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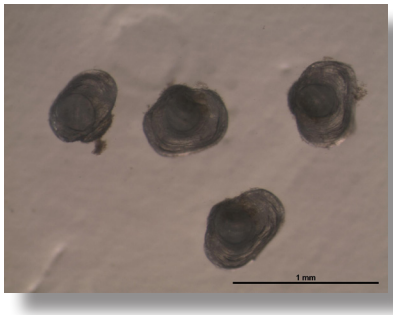
Patuxent Wildlife Research Center

Agricultural Chemicals and Stormwater Runoff: Impacts on Rare and Threatened Aquatic Species

The Challenge: Until recently, the Upper Conasauga River in northern Georgia was considered to have one of the most diverse communities of freshwater species in North America including numerous rare, endangered, and threatened species of fish and mussels. However, the occurrence of these species has declined significantly over the past decade coinciding with substantial increases in the use of glyphosate-resistant crops and the use of poultry litter (often elevated in heavy metals, hormones and vitamins) as a soil amendment within the watershed. With the introduction and use of glyphosate-resistant wheat along with resistant corn and soybeans, the utilization of glyphosate herbicides will increase substantially across the nation as farmers use multiple applications during the growing season. The use of chicken litter as an organic fertilizer will continue to increase nationally as the popularity of poultry production and consumption increases with the concomitant disposal of production waste as agricultural fertilizer. Both issues may pose serious threats to aquatic ecosystems nationwide with regard to the loss of endangered and threatened species and significant decreases in diversity.



The Science: A combination of multiple-year chemical surveys of sediments and surface waters along with field and laboratory toxicity assessments were employed to determine possible causes for the disappearance of aquatic species. Sediment and water chemistry (i.e. nutrients, hormones, vitamins, metals, glyphosate) were used in identifying potential contaminants, locating potential sources, and assessing effects on native biota. Nitrate concentrations in surface waters collected after rain events were often at levels that can impair invertebrate communities (up to 3 mg/l in the mainstem and major tributaries and up to 39 mg/l in farm tributaries). Glyphosate was rarely detected in water samples but its primary degradation product, aminomethylphosphonic acid (AMPA), was common. Sediments contained both chemicals; some in relatively high concentrations and most indicating seasonal changes in the glyphosate:AMPA ratio. Sediments also contained elevated concentrations of estrogen hormones at levels that may induce the feminization of male fish or other symptoms of endocrine disruption. Several localized sources of hormones can be identified, but concentrations at most sites were elevated which potentially implicates the wide-spread use of chicken litter in the watershed. Intersex conditions in fish (i.e. ovotestis) were observed primarily in larger species at sites throughout the study reach. Sediments collected from major tributaries negatively affected the growth of fathead minnows (*Pimephales promelas*) and tricolor shiners (*Cyprinella trichoistia*). Sediments downstream of several major tributaries reduced the growth of Hyalella azteca.

The Future: Field and laboratory projects have been completed. Data summary and report preparation continue.

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