Evaluating stream habitat connectivity improvements from fish movement barrier replacement in the Bear River Basin

by

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September 29, 2025

Executive Summary

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1. Introduction

The introduction will establish the importance of addressing habitat degradation and fragmentation for migratory fish species, overview the history of water development and habitat degradation in the Bear River Basin, establish conservation status and restoration goals for Bear River Cutthroat Trout, and state the goal (quantify barrier replacement project benefits with connectivity index measurements) and research objectives.

Research objectives:

1. Compile and summarize the location, type, and passability of barriers and barrier replacement projects in the Bear River Basin.
2. Estimate summer habitat suitability for Bear River Cutthroat Trout.
3. Calculate pre- and post-restoration stream habitat connectivity following instream barrier replacement projects to reconnect habitat for Bear River Cutthroat Trout.

2. Methods

2.1 Bear River Basin

This section will give an overview to the Bear River Basin including its size, drainage area, and ecological and hydro-economic water uses.

2.2 Bear River Cutthroat Trout in the Bear River Basin

This section will give an overview of Bear River Cutthroat Trout life history characteristics and their conservation status range-wide and within the Bear River Basin.

2.3 Conceptual overview

This section will provide a 1-paragraph summary of how we evaluate stream habitat connectivity to measure restoration success for barrier replacements.

2.4 Stream network and habitat data

This section will describe the geospatial stream network and habitat data (such as USFS NorWeST modeled August stream temperature and FlowMet modeled August streamflow) used to represent Bear River and tributary watersheds for connectivity analysis.

2.5 Habitat suitability calculation

This section will describe how we calculate habitat suitability index values ranging for 0 (unsuitable habitat) to 1 (ideal habitat). These values are used to weight stream lengths and prioritize high-quality habitats in restoration.

2.6 Barrier data and passability estimation

This section will summarize the barrier data we use to calculate stream habitat connectivity. Currently this includes TU's barrier dataset as well as the Southeast Aquatic Resources Partnership's National Aquatic Barrier Inventory database. This section will also include how we determine the upstream and downstream fish passability rating for all barriers.

2.7 Stream habitat connectivity

This section will describe how we calculate stream habitat connectivity using the dendritic connectivity index (DCI). DCI quantifies how connected each stream reach is to every other stream reach as a value ranging from 0 (completely disconnected with impassable barriers on all reaches) to 100 (completely connected with no barriers to fish movement).

3. Results

3.1 Summary of barrier replacement projects

This section will provide a summarize of the number, type (culvert, diversion, ect…), and passability of barriers removed throughout the Bear River Basin and quantify the total stream length reconnected across all barrier replacement projects. This section will include a table and map figure of all barrier replacement projects and watersheds.

3.2 Stream habitat connectivity: Bear Lake and tributaries

This section will summarize the number of barriers replaced, pre- and post-restoration stream habitat connectivity, and amount of suitability-weighted habitat reconnected in each focus watershed. Each section will include a map figure of barrier replacements (example: F1_BearLake_Map) and a timeseries of connectivity improvements from barrier replacements where appropriate (F2_BearLake_Connectivity).

4. Discussion

Discussion will include sections summarizing the contribution of this study, interpretation of results for focus watersheds, and limitations of this modeling approach. Result interpretation could include future directions for barrier replacement in watersheds, such as addressing the push-up dam and supporting irrigation system upgrades in North Eden Creek to build on the project's connectivity restoration. Limitations could focus on lack of complete knowledge of barrier locations, uncertainty in habitat estimates, and challenges for representing habitat improvements from screens that beneficially reduce connectivity.

Acknowledgements

References