Sex of Fish Determined by Access to Food, Surprised Researchers Say

By Erik Lief — March 29, 2017

Imagine if your sex was determined not at birth, but by the amount of food available in the early stages of your life. That if you had access to a wider range of choices you’d increase the chance of becoming one gender over the other.

And that if you were well fed and ate when the slightest hunger struck, your likelihood of becoming female would increase.

While not a possibility for humans, this does appear to be the case for a particular species of fish that is – and has been – imperiling aquatic life in the Great Lakes region since the early 19th century.

What's more, researchers stumbled upon this revelation by accident.

The fish is the sea lamprey, a rather unattractive, slithery and rope-like creature that survives by consuming the blood and bodily fluids of adult fish it comes into contact with.
In following the movements of this parasitic nuisance, scientists were surprised to learn that many more males lived in "unproductive" environments, ones lacking in food sources. And in places where food was more plentiful, the male population was greatly reduced.

Research included the tracking of the species from 2005 to 2007, when scientists “tagged and released sea lamprey larvae into unproductive lakes and productive streams,” according to details of the work provided by the U.S. Geological Survey, an agency that's part of the Department of the Interior, which supplied the accompanying photo (courtesy: Marisa Lubeck, USGS). "The researchers then recaptured the tagged fish as adults during their spawning migrations. The sex ratios in productive and unproductive environments were initially similar but quickly diverged, with unproductive lakes becoming increasingly male-dominated."

After three years, they discovered that 78 percent of sea lampreys were male. By comparison, areas with abundant food sources that were "more conducive to growth," had populations that were just 56 percent male.

“Remarkably, we didn’t set out to study sex determination in sea lampreys – we were planning to study environmental effects on growth rates only,” said Nick Johnson, a USGS scientist and the lead author of the study, published today in the journal *Proceedings of the Royal Society B*. “We were startled when we discovered that these data may also reveal how sex is determined."

The National Ocean Service, a federal agency that's kept a close eye on the sea lamprey because of the species' destructive nature and history, says it belongs in a class with sharks.

Sea lampreys are "an efficient killer of lake trout and other bony fishes," and they use "its disc-shaped, suction-cup mouth, ringed with sharp, horny teeth, with which it latches on to an unfortunate fish," the NOS states, adding that they began their invasion of the Great Lakes region beginning in the 1830s. "The lamprey then uses its rough tongue to rasp away the fish's flesh so it can feed on its host's blood and body fluids. One lamprey kills about 40 pounds of fish every year."

The unique discovery, of how a species gender develops based on available food supply, may prove to have a wider application in the field of marine biology.

"To the best of our knowledge, this is the first study suggesting that growth rate in a fish species directly influences sex determination," writes Mr. Johnson, and the study's co-authors, William Swink and Travis Brenden. "Understanding mechanisms of sex determination in lampreys may
provide unique insight into the underlying principles of sex determination in other vertebrates and provide innovative approaches for their management where valued and invasive.”

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