FLUVIAL WESTSLOPE CUTTHROAT TROUT MOVEMENTS AND RESTORATION OF THERMAL HABITATS

CFC CLIMATE CHANGE UNDERGRADUATE RESEARCH SCHOLARSHIP

RESEARCH SUMMARY AND FINDINGS

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PERSONAL STATEMENT AND ACCOMPLISHMENTS

There are many reasons I wanted to do this project. During Fall Semester, in a course at the University of Montana called Fundamentals of Restoration (NRSM265), I listened to a guest lecture by Ron Pierce of Montana Fish, Wildlife and Parks (MFWP) describing over 20 years of restoration projects in the Blackfoot River basin. His research combined several interesting aspects of natural resources: native trout habitat degradation and restoration, the role of temperature/climate in native and non-native trout interactions, and land-use conflicts and collaborative solutions. After months of dogged pursuit, I convinced him that I was ready and able to head up a research project he wanted to do over summer, including finding funding for my salary and various other costs.

I spent my spring break working for Ron, tagging 20 study fish. The second week of May, as soon as my semester was over, I started tracking these fish on a daily basis. This continued through spawning season towards the end of June, at which time tracking was cut back to a few times a week until my classes at UM started in August. I had tracked fish via radio telemetry before, but this project was different because it was <u>mine</u>. I knew that when summer was over and the data were all collected and organized, I would be analyzing it, writing it up, and presenting it in multiple venues. I had acquired funding and I didn't want to disappoint those who supported me. Therefore, any day I failed to relocate a fish felt like a failure. I knew it was impossible to find every fish, every day, yet I fretted over every missing relocation. To me, these were <u>my</u> fish. When creek and river flows dropped late in the summer, I worried that my fish were stranded in isolated riverbed puddles. I was unhappy when my fish sent signals from heron rookeries, indicating that they had been eaten. I felt responsible for them.

I learned more about telemetry, fish habits, habitat use, and restoration than I had on previous jobs or in classes. I expected that. However, I learned a lot that I didn't expect. I learned how to talk to landowners with varying priorities. I learned that some of the ranchers I previously thought were responsible for riparian degradation and stream sedimentation actually had responsible grazing practices and were not fond of ranchers who did not. I learned to relax a little if a fish didn't "show up" one day, and where to look to find it. I used maps and GPS more than I had on any previous jobs. I used a little something from nearly every course I have taken. I found that I have the technical skills I needed to collect data and find fish, but I also found that I have the people skills required to deal with the many agency, organization, and private people involved in large-scale restoration projects.

The opportunity to do this research has benefited me in so many ways. I learned a lot about fish research. I also made important contacts with agencies, organizations, and individuals that I am already using, and will continue to use, throughout my career. Applying for funding and research grants was an invaluable experience that will help me in graduate school, and probably in my future career, as will presenting this research. Ron Pierce and Laurie Marczak are hopeful that this research will be submitted for publication, which I find really exciting. The most valuable part of this project, to me, was the confidence I gained that will help me apply to graduate school and future jobs.

INTRODUCTION/BACKGROUND

Across the intermontane west, climate change is predicted to affect the distribution and abundance of salmonids by elevating water temperatures, leading to habitat loss and fragmentation (Rieman et al. 2007). Westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), which are native to Montana's Blackfoot River and its tributaries, have already suffered habitat loss and fragmentation due to anthropogenic influences, competition with non-native fishes, and genetic introgression (Pierce et al. 2007). However WSCT are particularly vulnerable to changes in water temperature, and cannot tolerate water temperatures above 13-15°C (Bear et al. 2007). WSCT necessarily avoid prolonged exposure to warmer water temperatures (Bear et al. 2007) – a factor which is aggravating their current population decline.

Locally, MFWP have been investigating restoration techniques specifically intended to mediate changes in thermal habitats including active channel habitat structures, grazing management improvements, instream flow enhancements, and riparian vegetation plantings. These projects – over a larger scale – have the potential to buffer these sensitive populations from a key driver of their declines. Over the past 20 years, MFWP have been involved in the restoration and monitoring of WSCT populations across >600 sites on the Blackfoot River and its tributaries (Pierce and Podner 2011). These studies have included the use of telemetry of individual fish to document the effects that thermal restoration efforts have had on WSCT home ranges, movement patterns and spawning habitat (Pierce et al. 2007). Although these historic monitoring data are available, the ability of the current array of restoration techniques to restore thermal habitat for WSCT has remained unevaluated across the larger landscape. Assessing the influence of current restoration practices on WSCT habitat is necessary to adjust the effectiveness of these practices so that moderation of future climate change can be achieved.

The intent of this project is to evaluate the utility of these restoration techniques in mitigating some of the known or anticipated effects of a changing climate on habitat usage of this species of concern. The specific objective of this study is to determine whether or not restoration efforts on Nevada, Grantier, and associated creeks have had an effect on the use of different habitats by monitoring movement and habitat usage of native WSCT. Telemetry relocations of WSCT, water temperature, and discharge data were collected and analyzed to evaluate the effects of restoration efforts on WSCT migratory life history and size of home range.

STUDY AREA

Restoration efforts in the Blackfoot River Basin have been on-going for over 20 years. Fish for this study were collected in Grantier and Nevada Creeks, both completely or partially restored tributaries of the Blackfoot River. Study fish utilized Moose Creek, Arrastra Creek, Copper Creek, Nevada Spring Creek, and Wasson Creek, as well as the Blackfoot River. Some of these tributaries are part of large-scale restoration work that has taken place in the Blackfoot River Basin (Figure 1).

Grantier Creek is a tributary to Poorman Creek, flowing into the Blackfoot River. Although Pierce and Podner do not indicate the source of degradation in their 2011 report, it is noted that the creek was severely degraded. Based on personal observations, I would estimate that cattle had played a part, by trampling banks and overgrazing. In 1990, Grantier Creek was reconstructed, then allowed to revegetate naturally (Pierce and Podner 2011).

Copper Creek has been much-studied because it is an important spawning stream for both fluvial bull trout and WSCT (Pierce and Podner 2011). There has not been restoration work done on Copper Creek, although a large fire in 2003 altered debris flow, vegetation, and stream temperatures, which have been studied at length (Pierce and Podner 2011).

Nevada Creek was heavily degraded (Pierce and Podner 2011) and although again the source is not mentioned, I would estimate the degradation to have been caused by cattle and agricultural practices. Restoration activities have taken place on multiple reaches of Nevada Creek, including grazing management plan implementation, fish screen exclusions, and channel work (Pierce and Podner 2011).

Nevada Spring Creek is a spring-fed creek that flows into Nevada Creek. Nevada Spring Creek was fully reconstructed and work was done to enhance instream flow, revegetate, reduce grazing impacts, and restore wetlands (Pierce and Podner 2011). In *Wasson Creek*, a tributary of Nevada Spring Creek, grazing plans were implemented, instream flow enhanced, a fish screen added, and parts of the channel reconstructed (Pierce and Podner 2011).

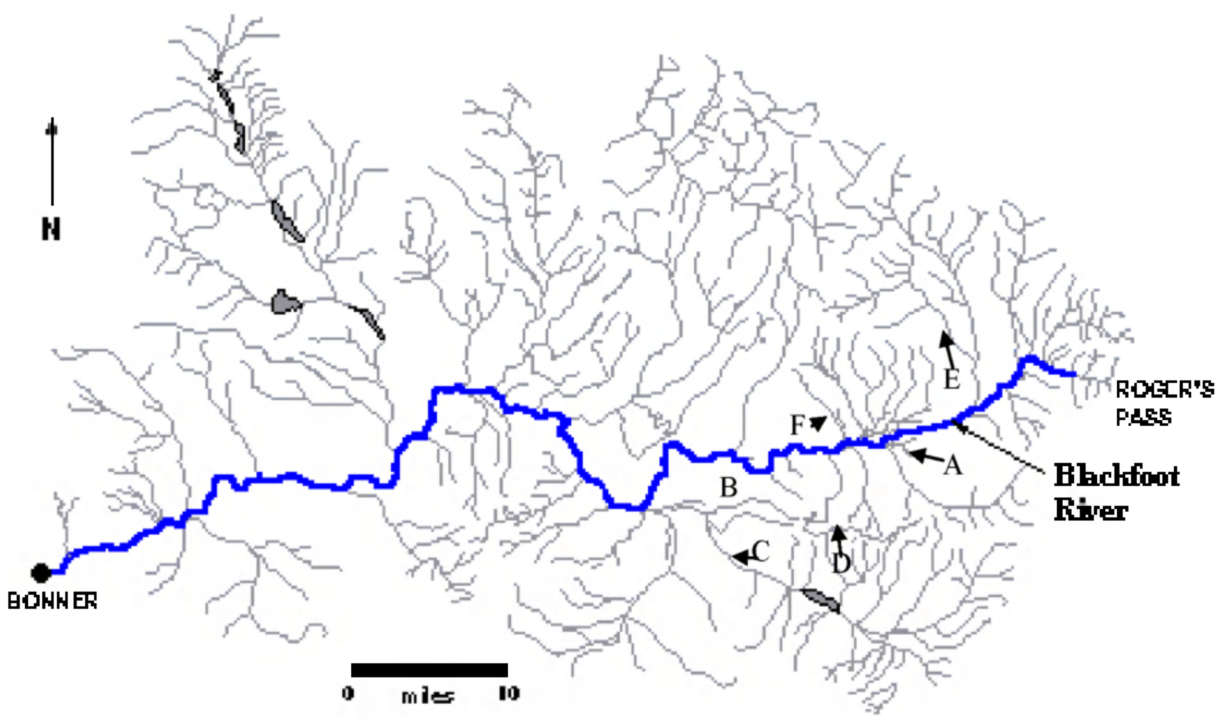

Figure 1. Map of the Blackfoot River basin and study area (US Fish and Wildlife Service)

A: Grantier Creek	D. Wasson Creek
B: Nevada Spring Creek	E. Copper Creek
C: Nevada Creek	F. Arrastra Creek

METHODS

Sampling protocol in this study followed those of previous monitoring work on these creeks as documented by Pierce et al. (2007) and Schmetterling (2003). Ten individual WSCT were be captured in wintering habitat in Grantier and Nevada Creeks and implanted with continuous radio Lotek™ transmitters before spring spawning began. These fish were tracked on a daily basis throughout the 2012 spawning cycle (through mid-June) and their locations recorded using GPS. Post-spawn, relocations of these individuals were recorded at least once a week, not usually more than three times per week. Water temperature and discharge data were collected from gauges already in place and currently monitored by MFWP.

RESULTS

Grantier Creek Fish (Table 1): Spawning activity and locations for eight of the study fish could not be confirmed. Fish 20-01 remained in Grantier Creek throughout the study. Though it was consistently found in the same location, efforts to incite activity resulted in fish movement of short distances, so it is not suspected to be a mortality. The timing and behavior of fish 20-07, which moved to Copper Creek, indicates probable spawning. Based on relocation data and timing of movement, fish 20-10 is likely to have spawned in Copper Creek as well, but I was unable to confirm because the signal was not picked up for several days at a time. The remainder of the fish spent the majority of the study in the Blackfoot River where spawning activity was possible, but difficult to confirm.

Nevada Creek Fish (Table 2): Two fish spawned in Moose Creek (one unconfirmed but likely). One fish spawned in Arrastra Creek. One fish was not relocated throughout study so spawning activity is unknown. The remaining six fish are confirmed or very likely to have spawned in Wasson Creek.

Table 1. Spawning activity for westslope cutthroat trout tagged in Grantier Creek (BFR = Blackfoot River; MIA = Missing)

Fish #	Spawning Activity and Location	Comments
20-01	None	Stayed in Grantier Creek throughout study
20-02	Unknown	Used Blackfoot and Landers Fork. Spawning unconfirmed
20-03	Unknown; possibly in BFR	Moved to BFR after surgery; remained in same location throughout study
20-04	Unknown; possibly in BFR	Moved to BFR after surgery; remained in same location throughout study
20-05	Unknown; possibly in BFR	Used BFR near Grantier mouth primarily, near fish 20-03. Moved upstream in BFR temporarily during spawning season
20-06	Unknown; possibly in BFR	Moved to BFR upstream from Grantier mouth after surgery and remained there until disappearing completely
20-07	Copper Creek	Spawning activity in Copper Creek (restoration project); returned to Grantier Creek
20-08	Unknown; possibly in BFR	Moved to BFR after surgery, stayed in same hole ~1.3 miles downstream of Grantier Creek mouth
20-09	Unknown; possibly in Grantier Creek	Moved to Grantier Creek pond upstream of surgery site and stayed there all summer
20-10	Unknown; Likely Copper Creek	Fish MIA for weeks after surgery. Found in Landers Fork downstream of Copper Creek. MIA again, reappeared in Grantier Creek by pond

Table 2. Spawning activity for westslope cutthroat trout tagged in Nevada Creek (BFR = Blackfoot River; MIA = Missing)

Fish #	Spawning Activity and Location	Comments
21-20	Unconfirmed: Moose Creek	Fish MIA for much of study. Relocated a couple times in Moose Creek but could not confirm spawning activity; MIA after returning to BFR
21-21	Arrastra Creek	Fish spawned in Arrastra Creek. Redds observed. Moved to BFR at end of summer
21-22	Wasson Creek	Several relocations in Wasson Creek near redd sites; returned to Nevada Spring Creek; moved to BFR at end of summer
21-23	Moose Creek	Several relocations in Moose Creek near redd sites. Moved to BFR end of summer.
21-24	Wasson Creek	Spawned in Wasson Creek, returned to Nevada Spring Creek; then MIA
21-25	Unconfirmed; Wasson Creek	Fish spent probable spawning time in Wasson Creek but did not travel all the way upstream to location of most redds; mortality by heron late summer
21-26	Unconfirmed; Wasson Creek	Fish spent probable spawning time in Wasson Creek but did not travel all the way upstream to location of most redds; mortality by heron late summer
21-27	Wasson Creek	Spawned in Wasson Creek; returned to Nevada Creek near surgery site
21-28	Unconfirmed; Wasson Creek	Spent probable spawning time in Wasson Creek but did not remain long; returned to Nevada Creek downstream of surgery site
21-29	Unknown	Fish MIA since early May; mortality by heron discovered late summer

DISCUSSION

The impetus for this study is recently published data collected over two decades that has indicated that WSCT populations are rebounding in restored streams (Pierce et al. 2012). There is not telemetry data for pre-restoration, so it is difficult to determine whether or not more WSCT are spawning in restored reaches than prior to restoration. What we hoped to determine with this study is how WSCT are using restored reaches – what kind of habitat are restoration efforts providing. In many cases, such as in Wasson Creek, we found that WSCT are spawning in restored reaches. Some of the Grantier study fish left their wintering habitat to spawn, but returned and appear to be utilizing the restored Grantier Creek for summering habitat. Because study fish were captured in Grantier and Nevada Creeks before spawning, we may infer that these restored creeks are used for overwintering.

In personal communication with Pierce, I learned that because Grantier and Nevada Creeks are both stream-fed, they maintain a year-round temperature (when they are "healthy"). In summer, this may provide cooler habitat than nearby waters, and in winter spring creeks may be warmer than other water. As global climates lead to warmer temperatures, these spring creeks are likely to become vital habitat for temperature-sensitive fish species such as the WSCT. Temperature data has not yet been acquired for all reaches, so it is difficult to determine whether seasonal habitat usage I observed is connected to water temperature.

Based on a similar study conducted in 2011, Pierce expected a large number of Nevada Creek study fish to utilize Wasson Creek for spawning. The majority of the 2012 study fish were confirmed or suspected of spawning in Wasson Creek. The reach used for spawning is above an extensively a restored reach, in an area where cattle management has been modified to improve WSCT habitat. Minor restoration has taken place in Moose and Arrastra Creeks to improve connectivity and fish passage, but is not likely to have impacted water quality or temperature. Study fish spawned in both of these creeks. Pierce and Podner were enthusiastic that fish had spawned in Moose Creek because fish from previous studies had not.

Data collected concerning the Grantier Creek fish was inconclusive. In most cases it was difficult to determine if spawning had taken place, and if so, where. There are many WSCT redds in the upper reaches of Grantier Creek (upstream of any study fish relocations). Pierce expected our study fish to spawn in Grantier Creek. It is difficult to tell whether or not this occurred, as it would have been a short migration that could easily have happened in between daily relocation efforts. WSCT spawn in Grantier Creek, and two of the study fish stayed in Grantier Creek, so they may have spawned there. I am working with Pierce to design a possible Master's thesis that will explore Grantier Creek WSCT spawning behavior using a larger sample size and tagging fish in the upper and lower reaches of the creek.

This study was complicated by limited access to the Blackfoot River at times. I was fortunate that MFWP has established good relationships with many land owners and I was able to walk or drive across their land to access the river in pursuit of study fish. I cultivated a few new relationships with land owners as well. However, I found some people were unwilling to let agency representatives onto their property. In some cases I was able to float the river in a canoe while tracking, but in some inaccessible areas, I had to simply go without data. When a fish entered one of these "black holes" I was unable to follow their movements or observe their behavior.

I am still in the process of analyzing flow and temperature data. These data were collected throughout the region and may tell us what temperature and flow cues might trigger fish movement -- both spawning migration movement and post-migration movement to summering habitat. I am still working with my advisors to determine how to use these data to learn about fish movements and habitat usage.

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