Chapter 1

Introduction
The continental shelves of the world’s oceans represent only about 10% of the total oceanic area, but account for 99% of the global fish harvest. These are generally shallow ocean areas that promote nutrient recycling and provide feeding opportunities for fish and shellfish populations. Benthic organisms form a vital component in the marine environment and play an important role in the ecology both as consumers of plankton and as food for demersal fishes and shellfishes. They provide key linkage between primary producers and higher trophic level animals in the marine food web. Thus benthic productivity of the adjacent seas of any maritime country is of pivotal interest to access the total fishery potential pertaining to that area.

Research into the benthic ecosystems of the world’s continental shelves has been most comprehensive in temperate rather than tropic latitudes (Alongi, 1990). In comparison to other tropical areas, work on the east and west coasts of India and along the west coast of Africa are to be mentioned.

The name ‘benthos’ is derived from the Greek, meaning “depths of the sea”. The benthos are a group of organisms living in or on the bottom of a body of water. The benthic community is composed of a wide range of plants, animals and bacteria from all levels of the food web. Three functional groups of benthos could
be recognized. They are the infauna, epifauna and hyper-fauna i.e. organisms living within the substratum, on the surface of the substratum, and just above it respectively. Based on the habitat, benthos are categorized into soft "bottom and hard bottom benthos. Benthic communities comprise of species differing in terms of their ecology, life strategies and body size. Benthic organisms are also grouped by their size. Generally, organisms larger than 500 μm are called macrofauna; meiofauna are between 500μm and 63μm; organisms smaller than 63 μm are microfauna. The microfauna are unicellular organisms that include bacteria, fungi, protozoans and blue-green algae and occur in every square millimeter of the sediment and water environment. Meiofauna consists of a broad taxonomic grouping that includes nematodes, harpacticoid copepods, kinorhynchs, tardigrades, and some of the micro invertebrate species living within the sediment grains temporarily as part of their life cycles. Macrofauna are organisms larger than 0.5mm, which are visible by naked eye, mainly invertebrate animals, polychaetes, bivalves and echinoderms living either on the sea floor (Epifauna) or buried in the bottom (Infauna).

The purpose of quantifying benthos of the sea includes their quantitative and qualitative aspects and their importance in nourishing demersal fish stocks. Generally benthic communities are much more diverse in terms of species richness than those of the surface and mid water layers (the so called pelagic realm).
Approximately 98% of all marine species are supposed to belong to the benthos (Peres, 1982).

Benthic organisms link the primary producers, such as phytoplankton with the higher trophic levels, such as finfish, by consuming phytoplankton and then being consumed by larger organisms. They also play a major role in breaking down organic material. Many of the benthic organisms have pelagic larvae, a component of planktonic community and influence considerably in the planktonic food web. Benthic algae and submerged aquatic vegetation provide ideal habitat for juvenile fish. Benthic invertebrates are among the most important components of estuarine and coastal ecosystems. Thus, the study of benthos in more recent years proved useful to follow changes in biological diversity, evaluating marine pollution effects especially assessing long term changes and detecting input from diffuse sources (Gray et al., 1992).

The study of meiofauna is a late component in benthic research, despite the fact that meiobenthic animals have been known since the early days of microscopy. While the terms macrofauna and microfauna had been established, it was not until 1942 that the term “meiofauna” was used by Mare to define an assemblage of mobile benthic invertebrates (meiobenthos) distinguished from macrofauna and microfauna by their small size. Derived from the Greek word μειος meaning smaller, members of the meiofauna are mobile and smaller than macrofauna but larger than microfauna (a term now restricted mostly to protozoa
and bacteria). Today the size boundaries of meiobenthos are based on the standardized mesh width of sieves with 500µm as upper and 42µm as lower limits: all fauna passing the coarse sieve, but retained by the finer sieve during sieving is considered meiofauna. In a recent move a lower size limit of 31µm has been suggested by deep-sea meiobenthologists in order to quantitatively retain even the smallest meiofaunal organisms (mainly nematodes). International Association of Meiobenthologists (IAM) on the other hand, defines its range from 63µm to 500µm. Currently, 20 Phyla of the 34 recognized phyla of the Kingdom Animalia have meiobenthic representatives; five of those are exclusively meiofaunal (Gnathostomulida, Kinorhyncha, Loricifera, Gastrotricha and Tardigrada); 2 Phyla of the Kingdom Protista (Sarcomastigophora and Ciliophora) also have meiofaunal representatives. Some individual species also are meiofaunal during some stages of their lives, forms the temporary meiofauna. "Permanent meiofauna" are species of meiofaunal size throughout their lives, while "temporary meiofauna" are of this size only when they are immature.

**Significance of the study:**

The benthic substratum contains a heterogeneous assemblage of animals and forms a major centre of secondary productivity. The members of the fauna are chiefly composed of worms, molluscs and crustaceans and they feed on organic matter and in turn form food of demersal fishes. Meiobefauna form a direct food of macrobenthos, juveniles of demersal fishes and also of shrimps (Coul, 1973).
Most of the meiofaunal organisms are having a very short generation time, thus contributing to the total benthic production significantly. It has been long suspected that bacteria and diatoms are the principal microbial foods of meiofauna (Brown and Sibert, 1977; Gerlach, 1978; Tietjen, 1980). Macro and meiobenthos are primary consumers and found to feed on organic matter. This consumption of organic matter in turn goes through a cycle of ingestion and ejection and colonized by bacteria and fungi (Hylenberg, 1975; Riemann and Schrage, 1978). Thus the interaction between meio and macrobenthos species allows an efficient utilization of detritus. Such processes are likely to affect the magnitude of the secondary production available to higher trophic levels. Benthic infauna introduces temporal and spatial heterogeneity to the aquatic sediments through processes such as burrow irrigation and sediment ingestion / ejection. Meiobenthos are actively participating in the biogeochemical cycles by their metabolic consumption and they affect the microbial regime spatially and temporally by affecting redox boundaries and chemical fluxes in sediments (Aller and Aller, 1992).

Meiofauna are also known to be sensitive indicators of environmental disturbances and have great potential as pollution indicators, by giving attention to their species diversity, abundance and biomass. The reasons which makes them a potential indicators are that they live in very high numbers in small areas, have high diversity, have limited mobility whereby more consistently and intimately exposed to what is in their immediate environment, and have short life cycles.
Despite a number of investigations on benthos from Indian subcontinent no serious efforts have been made till date on the meiobenthos from shelves of the east and west coasts of India. India, an old maritime nation is endowed with a coastline of about 8129Km. Scattered attempts have been made to understand the quantitative nature and community structure of benthos from different regions of the country. A number of benthic studies in Indian seas were published; most of them were pertaining to studies on major estuaries or backwaters and shallow coastal regions. Meiobenthos part were a neglected component, even in most studies and attention was given to macrobenthos. Attempts have been made to study the entire shelf region of west coast, so far by 3 workers viz. Neyman, (1969); Harkantara et al. (1980) and Parulekar et al. (1982). Since these studies were carried out with different methodologies and objectives, their utility is limited in understanding of the benthic community. Even in these studies attempt was restricted to macrofauna and no attention was made to account for meiofaunal production. This was mainly because of the difficulty in analysing the meiobenthos. This lacuna in the information regarding meiobenthos led to embark upon the present study. Earlier studies on meiofauna showed nematodes as the most dominant group representing meiofaunal samples worldwide. Therefore the present study was focused on free living marine nematode taxonomy and their ecology. The present study is the first ever-comprehensive attempt to screen the
entire shelf region of west coast extending from off Cape Comorin to off Dwarka with sampling up to a depth of 200 meters.

The main challenges were as follows:

- To understand the relationship of meiofauna to hydrography and sediment characteristics of the west coast.
- To understand the numerical abundance of meiobenthos and to understand their spatial variation.
- To obtain the standing crop of meiobenthos with respect to depth and latitude.
- To understand trophic relationships of meiobenthos
- To know the species composition of free-living marine nematodes of the shelf waters of the west coast of India.
- To know the distribution and ecology of free-living marine nematodes.

To pursue the above challenges, two dedicated cruises were conducted along the continental shelf waters of the west coast of India as part of the Department of Ocean Development’s (Government of India) efforts towards conducting Marine Living Resources related research in India’s Exclusive Economic Zone (EEZ). 74 stations were covered, falling under 17 transects, extending from off Cape Comorin to off Dwarka, with a view that distance between two transects and two stations are not exceeding 30 nautical miles, thereby covering all degree square of the shelf areas in the sampling.