INTRODUCTION
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'Estuary' is a unique aquatic environment which is composed of riverine and marine waters. In simple term, 'Estuary' is defined as a region where river water mixes with and measurably dilutes the sea water (Ketchum, 1951). But the widely accepted explanation is that of Pritchard (1967) who defined estuary as a semi enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage. The periodic flow of sea tides and land drainage are mainly responsible for the highly unstable physical, chemical and topographical features of this 'Buffer Zone' and the subsequent creation of diversified habitats such as marshes, creeks and backwaters, where organic matter is constantly built up in large quantity offering ideal biotic conditions to sustain considerable aquatic populations. Further, due to constant replenishment of nutrients, relative calmness and typical circulation patterns, estuaries serve as cradles wherein marine and freshwater organisms breed and the juveniles are 'nursed' to adult-hood.
It is interesting to note that a small transitionary area like estuary, despite showing enormous aberrations in the environmental order, is preferred by a multitude of planktonic benthic and nektonic organisms for one or other purpose in their life history. The oddities of this environment seem to provide diversity for settlement, feeding and breeding. In the event of the broad range in the variation of many physical and chemical factors, there is an efficient life strategy called eurytolerance by way of which the fauna withstands the fluctuations of nature. They are accordingly classified into Oligohaline, true estuarine, euryhaline marine, stenohaline marine and migrants on the basis of their extent of tolerance to the stress conditions (Carriker, 1967).

Eventhough estuaries are the areas where huge amount of organic detritus is built up, a considerable quantity sinks to the bottom, together with phytoplankton cell and zooplankton faeces, finally to rest on the sediment-water interface. Thus, even if the estuarine floor doesn't have
primary production of its own, it gets large quantity of organic matter by sinking and horizontal transport, on which a vast variety of bottom living organisms subsist and they are popularly called as "benthos".

'Benthos' is a collective term referred to the organisms living in, on or associated with aquatic sediments comprising of bacteria, plants and animals from almost all phyla.

Benthic animals are generally described on the basis of their position in the sediment. 'Infauna' are the animals living within the interstitial space or burrows. Those occupying the sediment surface are 'Epifauna'. An operationally useful method of separating benthic fauna has been provided by Mare (1942), who first suggested that benthic fauna be divided into 'Microfauna' (1-100 μm) comprising bacteria, protophytes and protozoans other than foraminifera; 'Meiofauna' (100-1000 μm) including foraminifers, small metazoans – nematodes and turbelarians; and the 'Macro' or 'Megafauna' (>1000 μm) to denote several macro – invertebrates. But usually, nowadays, metazoans passing through a 500 μm sieve are
considered as meiofauna (McIntyre, 1969). Those size separations are arbitrary and the classification has no biological meaning except that the relative size is depicted in the terminology. All feeding types from selective feeders on specific bacterial cell types to omnivores and carnivores, are represented in all size categories of benthic organisms. Besides, the bottom living fishes and crustaceans also enter the benthic environment in larval and post larval stages.

Unlike the three dimensional pelagic habitat of planktons, benthic organisms are adapted for an association with a two dimensional habitat or substrate, superficially more analogous to that of the land. While a planktonic existence requires a small size and a specific gravity close to that of the sea water, benthic life allows a variety of size, shape and density. Calcareous shells, elongated, stalked and branched body forms and the development of appendages like cilia and bristles and body musculature which enable movement over, into and through the sediment are characteristic of benthic organisms.
Consolidated research on benthic organisms is very recent. Some of the pioneer investigations on benthos are those of Schultz (1853), Bastion (1865) and Claus (1866) in the last century and until the studies of Moore in 1931, there was no quantitative report on benthos at all. However, as the interest in the field of benthic study increased in the last two decades, an approach into almost every relationship in the benthic ecology, such as, faunal composition, abundance, substrate affinity, community structure, biomass, dominance and diversity was made and some notable authors of these researches are Krogh & Spark (1936), Rees (1940), Smidt (1951), Remane (1952), Renaud Debyser (1959, 1963), Wieser (1960), Bregnballe (1961), Lackey (1961), McIntyre (1961, 1964, 1968, 1971), Wigley & McIntyre (1964), Kikuchi (1966), Tietjen (1966, 1967, 1969, 1976, 1977, 1980), Thiel (1966), Muus (1967), Coull (1968), McIntyre & Blefthereou (1968), Fenchel (1969), Schafer (1971), Maurer et al (1976), Coull et al (1977, 1982), Wildish (1977), Elmgren (1978), Alongi & Tietjen (1980), Ansari et al (1980), Bell & Coull (1980), Palmer & Coull (1980), Parulekar et al (1980).

Significant research on estuarine benthos in general are those of Eggleton (1931), Muus (1967) and Wolf (1974). While some others restricted their studies to estuarine microfauna (Fenchel & Jansson, 1966), meiofauna (Tietjen, 1966, 1969) and macrofauna (Warwick & Price, 1975; Young & Young, 1978; Larsen, 1979; Willish & Kristmanson, 1979), specific research on the most dominant benthic group, estuarine nematodes, was by Wieser & Kanwisher (1961) and Teal & Wieser (1966).

A few years ago, the study of benthos was primarily the province of basic research and emphasis was laid on satisfying the scientific curiosity as to life history studies on non-commercial bottom
animals, their physiology, composition and abundance. But in the recent past, the trophic and environmental importance has made the benthic faunal ecology, an interesting topic of research.

Benthic fauna have been found to play a significant role in the trophic network, as they utilise all forms of food material available in the sea bed and form an important link in the transfer of energy.


Another important aspect of the benthic studies is the effect of pollution on the standing

Abiotic relationship of benthos, especially with the sedimentological features, has explained most of the fluctuations in benthic abundance. Benthic fauna usually tend to concentrate in the upper oxygenated layer of sediment except the true anaerobes (Ponchel & Riedl, 1970). Coull & Bell (1979), from their studies, stated that burrowers prefer sediments where median particle diameter is below 125 μm, while the interstitial groups are excluded from muddy substrates. Benthic relationship to sedimentological features has also been suggested in the works of Wieser (1960), Tietjens (1967, 1971), Johnson & Matheson (1968), McIntyre & Elafthorocou (1968), McIntyre (1969), Rhoads & Young (1970), Warwick & Buchanan (1970), Bloom et al (1972), Wieser et al.
Benthic fauna are also influenced by the fluctuations in the overlying water parameters, such as oxygen (Hayos & Mac Aulay, 1959; Hargrave, 1969; Smith, 1974; Elmgren, 1975; Rosenberg, 1977), phosphorus (Kuonmoller, 1961), hydrogen sulphide (Lackey, 1961; Theede et al, 1969), salinity (Lango, 1970; Klokot, 1972) and detrital particles in water (Seinle et al, 1977).

In the realm of deep sea, there have been investigations on benthic ecology (McIntyre, 1961; Sanders, 1969; Rowo et al, 1975; Thiel, 1975; Smith, 1978) and particularly meiofauna (Thiel, 1966; Tietjen, 1971; Elmgren, 1975 and Coull et al, 1977) and macrofauna (Barham et al, 1967 and Andersin et al, 1978). While Jones & Sanders (1972) studied the distribution of cumacea in the deep Atlantic, the community structure of deep sea benthos was investigated by Jumars (1975, 1976) and Tietjen (1976).

There have been efforts to evaluate the deep sea benthos surrounding the Indian waters as well. Significant literature is available on the
benthos of northern part of Indian Ocean (Neyman, 1969), on meio and macrobenthos of Andaman seas (Parulekar & Ansari, 1981, 1981) and abyssal benthos of Indian Ocean (Sokolova & Pasternak, 1964; Parulekar et al., 1982).


Studies on the benthos of Indian waters are comparatively very less. But the significant investigations encompass the waters of both the east and west coast (Annandale & Kemp, 1915; Panikkar & Aiyar, 1937; Samuel, 1944; Ganapathi & Rao, 1952; Ganapathi & Lakehman Rao, 1959; Sanders, 1968; Panikkar, 1969;

Benthic studies on the west coast of India are comparatively more (Neyman, 1969; Harkantra et al. 1980 and Parulekar, 1981). While Ansari et al. (1977 and 1979) made exclusive studies on meio-benthos, Parulekar et al. (1976) carried out quantitative investigations on the benthic fauna off Bombay.


General studies on the benthos of Karwar waters are by Ansari (1972) and Harkantra (1975) while Sudarshana (1983) recently carried out a comprehensive research on the meio and macro benthic communities of
Karwar Bay, describing the environmental relationships of 28 groups of benthic organisms.

In the light of all the above mentioned literature and in the context of a deep-felt necessity to investigate the benthos of Kali estuarine system, a study comprising the interacting factors, abundance, distribution, community structure, ecological relationships, correlations among taxa and production in the benthic environment, was initiated. The results and discussions of this investigation are presented in four chapters.

Characterisation of benthic environment:

This chapter deals with the faunal composition with details of the general trends in distribution and abundance. In all, sixteen meiofaunal and fourteen macrofaunal taxa have been identified and studied. The macrofauna are further identified into fifty-two components. The role of environmental parameters, namely, hydrological and sedimentological, in the sustenance of different feeding habits of Kali estuary, is discussed and a general note on these
factors is given.

Further, the faunal interaction with the environmental parameters is described. The factors contributing to the maximum variation in benthic abundance has been found out by way of stepwise multiple regression analysis. The factors those are statistically insignificant are considered to be those which do not have any control over the benthic fauna.

A simple, comprehensive, graphical pattern has been drawn to show the salient features of the benthic assemblage in different stations under the sub heading 'population relationship of benthos'.

Pattern of distribution:

Temporal and spatial dispersion of meio and macrofauna have been discussed. Further, on the basis of statistical correlation on all possible combinations of meio and macrofaunal elements, the relationship between benthic entities are found out.
Seasonal variation in the benthic environment

Seasonal variation and the trend of various parameters over different months in the benthic environment have been detailed to supplement the data given in preceding chapters and to explain the benthic dynamics.

Benthic production

The components of benthic production, seasonal elimination and magnitude of biomass changes are estimated. Metabolic indices calculated separately for meio and macrofauna have been presented. It has also been envisaged to indicate the potentiality of edible bivalve resources of Kali estuary.