Big Hole Mountain Lakes Report

2011-2019

North Gorge Lake, East Pioneer Mountains

Jim Olsen

Montana, Fish Wildlife and Parks

Project Number: F-113-R, March 2020

Fisheries Division
Federal Aid Job Progress Report

MONTANA STATEWIDE FISHERIES MANAGEMENT

FEDERAL AID PROJECT NUMBER: F-113-R

April 1, 2011-April 1, 2020

Project Title: Montana Statewide Fisheries Management

Job Title: Big Hole River Drainage Fisheries Management

Abstract: A total of 34 mountain lakes in the Big Hole River drainage were surveyed from 2011-2019. The goal of this survey was to update existing information or survey lakes that have previously not been inventoried to guide fisheries management decisions. The emphasis for much of the research covered in this report was to survey lakes that are actively managed through stocking. Most actively managed lakes are stocked with westslope cutthroat trout, but golden trout were stocked into 4 lakes. The results of these lake surveys and management recommendations for individual lakes are covered in this report.

Contents

INTRODUCTION 5

METHODS 5

RESULTS 7

West Big Hole Lakes (Beaverhead Mountains) 7
Cowbone Lake 7
Darkhorse Lake 7
Rock Island Lake (lower) 8
Rock Island Lake (upper) 9
Ridge Lake 10
Upper Miner Lake 11
Upper-Upper Miner Lake 11
Hurley Lake 12
Van Houten Lake 12

Pintler Range Lakes 20
Oreamnos Lake 20
Upper Seymour Lake 20

Fleecer Lakes 21
Fish Lake 21
South Fork Reservoir 23

West Pioneer Lakes 24
Ferguson Lake 24
Foolhen Lake 26
Squaw Lake 27
Bobcat Lakes 29
Schwinger Lake 29
Odell Lake 30

East Pioneer Lakes 32
Cherry and Granite Lakes 32
Canyon Lake 34
Lake Abundance 36
Crescent Lake 37
Grace Lake 38
Teacup Lake 39
Tahepia Lake 39
Upper Schultz Lake 40
Tendoy Lake 41
North Gorge Lake 44

South Gorge Lake 45
Rainbow Lake 46
Bond Lake 49
Deerhead Lake...49

INTRODUCTION

The Big Hole drainage is home to 137 named lakes and at least as many unnamed lakes and smaller ponds. Most are natural lakes formed by glacial processes, some are manmade lakes, while others are water storage reservoirs. Nearly all of these lakes are located on public lands on the Beaverhead-Deerlodge National Forest. Given their pristine setting and open access to the public, these mountain lakes often provide unique and highly sought-after recreational sport fishing opportunities. Angling for native and non-native fishes in lakes located within the Beaverhead-Deerlodge National Forest accounts for a substantial portion of recreational activities undertaken in the forest (Oswald 1983).

Most of the high-country lakes were likely historically fishless because of impassible fish barriers and the lack of connectivity between the lakes and the streams. However, stocking efforts, beginning in the early 1900's, introduced a variety of primarily salmonid species to the lakes including brook trout, cutthroat trout, rainbow trout, golden trout and Arctic grayling. The fisheries in lakes with suitable spawning habitat became self-sustaining whereas those where such habitat was not present require periodic stocking to maintain the fishery. Currently, 29 backcountry lakes are stocked with fish whereas the other 99 that are believed to contain fish populations are self-sustaining. Beginning in 1976, Montana Fish Wildlife and Parks primarily stocked McBride strain Yellowstone cutthroat trout into alpine lakes due to their longevity and their ability to effectively utilize the dominant food base which consequently resulted in accelerated growth. However, because westslope cutthroat trout is the native trout in the Big Hole and because preliminary studies indicated westslope would perform equally as well as Yellowstone cutthroat trout in high elevation lakes (Hochhalter and Oswald 2007), stocking of cutthroat trout in alpine lakes in the Missouri River drainage was switched from Yellowstone cutthroat to westslope cutthroat beginning in 2006. Only 4 lakes in the Big Hole drainage are stocked with anything other than westslope cutthroat trout and they are lakes stocked with golden trout.

Previous research described the status of the fisheries and potential for future enhancement of recreational fishing opportunities in many alpine lakes located within the Beaverhead-Deerlodge National Forest (Wells 1982, McMullin 1983, Oswald 1983, Shephard 1990; Brammer et al. 1992, Olsen 2010). To effectively manage the existing backcountry lake fisheries, promote native species conservation and assess the potential to develop new angling opportunities, more recent population data is needed; therefore, surveys were initiated in 2008 and have been ongoing since. The information collected during these surveys is used to develop lake specific management recommendation to improve or maintain the quality of existing fisheries, enhance angling opportunities and conserve native fish populations.

METHODS

Fish populations in alpine lakes were sampled using 125x6-ft sinking, experimental, monofilament gill nets with 25 ft panels. Net mesh size ranged from 0.75 -2.0 inches (bar). Nets were generally set perpendicular to the shore across the lake outlet or inlet or a bay. Nets were set by either walking a rope around the shoreline and pulling the net across the lake or by using a single person watercraft. Generally, nets were set over night; however, in a few cases overnight sets were not possible or were not warranted (many fish were captured in a short net set) and only day sets were used. Angling was also used to sample fish in lakes and in some cases a combination of angling and nets were used. Generally, only one net was deployed per lake.

All fish captured were identified to species, measured (0.1 inch) and weighed (0.01 lb). Condition Factor (K) was calculated according to Shepherd (1990) and comparisons were made to previously collected data when available. Water quality measurements were taken including surface temperature, pH and conductivity. Spawning habitat was quantified in the inlet, outlet and shoreline. Inlet, outlet and shoreline spawning habitat was classified as either: excellent, good, fair or poor and assigned at least 1 qualifier according to the information in Box 1. For example, at Upper Tenmile Lake the spawning habitat in the inlet was scored P5 (Poor habitat because inlet was all boulders), the outlet was scored P5 and the shoreline was scored P3 (Poor because of less than 10 yards of suitable habitat). Lake habitat was qualitatively assessed (i.e., shallow silt bottom, or deep with rocky shores). In some cases bathymetric measurements were made by using a one-person watercraft, hand-held Garmin GPS and a hand-held Vexilar digital depth finder (accuracy to 0.01 ft). Bathymetry data was also collected with transducer mounted to a 1-person pontoon boat and a Garmin GPS which recorded both location and depth at specific time intervals as the boat was moved across the lake. Bathymetric maps were generated using ARC GIS software and the 3-D Analyst tool. In addition to fisheries and water quality measurements, lakes were surveyed for the presence of all life stages of amphibians. The amount of use at the lakes was qualitatively assessed (light, moderate, heavy) and camping areas and fire rings were noted. For the purposes of this report the lakes of the Big Hole were divided into 5 categories according to the following geography: West Big Hole Lakes (Beaverhead Mountains north to Highway 43, Pintler Lakes (Northeast of Highway 43 to Deep Creek, Fleecer Lakes (east of Deep Creek to I-15), West Pioneer Lakes (West Pioneer Mountains west of Wise River) and East Pioneer Lakes (east of Wise River in East Pioneer Mountains).

Box 1. Spawning habitat classification for mountain lakes in the Big Hole drainage.

Excellent (E) = (1) large stream (will not go dry), (2) abundant clean gravels (< 2 in), (3)> 50 yards of suitable habitat.
Good (G) = (1) moderate stream (could go dry in drought), (2) moderate gravels (<2 in), (3) 20-49 yards of suitable habitat.
Fair (F) = (1) small stream (likely dry in drought), (2) limited or silted gravels, (3) 10-20 yards of suitable habitat.
Poor (P) = (1) Intermittent stream (dry in most years), (2) no gravel mostly sand, (3) < 10 yards of suitable habitat. (4) no inlet or no outlet. (5) boulders.

RESULTS

West Big Hole Lakes (Beaverhead Mountains)

Cowbone Lake

Cowbone Lake is the southernmost lake in the Big Hole drainage and is located on an unnamed tributary to Darkhorse Creek approximately 0.3 miles southeast of Darkhorse Lake. The elevation of the lake is 8,565 ft and it is 8.0 surface acres and has a maximum depth of at least 35 ft (Peterson 1971). The lake is deep with much of the lake being greater than 8 ft deep (based on visual estimation). It has a boulder and silt bottom and appears to be relatively productive. Cowbone Lake was originally stocked with undesignated cutthroat trout from 1934 to 1960 with one rainbow trout plant ocuring in 1941. Beginning in 1968, the lake was stocked with Yellowstone cutthroat trout at 3-6 year intervals until 1984 when the lake was stocked every 4 years with 1000 fish. In 2008, Cowbone Lake was stocked with westslope cutthroat trout and stocking has continued at a rate of 125 fish/acre ever 4 years. Access to the lake is gained via the Darkhorse Lake Road, which Is a four-wheel drive/ATV trail.

Cowbone Lake was first surveyed in 1959 when a single gillnet set captured 1 rainbow and 1 cutthroat trout (Heaton 1960). It was sampled again in 1971 when a floating gill net was set overnight and only caught 1 cutthroat trout (Peterson 1971). Cowbone Lake was sampled again on August 7th, 2009 when a single gill net caught 8 Yellowstone and 1 westslope cutthroat trout (Olsen 2011). There has been no evidence of natural reproduction in the past and the condition of fish in the lake suggested the stocking rate or frequency was too high for the food supply. Sculpin have been found in stomach contents in the past indicating that this species is also present in the lake. A single gill net was set on 7/11/12 in Cowbone lake and caught 4 fish classified as Yellowstone cutthroat trout and 8 fish that were westslope cutthroat trout (Table 1). The Yellowstone cutthroat trout captured were 8 years old and averaged only 15.7 inches indicating slow growth. The 4-year-old westslope cutthroat also averaged only 13.1 inches.

Management Recommendations

The stocking rate at Cowbone Lake should be reduced from 125 fish/acre to 88 fish/acre (from 1000 fish to 700 fish) to reduce competition for available food supply to see if this results in a fishery that produces larger fish. The lake will be stocked in 2020 and should be monitored in 2024 to determine if the plant produced the desired result.

Darkhorse Lake

Darkhorse Lake sits at the head of Darkhorse Creek less than ½ mile from Cowbone Lake at an elevation of 8,686 ft. The lake sits adjacent to a patented mining claim and the outlet of the lake is on private property. The first known stocking record for Darkhorse lake was in 1934 when undesignated cutthroat trout were stocked. Rainbow trout were stocked in 1941 and Yellowstone cutthroat trout were stocked periodically from 1968-2004 when the stocking was switched to westslope cutthroat trout. It is stocked with westslope cutthroat trout every 4 years at a density of 125 fish/acre (2016 being the most recent plant). The earliest sampling recorded for Darkhorse Lake was on 1959 when a single gill net was fished in the lake and caught 2 rainbow trout and 12 cutthroat trout and 6 classified as hybrid trout all ranging in size from 4.3-12.2 inches (Heaton 1960). The lake was sampled again with an overnight gillnet set on 7/11/2012. The net captured 9 fish with 8 of the fish being classified as rainbow trout and 1 being classified as a Yellowstone cutthroat trout (Table 1). All trout captured were small (average 9.4 inches) and there was no evidence of the presence of westslope cutthroat trout which should have been 2 years old at the time of sampling. The lake receives a lot of use because it is accessible by ATV.

Management Recommendations

Stocking at Darkhorse Lake should be discontinued. The lake is supporting natural reproduction of rainbow trout which were last stocked in 1941 and it is likely that the westslope cutthroat trout stocking is only decreasing the quality of the fishery. Harvest of trout in Darkhorse Lake should be encouraged to reduced trout density and potentially improve the size of fish in the lake.

Rock Island Lake (lower)

Lower Rock Island Lake is located on an unnamed tributary to Miner Creek at an elevation of 8,325 ft. It gets its namesake from a small, sparsely treed, rocky island in the southern half of the lake. It is accessed by driving up the Miner Lakes road past lower Minter Lake to the trailhead. Approximately 1 mile upstream of the trailhead the trail forks and the right fork leads to Lower Miner Lake (not well signed). The trail follows an old roadbed so walking is relatively easy. Lower Rock Island Lake is relatively large (20 acres) but shallow (maximum depth <20 ft, Wells 1981). The lake is fed by 2 main inlet streams: the first enters from the north end of the lake and the second enters from the northeast and is the outlet stream of Upper Rock Island Lake. Both streams have adequate spawning areas to support natural reproduction. The lake bottom is primarily silt with large, shallow flats around most shores of the lake. Brammer et al. (1992) indicated that there was no stocking into Lower Rock Island Lake but that all plants were made into the upper lake; however, the stocking records do not distinguish between the lakes. These records indicated that stocking with rainbow trout occurred 3 times in 1938, 1941, and 1960. The upper lake was stocked again with Yellowstone cutthroat trout in 1990 (Brammer et al 1990). Lower Rock Island Lake was initially sampled in 1959 when 19 rainbow trout from 6.0-13.5 inches were caught in a single gill net. It was also sampled in 1973 (Peterson 1974) and again in 1981(Wells 1981) when there were good numbers of “pan-sized” rainbow trout present (largest fish captured was 12.7 inches). In 1992 rainbow, cutthroat and hybrids between the 2 were captured ranging in size from 5.6-15.1 inches. The condition of fish at that time was noted as good.

Lower Rock Island Lake was sampled again on 8/11/16. A single fisherman fished for 1.5 hours and caught 3 fish. The largest fish was a rainbow trout that was 17.7 inches long (Figure 1). The 2 other fish appeared to be westslope cutthroat trout and measured 14.2 and 10.3 inches. Numerous other fish were observed rising in the lake. Lower Rock Island Lake appears to continue to provide a nice self-sustaining fishery for rainbow and cutthroat trout. The average size of trout in the lake appears to have increased since it was last sampled. Columbia spotted frogs (adults) were also common at the lake. The lake receives relatively heavy traffic because it is part of the Continental Divide Trail system and camping areas are well used and firewood is scarce.

Figure 1. Rainbow trout from Rock Island Lake, 2016.

Rock Island Lake (upper)

Upper Rock Island Lake is located less than ¼ mile from Lower Rock Island Lake at an elevation of 8,360 ft. There is only a minimal elevation difference from one lake to the other and there are no fish barriers that would preclude movement between them. The two lakes share similar habitat characteristics. Upper Rock Island Lake is relatively shallow (no actual depth measurements taken) with large silt flats. The north end of the lake appears deeper with depths reaching beyond where the bottom was visible. The main difference between the habitat in the 2 lakes is the abundance of fallen timber in the lake. The south and west shorelines of Upper Rock Island Lake are littered with trees that have sunk to the bottom of the lake. Upper Rock Island Lake was sampled in 1973 (Peterson 1974) when a single 11.8-inch rainbow trout was captured. Wells (1981) suggested the lake was likely too shallow to support a fishery but given its productivity, recommended stocking the lake with McBride strain Yellowstone cutthroat.

Upper Rock Island Lake was sampled on 8/11/16 and 8/17/16 via angling. An overnight gillnet set was planned but the preponderance of sunken trees precluded the safe deployment of a gill net from shore. Five people angled for approximately 4 hours and caught 14 fish. Six of the fish had the appearance of rainbow trout and the other 8 appeared to be westslope cutthroat trout. The origin of the westslope cutthroat trout in these 2 lakes is unclear. There are no stocking records of the species in either lake. It is unclear if fish passage is present from Miner Creek which historically contained westslope cutthroat trout and Lower Rock Island Lake but no high gradient reaches are present immediately downstream of the lakes. A short high gradient reach is present near the confluence of Miner Creek but upstream of this point the gradient is only moderate. No cutthroat trout were noted in previous nettings of the lakes, so it is unknown how fish with the appearance of westslope cutthroat trout may have colonized both the upper and lower lakes. Ridge Lake in the drainage is currently stocked with westslope cutthroat but it is unclear if fish from this lake have colonized the stream. Regardless of their origins, the upper lake produces a good fishery for average to above average rainbow and cutthroat trout like the lower lake.

Management Recommendations:

No management changes are necessary at Rock Island Lakes. The lakes provide average to above average-sized fish which is rare for self-sustaining, alpine lake fisheries.

Ridge Lake

Ridge Lake is located in the same drainage as Rock Island lakes near the ridge that separates Miner Creek from the Rock Island Lakes drainage. Access to the lake is gained by the same trail as accesses Rock Island lakes. Approximately ¼ mile after passing the trail split leading to Upper Miner Lake there is an unmarked trail on the left which crosses the outlet stream from Rock Island Lake. This trail (actually an old road) leads past an old mining area to Ridge Lake. The lake has a maximum depth of 32 ft (Wells 1982) and is 8,449 ft in elevation. The south shore of the lake is a steep talus slope that extends into the water. The west shore is silty flat while the north shore is a mix of boulders and silt. Ridge Lake was first stocked with undesignated cutthroat trout in 1960 and was periodically stocked through the 1980's. From the early 80's through 2004 the lake was stocked on a 4-year rotation with Yellowstone cutthroat and in 2008 the species was stitched to westslope cutthroat trout. The lake is stocked with 500 fish every 4 years for a stocking rate of 56 fish/acre. The lake has been sampled 3 times previously: in 1959 no fish were captured (Heaton 1960); in 1973 (Peterson 1974) cutthroat from 11 to 14 inches were captured and in 1981 cutthroat up to 16 inches were captured (Wells 1981). The outlet stream was noted as being intermittent by Wells (1981).

Ridge Lake was sampled on 8/10/16 by setting a single overnight gill net on the eastern part of the lake. Nine westslope cutthroat trout were captured in the net ranging in size from 7.2-18.2 inches. Captured fish were in excellent condition. The lake was stocked in 2012 so the larger age-classes of fish were likely age-4. The presence of several smaller fish also indicates that there is some natural reproduction in the lake. Observations of the outlet stream confirm this as both age-0 and age-1 fish were observed swimming in the short low-gradient section of the stream approximately 100 ft downstream from the lake. The presence of multiple age classes of fish in the stream suggests the outlet is not intermittent during most years as suggested by Wells (1981). Spotted frog adults and tadpoles were also present at the lake mostly near the lake outlet. Use at the lake was moderate with several camp sites along the north side of the lake.

Management Recommendations:

No management changes are necessary Ridge Lake. The lakes provide average to above average-sized fish at the current low stocking rate. Future monitoring should occur to determine if natural reproduction is adequate to sustain the fishery and that stocking is not resulting in overpopulation.

Upper Miner Lake

Upper Miner Lake is a large (42 acre) lake at the head of the Miner Creek drainage at an elevation of 8,022 ft. The trailhead to Upper Miner Lake is approximately 3 miles upstream of Lower Miner Lakes. Approximately 1 mile from the trailhead the trail will fork and the left fork, which crosses the outlet stream from Rock Island Lake, leads to Upper Miner Lake. The 3.5-mile hike is relatively easy with no steep grades and a well-marked trail. The lake has a boulder and silt bottom. The south shore is a talus slope into the lake whereas the west shore is forested. The lake is relatively deep (60 ft, Wells 1981), but there are shallower shoals on the east near the outlet. The outlet is long and narrow and there are several smaller ponds before Miner Creek truly becomes a creek. The lake was stocked with undesignated cutthroat trout in 1959 and again in 1960. The first documented fisheries sampling of the lake occurred in 1959 when a single gillnet caught only rainbow trout ranging in size from 6.0-13.0 inches (Heaton 1960). In 1973 and again in 1981 and only brook trout were captured (Wells 1981). The fish ranged in size from 6.4-14.0 inches and were in good condition. Brook trout apparently came in from Miner Creek downstream and are able to reproduce in the inlet and outlet streams and/or along the shoreline.

Upper Miner Lake was sampled again via angling on 8/8/16. Five anglers fished for approximately 2 hours and caught 4 brook trout. Many fish were also observed rising in the lake. The lake appears to still be providing a good fishery for pan-sized brook trout. Excellent spawning habitat is present in the inlet stream to the lake entering the lake at the northeast corner of the lake near the outlet. Numerous age-0 brook trout were observed in the stream. Good camping spots are present around the lake near the outlet stream. Spotted frogs were also noted in the shallows around the long outlet area.

Upper-Upper Miner Lake

Upper-Upper Miner Lake is located roughly ½ mile northwest of Upper Miner Lake at an elevation of 8,749 ft. There is no trail between the two lakes but access is most easily obtained by roughly following the stream that connects the two lakes. The hike is short but very steep. Interestingly 2 wolverines were observed on this hike playing in a snowfield on the south side of the drainage. The lake is moderate in size (30 acres) and very deep at 99 ft (Wells 1981). The stocking records do not distinguish between Upper Miner and Upper-Upper Miner lakes (listed as only Miner Lakes) but only cutthroat trout were stocked. Upper-Upper Miner Lakes contains a self-sustaining rainbow trout fishery. The origins of the rainbow trout are unknown. The lake has been sampled 3 times previously in 1959, 1973 and again in 1981. In 1959 the rainbow trout ranged in size from 11.0-17.0 inches. In later sampling the rainbow trout ranged in size roughly from 6 to 14 inches. No spawning habitat was noted in these initial surveys in the inlet or outlet streams, so it was presumed that fish spawned along the shoreline.

Upper-Upper Miner Lake was surveyed again on 8/9/19. A single gill net was set for 7 hours during the day and caught 14 rainbow trout ranging in size from 11.7-14.8 inches. There appears to be good spawning habitat along the shoreline as pockets of sandy gravels are present along the east shore of the lake. There is little spawning potential in the inlet or outlet streams.

Management Recommendations:

No management changes are necessary for Upper Miner Lakes. The lakes provide good fisheries for pan sized brook and rainbow trout. Harvest should be encouraged at both lakes to reduce the potential for overpopulation and reduced fish size.

Hurley Lake

Hurley Lake is located in the Big Swamp Creek drainage at an elevation of 8,587 ft. Its outlet stream drains into Lena Lake and the lake is sometimes referred to as Upper Lena Lake because the USGS map does not list a name for the lake. Access is gained via the Big Swamp Creek road to the poorly marked Trail 3002 crossing leading to Lena Lake. Once at Lena lake, follow the inlet stream on the southwest side of the lake upstream to Hurley Lake (there is no trail). Hurley Lake was stocked one other time with undesignated cutthroat trout in 1948 but there is no other stocking record for the lake. Beginning in 2017 golden trout were stocked into Hurley Lake in an effort to provide an additional fishery for this sought-after species. Subsequent angler reports indicate the fish have survived over winter and are producing a viable fishery.

Van Houten Lake

Van Houten Lake is easily accessible by vehicle and has 2 associated Forest Service campgrounds. The lake is 12 acres and was reported to have a maximum depth of 14 ft. More recent bathymetric measurements suggest the maximum depth of the lake is only 9 ft (Figure 2). The lake appears to be a natural waterbody similar to the common pothole type lakes in this area but was enhanced through the construction of a small dam at the lake outlet. It is fed by 2 inlet streams: one on the west end of the lake and on the north end. Both inlets are short spring-fed channels the emerge from a glacial till terrace. Being spring-fed these tributary streams produce consistent, cold (< 45 F) flows into the lake. The outlet is located in the southeast corner of the lake and flows approximately 1 mile through a boggy meadow to the Big Hole River. The lake has a silty bottom with a large area of lilypads on the west side. Access to the lake is gained by taking the Skinner Meadows Road approximately 1 mile north of Jackson and following the signs to the lake. Van Houten Lake was first sampled in 1959 when a single gillnet was fished in the lake. At that time 5 rainbows and 3 brook trout were captured along with 3 burbot and 88 unspecified suckers (Heaton 1960). The lake was sampled again in 1965 when 2 gillnets were fished in the lake and caught brook trout (108, average length 9.6 inches, range 6.9-11.0 in) and longnose suckers (34 total) (unpublished data). The Beaverhead Forest Lake and Fish Inventory (1991) lists the lake as containing rainbow and brook trout. The stocking record for the lake indicates it was stocked extensively primarily with rainbow trout from 1941 through 1963. Undesignated cutthroat trout were stocked in 1945 and 1946 and brook trout were stocked in 1963. More recent sampling (Olsen 2011) indicated that the lake has become overpopulated with white and longnose suckers. The lake was netted in 2009 and suckers outnumbered brook trout 10:1. Management recommendations were made to take measures to reduce the sucker population to provide a higher quality brook trout fishery in the lake.

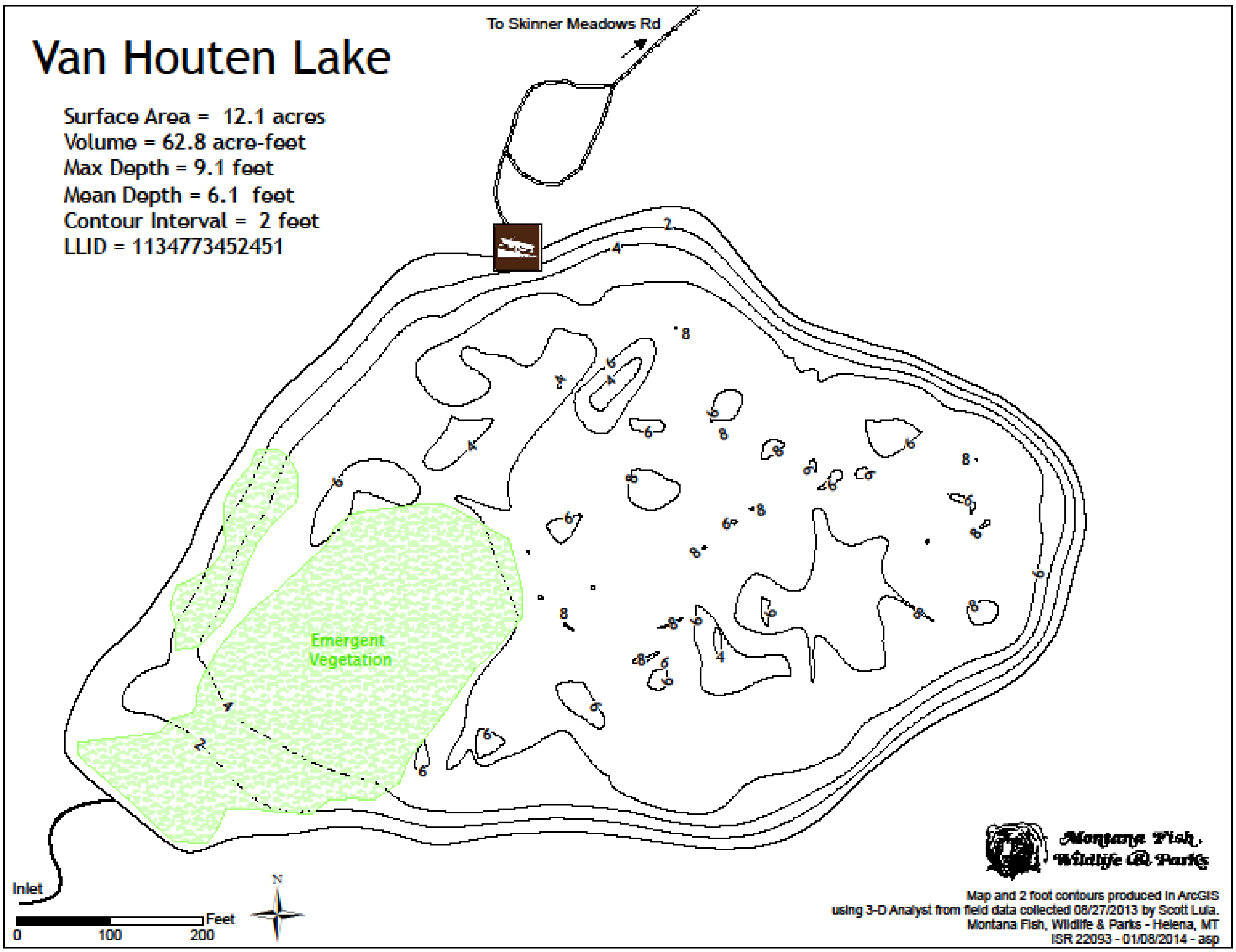

Figure 2. Bathymetric map of Van Houten Lake prior to fish barrier construction.

In 2011 an Environmental Assessment was prepared to introduce burbot into Van Houten Lake in an effort to try and reduce sucker abundance and increase the quality of fishery for brook trout. In other similar Big Hole lakes where burbot and suckers are present the sucker populations are not over-abundant and they maintain good fisheries for trout and grayling. In June of 2011, 114 burbot ranging in size from 9.2-28.9 inches (mean = 15.0) were trapped and transported from Twin Lakes in the Big Hole and released into Van Houten Lake. All fish moved were individually tagged with Floy Tags to be able to track growth and survival. In May of 2012 the lake was netted again by fishing 2 fyke nets and 5 baited cod pots overnight in the lake. The nets captured a total of 558 suckers (both longnose and white), 5 brook trout and only one burbot (Table 1). The one burbot captured was 18.6 inches and 1.40 lbs when it was released into Van Houten and in a little less than a year it grew to 21.0 inches and 1.70 lbs. However, given that this was the only burbot captured and there seemed to be no change in the abundance of suckers, it appears the burbot introduction was not successful.

A different management strategy was developed in 2015 with the goal of complete removal of suckers from Van Houten Lake. In order to do this a fish migration barrier would need to be established at the outlet of the lake to prevent the natural recolonization of the lake by suckers from the Big Hole River and a piscicide would have to be used to remove the suckers. In addition, it was determined that spawning enhancements could be made to the northern inlet stream and the lake outlet to encourage natural reproduction of salmonids. Another management objective was also added to this plan which was to include native species in the restocking of the lake once suckers were removed. Both Arctic grayling and westslope cutthroat trout were proposed for stocking.

In the fall of 2015 funding was secured to construct the fish barrier. The barrier structure increased the height of the existing earthen dam at the outlet of the lake so that a small waterfall with a drop of approximately 5 ft could be created (Figure 3). The existing berm was also widened to accommodate a spawning stream leading to the waterfall (Figure 4). The completed structure raised the surface elevation of the lake roughly 3 ft. Three inch minus washed gravels were added to the channel leading to the waterfall to provide spawning habitat. The north inlet channel which is the larger of the 2 inlets was enhanced for spawning by adding fill to raise the ground elevation of the first 75 ft of stream above the lake elevation. Native sods were transported to reform the stream banks and spawning gravels were added.

Van Houten Lake was treated with rotenone on September 26, 2015 to remove both white and longnose suckers. During the construction of the fish barrier the existing dam was lowered approximately 4 ft to partially drain the lake. By lowering the lake less rotenone would be needed to remove suckers and it would eliminate the need to detoxify the rotenone because no water would leave the lake for several weeks after the barrier was finished and while the lake refilled. Once the lake elevation was lowered 4 ft, it became clear that the previous depth measurements were inaccurate. Nowhere in the lake was there water deeper than 4 ft. The lake substrate consisted of very fine organic silts. It was possible to sink a 15-ft tall small lodgepole pine into the muck vertically and pull it back out with ease. It is possible that the light “fluffy” nature of this organic material did not produce accurate depth information when measurements were made. The nature of lake bottom suggests Van Houten was historically a pothole lake that through time eutrophied and filled with organic sediments.

In May of 2016 three gill nets were fished in Van Houten Lake for 2 days and did not capture a fish. Later that month 200, 5-inch, sterile westslope cutthroat trout from the Washoe Park fish hatchery in Anaconda were stocked into the lake. In addition, fertilized Arctic grayling eggs from Mussigbrod and Miner lakes were introduced to the lake via RSI's over the next 3 years. An additional 150 adult grayling from Mussigbrod and Miner lakes were also stocked into Van Houten Lake. In the fall of 2015 roughly 200 fertile westslope cutthroat trout from Cherry Creek were transported to Van Houten lake and released.

Westslope cutthroat eggs were collected from Van Houten Lake in May of 2018 in an effort to use the progeny of these fish for restoration of other streams. Fish were captured using trap nets focused primarily around the inlet streams. Eggs were collected on 5/24/18 and again on 6/1/18 and the sizes of fish are shown in Table 1. Measurements were also taken on the Arctic graying and the sterile cutthroat trout captured (Table 1). No measurements were taken on brook trout but approximately 30 brook trout were also captured. The sterile cutthroat were 16-inches long after only 2 growing seasons in the lake. Food is abundant in Van Houten Lake and fish growth for all species present is rapid and possibly only limited by warm summer temperatures. Fin clips from all cutthroat that were used for spawning were analyzed and found to primarily from the M012 brood stock in Anaconda and not wild Big Hole fish. This means that many of the fish that were in Cherry Creek were likely escapees from the adjacent private pond that was stocked from the Washoe Park Hatchery. This finding significantly limits where eggs collected from the current cutthroat Van Houten Lake can be stocked for restoration purposes. One white sucker was also captured during this sampling effort.

Figure 3. Photo of completed fish barrier on the outlet of Van Houten Lake.

Figure 4. Photo of completed fish barrier and spawning channel upstream on Van Houten lake before lake had filled and began spilling over structure.

Eggs were collected again from Van Houten Lake in 2019 and additional netting occurred in the fall. Average size of grayling and fertile cutthroat continued to climb but the number of these fish has started to decline. It is likely that Van Houten is receiving greater fishing pressure as the quality of the fishery has improved and that harvest is increasing at the lake. This drop in numbers of fish prompted an additional stocking of 1000, 5-inch sterile cutthroat into the lake in late spring 2019. These sterile fish were all adipose fin clipped. Concurrent with the drop in cutthroat and grayling, brook trout numbers increased dramatically prompting fall sampling in 2019. Five fyke nets were fished in the lake from 10/4/19 to 10/8/19 and 3 nets were fished from 10/8/19 to 8/15/19. Combined numbers of fish captured in these sets are shown in Table 1.

Despite spawning enhancement in the inlet and outlet streams, there has been no evidence of Arctic grayling naturally reproducing in the lake. Adult grayling are captured each spring in trap nets and are gravid but no juvenile fish have been captured. Westslope cutthroat redds have been observed in both inlet streams but not in the lake outlet.

Management Recommendations

With the removal of suckers, Van Houten Lake has turned into a high-quality fishery for westslope cutthroat trout, brook trout and Arctic grayling. Given the improvement in the fishery and the potential to use the lake as a brood source for Big Hole fish, more restrictive harvest regulations should be considered at the lake. A 2-fish limit for cutthroat trout will be proposed for the 2021 angling season with only one of those fish being over 14 inches. The presence of 1 sucker found in 2018 is concerning if suckers again become established in the lake. Subsequent netting events have not found any additional suckers. Because of its potential use as a westslope cutthroat brood lake with Big Hole origin fish, selective removal of fertile M012 fish should occur. Beginning in in 2019, 1,000 fertile fish from Cherry and Granite lakes (wild Big Hole brood, see below) were pelvic fin clipped and released into Van Houten Lake. This fin clip should allow for the Big Hole fish to be distinguished from either the fish that came from Cherry Creek or any of their wild progeny. All cutthroat trout captured without a pelvic fin clip will be moved downstream of the fish barrier and released.

Table 1. Fisheries survey data from West Big Hole lakes from 2008-2010 where length is in inches and weight is in pounds. The fish species abbreviations are: LL = brown trout, RB = rainbow trout, EB = brook trout, WCT = westslope cutthroat trout (WCT1 are fertile fish and WCT2 are sterile), YCT = Yellowstone cutthroat trout, M COT = mottled sculpin, LSU = longnose sucker, WSU = white sucker and AG = Arctic grayling. Condition factor (K) and Spawning habitat are described in the methods section. Use is a qualitative measure of use and recreation related impacts at the lake. Amphibian abbreviations are: SF = Columbia spotted frog, TF = tailed frog, WT = western toad and SS = spotted salamander.

Lake	Temp (°F)	pH	Cond. (µS)	Species	#/net	Avg L (range)	Avg W (range)	Spawning Habitat			Use	Amphibians
								Inlet	Outlet	Shore		
Cowbone	60.3	8.3	30	WCT	8	13.1 (12.0-14.8)					Heavy	
				YCT	4	15.7 (14.6-17.5)						
Darkhorse	55.1	8.3	39	RB	1	12.9					Heavy	
				YCT	8	9.0 (6.5-11.2)						
Rock Island (Lower)				RB	1	17.7					Heavy	SF
				WCT	2	12.3 (10.3-14.2)						
Rock Island (Upper)				RB	6	9.1 (5.8-12.4)					Mod	SF
				WCT	8	15.0 (11.3-21.5)						
Ridge Lake				WCT	13	13.0 (7.2-18.1)	1.05 (0.15-2.18)	P2	F2	F2	Mod	SF
Upper Miner				EB	4	11.6 (11.2-12.0)	0.50 (0.49-0.52)	E2			Mod	SF
Upper-Upper Miner				RB	14	13.1 (11.7-14.8)	0.71 (0.52-0.87)	P	P	G2	Light	None
Van Houten (2012)	54.5	8.4	24	EB	2	8.8 (8.2-9.9)	0.26 (0.24-0.30)					SF
				WSU	132.5	11.0 (7.8-16.5)	0.55 (0.20-1.58)					
				LSU	7.5	8.6 (7.4-11.0)	0.27 (0.20-0.40)					
Van Houten (2012)				EB	0.2	9.2	0.27					
Cod pots/hoops				WSU	55.6							

Table 1 (cont.)

Lake	Temp (°F)	pH	Cond. (µS)	Species	#/net	Avg L (range)	Avg W (range)	Spawning Habitat Inlet	Outlet	Shore	Use	Amphibians
Van Houten (2018)				WCT[1]	81[3]	12.2 (7.3-15.9)						
				WCT[2]	9	16.0 (15.2-16.9)						
				AG	83[3]	11.1 (6.3-18.3)						
				WSU	1[3]	9.8						
Van Houten (2019)	59			WCT	54[3]	13.7 (7.8-18.0)						
				AG	25	13.6 (11.7-15.1)						
Van Hout (2019) fall				EB	306[3]	12.8 (10.1-19.4)						
				WCT[1]	12	11.0 (7.1-13.8)	0.59 (0.09-1.01)					
				WCT[2]	498[3]	11.0 (7.2-12.9)	0.56 (0.14-0.97)					
				AG	117[3]	14.0 (12.1-15.1)	1.06 (0.62-1.32)					

[1]: fertile westslope cutthroat trout

[2]: sterile cutthroat trout

[3]: Total number captured, not number per net

Pintler Range Lakes

Oreamnos Lake

Oreamnos Lake is the only lake in the Pintler Creek drainage that contains a fishery. The lake is approximately 8.3 acres and 33 ft deep (Wipperman 1964) and is located within the Anaconda Pintler Wilderness Area. The lake habitat consists of a generally silt/sandy bottom on the south shore with bedrock outcrops on the western side of the lake. Access to the lake can be gained either by hiking up the Pintler Creek Trail (approximately 6 miles from trailhead) or from the Rock Creek side of the Continental Divide. In 1934, 1959 and 1960 the lake was stocked with rainbow trout. In 1951 undesignated cutthroat trout were stocked into the lake. Beginning in 1990 the lake was stocked on a 4-year cycle with rainbow trout and in 2006 the species was changed from rainbow trout to westslope cutthroat trout. The lake has been surveyed 3 times in the past. Wipperman (1964) sampled the lake with 2 gillnets fished for 48 hours and caught 44 rainbow trout while Shepherd (1990) surveyed the lake with a single gillnet and captured only 2 rainbow trout. In 2009 a single gillnet captured 12 rainbow trout (Olsen 2011). Despite the difficulty in accessing the lake, it sees moderate use. There is a well-established trail to the lake and camping areas are present near the outlet.

As part of a project to restore westslope cutthroat trout to Pintler Creek, Oreamnos lake was treated with rotenone in August of 2014. In July of 2015, 400 sterile westslope cutthroat from Washoe Park Hatchery were restocked into Oreamnos Lake. Additional plants of fertile Big Hole origin fish were planned in Oreamnos Lake and Pintler Creek, but egg takes were unsuccessful until 2018. In 2019 fertile cutthroat from Big Hole origin fish were collected and reared in the Anaconda Hatchery and stocked into the lake. The eggs were collected from York Pond and reared in the isolation building at Anaconda and then stocked via helicopter in July.

Management Recommendations for Oreamnos Lake

Oreamnos Lake historically was a fishery that produced large rainbow trout. The lake supports some natural reproduction and it is anticipated that the WCT stocked into the lake will similarly reproduce and potentially become self-sustaining; however, to facilitate this fish should be stocked annually through 2021 to provide 3 age classes of fish. Monitoring of the lake should occur in the late summer or fall of 2022 to determine if successful spawning has occurred. If the cutthroat trout do not become self-sustaining, the lake should be stocked on a 4-year rotation with roughly 800 westslope cutthroat trout.

Upper Seymour Lake

Upper Seymour Lake at 8,270 ft elevation is located at the northeast end of the Anaconda Pintler Wilderness Area along the Continental Divide Trail. The lake is relatively large (35 acres) and deep (84 ft; Shephard 1990). A bathymetric map of the lake shows that the west shore of the lake drops off quickly to depths exceeding 70 ft whereas the east shore is much more gradual (MFWP 1990). The inlet stream was noted as having relatively abundant spawning habitat, but the outlet stream has limited habitat because of boulders and high gradient. Access to the lake is obtained by driving the end of Seymour

Lake road to the trailhead and it is roughly a 6-mile hike to the lake. The lake can also be accessed from the north side of the Pintler Mountains from the Twin Lakes trailhead and is a similar distance to the lake. There is no stocking record for Upper Seymour Lake; however there is record of rainbow trout stocking into "Seymour Lake" from 1931-1940 and Shephard (1990) speculated that these fish were stocked into Upper Seymour Lake (there is also a lower Seymour Lake, Olsen 2011). There is no stocking record after 1940 for either Upper or Lower Seymour lakes after 1940. The fishery of the lake has been sampled once previously in 1990 (Shepard 1990). At that time a single gillnet was fished overnight and caught 14 rainbow trout ranging in size from 6.3-13.5 inches.

Upper Seymour Lake was surveyed again on 8/13/18 when a single gill net was fished for approximately 2 hours. No fish were captured in the gillnet but approximately 10-12 fish were captured via angling. No lengths were taken on the fish angled but they ranged in size from 10 to 12 inches. Multiple fish were observed rising in the lake. The condition of the fish caught was average. It was apparent that Upper Seymour Lake continues to provide an abundant fishery for pan-sized rainbow trout. Use at the lake is relatively high because it is located along the Continental Divide Trail. Despite the heavy use, the fishery in the lake appears robust.

Management Recommendations

No management changes are recommended for Upper Seymour Lake at this time. It is providing an average fishery for pan-sized rainbow trout that are self-sustaining.

Fleecer Lakes

Fish Lake

Fish Lake is a series of two lakes separated by a small stream located at the headwaters of Long Tom Creek in the Jerry Creek drainage. The lake elevation is 7,960 ft and it is the only natural lake that is known to support fish on Fleecer Mountain. The lakes have extensive littoral areas around the entire shoreline with shallow silt flats and lily pads. The shoreline is grassy with a shallow slope and sedges reaching out into the margins of the lake. Beyond the grassy banks, the lake is surrounded by lodgepole pine forest. There is no stocking record for Fish Lake, but anecdotal evidence indicates that at one time the lake did support a trout fishery. Access to the lake is gained by Forest Service Road 83 (Jerry Creek Road) to Road 2480 (Jimmy New Creek Road) to Road 1201. It should be noted that Forest Service Road 1201 is closed to motorized traffic except for snowmobiles during winter. At the end of Road 1201, the road crosses over the outlet stream of Fish Lake and there is an established trail leading ¼ mile to the south and west to the lake. The lake was previously surveyed in 2010 (Olsen 2011). Only longnose suckers were captured in the net ranging in size from 6.1-9.8 inches. It is unclear if longnose suckers are native to Fish Lake or if they were introduced. Evidence of the latter includes a lack of the species in Jerry Creek at similar elevation to the lake and the lack of the species in Long Tom Creek upstream of the confluence of the outlet of Fish Lake. There are two established campsites at the lake, but use appears to be minimal.

Previous management recommendations were to stock Fish Lake with westslope cutthroat trout. However, prior to stocking depth and oxygen measurements were taken. In August of 2012 a boat was brought into Fish Lake and depth measurements were collected. These data were used to produce a bathymetric map of the lake (Figure 5). The maximum depth of the lake was 20.1 ft. On March 12, 2013 snowmobiles were ridden into Fish Lake and oxygen measurements were taken. A single hole was drilled in an area of the lake that was 19 ft deep. Despite the lake's depth, oxygen levels in late winter were not adequate to support trout (Table 2). For trout to survive minimum oxygen levels should be no lower than 4 ppm. Not even immediately below the ice was there oxygen levels that exceeded 4 ppm. This likely explains the lack of trout in the lake and the abundance of suckers, which have a higher tolerance for low oxygen levels. The low oxygen levels in the lake were somewhat surprising given the lake's depth. Generally, lakes with deeper water are less likely to have low oxygen levels in the winter. The heavy snow load on the lake which blocks sunlight and limits oxygen producing photosynthesis likely contributes to low oxygen levels. It is possible that the high abundance of suckers may also have an influence on oxygen consumption in the lake. The inlet stream to Fish Lake is very small and may go dry during the winter.

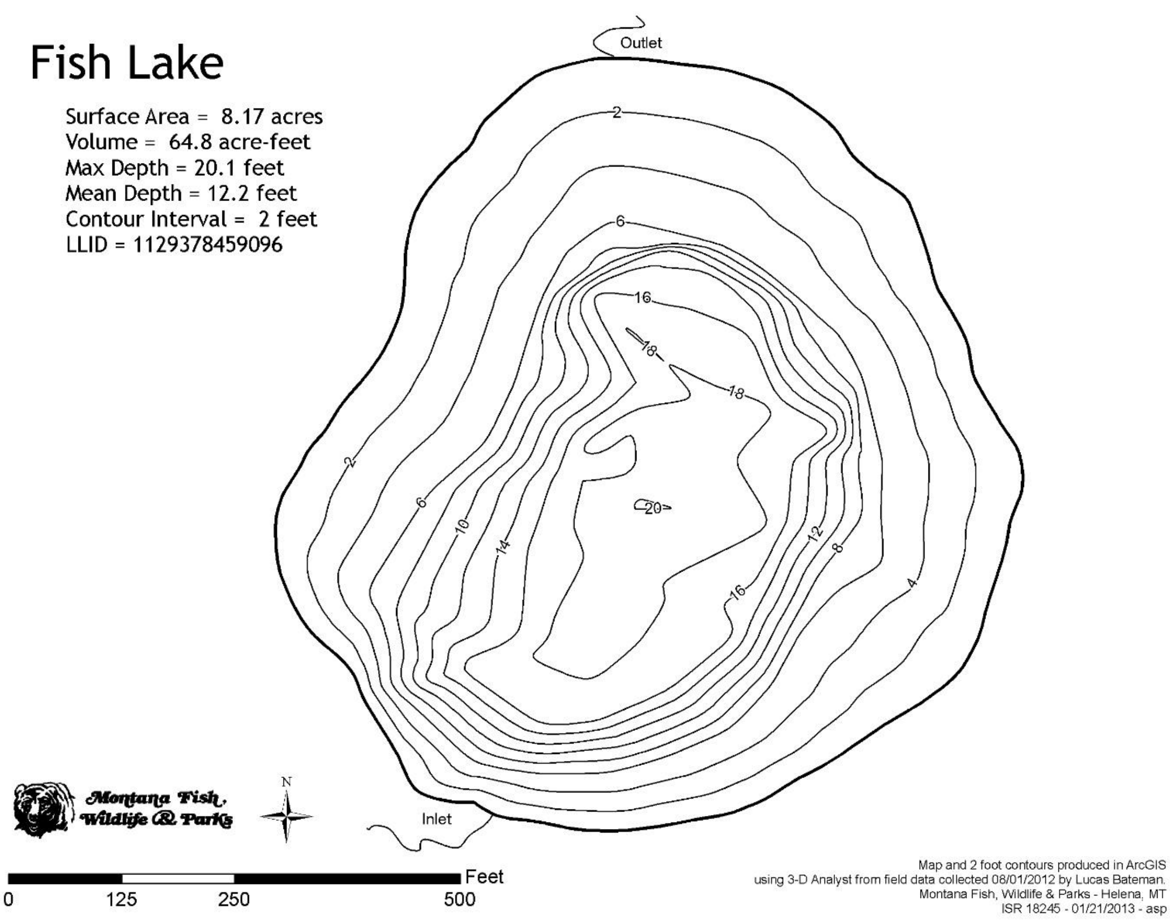

Figure 5. Bathymetric map of Fish Lake taken from 55 depth measurements across the lake in 2012.

Table 2. Water quality parameters from Fish Lake collected on 3/12/13 including oxygen measurements. An instrument was lowered through a single hole drilled through the ice.

Depth	Temp °C	O2 (ppm)	O2 % Sat	pH	Cond (uS)
2	0.68	3.66	6.6	6.6	88
5	2.07	0.93	6.4	6.38	88
7	3.05	0.35	2.6	6.5	
9	3.65	0.37	2.7	6.8	90
11	3.89	0.47	3.7	6.98	93

Management Recommendations:

Fish Lake should not be stocked with westslope cutthroat trout because the fish would not likely survive the winter. Unless management actions are taken to rectify the lack of oxygen in late winter, no stocking of trout should occur. The lake will continue to have an overabundant population of longnose suckers.

South Fork Reservoir

South Fork Reservoir is formed by a dam approximately 30 ft high on the South Fork of the North Fork of Divide Creek. Water is piped from an outlet structure located in the reservoir to the Butte water treatment plant at Feeley. The spillway of the pond is a fish barrier and is located on the northeast corner of the reservoir. The level of the reservoir can fluctuate with the demand for water in Butte-Silverbow; however, recent water management has resulted in the reservoir remaining full all year. A separate pond upstream of the fish barrier was used as a water treatment area and sediment catch basin. Within this basin is series of baffles that slow flow and allow suspended sediments to settle to the bottom. The water leaves the settling basin through an 18-inch pipe that discharges approximately 4 ft above the surface of the reservoir at full pool. Fish passage from the reservoir to the stream upstream is likely very limited. There is no public access to the reservoir because it is part of the Butte municipal water supply. The fishery in the lake has been sampled one time previously (Olsen 2011). In 2009 a single gill net was fished and caught both brook and westslope cutthroat trout. The South Fork North Fork Divide Creek upstream of the reservoir is home to a non-hybridized population of westslope cutthroat trout.

As part of a project to remove brook trout from the South Fork North Fork Divide a Creek and restore westslope cutthroat trout, the reservoir was drained in the summer of 2013. At the time the reservoir was drained it was also cleaned of sediment using dozers, excavators and dump trucks. Water was diverted around the reservoir through an existing ditch during this process. A fish passage project connecting South Fork Reservoir with the South Fork North Fork Divide Creek was performed in fall of 2013 (Figure 6) in cooperation with the Big Hole River Foundation (Olsen 2017). This structure replaced the perched culvert between the settling pond and the reservoir

(Figure 6). An intensive mechanical removal effort was employed in the stream upstream of the reservoir and brook trout were presumably completely removed in 2017.

Management Recommendations:

With brook trout removed from the reservoir, full fish passage upstream should be pursued. Upstream of the constructed fish way is a small concrete weir which likely restricts or blocks upstream fish passage. It may be possible to add a step pool structure downstream to lessen the jump height to clear the weir. This should greatly facilitate fish passage from the reservoir to spawning areas upstream.

Figure 6. Fish passage channel from the South Fork Reservoir to the South Fork North Fork Divide Creek.

West Pioneer Lakes

Ferguson Lake

Ferguson Lake is located on an unnamed tributary near the headwaters of Alder Creek at an elevation of 7,528 ft. The lake is 17 acres with a maximum depth of 48 ft and is highly productive (McMullin 1983). The lake habitat consists of a mostly silt bottom with submerged aquatic vegetation beds located throughout the lake and lily pads in shallower water. The shoreline is densely treed with lodgepole pine and alder. A fire recently burned down to the north shoreline of the lake. The trailhead for the lake is located at the end of the Bryant Creek Road and it is a short 1.3-mile hike to the lake. The trail is also open to ATV use so the lake receives significant fishing pressure with increasing use of personal watercraft. Ferguson Lake was originally stocked with undesignated cutthroat trout in 1938, 1940 and 1953. It was also stocked with rainbow trout in 1942, 1948, and 1949. It was stocked primarily with rainbow trout from 1958-1971 when the species stocked was switched to Yellowstone cutthroat trout. The lake was first sampled in 1967 and only rainbow trout were captured in the net ranging in size from 10.7-15.6 inches (McMullen 1983). The lake was sampled again in 1982 and only Yellowstone cutthroat trout were caught ranging in size from 16.6-21.2 inches (McMullin 1983). The largest cutthroat captured was 4.5 lbs and was likely a 6-year-old fish from the 1976 plant and age 3 fish from the 1979 plant averaged 17.5 inches and 2.46 lbs. The lake was stocked on a 4-year cycle with Yellowstone cutthroat trout at a density of 63 fish/acre until 2008 when the species was switched to westslope cutthroat trout. Ferguson Lake has a reputation of producing trophy sized cutthroat trout since the stocking of the lake was switched from rainbow to cutthroat trout. As a result, it was one of 2 lakes in the Big Hole drainage with special regulations that restricted the possession limit to the daily limit of fish. This regulation was lifted during the period covered in this report because it was felt that it was attracting more anglers to the lake.

Ferguson Lake was surveyed again on 7/6/2011 when a single gill net was fished overnight. The net captured 18 westslope cutthroat trout and 3 Yellowstone cutthroat trout (Table 3). The 3-year-old westslope cutthroat ranged average length was 15.3 inches with fish as large as 17 inches. The 7-year-old Yellowstone cutthroat trout were all over 20 inches and in excellent condition (Figure 7). The stomachs of the fish were full of freshwater shrimp. Ferguson Lake continues to provide an excellent trophy-sized cutthroat trout fishery. There is no significant inlet to the lake and the outlet appears to only flow during snowmelt. The generally silty bottom of the lake does not provide any potential spawning areas within the lake. As such the lake has never supported any natural reproduction of rainbow trout, Yellowstone cutthroat or westslope cutthroat trout.

Management Recommendations

In the years since the introduction of westslope cutthroat trout, angler reports of fish over 20 inches have been increasingly rare and some anglers have complained that the trophy component of the fishery is no longer present. The westslope cutthroat appear to grow very rapidly similar to the Yellowstone cutthroat trout but it is unclear if they are surviving to older age classes where trophy size can be achieved. It is possible that harvest of the age-3 and age-4 westslopes is high which is causing the trophy component of the fishery to decline. It is also possible that westslope cutthroat trout are not surviving to older ages like the Yellowstone cutthroat did. To determine if larger age classes of westslope cutthroat trout are present the lake should be netted again in 2020 to determine the abundance and size of age-4 fish and see if any age-8 fish are present. If age-4 fish are rare, it may be necessary to adjust fishing regulations to restrict harvest. If age 4 fish are common but no age 8 fish are present, it may be prudent to consider reverting to Yellowstone cutthroat trout in the lake which were known for longevity. Ferguson Lake is in a drainage where there are no conservation population of westslope cutthroat trout and no plans for native fish restoration.

Figure 7. Age-7 Yellowstone cutthroat trout from Ferguson Lake in the West Pioneer Mountains.

Foolhen Lake

Foolhen Lake is located only 1 mile from Ferguson Lake to the northeast in a separate tributary to Alder Creek. The lake is 17 acres with a maximum depth of 48 ft (McMullin 1983) and is 7,528 ft in elevation. The lake has extensive silty shoals around its margins with common lily pads. The northwest shoreline, which also contains the inlet stream, is formed by floating bogs with shrubby willows and a few spruce trees. The inlet stream is perennial but lacks suitable spawning gravels. The outlet is small and also lacks suitable spawning habitat. Access to the lake can be gained 3 different ways. The first is through private property where Highway 34 crosses Alder Creek. A Forest Service trail exists upstream of the private property and leads to the lake. The 2 other access routes are via the Bryant Creek Road. The first is identical to the Ferguson Lake access except at Ferguson Lake one would continue on the ATV trail that ascends Foolhen Ridge. This trail follows Foolhen Ridge approximately 2 miles where a poorly marked foot trail descends to Foolhen Lake below (visible from trail). This trail down to the lake is closed to motorized use but many ATV's have traversed it and caused damaged to the wet meadows above the lake. The last access is obtained by turning on Forest Road 7391 off the Bryant Creek road. Near the end of this road is an ATV trail that ascends straight up Foolhen Ridge and joins in to the ATV trail from Ferguson Lake.

Similar to Ferguson Lake, Foolhen has been stocked with undesignated cutthroat trout and rainbow trout from 1938 to 1971. From 1976 to 2006 the lake was stocked on a regular cycle with Yellowstone cutthroat trout. In 2010 westslope cutthroat were stocked on a 4-year basis at 111 fish/acre. The lake has been sampled 2 times prior to this report in 1967 and 1982. No fish were captured in 1967 (fish were observed rising in lake) and only Yellowstone cutthroat trout were captured in 1982 (McMullin 1983). Only 2 age-3 Yellowstone cutthroat were captured averaging 15.8 inches. The condition of the fish was good and growth was noted as excellent.

Foolhen Lake was sampled again on 7/6/2011 when a single gill net was set overnight. A total of 12 Yellowstone cutthroat trout were caught in the net and another 2 additional fish were captured via angling (Table 3). Two westslope cutthroat were caught via angling. The average size of Yellowstone cutthroat captured were much smaller than the nearby Ferguson Lake, despite having been stocked in the same year. Similarly, the age-3 westslope cutthroat trout were small compared to those in Ferguson Lake. It is possible that the stocking rate of Foolhen Lake is too high relative to the amount of fishing pressure the lake receives. There is 1 camping area near the outlet of the lake that appears to receive limited use.

Beginning in 2014, Foolhen Lake was stocked with golden trout. The stocking of golden trout has occurred by hand in this drainage rather than by air because of the potential of hybridizing species being mistakenly stocked in a nearby drainage where there are westslope cutthroat trout. Few fish were successfully stocked in 2014 because of a leak in the tank used to transport the fish to the lake caused high mortality. The lake was stocked again in 2017 with golden trout and the plant was initially more successful than the 2014 plan. The lake has not been subsequently monitored to determine the survival of the fish after being released to the lake.

Management Recommendations:

Given the relatively poor growth rate of Yellowstone and westslope cutthroat trout in Foolhen Lake, the stocking rate of golden trout was lowered from 100 fish/acre to 67. Foolhen Lake obviously receives less fishing pressure than Ferguson and therefore warrants a lower stocking rate. The current stocking rate should be evaluated in 2020 to determine if it is producing the size of fish expected for a relatively productive, stocked lake. Additionally, the success and angler satisfaction of the golden trout should be evaluated. Sampling at other recently stocked golden trout lakes suggests the survival of stocked fish can be variable (see Rainbow Lake below). It is unclear if the golden trout introduced to Foolhen Lake have survived. Golden trout also have a reputation of being difficult to catch. Therefore, it will be important to gage the satisfaction of anglers with golden trout in this lake. The stocking of the lake could easily be switch back to westslope cutthroat trout if anglers preferred this species over golden trout.

Squaw Lake

Squaw Lake is located near the headwaters of Christiansen Creek (formerly called Squaw Creek) at an elevation of 6,980 ft. The lake is likely the only remaining lake with an aboriginal population of non-hybridized westslope cutthroat trout. The lake is located on an unnamed tributary to Christiansen Creek and the size and depth of the lake appears to be influenced significantly by a beaver dam located at the outlet. It is interesting that beaver are actively using Squaw Lake because there are no willows around the lake. The constructed dam is made entirely of felled conifers. The lake habitat is shallow with a generally marshy perimeter and silt bottom. The lake appears shallow, but no depth measurements have been taken. Lilypads are common around the shore of the lake. The lake inlet is large enough to support spring spawning, but it is sandy and has no gravel. The stream outlet below the dam flows through a channel dominated by large boulders and other coarse substrate with very limited gravels. Access to the lake can be obtained through private property from downstream to Trail #3096 which leads past the lake. Access can also be obtained through the #2086 trailhead at the end of Bryant Creek road to Trail #3098. There is no stocking record for the lake and there is no previous sampling history.

Squaw lake was sampled in mid-June 2013 as part of an effort to collect wild westslope cutthroat trout eggs from the Christiansen Creek drainage to refound Cherry Creek and Cherry and Granite Lakes after non-native fish removal. A single gillnet was fish across the inlet stream for for10-min intervals and captured fish were removed alive and held in a live car in the stream for spawning. A total of 38 fish were captured in the net sets ranging in size from 10.8-15.4 inches. No weights were taken but the fish were noted as being in good condition. Nearly 10,000 eggs were collected from these fish and used to repopulate the Cherry Creek system. One 17-inch brook trout was also captured in Squaw Lake. Because of the success of the egg take in Squaw Lake crews returned to the lake in 2015 to determine if eggs could be collected again; however, no fish were caught in the overnight gill net set. During the intervening 2 years beavers had raised the elevation of the outlet dam by roughly 2 ft, raising the water elevation and increasing the surface acreage of the lake by 2.1 acres or by 42% (Figure 8). It is unclear if the change in elevation of the lake contributed to the loss of fish from the lake. It is possible that higher lake levels inundated more of the swampy shoreline and lead to greater organic decomposition in the winter under the ice and lower oxygen levels. It is also possible that the higher dam height precludes fish passage from downstream and given the lack of spawning habitat upstream of the lake it is possible that the fish simply died out. No juvenile fish were

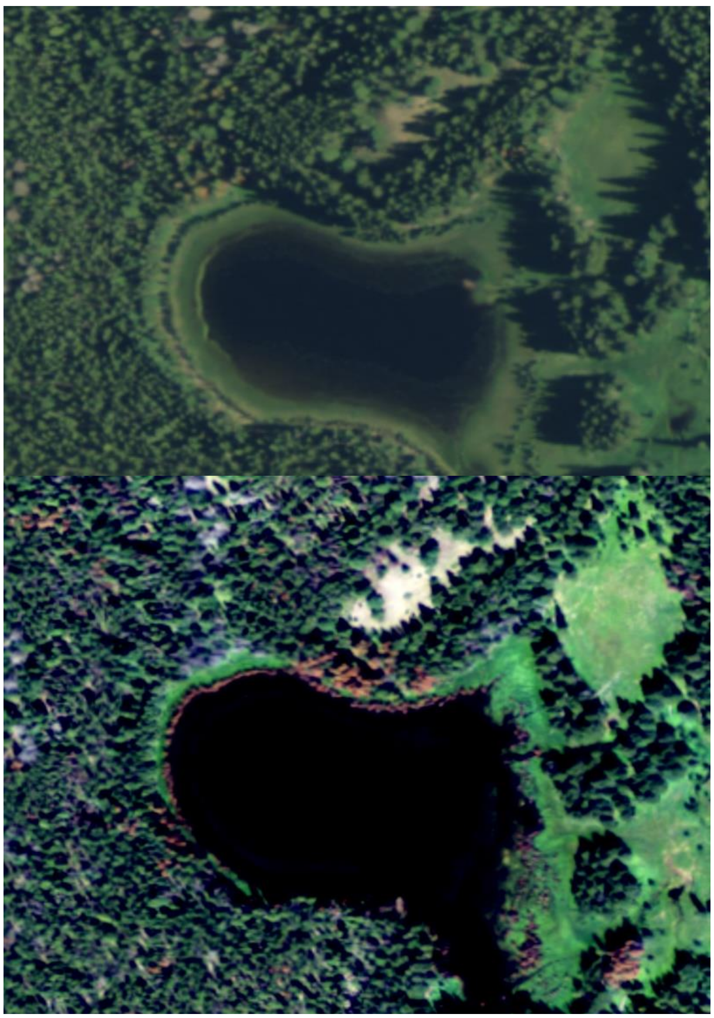

Figure 8. Squaw Lake in 2011 (upper) and in 2013 (lower).

captured in the 2013 sampling suggesting that even then there may have been limited or no fish passage. Additionally, stream surveys conducted in 2012 found several juvenile cutthroat in the stream downstream of the lake but it appeared that the dam at the lake outlet had recently been raised (Olsen 2012). It is possible that the recruitment of fish to the lake is entirely dependent on fish access from downstream Squaw Creek and when beavers emigrate to the lake and re-establish the dam fish in the lake are extirpated.

Management recommendations:

It is unclear what actions can be taken to return fish back to Squaw Lake. It does appear that the beaver dam on the outlet stream has had an impact on that fishery. However, since brook trout have now colonized the headwaters of the stream including Squaw Lake, it is uncertain if this population of aboriginal cutthroat trout will persist.

Bobcat Lakes

Bobcat Lakes are located at the headwaters of Bobcat Creek in the Lacy Creek drainage which empties into the Wise River. There are 4 lakes in the same general vicinity with the north lake being at an elevation of 8,405 ft. The north lake is listed is 6 acres and 34 ft deep (BNF 1992) and is contains a grayling fishery. The south lake is also listed as containing grayling and the middle lake is listed as fishless. The 4th lake is located to the southeast of the south lake and appears too shallow to support fish. There is no stocking record for any of the Bobcat lakes and there is no previous sampling history.

North, South and Middle lakes were gillnetted on 8/28/12. A single gill net was set in the south and middle lakes and 4 nets were set in the north lake. No fish were found in the south and middle lakes and 39 grayling were caught in the 4 gill nets. The objective of this netting was to collect fish for genetic analysis. The grayling ranged in size from 7.4-12.2 inches (Table 3). Genetic analysis indicated that the Bobcat Lake grayling are of Montana origin but most likely came from Red Rock lakes (Dehan et al. 2013).

Management Recommendations:

No management changes are recommended for North Bobcat Lake or the other Bobcat lakes. North Bobcat Lake supports a population of Arctic grayling that has conservation value.

Schwinger Lake

Schwinger Lake is a small (4 acres) but relatively deep (30 ft) lake located at the headwaters of Lacy Creek in the Wise River drainage. The elevation of the lake is 8,220 ft and it is located at the north end of a cluster of lakes that also includes Lake of the Woods and Odell Lake. Access to the lake can be obtained either through Lacy Creek (Trail 2750 to 2758) or from Odell Creek (Trail 2758) and both are about a 5 mile hike. There is no stocking record for Schwinger Lake nor any previous sampling history. The lake is reported to have a self-sustaining population of Arctic grayling (BNF 1992).

Schwinger Lake was sampled on 7/3/15 by fishing multiple (# of nets not specified in data) gill nets overnight in an effort to collect genetic samples from Arctic grayling. A total of 51 grayling were captured from 4.3-8.2 inches. The size of graying in Schwinger is small but the population is self-sustaining and thriving. It is likely that the grayling in Schwinger Lake are also of Montana origin and of conservation value.

Management Recommendations:

No management changes recommended for Schwinger Lake. Harvest of graying should be encouraged to increase the overall size of fish in the lake as it currently appears to be overpopulated.

Odell Lake

Odell lake is located at the headwaters of Odell Creek at an elevation of 8,310 ft. The lake is relatively large (33 acres) with a maximum depth of 35 ft. The lake is accessed from the Wise River Highway by turning off at the Wyman Creek road and following this road to its terminus at the Odell Creek Trailhead. Trail 2758 follows Odell Creek roughly 5 miles to Odell Lake. The lake has no previous stocking record or any previous sampling history. It is reported to have grayling and cutthroat trout (USFS 1992). Previous stream sampling immediately downstream of the lake in Odell Creek found non-hybridized westslope cutthroat trout. There are no fish barriers in Odell Creek and if cutthroat trout are present in the lake, Odell Lake may represent an aboriginal population of westslope cutthroat trout in an alpine lake.

Odell Lake was sampled on 8/28/12 when a series of 8 different gill nets were set over a 2-day period to capture grayling for genetic analysis. A total of 46 grayling, 7 cutthroat and 9 brook trout were captured (Table 3). The grayling ranged in size from 6.0-12.5 inches and the cutthroat and brook trout, although significantly less abundant ranged in size up to 14.5 inches. The cutthroat captured in the net had the appearance of being hybridized with rainbow trout. Previous genetic samples from farther down the drainage have shown indications of minor amounts of hybridization with rainbow and Yellowstone cutthroat trout. This is the first time brook trout have been documented in Odell Lake. Brook trout colonization is likely are result of the slow expansion of brook trout from downstream rather than an illegal introduction. Brook trout presence in the lake is likely less of a concern to native fish as the presence of the fish in the stream. The lake overall provides a diverse fishery for pan-sized graying and trout.

Management Recommendations:

Odell Lake should continue to be managed to provide a fishery for primary Arctic grayling. Future monitoring should include the taking of genetic samples from cutthroat trout in the lake. The abundance of brook should be monitored through time for potential impacts on grayling and cutthroat and the overall quality of the fishery in the lake.

Table 3. Fisheries survey data from West Pioneer lakes from 2008-2010 where length is in inches and weight is in pounds. The fish species abbreviations are: LL = brown trout, RB = rainbow trout, EB = brook trout, WCT = westslope cutthroat trout, YCT = Yellowstone cutthroat trout, M COT = mottled sculpin, LSU = longnose sucker, WSU = white sucker and AG = Arctic grayling. Condition factor (K) and Spawning habitat are described in the methods section. Use is a qualitative measure of use and recreation related impacts at the lake. Amphibian abbreviations are: SF = Columbia spotted frog, TF = tailed frog, WT = western toad and SS = spotted salamander.

Lake	Temp (°F)	pH	Cond. (µS)	Species	#/net	Avg L (range)	Avg W (range)	Spawning Habitat			Use	Amphibians
								Inlet	Outlet	Shore		
Ferguson	73.1	7.4	64	WCT	18	15.3 (13.7-17.1)		P1	P1	P2	Heavy	SF
				YCT	3	20.4 (20.1-20.8)						
Foolhen	68.0			WCT	2	10.6 (10.6-11.2)		P2	P5	None	Light	SF, WT
				YCT	14	14.8 (13.9-16.3)						
Squaw				WCT	38	12.6 (10.8-15.4)		P2	P5	None	Light	SF
				EB	1	17.8						
North Bobcat				AG	7.8	10.5 (7.4-12.2)						
Middle Bobcat				Fishless								
South Bobcat				Fishless								
Schwinger				AG	51*	6.9 (4.3-8.2)						
Odell				WCT	0.88	10.4 (7.2-14.5)						
				AG	5.8	10.1 (6.0-12.5)						
				EB	1.1	9.2 (6.0-14.5)						

* Total number captured not number per net

East Pioneer Lakes

Cherry and Granite Lakes

Cherry Lake is one of two lakes located at the headwaters of the Cherry Creek drainage. The lake is 7.4 acres and 25.7 ft deep (Olsen 2011). It was stocked with undesignated cutthroat trout in 1946 and with rainbow trout in 1948 and no other recorded stocking exists for the lake (stocking records mention Cherry Lakes, which may have included adjacent Granite Lake). Access to the lake is gained by an ATV trail that is rough and steep and follows Cherry Creek. The fishery was previously sampled in 1992 and 2005. Genetic samples collected during the 2005 sampling event indicated the fish in Cherry Lake were non-hybridized westslope cutthroat trout. Subsequent testing in 2006 indicated the fish were highly hybridized with both rainbow (2%) and Yellowstone cutthroat trout (16.4%). These very different results from samples collected only a year apart has led to confusion about how the fish in this lake should be managed.

Granite Lake is located approximately 0.5 miles from Cherry Lake. It is 7.0 acres and has a maximum depth of 15.9 ft (Olsen 2011). Access to the lake is via the same ATV trail as Cherry Lake except that shortly after the last crossing over Cherry Creek the trail forks and the north fork leads to Granite Lake. This lake is shallow with an extensive silt flats around most of the lake. The stream flowing into and out of Granite Lake is larger than that at Cherry Lake and contain good quality spawning habitat. There is no historical stocking record for Granite Lake and the origin of the fish in the lake is unknown (Brammer et al. 1992). It is likely that it and Cherry Lake were historically fishless because large cascades located farther downstream in Cherry Creek which likely precluded upstream fish passage. Genetic testing of the cutthroat trout in the lake in 2004 indicated the population was slightly hybridized with both rainbow trout (5%) and Yellowstone cutthroat trout (3%).

Both Cherry and Granite lakes were part of a large scale westslope cutthroat trout restoration project that was initiated in 2011. A fish barrier was constructed on Cherry Creek approximately 1.5 miles upstream of the confluence with the Big Hole River. The entire stream upstream of this location including Cherry and Granite lakes was treated with rotenone to remove non-native brook, brown and hybridized cutthroat trout. Although a section of the stream and Granite Lake both contained a conservation population of WCT, it was determined that restoring pure cutthroat from the Big Hole drainage was a higher priority because the Cherry Creek drainage including the headwater lakes could serve as a source non-hybridized fish to aid in restoration projects elsewhere in the Big Hole. A repopulation plan was developed, and eggs were collected from 7 sources of non-hybridized cutthroat trout within the Big Hole drainage over the course of 3 years (Olsen 2017) and uses to repopulate the lakes and the stream.

Beginning in the spring of 2016 attempts were made to collect and fertilize eggs from spawning cutthroat trout in Cherry and Granite lakes. Fish were captured via electrofishing in the inlet and outlet stream of Granite Lake on July 1. Fish size ranged from 8.8-15.6 inches. A total of 70 cutthroat were spawned. Generally one female was crossed with 2 males. Individual egg lots were kept separate and the eggs were transported to the Sun Ranch Isolation facility near Ennis for incubation to the eyed stage. There was 0% eye up of eggs collected from Granite Lake. It was postulated that the warm water temperatures in the lakes at the time of spawning contributed to poor fertilization success. The water temperature in the outlet stream of Granite Lake (also the surface water temperature of the lake) was in the mid 60's F at the time of egg collection. It was suspected that poor milt quality was the reason for poor egg success (milt was stringy). It was also postulated that the rough ride and long time between egg collection and transport to Sun Ranch could have also contributed to the poor success observed. Despite 0% success, it became clear that collection of eggs at these lakes could result in gathering tens of thousands of eggs if techniques could be refined.

In 2107, a second attempt was made at collect gametes from Cherry and Granite lakes. To improve milt quality, fish were collected in Cherry and Granite lakes soon after ice out in mid-June. Because fish had not yet migrated to the streams to spawn, they were captured using short duration gill net sets across the outlet areas of both lakes. The nets were set in shallow water and as fish would become entrapped in the net, they would be immediately removed and segregated by sex. Males were transported to the inlet streams which were snowmelt fed and significantly colder (mid 40's F) than the lake and outlet stream. Females were held in the lake near the outlet in warmer water. Males were almost exclusively caught in mid-June, but as the lake water warmed, more females began cruising the shore and would become entrapped in the nets. In 2017 rather than spawn all fish on single date, as females became ripe, they were spawned and the eggs transported to Sun Ranch. In addition, to test the theory that transport to Sun Ranch could also be causing egg mortality, a small proportion of the eggs collected from Granite Lake were placed directly into an incubator in the outlet stream of the lake. The first egg collection at Granite Lake occurred on 6/21/17 and egg collections occurred 3 additional times until 6/28/17. Egg were also collected from Cherry Lake beginning on 6/23/17. A total of 46 fish were spawned between the 2 lakes ranging in size from 10.7-18.7 in and the eggs transported to Sun Ranch. Sperm quality appeared to be significantly better by holding males in the cold inlet stream. There was near 0% eye-up of eggs at the Sun Ranch facility; however, the incubator at Granite Lake demonstrated over 80% eye-up. The eggs were incubated until swim-up in Granite Lake and the fry were captured and stocked into Granite and Cherry lakes.

In 2018 additional adjustments were made to spawning protocols. Large (6Lx4Wx3H), steel framed live cars were made to house males and females while awaiting spawning. These live cars were made such that they could be collapsed and transported via ATV. A sperm activator solution that is used during captive breeding spawning at Washoe Park hatchery was used at Cherry and Granite lakes to activate all sperm. In 2018 no eggs were transported to Sun Ranch; rather, they were incubated in the inlet streams to both Cherry and Granite lakes (eggs from Cherry Lake had to be transported to Granite Lake shortly after eye up due to low inlet flows). Additionally, 4x6 ft fyke nets were fished in each lake to catch spawning fish. This technique proved much more efficient at capturing fish and much easier on fish. Transport of the nets to the lakes proved difficult but was accomplished by use of a BLM UTV with a bed. Nets would be checked 2 or 3 times a week and all females were spawned as they ripened. A total of 16 females were crossed with 26 males at Granite Lake and 29 females were crossed with 63 males at Cherry Lake and close to 50,000 eggs were collected from June 20 to July 9. These eggs were incubated in the inlet stream for nearly 1 month in a series of 4, 5-gal incubator buckets. Eggs were checked 1-2 times per week and dead eggs were picked from the buckets. As eggs eyed, they were transported to various stream for stocking.

In 2019 4x6 ft trap net frames were modified so that they could be collapsed and transported separately from the net. This allowed the nets to be transported on ATV's rather than a larger UTV. Additionally, an isolation facility at Washoe Park was completed in the winter of 2018-2019 and was used to incubate all eggs collected at Cherry and Granite lakes. The eggs were raised to fingerlings in the hatchery before being stocked. A cold spring led to later than normal spawning at Cherry and Granite lakes. The first females were spawned on 7/3/19. A total of 8 females and 16 males were spawned from Granite Lake and 72 females and 89 males from Cherry Lake. The last lot of eggs was taken on 7/22/19.

The total number of fish collected at Granite Lake has steadily declined since 2016 whereas the number of fish in Cherry Lake has remained relatively constant. The average size of fish has declined as well during this time period. This decline in fish size is likely related to the high growth rate of trout introduced after treatment with rotenone when fish densities were low and food abundant. As additional age classes of fish have been added to the lake growth has steadily slowed. The decrease in abundance in Granite Lake is most likely related to the lack of recruitment in the lake except for 2018 and 2019. There appears to be some natural reproduction in Cherry Lake which has maintained numbers more constant in the lake. Cherry Lake was also initially stocked at a higher density than Granite Lake which may have resulted in slower growth and potentially longer survival. There are many younger aged fish in Granite Lake that will recruit to spawning age in the next two years. The peak spawning time of cutthroat trout Granite Lake is generally about a week earlier than Cherry Lake.

Management Recommendations:

Cherry and Granite lakes should be managed primarily for the purpose of maintaining a brood source of Big Hole origin WCT that can be used for restoration purposes. Numbers of fish should be managed such that average female size is from 12-14 inches. Currently the lakes are stocked annually at a rate of 30 fish/acre with Cherry and Granite fish. This rate may be adjusted based up on the size of fish that result. Maintaining average size of 12-14 inches will also produce a nice fishery for the anglers. There are no special regulation at the lakes and because of the relative ease of access they receive a fair amount of angling pressure. Beginning in 2020, a methodology of introducing additional wild genes into the brood at Cherry and Granite will begin to maintain the genetic diversity of the brood population and to mimic as closely as possible wild populations of westslope cutthroat trout from the Big Hole.

Canyon Lake

Canyon Lake is the first of a series of 3 lakes in the Canyon Creek drainage that contain fisheries. Access to the lake is gained by traveling up the Canyon Creek road to the end at the Canyon Creek Guest Ranch and trailhead. The trail (2092) to the lake follows Canyon Creek for 1.3 miles then splits and crosses Canyon Creek and begins to climb. The trial splits again (2088) and heads to Canyon Lake. Canyon Lake is 14 acres and is relatively shallow (9 ft) with a silt bottom. Past sampling in the lake suggested it was one of the most productive lakes in the East Pioneer Mountains (Oswald 1983). The lake has been stocked 3 times from 1936 to 1948 with rainbow and undesignated cutthroat trout. Canyon Lake has been sampled one other time in 1983 and at that time only rainbow/cutthroat hybrids were present in the lake.

Canyon Lake was sampled with a single overnight gillnet set on 7/16/14. A total of 52 brook trout and 8 cutthroat trout were captured in the net. Average brook trout length was only 8.4 inches (Table 4). Weights were only taken on the first 30 brook trout captured in the net. Cutthroat trout were only slightly larger but in poorer condition. No brook trout were captured in the previous sampling in the lake. It is unclear if brook trout were illegally introduced to the lake or if they migrated up from Canyon Creek below (the stream below was not surveyed for potential fish barriers). Regardless of their origin, Canyon Lake is overpopulated with fish and fish size and condition is poor (< 30 for cutthroat trout). Canyon Lake is picturesque and a great location to take a beginning angler where they can catch high numbers of fish (Figure 9). Angler harvest of trout from the lake is encouraged. Use at Canyon Lake appears to be less than Lake Abundance and Crescent Lake nearby. No amphibians were observed at the lake but it appears to have high quality amphibian habitat with grassy margins and abundant littoral areas.

Figure 9. Canyon Lake (top) and fish from a single gillnet from Canyon Lake.

Lake Abundance

Lake Abundance is located upstream of Canyon Lake and can be accessed either through the route described for Canyon Lake which trail leads from Canyon Lake to Lake Abundance or by staying on Trail 2092. Lake Abundance is a relatively small (7 acre) but moderately deep (35 ft) lake with low overall productivity (Oswald 1983). The lake habitat consists of large boulders and an otherwise silt bottom.

The shoreline is heavily treed with a scattering of boulders some of which extend out into to lake. The fishery in the lake has been sustained by stocking beginning in 1948 when cutthroat trout were stocked. In the early 1980's the lake was stocked on a consistent (typically 4 year) basis with Yellowstone cutthroat trout. The lake has been sampled twice previously in 1967 and again in 1983 (Oswald 1983). Initially 2,000 fish were stocked into the lake (over 200 fish/acre) and the number of fish stocked was lowered to 700 (77 fish/acre) in 1990 to produce better fish growth. The species stocked in the lake was switched to westslope cutthroat trout in 2006.

On July 18, 2014 a single gill net was set for 2 hours at Lake Abundance. The reason for the short gill net set was that many cutthroat were captured via angling and the gill net was set to check for evidence of natural reproduction. Only 2 westslope cutthroat trout were captured in the net but a dozen or more were captured via angling, all of which appeared to be the same age class. In 2014, the fish captured were only 11 inches and would have been from the 2010 plant and would have been 4 years old. Growth appears to be slow in the lake despite a lower stocking rate (77 fish/acre). Despite their small size, the condition of the cutthroat in Lake Abundance was average to above average. There is limited spawning habitat in the inlet and outlet. Use at the lake is moderate with a few camping areas on the north and west sides of the lake.

Crescent Lake

Crescent Lake is the largest lake in the Canyon Creek system of lakes (24 acres) with a maximum depth of 22 ft (Oswald 1983). The lake is approximately ¼ mile from Lake Abundance at the head of the Canyon Creek drainage at an elevation of 8,600 ft. The lake habitat is a mix of boulders and silt with several islands along the west, north and east shores with the south shore being a steeper talus slope into the lake. The shoreline is a mix of timber boulders with a few open meadows, particularly on the east shore. There are 3 inlet streams to the lake with the main inlet being on the southwest side of the lake. The inlet on the southeast side of the lake has some limited spawning habitat but is very sandy. Some limited spawning habitat was also present in the lake along the shoreline and fish were observed actively spawning in some of these areas. The lake was stocked with undesignated cutthroat trout from 1946 through 1949. The lake was stocked on a regular (4-year) basis starting in 1976 with McBride strain Yellowstone cutthroat trout. The lake was stocked at a low density (33 fish/acre). The species stocked into the lake was switched to westslope cutthroat trout beginning in 2008. Crescent Lake has been sampled 2 times before in 1967 and again in 1983. Both previous sampling events found both cutthroat trout and rainbow trout (and their hybrids) in the lake. The origin of the rainbow trout in the lake is unknown.

On July 18, 2014 a single gill net was fished on the southwest shore of the lake for 3 hours. The net captured 10 trout: 1 Yellowstone cutthroat trout, 4 westslope cutthroat trout, 4 rainbow trout and 1 hybrid (Table 4). The condition of the fish was average with some of the fish reaching quality size. If the one Yellowstone cutthroat trout captured was a result of stocking, the fish would have been a minimum of 10 years old. It is likely that the 14.5-inch westslope was a 6-year old fish while the others (average length 8.4 inches) were age-2 from the 2012 plant. Although the current stocking density of westslope cutthroat into Crescent Lake is low (34 fish/acre) it is recommended that stocking be discontinued because there appears to be adequate natural reproduction lake to support the fishery. The addition of fish through stocking could be detrimental to fish size in the lake by increasing competition for food resources. The lake received moderate use similar to Lake Abundance with several campsite along the western, northern and eastern shores. The area is used by the Canyon Creek guest ranch which use stock to access the lakes with their clients.

Grace Lake

Grace Lake sits in an isolated cirque basin roughly 2 miles north east of Lake Abundance (Figure 10). Access to the lake was gained by trail 2092 to Trail 2152 then heading cross country (no trail) to the northeast to Grace Lake. There is no stocking record for Grace Lake and no previous record of sampling. The lake habitat consists of boulders. There is not inlet or outlet stream to the lake. The lake surface elevation appears to fluctuate annually based on snowmelt. At the time of this visit on 7/18/14 the lake elevation appeared to be approximately 6 ft below its highest elevation as evidenced by the logs around the shore of the lake. Additionally, grass growing below the water surface in the outlet area of the lake suggests the water would still drop another 3 ft before reaching low pool elevation. For the lake to fill and spill out the outlet the surface elevation would need to increase roughly 20 ft. A single gillnet was fished in the lake for 3 hours and yielded no fish. No fish were observed while at the lake. There is some potential spawning habitat along the shoreline, but the fluctuating water surface elevation may reduce spawning success. It appears that there is adequate water depth to support a fishery in the lake if a future stocking proposal were developed.

Figure 10. Grace Lake in the East Pioneer Mountains.

Management Recommendations for Canyon Creek Lakes

Harvest of trout in Canyon Lake should be encouraged to reduce numbers of fish to provide a higher quality fishery. Beginning in 2014 Lake Abundance was switched from a 4-year stocking cycle to a 6-year cycle. This was switched back to 4-year cycle in 2020 and the stocking rate was reduced from 77/acre to 55/acre. Crescent Lake was removed from the stocking schedule after 2014 because reproduction appears adequate to sustain the fishery and the additional of cutthroat trout stocking could lead to overpopulation and reduced fish size.

Teacup Lake

Teacup Lake is in the Jacobsen Creek drainage in a small cirque basing located to the north of the main drainage. Access to the lake is obtained via the Jacobsen Creek trail leading to Tahepia Lake (1002) then to Trail 2751 which leads to the lake and then over the pass to Crescent Lake. The lake substrate consists of primarily silt with a scattering of boulders. The lake appears shallow although no depth measurements were made. There is no previous stocking record for Teacup Lake and no previous sampling. A single gillnet was set for 6 hours in the lake and no fish were captured. The lake may be too shallow to support a fishery; however, Teacup provides excellent habitat for amphibians. With its southern exposure and extensive littoral areas, there were abundant spotted frog adults and tadpoles present in the lake. Long-toed salamanders were also present at the lake.

Tahepia Lake

Tahepia Lake is a moderate sized (13 acres) but relatively shallow (20 ft) lake located at the head of Jacobsen Creek. Access is gained via the Jacobsen Creek trail (1002) and is about 6 miles from the trailhead. The grade of the trail is gradual for the first 2.5 miles as it follows Jacobsen Creek through a wide meadow but quickly increases after leaving Jacobsen Meadows. The lake is one of the highest in the Big Hole drainage (8,920 ft) and has moderate productivity for a mountain lake (McMullin 1983). The lake habitat consists of large silt flats near the outlet and around the west, north and east shorelines with some boulders. The south shore is a talus slope that extends down into the water. The north shore, which contains the lake inlet, is a large grassy flat that extends to the lake edge. The lake quickly drops off from this flat into depths where the bottom is no longer visible. The fisheries history of Tahepia Lake is interesting. Rainbow trout were historically stocked into the lake, but there is no stocking record. It has been sampled 4 times in the past: 1967, 1972, 1982 (McMillin 1983) and in 1992 (Brammer et al. 1992). Prior to the mid 1980,s the lake supported a self-sustaining, high quality rainbow trout fishery with fish over 4 lbs (McMillin 1983). However, sometime in the mid 1980's the fishery in the lake began to diminish and anglers began reporting poor fishing. Rainbow trout were stocked on a 4-year basis from 1992-2012 with 1,000 fish every 4 years and special regulations of a restricted possession limit of fish being 5, with only one over 18 inches was enacted. In 2012 stocking of rainbow trout stocking ceased and the special regulation was removed.

Tahepia Lake was sampled on 8/20/12 with an overnight gill net set. A total of 10 rainbow trout were captured in the net (Table 4). The net was set across the outlet lobe of the lake which was shallow (< 4 ft deep) which may have influenced the catch rate of fish. The size structure of the fish captured would suggest that natural reproduction is again occurring in the lake. The 2012 plant of rainbow trout would have been too small to have been captured in the gill net and there were clearly multiple age classes of fish up to the largest fish captured which was just over 17 inches. The condition of the trout captured in the lake was good. Use at the lake was moderate. The inlet stream comes in from the north and has some spawning habitat but most of the stream substrate is sand. The outlet stream has some spawning habitat but with larger substrate. Juvenile fish were observed in the outlet stream that were likely naturally produced.

Upper Schultz Lake

Upper Schultz Lake is a small (7 acre) and shallow lake (12 ft) lake located ¼ mile from Tahepia Lake. The lake sits in separate small basin southwest of Tahepia Lake and the main Jacobsen Creek drainage. Access is gained via the same trailhead as Tahepia Lake but approximately 1.5 miles before reaching Tahepia the trail forks and the right fork (Trail 2752) leads to lower and upper Schulz lakes and back around to Tahepia Lake. Upper Schulz Lake is one of the most productive lakes in the Big Hole (McMillin 1983) and has good spawning habitat in both the inlet and outlet streams. The stocking records do not distinguish between Upper and Lower Schultz lakes, but the lakes appear to have been stocked with both rainbow and cutthroat trout from 1941 through 1963. In 1979 Yellowstone cutthroat trout were stocked and no stocking has occurred since. The lake has been sampled twice previously in 1982 (McMullin 1983) and in 1992 (Brammer et al 1992). In 1982 it was found to contain both rainbow and Yellowstone cutthroat trout and one fish that was considered a hybrid (McMullin 1983) but the majority of fish in 1992 were classified as Yellowstone cutthroat (Brammer et al. 1992).

Upper Schultz was sampled on 8/21/12 when a single gill net was fished for 6 hours and caught 15 trout. The fish captured ranged in appearance from rainbow trout, Yellowstone and westslope cutthroat trout and their hybrids. Because of the lack of stocking at the lake and the difficulty in distinguishing the species, the fish were lumped and classified as cutthroat hybrids (Table 4). The presence of fish that appeared to be westslope cutthroat has not been noted in past sampling and their origin is unknown. The fish in the lake were in average condition and reached quality size (17 inches). Upper Shultz Lake appears to be still producing a fishery of average to above average trout without stocking. The condition of the fisher is very similar to what was found in 1982 when it was last sampled.

Lower Schultz Lake

Lower Schultz Lake is very similar in size and depth to the Upper Shultz Lake but is less productive (McMillin 1983). Spawning habitat is also present in the inlet and outlet of the lake and fish have been self-sustaining for at least the last 25 years. The lake was sampled with a single gillnet fished overnight on 8/21/12 and caught 16 trout (Table 4). Similar to Upper Schultz lakes, the fish appeared to be a mix of Yellowstone cutthroat, rainbow trout and their hybrids but no fish appeared to be westslope cutthroat. The condition of trout in Lower Schultz Lake was greater than that of upper Schultz Lake but the fish length was the similar. Lower Schultz Lake has a moderate quality fishery for self-sustaining trout.

Management Recommendations for Jacobsen Creek lakes

Stocking should not be considered for Teacup Lake because of its shallow depth and high-quality amphibian habitat. Tahepia Lake should be sampled in the near future to ensure that the rainbow trout population continues to be self-sustaining. If reproduction cannot sustain the fishery, it should be stocked with westslope cutthroat trout. No management changes are recommended for Schultz lakes.

Tendoy Lake

Tendoy Lake is a relatively large (21 acres) and deep lake (99 ft). The lake habitat consists of steep talus slopes along the southern shore that transitions to a sandy beach along the west shore that quickly drops off into depths where the bottom is no longer visible. The north shore is forested, and the limited littoral area is a mix of boulders and silt but still drops off quickly. The east shore has a more gradual slope with primarily boulder substrate. The lake has been modified to store water for irrigation by a small dam constructed across the outlet of the lake. The dam raises the water surface elevation of the lake roughly 4 ft. This increase in water surface elevation causes a secondary lake outlet to become activated to the north of the normal lake outlet. This alternative lake outlet would normally drain into Long Branch Creek which drains into Rock Creek; however, a ditch has been constructed to bring water around a small hill back into the Willow Creek drainage. That lake has been stocked with Yellowstone cutthroat trout beginning in 1968. In 2006 the species stocked was switched to westslope cutthroat trout. Some natural reproduction occurs at the lake but there is limited spawning habitat so stocking appears to be necessary to sustain the fishery (Oswald 1983). The stocking rate for the lake is 91 fish/acre. Tendoy Lake has been surveyed 2 times previously in 1972 and 1983 (Oswald 1983). In 1972 the fish captured ranged in size from 7.0-10.7 inches. Fish in 1983 were larger with the largest fish being 16.6 inches.

Tendoy Lake was sampled 2 times during the time period covered in this report. The first was on 8/13/15 when a single gillnet was fished across the lake outlet for 4 hours while bathymetric measurements were made. This net captured 3 trout that appeared to be Yellowstone cutthroat and 2 that appeared to be westslope cutthroat (Table 4). The bathymetric map generated is shown in Figure 11. Like past depth surveys (Oswald 1983), the lake was found to be nearly 100 ft deep with steep shores and a total volume of nearly 1,000 acre-ft of water. The lake was sampled again on 9/15/16 when 5 gill nets were fished overnight in various location across the lake. The purpose of this sampling was to collect genetic samples from cutthroat in the lake. In the 5 gill nets a total of 27 trout were captured. Of the fish that were genetically tested, 3 were westslope cutthroat trout, 10 were hybrids and 13 were Yellowstone cutthroat. The size of the trout in the lake exceeded 20 inches and although no weights were taken the condition of the larger fish was excellent. The diets of the fish were dominated by scuds which likely contributed the high growth rate of the fish. Unlike past surveys where Yellowstone cutthroat trout reproduction appeared to be limited (Oswald 1983), these surveys suggest that the Yellowstone cutthroat trout are able, with a relative high degree of success, reproduce in the lake. Given the limited observed spawning habitat (inlet is mostly sand, and outlet is mostly boulders) it is unclear where the spawning is occurring.

The headgate located on the dam outlet structure has completely failed and collapsed. The culvert flowing through the dam is also partially plugged by rocks and debris which have fallen down the face of the dam. Further, the ditch around the mountain which brings water that flows out the secondary outlet back into Willow Creek had completely failed. When the lake inflows in the spring exceed the capacity of the partially plugged culvert, Tendoy Lake surface elevation increases, and the secondary lake outlet flows water into Long Branch Creek. Westslope cutthroat trout restoration occurred in Long

Branch Creek and it was determined that fish from Tendoy Lake were making it to Long Branch Creek via the failed irrigation ditch.

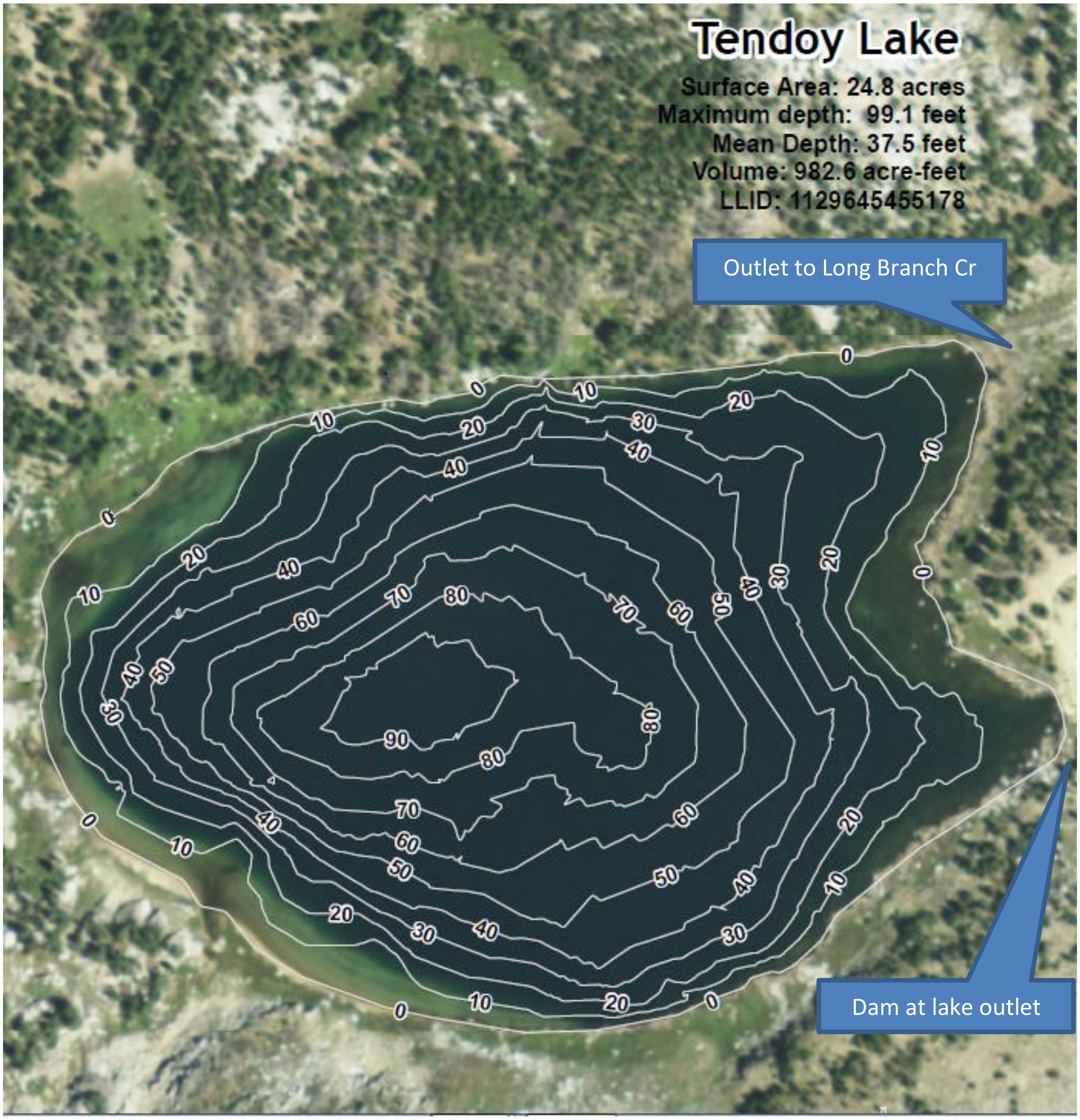

Figure 11. Bathymetric map of Tendoy Lake produced with depth and GPS measurements taken in 2015. Also show is the secondary outlet to Long Branch Creek and the normal lake outlet and dam to Willow Creek.

Because the dam on Tendoy Lake was causing water and fish from the lake to go into Long Branch Creek FWP worked with the water-right holder to develop a proposal to remove the dam. The water right holder agreed to allow FWP and the Forest Service to remove the dam and in mid-October 2017 the

Figure 12. Tendoy dam before breaching in 2015 (above) and 2 years after breaching in 2019 (below).

dam was removed using explosives. At the time of removal, the lake elevation was at low pool, so removal of the dam had no effect on stream flows. Two separate blasting events occurred on the same day to remove the dam material and open a channel that allowed water to freely exit the lake (Figure 12). The lake was surveyed to determine if the dam removal was successful at eliminating flows from the secondary outlet. In late June 2018 when flows began to recede there was no evidence that water had flowed down the secondary outlet. Snow drifts across the Long Branch outlet channel reached to the ground (no evidence that flowing water had formed a tunnel underneath). Even though the flows in the creek were still high in June the lake surface elevation would need to increase an additional 1.5 ft to reach the elevation where water would flow into Long Branch Creek. The dam removal appears to have been successful at eliminating flows and fish into Long Branch Creek. This will allow the restoration of westslope cutthroat trout in Long Branch Creek to be completed. Further, dam removal likely has created additional spawning habitat in the location of the old dam.

A proposal was developed to restore westslope cutthroat to the upper Willow Creek watershed. A natural fish barrier is present on Willow Creek downstream of the confluence of Gorge Creek and the area upstream has been proposed for cutthroat restoration. However, given the large size and volume of water in Tendoy Lake, treatment with rotenone would be very expensive (>$100,000). Therefore, a proposal was developed to attempt to “swamp” the Yellowstone cutthroat trout present in Tendoy

Lake. Swamping consists of stocking the desired species into the lake at a high frequency and high rate for a period of time with the hopes of replacing the existing fishery with the desired species. The process works through two potential mechanisms: first, the stocked species hybridized with resident fish and through continued stocking and multiple generations the genetics of the fish approach 90% westslope cutthroat trout. The second mechanism is a competitive one where the stocked fish which typically are introduced in late July at roughly 2-inches long have a competitive advantage over the naturally produced fry which still have not emerged from the gravels. In Tendoy Lake swamping is being done by annually stocking the lake at a rate of over 200 fish/acre for a minimum of 6 years beginning in 2016. The genetic samples collected in 2016 will serve as a baseline for the success of the swamping efforts. The goal is to reach > 90% westslope cutthroat genes in the lake.

North Gorge Lake

North Gorge Lake is the third highest lake in the Big Hole drainage that contains a fishery behind South Gorge and Tendoy lakes. Access to the lake is gained via the Willow Creek (8200) road to the Gorge Lakes turnoff. The trailhead is located at the end of this road. The trail to the lake (1154) is a good trail with a constant moderate grade all the way to the lake. North Gorge Lake is 10.5 acres and has a maximum depth of 35 ft (Brammer et al 1992). The lake habitat consists of a talus slope on the west shore that quickly drops to depths where the bottom is no longer visible. The north and east shore has a more gradual slope with boulder and silt substrate. The south shore which contains the outlet of the lake is the shallowest end of the lake with a more gradual slope and a boulder/silt bottom. The lake productivity is below average (Oswald 1983). The lake has been sampled 3 times previously: 1967, 1983 and 1992. In 1967 the lake was found to be fishless and Yellowstone cutthroat trout were introduced beginning on 1976. Yellowstone cutthroat were stocked (generally on a 4-year basis) until 2008 when the species was switched to westslope cutthroat trout. In early surveys it was noted that the majority of fish in the lake were natural produced rather than stocked (Oswald 1983, Brammer et al. 1992) and therefore the lake was stocked at a low density (50 fish/acre).

North Gorge Lake was netted on 8/15/16 when a series of 5 gill nets were fished in the lake overnight. The purpose of the multiple nets in the lake was to ensure that adequate numbers of fish were captured to collect 25 genetic samples from cutthroat trout. A total of 44 cutthroat trout were captured in the nets with the largest fish being over 17 inches. The genetic results of 30 of the fish sampled indicated that 29 were primarily Yellowstone cutthroat (very small admixture of rainbow trout) and one was a westslope cutthroat with no hybrids between the 2. The condition of the fish was average with larger fish in poorer condition than fish smaller less than 14 inches. Use at the lake was moderate with most campsites being located on the east shore and around the outlet. Gorge lakes are very picturesque with towering peaks above the lakes. Beginning in 2016 the lake was stocked with 3,000 westslope cutthroat (300 fish/acre) annually to swamp Yellowstone cutthroat trout in the lake with the goal of reaching 90% westslope cutthroat genes.

South Gorge Lake

South Gorge Lake is located only ¼ mile south of North Gorge Lake. There is a primitive trail at the outlet of North Gorge lake that leads to the South Gorge Lake. The lake is 12 acres and 43 ft deep. The lake habitat consists of more gradual slopes than North Gorge Lake despite being an overall deeper lake. The south shore is steep and rocky and the west shore is a large silt flat. The north and east shorelines are forested, and the lake habitat is a combination of silt flats and boulders. The lake shares the same sampling and management history as North Gorge Lake. South Gorge Lake is also very picturesque and sees much less use than North Gorge Lake. There were no campsites found around the lake (Figure 13).

Figure 13. South Gorge Lake in the East Pioneer Mountains

South Gorge Lake was sampled on 8/16/19 when 5 gill nets were fished overnight and caught 96 cutthroat trout (Table 4). The fishery in South Gorge Lake is very similar to that of South Gorge Lake except the maximum size of cutthroat trout in the North Gorge Lake was greater than that observed at South Gorge Lake. Genetic samples were collected from the first 30 fish collected and the results indicated that all fish were Yellowstone cutthroat trout (with 1% rainbow trout). None of the fish genetically tested were westslope cutthroat but some fish captured in the nets appeared to be westslope cutthroat trout. Beginning in 2016 South Gorge Lake has been stocked annually with 3,000 of westslope cutthroat trout (230/acre) annually to swamp the Yellowstone cutthroat in the lake. The intent of the swamping is to reach 90% westslope cutthroat in the lake to restore westslope cutthroat in the upper Willow Creek system.

Management Recommendations for Willow Creek Lakes

Tendoy and North and South Gorge lakes should be managed to restore at least 90% westslope cutthroat trout. Currently this is being done by annually stocking westslope cutthroat trout at a high density with the hope that the westslope cutthroat will “swamp” out the existing Yellowstone cutthroat trout. It may be necessary in the near future to intensively net all 3 lakes to reduce the overall trout abundance and to remove adult Yellowstone cutthroat trout to reach the overall goal of 90% westslope cutthroat. Stocking in the lakes has occurred for the past 4 years and is schedule for at least 2 more years.

Rainbow Lake

Rainbow Lake is located in the Rock Creek drainage a short distance from Lake Agnes. It is just over 10 surface acres and has a maximum depth of 34 ft (Figure 14). Three main access routes exist to the lake: access can be gained from Lake Agnes on Trail 1122 or from the Willow Creek Road via Trail 1120 or from then end of the Willow Creek road via trail 1122. Trail 1122 is the easiest hike into the lake with will little elevation change from the trailhead to the lake, but the road leading to the trailhead is rough. The lake habitat consists of a shallow silt flat on the west shore with emergent vegetation and lily pads. The north, east and south shore is steeper with sand, silt and boulders with several sunken trees. The shoreline is heavily forested. There are submerged aquatic vegetation beds along the east shore. There is no sampling history for Rainbow Lake in previous reports. The lake has been stocked with rainbow trout in 1942 and then stocked regularly with Yellowstone cutthroat trout and from 1970-2008. In 2008 the species was switched to westslope cutthroat trout. In 2014 the species was switched again to golden trout. Rainbow Lake is known for its high productivity and proclivity for producing large fish. It has the highest conductivity of any of the lakes sampled in this report (76 µS), similar to Ferguson Lake which is also highly productive.

Rainbow Lake sampled 3 times during the period covered in this report. The first sampling occurred on 9/5/14 when a single gill net was set for 6 hours while bathymetric measurements were taken at the lake. The net was set on the west shore and only caught 2 westslope cutthroat trout (Table 4). The fish in the net were age-2 and already averaged over 14 inches, indicative of the very fast growth rates in the lake. Additional fish were angled and verified the size of age-2 fish. Two age-6 westslope cutthroat trout were also caught via angling and were near 20 inches long (Figure 15).

Figure 14. Bathymetric map of Rainbow Lake produced from GPS and depth measurements taken on 9/5/14.

Figure 15. Six -year-old westslope cutthroat trout angled at Rainbow Lake in 2014.

Rainbow Lake was sampled again in August 2016 when a single gill net was fished for 6 hours. The intent of this netting was to monitor the introduction of golden trout that occurred in 2014. No fish were captured in the net. It appeared that the plant of golden trout was not successful. The golden trout stocking occurred packing fish in with a backpack. A second golden trout plant occurred in 2017 also using a backpack. The lake was netted again on 8/15/18 when 2 sinking gillnets were set overnight. The nets captured 2 westslope cutthroat trout (both over 20 inches) and 13 golden trout. The cutthroat would have been from the 2012 stocking and would have been 6 years old and all of the golden trout (average length 6.8) would have been age-1. All of the juvenile golden trout were captured in the smallest mesh size of the net set on the northwest shore. Survival of the second plant of golden trout appears to have been good and the apparent failure of the first plant was verified. Rainbow Lake should provide a quality fishery for golden trout in the future.

Because of its ease of access Rainbow Lake receives a fair amount of traffic. It appears most visitors to the lake stay only for the day as there is only one main camping area near the lake outlet. The lake outlet is dry in most years by the end of the summer. Rocky Mountain sculpin are also present in the lake and given the lack of connectivity with Rock Creek below it is likely that this fish species was introduced. The extensive littoral area on the north shore of the lake produces excellent amphibian habitat. Hundreds of recently metamorphosed western toads covered the ground near the lake outlet. Spotted frog tadpoles were also present in the lake.

Bond Lake

Bond Lake is a small irrigation impoundment on Bond Creek. A dam located at the downstream end of the meadow impounds the stream forming the lake. Additional water from the Mast Ditch, an extensive ditch system diverting flows from Dubois Creek to Birch Creek, flows into the lake. A short distance downstream of the dam, Bond Creek is diverted to Birch Creek. Bond Lake was sampled with a single gillnet on 5/16/12. A single 8-inch brook trout was captured in the net. At that time the lake was approximately 2 ft deep at low pool and potentially beginning to fill. It appeared that at full pool the lake level could raise an additional 6 ft. However, it seems that the lake is drained each year and left at base elevation during the winter. Bond Lake has little fishery potential if drained each year. If the lake elevation were maintained it could support a brook trout fishery.

Deerhead Lake

Deerhead is a small (21 acre) lake located on Bond Creek which drains into the Willow Creek drainage in the East Pioneer Mountains. Although no depth measurements were taken, the lake appears relatively shallow (15 ft, BNF 1992). There are large silt flats on the western edge of the lake. The east and south shoreline are a mix of boulders and decomposed granitic sand. There is a dam on the outlet of the lake that appears to have the capability of raising the water surface elevation of the lake an additional 4-5 ft, but the dam does not appear to be functional. The vegetation and erosion around the shoreline suggests the lake surface elevation does not fluctuate and the lake stays at low pool. The lake is accessed by traveling up the Birch Creek Road to its end at Dinner Station. From the trailhead, there is a foot trail that switchbacks up the ridge and over into the Bond Creek drainage. The lake is also accessible by ATV via the road leading to Bond Lake. There is no previous record of Deerhead Lake being surveyed for fish. The lake was initially stocked in 1950 with cutthroat trout. A plant of rainbows occurred 2 years after. Since that time the lake has been regularly stocked with Yellowstone cutthroat trout. The species stocked into the lake was switched in 2008 to westslope cutthroat trout. The density of cutthroat trout stocked on a four-year basis is 48 fish/acre.

Deerhead Lake was surveyed on 8/8/17 when a single gillnet was fished in the lake for 3.5 hours. Only cutthroat trout were captured in the net and a distinction between westslope and Yellowstone cutthroat trout was not made, although most fish appeared to be Yellowstone cutthroat trout. A total of 10 cutthroat were caught in the net up to 12.4 inches (Table 4) and an additional 10-15 cutthroat trout were caught via angling in the same general size range. There was limited potential spawning habitat in the lake inlet (mostly sand) but one juvenile fish was observed in the inlet stream. It was clear that the Yellowstone cutthroat stocked in the lake are successfully reproducing. It is possible the fish are using the sandy gravels found on the east shore of the lake and around the dam for spawning. Although not surveyed, it is also possible that the fish are migrating through dam at the outlet of the lake outlet into the stream downstream to spawn. Fish were observed in the ponds downstream of the lake on Bond Creek. The relatively small size of fish in the lake and the high catch rates suggest that the lake is overpopulated with cutthroat trout. Recreational use at the lake was high likely owing to the ease of access with most of the use being day-use. There was only one camping area located near the dam. There appears to be very high-quality habitat for amphibians in the lake. Both spotted frog and western toads were observed in the lake. The western shore of the lake was covered with thousands of recently metamorphosed toads. Additionally, freshwater sponges were present in the lake among the boulders on the southwest shoreline (Figure 16).

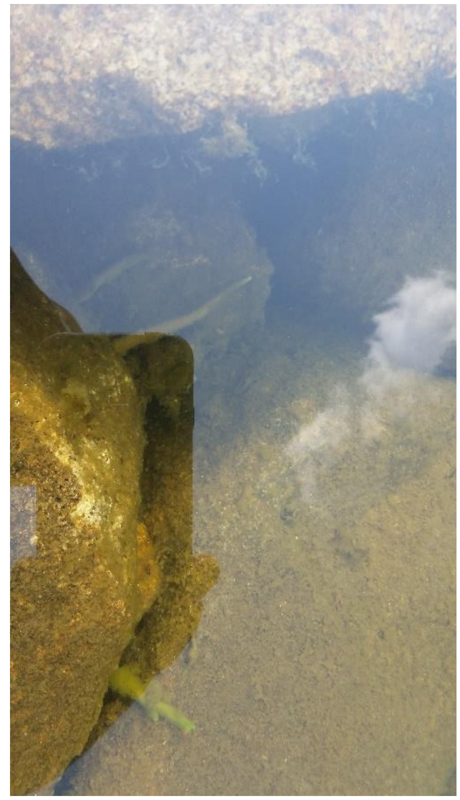

Figure 16. Freshwater sponges observed in Deerhead Lake along the southwest shore in 2017.

Management Recommendations:

Stocking fish into Deerhead Lake should be discontinued. Natural reproduction is adequate to sustain the fishery and addition of fish through stocking is likely detrimental to overall fish size.

Table 4. Fisheries survey data from East Pioneer lakes from 2010-2019 where length is in inches and weight is in pounds. The fish species abbreviations are: LL = brown trout, RB = rainbow trout, EB = brook trout, WCT = westslope cutthroat trout, YCT = Yellowstone cutthroat trout, R COT = mottled sculpin, LSU = longnose sucker, WSU = white sucker and AG = Arctic grayling. Condition factor (K) and Spawning habitat are described in the methods section. Use is a qualitative measure of use and recreation related impacts at the lake. Amphibian abbreviations are: SF = Columbia spotted frog, TF = tailed frog, WT = western toad and SS = spotted salamander

Lake	Temp (°F)	pH	Cond. (µS)	Species	#/net	Avg L (range)	Avg W (range)	Condition	Spawning Habitat Inlet	Spawning Habitat Outlet	Spawning Habitat Shore	Use	Amphibians
Canyon	54.0			EB	52	8.4 (6.0-10.8)	0.22 (0.13-0.36)	35.1	E1,2,3	F2	None	Heavy	None
				YCT	8	9.8 (8.6-11.0)	0.25 (0.18-0.35)						
Abundance	64.9	7.45	9	WCT	2	11.2 (11.1-11.4)	0.49 (0.48-0.50)	35	P1,2	P2,5	P2	Heavy	SF
Crescent	60.3	7.40	20	RB	4	11.1 (6.3-14.5)	0.52 (0.12-0.91)	33.9	P2	P3,5	P3	Mod	SF
				YCT	1	18.5	2.75	43.5					
				WCT	4	9.9 (7.6-14.5)	0.43 (0.14-1.08)	35.5					
				CTxRB	1	13.2	0.78	34.0					
Grace	58.3	7.50	6	Fishless					None	None	F3	Light	None
Teacup	63.4	7.52	27	Fishless					F1,2	F1,2		Light	SF,SS
Tahepia				RB	10	11.1 (6.8-17.2)	0.06 (0.11-1.70)	37	F2	G2,3	P2	Mod	SF
Up. Schultz	62.5	8.78	49	RbxCT	15	13.1 (7.0-17.0)	0.83 (0.12-1.76)	32.8	P2	G2,3	P2	Mod	SF
Low Schultz				RBxCT	16	11.7 (9.4-14.0)	0.60 (0.40-0.88)	38.1	G2	G2,3	P2	Mod	SF
Tendoy (2015)				YCT	3	10.4 (9.5-12.0)	0.44 (0.32-0.71)	37.0					
				WCT	2	8.1 (7.8-8.4)	0.20 (0.17-0.23)	38.1					

Lake	Temp (°F)	pH	Cond. (µS)	Species	#/net	Avg L (range)	Avg W (range)	Condition	Spawning Habitat Inlet	Outlet	Shore	Use	Amphibians
Tendoy (2016)				CT	5.4	14.7 (10.2-20.2)							
N. Gorge	58.6		9.0	CT	8.8	12.6 (7.0-17.6)	0.81 (0.13-1.70)	35.5	P3,4	F2,3	P2	Mod	None
S. Gorge	56.4		4.0	CT	19.2	12.2 (5.0-16.6)	0.65 (0.04-1.56)	34.2	P2	P2	P2	Light	None
Rainbow (2014)		8.34	76	WCT RCOT	2	14.6 (14.5-14.6)			P1,2	P,1,2	None	Heavy	SF, WT
Rainbow (2018)				WCT GT	2 13	20.1 (7.9-11.5) 6.8 (4.5-7.7)							
Bond					1	8.6	0.31	48.7					
Deerhead	68.3			CT	10	10.6 (7.2-13.6)			F3	?	F2	Heavy	SF, WT

References

Beaverhead National Forest Lake and Fish Inventory. 1992. USDA, USFS, Beaverhead National Forest, Dilllon, MT. 11 pp.

Brammer, J. A., R. A. Oswald, and K.M. Kuhn. 1992. Beaverhead National Forest Mountain Lakes Survey, 1992: Dillon, Wisdom and Wise River Ranger Districts. USDA, Beaverhead National Forest, Dillon, MT 59725.

Dehan, P., D. P. Peterson, B. Adams, and V. O'Byrne. 2013. Genetic Monitoring of Arctic Grayling in the Big Hole River and Red Rock Lakes and Association with Recent Climate Trends. U.S. Fish and Wildlife Service. Abernathy Fish Technology Center. Longview, WA 98632.

Heaton, J. R. 1960. Inventory of Waters of the Project Area—Big Hole River Drainage Survey. Project No. F-9-R-8. May 1, 1959-April 30, 1960, Montana Fish and Game Department, Helena, Montana.

Hochhalter, S. and R. Oswald 2007. Southwest Montana Native Fish Research and Conservation. Montana Fish Wildlife and Parks, Bozeman, MT 59718.

Lloyd, J. R. 1983. 2630 Management of Wildlife and Fish Habitat, Lake Fishery Analysis. Dillon Ranger District, Beaverhead National Forest Report to Forest Supervisor, Dillon MT 59725.

McMullin, S. L. 1983. Wise River District Mountain Lakes Survey, 1982. USFS Report, Beaverhead National Forest. 31pp.

Montana Fish Wildlife and Parks. 1990. Statewide Fisheries Investigations. Southwest Montana Cold Water Streams Investigation. July 1, 1989 through June 30 1990. Project F-46-R-3. Job Number II-C. Bozeman, MT.

Olsen, J. R. 2011. Big Hole Mountain Lake Survey, 2008-2011. Montana Fish Wildlife and Parks. Project Number: F-113-R8-10. Butte, MT 59701.

Olsen, J. R. 2017. Stream surveys of the Big Hole River Drainage 2010-2016. Montana Fish, Wildlife and Parks. Federal Aid Project Number F-113. April 2010-April 2016.

Olsen, J. R. 2017. Stream Surveys of the Big Hole Drainage, 2010-2016. Montana Fish Wildlife and Parks. Project Number: F-113. Butte, MT 59701.

Oswald, R.A. 1983. Pioneer Mountain Lake Survey, 1983, Dillon and Wise River Ranger Districts. Montana Department of Fish, Wildlife and Parks, Bozeman, Montana.

Peterson, N. W. 1971. Southwest Montana Fishery Study. Project No. F-9-R-20. Job I-b. Montana Fish and Game Department, Fisheries Division, Helena, Montana.

Shepard, B. B. 1990. Mountain Lakes surveyed on the Beaverhead National Forest from 1986 through 1989. USFS Report, Beaverhead National Forest, Dillon, MT. 36 pp.

Wells, J. D. 1982. West Big Hole Mountain Lake Survey, 1981. USFS Report, Beaverhead National Forest, Dillon, MT. 44 pp.

Wipperman, A. H. 1964. Southwest Montana Fishery Study. Project No. F-9-R-12. Montana Fish and Game Department, Fisheries Division, Helena, Montana.