Trout in hot water: Warming waters effect on Cutthroat Trout in the Blackfoot River

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Introduction

Climate change is negatively impacting trout populations in the Blackfoot River system in Montana. Increasing temperatures are considered to be the most damaging factor, impacting myriad factors including hydrological regime, habitat structure, runoff, and snow pack. Increasing water temperatures are of particular concern as it directly impacts nearly all aspects of the physiological requirements of trout at each stage of their life cycle.

Research question: How do increasing water temperatures impact the reproductive cycle of the Westslope Cutthroat Trout of the Blackfoot River?

Temperature and Trout

Westslope Cutthroat trout (*Oncorhynchuc Clarkii Lewisi*) are salmonoid fish that are considered an indicator species. Westslope cutthroat trout are found in freshwater systems in Western Montana, Washington, Idaho, Utah, and Wyoming. Environmentally pure conditions, with stable temperatures, are required for sustainable populations.

Temperature affects on adult trout:

- Dissolved oxygen levels: 5 mg/L
- Water temperature: 54-59 degrees F
- Invasive species: brown and rainbow trout
- Habitat loss
- Bacteria on eggs and adult fish
- Snow pack levels: water depth and temperature

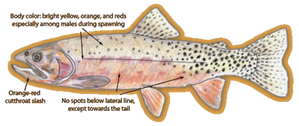

Fig 1. Westslope Cutthroat Trout Wild Trout Streams

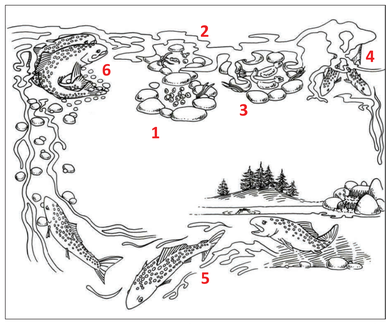

Fig 2. Westslope Cutthroat Trout Lifecycle. New Jersey Department of Environmental Protection, Division of Fish & Wildlife and NJ Chapters of Trout Unlimited. 2012. "Trout in the Classroom," March, 28.

Westslope cutthroat trout lifecycle.

1. Egg
2. Alevin
3. Fry
4. Juvenile
5. Adult
6. Spawning trout

Results

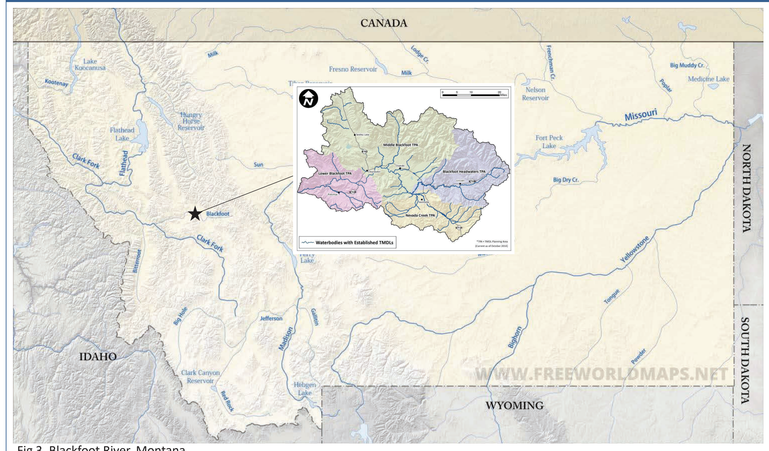

Fig 3. Blackfoot River, Montana
FreeWordMaps

Analysis of water regime, water quality, and air quality data.

- Analyze stream flow data to compare water and air temperatures during normal and extreme temperatures
- Warm water effects on Blackfoot River water regime
- Comparison of dissolved oxygen levels during drought and normal conditions
- Comparison of precipitation during drought and normal conditions
- Analyzing data on Westslope cutthroat trout requirements for survival
- Examine the biology and physiological aspects of cutthroat trout and compare them to other trout species
- Temperature requirements for WCT roe and compared the data with other trout species

Geophysical Data of Blackfoot River and basin obtained from HydroSHEDS data set to address the following questions:

- How does temperature affect snowpack? (Fig 7.)
- How does temperature affect flow regime? (Fig 6.)
- How does temperature affect turbidity? (Fig 5.)

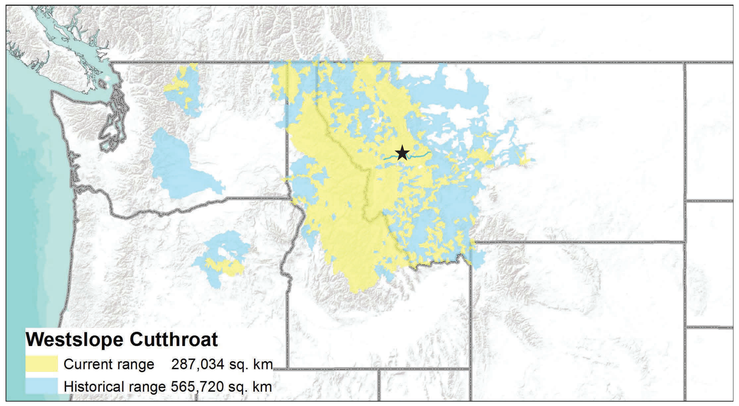

Fig 4. Westslope Cutthroat Trout Current and Historical Ranges Map Author: Josh Meisel
Date Source: Trout Unlimited

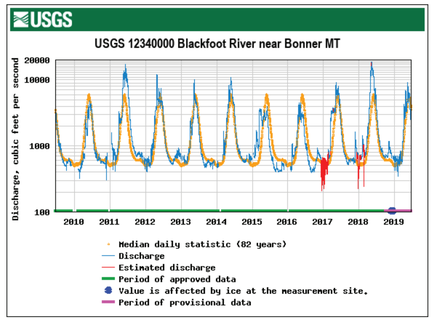

Fig 5. Discharge, cubic feet per second USGS.gov

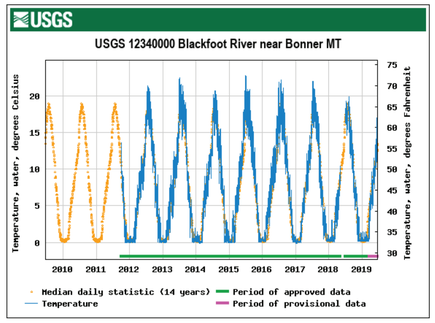

Fig 6. Temperature, water, degrees Celsius USGS.gov

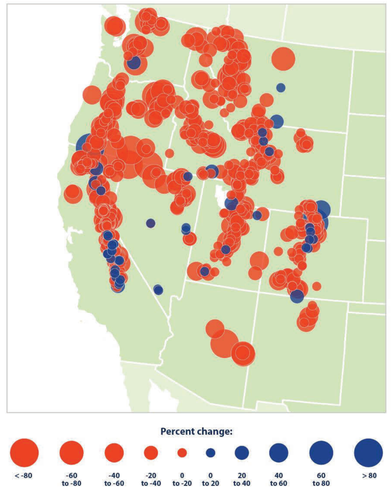

Fig 7. Trends in April Snowpack in the Western United States, 1955–2016. EPA.gov

Discussion

In the next century, the Blackfoot region is projected to increase 4-12 degrees F. This trend of increasing temperature is magnified during times of drought. Changing temperature is a significant factor in the decline of Westslope cutthroat trout distribution. Westslope cutthroat trout are an important species for tribal and state economies and, historically, a primary food source for Northwestern Native Americans. The Blackfoot River Restoration project conducted by the Montana Fish, Wildlife and Parks are actively securing cutthroat populations, habitat distributions, and participating in the prevention of invasive species interactions, including competition, hybridization, and predation.

Though research on the roe of WCT is limited. Using existing physiological data on adult WCT, in regards to temperature tolerance, we may assume that temperature has a detrimental impact on WCT roe in many forms, from elevated water temperatures, to lack of snowpack. Adult WCT and roe decline are expected. Future research should focus on spawning sites in cold, clear headwater streams. Additional physiological data needs to be focused on the roe of WCT. Specifically, data regarding temperature affecting viability and gestation needs to be collected and assessed.

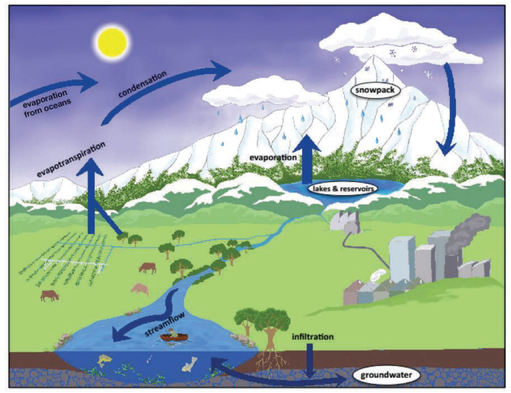

Fig 8. Simplified schematic of the water cycle. Montanaclimate.org

Prolonged warm temperatures may cause drought resulting in diminished water levels creating lower dissolved oxygen levels, and altering stream morphology and habitat structure. Temperature may also disrupt the hydrological cycle (fig 8.) including snow pack levels which feed seasonal river dynamics. Droughts resulting from extreme temperatures create ideal conditions for forest fires that may destroy river side trees and brush that provide shade and cover for trout. Climate change is creating conditions favorable for invasive species to outcompete native trout.

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