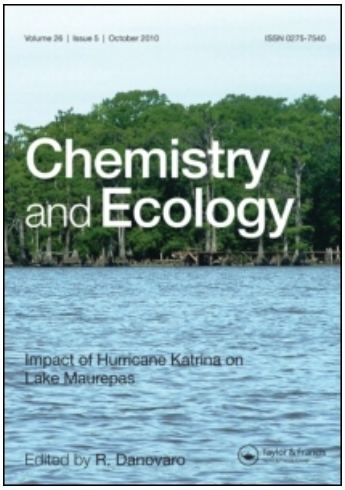

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FOREWORD

Benthic Chambers Experiments in the Rapallo Harbour (Gulf of Tigullio)

The coastal marine environments represent a fragile ecosystem increasingly affected by arthropogenic inputs. Coastal marine sediments receive many pollutants (including heavy metals) that are largely associated to suspended particles or adsorbed on to dissolved compounds. These elements when reaching the sediments are complexed to macromolecular organic compounds with eventual effects on their bioavailability and/or toxicity. They might be subsequently buried in sedimentary organic matter composition with many changes and transformations involving benthic biota. The introduction of different compounds in the system might have different effects.

This interdisciplinary study was designed to operate *in situ* manipulations of the sediment surface using benthic chambers. The use of this technique is open for debate since the effects and alterations might cause a change to the benthic system, but still this remains one of the most appropriate ways to evaluate the effects of different pollutants introduced to the benthic ecosystem.

This monograph reports the results of investigations whose aim was to assess the basic characteristics of the benthic environment in the Rapallo Harbour area and to plan further experiments on benthic manipulations simulating the effects of different pollutants disposal on the benthos.

In this frame, a brief synthesis of previous studies as carried out in the Gulf of Rapallo (Fig. 1) may be of interest.

Currents have reached speeds of 0.33 to 0.64 cm sec^{-1} westwards (Cortemiglia and Terranova, 1974) in accordance with the cyclonic circulation of the Ligurian Sea, although in summer the coastal current may reverse its direction eastwards (Dagnino, 1987).

Temperature, salinity and pH in the inner part of the Gulf, within the Harbour are included; yearly fluctuations between 11.84 to

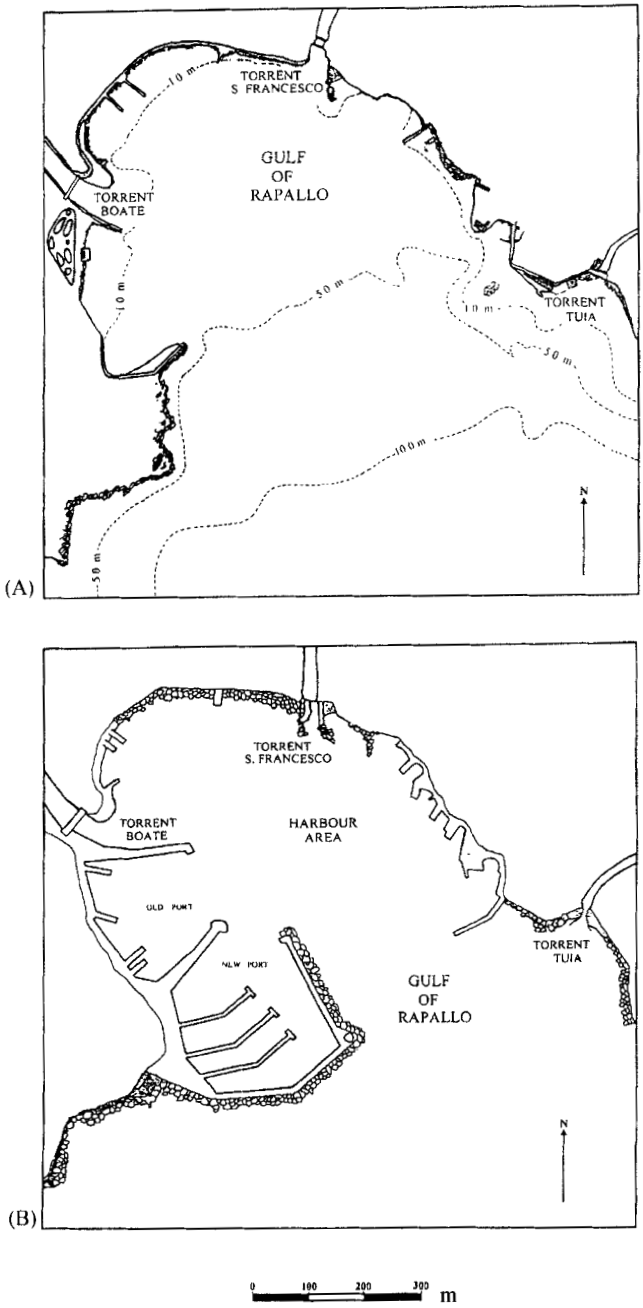

FIGURE 1 Gulf of Rapallo on 1953 (A), since 1986 (B).

25.31°C, 27.68 to 38.42‰ salinity and 7.72 to 8.40 pH (Cortemiglia and Terranova 1974; Dagnino, 1987). Secchi disc readings of 2.5 to 3.5 metres classified the inner waters of the Gulf as harbour waters (Della Croce, 1980). Isolated determinations of nutrients have concentrations of 0.30 to 0.64 μg at-l for $P-PO_4^-$ and 0.97 to 5.12 μg at-l for $N-NO_3^-$ (Capelli *et al.*, 1976a; Fabiano *et al.*, 1978).

Dissolved oxygen in the harbour area of the Gulf in a few seasonal water samples reached concentrations of 6.4 to 9.3 $mg\,l^{-1}$ (Siccardi, 1997); the waters being oversaturated in spring (110.6%) and undersaturated in winter (89.3%).

Zooplankton facies is a neritic one, but in the harbour waters together with some brackish copepods and rotifers (Picone *et al.*, 1978; Basso *et al.*, 1980; Cevasco *et al.*, 1980) because of the flow of three torrents into the Gulf (Fig. 1). Some pelagic copepods, collected also on a yearly hyponeuston sampling (Olivari, 1969) near the coast line, showed the penetration in the Gulf of open sea waters.

It is worth noting that in the Gulf of Rapallo, the protein content into the mantle and the hepatopancreas of mussels (*Mytilus galloprovincialis*) of tissue DNA was equal to 13.0 and 42.1 μg mg^{-1}, and the glycogen content to 18.7 and 9.5 μg mg^{-1}. Such high values, compared to the lower ones for mussels of seven harbours along the Ligurian and Tuscan coasts, with tourist harbours included, reflected indirectly an evaluation of their water quality (Viarengo and Della Croce, 1976). Mussels from the Gulf of Rapallo were also analyzed for their concentrations in heavy metals (Ceradini *et al.*, 1997). Heavy metals in the sea water, sediments and in another mussel (*Corbula gibba*) of the new and old port of Rapallo were studied recently (Siccardi, 1997).

Most of these observations were carried out before the beginning of the construction of the new port in 1973. The outer jetty of the new structure, facing that of Parco Casale (Fig. 1), has reduced considerably (about one third) the width of the inner part of the Gulf, which is considered now a harbour area with a surface of 307.190 m^2. This new configuration has modified direction and speed of the coastal current and the time of renewal of the water body. Flood torrents, especially the torrent Boate, greatly modify the dynamics and the transport of the terrigenous material coming from their drainage basins as well as from the town. The three main torrents (Fig. 1) drain basins covering a

surface of 37,978.165 m^2, with an estimated rainfall contribution of 30,455.966 m^3 each year. For the drainage basin (77.3%) and rainfall contribution (74.0%), the torrent Boate represents the main element influencing the harbour area of the Gulf of Rapallo.

It has to be pointed out, however, that most of waste waters are collected by sewers and canalize to the sea through a pipeline exiting from the coast about three kilometres long and reaching the depth of about 50 metres. Moreover, since the nineties, the Rapallo municipality has provided experimental dispersal of tripoli (a lightweight porous rock) over the sandy bottom of torrential origin in the western area of the Gulf, and recently the experimental transplant of *Posidonia oceanica* in the eastern end over dead *Posidonia* meadows (matte).

This section completes the results presented only in part as in the last Italian Ecological Society meeting (Ceradini *et al.*, 1997; Della Croce *et al.*, 1997a; Della Croce *et al.*, 1997b; Fiori *et al.*, 1987; Sei *et al.*, 1997). The sections of this report are to follow this intoduction.

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