

## MARINE BIODIVERSITY ASSESSMENT AND MANAGEMENT PLAN

The Marine Ecology and Biodiversity assessment and preparation of Biodiversity Management Plan has been prepared by the centre of advanced study in marine biology faculty of marine sciences annamalai university, Tamil Nadu. As a part of the study collected the baseline data on water and sediment quality, Marine Ecology and Biodiversity from 41 locations in the study area in the month of February and March 2018. Findings of the study are summarised as below:

- Sediment was largely dominated by clay material. Temperature of the seawater in the study area varied between 28.3-30.2°C and salinity was on higher side for the estuarine conditions and values varied between 2 to 27 ppt. Dissolved Oxygen (DO) varied in a very narrow range between (4.0 to 6.1 mg/l) both for surface and bottom waters suggesting well mixed oxygen conditions. pH of the surface and bottom water varied between 7.2 to 8.6.
- Chlorophyll (Chl) *a* is an indicator of the algal biomass in a water body. chlorophyll *a* concentration was higher in all the station its values ranged between 2.11 and 9.32 µg/L. The concentration of Phaeophytin ranged between 1.10 and 4.64 µg/L.
- A total of 39 species of phytoplankton were recorded from this area. The phytoplankton density ranged between 68083 and 142703 cells/L.
- The zooplankton community is generally considered as the chief index of utilization of aquatic biotope. In the present study, a total of 27 species were recorded from 41 stations. The Zooplankton density ranged between 10483 and 28431 org./m<sup>3</sup>.
- The coastal and estuarine biological communities, especially the benthic assemblages are routinely being used as indicators of ecosystem health. . In the present study, a total of 42 benthic organisms were collected from 41 different locations of Cochin back waters. Among the 42 species 25 were polychaete, two amphipod, 10 bivalves and five insect larvae. The density of benthic organisms ranged between 637 and 4022 org./m<sup>2</sup>.
- The fish assemblages and fish catch data are traditionally used as indicators of ecosystem health. Being a navigational channel area, large-scale commercial fishery is not conducted within the study area. In the present study, a total of 33 species were identified from Cochin backwaters. Among them *Oreochromis mossambicus* and *Anguilla bicolor* are coming under the category of Near Threatened as per IUCN status remaining species are under the category of Least concern and Not evaluate.
- Small mangrove patches scattered in the Cochin backwaters. The major species recorded in these areas are *Avicennia officinalis*, *Avicennia marina*, *Rhizophora mucronata*, *Rhizophora apiculata*, *Excoecaria agallocha*, *Acanthus ilicifolius*,

*Bruguiera gymnorhiza*, *Bruguiera sexangula*, *Bruguiera cylindrical*, *Sonneratia alba*, *Sonneratia caseolaris*. Among them *Avicennia* is the dominant one

- The main principle of environmental management is to ensure that the disturbance due to dredging is kept minimum and within the assimilative capacity of the affected environment. This has to be done by integrating action plan for mitigating predicted adverse impacts and should be done on regular basis through comprehensive environmental monitoring with seasonal (pre-monsoon and post-monsoon) investigations.

The aspects covered as a part of the Marine Environmental Management Plan are listed as below:

- Managing Turbidity
- Noise management
- Oil and other noxious spills
- Managing Terrestrial flora and fauna
- Aquatic Biodiversity Management

Systematic information has been derived from a set of survey conducted along the proposed project sites to derive detailed information on the prevailing environmental conditions and biodiversity in the region. Details have been discussed in the results section of the report. It is evident that the proposed sites of jetty construction are not sensitive areas as they don't have any mangrove coverage in the proposed regions. None of the regions were observed with any scheduled marine forms and hence construction in this region will not put any ecological pressure.

### **Ecological stressors and mitigation procedures**

The proposed project involves construction of jetties along the backwaters of Ernakulam region. As none of the proposed jetties are on any biologically sensitive zone, the construction of jetties in these regions poses null threat to the ecosystem. Constructional activities proposed in the region should have to be governed carefully with expert opinion, as activities involved in the construction may cause adverse impact onto the surrounding ecosystem. A well-defined management and monitoring plan needs to be in place for each of the aspects related to the proposed project activity. Management procedures include practices of various modes to support a developmental project by avoiding, support or mitigating environmental impacts.

## **Managing Turbidity**

### **Need of turbidity management**

Uncontrolled sediment plumes into the marine ecosystem hamper the productivity through disturbing the light penetration. Reduced productivity disrupts the trophic level of the system causing large scale disturbance in the ecosystem associated flora and fauna. High amount of plumes affect the fishery by blocking the gills resulting in anoxia and mass mortality. These management procedures are to minimise the volume of fine sediments / silts introduced into the marine environment through various construction activities and to minimise / manage the spread of sediments generated by construction activities.

### **Possible mitigation plans**

Turbidity should have to be monitored through observations and in-situ measurements to proactively manage sediment plumes into the surrounding system. Following steps can be taken to manage turbidity in the construction sites,

- In-situ measurement of turbidity and have to be careful not to exceed the limit given by state pollution board at 1000 meters from the construction sites.
- Estimate the plume extend and direction.
- All material from piling and other construction operations have to be recovered on land and not discharged directly into the marine environment.

## **Noise management**

### **Need of noise management**

Cochin backwaters are famous livelihood for a variety of migratory and local birds, dolphins and turtles. These animals are very sensitive to noise disturbances around them. Noise levels above the tolerating level for these animals from construction activities may pose a threat to them and will destroy the ecological niche. It is hence necessary to adapt proper procedures to manage the noise produced from constructional activities so that the ecosystem around the project sites will not be disturbed.

### **Possible mitigation plans**

Noise management is very important in near shore construction activities as large noise disturbances can disrupt the normal existence of birds and marine mammals in the

surrounding environment. The following plans may be followed for management of noise from construction,

- Construction activities to be undertaken in accordance with the noise pollution (regulation and control) rules, 2000.
- All equipment used during the construction phase to be regularly maintained to ensure efficient operation.
- Noise-dampening equipment to be used on equipment with excessive noise generating characteristics

### **Oil and other noxious spills**

Oil spill into the marine system has detrimental effect; Oil destroys the water repellency of a bird's feathers, thus exposing these creatures to the harsh elements. Without the ability to repel water and insulate from the cold water, birds and mammals will die from hypothermia. Many birds and animals also ingest oil when they try to clean themselves, which can poison them. Fish and shellfish may not be exposed immediately, but can come into contact with oil if it is mixed into the water column. When exposed to oil, adult fish may experience reduced growth, enlarged livers, changes in heart and respiration rates, fin erosion, and reproduction impairment. Oil also adversely affects eggs and larval survival. It is hence very crucial to govern the input of oil and other noxious materials to the aquatic ecosystem from the construction sites.

### **Possible mitigation plans**

- The potential for spills of oils and other noxious substances to the environment should be minimized as low as reasonably practicable. Steps should have to be taken to reduce the storage of oil and other noxious materials in the construction site and provide all necessary training and resources for a spill response.
- All oil and other noxious materials should be stored in an appropriate store room that is capable of holding 110% of a spill from the largest container, or 10% of total volume of stored liquids, whichever is greater.
- Refuelling of vehicles/equipment should be undertaken on land (not over water) so that the spill possibility can be reduced.
- Drip trays shall be placed under mechanical stationary equipment so that oil drips from the equipment will not get into the ecosystem hampering the living resources.
- All equipment should be regularly serviced to reduce emissions and to reduce the chance of oil leaks on site and in marine environments.

- Appropriate volume and type of spill response materials should be made available at each construction sites.

## **Managing Terrestrial flora and fauna**

### *Need of terrestrial flora/fauna management*

Construction activities in the near shore region can pose stress to the terrestrial flora and fauna surrounding it. Unmanaged transportation of construction materials through areas outside the constructional zone may destroy the prevailing vegetation in the region. Dumping of excavated sediment material onto the terrestrial region without considering the underlying vegetation also poses serious threat to the terrestrial flora and fauna.

### *Possible mitigation plans*

- Ensure that the terrestrial fauna surrounding the construction sites are minimized and activities outside the constructional zone will be avoided.
- A buffer area to be decided around the construction area, so that all construction activities have to be concealed within the buffer area.
- Ensure no activities outside the works zone through clear delineation of the works area. Ensure traffic is restricted to established tracks and roads, and speed limits observed.

## **Aquatic Biodiversity Management**

### *Need of terrestrial flora/fauna management*

A constructional activity in the near shore area for jetties includes piling of, that possibly excavate large load of sediments. Entrainment of these sediment plumes into the water column will increase the turbidity of the water column. This can have large scale impact on the survival of fishery resources. High sediment deposition in the near shore system may also largely affect the benthic animals residing in the region.

### *Possible mitigation plans*

- Proper maintenance of construction equipment, so that unwanted spill of oil and other construction materials into the aquatic environment can be controlled.
- Net enclosure using silt screens to be established along the jetty construction area (piling sites), as this can prevent the spread of sediment across the construction site as well as to the aquatic ecosystem.
- Vessels which are going to be used in the constructional activities should be equipped with spill response kits as well as experts with experience in spill response activities.

Endurance and recovery of biodiversity in the ecosystem depends on the local ecological factors as well as on the impact of stress induced onto the system. Complete avoidance of ecological impact while development is practically impossible, but measures can be taken to reduce the amplitude of impact on the ecosystem by adopting issue specific mitigation plans. Some of the common mitigation measures to be considered while implementing the project is briefed as follows,

- Impacts can be minimized by conducting timely visits on the construction sites by scientific experts to validate the activities in the construction zones.
- Adhere to the best construction practices available so that the impact can be reduced in a greater extend.
- Regular maintenance of all the activities and deployment of trained personnel will reduce many impacts. Unexpected accidents can be reduced in larger scale.
- Organic solid and liquid waste on the vessels involved in project as well as from the construction sites should not be disposed in the ambient waters. It should be properly processed and or disposed as per the guidelines.
- Breeding season (June-July) are sensitive period for the aquatic fauna and all modes of disturbances (piling and other activities) should be avoided during this period.
- Areas should be predefined way from coastal regions for the disposal of excavated sediments from construction activities. Adhere to these locations for disposal piled sediment material.