

Study of Wisconsin walleye finds recreational fishing contributes to stock declines

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There's a long-standing belief in the freshwater fishing community that once anglers find it too hard to land a particular fish for their dinner plate, they either move on to fishing for different species or fish in new

waters, giving depleted populations time to rebound.

But this "[self-regulation](#)" assumption, says University of Wisconsin-Madison Center for Limnology graduate student Holly Embke, turns out to be wrong. Embke is lead author of a study published this week [Nov. 18, 2019] in the *Proceedings of the National Academy of Sciences* that shows when stocks of fish get so low that it becomes a greater challenge to catch them, many anglers step up to the challenge and continue catching fish. This poses a threat to the long-term health of sportfish populations in Wisconsin and in inland recreational fisheries around the world.

The study examined stocks of the popular game fish [walleye](#) in 179 lakes in Wisconsin and found that 40 percent of walleye populations are overharvested, says Embke. By assessing fish stocks with the currently accepted models that minimize angler impacts, she and her co-authors say, resource managers miss this "hidden overharvest."

Over the last few decades, walleye populations in Wisconsin have dramatically declined because of [climate change](#). They are a cold-water species that thrive in cooler conditions, but as lakes in the upper Midwest warm, says co-author Steve Carpenter, director emeritus of the Center for Limnology, they offer less cold-water habitat for walleye.

Annual walleye production across the state's more-than 900 "walleye lakes" has declined by 35 percent over the last 30 years. On top of that, walleye stocks now take one and a half times longer to grow than they did in 1990.

However, despite climate-driven decline, walleye are as popular as ever among anglers and the annual percentage of walleye that they are permitted to harvest each year has stayed roughly the same, compounding the problem.

One way to think of it, Carpenter says, is in terms of a bank account. If you withdraw the same amount of money from your account each year, but start making smaller and smaller annual contributions, your savings shrink. Do this several years in a row, and those annual withdrawals begin to have an outsized impact on what little money is left in the bank.

Part of the reason harvest rules haven't changed, says Embke, is that the current practice of estimating the number of adult walleye in a [lake](#) doesn't reveal the full story of the health of the population.

In the late 1980s, after a U.S. District Court judge ruled that Ojibwe tribes had the right under federal treaty to hunt and fish in their former territories, the Wisconsin Department of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission worked together to set sustainable harvest limits on walleye. More than 450 tribal anglers spear walleye on roughly 175 lakes each spring, and more than 1 million recreational anglers fish nearly year-round on lakes across the state.

Using the best available science at the time, the agencies developed a management plan that estimated adult walleye populations and set regulations to ensure no more than 35 percent were harvested in any given year. The average exploitation rate for walleye stocks is closer to 15 percent, so the agencies assumed the regulations were sufficiently conservative to be sustainable.

These regulations "worked for a long time," says Carpenter, "and then they stopped working. Over the last couple of decades, there began to be walleye recruitment failures scattered around the state. And the rules didn't move with that. There was no change in the rules."

Embke and her colleagues set out to better understand the other factors that managers might consider when setting harvest rules. They sought to shift the focus from abundance to production, moving beyond an

estimate of how many walleye were in a given lake to a clearer picture of how well those populations were able to withstand harvest and continue to reproduce and grow.

"We wanted to take a more nuanced approach and ask not only how many fish are in a lake but also consider how fast they're growing, how big they are, and how many are produced every year," she says.

To continue the banking metaphor, Embke adds: "Abundance tells you the money in the bank while production tells you the interest rate."

Using data that state and tribal researchers had already collected across Wisconsin, Embke and her colleagues calculated how walleye biomass had changed over a 28-year period in 179 lakes. Measuring biomass is akin to throwing all of the walleye in a lake on a scale and recording the overall weight. Production, though, is a reading of how much biomass grows each year, an indication of a population's ability to replenish its losses.

By comparing walleye production to the total fishery harvest in these study lakes, they found that overharvest is ten times higher than the 4 percent estimates generated when fisheries managers consider abundance alone.

What's more, Embke says, the study found great variation in walleye production from lake to lake. By considering production, fisheries managers may be better equipped to set limits for individual lakes. Some remain walleye strongholds and can handle current fishing pressures, while others lakes can't sustain the 35 percent harvest benchmark.

These results, the researchers write, "highlight the urgent need for improved governance, assessment, and regulation of recreational fisheries in the face of rapid environmental change."

"Nature has changed," says Carpenter. "The climate now is different from what it was in the 1980s and it's not going back. That means habitat is decreasing and, on average, walleye stocks can't take the harvest levels they have seen."

The good news, he says, is that the data fisheries managers already collect can be plugged in to Embke's method for estimating production and help chart a way forward. By better understanding the resilience of Wisconsin walleye populations and by acknowledging the role that anglers play in reducing stocks, the future of this iconic fishery just may have a fighting chance.

More information: Holly S. Embke et al., "Production dynamics reveal hidden overharvest of inland recreational fisheries," *PNAS* (2019). www.pnas.org/cgi/doi/10.1073/pnas.1913196116

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