ESTIMATES OF THE FALL, 2013, CUTTHROAT TROUT POPULATION DENSITIES IN WINTER QUARTERS CANYON CREEK AND WOODS CANYON CREEK, TRIBUTARIES TO SCOFIELD RESERVOIR

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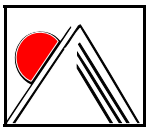

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INTRODUCTION

The northward extension of Skyline Mine, of Eccles Canyon mine is now under both Winter Quarters Canyon and Woods Canyon. The invertebrate communities in both canyons have been monitored since 2002 (Shiozawa 2004) and fish populations were assessed in the upper reaches of both streams at that time (Shiozawa 2005). Young-of-the-year trout were found in the upper reaches of Winter Quarters Canyon on U. S. Forest Service lands but the majority of the Winter Quarters Canyon trout populations occurred downstream on private land. That population was not sampled. Trout were not detected in Woods Canyon. In 2009 Skyline Mine began installation of a ventilator shaft in lower Winter Quarters Canyon and in 2010 was mining under lower Woods Canyon. These activities had the potential to impact the lower reaches of the two streams so the trout population in Winter Quarters Canyon Creek was monitored in the vicinity of the ventilator shaft and lower Woods Canyon Creek was surveyed for the presence of cutthroat trout.

Monitoring began in the fall of 2010 at one station in Woods Canyon and two in Winter Quarters Canyon. All sections were 150 meters in length. In Winter Quarters Canyon Creek one station was above the new ventilation shaft pad and one just below the pad. In 2013 the second series of population sampling was completed.

METHODS

The upper-most Winter Quarters Canyon Creek station begins just above the ventilation shaft pad (Table 1: Above Pad - Winter Quarters Canyon Station). The lower station begins at the bridge crossing the stream below the pad (Table 1: Below Pad - Winter Quarters Canyon Station). The Woods Canyon site begins at a trail crossing approximately in the center of section 36, just above a side canyon entering from the south. All three sites were sampled in September of 2010 and September to October, 2013. All field equipment, including boots, holding pens, buckets, nets, and the electrofisher, were sterilized with a quaternary ammonium-based compound prior to entering each stream section and again immediately after leaving each stream section to prevent inadvertent transfer of invasive aquatic taxa either into or out of the streams.

Fish population estimates were based on removal-summation sampling (Moran 1951; Zippen 1956, 1958; Van Deventer and Platts 1985) applied to the designated sections of stream. The fish were captured with a Smith-Root Model 12 battery-powered backpack electrofisher. All fish captured on the first run were transferred to buckets and held in flow-through holding pens placed in large pools. The fish captured on the second run were held in buckets until the electrofishing crew reached an appropriate location for measuring and releasing the fish. Fish were released approximately 5 meters below the active electrofishing location to avoid recaptures. Processing of second run fish shortly after capture minimized stress on the fish. The holding pens were temporarily removed from the stream when the second electrofishing run was approximately 5 meters below the pen. Depending on the complexity of the location, either

the fish in the pen were temporarily held out of the stream until the electrofisher was approximately 5 meters above the pen's original location, or the pen was moved downstream approximately 10 meters. On the second run, when an appropriate temporary stopping location was reached by the electrofishing crew, the first run fish in the adjacent holding pen were measured and released. Measurements consisted of total lengths.

Table 1. Sampling Stations on Eccles Creek

Station	GPS Coordinates Start Location	GPS Coordinates End Location
Below pad - Winter Quarters Canyon	N 39^0 43' 12.5" W 111^0 11' 57.9"	N 39^0 43' 12.5" W 111^0 12' 2.7"
Above pad Winter Quarters Canyon	N 39^0 43' 17.6" W 111^0 10' 57.8"	N 39^0 43' 54.48" W 111^0 10' 16.6"
Woods Canyon	N 39^0 44' 6.4" W 111^0 11' 58.5"	N 39^0 44' 5.9" W 111^0 12' 3.8"

RESULTS AND DISCUSSION

Both Winter Quarters Canyon and Woods Canyon creeks are relatively small and this resulted in high fish capture probabilities. All fish collected from both streams were cutthroat trout with no obvious signs of introgression with rainbow trout. However, it is likely that the trout are introgressed Colorado River cutthroat trout and Yellowstone cutthroat trout.

Trout have been in Winter Quarters Canyon throughout the period of benthic invertebrate monitoring. Adult trout can be found in low density into the lower part of the U. S. Forest Service lands. An occasional trout has been noted while sampling at the Lower Winter Quarters Invertebrate Monitoring Station (Shiozawa personal observations). Woods Canyon Creek did not have trout when surveyed in 2002 (Shiozawa 2005). At that time the conclusion was that the shallow stream had very little habitat suitable for overwintering trout. Yet in the fall 2010 electrofishing survey cutthroat trout were collected at low density, with a population estimate of eight fish (Table 2). The fish were similar in size to age 2+ trout in Winter Quarters Canyon. Thus it appears that the trout may have resulted from reproduction two years previous to the sampling survey. That suggests a downstream connection between Woods Canyon Creek and Mud Creek allowed spawning trout to enter the stream in 2008 (Shiozawa 2010), thus establishing the small population.

In 2013 densities in both Winter Quarters and Woods Canyon showed a significant decline from estimates made in 2010. No fish were collected in Woods Canyon in 2013. A single fish was seen, but it was in a deeply undercut bank and was not captured and thus could not be positively verified as a fish. It appeared to be small, which could indicate successful reproduction the previous year. Because that suspected fish was not captured, we were unable to make an estimate for the 2013 population in Woods Canyon. The absence or near absence of trout in Woods Canyon Creek in 2013 may be a result of fish not being able to survive summer drought or harsh winter conditions because of the shallow nature of the stream. Sustained populations of trout in Woods Canyon may require active connections with Mud Creek, and even then, Wood Canyon Creek would likely serve mostly as a nursery area for fluvial or adfluvial populations, with small fish out-migrating in the fall. Generally the stream appears to not be suitable for maintaining a closed fish populations over long time periods.

Table 2. Population estimates and confidence intervals for Winter Quarters Canyon and Woods Canyon creeks, September, 2010

Station	Year	Capture probability	Population Estimate	Lower 95% Confidence Interval	Upper 95% Confidence Interval
Below Pad - Winter Quarters Canyon	2010	0.820	51	50.0	54.7
	2013	0.800	12	9.6	14.3
Above Pad Winter Quarters Canyon	2010	0.914	64	62.3	65.6
	2013	0.728	19	14.3	23.7
Woods Canyon	2010	0.889	8	7.07	8.93
	2013	----	----	----	----

The populations in the two Winter Quarters Canyon stations were down considerably (Table 2). The 2013 population estimate for the Below Pad site was 12 fish in the 150 m reach while in 2010 the estimate was 51 fish. The Above Pad site had a population estimated to be 19 fish compared to an estimated 64 fish in 2010. These declines in numbers are also reflected in the density estimates (Table 3) for the fish. Overall the population in Winter Quarters Canyon Creek declines to between one third to one fourth of the 2010 densities.

The length frequencies for the Below Pad - Winter Quarters Canyon Station in 2013 (Figure 1) ranged from 12 to 15.5 cm in total length. This range is significantly more narrow than the 4.3 to 21 cm length range in 2010 (Shiozawa 2010). The trout collected in 2013 were in the size range of the 2+ fish in 2010. None of the 2013 trout were young-of-the-year (age 0+) nor age 1+. Older age classes were also absent. Some fish in this age class could possibly reproduce in

2014 (age class 3+), although in high elevation populations, constrained by short growing seasons, reproduction may be delayed even longer (Belk et al 2009).

Table 3. Densities per linear meter for Winter Quarters Canyon and Woods Canyon creeks, September 2010.

Station	Density per Linear Meter of Stream	
	2010	2013
Below pad - Winter Quarters Canyon	0.34	0.08
Above pad Winter Quarters Canyon	0.427	0.127
Woods Canyon	0.053	----

The Above Pad - Winter Quarters Canyon Station fish ranged in length from 7.0 to 19.5 cm (Figure 2). Only one age 0+ trout was present in the Above Pad - Winter Quarters Canyon Station, indicating either low reproduction or low fry survival in this section. Assuming age 2+ fish in Winter Quarters Canyon are between 12.5 and 16 cm in length, a few fish collected were probably age 3+ or older.

The changes in fish density and population estimates from 2010 to 2013 could be attributed to a number of factors. Weather could play a significant role, since both severe winters and prolonged below normal annual precipitation has impacted the area. Winter Quarters Canyon has higher discharge than Woods Canyon so either of these two factors would have less impact in Winter Quarters Canyon than they would have in Woods Canyon. Likewise both the Above and Below pad stations showed similar declines although the Below Pad station had only one narrow trout size range present.

Fishing may also play a role. Typically fishermen remove larger fish, leaving smaller ones to grow. However this selective harvest, especially in small populations, can readily eliminate the reproductive age classes, and without those, recruitment into the population can fail. The landowners do fish Winter Quarters Canyon Creek, but it is less likely that they fish in Woods Canyon. If fishing pressure was the primary cause one would expect Woods Canyon Creek to have maintained a measurable population at the study site.

Finally the mine ventilation shaft may have impacted the stream. In that case one would expect the Woods Canyon population to have persisted and the Below Pad site to have lost most of its fish. The Below Pad site did lose most of its fish, showing about a 75% decline, more than seen in the Above Pad station, which lost about 70% of its fish. However as noted above the Woods

Canyon population also disappeared. In addition, trout were present in the stream several hundred meters below the Ventilation pad, and the land owners did not notice any decline in the trout in that area.

At this time it appears that the main factor impacting the fish population is associated with changes in weather conditions, but one cannot rule out the potential impact of fishing mortality, nor of siltation in the Below Pad station. The downstream reaches of Winter Quarters Canyon Creek, below the study stations, flows more slowly, has deeper pools, and more woody vegetative cover in the riparian. It also has a more sandy-silt substrate. Yet it had what appeared to have a higher density of fish than either of the study reaches. The study reaches were selected because of their similarity to each other, not for similarity with the this downstream reach because habitat similar to the downstream reach is uncommon upstream of the pad site.

Figure 1. Length Distribution of Cutthroat Trout in the Below Pad Station on Winter Quarters Canyon Creek, 2013

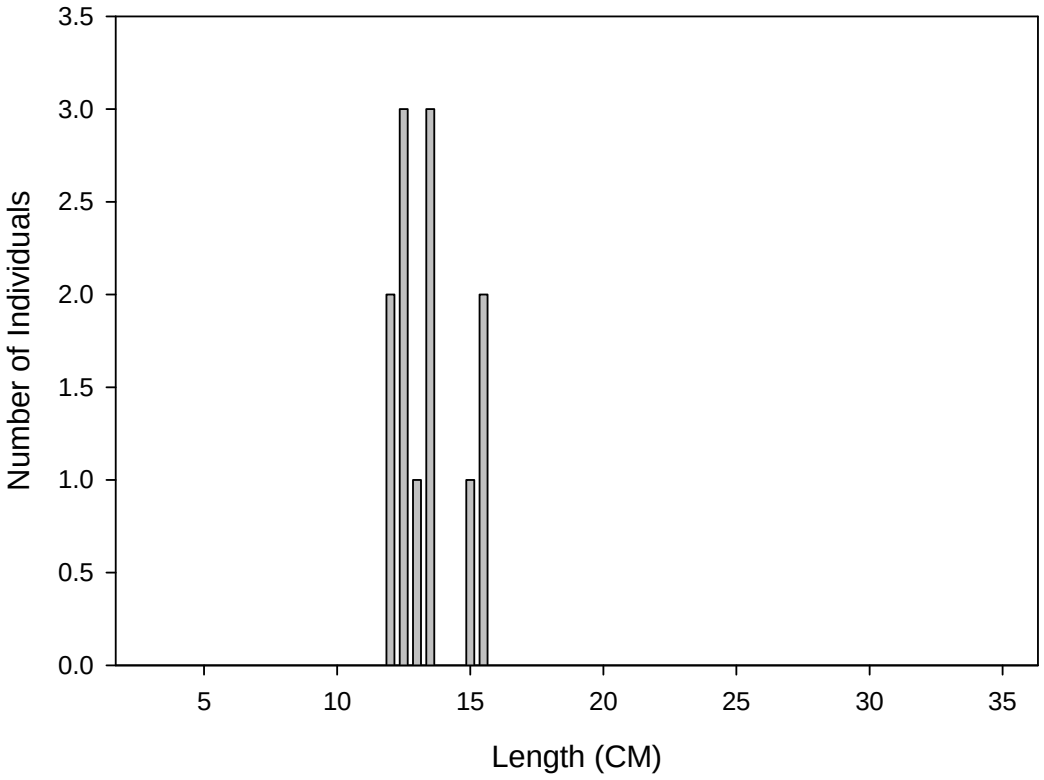
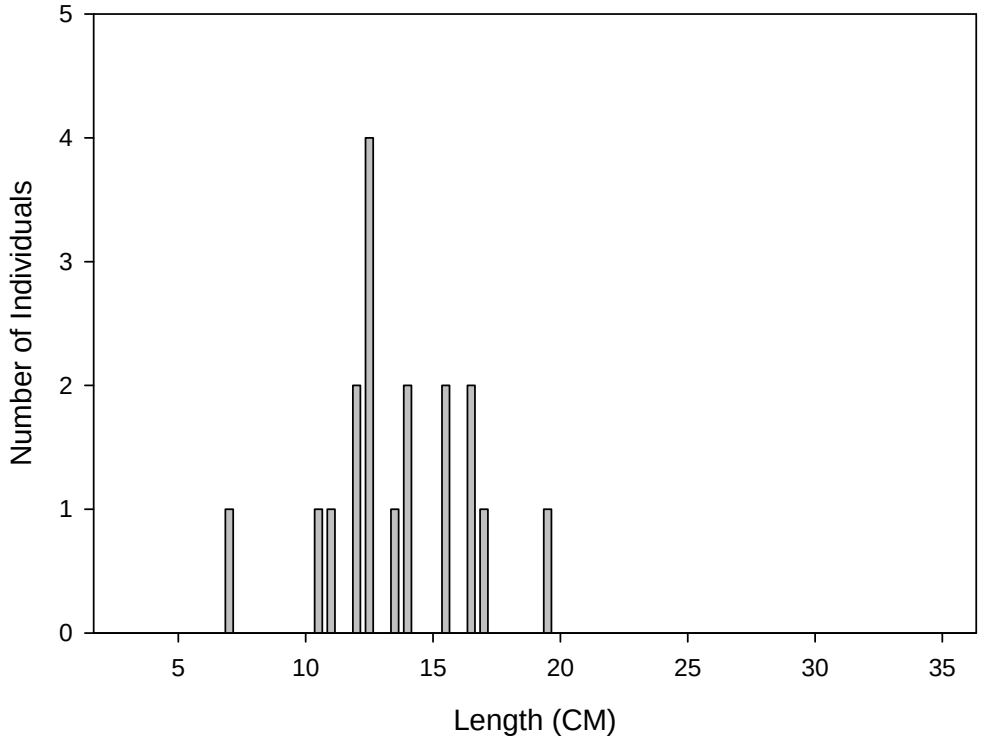


Figure 2. Length Distribution of Cutthroat Trout in the Above Pad Station in Winter Quarters Canyon Creek, 2013



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