GROUNDWATER QUALITY VARIATION IN KALPITIYA PENINSULA - SRI LANKA

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ABSTRACT

This study presents an evaluation of ground water quality in a unique coastal ecosystem Kalpitiya, which is a low-lying peninsula in north-western coast of Sri Lanka. This peninsula appears as a narrow strip of land which has an area of 160sq km and geographically it is bordered by the Indian Ocean from one side and Puttalam lagoon from inland. One salient feature of this landscape is that it comprises mainly of sand dunes. In addition, coconut and other cultivation and scrub land dominate in the area. Ground water is the main source of water supply for domestic and agricultural needs. The main impact on ground water is believed to be from the sea water intrusion and agricultural activities.

Objective of this study was to evaluate the physical quality of ground water during the dry season. Field investigations were carried out for 3 months (December 2013 to February 2014- dry season) and water samples collected from a network of dug wells were analyzed for pH, Electrical conductivity (EC), Temperature and Salinity. ArcGIS 10 package was used to identify the spatial distribution of ground water characteristics. Inverse distance weighted (IDW) technique of Spatial analysis tool was used in ArcGIS 10 version and maps were developed.

The study revealed that the range for the pH values was recorded between 6.8 and 8.5 mg/L. Average Electrical Conductivity (EC) was recorded between 103 µS/cm – 33016 µS/cm and average Salinity was recorded between recorded 0.1ppt - 31.40ppt during the sampling period. Talavila area, average EC was recorded as 33016µS/cm and salinity was 31.4 ppt. pH of water too was high in that area reaching the highest desirable level in Sri Lankan potable water standards (pH 7.0 – 8.5; SLS 614, 1983). This may be due to the contamination with ammonia based agrochemicals which are used heavily and higher evaporation rates. Electrical Conductivity levels were greater than the 750 µS/cm exceeding Sri Lankan standards. Thus, it is apparent that ground water in the area could not be recommended for domestic consumptions at least during the dry season. Changing climate resulting less rainfall and sea level rise will aggravate the problem.

***Keywords*:** Ground water, pH, EC, Salinity, Kalpitiya peninsula, GIS

1. INTRODUCTION

Ground water resource is most important to the human life and their activates. Specially for the drinking and for other domestic purposes. The quality of groundwater changes day by day and from source to source, which determines its use. Any change in the natural quality of water may disturb the equilibrium of the system and would become unfit for designated use. Sea water intrusion and farmers activities were pollute the ground water. In that case people were suffering in scarcity of pure water for drinking. A very rapid exploitation and utilization of the shallow groundwater resource of the North Central, North Western and North Eastern regions has been taking place over the last twenty years [2]. The water quality of the Puttalam Limestone aquifer and surrounding groundwater is affected by salinity, and some parts are also affected by nitrate and phosphate contamination (Kumarasinghe K.M.S.M. *et al*). The present research study was conducted to identify groundwter quality variation in the Kalpitiya peninsula.

2. STUDY AREA

Kalpitiya is a low-lying sand peninsula in north-west coast of Sri Lanka and it covers a total land area of about 160sq km. It was located between 79° 40'– 79° 50' Easting longitude and 8° 20' – 8° 90' Northern latitude. Figure 1 show the map of study area. Geographically it is bordered by the Indian Ocean from one side and Puttalam lagoon from inland. Coconut land, sand dunes,

scrub land and agro cultivated lands are main land cover in Kalpitiya peninsula [4]. Coconut and agricultural fields are the main two land use sector in this area. The climate is characterized by average annual rain fall between 500 – 600 mm from the North East monsoon between October and January. Average annual temperature of the Kalpitaya is maximum of 31^{o}C to minimum of 27^{o}C.

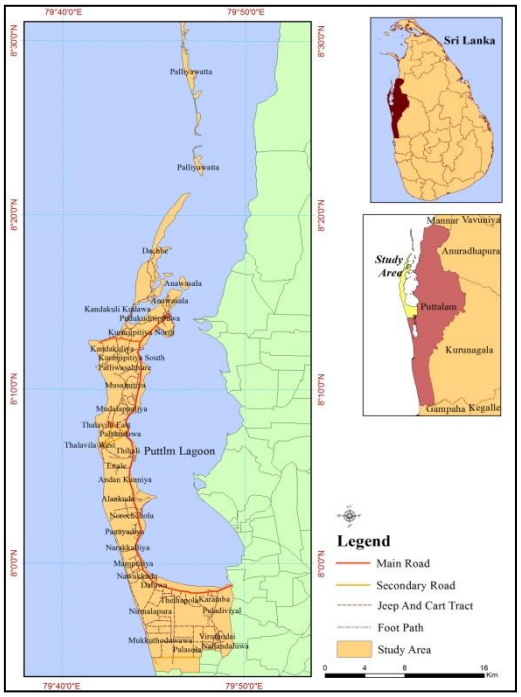

Figure 1: Study area of Kalpiyiya penisula

Study area has a total area of 202 Km2. The thirty six gramaniladhari divisions covered by selected study area. There were two District secretarial divisions (Kalpitiya and Mundalama). Thirty one divisions located in Kalpitiya as well as Five GN Divisions located in Mundalama GN Division. The people of Study area are mostly fishermen and farmer.

3. METHODOLOGY

Procedure for Analysis

Water sample were collected by using grid map. Study area divided by one km2, 4km2 and 8km2 grid. Figure 2 shows the map of grid. Sample locations were found out the center of grid. Global Position System (GPS – Magellan exploits 620) was helped for navigation to the location (Center point of grid). pH, Electrical Conductivity (EC), salinity and Temperature are measured on site using multi parameter. Water samples were tested during the period of December 2013 to February 2014. It will monitor continuously within 15 month in the future. Data was analysis using ArcGIS 10 package and Microsoft Excel 2010. Inverse distance weighted (IDW) technique of Spatial analysis tool was used in ArcGIS 10 version. All the data represent using maps and graph.

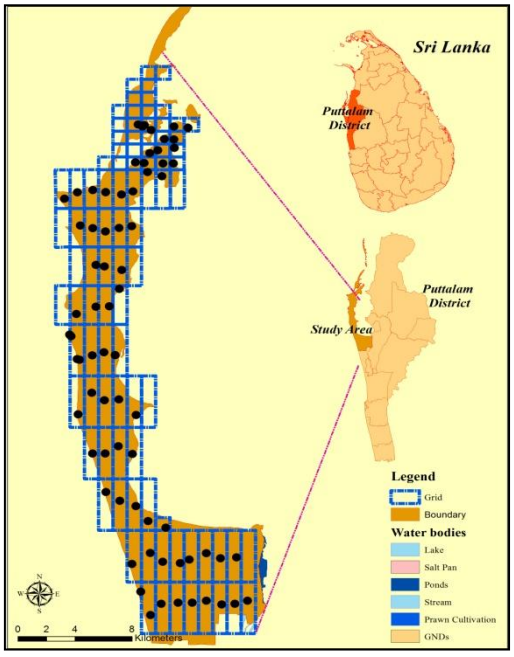

Figure 2: Distribution of Sample location and Grid in Kalpitiya.

4. RESULTS

Average pH values was recorded between 6.8 and 8.5 mg/L. highest average pH value was recorded close to Palliyawasathurei area (figure 3). It was 8.5 mg/L. Average lowest pH value was recorded Palaichola area and it was 6.8 mg/L. monthly pH value increase from the upper part to lower part (Mukkuthoduwawa) of the peninsula.

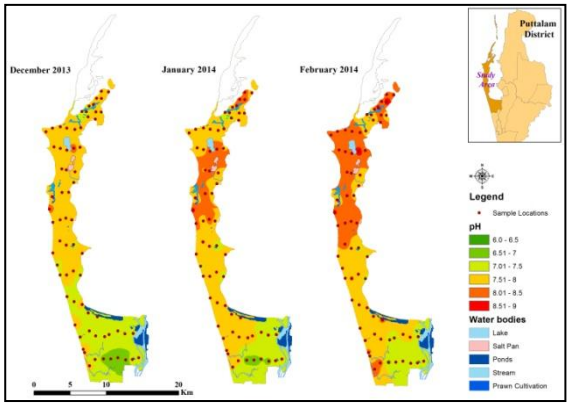

Figure 3: pH Distribution Kalpitiya in peninsula.

Average Electrical Conductivity (EC) was recorded between 103 µS/cm – 33016 µS/cm within these three months. Lowest value was recorded close to Mukkuthoduwawa, Daluwa area. Highest value was recorded close to Oddakkarai area. 52600µS/cm was recorded highest value in EC of the Ground water. It was recorded month of December close to Oddakkarai area. Figure 4 shows the spatial distribution of Electrical Conductivity in Kalpitiya peninsula.

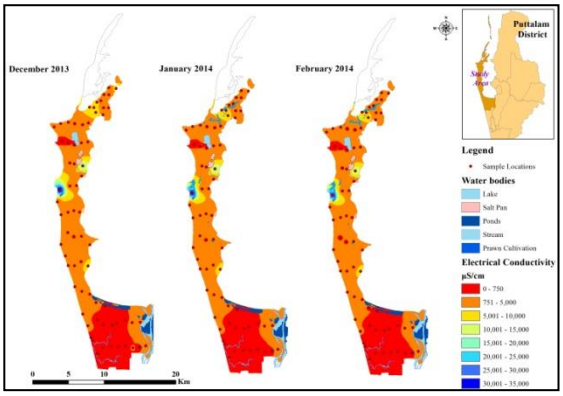

Figure 4: Spatial Distribution of Electrical Conductivity in Kalpitiya peninsula

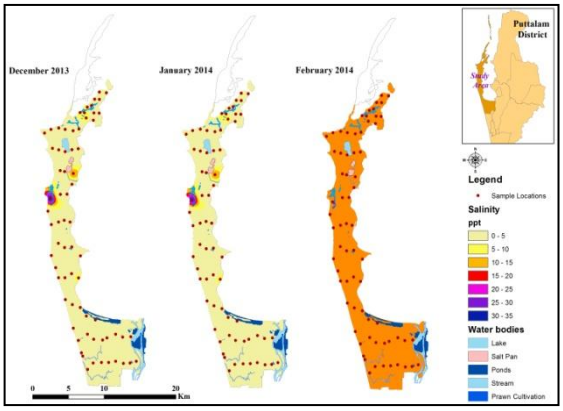

Figure 5: Distribution of salinity in Kalpitiya area

Salinity is a measure of the content of salts in water. Excessive amount of dissolved salt in water can affect agriculture, drinking water and ecosystem. Wind and human activities were providing salinity in this area. As well as clearing land cover and vegetation, salt water deranging in to the ground area and highly evaporation were affected to the salinization in Kalpitiya area. Anyhow, highest average salinity was recorded 31.40 ppt during the sampling period and lowest average salinity was recorded 0.1ppt in this three month. Temporally the highest salinity values were recorded in February in 2014 as well as the lowest values was recorded in December 2013 during the study period. Figure 5 shows the spatial distribution of salinity in Kalpitiya peninsula.

5. CONCLUSION

pH content and Salinity were increased in ground water with evaporation and decreasing ground water table. Majority of famers used agro chemical such as Ammonia contaminations for their farm. Because that OH- ions were increased. In that case pH value gets closer to Upper permissible level in Sri Lankan potable standards. Whole of the study area Electrical Conductivity (EC) level were greater than the 750 µS/cm. it was over the permissible level of the Sri Lankan drinking water standards.

6. ACKNOWLEDGMENT

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