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SEDIMENT FEATURES AND HEAVY METAL LEVELS IN FOUR AREAS OF SARDINIA DEVOTED TO BIVALVE CULTURE

CARATTERISTICHE DEI SEDIMENTI E LIVELLI DI METALLI PESANTI IN QUATTRO AREE DELLA SARDEGNA IDONEE ALL'ALLEVAMENTO DEI BIVALVI

Abstract – Sediment characteristics and Cd, Cu, Mn, Pb and Zn concentrations were assessed in the lagoons of Marceddi, Calich and Porto Pozzo, and in the inner part of the Gulf of Olbia. Sediment of the zones examined were quite similar, except for the Calich lagoon that showed the higher content of total organic carbon. High values of Cd, Pb and Zn were detected in the sediments of the Marceddi lagoon, while remarkable levels of Cu and Mn were found in the Calich lagoon and in the Gulf of Olbia.

Key-words: sediment pollution, heavy metals, mollusc culture, Mediterranean Sea.

Introduction - Bivalve mollusc culture has greatly increased in Italy during the last years. Along the Sardinian coasts, besides natural bivalve populations of commercial interest, there are a number of areas historically devoted to the mussel (*Mytilus galloprovincialis*) culture (e.g. the Gulf of Olbia; Bussani, 1983), and several other zones in which the culture of other bivalve species has been tested (Rossi & Cannas, 1992). Due to the increasing importance of these aquaculture practices, the purpose of this study was to determine heavy metal concentrations in the sediments of some areas of Sardinia devoted to bivalve culture.

Materials and methods – Sediment from four zones in which bivalve molluscs are usually fished and/or cultured (i.e. the lagoons of Marceddi, Calich and Porto Pozzo, and the inner part of the Gulf of Olbia, respectively) were studied in July 2009. Three samples from each location were collected by driving a polycarbonate cylinder ($\varnothing=5.5$ cm) about 30 cm into the bottom soil and retrieving the sediment cores that were then frozen and stored for subsequent analysis. Particle size measurements were carried out following the method of Gee & Bauder (1986), the pH and electric conductivity (EC) values were determined in 1:25 ratio of sediment/distilled water, and total organic carbon (TOC) was assessed using the method of Walkley & Black (1934). The total concentration of selected heavy metals (i.e. Cd, Cu, Mn, Pb and Zn) was determined by drying the sediments overnight at 105 °C and digesting them with HNO₃ and HCl (ratio 1/3) in a microwave Milestone MLS 1200. The heavy metal concentrations were detected using a Perkin Elmer Analyst 600 flame atomic absorption spectrometer equipped with a HGA-600 graphite furnace.

Results – General features and heavy metal levels of the sediments examined are reported in Tab. 1. Soil features of the four zones were quite similar, except for the Calich lagoon that showed the higher values of EC and TOC, and a silty-sand texture. The higher concentrations of Cd, Pb and Zn were detected in the sediments of the Marceddi lagoon, followed by those observed in the Calich one. In this latter area, as well as in the Gulf of Olbia, remarkable levels of Cu and Mn were also found. Finally, in the sediments of the Porto Pozzo lagoon heavy metal concentrations were always low.

Tab. 1 - Sediment features and heavy metal levels (mean±SD) in the four areas examined.
Caratteristiche dei sedimenti e livelli di metalli pesanti (media±DS) nelle quattro aree studiate.

	Marceddi	Calich	Porto Pozzo	Olbia
pH	8.57±0.04	7.61±0.04	7.60±0.08	8.12±0.15
EC (mS cm ⁻¹)	5.59±0.69	18.10±0.79	8.75±0.45	6.67±0.49
TOC (% DM)	0.15±0.01	1.52±0.06	0.36±0.04	0.26±0.02
Texture	sandy-silt	silty-sand	sandy-silt	sandy-silt
Cd (mg kg ⁻¹ DM)	1.39±0.55	0.10±0.01	0.08±0.02	0.09±0.02
Cu (mg kg ⁻¹ DM)	2.63±0.72	9.56±0.76	1.42±0.39	4.23±0.35
Mn (mg kg ⁻¹ DM)	7.86±0.70	95.58±3.67	18.50±2.15	41.69±4.36
Pb (mg kg ⁻¹ DM)	17.10±3.12	9.86±0.79	2.24±0.51	5.96±0.88
Zn (mg kg ⁻¹ DM)	239.36±27.67	26.80±7.96	-	19.02±1.92

Conclusions – The results of this study evidenced different sedimentological conditions in four Sardinian areas devoted to bivalve culture. In particular, the sediments of the Calich lagoon showed the higher level of TOC and Cu, probably due to sludge accumulation from wastewater treatment and/or agricultural practices in adjacent zones (Ghiglieri *et al.*, 2009). Conversely, the higher concentrations of Cd, Pb and Zn recorded in the Marceddi lagoon were almost certainly caused by mine tailings and flotation sludges containing critical amounts of heavy metals from a neighbouring mining area (Garau *et al.*, 2007). Additional research is therefore needed to evaluate heavy metal levels in autochthonous burrowing bivalves of economic importance (e.g. *Ruditapes decussatus*) from these polluted areas.

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