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Short Communication

STATUS OF HEAVY METALS IN COASTAL WATER OF DIGHA (WEST BENGAL)

INTRODUCTION

India has a vast coastline and utilisation of marine resources which has an important bearing in the national development. Apart from fishing prospects, other marine and aquatic forms of life may provide several useful substances. However, the increasing incidence of marine pollution by industrial, agricultural and domestic effluents, oil spillage etc. has resulted in a considerable environmental disbalance causing large scale damage to marine biota including the micro-organisms.

It is estimated that over 35×10^8 tons of sediments containing high values of metals in particulate matter is added annually into the Indian ocean. Observations on the dissolved metals showed that about 85% of it settle within the estuarine region and at the confluence, leaving only 15% to flow out into the Bay of Bengal. Unlike most of the organic pollutants, metals can not be degraded biologically and chemically in nature and many of the heavy metals are hazardous to marine organisms. The sources of heavy metal pollution to the marine system have been mainly the disposal of domestic sewage, agriculture and industrial waste as well as discharges of ship borne pollutants (deliberate and operational). The purpose of this study is to provide a status report for the occurrence of well known heavy metal pollutants eg. Copper (Cu), Cadmium (Cd), Manganese (Mn), Zinc (Zn), Lead (Pb) and Nickel (Ni) in Digha marine water samples in the Bay of Bengal.

Studies presented here were conducted for three consecutive years i.e. 1995, 1996 and 1997 at Digha coast which is situated close to the Gangetic mouth on East Coast of India at latitude 21° 36' N and longitude 87°30' E. Coastiline is straight and the beach is flat and compact. Marine water samples were collected fortnightly at 10-20 meters distance inside from the sea surface both at low and high tides in a stretch of 200-500 meters of either side of the beach near this research centre (Fig. 1).

MATERIALS AND METHODS

The marine water samples collected fortnightly were filtered to remove suspended impurities. The dilutions were made (when required) by the triply distilled water, to make it to the detectable range. The Hitachi made Zeeman Double Beam Absorption Spectrophotometer (Model no. Z-6100) and the Cathode lamp for each element (Separately) were utilised for routine analysis of such water samples. The instrument was calibrated for each metal to be detected with known standard reference solutions prepared from pure metals (Sigma/Aldrich grade). After calibration

and programming, samples were directly aspirated into the air acetylene flame and the concentration was recorded by Automatic Absorption Spectrophotometer. Before each determination, zero was set with double distilled water. Results on the instruments were displayed in µg/l from which the actual concentration of the heavy metal in the water sample could be computed. Metal content can also be obtained in ppm (mg/l). The other methods used here are those of APHA (1985), ADONI (1985), NEERI (1986) and further incorporated by Mitra *et al.* (1994) and Kataria (1995).

RESULTS & DISCUSSION

The concentration of the heavy metals detected in Digha marine water samples for the elements Cu, Cd, Mn, Zn, Pb, and Ni are depicted through figures 2 and 3 respectively. These values are expressed distinctly seasonwise i.e. premonsoon, monsoon, and postmonsoon expressing the block period of March to June, July to October and November to February respectively. From such observations, it has been found that the metal concentrations were higher during the monsoon period, which may be attributed to the influence of monsoon run off and simultaneously the lowering of pH and salinity was also noticed during this period.

The presence of heavy metals on the surface and deeper waters in the Bay of Bengal was evidenced as back as in 1980 by National Institute of Oceanography workers. The occurrence of heavy metals namely, Cu, Zn, Co and Ni in µg/l reported are 6.8-9.5, 15.3-20, 7-9 and 11.2-12.2 respectively. Also the maximum concentration of such heavy metals in zooplanktons occurring both in the Arabian sea and Bay of Bengal are reported to range (in ppm) between 232-228 for Cu, 22494-170 for Zn, 783-322 for Co and 178-81 for Ni in the dry weight samples. Unlike most of the organic pollutants, metals can not be degraded biologically and chemically in nature including the evidence that most of the heavy metals are quite hazardous to marine organisms. Elements like Tin (Sn), and Mercury (Hg) assume greater toxicity as they disrupt some enzyme related biological functions of the body, Mathur *et al.* (1986).

Though the heavy metal values obtained in our studies at this area are reasonably below the permissible limits, but the continuous influx and possible increasing trend of heavy metals concentration may adversely affect the growth of susceptible phyto and zooplanktons resulting into disrupting the entire food chain of a large number of marine organisms. Also the impact of such pollution load in combination with other physical and weather pattern factors may be much more than anticipated.

Monitoring of Digha coastal water in respect of heavy metal pollution threat assume more significance in view of ongoing industrial activities around this area which include the newly emerging Haldia Refinery/Industrial complex, Paradeep port trust, and the Vishakhapatnam port and the Industrial complex in the Bay of Bengal. Although, this area has been generally considered as of clean environment, but the same may not remain true for longer because of such ongoing activities. It is therefore necessary to remain vigilant and to maintain such profile in order to cope with any likely eventuality. Our studies on this line is an elementary attempt to establish a baseline for heavy metal impact on marine system

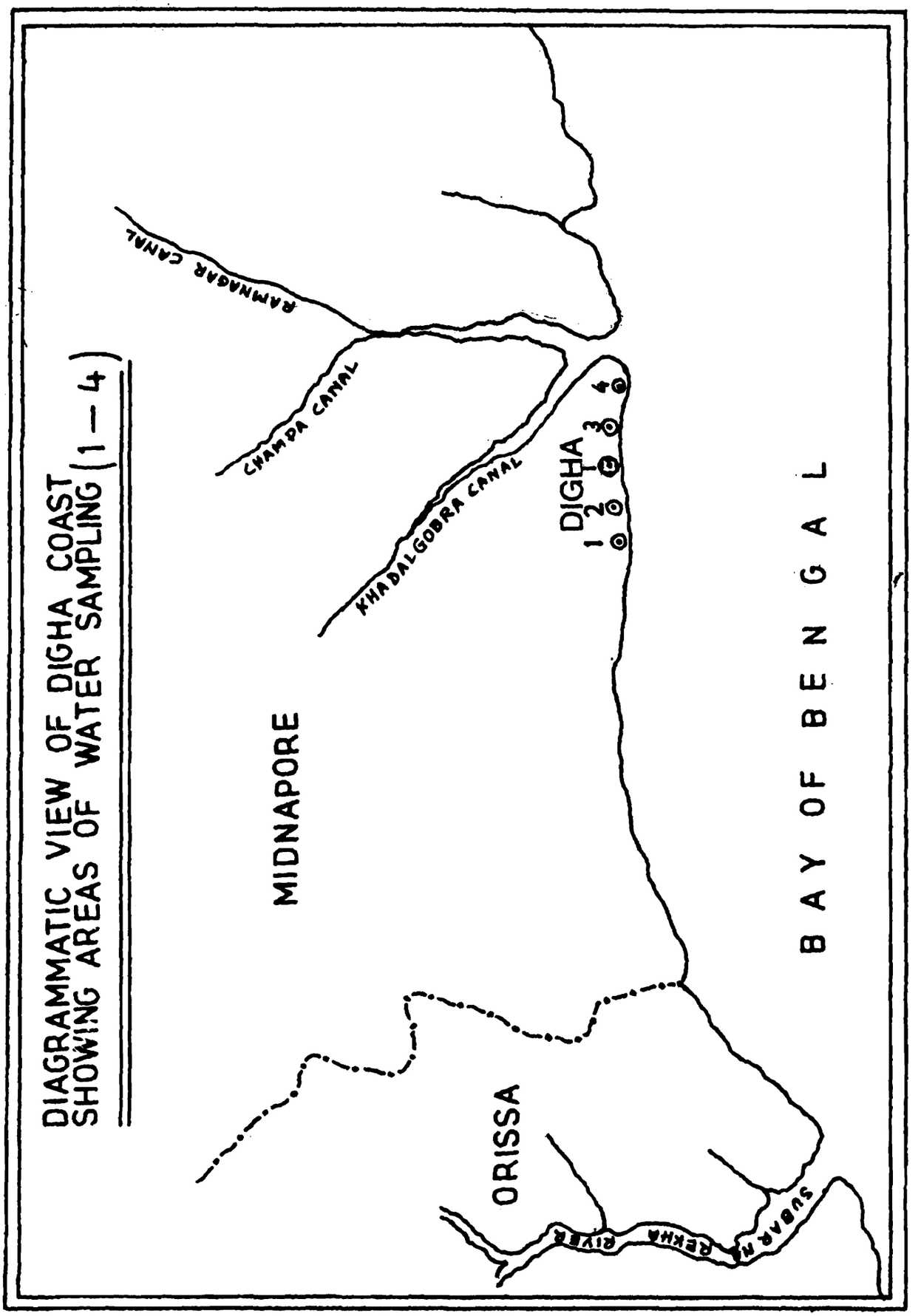
DIAGRAMMATIC VIEW OF DIGHA COAST
SHOWING AREAS OF WATER SAMPLING (1 — 4)
RAMNAGAR CANAL
CHAMPA CANAL
KHADALGOBRA CANAL
DIGHA
1 2 3 4
MIDNAPORE
BAY OF BENGAL
ORISSA
SUBAR N.
REKHA
RIVER

Fig : 1

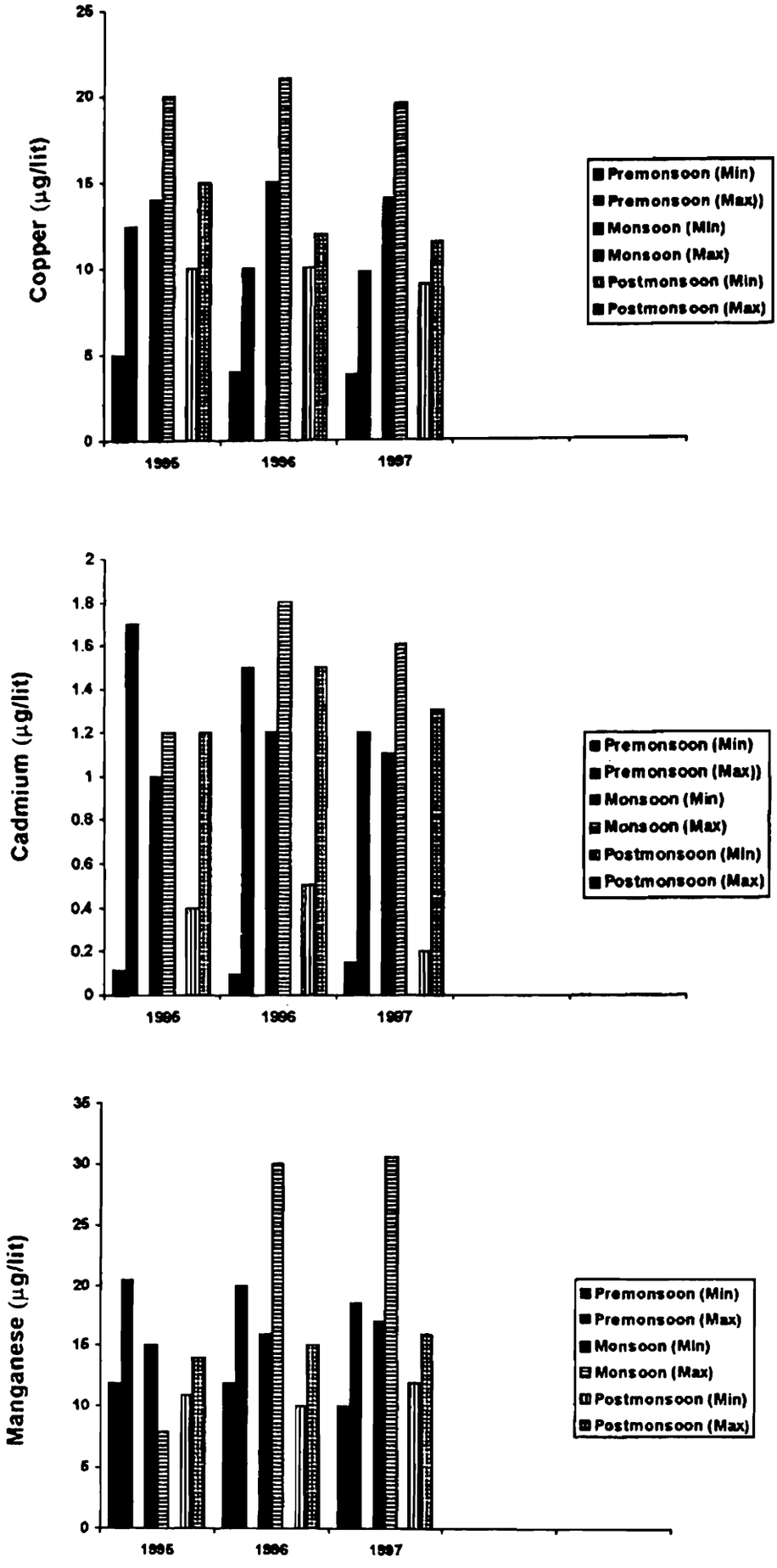
Copper (µg/lit)
25
20
15
10
5
0
1995
1996
1997
Premonsoon (Min)
Premonsoon (Max))
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
Cadmium (µg/lit)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1995
1996
1997
Premonsoon (Min)
Premonsoon (Max))
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
Manganese (µg/lit)
35
30
25
20
15
10
5
0
1995
1996
1997
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)

Fig : 2

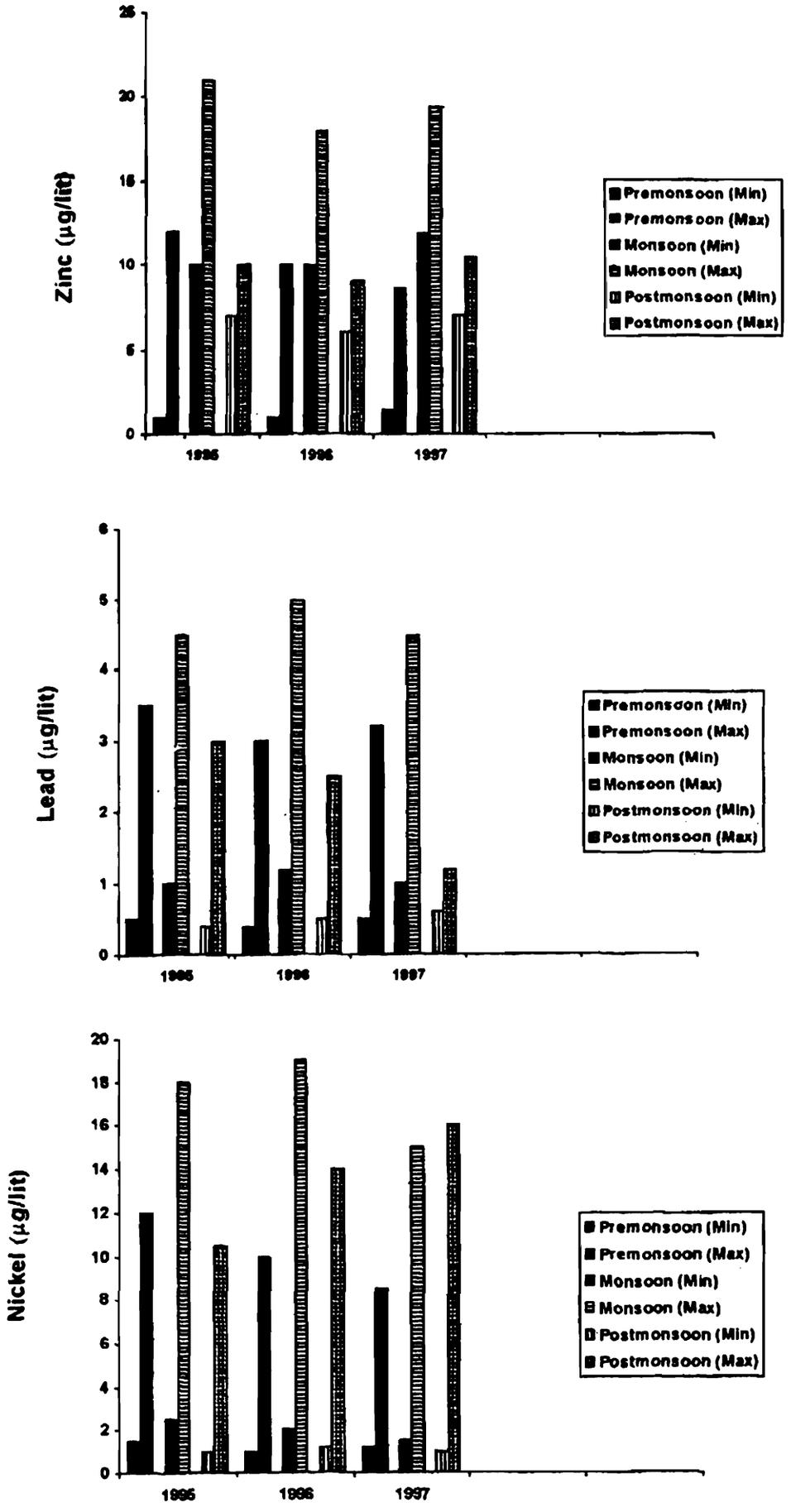
Zinc (µg/lit)
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
1995
1996
1997
Lead (µg/lit)
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
1995
1996
1997
Nickel (µg/lit)
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
1995
1996
1997

Fig : 3

SUMMARY

It is an established fact that most of the heavy metals are hazardous to marine organisms. Elements like tin and mercury assume greater toxicity as they disrupt some enzyme related biological functions of the body. Over 35×10^8 tons of sediments containing high values of metals in particulate matter, is added into the Indian Ocean annually. Observations on the dissolved metals showed that about 85% settle within the estuarine region and at the confluence, leaving only 15% to flow into the Bay of Bengal. The purpose of this paper is to provide a status report for the occurrence of well known heavy metal pollutants in and around Digha coastal water samples in the Bay of Bengal. The study depicts occurrence of heavy metals namely, copper, cadmium, manganese, zinc, lead nickel for the study period 1995 to 1997. Heavey metals reduce respiration, feeding, growth, development and sexual maturity and may also be responsible for morphological aberrations in almost all organisms. The synergistic effect of heavy metals with low pH, low dissolved oxygen, high temperature and alkalinity may cause episodal fish kills.

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