

Rocky Mountain Research Station Science You Can Use *(in 5 minutes)*

MAY 2018



Fishing for Climate Data: How Recent Research is Helping to Forecast Changes in Salmon and Trout Habitat

The New Normal?

Anyone familiar with the Columbia River's massive salmon die-off a few summers ago might also be concerned about how climate change will affect fish habitats. The 2015 die-off killed more than 250,000 fish and was blamed on record low streamflows and high water temperatures. While coldwater

fish such as salmon and trout can adjust to slightly warmer-than-normal temperatures for short periods, abnormally high temperatures for prolonged periods lower oxygen levels, increase the likelihood of deadly diseases, and cause life-threatening physiological stress.

To understand whether the 2015 die-off was an anomaly or part of a longer-term trend, scientists at the Rocky Mountain Research Station's Aquatic Sciences Lab in Boise, Idaho, compiled temperature records from more than a dozen natural resource agencies monitoring nearly 400 sites along large rivers in the northwestern United States. Results of the study, entitled "Global warming of salmon and trout in the northwestern U.S.: Road to ruin or path through



The South Fork of the Snake River and other world-famous northwestern U.S. fisheries are expected to lose trout and salmon habitat as a result of rising river temperatures. (Image: Bureau of Land Management.)

KEY FINDINGS

- Monitoring records indicate that river temperatures during the summer and early fall months have risen about 1 °C over the past 40 years in the northwestern United States.
- If river warming continues at rates similar to recent decades, water temperatures are expected to rise another 1 °C by 2050 and by 2-3 °C by the end of the century.
- In many locations, trout and salmon will have to shift into cooler areas or migrate at different times of the year to avoid thermally stressful conditions.
- River managers may be able to offset warming in some areas and preserve coldwater river habitats by employing various habitat and flow restoration techniques including minimizing flow diversions, increasing shade, enhancing habitat diversity and the number of deep pools, releasing cold water from storage dams during heat waves, and improving fish passages at dams that block access to cooler river sections.

purgatory?” were recently published in Transactions of the American Fisheries Society.

Serious but Not Yet Desperate

These scientists found that average river temperatures during summer and early fall months rose about 1 °C over the 40-year period of 1976 to 2015. This was slightly less than air temperatures rose during the same period; the discrepancy is because the impact to rivers and streams of a warmer climate is partially offset by inputs of snowmelt and cool groundwater. But according to research hydrologist Charlie Luce, “Based on past rates of warming, we’re probably looking at another increase of about 1 °C by 2050” compared to current conditions.

If that temperature increase occurs, Luce says, “we’d lose habitat and see shifts in the distributions of some coldwater fish species.” For example, rising water temperatures could reduce river trout habitat by 8-31%, depending on local river conditions and the species of concern. “A reduction of that magnitude is not hopeless,” Luce says, but it could lead to losses of place-based fishing traditions in some areas and

FURTHER READING

Isaak, Daniel J.; Luce, Charles H.; Horan, Dona L.; Chandler, Gwynne; Wollrab, Sherry; Nagel, David E. 2018. Global warming of salmon and trout rivers in the northwestern U.S.: Road to ruin or path through purgatory? Transactions of the American Fisheries Society. doi: 10.1002/tafs.10059. www.fs.usda.gov/treearch/pubs/56060

concentrate anglers in a smaller number of fishing holes. The real question, according to lead researcher and research fish biologist Dan Isaak, “is how much warmer these rivers will be at the end of the century, because a 2–3 °C increase could cause serious negative impacts to salmon and trout populations.”

Fish and River Management Options

Land and river managers have several management adaptation options when it comes to keeping rivers suitable for coldwater fish species. These options include minimizing flow diversions, increasing shade, enhancing habitat diversity and the number of deep pools, releasing cold water from storage dams during heat waves, and improving fish passages at dams that block access to cooler river sections. These options all have advantages and disadvantages. Luce explains, “We’d like to think that we can just get more shade from the trees, but many of these rivers are pretty wide. One of the more interesting options is using deeper water as microrefugia: Cold water tends to stay low, and by having deep pools, you’ll have cooler areas for fish to swim between when it’s warm. If we can keep those pockets so that the fish can cool off, we may be able to maintain fish habitat despite higher river temperatures.”



RMRS researchers use stream temperature probes across many sites to monitor water temperature trends (photos D. Isaak).

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