Mercury Bioaccumulation in Bluegill and Largemouth Bass from a Hunting and Fishing Site in South Carolina, USA

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Introduction

- Mercury can be a toxic pollutant and occurs naturally in the environment at very low levels but due to anthropogenic activities, these levels have increased significantly in the atmosphere[1]
- When mercury deposits into wetlands, bacteria coverts inorganic mercury to Methylmercury (MeHg)[1]
- MeHg is bioavailable and accumulates in fish tissue with the rate of accumulation depending on location attributes, trophic level, size, sex and age[1]
- MeHg bioaccumulates up the food web in aquatic ecosystems
- Objective of this study was to examine the Hg concentration in two species of fishes related to their size, age, and sex

Methods

Blugill *Lepomis macrochirus*
- Adults: 190-410 mm TL[2]
- Max age 10 years[2]
- Adults primarily consume invertebrates, zooplankton and sometimes small fishes[2]
- Popular subsistence and sportfish

Largemouth Bass *Micropterus salmoides*
- Adults: 400-970 mm TL[2]
- Max age 23 years[2]
- Adults primarily consume fish and sometimes inverts
- Extremely popular sportfish

- Fishes collected from a 2-acre pond at a hunting and fishing lodge north of Columbia, SC
- For each fish sample: size, weight, sex, age
- Total mercury (Hg) was measured as a proxy for MeHg
- Muscle tissue collected and analyzed for 55 bluegill and 29 bass using a Direct Mercury Analyzer (DMA)
- Because we measure Hg for a subsample of the bluegill samples, we ensured that the full size and age range were included in the subsampled population
- United States Geological Survey total mercury data used to compare our findings with data of other states reporting Hg for fish from similar habitats
- Utilized individual regression analyses to test if significant relationships existed between fish species size and Hg concentration and fish species age and Hg concentrations

Results

- A total of 138 bluegill were collected ranging in size 46-230 mm TL and age 0-8 years; 29 bass ranging in size 100-270 (0-3 in age) and one individual that was 700 mm TL (13 years old) (Figs 1-4)
- Bluegill Hg concentrations ranged from 0.02–0.26 ppm and largemouth bass Hg concentrations ranged from 0.02 –1.012 ppm (Figs 1-4)
- Hg concentration in bass appeared to be higher than bluegill of the same age (Fig 5)
- Bluegill size significantly correlated to Hg ($R^2 = 0.18$, $p < 0.01$); age significantly correlated to Hg ($R^2 = 0.25$, $p < 0.001$)
- Largemouth Bass size significantly correlated to Hg ($R^2 = 0.68$, $p < 0.001$); age significantly correlated to Hg ($R^2 = 0.43$, $p < 0.001$)

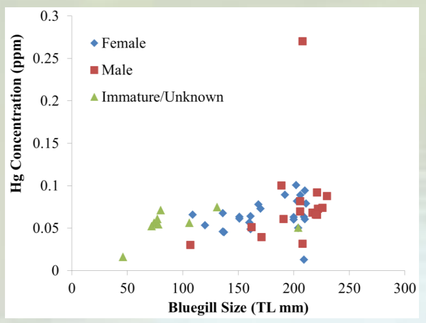

Fig 1. Relationship of bluegill size versus concentration of Hg for each specimen

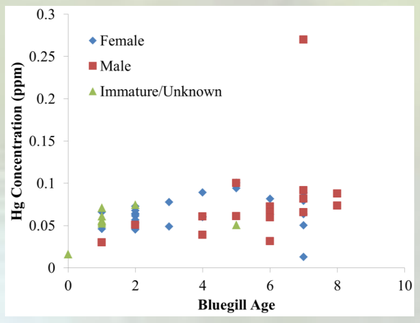

Fig 2. Relationship of bluegill age versus conc of total Hg for each specimen

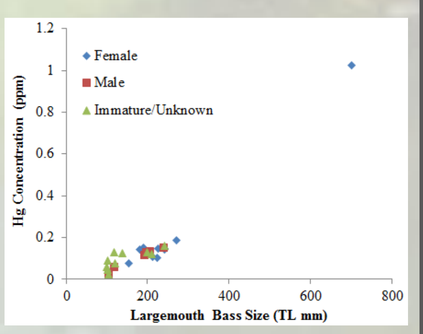

Fig 3. Relationship of bass size versus concentration of Hg

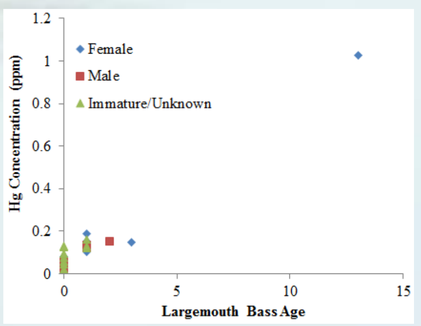

Fig 4. Relationship of largemouth bass age versus concentration of Hg for each specimen

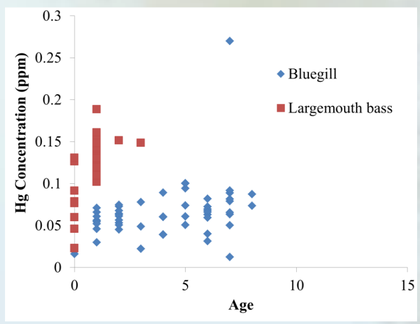

Fig 5. Relationship of age versus concentration of Hg between bluegill and largemouth bass

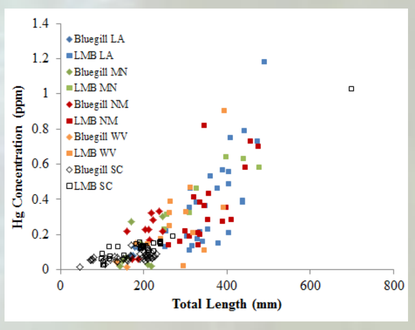

Fig 6. Hg in bluegill and bass from pond/reservoir/lake systems in other states compared with current study

Conclusions and Future Work

- As length and age increase for both species, total mercury also increases similar to other studies[3,4,5]
- Largemouth bass show higher Hg concentrations at the same age as bluegill which may relate to being at a higher trophic level since they tend to consume mainly fish while bluegill feed on invertebrates (including zooplankton)
- Compared to data from other states across the USA that reported Hg concentrations for skinless fillets in fishes from lakes/reservoirs/ponds, the bluegill and largemouth bass from our study seem to have average to low concentrations of Hg (Fig 6)
- Future: Continue to analyze Hg in addition samples, then conduct more complex statistical analyses to examine the significance of the relationships between size, age, and Hg concentrations and publish these results and findings in a peer-reviewed scientific journal

Literature Cited

1. Driscoll CT, Han YJ, Chen CY, Evers DC, Lambert KF, Holsen TM, Kamman NC, Munson RK. 2007. Mercury Contamination in Forest and Freshwater ecosystems in the Northeastern United States.Bioscience 57:1-12; 2. Fishbase.com 2013. Online web resource for fishes. Information accessed on 24 Apr 2013; 3. Lange TR, Royals HE, Connor LL. 1994. Mercury accumulation in largemouth bass (Micropterus salmoides) in a Florida Lake. Archives of Environmental Contamination and Toxicology 47:466-471; 4. Neumann RM and Warda SM. 1999. Bioaccumulation and Biomagnification of Mercury in Two Warmwater Fish Communities. Journal of Freshwater Ecology 14: 487-497; 5. Cizdziel J, Hinners T, Cross C, Pollard J. 2003. Distribution of mercury in the tissues of five species of freshwater fish from Lake Mead, USA. Journal of Environmental Monitoring 5:802-207