From brook trout to walleyes, warming waters to play havoc with fisheries

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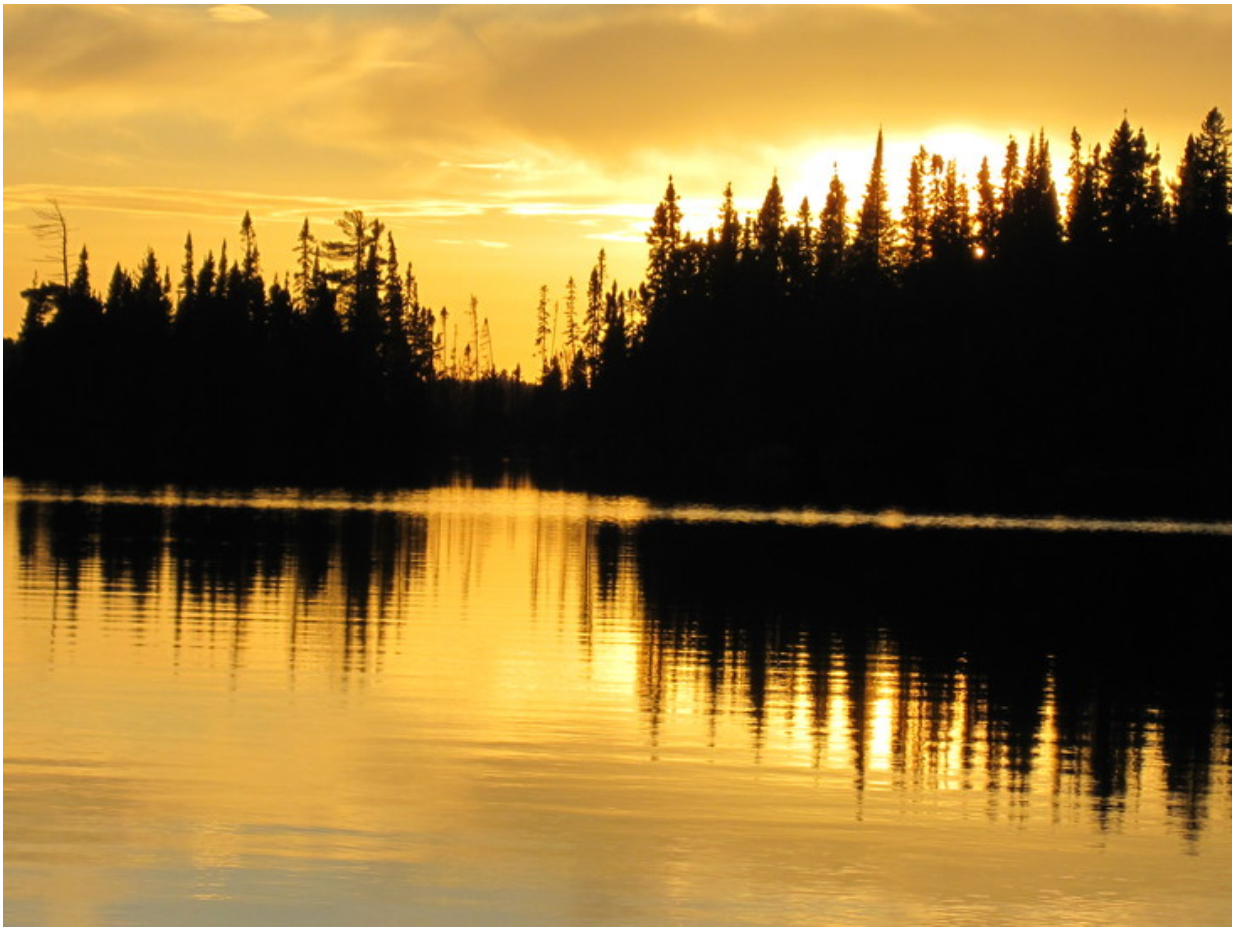

Previous studies have shown that, generally, there has been a decline in walleye populations in Wisconsin lakes and that warming water temperatures seem to be the culprit. But researchers have seen variability in the trend from lake to lake, so they are trying to determine what other factors are involved. Credit: Tyler Wagner

A few degrees, on average, can make a huge difference in lakes and streams as aquatic species struggle to compete and in some cases survive, and that's why a warming climate is of concern to fisheries managers.

In some cases, like that of Eastern brook trout, the effects will be painfully obvious, according to Tyler Wagner, a researcher in Penn State's College of Agricultural Sciences. Occupying only clean, cold streams, wild brook trout have been eradicated from nearly a third of their historic watersheds, and their populations have declined by more than half in an additional third of watersheds in their range in the eastern United States.

The fish has been a victim of pollution and degraded habitat resulting primarily from historical forestry practices and development.

If waters in the eastern United States continue to warm, "brookies" likely will occupy only small headwater streams in northern states and Canada in coming decades, warns Wagner, adjunct professor of fisheries ecology. He has studied brook trout habitat in the region extensively and developed a computer model to locate wild-trout waters. Brook trout prefer temperatures between about 52 F and 61 F and can't live for long in water temperatures above about 75 F.

But in the case of walleyes—a cool-water species—in the upper Midwest, warming lakes are expected to have a more subtle and complex influence. In just-published research in the *Canadian Journal of Fisheries and Aquatic Sciences*, Wagner and researchers from the Wisconsin Department of Natural Resources and Louisiana State University concluded that walleye recruitment success (adequate number of young fish surviving to enter and sustain the fishery) is less resilient to warming water temperatures in lakes with abundant largemouth bass populations.

An economically and socially important sport and food fish in the upper Midwest, walleye populations have been sagging in some lakes in the region, and fisheries managers aren't sure why. Previous studies have shown that warming water temperatures seem to be the culprit, which was motivation for the study. Optimum temperature for the growth of walleye fry is about 72 F.

Uneasy coexistence: More research is needed to determine if walleye (right) recruitment success is influenced directly by abundant largemouth bass (left) or if largemouth bass simply benefit from the same environmental conditions — such as warmer water — that reduce the resilience of walleye recruitment. Credit: Tyler Wagner

"Previous studies have shown that, generally, there has been a decline in walleye populations in Wisconsin, and a lot of that appears to be driven by poor recruitment in recent years," said Wagner, who is assistant unit leader of the Pennsylvania Cooperative Fish and Wildlife Research Unit at Penn State. "But it also has been acknowledged that there is a high level of lake-to-lake variability in that pattern. Lakes geographically close to each other have shown different trends in recruitment, so other factors are involved."

One of those factors may be the presence of largemouth bass, noted lead researcher Gretchen Hansen, now with the Minnesota Department of Natural Resources, who conducted the study when she was employed by the Wisconsin Department of Natural Resources. She pointed out that lakes with abundant largemouth bass populations are least likely to support successful, natural walleye recruitment.

"Additionally, walleye recruitment is more sensitive to water temperature increases in lakes with abundant largemouth bass," she said. "And climate change is projected to increase temperatures throughout Wisconsin over the next several decades."

Researchers collected walleye recruitment and temperature data from 359 Wisconsin lakes and determined which ones had bass populations. Because researchers were not able to assess relationships between fish species in this study, they can't tell if walleye recruitment success is influenced directly by abundant largemouth bass or if largemouth bass simply benefit from the same environmental conditions—such as warmer water—that reduce the resilience of walleye recruitment.

"Therefore, we don't know if intentionally changing largemouth bass densities would affect the probability of successful walleye recruitment in these lakes," Hansen said, "although an adaptive management test of this idea is currently underway."

Wagner—who met Hansen and other Midwestern colleagues while conducting doctoral research at Michigan State University related to largemouth and smallmouth bass on inland lakes from 2004 to 2006—explained that when temperatures rise, bass will experience more ideal conditions that could give them a competitive advantage over other fish species and result in increased foraging rates. That may result in them eating more walleye fry which, along with achieving larger body sizes, allows the females to deposit more eggs.

"It's not a good scenario for walleyes, and in many cases it doesn't take a large change in temperature to influence the species interactions," he said. "A few degrees warmer may favor bass over walleyes, and over time the largemouth populations could become dominant. In the upper Midwest, where most anglers cherish their walleye fishing most of all, any decline in walleye populations will not be welcomed, so fisheries managers may have to adjust regulations and habitat-management strategies to protect walleyes."

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