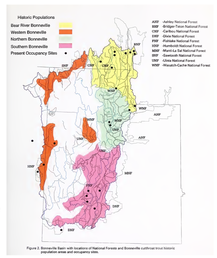
Analysis of physical stream qualities of East Canyon Creek to assess the possibility of a Bonneville Cutthroat Trout reintroduction project

Bobby Boone, Amanda Hale

Department of Biology, Texas Christian University

Introduction

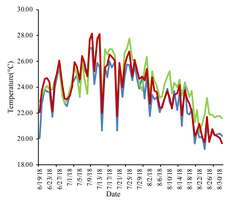
- Until recently, the Bonneville cutthroat trout(*Onchorynchus clarkii utah*) has experienced significant declines due to habitat alteration and introduction of invasive brown trout.
- Aquatic parameters temperature and dissolved oxygen are critical in determining the survival and ability to thrive of cutthroat trout.
- East Canyon Creek is a tributary stream of the Weber River Basin in Northern Utah, a stream where Bonneville cutthroat trout were once native, but have not occurred in since the 1980s.
- Due to urbanization, ranching, and habitat alteration, East Canyon Creek's overall habitat quality became unsuitable for native cutthroat trout.
- We analyzed stream temperature, dissolved oxygen concentrations, and flow of East Canyon Creek to determine if the water would be favorable for reintroducing Bonneville cutthroat trout.

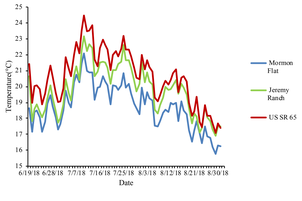


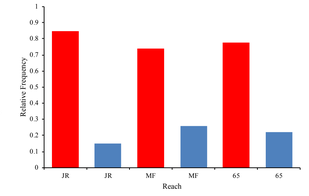
Methods

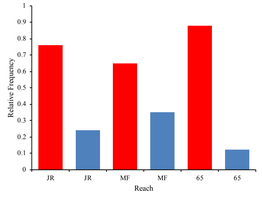
- I installed temperature loggers at eight different points along East Canyon Creek, recording continuous temperatures from June 19-October 1, 2018
- Temperature data from summer(June – August) months were selected for analysis.
- The summer temperature data was compared against previously determined acute(22.1° C) and chronic(17.0° C) upper thermal thresholds of cutthroat trout.
- Acute temperature data was calculated by finding the two hour daily max(4-6PM)
- Chronic temperature data was calculated by using the daily average
- One-proportion t-tests were performed to see if the data significantly differed from previously determined thresholds, as well as finding out what percentage of the time temperatures exceeded the thresholds throughout the summer.
- Flow and dissolved oxygen from the corresponding dates and times were gathered from USGS from the Jeremy Ranch Gauge
- Dissolved oxygen data was analyzed to determine what percentage of the time concentrations dropped below optimal limits
- Dissolved oxygen and temperature used to determine if there exists a linear relationship in East Canyon Creek
- Flow data from corresponding 2018 summer dates and times as well as yearly summer averages used to determine relationship flow has with temperature in East Canyon Creek.

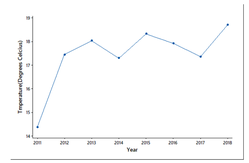
Results



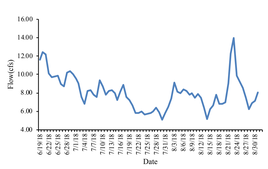


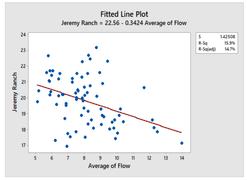


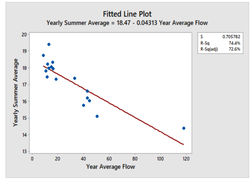


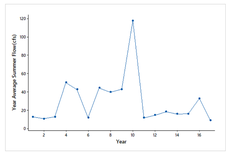


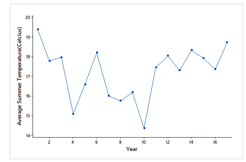
- Acute and Chronic temperatures were significantly higher than the upper thermal thresholds.(p value < 0.0001)
- Temperatures exceeded the acute upper thermal threshold 78.80 percent of the time and exceeded the chronic upper thermal threshold 76.19 percent of the time.
- July was the hottest month of the summer
- Yearly summer average temperatures have increased since 2011



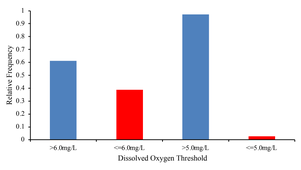








- Flow over the summer months of 2018 showed a general decreasing trend and inverse relationship with temperature
- TEMP = 22.56– 0.3424FLOW
- Yearly summer average flows and temperatures were also inversely related
- TEMP = 18.47 – 0.04313FLOW



- Dissolved Oxygen concentrations are negatively correlated with temperature
- DO = 7.871 – 0.10030TEMPERATURE
- Dissolved oxygen concentrations fell below the chronic lower limit 38.63 percent of the time and below the acute lower limit only 2.53 percent of the time

Conclusions

In East Canyon Creek, the temperatures alone make the stream uninhabitable for Bonneville cutthroat trout. While there are periods of the day when the temperatures do drop below the upper thresholds, these time periods are not long enough to allow trout to recover from the overheating. While some Bonneville cutthroat trout could survive through high temperatures, it is likely that many would die and be unable to establish a sustained population.

Dissolved oxygen concentrations do hover around the lower chronic limit, and while that limit is exceeded, it is not significant enough to conclude if the concentrations alone could prevent the survival of the trout.

Flow, like in other streams, plays a key role in dictating temperature in East Canyon Creek, and can be used as a predictor of temperature. The inverse relationship indicates that as flow decreases, water temperature increases.

Future Research

Because East Canyon Creek is currently not ready for reintroduction of Bonneville cutthroat trout, land and water management strategies should be explored on how to improve the habitat quality. Based on just these water parameters, my suggestion is to figure out how to allocate more water into the stream to increase the flow, and to improve shading along the stream. Both of these methods should decrease the temperatures significantly to the point where Bonneville cutthroat trout can return to one of their native streams.

References

Acknowledgements

Special thanks to Paul Burnett, Utah Trout Unlimited, and Utah Division of Wildlife for their contributions that made this study possible