HEAVY METAL CONCENTRATIONS IN RED MULLET *MULLUS BARBATUS* (L. 1758) FROM THE IBERIAN PENINSULA COAST (NORTHWESTERN MEDITERRANEAN)

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Abstract

In this paper we present the concentrations of heavy metal (Hg, Cd, Pb, Cu, Zn and As) in *Mullus barbatus* from seven areas of the Iberian Mediterranean coast under different degree of anthropogenic pressure. Hg, Cd and Pb levels obtained are compared with those found in specimens caught from the same areas during the period 1984-87.

Keywords : Bio-accumulation, Coastal Systems, Fishes, Metals, Western Mediterranean.

Introduction

Pollution of the marine environment with heavy metals from land-based sources (industrial, agriculture, mining, etc.) is one of the specific problems to be addressed in the Iberian mediterranean coast [1]. Red mullet is a demersal fish [2], associated with muddy bottoms, used as bioindicator in the Mediterranean Pollution Monitoring Programme (MED POL). The degree of exposure of *Mullus barbatus* populations to heavy metals was measured by the analyses of muscle tissue in specimens from each sampling site. Data obtained should help to establish the baseline concentrations of heavy metal in this specie along Iberian Mediterranean coast.

Material and Methods

Specimens of *Mullus barbatus* (n = 10; length interval: 12-18 cm.) were collected from seven areas (Santa Pola, Mar Menor, Cartagena, Mazarrón, Aguilas, Almería y Nerja) (Figure 1) using commercial bottom-trawler or gill net fisheries during Autumn 2004. Once collected, the specimens were identified, their length measured and immediately frozen at -20 °C.

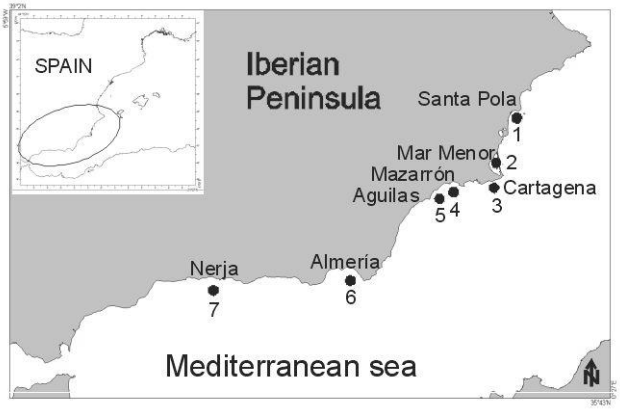

Fig. 1. Map of the study area and sampling sites.

Preparation of the samples included muscle tissue dissection, freeze drying, homogenization and wet digestion using microwave oven. The quantitative analyses were carried out by A.A.S (Perkin Elmer Model 4110 ZL) through graphite furnace (As, Pb, Cu, Cd), flame (Zn) and cold vapour (Hg). The accuracy of the analytical procedures was tested and controlled using certified reference material (CRM-422) and participating in the intercomparison exercise QUASIMEME. Statistical differences between mean metal concentrations in different areas were evaluated using parametric or non-parametric test (Kruskall-Wallis), in function of the nature of data obtained (Normality and Homogeneity in Variances). Post-hoc comparisons were also performed to test differences among areas (Tukey b or Tamhane tests).

Results and Discussion

Mean metal concentrations from the study areas are shown in Table 1. Cu concentrations ranged from 0.332 to 0.448 mg/kg of wet weight and they were similar in all study areas (1-way ANOVA, p=0.054). Hg concentrations ranged from 0.001 (Mar Menor lagoon) to 0.170 mg/kg w.w. (Mazarrón) and significant differences were observed among areas (1-way ANOVA, p=0.000). High Hg concentrations were also found in Aguilas and Cartagena areas. Cd levels ranged from 1.550 (Cartagena) to 1.059 mg/kg w.w. (Nerja). Pb concentrations ranged from 0.121 (Cartagena) to 0.038 (Nerja). For Cd and Pb, significant differences were also observed among areas (1-way ANOVA, p=0.000; Kruskall Wallis, p=0.000;). In the case of Zn and As, its levels were significantly higher in Mar Menor lagoon than in rest of the areas (1-way ANOVA, p=0.000). These high levels of As and Zn in the coastal lagoon could be explained by the inputs from the old of mine activities and the present intensive agricultural that is taking place into its drainage area.

If we compare the Hg, Cd and Pb concentrations measured in red mullet caught in the same areas during the period 1984-1987 (IEO, unpublished data), it can be observed a general increase of Hg mean concentrations and a strong decrease of Cd and Pb concentrations (Table 1), especially in the case of specimens caught in Cartagena area.

Tab. 1. Concentrations of metals (mean ± standard error of the mean) in muscle tissue of *Mullus barbatus* from areas sampled in 2004 and during the 1984-1987 period. Asterisks means pooled samples.

Area	Year	N	Hg	Cd	Pb
			mg/kg w.w.	mg/kg w.w.	mg/kg w.w.
1	2004	10	0.056 ± 0.006	1.359 ± 0.065	0.048 ± 0.005
	1984-87	15*	0.085 ± 0.010	2.21 ± 0.28	0.071± 0.015
2	2004	10	0.001 ± 0.001	1.122 ± 0.045	0.051 ± 0.008
	1984-1987	5*	0.035 ± 0.010	7.2 ± 2.58	0.028 ± 0.006
3	2004	10	0.137 ± 0.021	1.550 ± 0.040	0.121 ± 0.027
	1984-87	17*	0.080 ± 0.013	3.38 ± 0.72	0.618 ± 0.017
4	2004	10	0.170 ± 0.022	1.281 ± 0.097	0.097 ± 0.016
	1984-87	12*	0.136 ± 0.025	2.80 ± 0.36	0.084 ± 0.019
5	2004	10	0.147 ± 0.016	1.157 ± 0.062	0.068 ± 0.009
	1984-87	12*	0.048 ± 0.007	2.20 ± 0.033	0.070 ± 0.015
6	2004	10	0.101 ± 0.011	1.257 ± 0.053	0.051 ± 0.003
	1984-87	13*	0.053 ± 0.013	2.31 ± 0.28	0.076 ± 0.015
7	2004	7	0.025 ± 0.004	1.059 ± 0.046	0.038 ± 0.001
Area	Year	N	Cu	Zn	As
			mg/kg w.w.	mg/kg w.w.	mg/kg w.w.
1	2004	10	0.332 ± 0.015	3.30 ± 0.86	11.28 ± 0.83
2	2004	10	0.434 ± 0.036	5.06 ± 0.30	23.71 ± 2.59
3	2004	10	0.386 ± 0.019	4.16 ± 0.15	11.97 ± 1.67
4	2004	10	0.414 ± 0.027	3.62 ± 0.15	15.01 ± 1.42
5	2004	10	0.435 ± 0.033	4.02 ± 0.24	17.44 ± 2.35
6	2004	10	0.448 ± 0.023	3.77 ± 0.22	16.10 ± 1.49
7	2004	10	0.427 ± 0.049	4.16 ± 0.32	10.35 ± 1.10

References

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