LINKING HABITAT USE OF STRIPED BASS IN THE HUDSON RIVER, NEW YORK (USA) TO THE ACCUMULATION OF POLYCHLORINATED BIPHENYL CONGENERS

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Introduction

Since 1976, the commercial striped bass fishery in the Hudson River, New York has been closed due to total polychlorinated biphenyls (*t*-PCBs) concentrations that exceed the US Food and Drug Administration's advisory level of 2 µg/g-wet weight. The major historical source of PCBs to the Hudson River was located in the northern, freshwater reaches of the river, resulting in a large decreasing PCB gradient along the length of the Hudson River. Extensive monitoring of Hudson River striped bass demonstrates much more variability in *t*-PCB levels among individual striped bass than can be explained variation among age, sex, or lipid contents. We hypothesize that variation in PCB levels in Hudson River striped bass result from differing migration behaviors among contingents of this population. Specifically, this study explored whether non-migratory ('resident') members of the striped bass population are exposed to higher levels of PCB congeners.

Material and Methods

To investigate the possible role of differential habit use among subpopulations of striped bass in controlling their PCB exposures, seventy fish collected throughout the Hudson River estuary and Long Island Sound in 1994-95 were analyzed for PCB congeners and their life-time migration behaviors were estimated by otolith microchemistry. In this technique, the habitat use history of individual fish is estimated by measuring the relative amount of strontium and calcium is annual deposits within the otolith ('ear bone'). Since seawater is greatly enriched in strontium relative to freshwater, bony deposits deposited while the fish is in marine waters are enriched in strontium relative to that deposited while in freshwater. Laboratory experiments were conducted to calibrate the measured Sr/Ca ratios to ambient salinity. PCB congeners were analyzed in striped bass muscle tissue using high resolution gas chromatography with electron capture detection.

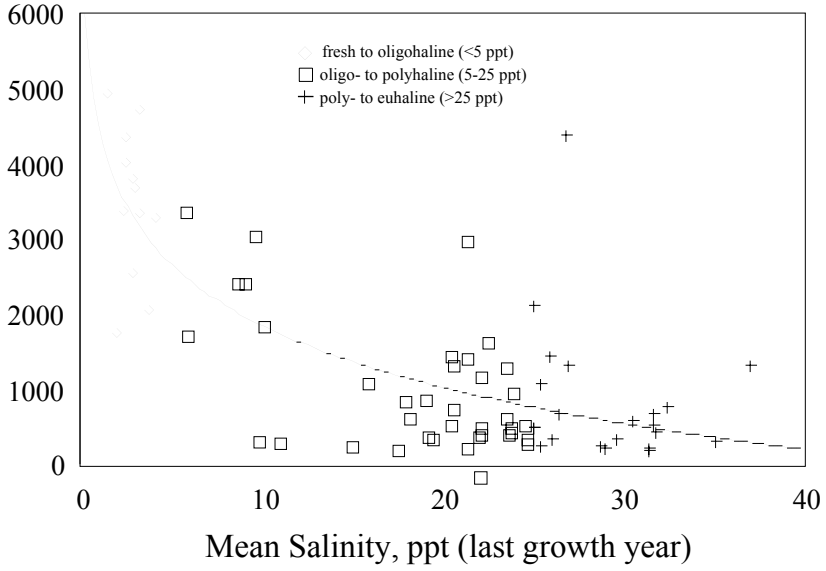
Results and Discussion

Otolith microchemical analysis demonstrates that the Hudson River striped bass population is comprised of individuals with widely varying migration patterns. Many fish follow the 'typical' pattern, remaining in the estuary until reaching sexual maturity, then beginning an annual migration cycle (Zlokovitz and Secor, 1999). A much smaller contingent, consisting almost

exclusively of males, are resident in the upper Hudson River system near the historical source of PCBs and do not migrate. Other individual striped bass alter their migration strategies during their lifetimes, shifting from resident to migratory behaviors or *vice versa*.

Using the sum of all quantified congeners in this study, *t*-PCB concentrations (expressed as mass/mass wet wgt) are well correlated to habitat use as expressed by mean salinity of the last growth season ($r=-0.75$; $p<0.001$; Figure 1). However, by eliminating the sub-population of resident, near-source fish, the strong negative correlation significantly diminishes ($r=-0.30$; $p<0.001$). Other factors such as lipid content, length, age, sex and weight are poorly correlated to *t*-PCB concentrations ($r<0.2$; $p<0.001$) suggesting habitat use as the major determinant of the magnitude of contaminant body burdens. Despite this, there was considerable scatter in PCB concentrations among the fish studied, reflecting the large variability in migration behavior of the sampled striped bass as well as in *t*-PCB body burdens. Striped bass permanently residing in fresh and oligohaline portions of the estuary adjacent to known PCB sources have elevated *t*-PCB levels and congeneric patterns with higher proportions of di-, tri-, and tetrachlorobiphenyls. Conversely, fish spending the majority of their life in more saline waters of the estuary or migrating frequently throughout the salinity gradient contain lower PCB levels composed of more highly chlorinated congeners. The approach used in this study allows habitat use to be incorporated into exposure assessments for anadromous fish species such as striped bass.

Figure 1. Relationship between total PCB concentrations in Hudson River striped bass muscle tissue and the mean salinity occuppied during the past growth year.



References

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