

Coastal contamination

A nearshore heavy metal survey

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In many developing countries, rapid urban and industrial expansion is closely linked to increasing environmental pollution. Untreated industrial and domestic discharges enter into watercourses, rivers, and eventually the sea. In many estuarine and nearshore marine settings there is evidence that contaminants enter the food chain and directly impact on people's health

Recognising such problems, the BGS established a coastal contaminant monitoring programme, the Land-Ocean Contamination Study (LOCS) under funding from the Department for International Development. Its objectives were the provision of data on the sources, transport pathways, and fates of contaminants along urbanised coastal margins, and the promotion of the need for contaminant-flux monitoring as a

component of integrated coastal zone management. Particular emphasis was placed on the development of rigorous, yet low-cost, monitoring methods which meet the social and economic requirements of the study regions.

As part of the study a systematic geochemical and hydrochemical survey of Sepetiba Bay, Brazil, was carried out in liaison with the Universidade Federal Fluminense, and the Rio de Janeiro State Pollution Control Agency. Heavy metals dissolved in waters, adsorbed on to suspended particulates, and hosted within sea bed sediments were sampled at 43 sites in Sepetiba Bay between the main point-sources and the open Atlantic. Sea bed sediment cores, up to a metre in length, were taken at 29 sites, while sediments at other sites were sampled using a Van Veen grab. Measurement of

temperature, salinity, pH and concentrations of coliform bacteria in waters, was undertaken at two metres depth (or mid-water depth, where shallower) at each site. Samples to determine the concentration of alkanes in sea bed sediments were taken at key sites.

The survey showed that land-derived anthropogenic fluxes of most heavy metals are low, relative to the natural background sediment loading concentrations. However, in the case of zinc, an average anthropogenic loading of greater than 400 per cent was found, which exceeds internationally-recognised sediment thresholds. On the basis of the zinc in the sediments the storage of contaminants in sea bed sediments throughout the bay was calculated. Most contaminants are stored in the delta systems at the mouths of the main distributaries entering the bay, or down current from them. Contaminant storage rates are greatest in areas of active delta growth. Many contaminants entering the bay over the past 30 years are likely to be stored in sea bed sediments; little will have reached the Atlantic. This is of concern as these may be remobilised by human activities such as fishing and dredging. Concentrations of many water-borne contaminants appear to be controlled by dredging activities that were ongoing at the time of the survey. Concentrations were enhanced in deeper parts of the bay, in which dredgings were being dumped, and relatively low in shallow-water areas where they may have been expected to be high (through resuspension of contaminated sea bed sediments).

Although zinc has a relatively low toxicity, high levels can suppress aquatic microbiological productivity which can in turn affect fish stocks. Also, many pollutants have a mutually synergistic effect, and high levels of zinc may enhance the toxicity of other metals such as copper and lead, even when these appear to be at non-critical levels. Reduced microbiological activity may allow pathogens from sewage and other organic wastes to persist for longer periods and accumulate in the food chain, increasing the likelihood of health problems in humans.

The data show that in order to minimise the risks to health, due consideration must be paid to limiting both the influx of contaminants entering the bay and the remobilisation of contaminants through human activities in the bay.



Dredging in Sepetiba Bay, Brazil, ongoing at the time of the survey.