# Historical and Current Heavy Metal Residues in Hudson River Fish

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INTRODUCTION - The metals, lead, mercury and cadmium are known to be toxins and are of great concern when one considers the possible contamination of fish and wildlife. These metals tend to accumulate in various organs of humans and animals and have been identified as the causes of several clinical problems (GRANT, 1971; PERLETEIN and ATTALA, 1966; TRUHAUT and BOUDENE, 1954). Since metals may be used as an indicator of industrial development, it is desirable to investigate historical presence of these metals if older samples are available. This has been done for a number of fish and water systems (HARRIS and KORCHER, 1972).

This investigation deals with fish taken from the Hudson River during 1976 and 1977 and samples from the same water system supplied by New York State Museum and Science Service, American Museum of Natural History and Vassar College. The samples were originally captured in a time period ranging from 1934 to 1973.

SAMPLING METHODS - Current samples were captured with both shore seining and deep water techniques. The physical characteristics of the fish, length and weight, as well as location caught were recorded.

Museum samples were usually supplied in chemical preservatives. They were removed and the weight and length recorded. It was, for the most part, impossible to specifically identify the location on the Hudson where the fish were captured. However they all were captured in the fresh water stretch of the river system.

ANALYTICAL METHODS - 10 gm. samples were taken from each specimen. The samples used for lead and cadmium determination were dry ashed at 485°C and the mercury samples were digested in a $HNO_3$-$H_2SO_4$ medium. All determination were carried out using previously accepted procedures (REHWOLDT et al, 1973).

The museum samples presented an additional problem in that there is the possibility that the preservatives may have leached organometallics from the tissue or the preservative may have imparted a residue to the tissue. In order to minimize these possible pathways for contamination two precautions were taken. Tissue samples were taken close to the center of the body of the fish and the preservatives were tested for residual metal concentrations.



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In addition, all samples were dried at 110°C before analysis so that a basis of comparison was established. The data therefore is reported in terms of dry weight.

TABLE I

NOMENCLATURE OF FISH

| | | |
|---|---|---|
| 1. | Alewife | Alosa Psuedoharengus |
| 2. | Atlantic Sturgeon | Acipensor oxyrhynehus |
| 3. | Fundulus Killifish | Fundulus diaphonus |
| 4. | Small-mouth bass | Micropterus dolomieui |
| 5. | Spot-tail Shiner | Notropis hudsonius |
| 6. | Striped Bass | Morone saxatilis |
| 7. | Sunfish | Lepomis gibbosus |
| 8. | White perch | Morone americana |

RESULTS AND DISCUSSION - As can be seen from the data the median value for the residues do not seem to follow any chronological relationship. In fact, they seem to be independent of time. The values themselves are similar to those found by previous investigators (KELSO and FRANK, 1974; LOVETT et al, 1971; PAKKALA et al, 1972). The only apparent relationship that seems to exist is that between the feeding habits of the species and the residues. The predators are higher in mercury. Lead and cadmium do not seem to be dependent upon feeding habits. This phenomena has been observed before (MICHIGAN DEPARTMENT OF NATURAL RESOURCES, 1972).

It becomes apparent therefore from this data that although metal residues may be an indicator of industrial activity and contamination in certain water systems in a relatively clean system such as the Mid Hudson area the residues are independent of time. While several pathways could be proposed if the data indicated a relationship between residues and industrial development they are not appropriate in this case. The most likely source of the

residue is the absorption of the metals from the waters which has leached them from the river banks and bottom.

TABLE II

Table II contains the average values for lead, mercury and cadmium in m/g dry weight.

| Common Name | Source * | Cd | Hg | Pb |
|---|---|---|---|---|
| Alewife | MC 10 (1976) | 0.091 | 0.16 | 0.30 |
| | VC 2 (1953) | 0.12 | 0.21 | 0.61 |
| | NYS - | | | |
| | AMNH - | | | |
| Atlantic Sturgeon | MC (1976) | 0.11 | 0.46 | 0.82 |
| | VC - | | | |
| | NYS 5 (1924) | 0.096 | 0.31 | 0.71 |
| | AMNH - | | | |
| Fundulus | MC 21 (1976) | 0.072 | 0.14 | 0.51 |
| | VC 4 (1953) | 0.031 | 0.19 | 0.62 |
| | NYS 3 (1936) | 0.044 | 0.21 | 0.41 |
| | AMNH (2) (1973) | 0.012 | 0.24 | 1.10 |
| Small Mouth Bass | MC 11 (1976) | 0.041 | 0.52 | 1.06 |
| | VC | | | |
| | NYS 3 (1936) | 0.072 | 0.61 | 0.99 |
| | AMNH - | | | |
| Spottail Shiner | MC 17 (1936) | 0.092 | 0.22 | 0.59 |
| | VC (5) (1953) | 0.16 | 0.19 | 0.69 |
| | NYS - | | | |
| | AMNH 2 (1973) | 0.071 | 0.16 | 0.77 |
| Striped Bass | MC 14 (1976) | 0.043 | 0.49 | 0.92 |
| | VC - | | | |
| | NYS 2 (1936) | 0.061 | 0.32 | 0.40 |
| | AMNH 5 (1973) | 0.099 | 0.51 | 0.21 |

TABLE II (cont.)

| Common Name | Source* | Cd | Hg | Pb |
|---|---|---|---|---|
| Sunfish | MC 23 (1976) | 0.26 | 0.42 | 0.25 |
| | VC - | | | |
| | NYS - | | | |
| | AMNH - | | | |
| White Perch | MC 26 (1976) | 0.062 | 0.41 | 1.06 |
| | VC 2 (1953) | 0.091 | 0.30 | 1.02 |
| | NYS 1 (1936) | 0.10 | 0.51 | 0.80 |
| | AMNH - | | | |

* MC Marist College
VC Vassar College
NYS New York State Museum and Science Service
AMNH American Museum of Natural History

Number after source is sample size
Number in paranthesis is year caught

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