INTRODUCTION

Of the thousands of anthropogenic substances produced and emitted into the environment, the suite of compounds collectively known as polychlorinated biphenyls (PCBs) have fallen under enormous public and scientific scrutiny. Globally ubiquitous despite their production ban in the mid-1970s, PCBs are of concern due to their bioaccumulative nature and, for some congeners, their toxicity and potential carcinogenicity to higher organisms.

Polychlorinated biphenyls, like other hydrophobic organic contaminants (HOCs), may enter coastal waters through point and non-point sources (e.g., Frithsen et al., 1995; Latimer et al., 1990), run-off (e.g., Hoffman et al., 1984), or atmospheric deposition (e.g., Leister and Baker, 1994). The transfer and fate of PCBs within natural waters is highly dependent on their sorptive behavior. They have varying but relatively high affinities for dissolved and particulate organic carbon. Consequently, a large fraction of the total aquatic reserve of HOCs occurs in the complexed or bound form with only a very small fraction existing in the truly dissolved phase. Their particle-reactive nature may transfer, through particle settling, a portion of the water column inventory to the sedimentary environment. Once there, redistribution within the sedimentary environment, burial, or recycling back into the overlying water column may occur. Aquatic organisms, especially those inhabiting benthic or epi-benthic regions of a contaminated system, may bioaccumulate PCBs. However, the factors controlling this transfer from environment to biota are numerous (e.g., proximity to source, lipid content, diet, etc.) and are often dependent on a spectrum of physical, biological and chemical properties of both the system and organisms.

Due to historical and current point and non-point source inputs of PCBs, the Delaware Estuary has been classified as "impaired" under the Clean Water Act Section 303(d). Consequently, the Commonwealth of Pennsylvania and the states of New Jersey and Delaware are required to develop a PCB Total Maximum Daily Load (TMDL) which would include PCB wasteload allocations for point source dischargers and load allocations for nonpoint sources (**www.state.nj.us/drbc)**. On the states' behalf, the Delaware River Basin Commission (DRBC) has taken the lead on developing these TMDLs over the next two years.

As part of their effort to establish scientifically-sound TMDLs for the four zones DRBC will 1) characterize PCB loadings from air, sediments and tributaries, 2) develop hydrodynamic water quality and food web models, and 3) assess the targets and pathways for fish consumption, human health and wildlife endpoints (**www.state.nj.us/drbc)**. This proposal will aid in the generation of a high-quality, spatially and temporally-descriptive congener-specific PCB data set that will be used by the Commission to attain their goals. In order to follow the transport of PCB within a portion of the Delaware River estuary food web, the bioaccumulation model will require a full suite of PCB data for not only the major fish species being modeled (white perch and channel catfish) but for their prey items as well. This project provided information regarding the trophic transfer and ultimately fate of PCBs within four zones of the Delaware River by targeting major biotic (white perch, channel catfish, small prey fish and amphipods) and abiotic phases (sediment) important in the estuary's food web (Fig. 1).

White perch (*Morone americanus*) and channel catfish (*Ictalurus punctatus*) were chosen as model species (Fig. 2). Both are important and abundant demersal predators and thereby represent a link between PCB loadings in the Delaware Estuary and human and ecological risk. Both species are commercially harvested, but the most significant route of human exposure is through recreational takes. In 1999, Delaware State recreational harvests were estimated at 420,000 and 40,000 individuals for white perch and catfish, respectively (National Marine Fisheries Service statistics; see **www.st.nmfs.gov/st1/recreational/index**). The two species were also chosen for this study because they exhibit contrasting migration (home-range) behaviors that are expected to affect bioaccumulation models (e.g., Thomann et al., 1991; Thomann et al., 1992; Thomann, 1989) that relate sediment, macrobenthic invertebrate, and fish PCB inventories.

White perch undertake semi-anadromous seasonal migrations as adults, migrating to freshwater tidal regions each spring to spawn. However, unlike the closely related striped bass (*Morone saxatilis*), which migrates to coastal waters, they remain resident to the Delaware Estuary throughout their lives. Channel catfish disperse much less over their juvenile and adult lives. In this spatially retentive behavior, channel catfish are representative of other important fishes such as white catfish *Ameiurus catus*, yellow-phase American eel *Anguilla rostrata*, and carp *Cyprinus carpio*. While catfish move to deeper waters in the winter, they return to small home ranges during other times of the year. Recent electronic tagging research by Dr. Roman Jessien's laboratory (University of Maryland, Eastern Shore) shows that channel catfish in the Anacostia River home to regions within a 4 km radius throughout the year. In the Wisconsin River, 60% of tagged catfish were recaptured within 2 km of where they were tagged; homing was observed in individuals recaptured during three consecutive summers (Pellett et al., 1998).

The overall goal of this study was to quantify the concentrations of PCBs in white perch and channel catfish and their prey items from the four zones of the Delaware River from Liston Point, DE to the Trenton, NJ area during two seasons (fall and spring).

Specifically, this study:

1) *Produced an extensive data set summarizing PCB concentrations in white perch, channel catfish, their major prey items, and surficial sediment during two seasons (fall and spring),*

2) *quantified the transfer of PCBs between predators (white perch and channel catfish) and some of their most abundant prey items (small prey fish and amphipods),*

3) *quantified the variability in accumulated PCBs in collected perch and catfish individual fillets within and among zones, and*

4) *assessed the similarities and differences in accumulated PCB congeners among zones and species within the estuary.*