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MARINE SAMPLING BY SCUBA DIVING
2. SAMPLING PROCEDURES FOR TRACE METAL ANALYSIS OF SEDIMENTS FROM THE NORTHERN ADRIATIC

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Heavy metals are either known or strongly suspected as highly toxic substances. Although primarily of natural origin, anthropogenic influence may locally cause extreme elevation of heavy metal concentration levels in the marine environment.

The investigations reported in this paper are part of an extensive national monitoring program, intended to develop environmental management strategies, particularly with respect to pollution from land-based sources.

Marine sampling methods for sediments, which are being currently applied are well documented in the literature. Most of them, however, use some kind of mechanical device (dredger etc.) and data on sampling techniques by scuba divers are very scarce.

Our preliminary investigations of sampling procedures by diving have shown that they do not necessarily result in sample contamination (1). The sampling techniques described here were applied during the August 1985 cruise of R/V "Bios". Sediments were collected on 6 stations, covering three transects, as shown in Fig. 1. Samples were retrieved by divers, using specially designed plexiglas corers fitted with screw-caps on both ends. The corer is inserted into the sediment, taking care not to disturb the unconsolidated upper layer of the core. In the laboratory, a 1 cm thick section of this layer is separated and sieved. In order to eliminate grain size influence, only the < 75 µm fraction is digested and analysed for metal content (2). Cu, Pb, Cd, Zn and Hg are determined by atomic absorption spectrometry (AAS).

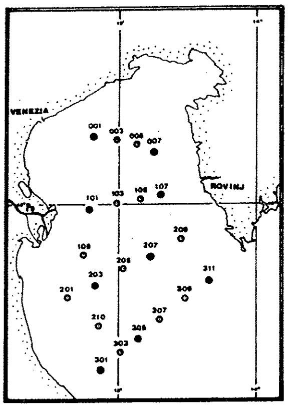

Fig. 1. The area investigated: the Northern Adriatic

The results obtained are shown in Table 1. The heavy metal concentrations are within the range of values for unpolluted sediments (with regard to these heavy metals).

Table 1. Heavy metal concentrations in sediment cores from the Northern Adriatic (August 1985 cruise of R/V "Bios"). Concentrations of Cd, Pb, Cu and Zn are in µg kg^{-1}, for Hg in ng kg^{-1}.

Station	Depth (m)	Cd	Pb	Cu	Zn	Hg
001 SJ	30	0.214	36.9	17.6	121.9	229
007 SJ	30	0.143	26.0	10.2	80.1	114
101 SJ	31	0.354	44.1	13.9	105.1	425
107 SJ	36	0.136	27.9	11.1	75.7	136
301 SJ	40	0.128	33.9	20.7	139.6	303
311 SJ	46	0.202	38.0	16.4	101.0	238

The primary advantages of the sampling technique described are
a) the possibility of a critical evaluation of the sampling site by the diver,
b) convenient retrieval of an undisturbed sediment core
c) exclusion of visible benthic species and other objects from the sample surface

As this sampling method eliminates most of the contamination-prone sediment handling, it should prove particularly suitable for baseline studies, in aquatories of comparative shallowness such as the Northern Adriatic. One of the inherent limitations of this procedure is the risk of successive sampling at greater depths and the necessity to engage several trained divers under such circumstances.

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H-2

THE FIELD METHOD OF "PLASTER BALLS" FOR WATER MOVEMENT ESTIMATES APPLIED TO POSIDONIA OCEANICA BEDS

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Here is described the application of the "plaster consumption" method, for measuring exposure to water movements (DOTY,1971; MUUS, 1974), to estimate exposure in Posidonia oceanica beds. The modifications of the original procedure were:
a) "Scagliola" plaster ($CaSO_4 \cdot 2H_2O$) was used instead of "plaster of Paris" ($CaSO_4 \cdot 1/2H_2O$) as the latter is not readily available in Italy.
b)The plaster/water (freshwater) ratio was constant (50 gr X 45cc).
c) The duration of field exposure of plaster balls was selected after preliminary experiments in the field under different weather conditions.(The method has been described in detail in GAMBI et al., in press).

The aims of this investigation were:
a) to describe the hydrodynamic flow pattern along the depth-gradient in a continuous Posidonia bed off Lacco Ameno (island of Ischia, Gulf of Naples),
b) to record the differences between the top of the leaves and the base of the rhizomes due to the effects exerted by the Posidonia canopy on water movements.

Plaster balls, encasing a thin steel bar (Fig.1), were numbered, weighed and placed at six different depths along the prairie and at two locations in the Posidonia canopy: about 10cm above the leaves, and at the base of the rhizomes, about 5cm from the bottom (Fig.2). The balls were placed on three different types of supports.

Support A (Fig.3,A) was used to position balls above the leaves, and consisted of a flat iron bar (800mm long) joined by a plastic screw to a four-armed candelabrium of crossed copper-tubes. The thin steel bar of the ball was inserted into the copper-tube opening that contained "plasticine". This latter is very suitable because it does not harden in the water, although it assures a good fixation of the balls.

The major problem in placing balls at the base of the rhizomes was to avoid plaster abrasion caused by contact between balls and plants. To overcome this difficulty , two types of supports were made with the same materials as support A,but different in shape and size (Fig.3,B and C).

Support B (Fig.3,B) was utilized in the deeper stands of the Posidonia prairie (from 30 to about 10m depth) where the shoot densities are generally not high and there is enough space among the rhizomes for four balls.

Support C (Fig.3,C) held only one ball and was utilized in shallow Posidonia stands (from about 6 to 1m depth) where shoot densities are high and there is insufficient space among the rhizomes for more than one ball at time. The stem of support C is only 100mm long because the "matte" is difficult to penetrate at these depths.

By SCUBA diving, the supports were hammered into the bottom taking care to avoid contact between balls and plants.

The results of preliminary experiments are reported in GAMBI et al.(in press). Less than the 10% of the balls placed at the base of the rhizomes presented signs of abrasion, and the entity of abrasion was negligible. In general, plaster consumption decreased as a "power" function of water depth at both locations. However, the balls above the leaves were always more consumed than those at the rhizome level and significant differences, in ball weights, were found between the two locations (ANOVA, $P<0.01$).

This first approach was encouraging. Further experiments will be conducted to improve this technique in order to better evaluate the role played by some phenological leaf parameters of Posidonia canopy in reducing hydrodynamism. If this method will be standardized, it can be used to compare the "exposure" of different prairies,and so contribute to a better understanding of the influence of hydrodynamic energy on the structure of Posidonia oceanica beds.

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FIG.1

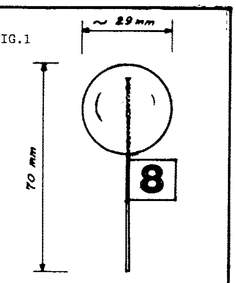


FIG. 2

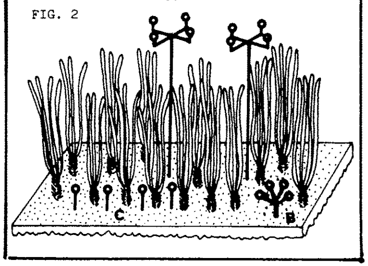
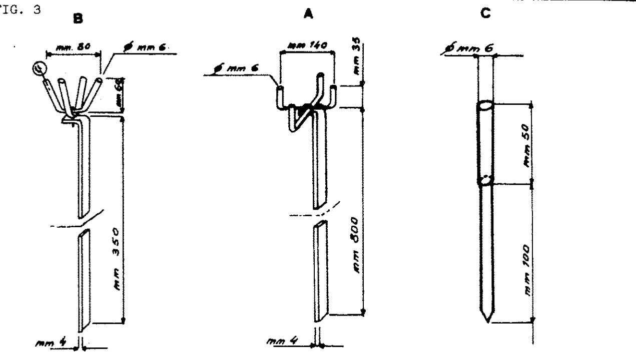


FIG. 3



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