CHAPTER V
SUMMARY

The existence of life on earth depends upon the availability of fresh water. Fresh water ecosystems provide man nutrient rich food, water and other resources. Fresh waters are home to a tremendous diversity of fishes, aquatic plants, invertebrates plankton and microorganisms. Rivers all over the world are deteriorating rapidly due to anthropogenic interferences; many rivers no longer provide the goods and service they used to some years back. Kerala, the land of rivers, has a cultural history that is closely intertwined with the river valley social life. Thutha River is one of the main tributaries of Nila River, the second longest river on the south – west coast of India. Kunthipuzha, Nellipuzha, Kanjirappuzha, Ambakadavu River and Thuppanadupuzha are the main tributaries of the Thutha River. The river acquires the name Thutha from Sreekrishnapuram village, Palakkad dt. It flows through Mudukurissi, Pulamanthole, Angadippuram, Thiruvelappura and joins (Nila River) at Velikulam in Irmbiliyam panchayath and finally empties into the Arabian Sea. No scientific studies on the ecology and biodiversity of Thutha River has been undertaken so far. This paucity of information has been the motivation to undertake this work.

In the present work, Thutha River in Karimpuzha village (Sreekrishnapuram, Palakkad) to Velikulam (Irmbiliyam) where it joins Nila River was selected as the study area. The total distance covering the area of study of the river is about 68 kms. Five stations with an approximately 13 to 20 kms distance were selected and
monitoring of the water quality, sediment quality and biodiversity were conducted by collecting monthly samples.

5.1. SALIENT RESULTS

Eventhough, anthropogenic activities like dumping of waste, fishing, sand mining and mining of pebbles from the river bottom were practiced in the Thutha River, the physico-chemical parameters have not deteriorated to any great extent and the river supports rich biodiversity.

5.1.1. PHYSICO CHEMICAL PARAMETERS

Most of the sediment quality parameters and water quality parameters were found to fluctuate with respect to different months, seasons and stations. High water temperature was recorded at all stations during summer months. Marginal difference was observed in the temperature recorded during 2007-2008 and 2008-2009. Comparatively higher values was recorded at SIII. The water was transparent during most part of the year but during monsoon season the turbidity in the river increases, reducing the transparency. The river was well oxygenated because of the fast flow. The pH, alkalinity and hardness never attained values harmful to organisms. Low values were recorded during monsoon months and high values during pre-monsoon months. Maginally high values of hardness was recoded at SIII. Not much variation was observed in the different parameters during the two consecutive years. Statistical analysis revealed significant station-wise and month-wise variations at 1% level for most physico-chemical parameters. The nutrients analysed at different stations also exhibited seasonal and station-wise variations.
The nutrients like phosphate, nitrate and nitrite showed higher values during monsoon season. The high concentration of nutrients during the monsoon period is due to geological weathering, agricultural activities together with heavy flow of water that washed through agricultural lands of the drainage basin. Marginally higher values of phosphate and nitrate were recorded at SI, SII and SIII during certain months. Correlation study revealed significant correlation between the biotic parameters and physico-chemical parameters. Sediment quality parameters also fluctuated with stations and seasons. Low values of available potassium, available phosphate, and organic carbon were recorded from the river. Throughout the study period, comparatively higher values of organic carbon were recorded at SIV. The sewage and other organic waste dumped to the river from the nearby vegetable and fish market might have contributed the high percentage of organic carbon.

5.1.2. BIOTIC PARAMETERS

The biota include ecologically important groups like phytoplankton, zooplankton, benthos and fishes. The biotic parameters also showed significant month-wise and station-wise variations. Year-wise variations in monthly percentage of biotic parameters were not significant. Seasonal variations showed higher abundance of all biotic parameters during post-monsoon season. Station-wise variations revealed higher abundance of phytoplankton and zooplankton at SI and SIV. Low percentage of abundance was recorded at SIII. The lentic nature of SIV and the higher amount of nutrients at SI favoured the plankton population. The plankton community of Thutha River is composed of 28 genera belonging to 3
classes. Bacillariophyceae was the dominant group followed by Chlorophyceae and Cyanophyceae.

The present study revealed the presence of six groups of zooplankton, ciliates, cladocerans, ostracods, copepods, arachnids and insect larvae. The copepods and insect larvae dominated the zooplankton community. Zooplankton showed positive correlation with transparency and with other biotic parameters.

The benthic community of Thutha River is represented by nematodes, oligochaetes, copepods, ostracods, insects, insect larvae, bivalves and gastropodes. Insect larvae dominated the benthos. The presence of ephimeropteran larvae indicate a less polluted condition of the river. Water penny beetles, larvae of biting midges and larvae of odonates were abundant. Oligochaetes, ostracods and copepods were the least represented groups. The gastropods were abundant at SIII. Benthic organisms showed a positive correlation with organic carbon in the sediment. They were negatively correlated with sediment pH, sediment temperature and sediment potassium. The low numerical density of oligochates also suggest a less polluted condition. Benthic organisms exhibited seasonal variation with low abundance during monsoon and high during post-monsoon season.

54 species of fishes belonging 37 genera, 23 families and 9 orders were recorded from the river. The most abundant order was Cypriniformes followed by Perciformes and Siluriformes. Cyprinidae dominated followed by Bagridae, Siluridae and Cichlidae. The order Tetraodontiformes was represented by a single species the \textit{Carinotetraodon travencoricus} \text{Hora \& Nair}. \textit{Anabas testudineus}, \textit{Chenna marulius}, \textit{Wallago attu}, \textit{Glyptothorax sp.} were represented by few
individuals. The most abundant genus was *Puntius* followed by *Etroplus*. *Puntius denisonii* (miss kerala) the most fetched fish in pet trade was represented from the upper three stations in the river. During the last decade *P. denisonii* has been requested in majority of trade enquiries and has been exported in large numbers regularly from India. Out of India’s total live ornamental fish exports during 2007-08 *P. denisonii* accounted for almost 60-65%. Now the Department of Fisheries, Government of Kerala has issued an order to restrict catching and exporting of *P. denisonii*. *P. denisonii*, *Chelafasciata sp.* and *Carinotetraodon travencoricus* are endemic to Kerala. Fishes like *Dayella malabarica*, *Gonoproctopterus curmuca*, *Puntius parrah*, *P. ticto*, *P. fasciatus*, *P. filamentosus*, *Salmostoma acinaces*, *Bhavaania australis*, *Macrognathus guentheri*, *Mystus cavasius*, *Mystus vittatus* and *Aplocheilus lineatus* are endemic to the Western Ghats. NBFGR (2010) categorized *Puntius denisonii* and *Carinotetraodon travancoricus* as endangered. Exotic species like *Oreochromis mossambica* was collected in small numbers. Introduced fishes like *Catla Catla*, *Labeo rohita* were collected from SII. Unscientific method of fishing was observed during the study. The local fishermen suggested that a steady decline in fish catch has made it difficult for them to earn a life.

Diversity indices (Shannon weiner index, Dominance index, Richness index and Evenness index) were calculated for the different biotic components by using the data collected. The monthly and seasonal variations of the diversity indices were analyzed. The diversity indices showed higher values during post-monsoon months for phytoplankton, benthos and fishes. Seasonal variations of diversity indices showed higher values during post-monsoon season. But zooplankton showed higher
diversity index during pre-monsoon season. Station-wise variation of diversity indices of phytoplankton showed marginally higher values at SII & SIV. The lentic nature of SIV favoured the algal communities. Marginally higher values of nitrate, phosphate and silicate were recorded from SII during certain months of the study period. The nutrients may have also favoured the phytoplankton. Maximum biodiversity index for benthos was observed at SII. The sandy bottom of the river at this site provide ideal habitat for most benthic organisms. Though high organic carbon was recorded from SIV and the benthos was positively correlated with organic carbon the rocky bottom of the river prevented the benthic fauna from colonizing there. The fish diversity indices showed only marginal difference between stations. Low diversity index was found at SIV. The increased human interference from the nearby town, the degradation of river margin vegetation etc may be the reasons.

5.2. CONCLUDING REMARKS

The analysis of the biotic parameters have revealed that the Thutha River is home to many endemic and threatened species. Eventhough significant pollution contributing factors have not been detected during the present study, in the river basin the deforestation and other anthropogenic interferences have obviously reduced the river flow. Fertilizers and nutrients washed down into the river have deteriorated the water quality to some extent. Sand mining and mining of pebbles from the river have resulted in the degradation of the river bottom in certain regions. This has harmfully affected the bottom dwelling fishes. A detailed study of other physico-chemical parameters like EC, BOD, COD etc. and saprobiological
parameters will provide a clear picture of the deterioration in the quality of river water. Proper conservation measures must be adopted to protect the river from anthropogenic interferences. A comprehensive study of the benthic organisms of the river is recommended. A more comprehensive study on the biodiversity of the river should be undertaken. A comparative study of an undisturbed stretch of the Kunthi River with that of the Thutha River to differentiate the human impact is also recommended. Proper afforestation programmes along the river basins, restoration of river margin vegetation, sustainable use of the resources of the river etc are crucial to conserve this fresh water body. Restriction on mining of sand and pebbles from the river is also suggested.