



GENETIC ANALYSIS OF LAKE STURGEON TISSUE RELATIVE TO SEX DETERMINATION



Current Status

17-month project, completed in June 2009

Funding Sources and/or Partners

State Wildlife Grant, DNR Nongame Fund, Great Lakes Fishery Trust

Project Personnel

Principal investigator, Andrew DeWoody; postdoctoral associate, Matthew Hale

Background(s) and Objective(s)

In mammals and birds, sex is dictated by the chromosomal constitution and is thus genetic (mammalian males are XY and females are XX). However, many fishes have environmental sex determination without sex chromosomes. Their sex is determined by egg incubation temperature or by social status. The objective of this project was to evaluate the working hypothesis that lake sturgeon sex is determined genetically. This is important for restoration efforts, as hatcheries could (in principle) rear cohorts with a strong sex-bias if sex determination is not genetic.

Methods

Gonad tissue was collected from adolescent male and

female lake sturgeon. The genes expressed in these tissues were isolated as mRNA molecules, which were then transcribed to cDNA. Male and female cDNA was sequenced and compared to each other. The pyrosequencing approach employed in this research allowed investigators to determine both the DNA sequence and the relative expression of the genes expressed in lake sturgeon gonads. Then, male genes were compared to female genes and vice-versa.

Progress

First, this research strongly suggests (but does not completely prove) that lake sturgeon sex is genetically determined. The DMRT1 gene, known to determine bird sex, is more highly expressed in male lake sturgeon gonads than in females. This is consistent with a dosage effect whereby females (ZW) receive one dose of the Z-linked DMRT1 gene and males (ZZ) receive two doses. Second, this research found evidence for positive selection on reproductive proteins expressed on the surface of lake sturgeon gametes; these genes have evolved rapidly. Finally, the DNA sequencing revealed the presence of two microorganisms in lake sturgeon gonads: a schistosome (trematode worm) and a trichomonad (protozoan).

Cost: \$22,243 for complete 17-month study



Sturgeon sampling in 2008, including surgery to extract gonad tissue for DNA analyses.