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

Joseph Zupan
Chippewa Creek
Haskell Indian Nations University,

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 (Oncorhynchus 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

Trout of the Blackfoot
Environmental Protection, Division of Fish & Wildlife and NJ Chapters
Research question:
- Westslope cutthroat trout are found in freshwater systems of dissolved oxygen levels during drought and normal conditions.
- Warm water effects on Blackfoot River temperature regimes.
- Comparison of dissolved oxygen levels during drought and normal conditions.
- Examining the biology and physiological aspects of cutthroat trout and compare them to other trout species.
- Temperature requirements for WCT 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)

Results

Westslope Cutthroat Current range: 287,034 sq. km
Historical range: 965,720 sq. km
Map Author: Josh Meisel
Date Source: Trout Unlimited

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.
- Analyzing data on Westslope cutthroat trout requirements for survival.
- Examining the biology and physiological aspects of cutthroat trout and compare them to other trout species.
- Temperature requirements for WCT and compared the data with other trout species.

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.

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 sedge 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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