

Waterfalls and Reservoirs as Population Isolating Mechanisms in Two Cascade Mountain Streams

Abstract

A population of the federally threatened bull trout inhabiting streams and lakes in the upper Naches River, WA has been identified as having a status of “healthy” according to the Washington Department of Fish and Wildlife. However, populations of the introduced brook trout are also found in some of the same streams and studies from other river systems have found that brook trout have detrimental effects on bull trout due to competition and hybridization. To determine if brook trout are posing a threat to a “healthy” bull trout population, characteristics of populations of both species will be compared in streams where they are found together and where one species is absent.

Scholarly Significance

The bull trout (*Salvelinus confluentus*) is a federally threatened species found throughout the Yakima Basin with populations that vary greatly both in population size and habitat use with the healthiest populations being found in the Naches River drainage. A similar species, the brook trout (*Salvelinus fontinalis*), is native to cold streams of eastern North America and was introduced into many mountain lakes and streams in the western U.S. to support recreational fisheries (Wydoski and Whitney 2003). Brook trout and bull trout interactions have been studied in streams in Montana, Idaho and Oregon, but no such studies have been conducted to date in Washington streams. Extensive hybridization between the two species was found in Montana streams with few individuals found to be genetically pure bull trout (Kanda, Leary and Allendorf 2002). A study in an Oregon stream found that brook trout and bull trout competed for similar food

and habitat space with brook trout being dominant in aggressive interactions and an overall conclusion that when found together, brook trout will likely displace bull trout (Gunckel, Hemmingsen, and Li 2002). Brook trout were also found to displace bull trout in Idaho streams with brook trout normally pushing bull trout into higher elevations and smaller stream reaches (Reiman, Peterson and Myers 2006).

An interesting situation exists in Washington in the upper Tieton River above Rimrock Lake where both bull trout and brook trout are found inhabiting streams and high mountain lakes. One of these streams, Indian Creek, supports a population of bull trout in its lower reaches below a barrier waterfall and supports a population of brook trout above and below the falls. The bull trout in Indian Creek are genetically pure (Reiss 2003) and have direct access to Rimrock Lake. A similar stream, Clear Creek, supports a population of brook trout above and below a barrier waterfall, but due to an impassable dam (Clear Lake Dam) no bull trout from Rimrock Lake can reach the stream. Based on previous studies of interactions between the two species, in Indian Creek I would expect to find either a high degree of hybridization between the two or competitive displacement of bull trout by brook trout. This situation does not appear to be the case, but the information is mostly anecdotal. Therefore, the overall objective of this study is to determine the population density (number/stream km) and distribution of the two species in a stream where they are found together and in a stream where only one is present. The results of this study will be used as a test of the hypothesis that brook trout pose a threat to bull trout when found together and thus will impede recovery efforts. If the results in Indian Creek show that bull trout are the dominant species below the waterfall barrier then it will be the first documented case where bull trout are out-competing brook trout

with a possible explanation that because bull trout have access to a large, productive reservoir they are growing larger and more fecund (higher egg number). The brook trout population in both streams will be compared with respect to population density and size range of adults. If the brook trout population in Clear Creek is similar to upper Indian Creek then it may be concluded that brook trout populations persist due to the absence of bull trout, which are excluded from Clear Creek due to a barrier dam. The overall findings will be significant in that they may contradict the conclusions of previous studies and may provide information into mechanisms that enable bull trout to out-compete brook trout.

Methods

The study will be conducted in two streams, Clear Creek and Indian Creek, in the upper Tieton River Basin near White Pass, WA. These streams are similar in that they both originate from natural glacial lakes, have waterfalls below the lakes that are barriers to upstream fish migrations, and are essentially the same with respect to gradient, elevation, flow regime, and water chemistry. Indian Creek will be used as the experimental or treatment stream as it has both species present and Clear Creek will be used as the control stream as it only contains brook trout. The data to be collected is very basic, fish numbers and sizes, but will require a large amount of effort to get. The methods used for this project will employ non-invasive underwater observations, which are preferred when studying a protected species such as bull trout. Sampling will be conducted at designated stream sections during daytime hours to census the diurnal brook trout and during nighttime hours to census nocturnal bull trout. During a census, a diver (myself) will snorkel upstream while recording the number and estimated size of each

brook trout and bull trout encountered. The sampling will occur during July and August prior to the bull trout spawning season so as not to affect their spawning and again in mid-October. Three sections of 100 stream meters will be surveyed in each stream above and below the barrier waterfalls for a total of 600 meters sampled in each stream. The number of each species counted will be used to estimate population densities above and below the waterfalls through extrapolation (numbers/km x total stream km). The estimated size of adults of each species will be compared (using t-tests) to determine if a significant difference exists, which may indicate a selective advantage as larger females can produce more eggs and larger males can fertilize more eggs.

Extramural Potential

The current draft of the official bull trout Recovery Plan identifies brook trout as a substantial threat to recovery. Proposals to Bonneville Power Administration, U.S. Fish and Wildlife Service and U.S. Forest Service are currently being discussed and submitted by biologists within their respective agencies to assess the effect of brook trout populations on bull trout within the Yakima and Wenatchee basins. Data collected in this study will be shared with regional biologists and will likely result in the submission of a larger proposal to fund a graduate student and myself to conduct a basin-wide study of brook trout abundance, distribution and genetics.

Budget Justification

| <u>Item</u> | <u>Amount Requested</u> |
|--|-------------------------|
| 1. Salaries and Wages (1 research assistant x 120 hours @ \$11/hr) | \$1320 |
| 2. Benefits (3% of wages) | \$39.60 |
| 3. Travel (8 days @ \$23/day = \$184 1100 mi. @ \$0.27/mi.= \$297) | \$481 |
| 4. Goods and Services (Headlamps, underwater lights, batteries) | \$75 |
| Total = | \$1915.60 |

Special Consideration

I have been fortunate to be able to support my past research projects with external funds and have therefore not applied for any form of CWU internal research funding within the past five years.

References Cited

- Gunckel S.L., A.R. Hemmingsen, and J.L. Li. 2002. Effect of bull trout and brook trout interactions on foraging habitat, feeding behavior, and growth. Transactions of the American Fisheries Society 131(6):1119-1130.
- Kanda N., R.F. Leary and F.W. Allendorf. 2002. Evidence of introgressive hybridization between bull trout and brook trout. Transactions of the American Fisheries Society 131 (4):772-782.
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- Reiss, K.Y. 2003. Genetic variability within bull trout (*Salvelinus confluentus*) populations in the Yakima River Basin. M.S. Thesis, Central Washington University, Ellensburg, WA. 62 pp.
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