METALS AND POPS IN SEDIMENTS ALONG THE ITALIAN ADRIATIC AND IONIAN COAST

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Abstract
Concentrations of inorganic and organic contaminants along the costal zone of the Adriatic and Eastern Ionian Seas in the central-southern part of Italy were obtained from the Ministry of Environment database and analysed to assess the quality of these areas, and understand their variability and its main causes. Peak values were found mainly in occasion of floods, which deliver land based contaminated materials to the coastal zone. To evaluate both contamination degrees and potential ecotoxicological effects, the values of metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) were compared with sediment quality guidelines (SQGs). The mean concentrations are mostly below the lower SQGs, although maxima are higher, in some cases exceeding the limit above which adverse effects are expected.
Keywords: Metals, Pcb, Pah, Sediments

Introduction
The presence of urban areas, ports and industrial settlements is one of the main factors influencing the quality of coastal marine environments. This work aims to assess near-shore sediment quality and variability along the central-southern Adriatic coast of Italy, based on the data from Si.Di.Mar., web GIS of the Italian Ministry of Environment Marine Monitoring program, that stores information on contaminants in environmental matrices.

Material and Methods
We considered surficial sediments (0-3 cm) sampled every six months at 16 selected sites along the coast of Marche, Abruzzo, Molise and Puglia by Regional Environmental Protection Agencies in the years 2001-2006. Sampling areas, located within 1NM from the coastline, were selected among those subject to anthropogenic pressures, in general close to river mouths, ports and urban areas. In addition, a reference station, located inside a Protected Marine Area, was chosen for each region. The analysed contaminants include metals (Cd, Hg, Ni, Zn) and POPs (PAH and PCB priority congeners). Sediment characteristics, such as grain size composition, total (TC) and organic carbon (OC) contents, were also determined.

Results and discussion
The grain size composition indicate a predominance of sand at all sites, with significant fluctuations that can be attributedto increases of system dynamics and/or significant inputs of coarse material from land. OC concentrations are relatively high (0.02-3.00%), which is rather peculiar in coarse sediments. Contaminant concentrations show a decreasing trend, except for PAHs (Fig. 1). Pattern of both sediment characteristic and contaminants are similar on the regional scale.

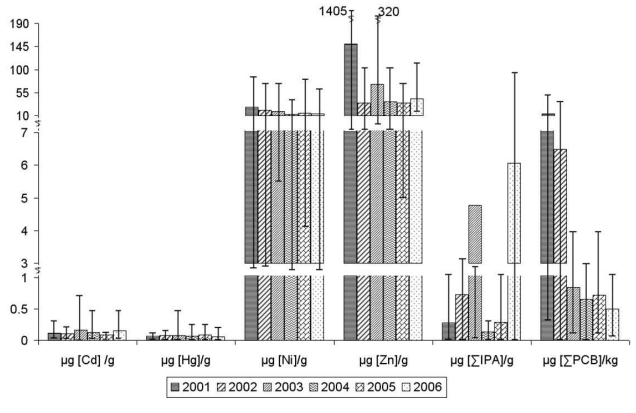

Fig. 1. Average values calculated annually for the whole study area for metals, ∑PCB and ∑PAH. The vertical bars show the maximum and minimum values.

Sediment quality guidelines (SQGs) are useful screening tools to asses the potential toxicity of contaminants in sediments in absence of direct biological effect data [1].
Table 1 shows a comparison of the contaminant data with different SQGs adopted for the Italian contest [2] and worldwide [3], [4], [5].

Tab. 1. Mean, minimum and maximum values for the whole study area on yearly basis for metals, ∑PCB and ∑PAH. The sediment quality guidelines used for comparison are listed above.

		Cd (µg/g)	Hg (µg/g)	Ni (µg/g)	Zn (µg/g)	∑IPA(µg/g)	∑PCB(µg/kg)
[2] LCB (fines <10%)	*	0.20	0.20	40.0	50.0	0.90	5.00
[2] LCL	**	0.80	0.80	75.0	170	4.00	189
[3] ERL	▪	1.20	0.15	20.9	150	4.00	22.7
[3] ERM	▪▪	9.60	0.71	51.6	410	45.0	180
[4] TEL	•	0.68	0.13	15.9	124	0.62	22.0
[4] PEL	••	4.21	0.70	42.8	271	15.2	180
[5] TEC	+	0.99	0.18	23.0	120	1.61	60.0
[5] PEC	++	5.00	1.10	49.0	460	22.8	676
2001	mean	0.12	0.06	26.2	150 *	0.28	13.0 *
	min	0.05	0.01	1.94	7.40	0.00	0.20
	max	0.34 *	0.10	‡‡75.1▪▪	‡‡1405▪▪	•1.30 *	47.8 *
2002	mean	0.10	0.07	20.3	35.2	0.73	6.48 *
	min	0.01	0.02	2.10	6.68	0.00	0.01
	max	0.28 *	0.14	‡‡ 60.8 ‡▪	107 *	‡3.20 *	• 40.1 *▪
2003	mean	0.17	0.08	17.9	71.2 *	0.48	0.85
	min	0.02	0.01	5.40	7.82	0.02	0.10
	max	•0.68 *	‡0.50 ‡▪	‡‡61.0 ‡▪	‡• 320*▪	‡1.98 *	4.00
2004	mean	0.12	0.07	12.7	37.5	0.13	0.66
	min	0.04	0.01	1.70	6.66	0.01	0.01
	max	0.50 *	‡0.22 ‡▪	‡35.5 ▪	107 *	0.31	2.93
2005	mean	0.08	0.08	14.3	34.4	0.29	0.72
	min	0.01	0.01	4.10	5.00	0.02	0.09
	max	0.20 *	‡0.25 ‡▪	‡‡58.7‡▪	67.0 *	•1.04 *	3.97
2006	mean	0.15	0.06	14.1	43.1	6.05 *	0.50
	min	0.03	0.02	2.03	14.0	0.02	0.05
	max	0.47 *	• 0.17▪	‡‡54.6 ‡▪	114 *	‡‡ 94.0‡▪	1.20

The annual mean values are mostly below the lowest benchmark, whereas maxima are usually higher, sometimes exceeding the upper limit above which adverse effects are expected (Table 1). This was observed for Hg (2003, 2004, 2005), Ni (each year except 2004), Zn (2001, 2003) and PAHs (2006). The main cause of the peak contaminant inputs recorded by sediment can be related to the particular rain regime in the last decades, which has been characterised by both a reduction of average precipitations and a higher occurrence of extreme events. These, apparently, have the capacity to mobilise contaminants stored on land and deliver them to the coastal zone.

Acknowledgements
Thanks are due to G. Pelliccia, G. Marchionne and D. Buzzi of the Pescara Province. The work was carried out within the INTERREG IIIA "O.A.S.I.S."

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