Researchers identify environmental risks and opportunities for conservation of native Colorado trout populations

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(Phys.org) —With only 14 percent of their original habitat remaining, native Colorado River cutthroat trout have been forced into isolation by habitat loss and invading non-native trout in relatively short reaches of high-altitude headwater streams. A new research paper by scientists at Colorado State University's Warner College of Natural Resources has found that 63 percent of the remaining populations will be at some risk of decline or extinction by 2080.

There are 309 individual fragments of rivers and streams where pure Colorado River cutthroat trout still persist in the Colorado River Basin. The CSU researchers developed models to assess the probabilities for a variety of risks to trout in these populations, including those from a warming climate as well as increases in drought that causes stream drying and wildfire that can produce erosion of sediment into streams.

Researcher and lead author on the paper James Roberts first developed a sophisticated model to predict future stream temperatures from the latest predictions of future air temperatures and stream flow under climate change, as well as a range of other important variables such as latitude, slope, and elevation. The researcher team then analyzed the impacts of potential environmental disturbance events, such as fire, erosion and drought. What they found was a surprising paradox, and an opportunity for conservation.

The scientists report that none of the populations of cutthroat trout are expected to be at risk of acute mortality from increasing temperatures as the climate warms, even 70 years in the future. This is because these native fish have already been forced into refuges in short high-altitude streams, above barriers that prevent invasion by non-native brook, rainbow, and brown trout. As a result, the surviving populations are less susceptible to extreme temperature changes such as those that will occur at lower elevations. However, these isolated havens of cool-water habitat are also at the crux of what is jeopardizing the Colorado River cutthroat trout population.

The study reported that the fish living in these short stream reaches are highly vulnerable to potential effects of drought, fire, sediment deposition and freezing because they lack the habitat that would shelter them from these events that longer stream segments would afford. In addition, the isolated populations are also compromised by genetic risks that occur in small populations.

Because Roberts' models looked at each risk factor for each stream where the native trout still occur, the researchers are able to identify in which of the 309 fragments restoration to expand the native trout's habitat can be most effective. Furthermore, they are able to determine approximately how many kilometers long a stream fragment needs to be in order to provide adequate habitat for enhanced persistence rates.

"The complexity and depth of this study has allowed us to sharpen our focus and help managers create sustainable solutions for this iconic native fish species," said Roberts. "Our hope is that this research will empower land managers with the tools and information needed to make a significant impact on the conservation of native Colorado River cutthroat trout for generations to come."

The paper, "Fragmentation and thermal risks from climate change

interact to affect persistence of native trout in the Colorado River basin," is published in the May 2013 issue of *Global Change Biology*. The study was conducted using data from the upper Colorado River Basin, which includes all tributaries above Glen Canyon Dam and Lake Powell.

Roberts, now working with the U.S. Geological Survey, conducted the research over three years while he was a post-doctoral researcher with CSU's Warner College. CSU scientist Kurt Fausch served as Roberts' research advisor and co-author, and is a professor in the Department of Fish, Wildlife, and Conservation Biology and a world-renowned expert in the ecology and management of trout and other stream fishes. Other co-authors of the study are Mevin Hooten with the USGS Colorado Cooperative Fish and Wildlife Research Unit and CSU alumnus Doug Peterson with the U.S. Fish and Wildlife Service.

"The exciting outcome of this research is that we now have a targeted tool to help land managers plan efficient and strategic habitat restoration to reduce these risks," said Fausch. "In many other cases, managers may be able to do little for native trout as the climate changes and makes streams too warm for their survival."

More information:
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