LEAD CONCENTRATIONS IN WATER, SEDIMENTS AND BIOTA FROM A MEDITERRANEAN COASTAL LAGOON

Theodora Boubonari [1] *, Theodoros Kevrekidis [1] and Paraskevi Malea [2]

[1] Laboratory of Environmental Research and Education, Democritus University of Thrace, Nea Hili, GR-68100 Alexandroupolis, Hellas - tmpoumpo@eled.duth.gr

[2] Department of Botany, School of Biology, University of Thessaloniki, PO Box 109, GR-54124 Thessaloniki, Hellas

Abstract

Lead concentrations were measured in column, sediments and dominant macrophyte, macroinvertbrate and fish species of a coastal lagoon (Monolimni Lagoon, Northern Aegean). Sediments had the highest Pb contents. *Ruppia maritima* roots, compared to other anatomic plant parts, accumulated higher Pb loads, while this angiosperm leaves contained similar Pb signatures with the green seaweed *Ulva rigida*. Soft tissues of the bivalve *Abra ovata* showed the highest Pb loads among invertebrates. Lead concentrations in whole body of gobies and muscle tissues of mullets were generally lower than those within invertebrates.

Keywords : Metals, Bio-accumulation, Phanerogams, Zoobenthos, Lagoons.

Introduction

Anthropogenic input of heavy metals to coastal lagoons is a potentially serious problem. Nevertheless, scientific knowledge concerning the biological fate and effects of heavy metals in coastal lagoons is limited. This study aims to determine and compare lead concentrations in basic abiotic and biotic components of the ecosystem of a relatively enclosed, macrophyte based Mediterranean lagoon (Monolimni Lagoon, Northern Aegean).

Materials and Methods

Samples of water, surface sediments and biota were collected seasonally from the innermost section of Monolimni Lagoon, where a *Ruppia maritima* meadow occurred. *Ruppia maritima*, the dominant macroalga (*Ulva rigida*), the dominant macroinvertebrates (*Ventrosia maritima*, *Abra ovata*, *Hediste diversicolor*, *Corophium orientale, Gammarus aequicauda* and *Crangon crangon*) and the dominant fish species (*Knipowitschia caucasica, Mugil cephalus* and *Liza aurata*) were used for analysis; in particular, three anatomic parts of *R. maritima* (roots, rhizomes plus stems, leaves), soft tissues of *A. ovata*, muscle tissues of mullets and whole tissues of the rest species. Lead concentrations were measured using graphite furnace AAS (Perkin-Elmer 4100) with Deuterium background correction.

Results and Discussion

Amounts of Pb obviously reached Monolomni Lagoon; mean dissolved Pb concentrations (25.1 μg l^{-1}) exceeded the European Environmental Quality Standards of waterborne contamination in estuaries (<25 μg l^{-1}) and mean Pb contents in sediments (99.1 μg g^{-1} dry wt) the baseline Pb levels in estuarine sediments (about 25 μg g^{-1} dry wt) ([1]). Lead contents in sediments were significantly higher than those in the biotic components (Mann-Whitney's U-test, $p<0.05$ or 0.01), reflecting the low bioavailability of this element from sediments. Lead concentrations in *R. maritima* roots (mean 35.7 μg g^{-1} dry wt) were markedly higher than those in the other plant parts ($p<0.05$ or 0.01). This can be explained by the comparatively high sediment metal burden; it may also suggest a high abundance of binding sites in roots and a low or no acropetal Pb translocation ([2], etc.). Leaves and rhizomes plus stems showed similar Pb signatures (10.9-11.5 μg g^{-1} dry wt; $p>0.05$). Lead concentrations in *R. maritima* leaves did not significantly differ to those in *U. rigida* (6.9 μg g^{-1} dry wt), despite the differences in morphology and physiology. Soft tissues of the deposit-feeding bivalve *A.ovata* had the highest Pb contents (mean 52.7 μg g^{-1} dry wt) among invertebrates, followed by the primarily deposit-feeding polychaete *H. diversicolor* and the selective deposit-feeding amphipod *C. orientale* (15.2-10.2 μg g^{-1} dry wt), the epifaunal herbivore amphipod *G. aequicauda* and the selective deposit-feeding mudsnail *V. maritima* (5.2-3.4 μg g^{-1} dry wt), and finally the epibenthic shrimp *C. crangon* (0.5 μg g^{-1} dry wt), that feeds preying on invertebrates ($p<0.05$). This pattern may mainly reflect interspecific differences in rates of Pb uptake from sediments, since this metal was substantially accumulated in sediments and, being a non-essential one, is taken up by organisms in relation to its environmental levels ([3]). Lead concentrations in fish were generally lower than those within macroinvertebrates. Muscle tissues of both mullets, *M. cephalus* and *L. aurata*, showed similar Pb contents (mean 0.8-1.0 μg g^{-1} dry wt; $p>0.05$), probably owing to similar ecological characteristics. Lead contents in mullet muscles did not significantly differ ($p>0.05$) to those in the whole body of the goby *K. caucasica* (1.5 μg g^{-1} dry wt) despite in fish muscle tissues low metal accumulation generally occurs ([4],etc.).

References

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