

Project Summary

Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Using mtDNA and microsatellites from current reference populations and museum specimens to explore the heritage of cutthroat trout in Rocky Mountain National Park

Discipline: Interdisciplinary

Type of Project: Research

Funding Agency: National Park Service

Other Partners/Cooperators: University of Colorado at Boulder

Effective Dates: 6/1/2009 - 3/31/2013

Funding Amount: \$156,023 [FY11: \$45,549; FY10: \$50,490; FY09: \$59,984]

Investigators and Agency Representative:

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Project Abstract: Colorado is home to three subspecies of native cutthroat trout, all of which are state species of special concern, and have been petitioned to be listed or are currently listed as threatened under the Endangered Species Act. All three subspecies look very similar. As they could not be reliably identified visually or with traditional genetic techniques, their historic range had been used to distinguish them. Recent highly publicized genetic studies confirmed the presence of three discrete cutthroat trout taxa in Colorado (Metcalf et al. 2007), but this work suggested that some of our key greenback cutthroat trout populations may actually be descendants of Colorado River cutthroat trout, possibly stocked east of the Continental Divide in the late 1800's. Similarly, several of the core conservation populations of Colorado River cutthroat trout appear to be more closely related to what Metcalf et al. (2007) refer to as greenback cutthroat trout.

Cursory molecular exploration of museum specimens collected from 1860-1890 have complicated the issue further. Only museum specimens from a single east slope collection match the greenback cutthroat trout genotype whereas several west of the Continental Divide fit that description, calling into question whether the greenback cutthroat trout was really an east slope native or whether it was moved there by anthropogenic means. A single population of putative greenback cutthroat trout near Colorado Springs displays a genotype similar to that of several museum cutthroat trout specimens collected east of the Continental Divide in the late 1800's suggesting that descendants of an east slope relic could still be alive today.

Although the multi-agency Greenback Cutthroat Trout Recovery Team (henceforth Recovery Team) initiated development of a long-range greenback management plan after decades of progress, unresolved taxonomic issues regarding what constitutes a greenback cutthroat trout have brought recovery efforts to a halt. While it is possible that cutthroat trout were moved prior to collections that occurred in the late 19th century, it is clear that these museum specimens represent the best hope for elucidating the native range of cutthroat trout in Colorado - and allowing recovery efforts to resume.

The goals of this project are to determine: (a) the distribution of GBC in ROMO, (b) the purity of those populations, and (c) the most appropriate populations to use as sources for reintroduction. Genetic analyses will be conducted from previously collected tissue samples and DNA extractions.

Specific objectives include:

1. Cutthroat populations will be classified as either GBC or CRC or GBC/CRC mixes. Results will include the lineage based on contemporary studies (Metcalf et al.) as well as information from museum samples to provide the most detailed overall assessment of each population. This addresses the question of Are these populations GBC, CRC, or a mixture of both?
2. For populations that are confirmed as GBC, the percent of hybridization with Yellowstone cutthroat trout and rainbow trout will be determined. In addition, if the population is a mixture of GBC and CRC, the degree of introgression of one cutthroat subspecies with the other will be determined. This addresses the question of what is the purity of each GBC population?
3. For cutthroat populations that are determined pure (less than 1% introgression detected), the overall genetic diversity will be calculated. This addresses the question of which populations are most appropriate as sources for future GBC reintroductions?

Provided sufficient DNA can be isolated from museum samples, the investigator will relate modern samples to the museum samples and to contemporary reference samples using methods described in Metcalf et al. (2007) and Martin (2008). CU will characterize molecular variation for mitochondrial and nuclear DNA markers for sufficient numbers of individuals to permit robust hypothesis testing.

The University of Colorado has demonstrated expertise in phylogeographic analyses for testing hypotheses related to the origin and distribution of native cutthroat trout in Colorado. They have previously collaborated on studies to distinguish populations of native cutthroat trout using mtDNA and microsatellites.

Outcomes with Completion Dates: The final report and electronic copy of data will be expected by December 31, 2012.

Keywords: Colorado's state fish, **cutthroat trout**, native range, Rocky Mountain National Park, University of Colorado at Boulder