

THE MARINE MUSSEL *PERNA PERNA* (MOLLUSCA, BIVALVIA, MYTILIDAE) AS AN INDICATOR OF CONTAMINATION BY HEAVY METALS IN THE UBATUBA BAY, SÃO PAULO, BRAZIL

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Abstract. Heavy metal levels were determined in marine mussels *Perna perna* collected from Ubatuba Bay, northern coast of the State of São Paulo, Brazil, during the period from January to October 1995. The objective of the present study was to analyze the seasonal concentrations of some metals of toxicological interest (Cd, Cu, Cr, Pb and Zn) in Ubatuba Bay using the bivalve *Perna perna* (Linnaeus, 1758) as a biological monitor. Collections were performed at three month intervals at Itaguá beach. In the laboratory, the frozen specimens were thawed at room temperature, removed from their shells, partially dried on filter paper, weighed and individually submitted to acid digestion with sulfuric acid and hydrogen peroxide. The analyses for the detection of Cd, Cu, Cr, Pb and Zn were carried out by flame atomic absorption spectrophotometer. The results showed higher metal accumulation during July. The values detected for Pb and Cr were relatively high in all seasons, especially in January and July (vacation periods) in Ubatuba Bay, with the consequent risk of contamination by mussel ingestion for the local population and for tourists from other regions.

Keywords: biomonitoring, Brazilian coast, heavy metals, mussel, *Perna perna*

1. Introduction

In general, many metals occur naturally in marine environments. Some of them are classified as pollutants only when added by man in sufficient amounts to produce deleterious effects on some features of the ecological system (Wolfe, 1974). The levels of heavy metals present in the marine environment are known to vary with tidal patterns, the phenomenon of dilution caused by the fresh water supply occurring in estuary regions, and variations in discharge. Direct measurements on water may not yield reliable data about the contamination of the marine environment with heavy metals (McConnel and Harrel, 1995), whereas living organisms can be used as more efficient monitors of environmental contamination (Foster and Bates, 1978; Kraak *et al.*, 1991; Van Hattum *et al.*, 1996). Some animals such as bivalve molluscs are well known for their ability to concentrate heavy metals



and other substances in their tissues (Lakshmanan and Nambisan, 1996). For example, oysters and mussels can accumulate in their tissues Hg and Cd levels up to 100 000 times higher than the levels observed in the water where they live (Baird, 1995). High concentrations of trace metals have been detected in several species of marine bivalves in many parts of the world (e.g. Brooks and Rumsby, 1965; Phillips, 1976; Farrington, 1983; Lima *et al.*, 1986; Rezende and Lacerda, 1986; Sukasem and Tabucanon, 1993; Fagioli *et al.*, 1994; McConnell and Harrel, 1995; Fisher *et al.*, 1996; Lakshmanan and Nambisan, 1996). The ability of these animals to concentrate metals and other pollutants led to the concept of Mussel Watch in the 1970's in the U.S. as a form of monitoring the marine environment (Farrington, 1983). Similar problems of marine pollution were particularly discussed in Europe, Japan and Australia.

In Brazil, few and localized programs of biological monitoring of the marine environment were implemented, clearly indicating the necessity of studies such as this. The few studies of biological monitoring that have been carried out in Brazil, were concentrated in the southeast coast of Brazil (Lacerda *et al.*, 1983; Pfeiffer *et al.*, 1985; Rezende and Lacerda, 1986; Lima *et al.*, 1986; Boldrini and Pereira, 1987). Thus, considering the wide extension of the Brazilian coast, and the fact that some species of bivalves are widely consumed by local population, a broad study on contamination mainly by heavy metals should be conducted in Brazil.

The objective of the present study was to analyze the seasonal concentrations of some metals of toxicological interest (Cd, Cu, Cr, Pb and Zn) in Ubatuba Bay using the bivalve *Perna perna* as a biological monitor, in order to initiate an extensive program of biological monitoring along Brazilian coast. The bivalve *Perna perna* has a wide geographic distribution in South America (Rios, 1994) and is highly appreciated as a gourmet food.

2. Material and Methods

2.1. STUDY AREA

Ubatuba Bay (23°26'23"S and 45°02'24"W), situated in the town of Ubatuba, northern coast of the State of São Paulo, is characterized by receiving the outflow of four rivers: Indaiá, Grande de Ubatuba, Lagoa and Acurai (Figure 1). The waters of these rivers contain industrial effluents mainly from the naval construction industry and from fish canneries. Many commercial fishing and tourist boats cruise along this area, and mooring and boat maintenance areas are common. During periods of vacation (January and July) there is a temporary tourist migration that increases the flow of organic matter from domestic sewage, accompanied by leisure and fishing activities. The bay is under the influence of three water masses that modify the conditions of temperature, salinity and nutrients throughout the seasons of the year: central water of the south Atlantic, tropical water and coastal water (Castro