Reproductive Health of Yellow Perch, *Perca falavescens*, in Chesapeake Bay Tributaries

Yellow Perch

Yellow perch live in creeks, rivers, ponds, lakes and estuaries across the central and eastern United States and Canada. In the Chesapeake Bay, they tolerate salinities up to one third the strength of seawater. The adults reside in brackish waters of the Bay tributaries and migrate upstream to spawn. Yellow perch are eagerly sought by recreational fishermen for their excellent taste and, because their late winter spawning runs are the earliest of the year, as a harbinger of spring. Yellow perch also support a small, valuable, tightly regulated commercial fishery in Maryland's portion of Chesapeake Bay.

Background

In the early 20th century, the Chesapeake Bay supported a major commercial yellow perch fishery. This catch declined drastically reaching a low in the late 1970s. In the early 1980s, Maryland Department of Natural Resources (DNR) reported a decline in recreational fishing for yellow perch in rivers in the Baltimore-Washington-Annapolis area that had long been closed to commercial fishing. After being closed to recreational fishing for yellow perch for 20 years, these rivers were reopened in 2009. The DNR noted the decline in egg hatching success from over 80% during the 1920s to 1960 to less than 10% in 2001 to 2005 and concluded that banning fishing would not overcome the poor hatch. It appeared that these western shore yellow perch fisheries were supported by occasional "natural stocking" from strong upper Bay year-classes.

In the rivers of the Chesapeake, yellow perch usually spawn in early March. Females extrude long, accordion-like egg chains which are fertilized by males. These chains can be easily counted by volunteers walking stream banks or in kayaks. The egg mass counts are not consistently collected for all tributaries; however, they are useful for comparing spawns among rivers. In spring, DNR conducts larval surveys in some Bay tributaries and calculates the percent of samples with yellow perch larvae. This index provides an indication of how well eggs and early larvae have survived.

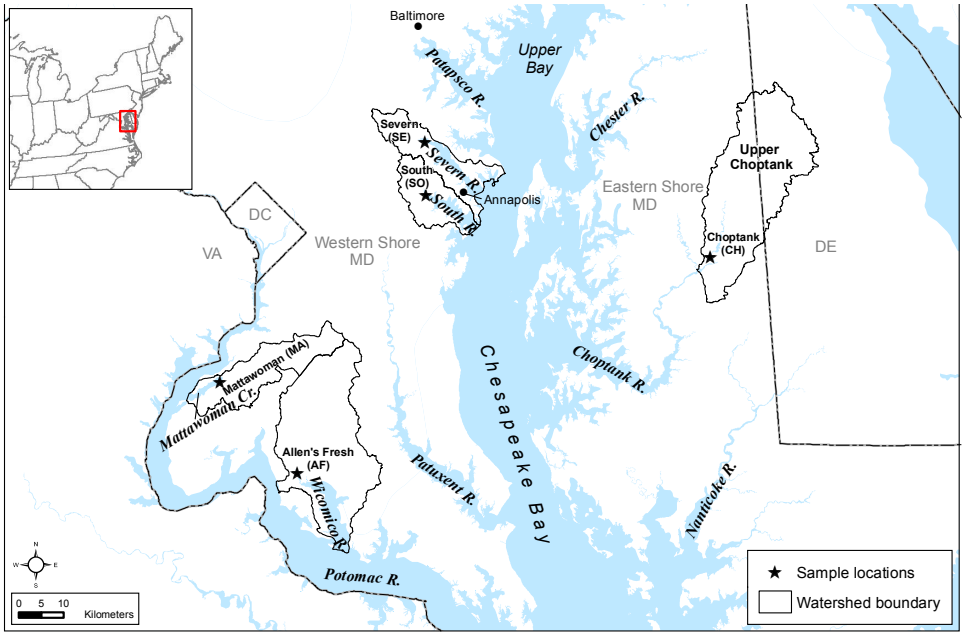

Figure 1. Locations and watersheds sampled (2007–2009)

Survey Goals

We studied five Chesapeake Bay tributaries (Figure 1) with varying degrees of urbanization indicated by impervious surface percentages (the more roads, roofs, parking lots, etc., the higher the impervious surface percentage): Choptank (2%), Allen's Fresh (5%), Mattawoman (10%), Severn (21%), and South (25%).

The goal was to compare the reproductive health of yellow perch from historically important spawning areas to better understand the reasons for reduced reproduction. We compared two tributaries with highly suburbanized watersheds and very low

spawning success (South and Severn Rivers) with Mattawoman Creek (a rapidly suburbanizing watershed, but still having extensive forest cover), Choptank River (largely agricultural), and Allen's Fresh (largely forested).

Field and Laboratory Work

During the 2007, 2008, and 2009 spawning seasons, we collected about 10 male and 10 female yellow perch from these rivers (Figure 1). To compare the reproductive status of the spawning fish, we (1) examined the ovaries and testes microscopically, (2) made sperm counts, (3) measured sperm motility (movement) and other measures of sperm quality, and (4) measured plasma concentrations of vitellogenin (a protein involved

in the production of egg yolk) and reproductive hormones.

Key Findings

In females, we observed two types of egg abnormalities: thin and irregular zona pellucida (egg envelope) and abnormal yolks (Figure 2). The percentage of egg envelope abnormalities was highest in perch from the South (2007) and Severn (2008, 2009) Rivers. In all three years, the percentage of yolk abnormalities was significantly higher in the Severn and South River perch compared with all other locations. In all years, none of the Severn River females had eggs that were fully developed at the time of collection.

In males, the major microscopic abnormality was an increase in the number and size of Leydig cells, which secrete the hormone testosterone. This abnormality was observed in perch from the Severn River and less commonly from Mattawoman Creek. There was no consistent ranking in the rivers with respect to sperm counts. Sperm motility was significantly higher in the Choptank perch compared with Mattawoman perch (in 2008) and compared with both Mattawoman and Severn perch (in 2009).

Conclusions and Recommendations

We documented abnormalities in yellow perch ovaries and testes at spawning time. The most frequent and severe problems were in perch from the South and Severn Rivers, within the most suburban watersheds. Detecting these abnormalities helps explain the biology behind poor survival of yellow perch eggs and larvae in these rivers. Published studies suggest that the abnormalities may result from exposure to environmental contaminants. Follow-up studies are needed to discover which contaminants may be involved, how such contaminants enter and move through the rivers, and how they affect the fish.

The Research Team

Partners included the U.S. Geological Survey's National Fish Health Research Laboratory, U.S. Fish and Wildlife Service's Chesapeake Bay Field Office and Maryland Fisheries Resource Office, USGS National Wetland Research Center, and Maryland Department of Natural Resources. Funding was provided by Mirant Corporation (now a part of NRG Corp.), USFWS, and the USGS' Chesapeake Bay Priority Ecosystems, Fisheries and Toxic Substances Hydrology programs. We appreciate the assistance of the Coastal Conservation Association Maryland and Arlington Echo.

For More Information

Blazer, V.S., A.E. Pinkney, J.A. Jenkins, L.R. Iwanowicz, S. Minkkinen, R.O. Draugelis-Dale, and J.H. Uphoff. 2013. Reproductive health of yellow perch Perca flavescens in selected tributaries of the Chesapeake Bay. Science of the Total Environment 447:198-209.

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Figure 2. Microscopic appearance of yellow perch gonads. A. Normal stage 3 oocyte with yolk globules (a) and zona pellucida or envelope (b). B. Normal stage 4 oocyte with fused yolk (a) and egg envelope (b). C. Abnormal oocytes from a South River perch with thin, irregular egg envelope (arrows). D. Oocytes from a Severn River perch with abnormal yolk (arrows). E. Enlarged Leydig cells (arrows) in the testis of a Severn River perch. F. Abnormal accumulation of Leydig cells (a) in testis of a Severn River perch.