Petroleum is the most critical source of energy and a major determinant of development at the international level. Total estimated input of petroleum to oceans is $2.37 \times 10^6$ tonne per year. Hydrocarbons are the most important constituents of petroleum which have inherent toxic effect on a variety of biological processes. The coastal ecosystem and its fishery resources are particularly at high risk of exposure to petroleum hydrocarbon during large oil spill. Long term but low addition of oil into the marine environment from shipping, de-ballasting and other anthropogenic activities is absorbed by marine organisms because of its low degradability and persistence. The behaviour and fate of oil pollutants, as well as their toxicity to marine organisms largely depend on the physical and chemical state in which they are present, and the prevailing environmental conditions. Impact of oil is known more due to its physical rather than its chemical properties. The manifestation of petroleum hydrocarbon in the food is a serious human health hazard and needs to be studied in detail for a better understanding and management.

Indian coast line has been focal point of activities for development of port and harbours. The health status and the biological diversity of the Indian coastal ecosystem are deteriorating day-by-day through man-made activities such as the discharging of enormous quantities of sewage and industrial effluents. Gulf of Kachchh is not an exception to this trend. Conversely, GoK is harboring some of the most fragile and sensitive ecosystems like mangroves and corals. So it is reasonable to presume increased anthropogenic stress in Gulf of Kachchh in the days to come. It is therefore, a need of the hour to undertake “Studies on Distribution of Petroleum Hydrocarbon and Phenol in Relation to Planktonic Biota in Vadinar waters, Gulf of Kachchh, Gujarat.

In the present two years study from November 2010 to October 2012, monthly data on four important biotopes along the coastal waters of Vadinar in Jamnagar district, Gujarat in and around the Vadinar were collected in order to ascertain the health of this coastal water. This monthly study was carried out in 4 pre-fixed sites (Jetty, SBM, NJW and PCW) in a radius of 15 km.
Analysis of coastal water health through physical and chemical parameters indicated that all the parameters are well within the prescribed limits and no gross contamination could be discerned showing that the coastal water in and around Vadinar. Parameters like Salinity, Temperature pH, Total Dissolved solids, DO, BOD, COD are either comparable with the other unpolluted coastal waters or are within the prescribed limits which do not pose threat to the marine biota. Elevated levels of salinity (37.7 ± 1.86 ppt) observed presently is due to the inherent nature of Gulf of Kachchh waters induced by negative water balance, high rate of evapo-transpiration and poor rainfall and terrestrial run-off.

Surface and bottom temperature varied from 20.5°C to 32.2°C with a mean and ± SD of 26.9±3.02°C in all the stations and during the second year, temperature varied from 20.0°C) to 32.4°C with a mean and ± SD of 26.6 ± 3.78°C at all 4 stations Water pH during the first year study varied from 7.3 to 8.6 with a mean and ± SD of 8.14±0.24 and during the second year study, the minimum pH value was 7.1 and the maximum was 8.2 with a mean and ± SD of 7.86±0.21. The monthly variation of DO in the first year was from 2.8 mg/L to 7.7 mg/L (PCW-November, 2010) with a mean (±SD) of 5.14 ±1.16 mg/L and during the second year it was from 2.1 mg/L to 8.4 mg/L with a mean (±SD) of 5.08 ± 1.5 mg/L at all the stations.

Levels of BOD in the first year varied from 0.2 mg/L to 5.9 mg/L with a mean and ±SD of 1.84 ±1.12 mg/L at all 4 stations and in the second year, BOD levels in the study area varied from 0.2 mg/L with a mean and ±SD of 1.68 ±0.89 mg/L. Values of COD showed a maximum of 40 mg/L in Jetty Surface water whereas the minimum of 0.6 mg/L with the mean of 7.64 ±10.59 mg/L and during the second year values of COD showed a maximum of 26.7 mg/L whereas the minimum of 2.7 mg/L with the mean of 12.32 ± 6.74 mg/L among all the stations.

This two year study showed variation in the PHc of the surface water from 0.1 to 28.1 µg/L (Nov 2010-Oct 2012) and in the second year it varied from 0.03 to 20.1 µg/L. The recorded values in the 4 stations were within the prescribed limit of the CPCB of 100 µg/L. Generally, total hydrocarbon concentration in seawater can induce harmful effect on the aquatic organisms in the range of 100 µg/l and above. This limit was not exceeded in any of the four stations in the present study and the results were well within the
prescribed standard of CPCB. In the present study the phenol content varied from 0.02 to 52.1 µg/l which shows that the water is moderately polluted. Phenols during the first year of study varied from 0.02 µg/l to 52.1 µg/ L with an average value of 12.7 µg/L and in the second year, minimum value varied from 0.5-0.7 µg/L to maximum value of 33 µg/L with an average value of 8.3 µg/L.

The levels of petroleum hydrocarbon varied from 0.2 µg/g to 16.2 µg/g. The maximum was measured at SBM and minimum at JSW during 2010-11. In 2011-2012, it varied from 0.2 to 3.8 µg/g. The maximum was measured at JSW and minimum at Jetty. In rest of the seasons and stations the petroleum hydrocarbon ranged between BDL to 2.9 µg/g.

Sediment texture in all the four stations was predominantly composed of fine sand followed by silt and clay. The average value of organic carbon contents were relatively higher during pre-monsoon season (1.5%) compared to post-monsoon season (0.9 ± 0.63%) during 2010-11 and whereas in 2011-12 no such seasonal fluctuations were seen and the values observed were similar which ranged from 0.3 to 0.8%. Higher organic content was observed (2.65%) in SBM during the month of Feb (2.30%) and in NJW during the month of Dec (2.30%) 2011 which shows that the sediment in the study area is organically rich.

Recorded values of chlorophyll ‘a’ were comparatively lower which might be due to higher turbidity and low nutrient levels. Given the ambient environmental conditions such as high salinity, TDS and temperature the observed values of density, composition, chlorophyll ‘a’ and Phaeophytin and their temporal and spatial variation was normal and comparable with any unpolluted coastal waters. Pollution, especially due to oil spills is only one of the major man made causes for the imbalance. Chlorophyll ‘a’ ranged from 0.03 mg/m³ to 1.3 mg/m³ with an average value of 0.5 mg/m³ during the first year and during the second year, Chlorophyll ‘a’ values varied from 0.2 mg/m³ to 2.4 mg/m³ with an average value of 0.83 mg/m³. Phaeophytin concentrations ranged from 0.05 mg/m³ to 1.9 mg/m³ with an average of 0.5 mg/m³ in all the four stations during the entire study period.

A total of 48 phytoplanktonic genera were recorded during the first year and 36 genera during the second year in the four study stations, phytoplankton community is
consolidated by four major groups namely pennate and centric diatoms, dinoflagellates and cyanobacteria with the dominance of diatoms (84%). The density recorded for the present study varied across stations. Among the phytoplankton, Coscinodiscus, Biddulphia, Ditylum, Chaetoceros were present throughout the study period. Variation in planktonic population may be due to environmental fluctuation and poor upwelling.

Composition of zooplankton was diverse and a total of 23 groups were recorded in all the stations throughout the study. Copepods, especially calanoids constituted the major group followed by decapods, bivalve larvae, brachyuran larvae and fish eggs/larvae. The observed variations in zooplankton density, composition and distribution were normal and similar to any other pristine coastal waters and no events negatively influencing the zooplankton community was noticed during this study.

Statistical studies between plankton density, genera, Chl a, Phaeophytin and phenol and PHc clearly showed that all the sites selected does not found any statistically relationship between the Primary productivity and planktonic forms during the present study but in long run it may affect the region as a whole. Hence a regular monitoring is imperative for effective environmental management and sustainable development of Vadinar coast.