

Assessment of Heavy Metals Pollution in Surface Sediment of the Montenegro coastline

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Introduction: Seawater pollution by heavy metals under anthropogenic factor has grown significantly over the last decades. These pollutants have tendency to accumulate in bottom sediments. Sediments have significant role in defining main chemical, physical or biological characteristics of aquatic environment. In recent decades anthropogenic activities (agricultural, urban and industrial) have led to increased pollution of marine ecosystems, especially in the bays. As a consequence of these actions, pollutants get into the water and often cause irreversible changes in marine ecosystem [1, 2].

Methods: Samples of bottom sediments were taken from a depth of 15-20 cm using an internal diameter plastic gravity corer. The sampling was done during Oct 2005/Nov 2016 at the different stations in the Montenegrin coast: seven stations located in the „inner shore“ waters Boka Kotor Bay (Port of Kotor, Dobrota – IBM, Kotor-Orahovac, Port of Risan, Porto Montenegro, Shipyard of Bijela, Port of Herceg Novi), and at four located „off shore“ Montenegrin coast (Žanjice, Port of Budva, Port of Bar, Ada Bojana), Fig 1. Determinations of heavy metals in sediment (Fe, Mn, Zn, Cu, Ni, Pb, Cr, Cd, As and Hg) were measured according to methods Laboratory Procedure Book, IAEA (International Atomic Energy Agency), Marine Environment Laboratory, Monaco 2009 [3]. All measurements are performed on ICP-OES, Spectro Arcos and Shimadzu AA 7000.

samples collected during 2005-2016 from Montenegrin coast decreases in the following order $Fe > Cu > Zn > Mn > Pb > Cr > Ni > As > Hg > Cd$, for all years of investigated. High values of metals at some locations can be explained by the wastewaters and industrial waters which through a system of Skadar Lake, the Bojana River and the Drim River bring large amounts of sediment laden with many pollutants. Also, many stationary industrial facilities and hospitals on the coast contribute to quite adverse anthropogenic influence to this area [4, 5, 6]. Comparing the concentrations of trace elements in the sediments from Boka Kotorska Bay were higher in relation to certain locations that are under the influence of the open sea.

Discussion: A comparison of the investigated metal concentrations in sediments along the Montenegrin coast for eleven locations and ten years, showed differences clearly associated with anthropogenic impact and geographical location. The metal contents in sediment samples generally higher in locations, for example hot spot location, than other investigated location. The concentrations of the trace elements in sediment of Boka Kotorska Bay were higher in relation to certain open sea locations, and that may point out the same or similar source of these contaminants.

References: [1] Mucha et al. (2003) *Environ. Poll.* 121: 169-180; [2] Loring DH (1991) *J of Mar. Sci.* 48: 104; [3] International Atomic Energy Agency-IAEA (2003) Iaea-tecdoc 1360; [4] Joksimović et al. (2011) *Food Chem.*127: 632-637; [5] Joksimović et al. (2012) *Jof Serb. Chem. Soc.*77: 105-117; [6] Tanaskovski et al. (2016) *Ecotox. Environ. Saf.* 130: 65-73.

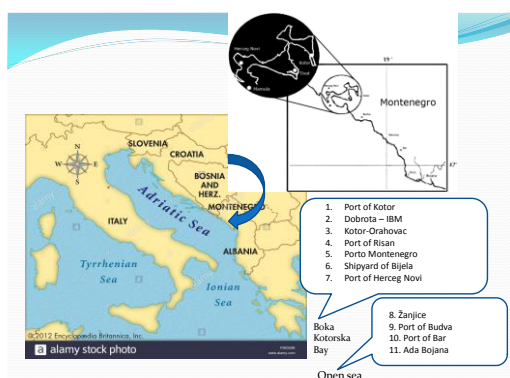


Fig. 1: Map of the investigated area

Results: The investigation has showed that the concentration (mg/kg dw) of trace metals (Fe, Mn, Zn, Cu, Ni, Pb, Cr, Cd, As and Hg) in sediment