Project Title:

Helping managers develop and implement a consistent method to prioritize conservation and identify climate adaptation strategies for Yellowstone cutthroat trout: identifying and ranking risks to mitigate stressors under anticipated changes in climate

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Project Summary (3 sentence target): Through funding awarded through the GNLCC in 2013 we and our state and federal partners and collaborators from Idaho, Wyoming, Utah, Nevada, and Montana have developed criteria and a framework for prioritizing populations of Yellowstone cutthroat trout; this spatially-explicit conservation priority framework was adapted from a financial portfolio concept aimed at maximizing species persistence in the face of adversity (Schindler *et al.*, 2010; Haak & Williams, 2012). We have completed prioritization at multiple spatial scales within the historical range using both ecological and conservation opportunity criteria and will complete prioritization of extant conservation populations within the

context of climate change within the next year. Through suggestions from the Multi-State Interagency Yellowstone Cutthroat Trout Conservation Work Group, we propose to continue this project and apply this framework with population-specific ranking of risks and to identify and prioritize areas for reintroduction of Yellowstone cutthroat trout (i.e., reintroductions) into streams historically occupied, that are likely more resilient to regional changes in climate. Given the continued support and interest from agency partners, including on-the-ground managers, we consider this a pivotal opportunity for Yellowstone cutthroat trout conservation and a relevant case example of research, management, and policy combining to demonstrate meaningful and long-term conservation solutions in the context of global climate change.

Need: As a native species, Yellowstone cutthroat trout has high societal value (Gresswell & Liss, 1995) and is a key food resource for over 40 species throughout its range (e.g., grizzly bear *Ursus horribilis* and bald eagles *Haliaeetus leucocephalus*) (Stapp & Hayward, 2002; Wengeler, Kelt, & Johnson, 2010). The historical range of Yellowstone cutthroat trout extends over approximately 4° of latitude and 7º of longitude comprising an area of 166,450 km^2. However, many local populations have been lost over a broad range of elevations (820 to 3,126 m) as a result of land use, fragmentation of stream habitat, and the ingress of non-native species (Kruse, Hubert, & Rahel, 2000; Gresswell, 2011). Today, genetically pure Yellowstone cutthroat trout occupy less than 28% of their historical range.

In addition to current threats, anticipated changes in global and regional climate are likely to considerably alter existing thermal and hydrologic regimes (Al-Chokhachy *et al., 2013;* Isaak *et al.*, 2012). The growing concern for native salmonids such as Yellowstone cutthroat trout in a changing climate stems from their relatively narrow thermal tolerances (Bear, McMahon, & Zale, 2007; McMahon *et al.*, 2007; Gresswell, 2011) and influences of climate-related attributes such as temperatures and stream flows on life-history patterns. Furthermore, recent research suggests that changing climatic conditions are likely to favor non-native species over Yellowstone cutthroat trout (Al-Chokhachy *et al. 2013*), thus increasing threats to extant populations.

An imperative step in ensuring long-term persistence of Yellowstone cutthroat trout across its historic range is the development of a comprehensive conservation strategy that encompasses existing data regarding species distribution and status, current limiting factors, and potential threats of climate. Within this framework it is becoming increasingly important to identify and prioritize population-specific restoration and management actions, particularly given the limited amount of resources available, and evaluate these actions for their value as potential climate adaptation strategies.

The Multi-State Interagency Yellowstone Cutthroat Trout Conservation Work Group (YCT Work Group) was formally chartered through a Memorandum of Understanding in 2000 to conserve Yellowstone cutthroat populations across their historical range. This YCT Work Group includes state management agency personnel from Montana, Wyoming, Idaho, Utah, and Nevada, and federal agency managers from the U.S. Forest Service, U.S. Fish and Wildlife Service, and National Park Service (Yellowstone and Grand Teton National Parks), as well as numerous non-governmental partners. The YCT Work Group has formed three geographic management unit (GMU) teams that annually convene biologists, managers, and researchers

within GMU regions to share information, work together to conduct conservation actions, and update status and threat information for individual YCT populations. Individual GMU Team Leaders report annually to the full YCT Work Group on their conservation accomplishments, research results, and emerging issues. Our efforts this past year has allowed us to become fully integrated into both the Multi-state Work Group and each GMU Team.

Here, we propose to continue this collaborative project between the USGS Northern Rockies Science Center, the Wildlife Conservation Society, the Western Native Trout Initiative, the YCT Work Group, and Trout Unlimited to identify and prioritize population-specific restoration and management actions, and evaluate these actions for their value as potential climate adaptation strategies. We have successfully adapted and further developed a conservation priority framework suggested by Haak and Williams (2012) that modifies a financial portfolio concept to spread the risk for conservation of species (Schindler *et al.*, 2010). The portfolio concept is built upon the premise of maintaining and enhancing a species' resilience to stressors (e.g., climate change) through the preservation of genetic, life-history, and spatial diversity across the landscape. Portfolio components we have currently applied include population or habitat patch size, degree of connectedness (i.e., metapopulation structure), genetic status, life-history diversity, number of populations or sub-populations, spatial and landscape uniqueness, and existing threats. We have also included criteria related to potential "opportunity" to implement conservation based on recommendations of managers, as these opportunities often drive our ability to implement conservation actions.

As part of our existing project, we will next integrate the manager-based portfolio for YCT with local and regional climate products including streamflow models from the Climate Impacts Group (VIC model, http://cses.washington.edu/cig/; Wenger *et al.*, 2010), temperature models from the GNLCC funded NorWeST stream temperature modeling effort (Isaak et al.) and Al-Chokhachy et al. (2013), and climate simulations from Hostetler et al. (2011). Merging the YCT portfolio framework with climate vulnerability measures will help refine conservation priorities and identify and prioritize spatially-explicit climate adaptation opportunities.

Through our previous meetings and suggestions from the Multi-State Interagency Yellowstone Cutthroat Trout Conservation Work Group, we propose to advance this existing effort by applying this framework with population-specific ranking of risks as a means to target specific management actions possible for mitigating the direct and indirect effects of climate change. Agency partners have also expressed interest in formally identifying and prioritizing areas for expansion of Yellowstone cutthroat trout (i.e., reintroductions) into streams historically occupied, that are likely more resilient to regional changes in climate. Given the continued support and interest from agency partners, including on-the-ground managers, we consider this a pivotal opportunity for Yellowstone cutthroat trout conservation and a relevant case example of research, management, and policy combining to demonstrate meaningful and long-term conservation solutions in the context of global climate change.

To date, this project has been extremely successful in developing sound relationships with natural resource managers throughout the region and we are confident we will be able to prioritize all extant YCT conservation populations both in terms of attributes related to the population ecology and attributes related to opportunities to implement conservation actions.

We are also confident that field managers will use these priorities in their conservation efforts. We want to expand this effort to establish criteria for ranking threats to each population, establishing priorities for proposed conservation actions to address identified threats, rate each population's resilience in the face of a changing climate, and conduct some limited field tests of these criteria. YCT managers in the GNLCC region and Rocky Mountain Forum area have been doing a great job in implementing conservation actions and we believe managers are ready to work with us to help them prioritize their conservation actions. Since we have begun this project, we have been contacted by conservation practitioners for several other native fish species and asked for information and potential assistance in helping them prioritize conservation efforts for their particular species of interest. This demonstrates a region-wide interest to objectively prioritize conservation efforts.

Objectives: Utilize existing Yellowstone cutthroat trout status and distribution data and collaborate with state and local managers to:

1) Rank individual threats to Yellowstone cutthroat trout populations by integrating local data within an existing framework successfully used for westslope cutthroat trout.
2) Identify areas that will likely be most resilient to climate change or climate change refugia and rank opportunities for reducing factors limiting range expansion and reintroduction across the historical range of Yellowstone cutthroat trout.
3) Develop a comprehensive strategy to effectively and efficiently conserve Yellowstone cutthroat trout by merging information and decision rationales regarding population prioritization, ranked threats, and opportunities for species expansion or reintroduction.

Methods: The initial prioritization framework for river basins has been developed and reviewed by both GMU Teams and the full Work Group. We have assisted the GMU Teams in setting prioritization criteria and together we have determined the appropriate geographic scale for prioritizing individual conservation populations. We have begun to prioritize individual conservation populations and want to continue and expand on that effort by:

- Helping GMU Teams set prioritization criteria for individual conservation populations and rank each population according to those criteria.
- Working with GMU Teams to develop criteria to rank threats to existing YCT conservation populations and apply these criteria to rank each YCT conservation population.
- Assisting GMU Teams to evaluate and prioritize their proposals for addressing high priority threats to high priority conservation populations.
- Attending the annual meeting of the YCT Work Group to help them prioritize conservation projects during 2015 and 2016, so that they can recommend projects to national funding organizations.
- Working with national and regional funding organizations to promote the use of this type of range-wide prioritization criteria for evaluating funding proposals.
- Characterizing opportunities for YCT expansion and document where opportunities for expansion will not be possible in the foreseeable future, along with the rationale used to include or exclude areas for this potential expansion.
- Presenting these criteria and the process to develop and implement these criteria to professional and public groups through workshops, meetings, reports, and publications.

- Quantitatively assessing the likely effects of climate change on YCT conservation populations and compare this assessment to the qualitative assessment of effects of climate change on population resilience done by the GMU Teams.
- Working with Montana FWP data and GIS managers, who house the YCT assessment database, to incorporate all prioritization information into the YCT assessment database.

Deliverables: We will provide a map (with spatially explicit database) displaying the priority areas for conserving Yellowstone cutthroat trout throughout their range, ranked threats to each high-priority population and specific priority conservation actions that could be implemented to reduce those threats to secure or expand those populations, and habitats most-suitable and feasible for establishing additional conservation populations. We will also identify research needs to better conserve native salmonids in the Great Northern region. We will provide a final report describing the information on the prioritization framework and criteria used to prioritize conservation of Yellowstone cutthroat trout, a draft manuscript for publication, and make several presentations to scientific and public meetings that present the results of this effort.

Statement of compliance: We have read the "Great Northern Landscape Conservation Cooperative Information Management, Delivery, and Sharing Standards" and agree to comply with these standards if our proposal is funded by the Great Northern LCC.

Schedule:

Summer 2015

- Finalize prioritization of individual conservation populations within high priority geographic areas and identify and prioritize conservation actions to reduce threats to secure or expand existing populations.
- Identify high priority areas where "new" conservation populations could be established.

Fall 2015

- Make oral and poster presentations on results to scientific and public groups.
- Incorporate prioritization of conservation populations into the YCT assessment database.

Winter 2015- 2016

- Conduct the analyses to assess climate change impacts to individual conservation populations.
- Make additional oral and poster presentations on results to scientific and public groups.
- Collaborate with GNLCC and Multi-state Interagency Yellowstone Cutthroat Trout Conservation Work Group to prepare a press release on these results.

Spring 2016

- Prepare a final report and draft manuscript for publication.
- Make additional oral and poster presentations on results to scientific and public groups.

Budget: (See attached PDF)

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