CHAPTER-VI

SUMMARY

The present study area, Ennore creek (Lat. 13° 15’ N and Long. 80° 19’ E) is a brackish water system, which is nearly 800 m wide, elongated in a NE–SW direction. Ennore creek is complex, the average depth rarely exceeding 5 m in the non-monsoon period, being fed by Kortalaiyar river and the Buckingham Canal; it is also connected to the Pulicat brackish water lake on the northern side, which once nurtured rich fauna and flora, including mangroves. The Ennore creek flows from the west to east and opens into the Bay of Bengal. Ennore estuary was highly polluted with anthropogenic activities due to river bed human settlement and industrial constructions.

The physico-chemical parameters in water at Ennore creek were analyzed for the period of one year covering four seasons (February 2011–March 2012).

The Ennore water samples were analyzed for physico chemical parameters. All the parameters were higher than ANZECC permissible limit except fluoride.

In the present investigation, the surface water, sediment and biota samples were collected to analyze the level of heavy metal load in the estuary and to assess the impact on inhabiting biota.

The levels of heavy metals in surface water of Ennore creek showed the following sequential order: Zn > Cu > Cr > Ni > Pb > Cd for all the four seasons. Among the six heavy metals tested in surface water, the level of Cd was the lowest (0.009±0.003 mg/l) during post monsoon season at site-I, whereas the highest level (0.298±0.08 mg/l) was recorded during monsoon season for Zn at Site-IV. The results
showed that all the heavy metals concentration in surface water of Ennore creek was moderately higher than the permissible limits recommended by National Environmental Board (1994).

The concentrations of selected six metals (Zn, Cu, Cr, Ni, Pb and Cd) in the surface waters of the Ennore creek varied significantly ($P<0.05$) with the seasons in all the sites.

The concentrations of heavy metals in sediment samples of Ennore creek showed the following sequential order: Zn $>$ Cu $>$ Ni $>$ Cr $>$ Pb $>$ Cd for all the four seasons. Among the six heavy metals, concentrations of Cd ($21.23\pm1.56$ mg.kg$^{-1}$) was the lowest during postmonsoon, whereas the highest level ($492.01\pm33.05$ mg.kg$^{-1}$) was observed in the case of Zn at site IV during summer. Similar trend was also noticed during other seasons.

In the present study, the accumulation of heavy metals in the biota of Ennore creek has been undertaken to establish a baseline data on the heavy metal profile of Ennore creek environment. The biota (fishes, crustaceans, and molluscs) samples such as fishes (*Oreochromis mossambicus*, *Mugil cephalus* and *Clarias batrachus*), shrimp (*Penaeus monodon* and *Fenneropenaeus indicus*), crab (*Scylla serrata* and *Portunus pelagicus*) and mussels (*Perna viridis* and *Crassostrea madrasensis*) have been subjected to analyses. These selected biota samples have high commercial value. In the case of *O. mossambicus*, the highest level ($547.21\pm26.32$ mg.kg$^{-1}$) of Zn was noticed during summer and the lowest level of Cd ($21.23\pm1.56$ mg.kg$^{-1}$) was observed during postmonsoon. Among 6 metals, the level of Zn was invariably higher in all
animals tested whereas the level of Cd was lower. Of the four seasons, the concentrations of heavy metals were higher during summer season.

Among the crustacean species, the highest concentration of Zn was observed in *S. serrata* (587.21±39.00 mg.kg\(^{-1}\)) followed by *P. monodon* (568.12±34.20 mg.kg\(^{-1}\)) whereas the lowest concentration (462.10±31.36 mg.kg\(^{-1}\)) was noticed in *P. pelagicus*. The highest Cd concentration (57.10±2.30 mg.kg\(^{-1}\)) was recorded in *S. serrata*, whereas the lowest concentration (36.10±1.80mg.kg\(^{-1}\)) was observed in *P. pelagicus*. Among the mussel species, *C. madrasensis* accumulates the higher concentration of Zn (598.21±32.65 mg.kg\(^{-1}\)) followed by *P. viridis* (572.34 ±33.36 mg.kg\(^{-1}\)).

The results of this study reveal the valuable information about the metal contents in fish, crustacean and molluscan species from the Ennore creek. In the present study bivalve molluscs *C. madrasensis* have been identified to accumulate higher concentrations of non-essential and essential heavy metals suggesting that they could serve as bioindicator of severe heavy metal pollution.

The present study summarizes the seasonal fluctuations in various physico-chemical parameters in the coastal waters of the Ennore estuary as exploratory statistical data output. Freshwater discharge through the river and rivulets includes additions of salinity and total hardness to the coastal water and is marked during throughout the study period. The addition of NO\(_2\) and NO\(_3\) from anthropogenic sources such as fertilizer output, as an effect of industrialization in the northern region of the Ennore estuary, has been observed during premonsoon in the water near the
mouth the Ennore estuary. The interrelationship between physico-chemical parameter suggests the association of inorganic nutrients during premonsoon. The observed loadings of nitrogenous waste (NO₂ and NO₃) to the near-shore coastal water of the Ennore estuary being much less during summer relative to that during premonsoon, suggests well-oxygenated condition of the water in summer.

In conclusion, regardless of seasonal variations in metal concentrations in the Ennore estuary, an accumulation of heavy metals in surface water, sediments and selected biota samples are observed which may be explained in terms of long term overloading the water with pollutants leading the estuarine ecosystem. We suggest that effluent discharge should be reduced during the summer season in order to minimize the negative impacts of these pollutants. For the better management of the estuary, detailed metal speciation can be carried out in future.