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Knowledge to Go Places

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Mr. Al Pfister
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Dear Al and Committee,

I was asked to provide peer review for the status assessment for Colorado River cutthroat trout, titled "Range wide status of Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*): 2005" by Hirsch, Albeke, and Nesler, published March 2006. As background, I have conducted research on stream salmonids for 30 years, including >15 years of research on native cutthroat trout in Colorado. I have interacted fairly closely with the Colorado River cutthroat trout Conservation Team during the last two years, attending two annual meetings. I am not employed by the U.S. Fish and Wildlife Service, and have always attempted to provide independent and objective advice when asked. I am the senior author of a recent publication on extinction risk analysis for salmonids in the interior West, titled "*Strategies for conserving native salmonid populations at risk from nonnative fish invasions: tradeoffs in using barriers to upstream movement*", General Technical Report RMRS 174, U.S. Forest Service, Fort Collins.

Summary of the report

The Hirsch et al. (2006) report summarizes an effort by 48 fisheries biologists who manage waters with Colorado River cutthroat trout (CRCT) to assess their historical distribution, present distribution, the status of these current populations, and the options for increasing the number of populations. Data of various types and professional opinion were used to systematically assess each of these attributes for each stream segment in 4th-level HUCs throughout the entire Colorado River basin. The main findings were that CRCT now occur in about 13% of their native range, and were also translocated and became established in streams where they were not originally found (primarily above natural barriers) equivalent to another 1% of the original range. Fish in about 26% of this occupied habitat have been tested and are considered genetically pure, although agencies consider CRCT in 59% of occupied habitat (285 populations) to be either pure or of significant conservation value, and have designated these as "conservation populations." These conservation populations are well distributed throughout the basin, but most are small isolated populations at relatively high risk of extinction (e.g., 69% of conservation populations occur in isolated segments <6 miles long; median length 3.7 miles). Only 37% of the current range has no nonnative trout present, and these nonnatives have invaded

stream segments where they were never stocked. Nearly half (42%) of habitat is rated excellent or good, but more than half the conservation populations are affected by recreation, angling, grazing, and roads as habitat risk factors. Given these constraints, about 582 miles of historical habitat (about 3%) is considered of intermediate or high potential for restoration of CRCT in the future, which could raise the total occupied range to 17 or 18% of the historical range if most of the feasible restoration occurred. This suggests to me that the options for expanding the range significantly are limited, and that it will be important to conserve the populations that currently persist.

Questions for Peer Review

I was asked to address four main questions about the report, which I summarize below.

Is the assessment accurate and scientifically supported?

Overall, the CRCT Conservation Team, and the authors of the report, provide an honest assessment of what is known about the distribution and status of Colorado River cutthroat trout. I was impressed with the maps that give an immediate visual assessment of the historic and currently occupied range, and with the honest assessment of the data assembled. In most cases, the assessment was conservative, and did not make assumptions about stream segments or attributes of fish (e.g., genetic purity) that were not sampled. I was also impressed that the Team has committed to improve inventory data, through GMU team workshops, with the goal of updating this assessment periodically. The assessment is liable to be least accurate where data are unavailable or difficult to collect, such as for genetic purity (i.e., many populations remain untested, and results of testing seem always subject to interpretation and revision).

Does the report provide adequate analysis of risk factors for the species?

The report itself addresses the main risk factors that affect the species, but the Executive Summary (the part that most readers will see) does not portray some of the most important ones, in my view. The greatest risks to CRCT rangewide, in my view, are habitat loss, biotic interactions with nonnative salmonids, potential for loss from disease, and overfishing, in that order. In this report, the two risks most discussed are loss of genetic purity and risk of catastrophic disease. However, displacement of entire populations by brook or brown trout is an important risk for many populations. The report found that only 37% of the currently occupied range is without one or more nonnative species (which could also include rainbow trout or other nonnative subspecies of cutthroat trout that hybridize with native cutthroat), and nonnative trout were deduced to have actively invaded stream segments where they were not stocked (i.e., they are found in more of the current range than they were recorded to have been stocked in). The CRCT, like other cutthroat supbspecies in the central and southern Rockies, are at high risk from extirpation by brook trout in many watersheds. For example, Peterson et al. (2004. *Ecological Applications* 14:754-772) reported that survival of age-0 CRCT was 13 times greater when brook trout were removed than when they were present, based on a large-scale field experiment and state-of-the-art survival estimation, and that survival of age-1 CRCT was also about twice as high when brook trout were removed.

A second main risk factor that was reported but not highlighted is the risk of isolation. Unfortunately, addressing this risk is in direct conflict with preventing the invasions discussed just above (see Fausch et al. 2006. US Forest Service General Technical Report RMRS-174). The majority of conservation populations are isolated in relatively short stream segments (69% are in less than 6 miles, and the median length is 3.7 miles), which results in small populations that are at some heightened risk of local extinction from catastrophic or stochastic events like fires, floods, harsh winters, or anthropogenic effects. Larger habitats are more likely to provide refuge habitats from these risks. The bottom line is that, although isolated populations are an important component of any cutthroat trout conservation strategy in this region, and many isolated populations may persist for long periods, loss of these small populations will likely be an increasingly important problem as climate change intensifies, and fires, floods, and droughts become more common and more extreme.

Overall, this report does provide data to assess these important risks, but does not emphasize them in the Executive Summary that is most read.

Are there any significant oversights in the report?

In the previous section I outline oversights in the Executive Summary. Here I bring up a larger issue that has not been considered in any native salmonid assessment of this type, as far as I know. This is the aggregate risk to the set of small isolated populations of the important risk factors that are considered individually. For example, if small populations begin to be lost from local extinction, managers will attempt to either translocate fish into these habitats, or find new places to start new populations, or both. However, large changes to stream temperature, large-scale wildfires, the sediment pulses that occur after fires and floods, and widespread droughts could cause extinctions of sets of populations together. What is needed is to begin analysis of what sets of populations and GMUs are at most risk from these larger effects, based on forest type, geomorphology, proximity to sources of new invasions, and the like. I realize that this is beyond the scope of this assessment or this listing decision, but in my view it is the next step that will be required in CRCT conservation planning.

Are the conclusions logical and supported by evidence?

Overall, the conclusions are logical and supported by the available evidence. Efforts to gather better data are ongoing, and the CRCT Conservation Team is to be commended for these ongoing efforts.

Thank you for the opportunity to provide scientific peer review of this assessment. Please do not hesitate to contact me if you have questions.

Sincerely,

Kurt D. Fausch
Professor