CHAPTER 2
MATERIALS AND METHODS

1. INTRODUCTION

Cochin harbour is the second largest harbour along the west coast of India, located in the central parts of State of Kerala (9°55′44″-9°58′04″N; 76°14′50″-76°16′10″E). Source of water and sediments to this estuarine harbour is from two large rivers, one from the south, named as Muvattupuzha and other from the north, Periyar river and also from four smaller river catchment systems (Pamba, Meenachil, Manimala and Achankovil rivers) joining the estuarine system on the southern end. These rivers empty large amounts of freshwater to the adjoining nearshore region through the stable Cochin inlet. This harbour is maintained operational by three dredged channels, one being the approach channel having an orientation along the east west direction through the Cochin inlet. Within the harbour, two channels are maintained - the Ernakulam channel of 5km in length and 250-500m in width and the other Mattancherry channel of 3km length and 170-250m width. All three channels are marked in Figure 1. The channels are intermittently dredged throughout the year except during monsoon period in the approach channel due to rough weather conditions in the nearshore region. The amount of material dredged during different years is given below:
Fig. 1 Location map of stations 1 to 6 at Cochin harbour.
2. AREA OF INVESTIGATION

The area of investigation and location of stations are shown in Figure 1. Six stations were selected; four in the dredged channel sites of Ernakulam (stations 2 & 3), maintaining a depth of 10 to 13m and Mattancherry (stations 5 & 6) channels keeping 9.75 to 11m depths and the other two in the nondredged sites which are located away from the channel(s) which are at a depth of 3 to 5m (stations 1 & 4).

The field investigation was carried out on monthly basis for a period of two years (November 1994 to October 1996) at the dredged and non-dredged sites. A special field survey was also conducted near the Dufferin point on 12/04/94 to study the
features of salt-silt wedge; another study was held at a capital dredged area in the upstream of the Mattancherry channel (January 1994 to August 1994) to study the effects of intermittent dredging activity and associated sedimentation processes. Mattancherry channel was also investigated to identify short term impact on the environment before, during and after (from 09/01/96 to 11/01/96) dredging (see Figure 2 for above locations).

3. PARAMETERS

The instruments and procedure adopted during this study on various oceanographic parameters are given below.

a. Current speed and direction

These parameters were determined by direct reading current meter(s) (EMCON make) of accuracy ($\pm 2\text{cm/s}$) which suits to read an integrated current value, utilizing savonious rotor plus magnetic compass of directional sensitivity $\pm 5^\circ$; the final current values were taken as the average of 3 consecutive readings.

b. Salinity

The salinity readings are obtained from a Hydrobios make Temperature-Salinity Bridge Model MC-5. Accuracy of the inductively coupled salinometer was $\pm 0.05$.

c. Suspended solids (Turbidity)

The suspended solids concentration (in JTU) was determined in the field by making use of an in-situ turbidity meter which makes use of the optical scattering principle (in range of 0 to 1000JTU, $\pm 2\%$) make CIFT. Linear calibration was achieved by means
Fig. 2 Location of special field surveys
   a) Dufferin point
   b) Study area of capital dredging
   c) Study area of short term impacts
of the following method. Water samples collected in a Hytech water sampler of 1.2 litre capacity from selected depths were filtered at 0.45μm (Whatman filter cum Millipore unit) and dry weight of filtrate was determined and instrumental readings calibrated (56 data sets) to report values in mg/l.

d. Transparency

Transparency of the water column was determined in terms of the mean of the depth (dm) of disappearance and reappearance of Secchi disc. The extinction coefficient (K) was determined by the empirical relation K = 1.7/dm, where dm is expressed in meters.

e. Sediment textural characteristics

The sediment samples were collected using van Veen grab. The standard procedure as given by Carver (1971) was adopted towards pipette analysis. The grain size parameters such as mean size, S.D., skewness and kurtosis were calculated based on Folk and Ward (1957) and Lewis (1984).

f. Nutrients (Nitrite and Phosphate)

A. Nitrite: Bendschneider and Robinson (1952) method as suggested by Grasshoff (1976) was adopted for the estimation of nitrite. The nitrite in the sample was allowed to react with sulphanilamide in an acidic solution. The resulting diazo compound proportional to the initial concentration of the nitrite, was coupled with N-1 naphthyl ethylene diamine dihydrochloride forming a diazo dye. The extinction of the diazo dye was measured using spectrophotometer at 545nm. Cell to cell
blanks and reagent blanks were also read and appropriate corrections applied.

B. Phosphate: Inorganic phosphate was estimated by the method of Murphy and Riley (1962). The samples were treated with a composite reagent containing molybdic acid and trivalent antimony. The resulting complex was reduced with ascorbic acid and molybdenum blue solution thus formed and was measured using spectrophotometer at 880nm. The cell to cell blanks and reagent blanks were determined and necessary corrections applied.

g. Chlorophyll a, b, c

The water samples from surface and bottom were collected using Hytech water sampler of capacity of 1.2 litres. Chlorophyll content in the samples were determined by the method proposed by Strickland and Parsons (1972).

h. Bottom fauna

Benthic fauna from the dredged and nondredged sites were collected using van Veen grab of size 0.05m² every month between November 1995 to October 1996. The grab contents were hand sieved through a 0.5mm square mesh sieve in order to separate the organisms from the sediment. The residue from the sieve was preserved in 5% formalin. Organisms were identified up to genera. Field sampling and other procedural details followed are available elsewhere (Fauval, 1953; Damodaran, 1973; Ludwig and Reynolds, 1988).
1. Bathymetry

The data was collected onboard research vessel R.V. Nautilus (12m long with inhouse laboratory) and Flying Fish. The channel configuration and morphology was monitored by making use of STD meter (CIFT make) and corrections if any were incorporated by verifying the depth contours with bathymetric chart of Cochin Port Trust (CPT). The real time tidal observations were provided from the tide gauge installed at the harbour region.

Dredging data relevant to the period of study was collected from the Cochin Port Trust.

The months pertaining to different seasons were selected as follows: Postmonsoon - October to January, Premonsoon - February to May and Monsoon - June to September.