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Session 1D: Biology

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LONG-TERM ASSESSMENTS AND SEASONAL VARIATIONS OF POLYCHLORINATED BIPHENYLS (PCBS) IN WATER, SEDIMENTS, FLOODPLAIN SOILS, AND SENTINEL FISH SPECIES FROM BIG AND LITTLE BAYOU CREEKS, MCCRACKEN COUNTY, KENTUCKY

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PCB assessments at two moderately impacted streams, Big and Little Bayou Creeks, were conducted in 1988-2005. Samples collected during spring and summer corresponded with periods of high- and low-flow. The two streams were impacted by effluents from the Paducah Gaseous Diffusion Plant. Water, stream sediments, floodplain soils, and fish were analyzed for Aroclor 1248, 1254, and 1260. Five sport fish were selected for the study: green sunfish (*Lepomis cyanellus*), longear sunfish (*L. megalotis*), bluegill (*L. macrochirus*), largemouth bass (*Micropterus salmoides*), and the yellow bullhead catfish (*Ameiurus natalis*). The stoneroller minnow (*Campostoma anomalum*), a benthic feeder, was included since they are in direct contact with and ingest contaminated sediments. Only 8 of 263 water samples analyzed showed detectable PCBs, indicating the transitory nature of PCBs in the water column. Detection of Aroclor 1248 in sediments was sporadic, while Aroclor 1254 and 1260 were prevalent, indicating greater binding capacity to sediment/soil particles. Aroclor 1248 sediment concentrations were lower during the summer compared to spring values, whereas 1254 and 1260 were influenced less by seasonal variations. Floodplain Aroclor 1254 and 1260 were detected mainly in the spring, but all three Aroclor were detected in the summer, indicating that floodplain areas were receiving recently contaminated sediment particles following high-flow events and acting as PCB sinks. Overall PCB concentrations in fish fillets decreased in all sunfish species after 1991, but not all PCBs were eliminated from the sunfish and a "baseline" concentration was observed. Although Aroclor 1248 and 1254 in stoneroller minnows decreased over time, Aroclor 1260 levels remained somewhat constant. As with the sunfish, a "baseline" PCB concentration was observed in stoneroller minnows. Species specific trends were observed when comparing PCB concentrations and stream flow. In green sunfish, Aroclor 1248 and 1254 levels were not strongly influenced by flow, but Aroclor 1260 levels increased with increasing flow. The green sunfish has a unique metabolism that allows it to eliminate PCBs more rapidly than other sunfish and may partially explain these results. PCB concentrations in longear sunfish increased with increasing flow. However, opposite results were observed for stoneroller minnows, where PCB concentrations decreased with increasing flow. These results correspond to seasonal variations seen for the stoneroller minnow, with higher summer Aroclor 1248 levels. Seasonal trend were less distinct for Aroclor 1254 and 1260. Based on our findings, we propose that PCBs are being remobilized during high-flow events, then redistributed into fish after a lag-time, thus increasing summer body burdens. Results from this field study demonstrate that seasonal variability and flow conditions can alter PCB bioavailability.
Key words: PCB, sentinel fish, stoneroller minnow, seasonal variability, stream flow

NOTES

CHARACTERIZATION OF TOTAL DISSOLVED SOLIDS (TDS) TOXICITY TO *Ceriodaphnia dubia* ASSOCIATED WITH EFFLUENT DISCHARGES FROM A MEAT PACKAGING INDUSTRY

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Total dissolved solids (TDS) are common components in meat packaging industries due to the abundant use of salts (*i.e.*, NaCl) during processing. Toxicity related to TDS is mainly due to specific combinations and concentrations of contributing ions such as sodium, potassium, magnesium, chloride, sulfate, nitrate, and bicarbonate. The correlation between increasing TDS concentration and toxicity may vary with different ionic combinations. Therefore, TDS concentration is not a good predictor for toxicity. However, some regulatory authorities have set TDS limits for many effluents around 1,000 mg/l. To determine the contribution of TDS to toxicity, characterization of effluent discharges from a meat packaging company were conducted in 2004-2006. Several artificial waters with various TDS concentration were also tested to determine the correlation between TDS and toxicity. The tests were performed using standard method 1002.0 and 2002.0 for *Ceriodaphnia dubia* chronic and acute toxicity tests, respectively. Results of acute toxicity tests showed that *C. dubia* was able to tolerate the highest TDS concentration tested (2943.55 mg/l). Whereas results of chronic toxicity showed that *C. dubia* was able to tolerate TDS as high as 1314.76 mg/l. Correlation between TDS and chronic toxicity was relatively strong (r^2=0.52). Further investigation revealed that the toxicity was mainly due to the ionic combination with chloride as the primary toxic element (r^2=0.66), while sulfate and sodium showed to be weak contributors (r^2=0.23 and 0.10, respectively). However, sulfate and sodium ions also contributed to TDS toxicity at much higher concentrations. These findings indicate that TDS is not a good regulatory predictor for toxicity. Determination of ionic combinations in effluents with high TDS concentrations would be more useful in regulatory strategies.

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WILSON CREEK RESTORATION AND THE RESPONSE IN FOOD WEB FUNCTION AND FISH COMMUNITY STRUCTURE.

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Stream restoration projects are often justified based on expected improvements in habitat and biodiversity, but few have been systematically studied to assess their "success." A channelized section of Wilson Creek (Bernheim Arboretum and Research Forest, Kentucky) was relocated to a new, meandering channel using a natural channel design approach. Fish communities were sampled before and after the restoration and compared to an upstream site in Wilson and two control streams that were not restored. We analyzed the stable isotope signatures of a sub-set of the sampled fishes along with macroinvertebrates, periphyton, and detrital leaf material to reconstruct the stream food webs. Museum fish specimens from Wilson and a control stream where used to recreate historical food webs. Kentucky Fish Index of Biotic Integrity (IBI) scores in Wilson were Excellent for the pre-restoration fish community and most of the reaches sampled after the restoration retained that classification. The reference streams' IBIs were classified as Good and remained unchanged throughout the study period. Pre and post restoration Wilson isotope signatures showed very little change in food web base resources and the general trophic structure. More pre- and post restoration studies are needed to help develop success criteria and incorporate "lessons learned" in stream restorations.

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