Integrated approach for chemical and ecotoxicological evaluation of environmental quality in sediments from the Mar Piccolo of Taranto

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Introduction: In this study contamination levels of PAHs, PCBs and metals in sediments from the Mar Piccolo of Taranto (Ionian Sea, Southern Italy) were analyzed. In order to evaluate environmental quality of sediments and to predict adverse biological effects in benthic organisms, chemical data were compared to numerical, effect-based Sediment Quality Guidelines (SQGs) [1]. Moreover ''mean PEL quotient'' and ''mean ERM quotient'', developed by Long et al. [2], were used to establish empirical relationships between the expected incidence of toxicity and the number and/or degree to which SQGs values were exceeded.

Methods: Surface sediments (0-2 cm) were collected with a Van Veen grab in nine stations of the Mar Piccolo of Taranto (Fig.1). Total metals (Hg, Cd, Pb, Ni, Cu) were determined by ICP–MS technique after acid digestion in a microwave oven. For PAHs (17 parent) and PCBs analysis, samples were extracted and purified as described by Cardellicchio et al. [3].

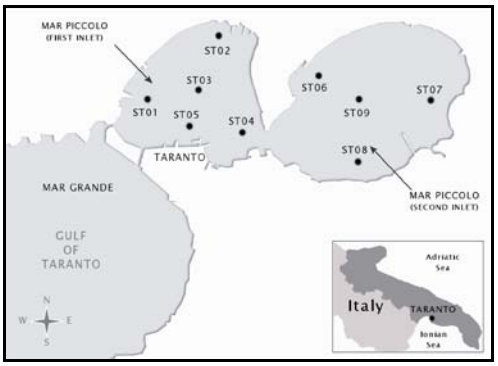

Fig. 1: sampling stations.

Results: PAH_{tot} in sediments ranged from 380 (st. MP09) to 12750 µg/kg d.w. (st. MP02) while PCB concentrations ranged from 2 (st. MP07) to 1684 µg/kg d.w. (st. MP05). Concerning metals, Hg, Pb and Cd concentrations ranged from 0.03-11.55, n.d.-0.29 and 10.73-137.90 respectively. Concentration range for Cu and Ni were 14.34-149.86 and 43.19-61.98 respectively. Comparing chemical concentrations with SQGs, PAHs contamination levels in all stations were lower than ERM values, while PEL level was exceeded in 22.2% of the stations (MP2, MP04) for DB[ah]A, B[a]P, B[a]A and Phen. PCB concentrations were lower than ERL and TEL values only in station MP07, while PCB levels in MP01, MP03, MP04, MP08, MP09 stations were in the median range and finally in the stations MP02 and MP05, PCB concentrations were higher than PEL and ERM values. In particular, PCB concentration in the station MP05 (first inlet) was about ten times greater than PEL value. Concerning metals, PEL levels were exceeded in all stations for Ni and in 78% of the stations for Hg.
Mean PEL and ERM quotients [2] showed that sampling stations were mostly included in medium-low range of toxicity; only two stations were in the lowest range (MP07 and MP09). The station MP04, characterized by an high levels of contamination, was included in medium-high range of toxicity. These results were in agreement with distribution of contaminants in the Mar Piccolo basin; in fact, the first inlet has been strongly influenced by harbor activities of Italian Military Navy.

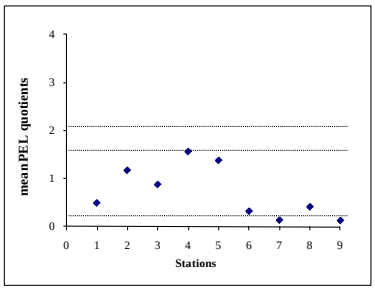

Fig. 2: meanPEL quotients.

Discussion: The obtained results demonstrate high contamination levels for different pollutants in sediments of Taranto coastal area. Worrying concentrations of PCBs and Hg were found close to the Navy Harbor in the first inlet. The application of SQGs showed an evident ecological risks for marine organisms, especially for benthic species.

References: [1] US EPA (1992) *Sediment classification methods compendium*. EPA 823-R-92-006; [2] Long *et al*. (2006). *Environ Sci Technol* **40**:1726–1736; [3] Cardellicchio *et al*. (2007) *Mar Pollut Bull* **55**:451-458.