CHAPTER VI

CONCLUSION
This study conducted in the abyss of the Central Indian Ocean Basin was committed to gain knowledge of the community structure of macrofauna, in addition to the study of temporal variation and sieve size influence. It provides a baseline data for macrofaunal species diversity and abundance in the CIOB, which would be helpful for any impact assessment in the area.

In the Indian Ocean Basin, manganese nodules are reported in a large area that extends from 10°S to 25°S and 70°E to 86°E. India is the 'Pioneering Investor' in the area. As a potential contractor, India under the INDEX programme has conducted different deep-sea experiments in order to collect the deep-sea environmental data. The current study is a part of the above multidisciplinary oceanographic programme.

The sampling depth ranged between 4252 to 5693 m. Organisms adaptable to high pressure, low temperature, total darkness and low food environment, only can survive in the deep-sea. The fauna depend on the surface primary production and only 1-3% of the surface production reaches the deep-sea.

The mean macrobenthic density of 30 no.m$^{-2}$ and 44 no.m$^{-2}$ observed in CIOB during March 2003 and April 2005 respectively is much lower than the other deep-sea areas and is attributed to the lower surface primary production in the region. Since only a fraction of this surface production reaches the deep-sea, the CIOB abyss is a highly food limiting habitat for the benthic fauna.

Higher abundance of deposit feeding polychaetes in the macrofauna indicates that the benthic macrofauna in the CIOB feeds on the organic matter supplied from the euphotic zone. The surface deposit feeders such as polychaetes ampharetids and spionids were dominant in the CIOB.
The omnivores-carnivores/facultative predators were the most dominant nematodes in the CIOB during both the sampling occasion. The feeding approach of the deep-sea nematodes may vary, since the predator-prey encounter in the deep-sea will be very less. *Leptognathia* sp., which dominated the tanaid fauna are known to feed on micro-organism/detritus aggregates. Thus, it can be concluded that, majority of the macrobenthic genera reported in the present study were deposit feeders.

Grazing by the benthos has proven to be an important factor in balancing the carbon budget. Macrofauna is known to control the concentration and accretion of metals in the deep-sea and indirectly help in the nodule growth. Bioturbation by these sediment-dwelling organisms also influence the mixing of organic and inorganic matter in the upper sediments layers, this in turn keep the upper sediments well oxygenated.

The well-oxidized environment of the abyssal CIOB is noted by the low organic carbon content, which is due to the influx of the Antarctic bottom water. A positive relationship of macrofauna with the sediment organic carbon and sediment protein shows that, organic matter is the first order parameter to control the faunal distribution in the deep-sea.

Higher abundance of surface deposit feeding fauna in the CIOB was mainly due to the higher protein to carbohydrate ratio (2:1). The positive relationship of chl-α, organic carbon and macrofauna reveals that, surface water primary production contributes to the flux of organic matter to the deep-sea. This is further confirmed by the spatial variation of macrofauna with increasing latitude southwards.

Vertically, the presence of fauna at depths > 30 cm, was probably due to the distribution of organic matter to the lower sediment depths. Some macrofauna build deeper tubes (ampharetids and capetellids) in the sediment, reaching more
Conclusion

than 15 cms. This behavior of subsurface deposit feeders helps the organism to store food in their tubes, protecting from the other competitors and ensure survival till the next flux arrives. Further, it helps in the oxygenation of the deeper depth and increases the available food to the deep burrowing organisms.

Marginal increase in macrofaunal density in April 2005 was mainly due to the increase in sediment protein and carbohydrate. Proteins are the most important nitrogen source and are utilized at a faster rate than carbohydrates by consumers; therefore their availability may enhance the population growth. The studies conducted on two occasions suggest that, benthic environment in the CIOB remains unchanged temporarily.

Majority of the macrobenthic organisms had smaller body size, which was probably due to the availability of limited food material, which is known to act as a major contributing factor in controlling the optimal body size of benthic communities. Hence, it is recommended to use a smaller mesh size, preferably 0.3 mm for separating deep-sea macrofauna since it results in higher diversity.

In the current study a total of 77 macrobenthic genera were identified and reveals that the collection probably include few new species of nematode, harpacticoid and tanaid, but will need further detailed taxonomic analysis. In view of the importance of the deep-sea organisms in the benthic ecosystem, any step leading to the disturbance to the highly sensitive abyssal fauna should be conducted with utmost caution.

Exploitation of the manganese nodules in the future would be a threat to the deep-sea benthic communities and is likely to affect tens to hundreds of thousands of square kilometer with the ecosystem recovery requiring many decades to millions of years (e.g., for nodule regrowth) and consequently causing the mortality of the less known deep-sea species. It could perhaps lead to the extinction of some rare
species and species still unknown to science. Our limited knowledge of the
taxonomy, species structure, biogeography and basic natural history of deep-sea
animals prevents accurate assessment of the risk of species extinctions from large-
scale mining and other human threats.

The scope of this study will go a long way in the future, with the species level
identification of these organisms using molecular technique. There is a need to
develop an advanced and appropriate sampling technique that can overcome the
pressure barrier and provide these organisms in an intact form to the researchers.
The study of nodule associated fauna is another important aspect related to this
work which has not yet been adequately looked upon.