Since time immemorial, Man has started living and building up his activities around the estuaries, which are the most dynamic and productive environments on earth. With the increasing population and consequent industrial and agricultural developments, besides programmes like deforestation, the ecosystem and the environment of the estuaries got deteriorated. Disposal of sewage and industrial effluents have not only polluted the estuaries but also biologically affected the marine life. Almost all marine coastal ecosystems have complex structural and dynamic characteristics that can be easily modified by anthropogenic influences. Thus, the delicate balance maintained between human settlements and estuarine environment has got affected and destroyed. Any change in chemical properties of the water and the sediment can affect benthic communities, including their survival. Contaminated marine sediments have been recognized as a very important repository for persistent toxic substances (Xenobiotic organic compounds, Heavy metals etc.) released from various point and non point sources and finally enter reside into the water bay. Sediment toxicity to marine organisms and their risk posed to the environment have arouse growing interest to both the researchers and Environment Development Authorities.
As estuaries are geochemical barriers regulating the export of materials, emerging metropolises like Cochin, necessitates information on the fate of pollutants in the coastal environment. CES comprises one of the most important harbour and industrial centres in the West coast of India. Moreover, it receives large inputs of terrigenous materials exported from land and autochthonous marine materials from the ocean. Therefore, understanding the nature and origin of organic matter could provide valuable information regarding the anthropogenic pressures in this estuarine niche.

Seventeen surface sediments and six core sediment samples from regionally important locations of CES were collected during November 2009 and November 2011 (post monsoon season) for performing the analysis of biogeochemical constituents and OCIs. These 17 surface sediment samples were grouped into three zones - South, Middle and North based on environmental variability such as the physicochemical and sedimentary characteristics. Two core sediment samples from each of these three zones were grouped as (S₁ and S₂) south, (M₁ and M₂) middle and (N₁ and N₂) north. The results discussed on the basis of three zones.

Biogeochemical evaluation of the study region revealed that organic matter in the sediments of CES is aged and the role of protein contribution as a potentially limiting factor for benthic consumers. Besides, the C/N ratio supports the allochthonous character of the sediments in the aquatic niche during the entire sampling periods and attributes a profound influence in the biogeochemical processes. In both the sampling periods, estimated chlorophyll-a to pheophytin value shows <1 in all the sediment cores, which
indicates the prevalence of detritus matter in the sediments. The accumulation of detrital organic matter in sediment degrades the quality of organic constituents; limiting the benthic ecology and act as a potential carrier of toxic pollutants.

Distribution of various organochlorine insecticides presented in this research work will constitute the first judicious baseline data set in the sediment cores of CES. For this assignment, the following organochlorine insecticides were quantified: α-hexachlorocyclohexane (α-HCH), β-HCH, γ-HCH, heptachlor, aldrin, heptachlor epoxide (B), 4,4’-DDE, dieldrin, endrin, 2,4’-DDD, 4,4’-DDD, 2,4’-DDT, 4,4’-DDT, α-endosulfan, and β-endosulfan. Among these contaminants, cyclodienes followed by HCH and DDT compounds are the predominant OCIs in the study area. The high concentration of biologically degraded metabolite - p,p’-DDD from the parent DDTs depict that OCIs contamination was mainly from aged and weathered agricultural soils and was retained under anaerobic conditions in the sediment. The results also indicate that there exists a certain potential health risk to the habitat in the study area. The elevated concentration of OCIs in the CES is due to the direct discharge of partially treated or untreated industrial effluents into the river Periyar. Despite the restriction in use, the prevalent nature of OCIs in the core sediment reflects the illegal use, runoff from the tributaries, the persistent nature and the lipophilic character of these insecticides. The vertical distribution of these trace contaminants in the CES reveals an erratic pattern in all the sampling stations due to the varying environmental conditions exists in the CES. The study reveals that absolute comparability is difficult to achieve between the
sediment cores taken within the same profundal zone in the estuary. Accumulation pattern cannot be expected to be uniform over the aquatic bed. As compared to first sampling campaign, residual levels of OCIs and the concentration of organic matter were decreased during 2011 sampling period, particularly in the southern part of the estuary. Frequent dredging and sand mining in the CES leads to resuspension and redistribution of sediment bound contaminants, may be the reason for reduction OCIs in the aquatic niche. The present zone wise analysis would provide a better understanding of trace organics in the environment and could develop more effective strategies for protecting this vulnerable ecosystem from further pollution. There is also an urgent need to bring into notice the attention of researchers and technologists to the hitherto neglected estuarine ecosystem. Further, using sediment screening bioassays can also be conducted for both sediment quality evaluation and to identify the existing potent toxicants.
Career Achievements and Publications
Career achievements and Publications

School of Marine Sciences, Cochin University of Science and Technology