

COMPARATIVE STUDY OF HEAVY METAL RESIDUES IN SOME TISSUES OF THE FISH *GALEUS MELASTOMUS* CAUGHT ALONG THE ITALIAN AND ALBANIAN COASTS

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Abstract

This work presents results obtained during an investigation on the levels of heavy metal residues (Hg, Cd, Pb and Cr) in various tissues (dorsal and ventral muscle, liver and skin) of *Galeus melastomus* specimens caught along Italian and Albanian coasts. Analytical results for 757 specimens have demonstrated a variable distribution of metals in these tissues with maximum levels of Pb, Cr, Cd in liver, and Hg in dorsal and ventral muscle. Furthermore, with respect to certain tissues, significant correlations between mercury concentration and fish weight have been observed.

Key-words: trace elements, pollution, monitoring, Adriatic Sea

Introduction

Investigations of metals in fish are an important aspect of environmental pollution control (1). The subject of this study was to screen the metal content of different-sized specimens of *Galeus melastomus* caught along Italian and Albanian coasts, and to compare the metal concentrations found in these fish from two different areas of the southern Adriatic Sea in order to determine the relative degree of contamination in these regions.

Materials and methods

During the period June-September 1996, along Italian and Albanian coasts (southern Adriatic Sea) 757 *Galeus melastomus* specimens were caught. Eleven pooled samples were obtained from the 501 specimens weighing between 20.8 and 387.8 g caught along Italian coast in three different areas (Vieste-Bari-Brindisi), while the remaining 256 specimens between 15.1 and 252.4 g, caught along Albanian coast, formed 5 pools. Dorsal and ventral muscle, liver and skin were taken from specimens of similar size. From single homogenized tissues, samples were also taken for analyses. The quantitative analysis of heavy metals was carried out by A.A. spectrophotometry (Perkin Elmer 5000) after organic matrix digestion with HNO₃-HC10₄ (8:3) for Pb, Cr, Cd, (2), and H₂SO₄-HNO₃ (1:1) for Hg (3). For Pb, Cr and Cd determination a graphite furnace (HGA-500 Perkin Elmer) with L'VOV technique was used. Mercury was determined by the cold vapour technique after reduction to Hg⁰ with SnCl₂ using a A.V.A. Thermo Jarrel system connected to A.A. spectrophotometer. The analytical procedures were tested and controlled using certified Reference Material DORM-1 of the National Research Council of Canada.

Results and discussion

Table 1 shows minimum, maximum, and average values of metal concentrations (Hg, Cd, Pb and Cr) expressed in mg/Kg wet wt. in skin, liver, dorsal (D.M.) and ventral muscle (V.M.) of *G. melastomus* caught along Italian and Albanian coasts. Figure 1 presents mean concentrations of metals in the tissues of both Italian and Albanian samples.

For dorsal and ventral muscle, Hg concentration in specimens caught along Italian coast was higher than fish of Albanian origin while the average Hg level in skin was about the same in both. Concentrations in the liver of Italian specimens ranged from N.D.-0.66 mg/Kg wet wt.; in 36.4 % of these samples and in all liver samples of Albanian origin, Hg concentrations were below the instrumental detection limit. The highest Hg concentrations in Italian fish were found in dorsal muscle, followed by ventral muscle, skin and

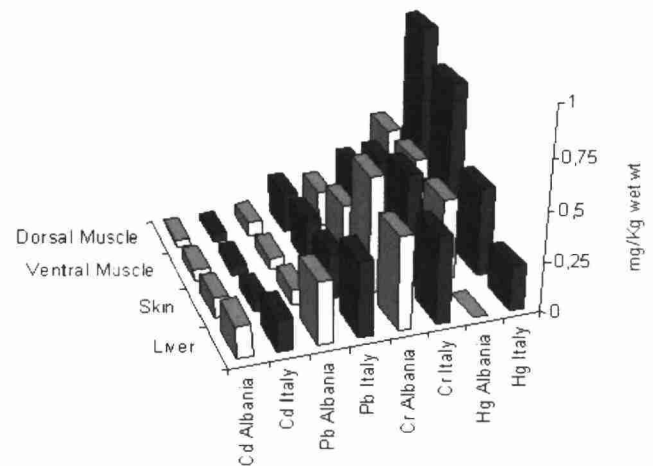


Fig. 1 - Mean concentrations of metal residues in different tissues of fish caught along Italian and Albanian coasts.

liver. Specimens of Albanian origin did not show remarkable differences in Hg concentrations in dorsal muscle, ventral muscle and skin. It is known that, normally, liver is the organ which shows the highest metal levels. Hg included, as demonstrated in previous studies involving different species of fish (4, 5). Nevertheless, Hg concentrations in liver lower than those in the muscle, as observed in this work, were also found by other authors in plaice (*Pleuronectes platessa*) (6) and in cod (*Gadhus morhua*) (7). Moreover, in a study of uptake and depuration of Hg in cod exposed to methylmercury, muscle had higher levels of Hg than in liver measured during the time of depletion (8). This unusual trend, could be ascribed to a greater total percentage of lipids in liver (22.72%-52.50) compared to that found in muscle (0.19%-0.80%) in the fish examined.

Grimas *et al.* (9) reports that it is not only levels of nonpolar substances that are correlated with the amount of fat in tissue, but also substances which are protein-bound. In some monitoring studies which examined heavy metals in cod liver, it has been observed that as the percentage of fat increases, the protein fraction decreases and with it the amount of protein-bound metals as well (9). Statistically positive correlations between concentration of Hg and weight of the specimens from Italy have been found in some tissues (D.M. $r = 0.89$, $P < 0.001$; V.M. $r = 0.91$, $P < 0.001$; Skin $r = 0.96$, $P < 0.001$) (Fig. 2) as previously observed by other authors for similar species (10, 11).

Our results for Hg in the muscle of *G. melastomus* were lower than those found in *Scyliorhinus canicula* (belonging to the same family), caught in the central Adriatic (aver. 0.45mg/kg wet wt.) (12) and northern Adriatic Sea (0.12-0.60 mg/Kg wet wt.) (13). In all analyzed tissues, Pb concentrations were higher ($P < 0.05$) in specimens of Italian origin compared to those of Albanian origin except for liver, in which average concentrations were the same. Among the Italian specimens sampled, significantly higher concentrations ($P < 0.05$) were found in liver, with respect to skin, ventral and dorsal muscle. A similar distribution was observed in samples caught along Albanian coast, where concentrations in liver ($P < 0.05$) were higher than those in other tissues. In 9% of dorsal and ventral muscle and skin samples from Italy, and in 25% of dorsal muscle samples from Albania, concentrations were below the instrumental detection limit. Pb values reported in the

Tab. 1 - Min., max., mean values of metal residues (mg/Kg wet. wt. \pm standard deviation) in different tissues.

| Metals | Location | Dorsal Muscle | Ventral Muscle | Skin | Liver |
|--------|--------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Hg | S Adriatic Sea (Italy) | 0.14-3.39 0.97 \pm 0.96 | 0.18-2.05 0.82 \pm 0.62 | 0.18-0.76 0.44 \pm 0.22 | N.D.-0.66 0.22 \pm 0.20 |
| | " | N.D.-0.45 0.20 \pm 0.11 | N.D.-0.79 0.23 \pm 0.21 | N.D.-0.45 0.22 \pm 0.10 | N.D.-0.65 0.37 \pm 0.16 |
| Cr | " | 0.10-0.55 0.29 \pm 0.14 | 0.21-1.12 0.47 \pm 0.29 | 0.24-1.14 0.56 \pm 0.24 | 0.18-0.82 0.43 \pm 0.18 |
| | " | 0.03-0.06 0.04 \pm 0.01 | 0.03-0.07 0.05 \pm 0.02 | 0.04-0.09 0.06 \pm 0.02 | 0.09-0.28 0.16 \pm 0.05 |
| Hg | S Adriatic Sea (Albania) | 0.20-0.88 0.46 \pm 0.31 | 0.10-1.21 0.46 \pm 0.51 | 0.15-1.10 0.41 \pm 0.46 | N.D. |
| | " | N.D.-0.09 0.07 \pm 0.02 | 0.04-0.07 0.06 \pm 0.01 | 0.05-0.11 0.08 \pm 0.03 | 0.21-0.42 0.31 \pm 0.09 |
| Cr | " | 0.14-0.29 0.18 \pm 0.07 | 0.12-0.40 0.27 \pm 0.12 | 0.43-0.77 0.58 \pm 0.15 | 0.38-0.58 0.46 \pm 0.08 |
| | " | 0.02-0.07 0.04 \pm 0.02 | 0.03-0.10 0.06 \pm 0.03 | 0.03-0.21 0.10 \pm 0.08 | 0.13-0.19 0.16 \pm 0.02 |