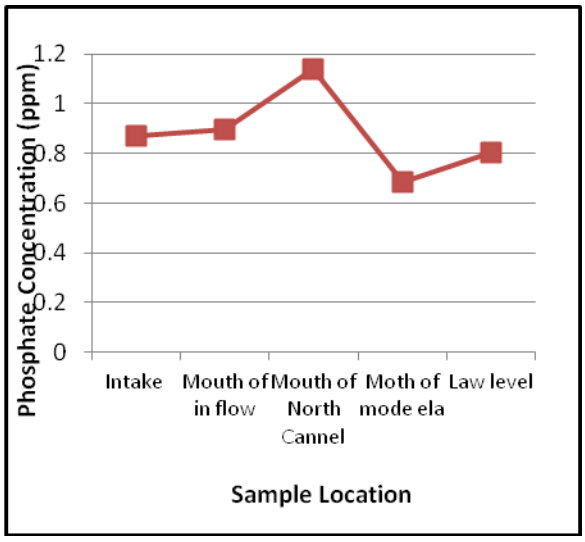

Figure 4: Variation of Total Phosphate Concentration with the Sample Location

Figure 3 and Figure 5 shows increasing trend of total nitrogen and PO43- concentration between 2010 and 2011. This can be attributed to two reasons. Firstly, increasing anthropogenic Figure 3 and Figure 5 shows increasing trend of total nitrogen and PO43- concentration between 2010 and 2011. This can be attributed to two reasons. Firstly, increasing anthropogenic activities could have a significant impact on Lake Nutrient loading. Secondly, the amount of nutrient can increases due to the increase in siltation with the increases amount of soil erosion and other related human activates. It can be hypothesized that the reason for occasional eutrophication is due to this variability of the accumulation of nitrogen with time.

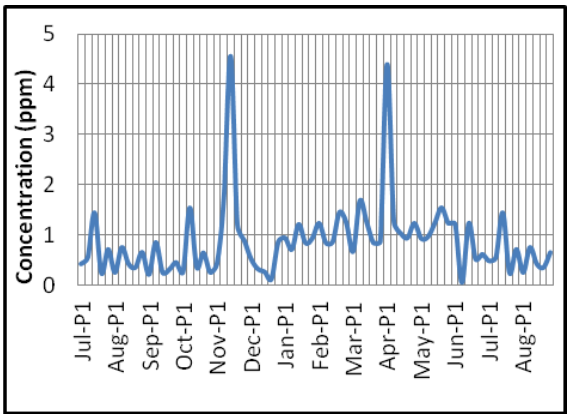

Figure 5: Variation of Phosphate Concentration with Collected Month

4. CONCLUSION.

This research concludes that the presence of nutrients especially nitrogen and the phosphorus in the Kurunegala lake, leads to eutrophication. The variability of the extent of the siltation and the anthropogenic activities in the surrounding area of the lake can be the major reasons for the occasional eutrophication. It is also found that more than 80% of the Total nitrogen is attributed to the NO^{3-} .

In order to minimize the eutrophication it is recommended that the periodic monitoring of lake water quality, source recognition of nutrient loading to the lake and the degree of contribution are in crucial importance.

It is also be recommended that implementation of preventive measures and best management practices such as storm sewers, would also be effective in minimizing nutrient loading due to non point source pollution.

5. REFERENCES.

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