ABSTRACT

Monitoring the surface run-off of a river on a regular basis provides valuable information on the eco-hydrologic conditions of a river basin. Such data provide valuable insights into spatial and temporal variation in water quantity and quality, considered as a measure of the health of a river. Such data are also a measure of the reliability of water quality models and their predictability. The physicochemical characteristics of any aquatic ecosystem and the nature and distribution of its biota are directly related and to influence by each other and controlled by a multiplicity of natural regulatory mechanisms. Because of it man's exploitation of the water resources, the normal dynamic balance in the aquatic ecosystem is continuously disturbed and often results in each dramatic response as depletion of fauna and flora, fish kill, change in physicochemical character etc. The river Tamiraparani is one of the few perennial rivers of the southern peninsular India extending between the latitude 8°10′ and 9°13′ N and longitude 77°10′ and 78°10′ E. The river originates in the eastern slope of the Western Ghats at an altitude of 2000 m above mean sea level. The river wander through a distance of about 125 km with a drainage area of 5896 km^2 and drains through three important geological formations, Archean rocks, Tertiary and recent sediments. The seven important tributaries of the river are Servalar, Karayar, Chittar, Manimuthar, Gadana, Pachiyar and Ramanathi. The present study focuses on greater details, of the spatial and temporal variations of river quality parameters such as physicochemical, organochlorine pesticides and pathogenic indicator microorganism loads of water and sediment constituents in the river.

The first phase of the present study focuses on the spatial and temporal distribution changes of major ions, nutrients, and its transport characteristics within the river and its flux to the Bay of Bengal. Spatial and temporal variations of dissolved major ions and inorganic nutrients (NO_2^-, PO_4^{3-}, and SiO_4^{2-}) parameters were measured

in water samples during premonsoon, monsoon, postmonsoon and summer seasons during 2007-08. In general, the nutrient concentrations were high in the upstream region but distinct changes were observed in different seasons. The high nutrient levels observed in the headwater during wet season rapidly decreases with increasing river order. In the mid-stream, the effect of dam plays a vital role in the temporary storage of nutrients during dry season. However, when discharge is high during monsoon, the effect of floodwater is felt far below, giving rise to very small spatial changes in nutrient levels in the downstream region. Thus, a clear stratification in nutrient content between the upstream and downstream reaches has been observed and is represented as: forest, watershed, agricultural inputs and damming activities.

The results show that the agricultural activities have causes 1.6 fold increase in nutrient level in the surface water during wet season, in comparison to the dry season. In the upstream region, the natural forest ecosystem enhances storage of N while the presence of reservoirs reduces nutrient concentration in the midstream significantly. Among the major ions, Sulphate contributes about >36.3%, HCO_3^- gives to 27% of the average chemical composition and is derived from both silicate (1.7%) weathering. Chloride contributes about 17.5%, followed by Na^+ (9%), Ca^{2+} (5%) and Mg^{2+} (1.8%) of the total dissolved solids. Other factors that probably influence nutrient distribution in the river include the N: P ratio-the nutrient utilization by phytoplankton or primary production. Phosphorus was found to be the controlling nutrient in this river basin. Two main problems have been identified based on the biogeochemistry of this river: i) effect of damming, which significantly restricts not only water movement but also nutrient fluxes from the upstream to the Bay; ii) non-point sources such as agricultural run-off, largely affects the surface water quality. In addition, the presence of large dams across the river plays a vital role in trapping the nutrients particularly during summer. Hence, we have observed a non-linear distribution of nutrients and other elements through the entire course of the river.

The second part of the study deals with the spatial and temporal variations of the pesticides in both surface and sediment samples. The major impacts of agricultural activities on the water quality are the following: i) increasing water quality deterioration due to addition of chemical fertilizers and pesticides; ii) possible eutrophication due to the leaching of fertilizers and pesticides. The influence of agriculture activities play a dominant role in causing a 7.8 fold increase in pesticides level in the surface water during monsoon, in comparison to the summer season. The low DDT concentration in the surface water of the river basin shows its restricted use for agricultural practices. The occurrence of DDT in high concentrations in the sediments is attributable to its non-degradable nature and its extensive usage in the past. The concentration of 17 organochlorine pesticide residues in surface water samples of the present studies are ranged from 2.5 to 79.9 ng l^{-1} and the ΣOCPs concentrations in sediments were varied from 1534.4 to 3839.7 ng g^{-1} – dry weight. The presence of multivariate OCPs in both water and sediments indicates prehistoric usage, non-degraded nature, agriculture and municipal discharge of pesticides in the river basin. Dieldrin and DDTs are the dominant OCPs present in water and sediment samples. The dominance of dieldrin in most of the water and sediment samples reflects the recent use of dieldrin for agriculture and other industrial purpose. The hydrological characteristic of the river basin, such as seasonal variation of flow and damming activities, can influence the spatial and temporal distribution of OCPs in water and sediments. New promising tools such as GIS, water nutrient and pesticides budgeting have been used in this study to map the most sensitive areas, vulnerable to water quality and quantity changes in the river basin.

In the third phase of the presence works was focuses on the enumeration of the pathogenic indicator organisms in the river water and sediment samples. The presence of such indicator organisms may provide indication of water borne problems and is a

direct threat to human and animal health. Monitoring of microbial contamination in the runoff of river should be an essential component of the protection strategy in river area. Total viable count (TVC) for water sample was high during the month of November and low during March in both water and sediments. In water, the mean TVC ranged from 1.1-14.2 [$\times 10^4$] m l^{-1} during November and 3.5–85.0 [$\times 10^3$] m l^{-1} during March. In sediments, the mean TVC ranged from 2.4-94.0 [$\times 10^4$] m l^{-1} during November and 0.83-61.0 [$\times 10^4$] m l^{-1} during March. Variations in total viable count (TVC) were large in both month and in all the sites. Commonly, the total coliform count was relatively higher in November (monsoon season) month than the other months, except Kuttralam (S6) and Tenkasi (S7). A lower count of total coliform was obtained during March and July month. In lower stretch of the study, high values of TC were obtained in November mainly in Eral (S17), Athoor (S18) and Punnakayal (S21). Because of sites S17, S18 are populated area and S21 is a fishing harbor. So these contribute high level of pollution in down stream region. Similarly, in middle stretch, higher counts obtained in Tirunelveli (S13), Srivaikundam (S15), Alwarthirunagari (S16) are due to the people use the river water for bathing purpose, cloth washing, and directly mixing untreated sewage, industrial and agricultural activities. In the case of upstream higher bacterial loads at Kuttralam (S6) and Tenkasi (S7) were observed during the months of July because, more tourist activities in this month.However, in upstream region the TC, TS and VLO counts were highest in November (monsoon) as compared to other months. The value for TS was also observed higher concentration during the rainy season, as similar to the examined of TC count.

In this study was monitoring on microbial loads in the runoff of the Tamiraparani in relation to pollution have clearly revealed that there is significant presence of bacterial indicators of faecal pollution in middle and downstream region, the situation of river is not very serious but alarming. For this reason, monitoring of microbial contamination in the runoff of Tamiraparani should be an essential

component of the protection strategy in river area. The base line data generated on bacteriological water quality of runoff of the Tamiraparani river may serve as biomonitoring standard and comparisons for other river and may be useful for all scientists, decision makers and resource managers working with environmental planning and management of such areas. The appraisal of water of Tamiraparani river system with respect to bacteriological pollution is of immense significance for improving living standard and quality of life in this region. Therefore, monitoring of microbial contamination on periodic basis should be an important component of the protection strategy in this area. Also, understanding of pathogenic bacterial genera in Tamiraparani river system is important and useful to arrive at measures that may act as indicators of water quality and pollution. Every effort leading to reduction in pollution indicating bacteria and microbes of human health concern has to be promoted and implemented.