I

INTRODUCTION

The topic of present investigation has two facets, the estuarine water and the heavy metals. At the very outset, it is necessary to define 'estuary'. According to Cameron and Pritchard (1963), an estuary is "a semienclosed coastal body of water, having a free connection with the open sea and within which the sea water is measurably diluted with fresh water deriving from land drainage." This definition has been accepted by all ecologists, in one form or the other. Day (1980) has slightly modified the above definition and has stated that, "an estuary is a partially enclosed coastal body of water which is either permanently or periodically open to the sea and within which there is a measurable variation of salinity due to the mixture of sea water with fresh water derived from land drainage." More recently, Umamaheshwar Rao (1987) has described estuary as "a basin where one or more rivers or coastal streams introduce fresh water into the sea." The salinity of water is in between 0.5 and 35‰. This range is termed brackish as a distinction from fresh or marine water. The salinity of estuarine water is extremely variable.

Since very ancient times, right from the human civilization, settlements took place near the estuaries because they proved to be useful means of transportation. Moreover, they provided the basic needs such

as water and food (fishes etc.). The subsequent use, perhaps unnoticeably made, of estuary, was to dump unwanted products from the settlement areas. As a consequence of developement industrialization took place when the third use of estuary invited the attention of planners who treated the estuaries as "dumping places". This 'position' of estuaries continued until recently. This posed several problems of environmental pollution and health hazards.

Industrial effluents add a variety of pollutants to the estuary, amongst them, most important are the heavy metals.

Water pollution is one of the much discussed subjects in the recent years. Nevertheless, marine pollution needs to be considered in more depths with respect to its effect on plant life. In the last few decades, there has been an increasing intrest in the consequences of the effects of discharge of industrial effluents containing heavy metals into the estuarine water. The metals such as copper, zinc, lead are the normal constituents of estuarine sediments. When additional quantities are introduced from water or sewage, they enter the biogeochemical cycles and as a result of being potentially toxic, may interfere with the ecology of a particular environment. Some of them get accumulated in higher trophic levels, e.g. fish, crabs and other aquatic organisms leading to biomagnification. Significant quantities of heavy metals get transported through agricultural run-off containing residues of organo-metallic pesticides.

At this conjuncture, it will be worth defining the term 'heavy metals'. The metals having density five times that of water are referred

to as 'heavy metals' (Passow et. al., 1961). According to another definition, the term heavy metal includes all those metals which have atomic number greater than twenty. As a matter of fact, there is a lack of clarity regarding the terminology used in connection with heavy metal pollution (Macfadyen, 1980). The term 'heavy metal' itself is very vague and is used without critical examination (Burrell, 1974). The adjective 'heavy' refers to density which hardly shows relevance to biochemical or physiological effect or biogeochemical mobility. Nieboer and Richardson (1980) have pointed out that the term 'heavy metal' is often used to imply toxicity. They further state that many authors use the term without defining it and that it be abundoned entirely and the classification of metal ions should be based on their oxygen-seeking property. Schubert (1984) has advocated that the term 'heavy metal' should continue to be used in pollution studies. The terms trace metals, trace organics, heavy metals, microelements and micronutrients are treated as synonymous with the term trace element (as cited by Sanz giry, 1989). As per the definition given by Passow et. al. (1961) a comparison between the density of water and the metal is considered. This definition includes about thirtyeight elements.

Some metals in trace amount are essential for biological functions, but are toxic in excessive quantities; the toxicity may be lethal. There are three heavy metals which are toxic to most of the living organisms at their lowest concentrations and which are considered never beneficial to them. They are cadmium (Cd), lead (Pb) and mercury (Hg).

The selection of heavy metals for the present study is based on this. Further, zinc is also studied. However, it does not fit into the definition given by Passow et. al. (1961), but it can be considered along with heavy metals as no distinction in trace metals and heavy metals is made on certain grounds in inorganic chemistry. Nevertheless, zinc is referred to as a trace element in the present study.

Scope of present investigation

The first and the foremost restriction on the investigation is the time limit described for M.Phil. degree course. Accordingly, the scope of the problem is elaborated. The selection of site is restricted to three on each of the banks, with an additional site for sea water collection. Water analysis data is collected for one year in between August 1987 to July 1988. Obviously, it covers the seasonal variations. Heavy metal constituents from water and plants are taken into consideration. Due to technical difficulties, data on heavy metals from soil could not be included. Further, present investigation covers the primary productivity of estuarine water with respect to phytoplanktons and heavy metals. The plant analysis for assessing the effect of heavy metals is restricted to heavy metal composition and some common organic constituents of the leaves of the mangroves occuring at collection sites.

Thus, heavy metals in estuarine water are studied for their presence and effects.