FISHERY MANAGEMENT INVESTIGATIONS

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FISHERIES MANAGEMENT ANNUAL REPORT
Virgil Moore, Director

SALMON REGION 2014

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ABSTRACT

Salmon Regional fisheries staff coordinated with Mackay Fish Hatchery and Sawtooth Flying Service to stock approximately 30,000 trout fry in 56 high mountain lakes in the Salmon Region in 2014. A total of forty-eight lakes were stocked with Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* (~25,159 fry), eight lakes with Arctic Grayling *Thymallus arcticus* (~1,856 fry), seven lakes with triploid Rainbow Trout *O. mykiss* (~1,415 fry), one lake with Golden Trout *O. mykiss aguabonita* (~418 fry), and one lake with Tiger Trout *Salmo trutta x Salvelinus fontinalis*(~1,034 fry). Aerial stocking took place between September 6 to 15, 2014. Flight costs totaled $6,439.

Fifty-three high mountain lakes were surveyed in the Salmon Region in 2014 and fish were observed in 31 (58%). Westslope Cutthroat Trout were found in 20 lakes, Rainbow Trout were found in seven lakes, apparent Cutthroat x Rainbow Trout hybrids were found in four lakes, Golden Trout were found in one lake, Eastern Brook Trout *Salvelinus fontinalis* were found in three lakes, Arctic Grayling were found in five lakes, and Tiger Trout were found in one lake.

Amphibians were observed in 12 (23%) of the 53 lakes surveyed in 2014. Of the 22 lakes where fish were not detected, amphibians were found in eight (36%). Amphibians occurred sympatrically with fish in four lakes surveyed in 2014.

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INTRODUCTION

The Salmon Region has over 1,000 high mountain lakes. These lakes range from small ponds that are less than one hectare in size to our largest, Sawtooth Lake #1 in the Stanley Basin, at 70 ha. High mountain lakes in the Salmon Region range in elevation from 1,970 m to almost 3,000 m. Anglers fishing high mountain lakes have consistently expressed a high level of satisfaction with their fishing experience (IDFG, 2013). High mountain lakes offer diverse fishing opportunities in highly scenic areas and are an important contributor to the state's recreational economy. Management of the Region's high mountain lakes that are located in national forest, designated wilderness, and national recreation areas is coordinated with appropriate land management agencies, including the Salmon-Challis and Sawtooth National Forests, Bureau of Land Management's Salmon District Field office, and the Sawtooth National Recreation Area (SNRA).

One-hundred and ninety-seven high mountain lakes in the Salmon Region are requested to be stocked on a three-year rotation. These lakes typically receive either Arctic Grayling *Thymallus arcticus*, Golden Trout *Oncorhynchus aguabonita*, triploid Rainbow Trout *O. mykiss*, or Westslope Cutthroat Trout *O. clarkii lewisi* fry (< 3" in length). In a few cases, we have also stocked species such as Tiger Muskellunge (Muskie) *Esox masquinongy x Esox Lucius* or Tiger Trout *Salmo trutta x Salvelinus fontinalis* as management tools to reduce abundance or eliminate undesirable fish populations in high mountain lakes. This stocking program provides diverse angling opportunities in remote backcountry areas, and our three-year stocking rotation model ensures diversity in size-structure and persistence of fish populations over long-term periods. Stocking rotation A includes 59 lakes, rotation B is comprised of 77 lakes, and rotation C has 61 lakes.

High mountain lake surveys in the region are prioritized based on regional needs each year. Lakes are typically surveyed to 1. verify the success of stocking events and effectiveness of current stocking densities, 2. verify the persistence of naturally reproducing populations, or 3. provide up-to-date information for anglers inquiring about angling opportunities in regional high mountain lakes.

OBJECTIVES

<u>High Mountain Lake Stocking</u>

1. Maintain viable and diverse high mountain lake fisheries throughout the Salmon Region via a detailed stocking regime, with emphasis placed on high-use areas where natural reproduction does not occur.

2. Continue stocking high mountain lakes in a cost effective manner by evaluating stocking successes and future needs through the use of high mountain lake surveys.

High Mountain Lake Surveys

1. Assess the current status of high mountain lake fish and amphibian populations in the Salmon Region.

2. Use current survey data to inform any needed changes to stocking strategies.

STUDY AREA AND METHODS

High Mountain Lake Stocking

Fifty-six high mountain lakes were stocked with trout fry in the Salmon Region in 2014 by airplane or backpack. Lakes were stocked with Arctic Grayling, Golden Trout, Rainbow Trout, Westslope Cutthroat Trout, or Tiger Trout fry. Rainbow Trout eyed eggs were obtained from Troutlodge Fish Hatchery in Sumner, Washington, Cutthroat Trout eyed eggs were contributed by IDFG's Cabinet Gorge Fish Hatchery, Arctic Grayling eggs came from Meadow Lake, Wyoming, and Golden Trout and Tiger Trout eggs were obtained from Story Fish Hatchery in Story, Wyoming. All stocked fry were reared at Mackay Fish Hatchery prior to stocking. Regional high mountain lake stocking follows a three-year rotation, using the nomenclature rotations A, B, and C to describe which lakes are to be stocked each year (Table 1). Specific high mountain lakes included in rotations A, B, and C can be found in Appendix A. We stocked rotation A in 2014.

Beginning in 2012, IDFG has contracted aerial high mountain lake stocking with Sawtooth Flying Service based in McCall, Idaho. The pilot and an assistant are provided with a list of high mountain lakes to be stocked, bags of fry for each lake, GPS coordinates, and physical maps and best flight routes for each rotation. Each stocking rotation includes 59 to 77 lakes and usually requires multiple flights and/or days to complete all stocking for one rotation. Flights were conducted on September 6, 8, 12, and 15 in 2014. Flight routes for each rotation were refined in recent years to keep flight time and fuel costs efficient. Further details of regional aerial stocking methodology were reported in Flinders et al. (2013).

High Mountain Lake Surveys

We surveyed 53 high mountain lakes in the Upper Salmon, Lemhi, and Pahsimeroi River drainages in 2014. Regional survey crews documented fish presence, species composition, relative abundance, and CPUE (fish per hour) for angling and/or gillnetting surveys. Fish were measured to the nearest mm total length (TL), and weighed in grams (g). Spawning potential was assessed at each lake, and the presence of fry and fingerlings was noted to detect the presence of natural reproduction. Physical characteristics of each lake, accessibility, and level of human-use (low, med, high) were also recorded.

Amphibian surveys were conducted at each lake using a modification of the timed visual encounter survey (VES) described in Crump and Scott (1994). Our main deviation from the VES methodology was that a full perimeter search was performed without accounting for various habitat types. Amphibian genetic samples were taken when possible. Survey data were entered into the statewide 'Lakes and Reservoirs' database for further analysis.

RESULTS AND DISCUSSION

High Mountain Lake Stocking

Fifty-four high mountain lakes in rotation A were stocked by airplane in September 2014, and two lakes were stocked by backpack (Table 2). Due to a shortage of Grayling fry at Mackay Hatchery, four lakes that were requested to be stocked with Grayling were not stocked at all in 2014 (Cache Creek Lakes #3 and #5, Martendale Lake #1, and Nelson Lake #2).

High Mountain Lake Surveys

Regional fisheries staff surveyed 39 high mountain lakes in the Upper Salmon River main stem drainage, 13 lakes in the Lemhi River drainage, and one lake in the Pahsimeroi River drainage, for a total of 53 lakes in 2014.

Upper Salmon River Main Stem Drainage

Alpine Creek Lakes (ACL)

Twenty-one lakes were surveyed by angling in the ACL basin on August 18, 19, and 20, 2014 (Table 3). Of these 21 lakes, fish were detected in 11 (Figure 1). Westslope Cutthroat Trout, Rainbow Trout, Golden Trout, and Arctic Grayling were all found within the ACL series of lakes. Catch rates were especially high in ACL #12 (6.6 fish/hr), #12A (8.3 fish/hr), and #12B (36.3 fish/hr) (Table 3). Amphibians were detected at two ACL lakes in 2014, one of which also contained fish.

Alpine Creek Lakes #8, #8A, #9, and #10 - no fish were found in 2014 (Figure 1). All four ponds are connected together in a series, and the last stocking events in the series were in 1997 (#8-WCT, #9-WCT, and #10-Grayling). Our findings conclude that these lakes are likely too shallow to support fish and should not be stocked in the future. No amphibians were documented at any of these lakes in 2014, but have been documented in previous surveys.

Alpine Creek Lake #11 contained Rainbow Trout and Golden Trout in 2014 (Figure 1). Rainbow Trout averaged 237 mm TL (SE ± 32) (*n* = 8) and the Golden Trout measured 266 mm TL (*n* = 1). The overall catch rate was 1.2 fish/hr. ACL #11 has been stocked with a variety of trout species (500 Cutthroat Trout fry in 1997, 400 Golden Trout fry in 2001, 400 Grayling fry in 2006, and 419 Rainbow Trout fry in 2012). Although Westslope Cutthroat Trout were present during our last survey in 2001, they were not detected in 2014. ACL #11 is the highest lake in a series of eight connected lakes that includes #11A, #11B, #12, #12A, #12B, #12C, and #13 (Figure 1). It is likely that fish stocked into any of these waters are able to move freely throughout the series at certain times of the year. Fish are likely also able to colonize connected lakes that have never been stocked (e.g. ACL #11A and #11B). No amphibians have been documented in ACL #11 in either of two surveys (2001 and 2014).

Alpine Creek Lakes #11A and #11B have never been stocked, and fish were not detected in either in 2014 (Figure 1). The survey crew noted that both lakes are too shallow to support fish, and ACL #11A was dry at the time of the 2014 survey in late August. Amphibians were not documented in either lake in 2014 or during the last survey in 2001.

Alpine Creek Lake #12, #12A, and #12B contained Cutthroat Trout in 2014 (Figure 1). Cutthroat Trout averaged 235 mm TL (SE ± 14) in ACL #12 (*n* = 11), 225 mm TL (SE ± 13) in

ACL #12A (*n* = 11), and 213 mm TL (SE ± 10) in ACL #12B (*n* = 12). Catch rates from angling surveys were 6.6 fish/hr, 8.3 fish/hr, and 36.3 fish/hr in ACL #12, #12A, and #12B, respectively. ACL #12 was last stocked with 250 Cutthroat Trout fry in 1995, but ACL #12A and #12B have never been stocked. The 2014 survey crew noted that there is good connectivity between all three of these lakes, and there is natural reproduction occurring in ACL #12 and #12A. The Cutthroat Trout in these three lakes are likely able to move between them, and likely all originated from past stocking events in #12. As mentioned previously, these lakes are also part of a larger connected series of lakes, and dispersal between all of them is likely. No amphibians were observed at these lakes in 2014, although Columbia Spotted Frogs have been observed in past surveys.

Alpine Creek Lake #12C has never been stocked, and fish were not detected during our survey in 2014 (Figure 1). The lake is very shallow and would likely not support fish if stocked. Western Long-toed Salamanders were observed during the 2014 survey, and the 2001 survey documented hundreds of Columbia Spotted Frogs.

Alpine Creek Lake #13 contained Arctic Grayling and Westslope Cutthroat Trout in 2014 (Figure 1). Grayling averaged 265 mm TL (SE ± 5) (*n* = 4) and Cutthroat Trout averaged 368 mm TL (SE ± 13) (*n* = 2) in 2014. Overall catch rate from angling surveys was 1.3 fish/hr. ACL #13 was last stocked with 310 Arctic Grayling fry in 2012 and has never been stocked with Cutthroat Trout. Although we do not have record of stocking Cutthroat Trout in ACL #13, they were documented during surveys in 1973, 2001, and 2014. Cutthroat have likely colonized ACL #13 from the ACL #11/#12 system, which has been stocked (see above). In any case, the Cutthroat Trout we measured in 2014 were very large and provide great opportunity for anglers. It seems Grayling are only present in the lake due to recent stocking efforts, as they were not detected during the last survey in 2001. Grayling in ACL #13 provide a unique opportunity for anglers in the ACL basin, and seem to be growing well in ACL #13. No amphibians have been observed in ACL #13 in any of the survey years.

Alpine Creek Lake #14 contained Cutthroat Trout and Grayling in 2014 (Figure 1). The lake has never been stocked with Cutthroat Trout, but was last stocked with 319 Arctic Grayling fry in 2012. The angling survey catch rate was 1.0 fish/hr in 2014. Cutthroat Trout averaged 227 mm TL (SE ±23) (*n* = 9) and Grayling averaged 190 mm TL (SE ± 18) (*n* = 2). The survey crew noted Cutthroat Trout were very skinny and difficult to catch, and Grayling were small as well. ACL #14 is the lowest lake in a nine lake series including ACL # 14A, #14B, #14C, #14D, #14E, #14F, #15, and #16. It is likely that any species of fish stocked in a lake in this series has the potential to colonize ACL #14, which is probably how Cutthroat colonized the lake (Cutthroat were stocked in ACL #16 in 1991). We did not detect amphibian presence at ACL #14 in 2014, but Columbia Spotted Frogs were observed at the lake in 2000 and 2001.

Alpine Creek Lake #14A, #14B, #14C, #14D, #14E, and #14F have never been stocked with fish, and all six lakes are likely too shallow to support fish persistence over winter. However, we detected fish presence in four of these lakes during angling surveys in 2014 (Figure 1). Survey crews visually noted small fish in ACL #14A, #14B, and #14E, but were unable to capture them to determine the species. One Grayling was caught in ACL #14F during three hours of angling (0.34 fish/hr), measuring 356 mm TL. As mentioned in the previous paragraph, fish likely colonize the lakes in this series through the network of tributaries connecting them. In 2014 we observed Columbia Spotted Frogs in ACL #14A, but amphibians were not seen in any other lake in the series. Columbia Spotted Frogs were also detected during previous surveys in this series of lakes.

Alpine Creek Lake #15 contained Arctic Grayling in 2014 (Figure 1). The survey crew caught two Grayling in 5.8 hours of angling, for a catch rate of 0.35 fish/hr. Grayling averaged 150 mm TL (SE ± 22). The last survey at ACL #15 in 2001 did not detect any fish presence, but Cutthroat Trout were found in the lake during a survey in 1973. This lake likely does not support natural reproduction, and a fishery is only maintained through stocking efforts. Arctic Grayling were stocked in the lake in 2013. No amphibians were observed in 2014, but Western Long-toed Salamanders were detected during the last survey in 2001.

Alpine Creek Lake #16 is a small pond that was last stocked in 1991 with 500 Westslope Cutthroat Trout fry. Our survey results in 2014 indicate the pond is too shallow to support fish persistence, and no fish were detected (Figure 1). No amphibians were observed at the lake in 2014.

Alpine Lake (Iron Creek drainage)

Alpine Lake in the Sawtooth National Recreation Area was surveyed on June 30, 2014. Survey crews found Westslope Cutthroat Trout, Rainbow Trout, Golden Trout, and hybrid variations of the three in a 12 hour gill net set and 13 combined hours of angling (Figure 2, Table 3). Alpine Lake has been stocked with Golden Trout in various years from 1936 to 2013, and was stocked with Westslope Cutthroat Trout in 1998. The angling catch rate was 1.4 fish/hr and gill netting CPUE was 3.7 fish/hr in 2014. Westslope Cutthroat Trout averaged 225 mm TL (SE ± 13) (*n* = 31), Rainbow Trout averaged 253 mm TL (SE ± 20) (*n* = 10), Golden Trout averaged 289 mm TL (SE ± 7) (*n* = 2), and hybrids averaged 312 mm TL (SE ± 20) (*n* = 10). Although Rainbow Trout have never been stocked in the lake, they may have colonized via the outlet stream, connected to Iron Creek. Previous surveys at the lake in 1971, 1977, and 2001 did not document Rainbow Trout presence at the lake, so colonization may have been somewhat recent. No amphibians were found in 2014, but Western Long-toed Salamanders were documented in the 2001 survey.

Casino and Garland Lakes

Seven Lakes were surveyed in the Casino and Garland Lakes basins on July 26 and 27, 2014 (Table 3). The sampling crew angled and found Brook Trout in Casino Lakes #1 and #3, and Westslope Cutthroat Trout in Casino Lake #2 and Garland Lakes #1 and #2 (Figure 3). Garland Lakes #2A and #3 were identified as fishless ponds with large numbers of amphibians present.

Casino Lakes #1 and #3 contained naturally reproducing Brook Trout populations in 2014 (Figure 3). Casino Lake #3 was angled for 1.6 hours and 30 Brook Trout were caught, for a catch rate of 18.8 fish/hr. Brook Trout in Casino #3 averaged 218 mm TL (SE ± 5). Casino Lake #1 was not angled due to time constraints, but surveyors noted that there was an abundance of Brook Trout in the lake, which appeared to exhibit similar size structure to those caught in Casino #3. The lakes were last stocked in 1957 with Cutthroat Trout, but we have no records of Brook Trout ever being stocked in the Casino Lakes basin. Surveys at the Casino Lakes in 1993 and 2003 also documented Brook Trout in both lakes. No amphibians were documented at either lake in 2014, nor were they found in any previous surveys.

Casino Lake #2 contained Westslope Cutthroat Trout in 2014 (Figure 3). Eleven Cutthroat Trout were caught during 2.5 hours of angling for a total catch rate of 4.4 fish/hr. Westslope Cutthroat Trout averaged 258 mm TL (SE ± 12) in 2014. The lake was last stocked in 1990 with 500 Cutthroat Trout fry, thus the current Cutthroat population is likely naturally reproducing. Surveys in 2003 also found that Westslope Cutthroat Trout were the only fish species present. Although Columbia Spotted Frogs were documented at the lake during both of two surveys in 2003, we did not find any amphibians at the lake in 2014.

Garland Lakes #1 and #2 contained Westslope Cutthroat Trout in 2014 (Figure 3). Sixteen Cutthroat were caught in Garland #1 during 1.2 hours of angling for a catch rate of 13.7 fish/hr, and nine Cutthroat were caught during 1.1 hours of angling at Garland #2 for a catch rate of 8.0 fish/hr. Cutthroat averaged 328 mm TL (SE ± 6) in Garland #1 and 286 mm TL (SE ± 13) in Garland #2. Both lakes were last stocked in 2014 with approximately 500 Westslope Cutthroat Trout fry each. Although numerous smaller fish, likely from the 2014 stocking event, were observed swimming in both lakes in 2014, those fish were not represented in our angling sample. The fish that we caught during angling surveys were much larger and likely originated from previous stocking events between 2008 and 2011. We do not believe natural reproduction is occurring in the Garland Lakes. Both lakes likely receive very little human use, but have potential to provide quality fishing opportunities for anglers. We documented presence of Columbia Spotted Frogs and Western Toads *Bufo boreas* at Garland #1 in 2014, but did not observe amphibians in Garland #2. The last survey on these lakes, in 2003, confirmed presence of Columbia Spotted Frogs in #1, and Western Toads in #2.

Garland Lakes #2A and #3 were surveyed via angling but no fish were detected in 2014 (Figure 3). Garland Lake #2A has never been stocked, and #3 was last stocked with 341 Westslope Cutthroat Trout in 2014. Both lakes are shallow and likely would not support fish over winter. Since #3 was stocked previous to our survey in 2014 but we did not document fish presence, we believe the fish were either in such low abundance that it prevented us from detecting them, or the fish may have exited the lake via the inlet or outlet streams. Both lakes were also described as fishless in the 2003 surveys. Although they were not detected in the 2003 survey, we counted hundreds of Western Toad tadpoles at Garland #2A in 2014. We also confirmed presence of Columbia Spotted Frogs in Garland #3 in 2014, which were previously documented in the 2003 survey.

Iron Lake #1

Iron Lake #1 was surveyed on July 2, 2014 via both gill netting and angling, and naturally reproducing Cutthroat and Rainbow Trout were found (Figure 4). An angling survey conducted by five crew members, who fished for 1.5 hours each, resulted in landing 15 Rainbow Trout, nine Cutthroat Trout, and 13 suspected hybrids for a combined catch rate of 5.0 fish/hour (Table 3). The crew also set a gill net overnight for 13.5 hours and caught 11 Rainbow Trout, seven Cutthroat Trout, and eight suspected hybrids for a gill net CPUE of 1.9 fish/hr. Rainbow Trout length during the 2014 sampling events averaged 217 mm TL (SE ± 14), while Cutthroat Trout averaged 247 mm TL (SE ± 18), and Rainbow hybrids averaged 238 mm TL (SE ± 14). The lake is currently not being stocked, but was last stocked with Westslope Cutthroat Trout in 1998, and had also been stocked with Rainbow Trout prior to 1987. Previous surveys in 1956, 2001, and 2009 documented presence of Rainbow and Cutthroat Trout as well. No amphibians were detected at the lake in 2014, nor were they detected during any of the previous surveys.

North Fork East Fork Reynolds Lakes

Three lakes were surveyed in the North Fork East Fork (NFEF) Reynolds Lakes basin in 2014 (Table 3). All three lakes contained Westslope Cutthroat Trout (Figure 5). The survey crew angled NFEF Reynolds #2 and #4 on August 13, and surveyed #4A visually. One crew member fished NFEF Reynolds #2 for one hour and landed six Westslope Cutthroat Trout averaging 242 mm TL (SE ± 72), for a catch rate of 6 fish/hr. The crew was not able to catch any fish in #4, but noted many 100-150 mm Cutthroat Trout swimming in the lake, and a few larger fish in the 250-325 mm range were also observed. The crew also observed Cutthroat swimming in #4A, which is a small shallow pond connected to the larger #4. NFEF Reynolds Lakes #2 and #4 are currently stocked on a three-year rotational basis with Westslope Cutthroat Trout fry, and were last stocked in 2013. Columbia Spotted Frogs were found in NFEF Reynolds #4 in 2014, but no amphibians were detected in the other two lakes.

North Fork Hat Creek Lakes

One larger lake (NF Hat Creek Lake) and five smaller, shallower ponds (#A, #B, #C, #D, and #E) were surveyed in the North Fork Hat Creek drainage in 2014 (Table 3). Westslope Cutthroat Trout were found in NF Hat Creek Lake, but fish were not detected in any of the five smaller ponds (Figure 6). Fourteen Cutthroat Trout were caught during three hours of angling for a catch rate of 4.7 fish/hr, and 15 Cutthroat Trout were captured in 12.5 hours of gill netting for a CPUE of 1.2 fish/hr. All Cutthroat Trout, gill-netting and angled combined, averaged 215 mm TL (SE $\pm$ 10) in NF Hat Creek Lake in 2014. NF Hat Creek Lake was last stocked with 250 Westslope Cutthroat Trout fry in 1998, and currently appears to be supporting a naturally reproducing population. Out of the five ponds we surveyed in 2014, #A, #C, and #D contained Columbia Spotted Frogs and the outlet of #C also contained Tailed Frogs *Ascaphus montanus*.

Lemhi River Drainage

Bear Valley Lakes (BVL)

Seven lakes were surveyed in the Bear Valley Lakes series on July 16, 2014 (Table 3). The survey crew found Rainbow Trout in BVL #1, Westslope Cutthroat Trout in BVL #2, #2A, and #3, and apparent Rainbow Trout x Westslope Cutthroat Trout hybrids in BVL #3 (Figure 7). Angling catch rates were highest in BVL #3 (19.0 fish/hr). No fish were found in BVL #2B, #3A, and #3B in 2014.

Bear Valley Lake #1 contained Rainbow Trout in 2014 (Figure 7). Four Rainbow Trout were caught in 1.5 hours of angling for a catch rate of 2.7 fish/hr. Rainbow Trout in BVL #1 averaged 220 mm TL (SE $\pm$ 12). Although the lake has been stocked with Cutthroat x Rainbow Trout hybrids but never with pure strain Rainbow Trout, survey crews indicated presence of Rainbow Trout during surveys in 1992, 2000, 2004, and 2014. However, phenotypic differentiation of hybrids and pure strain Rainbow and Cutthroat Trout can be somewhat difficult. Cutthroat x Rainbow hybrids were planted in the lake in 1980 and Cutthroat Trout were stocked from 1968-1998. The lake is currently not being stocked, thus natural reproduction is likely occurring. Cutthroat Trout were detected in the lake in previous years, but were not detected in 2014. However, once again, identification and differentiation can be difficult without the use of genetic tools. No amphibians were documented in BVC #1 in 2014.

Bear Valley Lake #2 contained Westslope Cutthroat Trout in 2014 (Figure 7). Anglers fished the lake for 1.5 hours and caught eight fish, for a catch rate of 5.3 fish/hr. Cutthroat Trout averaged 240 mm TL (SE $\pm$ 18) in 2014. BVL #2 was stocked with Cutthroat Trout in 1989, 1992, 1996, and 1998, but is currently not stocked. Prior to 2014, survey crews had found both Cutthroat and Rainbow Trout in the lake, but Rainbow Trout were not encountered in 2014. Amphibians have never been detected in our surveys at BVL #2.

Bear Valley Lake #2A and #2B are small ponds located just above BVL #2. In 2014, the survey crew visually observed Cutthroat Trout in the outlet of #2A, but fish were not captured and measured (Figure 7). No fish were observed in BVL #2B. Both of these ponds are shallow and likely will not support fish survival over winter. However, fish may use both throughout the year when connectivity allows. Columbia Spotted Frogs were observed in #2A in 2004 and 2014, but amphibians were not detected in #2B.

Bear Valley Lake #3 contained Westslope Cutthroat Trout and Rainbow x Cutthroat hybrids in 2014 (Figure 7). Overall catch rate for angling surveys was 19.0 fish/hr. Westslope Cutthroat Trout averaged 225 mm TL (SE ± 6) (*n* = 16) and hybrids averaged 237 mm TL (SE ± 11) (*n* = 3). BVL #3 has been stocked with Cutthroat Trout since 1983, and is currently stocked every third year with Cutthroat Trout. The lake has never been stocked with Rainbow Trout, but according to our survey results in the Bear Valley Lakes in 2014, Rainbow Trout are present throughout the drainage and could potentially colonize any of these lakes via the outlets (Bear Valley Creek). Rainbow Trout were detected in the lake in 1992, but only Cutthroat Trout and hybrids have been detected since then. Although no amphibians were observed in 2014, Columbia Spotted Frogs were detected in 2004.

Bear Valley Lake #3A and #3B are small ponds located near BVL #3. Both lakes are likely too shallow to support fish, and no fish were detected in 2014. Both contained juvenile Columbia Spotted Frogs in 2004 and 2014 (Figure 7).

Buck Lakes

Four lakes were surveyed in the Buck Lakes series on July 16, 2014 (Table 3). Buck Lakes #1, #3, and #4 all contained Westslope Cutthroat Trout in 2014 (Figure 8). In addition to Cutthroat Trout, Buck Lake #1 and #3 contained Rainbow Trout and Rainbow x Cutthroat hybrids, and Buck Lake #4 contained Arctic Grayling. Angling catch rates were highest in Buck Lake #4 (8.8 fish/hr). No fish were found in Buck Lake #2 in 2014.

Buck Lake #1 contained Westslope Cutthroat Trout, Rainbow Trout, and hybrids in 2014 (Figure 8). Overall angling catch rate was 6.3 fish/hr. Westslope Cutthroat Trout averaged 225 mm TL (SE ± 9) (*n* = 12), Rainbow Trout averaged 235 mm TL (SE ± 20) (*n* = 7), and hybrids averaged 253 mm TL (SE ± 20) (*n* = 6). Buck Lake #1 was last stocked with both Westslope Cutthroat Trout and Arctic Grayling in 1992. Arctic Grayling have never been detected in the lake during surveys, thus stocking was likely not successful. However, Westslope Cutthroat Trout and Rainbow Trout are naturally reproducing in the lake and offer quality fishing opportunity. No amphibians were detected at the lake in 2014.

Buck Lake #2 is a small pond in which fish were not detected in 2014 (Figure 8). The lake has never been stocked, has never shown confirmed fish presence, and has been surveyed twice prior to 2014; 2000 and 2004. No amphibians were observed in 2014, but Western Long-toed Salamanders were found during a survey in 2000.

Buck Lake #3 contained Westslope Cutthroat Trout, Rainbow Trout, and hybrids in 2014 (Figure 8). Anglers fished the lake for four hours and caught 17 trout, for an overall catch rate of 4.3 fish/hr. Westslope Cutthroat Trout averaged 193 mm TL (SE ± 25) (*n* = 6), Rainbow Trout averaged 235 mm TL (SE ± 9) (*n* = 9), and hybrids averaged 245 mm TL (SE ± 10) (*n* = 2). Buck Lake #3 was last stocked in 2007 with Arctic Grayling, but has also been previously stocked with Westslope Cutthroat Trout in 1992, 1996, and 1998. Although there are no records of Rainbow Trout ever being stocking in the lake, we have detected Rainbow Trout presence in the lake during each survey year; 1973, 1992, 2000, and 2014. As with the Bear Valley Lakes, Rainbow Trout may have been able to colonize the lake via the outlet stream (Buck Creek/Bear Valley Creek). We have never detected amphibians in Buck Lake #3.

Buck Lake #4 contained Arctic Grayling and Westslope Cutthroat Trout in 2014 (Figure 8). Survey crews angled for four hours and caught 35 fish, for a total catch rate of 8.8 fish/hr. Arctic Grayling averaged 237 mm TL (SE $\pm$ 3) (n = 34) and the Westslope Cutthroat Trout was 302 mm TL (n = 1). Buck Lake #4 has been stocked with Grayling in 2001, 2005, 2010, and 2013 and Westslope Cutthroat Trout in 1996. The lake is currently stocked on a 3-year rotation and receives approximately 250 Grayling per event. Grayling were not detected in our 2007 survey at the lake, but were detected in 2000. There is likely a naturally reproducing population of Cutthroat Trout in the lake, as they have been detected at Buck Lake #4 since 1992. The presence of naturally reproducing Westslope Cutthroat Trout in Buck Lake #4 may reduce the likelihood that Arctic Grayling establishment will be successful. No amphibians have ever been observed in the lake during any of our surveys.

Starr Lake

Starr Lake (also called Geertson Lake) and Geertson Lake #2 were surveyed on July 12, 2014. Starr Lake contained Rainbow Trout and no fish were detected in Geertson #2 (Figure 9, Table 3). Three Rainbow Trout were caught during 1.8 hours of angling at Starr, for a catch rate of 1.6 fish/hr. Average fish length was 358 mm TL (SE + 35). Starr Lake has been stocked with both Cutthroat Trout and Grayling form 1968 to 1998, but the lake is not currently stocked. Grayling have never been detected in the lake during any of our surveys, thus likely have never become established. However, Rainbow Trout have been detected every year the lake has been surveyed (1977, 1979, 1991, 2007, and 2014) and are currently naturally reproducing in the lake. Cutthroat were detected in our 1977 survey, but have not been documented since. Amphibians have never been detected during any of our surveys at either lake.

Pahsimeroi River Basin

Merriam Lake

Merriam was surveyed on June 26, 2014 and contained Brook Trout (Figure 10, Table 3). Twenty Brook Trout were angled in 4.5 hours, for a catch rate of 4.4 fish/hr. Brook Trout length averaged 217 mm TL (SE $\pm$ 14). Brook Trout have been detected in the lake during every year that we have surveyed Merriam (1991, 2005, and 2014). Brook Trout were first introduced into Merriam in 1949. Brook Trout growth in the lake was limited due to overabundance, so Tiger Muskellunge *Esox masquinongy* x *Esox lucius* were stocked in 2007 (n = 107) as a management tool to reduce Brook Trout abundance, but they did not survive (Koenig 2011). In fall 2014, 1,034 Tiger Trout *Salvelinus fontinalis* x *Salmo trutta* fingerlings were stocked as another attempt to reduce Brook Trout abundance through predation. We have not detected amphibians at the lake during any of our surveys.

MANAGEMENT RECCOMENDATIONS

1. Change species stocked in Alpine Creek Lake #11 to Golden Trout on a 3-year rotational basis.

2. Attempt elimination/ removal of Brook Trout in the Casino Lakes basin via intensive gill net removal, introduction of predators, stream electrofishing, and/or other processes necessary.

3. Remove Garland Lake #3 from the stocking plan, as it is very shallow and does not appear to be adequate for supporting fish persistence over winter.

4. Evaluate the success of Tiger Trout introduction in Merriam Lake in 2015, to help prioritize future management efforts aimed at reducing Brook Trout abundance.

Table 1. Salmon Region high mountain lake stocking rotations A, B, and C by year, 2014 through 2022.

	Stocking rotation sequence		
	A	B	C
Year	2014	2015	2016
of	2017	2018	2019
stocking	2020	2021	2022

Table 2. High mountain lakes stocked in the Salmon Region in 2014.

Lake name	LLID[a]	Species[b]	No. of fish stocked	Stocking method
Big Frog #2	1145459440792	C2	1002	Plane
Cache Creek #1	1147060447696	C2	1007	Plane
Castle	1145764440463	C2	641	Plane
Castle #1	1143719448008	C2	122	Plane
Castle View	1145949440206	C2	251	Plane
Challis Creek #2	1145181445498	C2	748	Plane
Challis Creek #3	1145208445520	C2	946	Plane
Chamberlain #7	1145928440269	C2	501	Plane
China #3	1147857444767	GN	418	Plane
Cirque	1146208441064	C2	1142	Plane
Cove	1146086441013	C2	1092	Plane
Crater	1145787451632	C2	870	Plane
Drift	1145991440632	C2	381	Plane
East Basin Cr #1	1147924443262	C2	485	Plane
Elk	1147476442291	C2	675	Plane
Feldspar	1145904440905	GR	380	Plane
Fourth of July	1146313440433	C2	717	Plane
Garland #1	1147832441610	C2	506	Plane
Garland #2	1147932441657	C2	506	Plane
Garland #3	1148012441759	C2	359	Plane
Goat	1145813440983	C2	1142	Plane
Gunsight	1146076441271	C2	443	Plane
Hindman	1149217443864	C2	502	Backpack
Honey	1146054440368	C2	641	Plane
Hoodoo	1146418441669	C2	253	Plane
Hope	1146102440386	GR	454	Plane
Liberty #1	1146502447588	TT	163	Plane
Liberty #2	1146485447545	TT	211	Plane
Lightning	1146643440160	C2	271	Plane
Little Redfish	1145361441038	C2	251	Plane
MacRae (Up Deer)	1146294439391	GR	81	Plane
Martindale #2	1146208448312	C2	198	Plane
Merriam	1137549441153	BB	1034	Backpack
Mystery #3	1147985444939	C2	84	Plane
Ocalkens #1	1146360441277	C2	506	Plane
Ocalkens #2	1146412441245	C2	760	Plane
Phyllis	1146491440230	C2	380	Plane
Pipe	1146638440043	C2	211	Plane
Pole	1146578447652	TT	195	Plane

Lake name	LLID[a]	Species[b]	No. of fish stocked	Stocking method
Rainbow	1147219439860	C2	211	Plane
Rock #1	1146696447553	TT	146	Plane
Rock #2	1146718447535	TT	569	Plane
Sapphire	1146152441033	C2	1242	Plane
Sheep	1146111441133	C2	501	Plane
Six #1	1146776440290	C2	485	Plane
Slide	1146198441124	C2	271	Plane
Snow	1146138440957	C2	370	Plane
Swimm	1146675441491	C2	865	Plane
Thunder	1146605440221	C2	232	Plane
Tin Cup	1146095441228	GR	941	Plane
Twin Creek #2	1144768445832	TT	131	Plane
W.F. Bear Cr #1	1144874445667	C2	211	Plane
W.F. Camas Cr #1	1146492448005	C2	1182	Plane
W.F. Camas Cr #3	1146624447965	C2	748	Plane
W.F. Camas Cr #5	1146689447976	C2	496	Plane
Washington #2	1146211440319	C2	752	Plane

[a] LLID = Latitude and Longitude Identification number
[b] C2=Westslope Cutthroat Trout, TT=Triploid Rainbow Trout, GR=Arctic Grayling, GN=Golden Trout, and BB=Tiger Trout (Brook X Brown)

Table 3. High mountain lakes surveyed in the Salmon Region in 2014, including survey results.

					Total length (mm)			
Lake name	LLID	Survey type	Species caught[a]	# Caught	Minimum	Maximum	Mean	CPUE (fish/hr)
Alpine Creek #8	1149607439143	Angling	None	0	-	-	-	0.0
Alpine Creek #8A	1149574439126	Angling	None	0	-	-	-	0.0
Alpine Creek #9	1149625439145	Angling	None	0	-	-	-	0.0
Alpine Creek #10	1149662439154	Angling	None	0	-	-	-	0.0
Alpine Creek #11	1149701439146	Angling	RBT	8	149	390	237	
			GNT	1	266	266	266	
			Total	9				1.2
Alpine Creek #11A	1149685439158	Visual	None	0	-	-	-	0.0
Alpine Creek #11B	1149683439174	Visual	None	0	-	-	-	1.0
Alpine Creek #12	1149699439196	Angling	WCT	11	195	335	235	6.6
Alpine Creek #12A	1149717439208	Angling	WCT	11	145	280	225	8.3
Alpine Creek #12B	1149706439211	Angling	WCT	12	170	270	213	36.4
Alpine Creek #12C	1149668439221	Angling	None	0	-	-	-	0.0
Alpine Creek #13	1149734439270	Angling	GRA	4	260	270	265	
			WCT	2	355	380		
			Total	6				1.3
Alpine Creek #14	1149599439213	Angling	WCT	7	137	297	227	
			GRA	2	172	208		
			Total	9				1.0
Alpine Creek #14A	1149626439230	Visual	Unknown	1	-	-	-	0.0
Alpine Creek #14B	1149608439240	Visual	Unknown	5	-	-	-	0.0
Alpine Creek #14C	1149623439263	Visual	None	0	-	-	-	0.0
Alpine Creek #14D	1149689439275	Visual	None	0	-			0.0
Alpine Creek #14E	1149673439290	Visual	Unknown	1	-			0.0
Alpine Creek #14F	1149687439285	Angling	GRA	1	356	356	356	0.3
Alpine Creek #15	1149715439307	Angling	GRA	2	128	172		0.4
Alpine Creek #16	1149745439323	Visual	None	0	-			0.0
Alpine Lake	1150532441816	Angling	WCT	12	240	365	295	
			GNT	2	282	296		
			RBT	1	320	320	320	
			Hybrids[b]	3	296	345	329	
			Total	18				1.4
		Gillnet	WCT	27	142	365	224	
			RBT	10	172	332	253	
			WCTxRBT	1	322	322	322	
			Hybrids[b]	6	192	371	248	
			Total	44				3.7
Bear Valley #1	1138702448026	Angling	RBT	4	189	250	220	2.7

Lake name	LLID	Survey type	Species caught[a]	# Caught	Total length (mm) Minimum	Maximum	Mean	CPUE (fish/hr)
Bear Valley #2	1138569448113	Angling	WCT	8	170	320	240	5.3
Bear Valley #2A	1138535448135	Visual	WCT	0	-	-	-	0.0
Bear Valley #2B	1138575448139	Visual	None	0	-	-	-	0.0
Bear Valley #3	1138585448175	Angling	WCT	16	190	270	225	
			WCTxRBT	3	215	250	237	
			Total	19				19.0
Bear Valley #3A	1138544448160	Visual	None	0	-	-	-	0.0
Bear Valley #3B	1138592448146	Visual	None	0	-	-	-	0.0
Buck #1	1138378447814	Angling	WCT	12	135	251	225	
			RBT	7	121	281	235	
			WCTxRBT	6	159	292	253	
			Total	25				6.3
Buck #2	1138413447865	Angling	None	0	-	-	-	0.0
Buck #3	1138464447843	Angling	RBT	9	208	285	235	
			WCT	6	122	277	193	
			WCTxRBT	2	235	255		
			Total	17				4.3
Buck Creek #4	1138529447819	Angling	GRA	34	201	265	237	
			WCT	1	302	302	302	
			Total	35				8.8
Casino #1	1148174441764	Visual	EBT	0	-	-	-	0.0
Casino #2	1148159441732	Angling	WCT	11	190	340	258	4.4
Casino #3	1148243441716	Angling	EBT	30	167	280	218	18.8
Garland #1	1147832441610	Angling	WCT	16	300	355	328	13.7
Garland #2	1147932441657	Angling	WCT	9	265	390	286	8.0
Garland #2A	1147872441656	Visual	None	0	-	-	-	0.0
Garland #3	1148012441759	Angling	None	0	-	-	-	0.0
Iron #1	1141832449129	Angling	RBT	15	136	316	229	
			WCTxRBT	13	80	319	231	
			WCT	9	210	320	283	
			Total	37				4.9
		Gillnet	RBT	11	76	340	217	
			WCTxRBT	8	97	315	248	
			WCT	7	92	292	199	
			Total	26				1.9
Merriam	1137549441153	Angling	EBT	20	130	313	217	4.4
NF EF Reynolds #2	1145482455479	Angling	WCT	6	155	385	242	6.0
NF EF Reynolds #4	1145447455576	Angling	None	0	-	-	-	0.0
NF EF Reynolds #4A	1145438455567	Visual	None	0	-	-	-	0.0
NF Hat Creek	1141861448863	Angling	WCT	14	177	299	246	4.7
		Gillnet	WCT	15	130	284	187	1.2

Lake name	LLID	Survey type	Species caught[a]	# Caught	Total length (mm) Minimum	Maximum	Mean	CPUE (fish/hr)
NF Hat Creek #A	1141915448838	Visual	None	0	-	-	-	0.0
NF Hat Creek #B	1141922448847	Visual	None	0	-	-	-	0.0
NF Hat Creek #C	1142004448936	Visual	None	0	-	-	-	0.0
NF Hat Creek #D	1142028448921	Visual	None	0	-	-	-	0.0
NF Hat Creek #E	1142039448868	Visual	None	0	-	-	-	0.0
Starr	1136639452386	Angling	RBT	14	310	425	358	7.7

[a] = RBT=Rainbow Trout, WCT=Westslope Cutthroat Trout, EBT=Eastern Brook Trout, GNT=Golden Trout, GRA=Arctic Grayling, WCTxRBT=hybrid.
[b] = Unknown hybrid trout. Potential hybridization between Rainbow Trout, Westslope Cutthroat Trout, and Golden Trout.

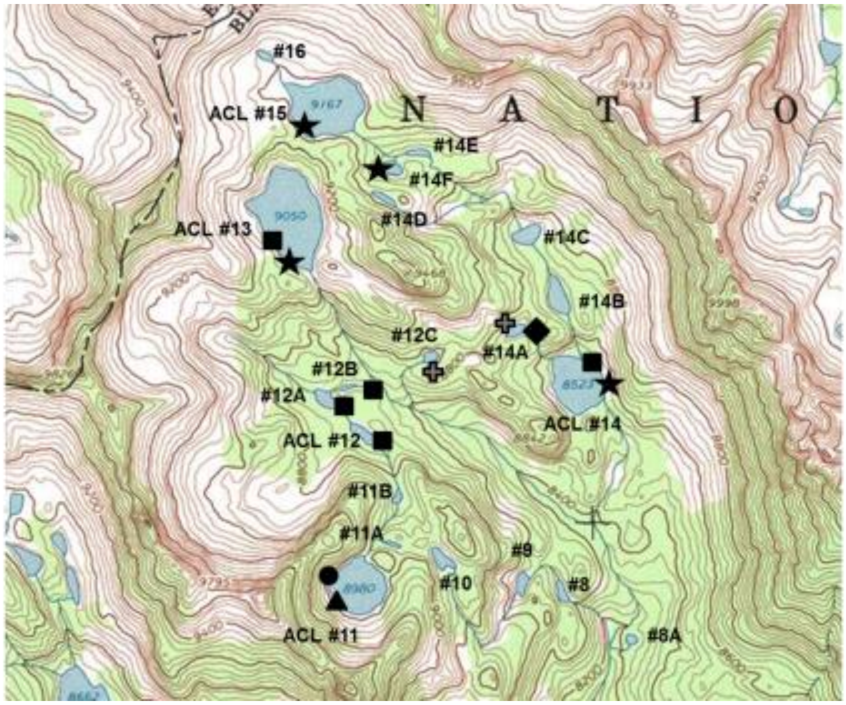

Figure 1. Alpine Creek Lakes basin, Alturas Lake Creek drainage, Sawtooth Mountains, southwest of Stanley, Idaho. Names of lakes surveyed in 2014, and fish and amphibian species observed during the surveys (▲ = Golden Trout, ● = Rainbow Trout, ■ = Cutthroat Trout, ★ = Arctic Grayling, ◆ = Unknown species, ✚ = Western Long-toed Salamander).

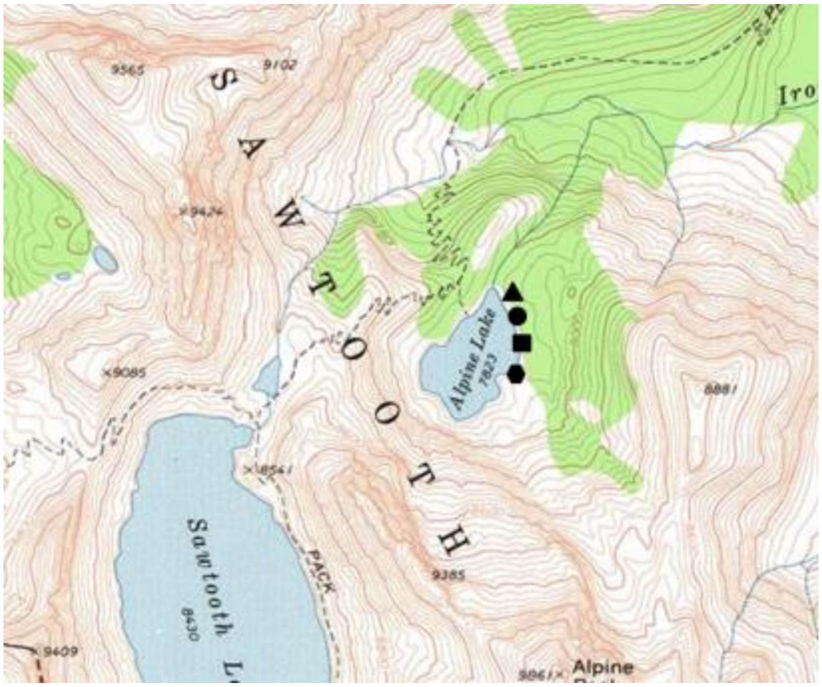

Figure 2. Alpine Lake, Iron Creek drainage, Sawtooth Mountains, west of Stanley, Idaho. Fish and amphibian species observed during the 2014 survey (▲ = Golden Trout, ● = Rainbow Trout, ■ = Cutthroat Trout, ⬢ = hybrid fish species).

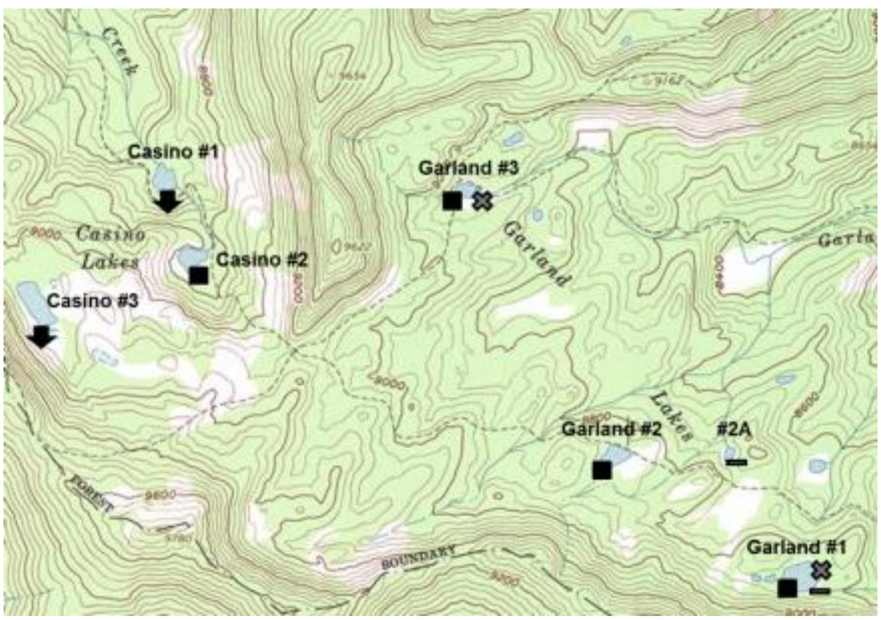

Figure 3. Casino and Garland Lakes basins, upper Salmon River basin, southeast of Stanley, Idaho. Names of lakes surveyed in 2014, and fish and amphibian species observed during the surveys (■ = Cutthroat Trout, 🡇 = Brook Trout, ✖ = Columbia Spotted Frogs, ▬ = Western Toads).

Figure 4. Iron Lakes, Iron Creek drainage, Salmon River Mountains, southwest of Salmon, Idaho. Names of lakes and fish and amphibian species observed during the survey at Iron Lake #1 in 2014 (■ = Cutthroat Trout, ● = Rainbow Trout).

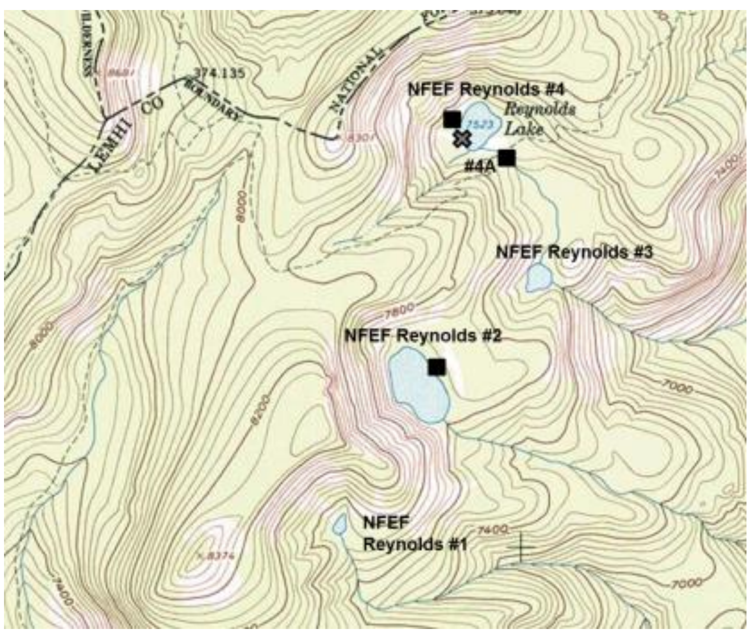

Figure 5. North Fork East Fork Reynolds Lakes, Horse Creek drainage, Frank Church Wilderness, northwest of Salmon, Idaho. Names of lakes and fish and amphibian species observed during the surveys at NFEF Reynolds #2, #4, and #4A in 2014 (■ = Cutthroat Trout, ✖ = Columbia Spotted Frogs).

Figure 6. North Fork Hat Creek Lakes basin, Hat Creek drainage, Salmon River Mountains, southwest of Salmon, Idaho. Names of lakes surveyed in 2014 and fish and amphibian species observed during the surveys (■ = Cutthroat Trout, ✖ = Columbia Spotted Frogs, ▬ = Tailed Frogs).

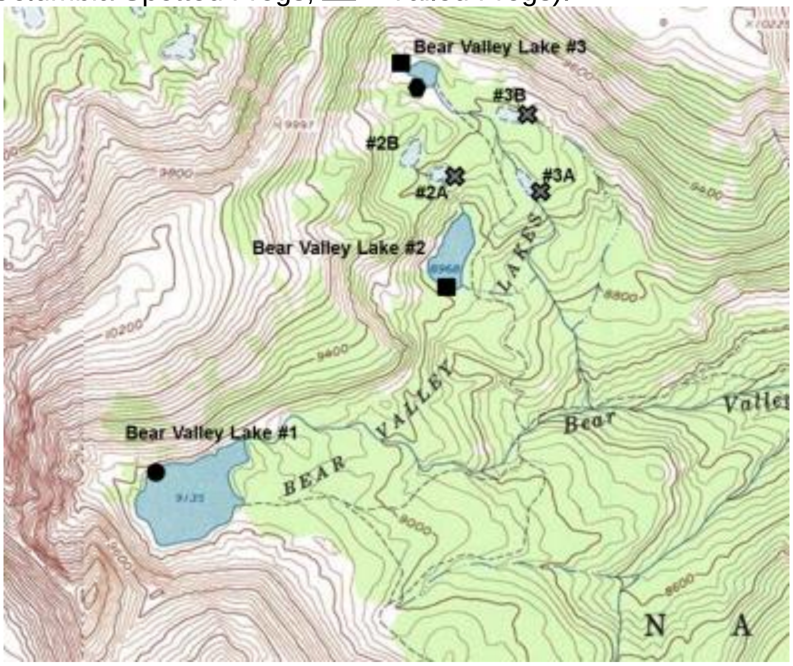

Figure 7. Bear Valley Lakes basin, Lemhi River drainage, Lemhi Mountains, south of Salmon, Idaho. Names of lakes surveyed in 2014 and fish and amphibian species observed during the surveys (■ = Cutthroat Trout, ● = Rainbow Trout, ⬣ = hybrid fish species, ✖ = Columbia Spotted Frogs).

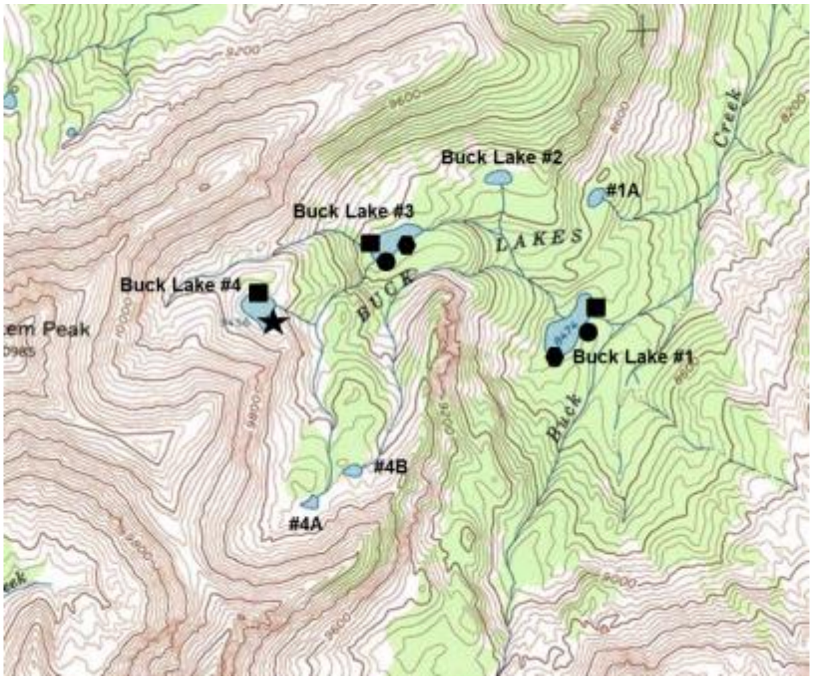

Figure 8. Buck Lakes basin, Lemhi River drainage, Salmon River Mountains, south of Salmon, Idaho. Names of lakes and fish and amphibian species observed during the surveys in 2014 (#4A and #4B were not surveyed in 2014) (★ = Arctic Grayling, ■ = Cutthroat Trout, ● = Rainbow Trout, ⬣ = hybrid fish species).

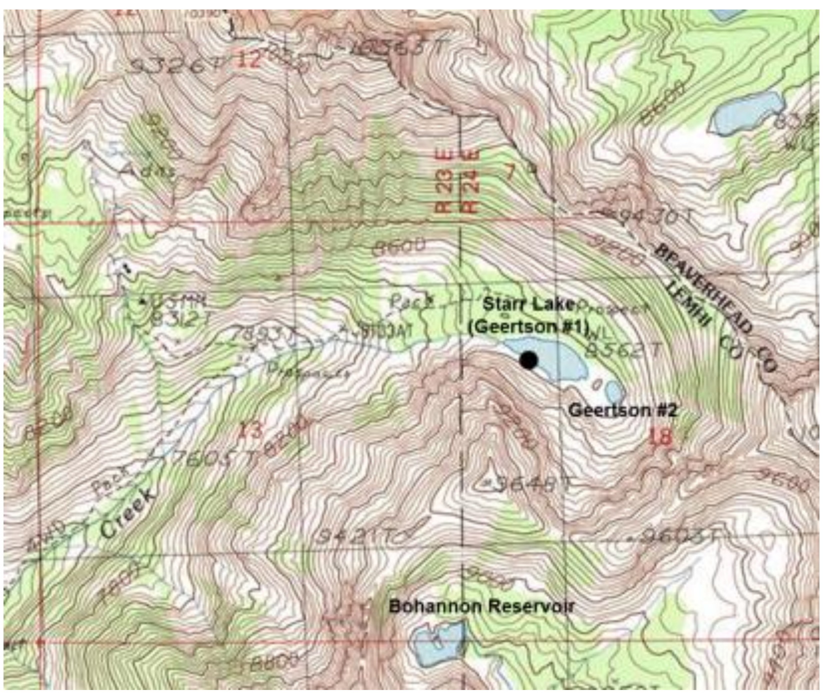

Figure 9. Starr Lake and Geertson #2, Lemhi River drainage, Beaverhead Mountains, east of Salmon, Idaho. Names of lakes and fish and amphibian species observed during the surveys in Starr and Geertson #2, 2014 (● = Rainbow Trout).

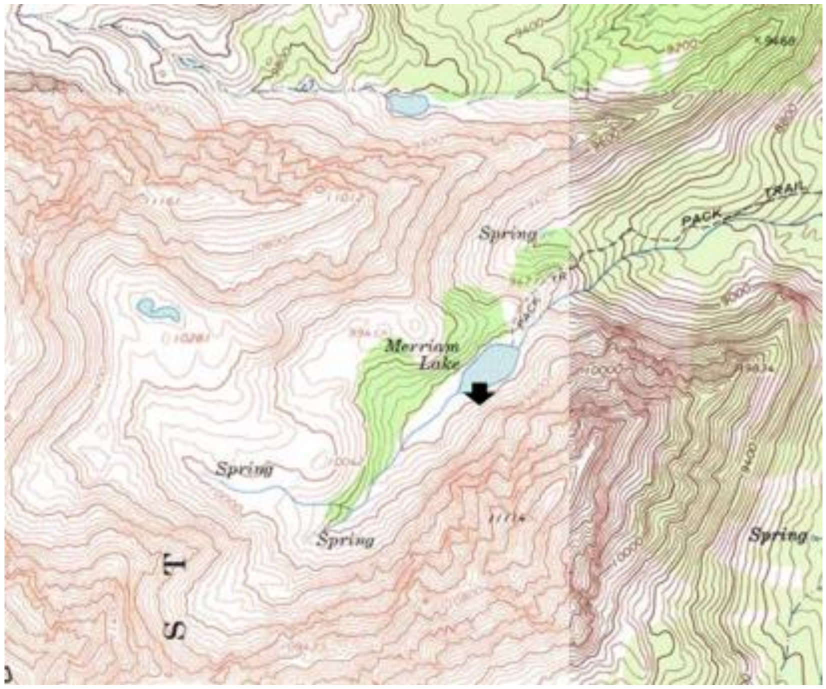

Figure 10. Merriam Lake, Pahsimeroi River drainage, Lost River Range, north of Mackay, Idaho. Names of lakes surveyed in 2014 and fish and amphibian species observed during the surveys (⬇ = Brook Trout).

Appendix A. Salmon Region high mountain lakes scheduled to be stocked using Rotations A, B, and C.

Lake name	IDFG catalog #	Location in WGS84 Latitude °N	Longitude °W	Land area[a]	Species[b] to be stocked	Approx. # fish to be stocked
Rotation A:						
Big Frog #2	700001385	44.07925	-114.54581	SNRA	C2	1,000
Cache Creek #1	700000843	44.77519	-114.68877	SCNF	C2	250
Cache Creek #3	700000845	44.77490	-114.69730	SCNF	GR	250
Cache Creek #5	700000848	44.76954	-114.70607	SCNF	GR	375
Castle	700001420	44.04621	-114.57640	SNRA	C2	650
Castle #1	700000835	44.80260	-114.37293	SCNF	C2	125
Castle View	700001440	44.02078	-114.59486	SNRA	C2	250
Challis Creek #2	700001333	44.55194	-114.51875	SCNF	C2	750
Challis Creek #3	700001335	44.55344	-114.52182	SCNF	C2	950
Chamberlain #7	700001439	44.02655	-114.59303	SNRA	C2	500
China #3	700000885	44.47724	-114.78585	SCNF	GN	400
Cirque	700001369	44.10650	-114.62095	SNRA	C2	1,150
Cove	700001364	44.10136	-114.61163	SNRA	C2	1,100
Crater	700001460	44.14432	-114.60979	SNRA	C2	875
Drift	700001424	44.06538	-114.60023	SNRA	C2	375
East Basin Creek#1	700001514	44.33356	-114.79403	SCNF	C2	475
Elk	700001479	44.23096	-114.74874	SNRA	C2	675
Feldspar	700001380	44.09032	-114.59042	SNRA	GR	550
Fourth of July	700001685	44.04505	-114.63216	SNRA	C2	725
Garland #1	700001468	44.16268	-114.78395	SNRA	C2	500
Garland #2	700001469	44.16742	-114.79421	SNRA	C2	500
Garland #3	700001470	44.17767	-114.80196	SNRA	C2	350
Gentian	700001370	44.09890	-114.61311	SNRA	TT	325
Goat	700001375	44.09977	-114.58104	SNRA	C2	1,150
Gunsight	700001350	44.12724	-114.60790	SNRA	C2	450
Honey	700001433	44.03671	-114.60517	SNRA	C2	200
Hoodoo	700001463	44.16883	-114.64272	SNRA	C2	250
Hope	700001430	44.03862	-114.61013	SNRA	GR	650
Liberty #1	700000830	44.76059	-114.65108	SCNF	TT	150
Liberty #2	700000833	44.75634	-114.64936	SCNF	TT	200
Lightning	700001680	44.01601	-114.66419	SNRA	C2	275
Little Redfish	700001347	44.10561	-114.53697	SNRA	C2	250
MacRae	700001450	43.94057	-114.63004	SNRA	GR	600
Martendale #1	700000815	44.83008	-114.61594	SCNF	GR	250
Martendale #2	700000816	44.83124	-114.62061	SCNF	C2	200
Mystery #3	700000879	44.49383	-114.79855	SNRA	C2	75

Lake name	IDFG catalog #	Location in WGS84 Latitude °N	Longitude °W	Land area[a]	Species[b] to be stocked	Approx. # fish to be stocked
Nelson #2	700000873	44.50565	-114.81396	SCNF	GR	500
Ocalkens #1	700001464	44.12943	-114.63709	SNRA	C2	500
Ocalkens #2	700001465	44.12606	-114.64130	SNRA	C2	750
Phyllis	700001683	44.02290	-114.64895	SNRA	C2	375
Pipe	700001732	44.00190	-114.65640	SNRA	C2	200
Pole	700000834	44.76517	-114.65772	SCNF	TT	175
Rainbow	700001727	43.98592	-114.72216	SNRA	C2	200
Rock #1	700000863	44.75698	-114.67047	SCNF	TT	125
Rock #2	700000864	44.75531	-114.67266	SCNF	TT	550
Sapphire	700001367	44.10294	-114.61518	SNRA	C2	1,250
Sheep	700001356	44.11324	-114.61120	SNRA	C2	500
Six #1	700001672	44.02890	-114.67804	SNRA	C2	475
Slide	700001363	44.11410	-114.62057	SNRA	C2	275
Snow	700001374	44.09574	-114.61406	SNRA	C2	375
Swimm	700001467	44.14698	-114.66780	SNRA	C2	875
Thunder	700001679	44.02224	-114.66052	SNRA	C2	225
Tin Cup	700001349	44.12465	-114.61047	SNRA	GR	1,350
Twin Creek #2	700001319	44.58320	-114.47685	SCNF	TT	125
West Fork Bear Creek #1	700001328	44.56676	-114.48765	SCNF	C2	200
West Fork Camas Creek #1	700000818	44.80228	-114.65012	SCNF	C2	1,200
West Fork Camas Creek #3	700000820	44.80184	-114.65930	SCNF	C2	750
West Fork Camas Creek #5	700000824	44.79862	-114.66245	SCNF	C2	500
Washington #2	700001444	44.03372	-114.62199	SNRA	C2	750
Rotation A Total						**30,025**
<u>Rotation B</u>:						
Alpine	700001540	44.17869	-115.05515	SWA	GN	3,850
Alpine Creek #2	700001784	45.06828	-114.62418	SWA	C2	375
Alpine Creek #4	700001787	43.90737	-114.97360	SWA	GR	2,375
Alpine Creek #5	700001788	43.90509	-114.98187	SWA	TT	125
Alpine Creek #6	700001789	43.91085	-114.98285	SWA	C2	300
Alpine Creek #7	700001790	43.90906	-114.99277	SWA	C2	350
Alpine Creek #11	700001797	43.91504	-114.96888	SWA	TT	425
Alpine Creek #12	700001798	43.91990	-114.97061	SWA	C2	50
Alpine Creek #13	700001800	43.92818	-114.97220	SWA	GR	1,250
Alpine Creek #14	700001802	43.91997	-114.95877	SWA	GR	400

Lake name	IDFG catalog #	Location in WGS84 Latitude °N	Longitude °W	Land area[a]	Species[b] to be stocked	Approx. # fish to be stocked
Alpine Creek #15	700001804	43.93059	-114.97169	SWA	GR	925
Baldwin Creek	700001007	44.49531	-115.11254	SWA	C2	350
Bear Creek #1	700001137	44.48584	-115.09418	SCNF	C2	200
Cliff Creek #1	700001144	44.47941	-115.03307	SCNF	C2	150
Cliff Creek #4	700001146	44.48155	-115.04370	SCNF	C2	75
Collie Creek #1	700001111	44.40881	-115.22541	SCNF	C2	1,075
Decker Creek #1	700001659	44.04955	-114.93535	SWA	C2	575
Elizabeth	700001570	44.26758	-115.15233	SCNF	C2	500
Elk	700001163	44.41244	-115.03845	SCNF	C2	675
Fishhook Creek #2	700001607	44.11579	-114.98307	SWA	C2	75
Fishhook Creek #3	700001610	44.11061	-114.98761	SWA	C2	75
Goat #1	700001530	44.17401	-115.02008	SWA	C2	2,225
Goat #4	700001535	44.16100	-115.01520	SWA	C2	425
Goat #5	700001536	44.15845	-115.01762	SWA	C2	50
Hanson #1	700001555	44.22342	-115.11841	SWA	C2	225
Hanson #3	700001558	44.20939	-115.11718	SWA	C2	725
Hanson #5	700001561	44.19971	-115.11754	SWA	C2	125
Harlan Creek #1	700000980	44.53028	-115.14022	SCNF	C2	300
Harlan Creek #2	700000983	44.52185	-115.14804	SCNF	C2	250
Hasbrook #1	700000992	44.52178	-115.17858	SCNF	C2	375
Helldiver	700000989	44.53484	-115.17217	SCNF	C2	550
Hidden	700001573	44.29554	-115.11644	SCNF	C2	250
Imogene #1	700001713	43.99631	-114.95119	SWA	TT	1,850
Imogene #2	700001714	44.00110	-114.96111	SWA	C2	200
Imogene #3	700001715	44.88833	-114.93243	SWA	C2	625
Imogene #4	700001717	43.99167	-114.96502	SWA	C2	100
Imogene #6	700001719	44.88921	-114.94127	SWA	C2	525
Iris #1	700001074	44.51111	-115.19269	SCNF	C2	225
Iris #3	700001077	44.51751	-115.20132	SCNF	C2	350
Iron Creek #6	700001547	44.16405	-115.03666	SWA	TT	75
Iron Creek #7	700001548	44.16708	-115.04336	SWA	TT	75
Island	700001127	44.47764	-115.14403	SNRA	TT	1,575
Kidney #2	700001033	44.52244	-114.97227	SCNF	C2	150
Langer #1	700001133	44.48228	-115.13572	SCNF	TT	1,000
Lost	700000988	44.53062	-115.15817	SCNF	C2	200
Lower Island	700001129	44.47229	-115.13659	SCNF	C2	550
Lower Valley Creek	700001584	44.37281	-115.03789	SNRA	C2	550
Lucille	700001708	44.00517	-114.96835	SWA	C2	775
Marshall #2	700001525	44.15520	-114.99604	SWA	C2	500

Lake name	IDFG catalog #	Location in WGS84 Latitude °N	Longitude °W	Land area[a]	Species[b] to be stocked	Approx. # fish to be stocked
Martha	700001569	44.28575	-115.09613	SCNF	C2	200
McGown #3	700001565	44.17958	-115.07673	SWA	C2	250
Muskeg #1	700001043	44.54426	-115.20971	SCNF	TT	500
Muskeg #3	700001046	44.54057	-115.21991	SCNF	TT	500
P 38	700001160	44.42239	-115.08412	SCNF	C2	325
Parks Peak #1	700001745	43.96081	-114.94360	SWA	C2	500
Profile	700001710	44.01390	-114.97367	SWA	C2	775
Rainbow	700001153	44.33560	-115.26710	SCNF	GRA	250
Ruffneck	700001130	44.47510	-115.14771	SCNF	TT	1,250
Seafoam #6	700001005	44.50407	-115.13228	SCNF	GRA	600
Soldier #4	700001050	44.53024	-115.19434	SCNF	C2	975
Soldier #7	700001055	44.53004	-115.19855	SCNF	C2	250
Soldier #8	700001057	44.52745	-115.20248	SCNF	C2	250
Soldier #10	700001059	44.52926	-115.20198	SCNF	C2	250
Soldier #11	700001060	44.53082	-115.20336	SCNF	C2	250
Thompson Cirque	700001604	44.14641	-115.00321	SWA	C2	900
Upper Cramer	700001657	44.03002	-114.98970	SWA	C2	500
Upper Hell Roaring #1	700001687	44.02751	-114.95190	SWA	C2	275
Upper Hell Roaring #2	700001688	44.03064	-114.96008	SWA	C2	275
Upper Redfish #1	700001634	44.04723	-115.03618	SWA	GRA	725
Upper Redfish #2	700001635	44.04518	-115.03680	SWA	C2	425
Upper Redfish #3	700001636	44.03831	-115.03539	SWA	C2	625
Valley Creek #2	700001587	44.37420	-114.95413	SCNF	C2	400
Vanity #1	700001009	44.49344	-115.05297	SCNF	TT	300
Vanity #4	700001014	44.48815	-115.04923	SCNF	TT	250
Vanity #5	700001015	44.48849	-115.05599	SCNF	C2	125
Vanity #7	700001017	44.48483	-115.06491	SCNF	TT	200
Vanity #13	700001027	44.47721	-115.07963	SCNF	GRA	250
Rotation B Total						**41,375**
Rotation C:						
Basin Creek #5	700001237	44.84145	-113.85536	SCNF	C2	1,000
Bear Valley #3	700001245	44.81730	-113.85856	SCNF	C2	150
Birdbill	700001197	45.15255	-114.58801	SCNF	C2	500
Broncho	700000566	45.46751	-114.65358	SCNF	C2	725
Buck #4	700001242	44.78248	-113.85286	SCNF	GRA	225
Cabin Creek #3	700001503	44.41909	-114.90180	SCNF	C2	100

Lake name	IDFG catalog #	Location in WGS84 Latitude °N	Longitude °W	Land area[a]	Species[b] to be stocked	Approx. # fish to be stocked
Cabin Creek #4	700001504	44.42016	-114.89059	SCNF	C2	600
Cabin Creek #7	700001508	44.41496	-114.88969	SCNF	C2	200
Cabin Creek Peak #1	700001487	44.40208	-114.91479	SCNF	C2	150
Crater	700001185	44.14432	-114.60979	SCNF	GN	700
Devils	700001260	44.60342	-113.54079	SCNF	C2	350
Everson	700001257	44.62742	-113.61512	SCNF	C2	1,500
Finger #3	700001094	44.48951	-115.14975	SCNF	C2	475
Glacier	700001189	45.17030	-114.58697	SCNF	GN	275
Golden Trout	700001201	45.11373	-114.52246	SCNF	GN	950
Gooseneck	700001187	45.16717	-114.58337	SCNF	GN	200
Harbor	700000796	45.14446	-114.59352	SCNF	C2	3,000
Heart	700000793	45.13725	-114.59571	SCNF	C2	1,675
Hidden	600000616	45.47708	-114.67560	BNF	C2	1,125
Knapp #7	700001169	44.42225	-114.92367	SCNF	C2	200
Knapp #14	700001179	44.43341	-114.93996	SCNF	GRA	250
Line	600000603	45.57215	-114.57350	BNF	C2	350
Lola #2	700001148	44.39115	-115.22577	SCNF	C2	500
Lola #3	700001149	44.39132	-115.23997	SCNF	C2	500
Loon Creek #3	700000904	44.44245	-114.92812	SCNF	C2	150
Loon Creek #11	700000917	44.46694	-114.94871	SCNF	C2	175
Loon Creek #13	700000919	44.49265	-114.94664	SCNF	C2	225
Loon Creek #15	700000923	44.49837	-114.94357	SCNF	C2	175
Lost Packer	700000564	45.47156	-114.77733	SCNF	TT	1,000
Middle Fork Hat Creek #2	700001288	44.87496	-114.20906	SCNF	GRA	500
Middle Fork Hat Creek #3	700001289	44.87611	-114.20441	SCNF	TT	1,000
Middle Fork Hat Creek #4	700001290	44.85778	-113.44562	SCNF	TT	300
Middle Fork Hat Creek #5	700001293	44.87941	-114.20992	SCNF	TT	1,075
McNutt	700001236	44.82698	-113.84794	SCNF	C2	350
North Fork East Fork Reynolds #2	700000575	45.54757	-114.54794	SCNF	C2	1,325
North Fork East Fork Reynolds #4	700000578	45.55739	-114.54489	SCNF	C2	1,000
Nez Perce	700001273	44.50919	-113.39022	SCNF	GRA	250
Paragon	700000756	45.08494	-114.62064	SCNF	C2	275
Park Fork Creek	700001261	44.53403	-113.54035	SCNF	C2	150
Pass	700001307	44.09029	-113.75723	SCNF	GN	350

Lake name	IDFG catalog #	Location in WGS84 Latitude °N	Longitude °W	Land area[a]	Species[b] to be stocked	Approx. # fish to be stocked
Patterson Creek #1	700001258	44.63733	-113.65478	SCNF	C2	125
Patterson Creek #2	700001259	44.62776	-113.65704	SCNF	C2	200
Puddin Mountain #1	700000764	45.09959	-114.59641	SCNF	TT	500
Puddin Mountain #2	700000766	45.09998	-114.60019	SCNF	TT	500
Puddin Mountain #5	700000770	45.10735	-114.60488	SCNF	TT	1,000
Puddin Mountain #6	700000773	45.10243	-114.60522	SCNF	TT	1,000
Puddin Mountain #10	700000778	45.11351	-114.61418	SCNF	C2	275
Puddin Mountain #15	700000787	45.11961	-114.60880	SCNF	C2	675
Right Fork Big Eightmile	700001264	44.59168	-113.60992	SCNF	C2	150
Ramshorn	700000755	45.08700	-114.61424	SCNF	C2	350
Rocky	700001135	44.48829	-115.13586	SCNF	C2	450
South Fork Moyer Creek	700001205	44.88418	-114.22993	SCNF	GRA	275
Ship Island #5	700000618	45.15682	-114.60120	SCNF	C2	1,000
Ship Island #7	700000620	45.15110	-114.60327	SCNF	C2	325
Tango #4	700000893	44.44851	-114.89875	SCNF	C2	675
Tango #5	700000894	44.44411	-114.89286	SCNF	C2	250
Tango #6	700000895	44.44083	-114.89579	SCNF	C2	900
U P	700001220	45.23706	-114.01507	SCNF	C2	1,000
Welcome	700000790	45.13060	-114.59208	SCNF	C2	1,225
Wilson	700000794	45.14559	-114.58780	SCNF	C2	1,000
Rotation C Total						**35,875**

[a] SNRA = Sawtooth National Recreation Area, SCNF = Salmon-Challis National Forest, SWA = Sawtooth Wilderness Area, and BNF = Bitterroot National Forest.
[b] C2 = Westslope Cutthroat Trout, GRA = Arctic Grayling, GN = Golden Trout, and TT = Troutlodge triploid Rainbow Trout

LOWLAND LAKES AND RESERVOIRS

EXPLOITATION OF HATCHERY TROUT IN REGIONAL WATERS

ABSTRACT

We assessed the level of use and exploitation of stocked catchable Rainbow Trout *Oncorhynchus mykiss* in seven put-and-take fisheries in the Salmon Region, in 2014. Use and exploitation of hatchery stocked Rainbow Trout in 2014 was highest in Meadow Creek Lake, and lowest in Alturas Lake. Total use and exploitation values in Big Bayhorse Lake, Hayden Pond, Iron Lake, Stanley Lake, and Wallace Lake were similar to the statewide averages (23.3% use, 17.5% exploitation, *n*=64) for 2014. When tested, Rainbow Trout stocked at a larger size, termed 'magnums' (~330 mm), seemed to return-to-creel at higher rates than those stocked at the traditional size (~250 mm). 'Magnums' stocked in Stanley Lake in June returned at a rate of 43.4% (total use).

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HISTORY AND INTRODUCTION

IDFG research staff initiated the “Tag-You’re-It” study in 2006, which uses angler reporting information from tagged fish to estimate use (fish caught) and exploitation (fish harvested) of catchable Rainbow Trout *Oncorhynchus mykiss* stocked in put-and-take waters (Cassinelli 2014). Given that hatchery production of catchable Rainbow Trout (averaging ~250 mm TL) typically accounts for over 50% of IDFG’s annual Resident Hatchery budget (Cassinelli 2014), we recognized the need to quantify use and exploitation patterns to better inform management decisions. The Tag-You’re-It program evaluates return-to-creel for hatchery stocked catchable Rainbow Trout in select waters by tagging a proportion of stocked fish during each stocking event, and relying on angler reporting of tagged fish to generate estimates. Use and exploitation estimates for each stocked group of fish are adjusted by factoring in estimated tag reporting rates, estimated tag-loss rates, and estimated tagging mortality rates (Cassinelli 2014). In addition to using this information to maximize stocking efficiency in regional waters, the tagging program is also used to evaluate how changes in rearing and stocking practices at the hatcheries (such as rearing density, size-grading, and size-at-release) could affect return-to-creel rates (Cassinelli 2015). We used the tagging program in 2014 to evaluate return-to-creel rates in popular put-and-take waters in the region, in order to prioritize stocking efforts where they are most beneficial, alter stocking timing to maximize angler use and satisfaction, and understand how anglers use our regional fisheries.

STUDY AREAS

Alturas (WGS84 datum: 43.91372ºN, 114.86088ºW) and Stanley (WGS84 datum: 44.24371ºN, 115.05653ºW) Lakes are located in the Sawtooth Basin, near Stanley, Idaho. Alturas Lake has a 334 ha surface area and sits at an elevation of 2,140 m. Stanley Lake is 71.3 ha in size and sits at 1,990 m in elevation. IDFG has been stocking both lakes since the 1940’s, and has been stocking hatchery Rainbow Trout in both lakes since 1956 (IDFG stocking website). The Sawtooth Basin is a popular destination for tourists during summer months, so both lakes are currently managed as put-and-take fisheries to offer opportunity for visiting anglers in the area. Trout limit is six per person per day on both lakes. A creel survey conducted by IDFG’s Sockeye Recovery Program staff in 2013 found that Stanley Lake received an estimated 9,217 hours (95% CI ± 2,026) of angler effort, resulting in an estimated 6,231 (SE ± 799) Rainbow Trout caught and 2,959 (SE ± 521) Rainbow Trout harvested (Mike Peterson, personal communication). The last creel survey at Alturas Lake was conducted in 1987, when effort was estimated at 10,126 hours (Lukens and Davis 1989). However, angler-use patterns in the Sawtooth Basin have likely changed since then, especially where motor boating sports are popular (i.e. Alturas and Redfish Lakes). For the past five years, Alturas Lake has been stocked with approximately 9,000 catchable Rainbow Trout per year, and Stanley Lake has been stocked with approximately 15,000 to 20,000 per year. In 2014, Alturas and Stanley Lakes were study lakes as part of a statewide research project focused on improving return-to-creel rates by altering hatchery production practices. Both lakes received size-graded fish, and Stanley Lake received ‘magnums’ (see explanation below) in addition to standard catchable trout.

Hayden Creek Pond (WGS84 datum: 44.83873ºN, 113.66204ºW) is a popular community fishery near Salmon, Idaho, that is 0.52 ha in size and sits at 1,650 m in elevation. Hayden Creek Pond is easily accessible by paved road, is wheelchair accessible, and is open to fishing year-round. The region manages Hayden Pond as a put-and-take fishery with general bag and possession limits (six trout per day). Stocking catchable Rainbow Trout throughout the year (February through November) is intended to provide high catch rates throughout the year. Over the last five years, Hayden Creek Pond has received 2,700 to 5,000 catchable sized hatchery Rainbow Trout annually. The main focus for estimating exploitation and use of hatchery Rainbow Trout in Hayden Pond in 2014 was to determine how return-to-creel varied by stocking event (April – November, *n*=7), in order to help us maximize efficiency of our stocking schedule.

Big Bayhorse Lake (WGS84 datum: 44.41307ºN, 114.40231ºW), Iron Lake (WGS84 datum: 44.90687ºN, 114.19280ºW), Meadow Creek Lake (WGS84 datum: 44.43359ºN, 113.31486ºW), and Wallace Lake (WGS84 datum: 45.24625ºN, 114.00730ºW) are four popular, easily accessible alpine lakes in the Salmon Region. Big Bayhorse Lake is 7.5 ha in size and sits at 2,621 m in elevation, Iron Lake is 6.1 ha in size and sits at an elevation of 2,690 m, Meadow Creek Lake is 7 ha in size and sits at 2,790 m in elevation, and Wallace Lake is 3 ha in size and sites at an elevation of 2,480m. All four lakes are regulated under general bag and possession limits (six trout per day). Typically, the fishable season on these lakes is short due to surface ice and poor access until about July. Over the last five years, we have annually stocked approximately 3,000 to 4,000 catchables in Big Bayhorse, 2,000 catchables in Iron, 4,000 catchables in Meadow, and 1,000 to 2,000 catchables in Wallace. The main focus of assessing return-to-creel rates for hatchery catchable Rainbow Trout in these four lakes in 2014 was to determine whether stocking rates need to be adjusted in order to meet current angler demand.

METHODS

Estimating Return-to-Creel

Total use (fish caught) and exploitation (fish harvested) of hatchery-stocked catchable Rainbow Trout was evaluated for seven popular lake fisheries in the Salmon Region in 2014. Stanley Lake, Alturas Lake, Big Bayhorse Lake, Hayden Pond, Iron Lake, Meadow Creek Lake, and Wallace Lake are stocked with catchable Rainbow Trout several times each year. For some stocking events in 2014, a proportion of stocked fish (usually between 5% and 10%) were implanted with FLOY T-bar anchor tags printed with a unique numerical code and information for anglers to report caught and harvested fish. IDFG contact information on the tags directed anglers to report tags to the Nampa Fish Research office where the data is stored and analyzed. Estimated total use (fish caught) and exploitation (harvest) for each stocking event were calculated based on methods reported in Meyer et al. (2010). Unadjusted harvest and catch were calculated for each stocking event, and adjusted by factoring in the statewide angler reporting rate estimate (40.9% in 2014), the statewide estimated tag-loss rate (8% for first year at large in 2014), and the estimated tagging mortality rate (constant = 0.8%) found in Cassinelli (2014). In this report, we only generated estimates for each stocking group's first year at large. Estimates for adjusted harvest or catch rate (u') were calculated using the formula:

$$u' = \frac{u}{\lambda(1 - Tag_l)(1 - Tag_m)}$$

Where:
u = unadjusted harvest/catch rate
λ = angler tag reporting rate
Tag_l = first year tag-loss rate
Tag_m = tagging mortality rate

Ninety percent (90%) confidence intervals were calculated for all harvest and catch estimates. For more information and details regarding these methods and associated formulas, see Meyer et al. (2010).

Size Grading

The prerelease size grading study began in 2013 at American Falls, Hagerman, and Nampa fish hatcheries, as part of a research effort to determine if such practices could be used to improve return-to-creel rates of hatchery stocked catchable Rainbow Trout. Lakes received paired groups for each stocking event: graded and non-graded (control). Graded groups were sorted twice before all fish were stocked. During the first grading event, fish larger than 250 mm TL were stocked and the remaining fish were reared an additional four weeks. Fish were then graded a second time in the same fashion, and fish smaller than 250 mm TL were reared an additional four weeks before they were stocked. During each stocking event that received graded fish, ungraded fish were also stocked as controls. Approximately 10% of fish in each group (control and graded) were tagged before release to assess differences in return-to-creel between each group. For more detailed information on the prerelease size grading study, see Cassinelli (2015).

Magnums Grading

In 2013, IDFG began evaluating if stocking catchable Rainbow Trout at an overall larger size could be used to improve return-to-creel rates (Cassinelli 2015). At American Falls Hatchery, a group of catchable Rainbow Trout were reared to reach an average 330 mm TL before being stocked (compared to the traditional 'standard' 250 mm TL catchables). During each stocking event that received magnums, a control group of standard catchables was also stocked. In addition to testing return-to-creel for magnums at Stanley Lake in 2014, we also tested the effects of prerelease size grading on the magnum raceways. Approximately 10% of fish in each group (standards, magnum graded, and magnum ungraded) were tagged before release to assess differences in return-to-creel between each group. For more detailed information on the 'magnum' study, see Cassinelli (2015).

Angler Effort

A creel crew visited Stanley Lake on 61 occasions from May 24 to October 30 to estimate angler effort and catch (M. Peterson, IDFG, personal communication). Approximately 13 to 15 days were surveyed each month, and days were stratified to include an even number of weekdays and weekend days each month. During each creel day, two randomly selected times were identified for each angler count and interview period. Creel crews counted the number of anglers actively fishing during each time period, and interviewed each group of anglers to obtain effort, catch, and harvest information. If anglers were not done fishing, they were given a mail-in creel card to report their total effort, catch, and harvest after completing their trip. Data was summarized and total effort, catch, and harvest estimates were generated using CAS (Creel Application Software).

RESULTS AND DISCUSSION

Alturas Lake

Total use and exploitation of hatchery Rainbow Trout stocked in Alturas Lake was estimated for two stocking events in 2014. Ten percent of stocked Rainbow Trout were tagged during each of two stocking events (July and August, ~200 tagged fish per event). Half (*n*=100) of the tagged/stocked fish in each event were “size-graded” prior to release from the hatchery, and the other half were controls (not graded). From the July stocking event, as of August 10, 2015, two fish were reported as harvested (one graded and one control) and no fish were reported as caught and released. Total use and exploitation were both estimated at 2.7% (±3.7%) for each of the two groups. From the August stocking event, one fish from the graded treatment group was reported as harvested and no fish were reported as caught and released. Use and exploitation were estimated as 2.7% (±3.7%) for the graded group and 0.0% for the ungraded group in August.

Overall, for all stocking events in Alturas Lake in 2014, both angler exploitation and total use was estimated at 1.4% (Figure 11). Estimated return-to-creel for hatchery Rainbow Trout stocked in Alturas Lake is very low compared to other regional waters (Figure 11), and the statewide average for 2014 (23.3% use, 17.5% exploitation, *n*=64). Return to creel for hatchery Rainbow Trout at Alturas Lake has historically been much higher; 39% and 22% in 1986 and 1987, respectively (Lukens and Davis 1989). However, estimated angling effort in 1986 and 1987 was quite high (12,577 hours and 10,126 hours, respectively) and perhaps a more recent shift toward other types of recreational use at the lake has led to a decline in angling pressure. We recommend evaluating angler use and effort on Alturas Lake, and determining whether stocking larger ‘magnum’ catchables in Alturas Lake would increase return-to-creel rates, as has been shown in other waters.

Stanley Lake

Total use and exploitation of hatchery Rainbow Trout stocked in Stanley Lake was estimated for three stocking events in 2014 (June, July, and August). On June 6, 3,620 catchable Rainbow Trout were stocked and 268 were tagged for this study. Fish were stocked from three different groups to assess the effects of hatchery rearing practices on return-to-creel rates. The three groups were ‘standards’, a ‘magnum’ control group (ungraded magnums), and a ‘magnum’ treatment group (graded magnums). For more information on the details of how each group was reared in the hatchery, see Cassinelli (2015). As of August 10, 2015, estimated total use and exploitation for the June stocking event was 15.3% (±9.3%) and 12.2% (±8.3%), respectively for standard catchable trout, 56.9% (±17.7%) and 41.9% (±15.2%), respectively for the magnum control group, and 29.9% (±12.9%) and 6.0% (±5.8%), respectively for the magnum treatment group (Table 4). Overall estimated use for both magnum groups combined was 43.4%.

On July 22, 3,560 catchable Rainbow Trout were stocked and 597 were tagged. Half of the fish stocked and tagged were ‘size-graded’ at the hatchery prior to release, and the other half were not graded and used as ‘controls’ to assess the effects of size grading on return-to-creel rates. As of August 10, 2015 estimated total use and exploitation for the July stocking event was 7.3% (±3.6%) and 4.5% (±2.8%), respectively for standard catchable trout ('control' group), and 20.7% (±6.3%) and 17.1% (±5.7%), respectively for the 'graded' group (Table 4).

On August 21, 3,501 catchable Rainbow Trout were stocked and 298 were tagged. Just like the July stocking event, half of the fish stocked and tagged in August were 'graded' for size at the hatchery prior to release, and the other half were not graded and used as 'controls'. As of August 10, 2015, only one tagged fish from the August group was reportedly caught and harvested, so estimated total use and exploitation for the group of fish stocked in August was 1.8% (±2.5%) for the standard catchable trout ('control' group), and 0.0% for the 'graded' group (Table 4).

Overall, total use and exploitation of stocked catchable Rainbow Trout in Stanley Lake in 2014 was estimated at 18.9% and 11.9%, respectively (Figure 11), based on a total of 64 reported tags throughout the entire duration of the study. Although these overall use and exploitation values for Stanley Lake are just below the statewide average for catchable Rainbow Trout in 2014 (23.3% use, 17.5% exploitation, *n*=64), certain groups of stocked fish returned-to-creel at much higher rates. For the June and July stocking events, for instance, return-to-creel values were much higher than for the August event, perhaps as a result of reduced angler effort later in the year, or an inadequate amount of time for those later fish to recruit into the summer fishery. Estimated total use and exploitation values for the magnum control group stocked in June were the second highest values observed in the region in 2014 (56.9% and 41.9%, respectively [Table 4]). Statewide, grading the magnum group did not appear to affect return-to-creel rates (J. Cassinelli, IDFG, personal communication). During the first year of the statewide 'magnum' study, however, magnum catchables returned-to-creel at a 120% higher rate than standard catchables (Cassinelli 2015). Larger fish seemed to return-to-creel at higher rates than 'standards' during both the June and July stocking events in Stanley Lake in 2014. Anglers also expressed a high level of satisfaction with the larger fish being caught (information gathered from angler comments when reporting tags). Our general impression of the 'magnum' experiment is an overall positive one.

Total estimated angler effort gathered from creel counts and interviews from May through October, 2014 was 8,428 hours (SE ± 923.8). Creel crews obtained 259 angler interviews during the six month period, which resulted in an overall catch estimate of 6,772 Rainbow Trout. Similarly, estimated effort in 2013 was 9,217 hours (95% CI ± 2,026), resulting in an estimated 6,231 (SE ± 799) Rainbow Trout caught. In 2011, overall angler effort was estimated at 12,848 hours from May to October, with an overall catch estimate of 11,478 hatchery Rainbow Trout (Curet et al. 2013). Estimated angler effort from May to September, 1986 was 11,326 hours and overall catch of hatchery Rainbow Trout was 4,408, based on 1,037 interviews (Reingold and Davis 1987).

Creel surveys conducted at Stanley Lake over the last several years have produced results that are not consistent with results obtained through the tag-you're-it exploitation study. For instance, in 2014, creel surveys estimated 6,772 Rainbow Trout caught, out of 14,326 stocked (47% use). However, adjusted total use for all tagged groups stocked in 2014 was estimated at 22%, based on tag returns. One or both of these methods for estimating return-to-creel for hatchery stocked Rainbow Trout at Stanley Lake is/are ineffective at producing accurate estimates. Further investigation is warranted.

Stanley Lake has been a consistently good Rainbow Trout Fishery for decades. It is also currently one of the most popular put-and-take fisheries in the Stanley Basin, and provides high catch rates for anglers. Based on return-to-creel values and reportedly high angler satisfaction with stocking larger Rainbow Trout in the lake in 2014, it is recommended that stocking 330 mm magnums in Stanley Lake be continued.

Hayden Creek Pond

Total use and exploitation of hatchery Rainbow Trout stocked in Hayden Pond was estimated for seven stocking events in 2014. Approximately 600 general production, 'standard' size catchable Rainbow Trout were stocked during each event (April, May, June, July, August, September, November), and 10% of those fish were tagged on each occasion.

Estimated total use of stocked Rainbow Trout was highest in August and September (41.4% and 27.4%, respectively), followed by April and May (26.9% and 26.9%)(Table 4). Overall, for all stocking events in Hayden Creek Pond in 2014, angler exploitation and total use was estimated at 20.1% and 23.4%, respectively (Figure 11). Although use and exploitation of fish stocked in June and November were low compared to other months (Table 4), overall total use and exploitation throughout the study period at Hayden Pond (23.4% and 20.1%, respectively) was slightly higher than the 2014 statewide average (23.3% use, 17.5% exploitation, *n*=64).

Based on the findings presented here, the current stocking rates and times at Hayden Pond seem to be effective at producing a quality fishery. However, estimated exploitation at its peak in August (37.3%) is still low enough we may be able to stock fewer larger fish without having a negative impact on return-to-creel. Recommend evaluating the use of larger hatchery Rainbow Trout ('magnums') for Hayden Pond, and how this practice may affect return-to-creel rates and overall angler satisfaction.

Big Bayhorse Lake

Total use and exploitation of hatchery Rainbow Trout stocked in Big Bayhorse Lake was estimated for two stocking events in 2014. The lake was stocked with approximately 2,000 catchable Rainbow Trout on two occasions in June and August, and approximately 200 stocked fish were tagged on each occasion. As of August 10, 2015, estimated total use and exploitation of standard catchable trout in Big Bayhorse was 47.6% (±12.0%) and 36.7% (±10.3%), respectively for fish stocked in June and 20.2% (±7.4%) and 18.9% (±7.1%), respectively for fish stocked in August (Table 4).

Overall, for both stocking events in Big Bayhorse Lake in 2014, total use and exploitation was estimated at 31.8% and 25.6%, respectively (Figure 11), well above the statewide average for 2014 (23.3% use, 17.5% exploitation, *n*=64). Additionally, angler comments received at the time of tag reporting indicated a high level of satisfaction with the fishery in 2014. No change is recommended for Big Bayhorse Lake.

Iron Lake

Total use and exploitation of hatchery Rainbow Trout stocked in Iron Lake was estimated for two stocking events in 2014. Iron Lake (Iron Lake #2) was stocked with approximately 1,000 'standard' size hatchery Rainbow Trout in June and 1,000 in July. Approximately 10% (n=100) of the fish were tagged for use and exploitation analysis on each occasion.

As of August 10, 2015, estimated total use and exploitation of Rainbow Trout stocked in Iron Lake in June was 10.9% (±7.4%) and 8.2% (±6.4%), respectively, and for fish stocked in July was 10.8% (±7.4%) and 8.1% (±6.4%), respectively (Table 4). Overall total use and exploitation for Iron Lake in 2014 (both groups combined) was estimated at 10.9% and 8.2%, respectively (Figure 11). Use and exploitation of hatchery stocked Rainbow Trout in Iron in 2014 is well below the statewide average. Additionally, in 2012 and 2013, condition of hatchery Rainbow Trout in Iron Lake was reportedly poor based on angler contacts and gill netting data. However, the lake does provide fishing opportunity for Westslope Cutthroat Trout *O. clarkii lewisi* as well, which were in better condition than Rainbow Trout in 2013 (Messner et al. *in press*). Recommend evaluating how stocking fewer but larger Rainbow Trout in Iron Lake would affect return-to-creel. Also recommend evaluating return-to-creel of stocked Cutthroat Trout fingerlings, once they are large enough to recruit to the fishery.

Meadow Creek Lake

Total use and exploitation of hatchery Rainbow Trout stocked in Meadow Creek Lake was estimated for two stocking events in 2014 (June and August). Meadow Creek Lake was stocked with 2,190 catchable Rainbow Trout in June and 1,931 catchable Rainbow Trout in August. For each stocking event, approximately 10% were tagged this study. As of August 10, 2015, estimated total use and exploitation of 'standard' size catchable Rainbow Trout stocked in Meadow Creek Lake was 67.0% (±14.8%) and 51.6% (±12.7%), respectively for the June group and 40.4% (±10.9%) and 32.3% (±9.6%), respectively for the August group (Table 4).

Overall (combined) return-to-creel estimates for Rainbow Trout stocked in Meadow Creek Lake in 2014 was 49.2% caught and 38% harvested (Figure 11). Meadow Creek Lake had the highest return-to-creel value in the region in 2014, and one of the highest values in the state. However, angler comments submitted through the tag reporting webpage indicated low satisfaction with the size of Rainbow Trout caught in the lake. Approximately 4,000 to 6,000 Westslope Cutthroat Trout fry have also been stocked in Meadow Creek Lake every year since 2010, and adults are reportedly in better body condition than stocked catchable Rainbow Trout (angler tag reporting comments). Additionally, Westslope Cutthroat Trout made up 80% of the species catch composition during gill netting surveys at Meadow Creek lake in 2013, while Rainbow Trout made up only 20% (Messner et al. *in press*). Recommend determining how stocked Westslope Cutthroat Trout return-to-creel at Meadow Creek Lake, and evaluate whether stocking fewer but larger Rainbow Trout in the lake could improve angler satisfaction without negatively impacting return-to-creel.

Wallace Lake

Total use and exploitation of hatchery Rainbow Trout stocked in Wallace Lake was estimated for two stocking events in 2014 (June and August). Wallace was stocked with 1,148 catchable Rainbow Trout in June and 1,000 in August. Approximately 10% of the fish stocked at each event were tagged for total use and exploitation analysis. As of August 10, 2015, estimated total use and exploitation of catchable Rainbow Trout at Wallace was 35.7% (±13.6%) and 24.7% (±11.3%), respectively for the June group and 18.9% (±9.7%) and 8.1% (±6.4%), respectively for the August group (Table 4).

Overall total use and exploitation for hatchery Rainbow Trout stocked in Wallace Lake in 2014 (both groups combined) was estimated at 22.3% and 15.4%, respectively (Figure 11), slightly below the statewide average for 2014 (23.3% use, 17.5% exploitation, *n*=64). In 2012 and 2013, angler comments suggested Rainbow Trout in Wallace were very small and skinny (Messner et al. *in press*). Zooplankton tows confirmed that the lake was lacking adequate forage for supporting stocked Rainbow Trout and facilitating good growth. Recommend stocking Tiger Trout in 2015 to reduce Redside Shiner abundance and thereby increase forage quality and abundance for Rainbow Trout. All other trout stocking should be discontinued or reduced until zooplankton quality and abundance increases in the lake. Monitor return-to-creel for stocked Tiger Trout in 2015.

MANAGEMENT RECOMMENDATIONS

1. Evaluate angler use-effort on Alturas Lake and determine whether return-to-creel rates can be improved using alternative rearing/stocking methods.

2. Continue stocking Stanley Lake at current rate, and continue stocking larger 'magnum' size fish when available.

3. Recommend stocking larger hatchery Rainbow Trout ('magnums') for Hayden Pond, Iron Lake, and Meadow Creek Lake, and evaluating effects on return-to-creel and angler satisfaction.

4. Tag Westslope Cutthroat Trout in Meadow Lake in 2015 to compare exploitation values with those generated for catchable Rainbow Trout.

5. Discontinue stocking Rainbow Trout in Wallace Lake until zooplankton analysis indicates an increase in forage quality and abundance for stocked 'catchable' size Rainbow Trout. Tag Tiger Trout for exploitation analysis in 2015 and monitor angler effort.

6. Continue assessing exploitation in catchable stocked fisheries in the region to prioritize management efforts.

7. Develop baseline exploitation data for each catchable stocked fishery in the region.

Table 4. Estimated angler exploitation and total use of hatchery trout stocked in 2014 in selected Salmon Region waterbodies.

Water Body	Tagging Date	Treatment	Tags Released	Disposition: Harvested	Disposition: Harvested b/c tagged	Disposition: Released	Adjusted Exploitation: Estimate	Adjusted Exploitation: 90% C.I.	Adjusted Total Use: Estimate	Adjusted Total Use: 90% C.I.
Alturas Lake	21-Jul-14	Grading Ctrl	100	1	0	0	2.7%	3.7%	2.7%	3.7%
		Grading Tx	100	1	0	0	2.7%	3.7%	2.7%	3.7%
	20-Aug-14	Grading Ctrl	100	0	0	0	0.0%	--	0.0%	--
		Grading Tx	100	1	0	0	2.7%	3.7%	2.7%	3.7%
Stanley Lake	6-Jun-14	Standards	88	4	0	1	12.2%	8.3%	15.3%	9.3%
		Magnum Ctrl	90	14	0	5	41.9%	15.2%	56.9%	17.7%
		Magnum Tx	90	2	0	8	6.0%	5.8%	29.9%	12.9%
	21-Jul-14	Grading Ctrl	297	5	1	2	4.5%	2.8%	7.3%	3.6%
		Grading Tx	300	19	1	3	17.1%	5.7%	20.7%	6.3%
	20-Aug-14	Grading Ctrl	150	1	0	0	1.8%	2.5%	1.8%	2.5%
		Grading Tx	148	0	0	0	0.0%	--	0.0%	--
Big Bayhorse Lake	26-Jun-14	Production	198	27	3	5	36.7%	10.3%	47.6%	12.0%
	12-Aug-14	Production	200	14	0	1	18.9%	7.1%	20.2%	7.4%
Hayden Pond	23-Apr-14	Production	60	5	0	1	22.4%	13.5%	26.9%	14.7%
	21-May-14	Production	60	6	0	0	26.9%	14.7%	26.9%	14.7%
	11-Jun-14	Production	60	2	0	1	9.0%	8.6%	13.5%	10.5%
	17-Jul-14	Production	56	3	0	1	14.4%	11.2%	19.2%	12.9%
	14-Aug-14	Production	65	9	0	1	37.3%	16.6%	41.4%	17.4%
	11-Sep-14	Production	59	5	0	1	22.8%	13.7%	27.4%	15.0%
	10-Nov-14	Production	57	2	0	0	9.5%	9.0%	9.5%	9.0%
Iron Lake	30-Jun-14	Production	99	3	0	1	8.2%	6.4%	10.9%	7.4%
	29-Jul-13	Production	100	3	0	1	8.1%	6.4%	10.8%	7.4%
Meadow Creek Lake	30-Jun-14	Production	193	37	3	8	51.6%	12.7%	67.0%	14.8%
	18-Aug-14	Production	200	24	2	4	32.3%	9.6%	40.4%	10.9%
Wallace Lake	30-Jun-14	Production	98	9	1	3	24.7%	11.3%	35.7%	13.6%
	19-Aug-14	Production	100	3	1	3	8.1%	6.4%	18.9%	9.7%

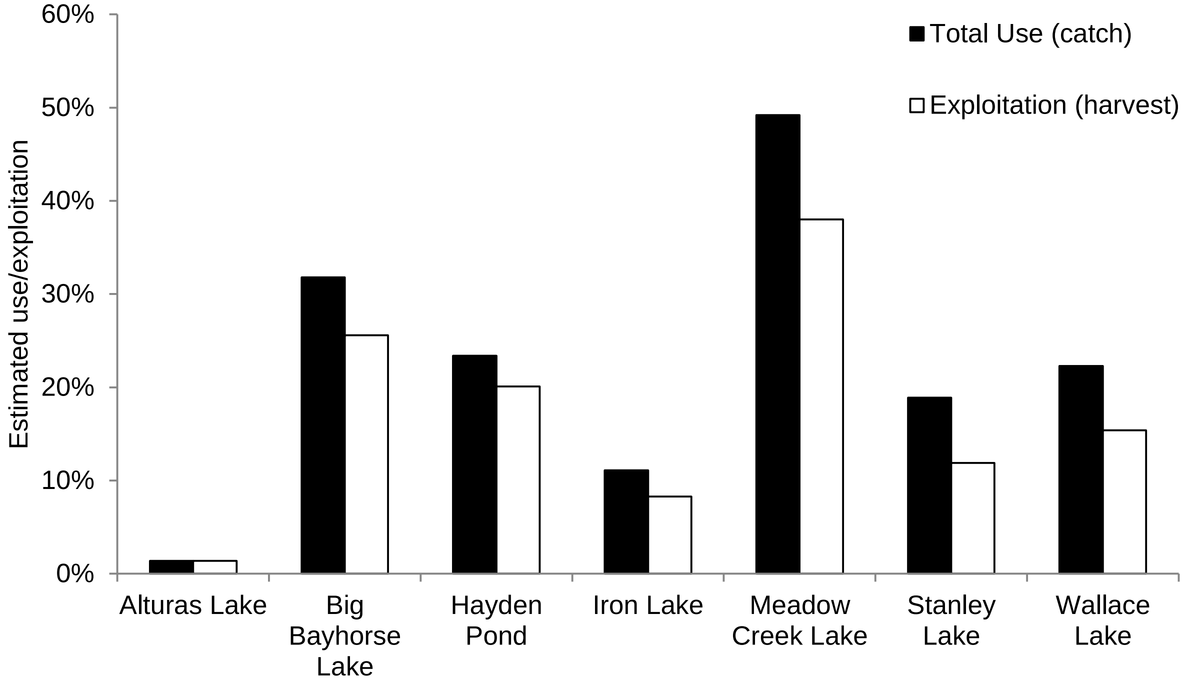

Figure 11. Overall estimated total use (catch) and exploitation (harvest) of hatchery Rainbow Trout stocked in selected waterbodies in the Salmon Region, 2014.

LOWLAND LAKES AND RESERVOIRS

JIMMY SMITH LAKE FISHERY MONITORING

ABSTRACT

We conducted a mark-recapture population estimate at Jimmy Smith Lake in 2014 to assess the effects of regulation changes implemented in 2011. Fish collected in gill-nets during the recapture event were also used to describe the current size and age structure of the population. For the initial marking events in 2014, 504 Rainbow Trout *Oncorhynchus mykiss* were caught and marked in 161.5 hours of angling for a total angling catch-per-unit-effort of 3.1 fish/hour. During the gill-netting recapture event, 539 Rainbow Trout were collected during 110.3 gill net hours, of which 22 were marked. Total gill netting catch-per-unit-effort was 4.9 fish/hour, and total population abundance was estimated at 11,856 Rainbow Trout (95% CI: 8,030 – 18,324). Gill netting catch-per-unit-effort at Jimmy Smith Lake in 2014 was slightly higher than in 2012, but lower than was found from 2008 to 2011. Average and maximum fish length in 2014, 241 mm and 425 mm respectively, were the highest values observed since 2005.

Zooplankton sampling was conducted at Jimmy Smith Lake on August 20, 2014 to determine the quality and abundance of forage available for fish consumption. Total zooplankton biomass, zooplankton ratio index (ZPR), and zooplankton quality index (ZQI) were quantified (Teuscher 1999). Average total zooplankton biomass was 6.1 g/m and average ZPR and ZQI values were 0.57 and 4.59, respectively. Results from sampling in 2014 suggest current zooplankton quality and abundance at Jimmy Smith Lake is the highest it has been since sampling began in 2002.

All biological information we have collected at Jimmy Smith Lake over the last two decades indicate a reduction in Rainbow Trout abundance, an increase in fish size, and an increase in the quality and abundance of zooplankton available for fish consumption since 2011, when bag limits were increased from 6 to 25 fish per day.

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HISTORY AND INTRODUCTION

Jimmy Smith Lake supports a naturally reproducing Rainbow Trout *Oncorhynchus mykiss* population that likely originated from stocking events in the early 1930s (Flinders et al. 2013). The earliest size structure information collected from the lake in 1966 reported Rainbow Trout mean length at 217 mm (*n*=99; Liter et al. 2000a). Thirty years later, in 1996, average total length remained nearly the same at 213 mm (*n*=157), and maximum observed total length was 332 mm (Liter et al. 2000a). In July 2000, a fish kill was reported at Jimmy Smith Lake, where approximately 1,000 fish died as a result of high water temperature and low dissolved oxygen concentration (Brimmer et al. 2003). This is the only documented fish kill for Jimmy Smith Lake in our records. Subsequent gill netting efforts in 2001 found a mean total length of 203 mm (n=113) and maximum total length of 370 mm (Brimmer et al. 2003). Over the next several years, average and maximum total length increased, and by 2005 gill net sampling found average and maximum total length were 251 mm and 427 mm, respectively. The apparent increase in average and maximum total length, thought to be a result of a reduction in fish abundance from the fish kill, led biologists to conclude that fish size was ultimately related to density and controlled by competition for forage and space in Jimmy Smith Lake (Brimmer et al. 2003). From 2005 to 2010, gill net sampling indicated an increase in relative fish abundance, and decrease in average and maximum total length to 205 mm and 295 mm, respectively (Curet et al. 2011). The first population estimate we conducted at the lake, in 2011, resulted in an abundance estimate of 18,955 fish (95% CI 10,540-36,970)(Curet et al. 2013). Regional biologists sought to decrease Rainbow Trout abundance in the lake to improve size structure, and outreached for public input on the topic. Local anglers were opposed to introducing predators in Jimmy Smith Lake (i.e. Tiger Muskellunge *Esox masquinongy x Esox lucius*), but were receptive to increasing bag limits and promoting increased angler harvest as a way to decrease fish abundance. In January 2011, IDFG increased daily bag from six trout per day to 25 trout per day, and improved angler access to the lake (Flinders et al. 2013). Since then, annual gill netting surveys have shown a decrease in relative fish abundance and overall increase in fish size, and zooplankton monitoring suggests improvement in the overall quality and abundance of available forage in the lake.

Zooplankton quality and abundance monitoring began in 2002 at Jimmy Smith Lake to assess relationships between fish yield and forage characteristics (Brimmer et al. 2006). To describe zooplankton quality and abundance in Jimmy Smith Lake, IDFG has measured the zooplankton ratio index (ZPR) to describe the ratio of large-bodied zooplankton (>750µm) to medium-bodied zooplankton (>500µm<750µm), and the zooplankton quality index (ZQI) to describe the overall abundance of large-bodied zooplankton (Tuescher 1999). Forage quality and abundance was low in Jimmy Smith Lake during the early years of monitoring (2002 to 2011) when relative fish abundance was high, but increased substantially in 2012 when fish abundance decreased (Flinders et al. 2013). In 2013, ZPR and ZQI values were the highest observed in any lake in the region to date (Messner et al. *in press*).

OBJECTIVES

1. Quantify fish abundance and assess size structure to determine whether further management actions are needed to improve size structure.

2. Monitor zooplankton quality and abundance to assess the potential for fish growth into 2015.

STUDY AREA AND METHODS

Jimmy Smith Lake (WGS84 datum: 44.16907°N, -114.40249°W) is a landslide lake, located in north central Custer County, near Clayton, Idaho, at 1,948 meters elevation with a surface area of 26 hectares. The lake has one outlet and three inlet streams. The outlet stream, Big Lake Creek, is located at the southeast end of the lake, two small inlet streams, Corral Creek and Jimmy Smith Creek, are located at the north end of the lake, and the major inlet and spawning tributary, Big Lake Creek, enters from the west end of the lake.

Jimmy Smith Lake is eutrophic body of water dominated by an abundance of aquatic macrophytes. It supports a naturally reproducing population of Rainbow Trout that likely originated from stocking events in the 1930s. No other fish species have been documented in the lake.

In 2014, we conducted a mark-recapture population estimate at Jimmy Smith Lake from June 17-25. Fish were caught by angling on June 17-20 and marked with a notch in the upper caudal lobe. On June 24, six gill nets were deployed overnight for the recapture event. Fish captured in the gill nets were enumerated, checked for marks, measured (mm TL) and weighed (g), and sagittal otoliths were taken from 72 fish (~3-5 fish per 5 mm length class) for age and growth analysis. Otoliths were cleaned of debris and mucus, and stored in dry vials, then were mounted in epoxy and sectioned using an isometric saw (Beamish 1979; Casselman 1983). Sections were mounted on microscope slides and digitized under 25x to 40x magnification. Digital images were read by two independent technicians and if independent readers were not in agreement on an age, a referee session with a third reader was used to assign an age to the otolith. Age analysis results are not yet available, and will be reported in the 2015 annual fisheries management report.

Rainbow Trout abundance ($\hat{N}$) was estimated using a Peterson single mark-recapture population estimate with the Chapman (1948) modification (Ricker 1975):

$$\hat{N} = \frac{(M+1)(C+1)}{(R+1)} - 1$$

where *M* = number of fish caught and marked in the first sampling period; *C* = number of fish caught in the second sampling period; and *R* = number of marked fish recaptured in the second sampling period.

Zooplankton sampling was conducted at Jimmy Smith Lake on August 20, 2014. Samples were collected near the inlet, mid-lake, and at the outlet following methods outlined by Teuscher (1999). The sample crew deviated from Teuscher's methods by sampling all three locations at 4.0 m depth, as maximum depth in the lake is not more than 6.0 m. Samples were stored in 100% ethyl alcohol for twelve days, at which time ZPR/ZQI values were quantified using methods reported in Teuscher (1999).

RESULTS AND DISCUSSION

The sampling crew angled 161.5 hours between June 17-20, 2014 and marked 504 Rainbow Trout with an upper caudal clip. Angling catch-per-unit-effort (CPUE) was 3.1 fish/hour. On June 24, six gill nets were fished a total of 110.3 hours overnight for the recapture event, and 539 Rainbow Trout were captured. Gill netting CPUE was 4.9 fish/hour (Table 5). Twenty-two marked fish were collected during the recapture event, and population abundance was estimated at 11,856 Rainbow Trout (95% CI: 8,030 – 18,324), which was not a significant change from the 2011 and 2012 estimates (Figure 12). Rainbow Trout caught during gill netting in 2014 ranged in size from 144 mm TL to 425 mm TL, and averaged 240.5 mm TL (SE $\pm$ 2.4), the highest observed values since 2005 (Table 5).

In 2012, the survey crew noted that a large number of Rainbow Trout were observed in the Big Lake Creek inlet, presumably spawning, on June 26 (Flinders et al. 2012). The crew suggested not conducting population estimates this time of year in the future to avoid violating assumptions of no movement in and out of the population. However, we walked the inlet stream for approximately 0.5 miles in 2014 and didn't see fish, thus we assumed spawning was not currently occurring. Additionally, many fish captured in gill nets were in still in prespawn condition. We feel that we did not conduct our estimate during spawning, but that spawn timing should still be considered when conducting population estimates in Jimmy Smith Lake in the spring/early summer in future years. Walking inlet streams should therefore be incorporated into annual surveys at Jimmy Smith Lake.

Zooplankton sampling was conducted at three locations (near inlet, mid lake, near outlet) on August 20, 2014. Average total zooplankton production, as measured in the 153µm net, was 6.1 grams/meter in 2014 (Table 6). By comparison, average total zooplankton production in 2011, 2012, and 2013 was 1.4 g/m, 6.2 g/m and 5.1 g/m, respectively. ZPR and ZQI values in 2014 were the highest ever observed in the lake since sampling began in 2002 (0.57 and 4.59, respectively) (Figure 13). ZPR and ZQI values above 0.60 suggest competition for food is unlikely (Teuscher 1999). The index values calculated for 2014 suggest large-bodied zooplankton (most preferred by Rainbow Trout) are only slightly more abundant than medium-bodied zooplankton, but that both are very abundant relative to the period from 2002 to 2011 (Figure 13).

As previously suggested by Brimmer et al. (2003), our results suggest size structure of the Rainbow Trout population in Jimmy Smith Lake is heavily density-dependent. Average total length and relative weight for survey years 1996 to present are negatively correlated with relative trout abundance (CPUE; r^2 = 0.54 and r^2 = 0.37, respectively [Figure 14]). During years of relatively higher Rainbow Trout abundance smaller fish dominated our gill net catch, and vice versa (Figure 15). Our 2014 sampling found the presence of a larger size class of fish that has not been observed since the mid-2000s (i.e. 2003, 2005, and 2006 [Figure 15]). Although population estimates generated in 2011, 2012, and 2014 do not show a significant change in fish abundance (Figure 12), annual zooplankton monitoring suggests competition for forage resources has been reduced (Figure 13), and catch-per-unit-effort values generated from gill net surveys suggest fish abundance has decreased since regulation changes were set in place in 2011 (Figure 15). The recent increase in zooplankton quality and abundance at Jimmy Smith is likely to result in excellent growth and survival of fish into 2015, as previous data indicates a positive relationship between ZPR values and maximum fish size (Figure 16).

It is likely that a combination of factors have contributed to the improved size structure of fish in Jimmy Smith Lake in recent years. Increased bag limits, along with favorable environmental conditions and an increase in forage quality and abundance, have likely contributed to improving the quality of the fishery. However, continued monitoring is necessary to evaluate how the observed changes will affect the future of the fishery.

Otoliths and age information collected during sampling in 2014 will be used in conjunction with otoliths collected in 2015 to build growth curves for Rainbow Trout in Jimmy

Smith Lake. Age and growth information from 2014/2015 will then be compared with data from the mid-2000's to determine how decreased fish abundance and increased forage quality and abundance has influenced overall fish growth in the lake over the past decade.

MANAGEMENT RECOMMENDATIONS

1. Continue monitoring Rainbow Trout population abundance and size structure to study population responses to increased forage quality and abundance and increased bag limits.

2. Incorporate estimates of spawner abundance in Jimmy Smith Lake spawning tributaries as part of annual monitoring program.

3. Continue monitoring forage quality and abundance (ZPR/ZQI) annually.

4. Conduct a winter creel survey during the 2014/2015 ice fishery to estimate angler effort and harvest.

5. Adjust bag limit as necessary, based on biological data, to sustain current size structure and angling catch rates.

Table 5. Summary statistics for gill netting efforts during all survey years at Jimmy Smith Lake, 1996 to 2014.

	Year										
	1996	2001	2003	2005	2006	2008	2009	2010	2011	2012	2014
Survey dates	6/11	6/21-22	7/21	6/7-8	6/13-15	7/31-8/1	5/20-21	5/25-26	6/27-28	6/25-26	6/24-25
Sample size	157	113	144	351	779	914	689	509	345	419	539
Size range	155-332	110-370	112-368	151-427	133-419	147-320	132-325	115-295	150-250	126-295	144-425
Avg. TL (mm)	213	203	278	251	222	202	203	205	183	229	241
Length SE	ND	ND	2.9	3.0	1.9	1.1	1.2	1.2	0.9	1.8	2.4
Avg. weight (g)	ND	ND	283	311	163	100	84	81	67	126	166
No. of gillnets	1	1	4	4	16	4	4	4	4	8	6
Total gillnet hours	15.0	16.5	62.2	65.2	181.5	90.3	69.8	71.7	90.3	121.7	110.3
CPUE (fish/hr)	10.5	6.9	2.3	5.4	4.3	10.1	9.9	8.2	7.5	3.4	4.9
Relative Weight	ND	ND	105.5	107.8	107.5	80.3	77.7	77.0	89.1	87.7	85.8
pop estimate	--	--	--	--	--	--	--	--	18,955	33,109	11,856
95% LCI	--	--	--	--	--	--	--	--	10,540	15,796	8,030
95% UCI	--	--	--	--	--	--	--	--	36,970	75,589	18,324

Table 6. Zooplankton quality index (ZQI) values and average zooplankton ratio (ZPR) values at Jimmy Smith Lake, 2002 to 2004, 2006 to 2009, and 2011 to present.

	ZQI Sample Location				ZPR Sample Location				
Sample Date	Inlet	Mid-lake	Outlet	ZQI Average	Inlet	Mid-lake	Outlet	ZPR Average	Avg. Total Biomass (g/m)
08/01/2002	--	0.00	0.00	0.00	--	0.00	0.00	0.00	2.85
08/01/2003	0.10	0.20	--	0.20	0.10	0.10	--	0.10	2.25
08/09/2004[a]	--	--	--	0.03	--	--	--	0.03	--
08/24/2006	0.02	0.26	0.17	0.15	0.04	0.34	0.30	0.23	0.93
08/24/2007	--	0.02	0.02	0.02	--	0.12	0.20	0.16	3.10
08/29/2008	--	0.02	0.02	0.02	--	0.25	0.25	0.25	1.40
08/31/2009	0.01	0.01	0.01	0.01	0.01	0.06	0.08	0.05	2.53
08/19/2011	0.01	0.02	0.11	0.05	0.01	0.05	0.14	0.07	1.40
08/17/2012	2.30	2.05	1.70	2.02	0.23	0.28	0.21	0.24	6.20
08/15/2013	1.50	2.07	2.35	1.97	0.22	0.35	0.34	0.30	5.10
08/20/2014	7.97	3.78	2.01	4.59	0.76	0.41	0.55	0.57	6.10

[a] Field data lost during a computer hard drive failure; averages taken from annual report

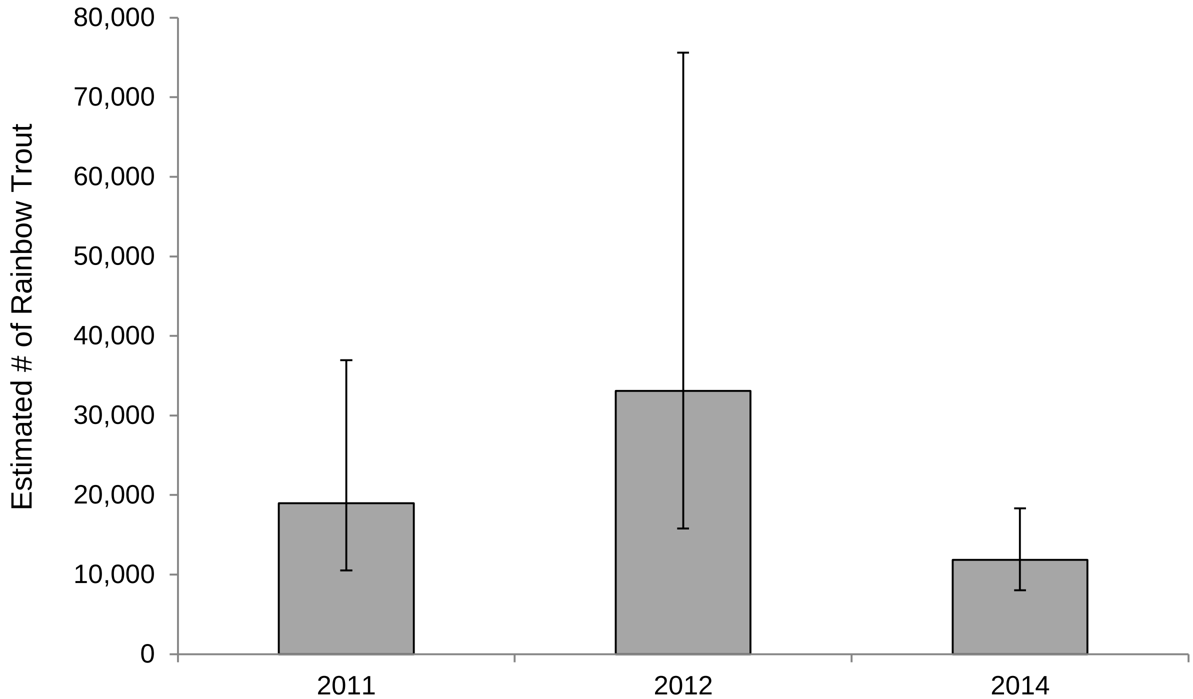

Figure 12. Estimated Rainbow Trout abundance in Jimmy Smith Lake for years when mark/recapture population estimates were conducted.

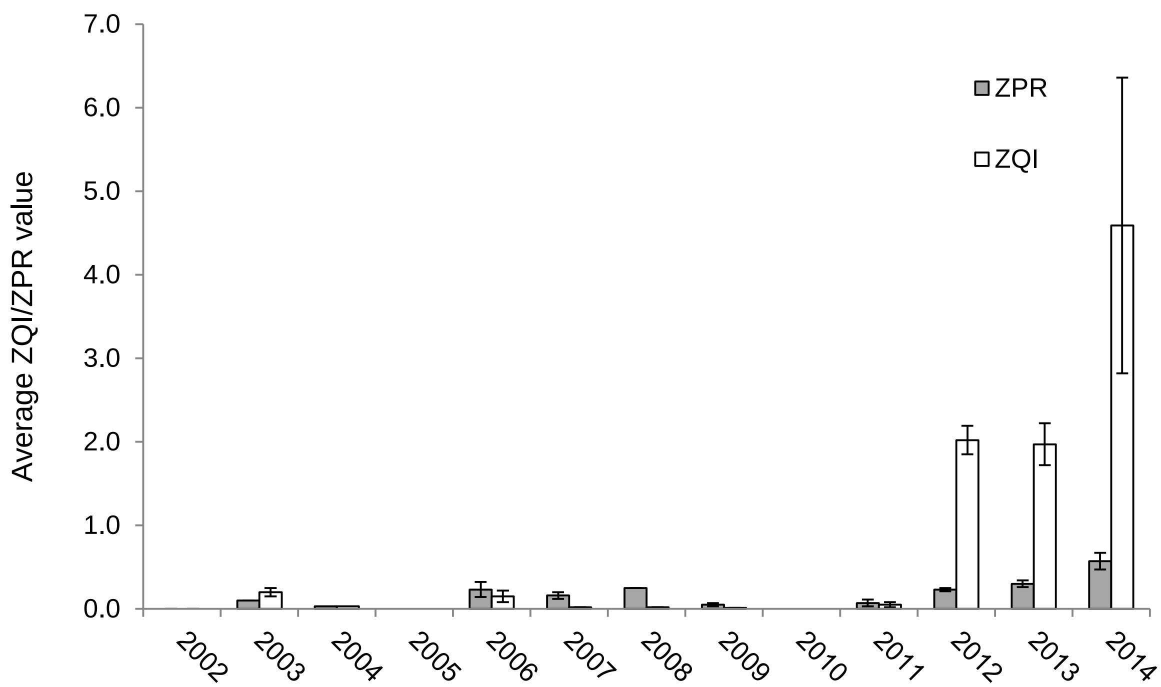

Figure 13. Estimates of zooplankton quality (ZPR) and abundance (ZQI) in Jimmy Smith Lake from 2002 to present. Sampling was not conducted in 2005 or 2010.

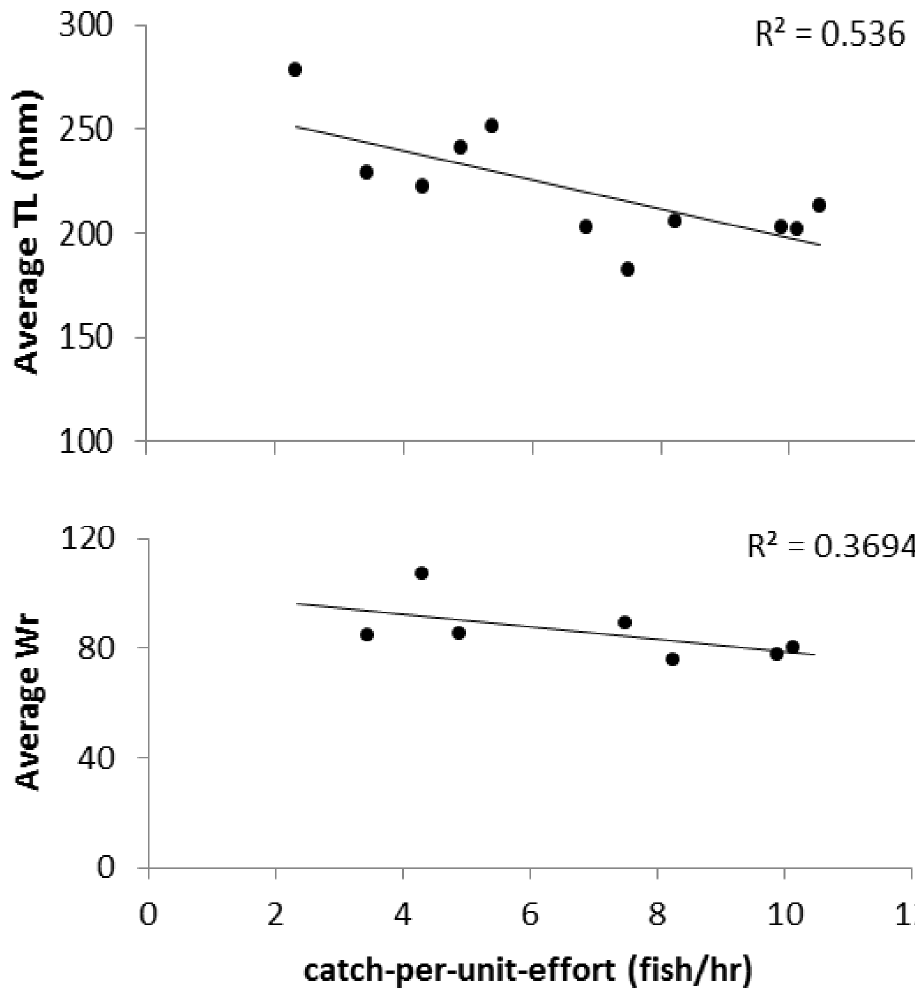

Figure 14. Relationship between Rainbow Trout relative abundance (gill net catch-per-unit-effort - CPUE) and average total length (TL) (*n* = 11; 1996 – 2014) and relative weight (Wr) (*n* = 7; 2006 – 2014) in Jimmy Smith Lake for sampled years 1996 to 2014.

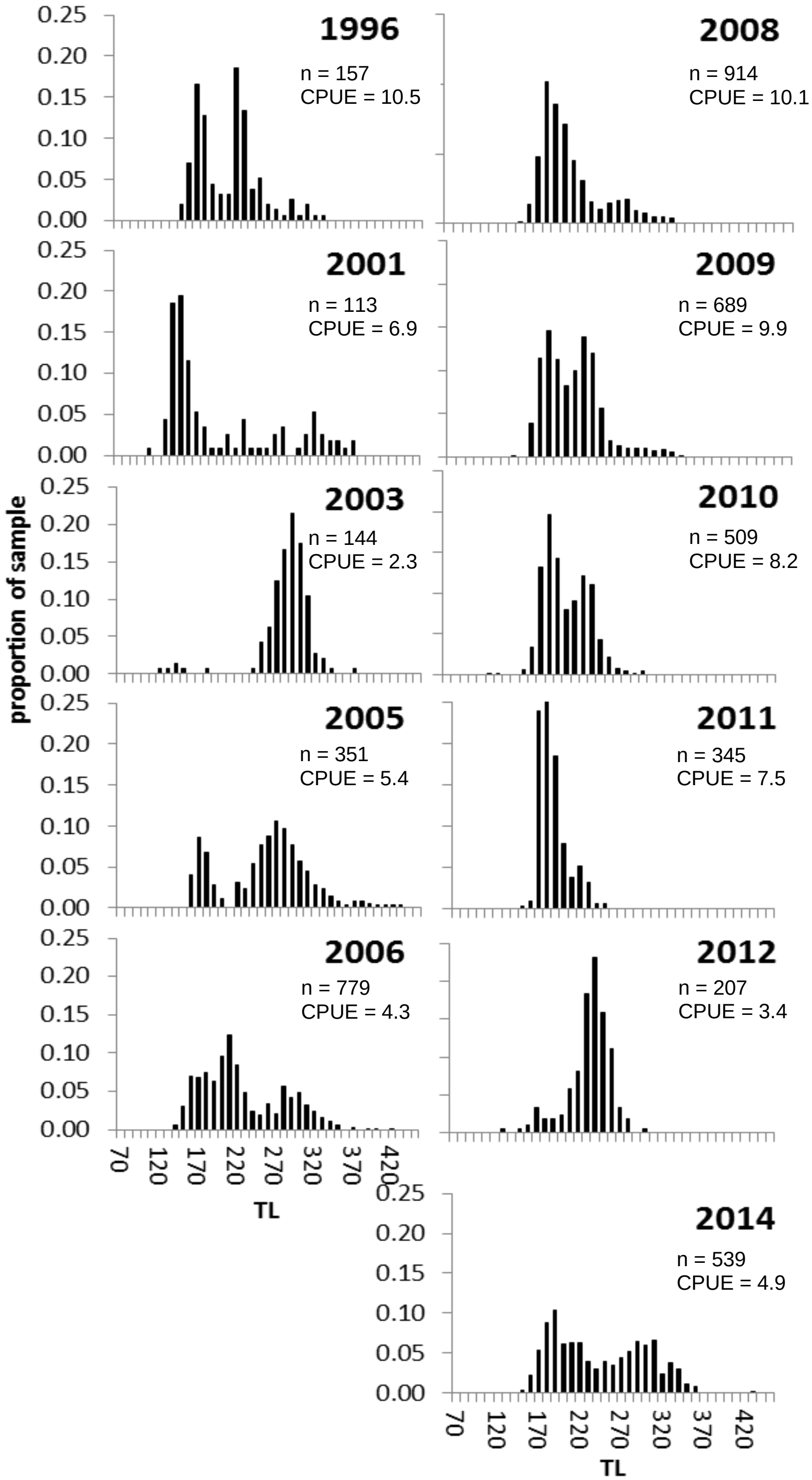

Figure 15. Length-frequencies and catch-per-unit-effort (CPUE) for Rainbow Trout captured at Jimmy Smith Lake during all survey years from 1996 to 2014.

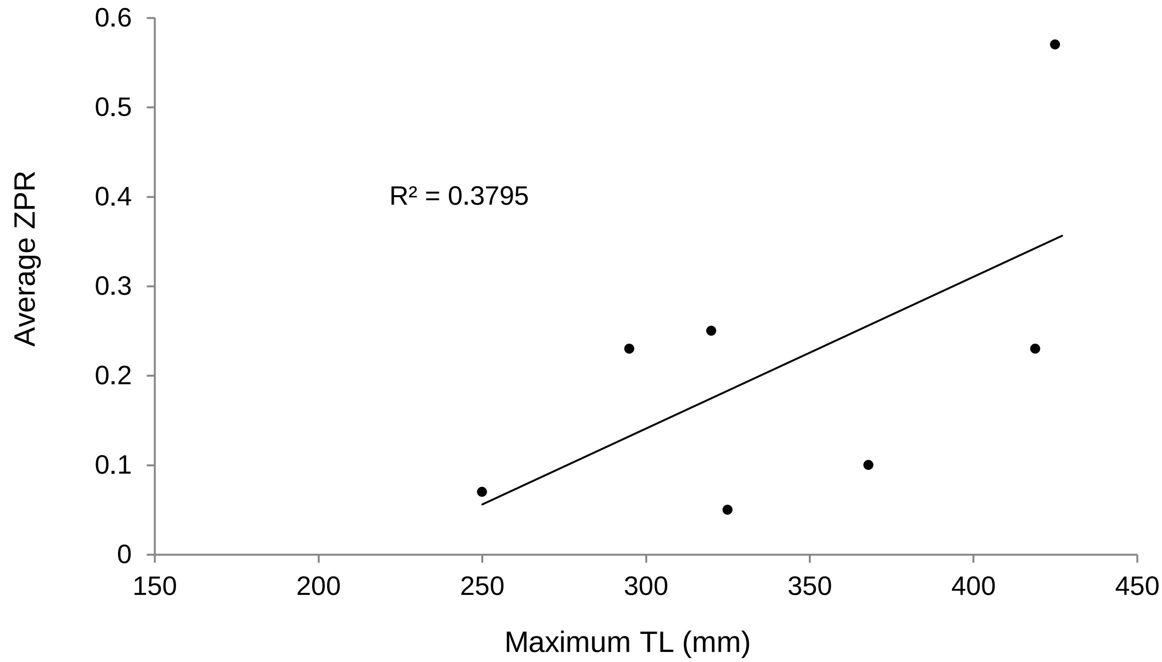

Figure 16. Relationship between estimated zooplankton quality and Rainbow Trout maximum total length (mm) observed during gill netting at Jimmy Smith Lake, 2002 to 2014.

LOWLAND LAKES AND RESERVOIRS

WALLACE LAKE FISHERY MONITORING

ABSTRACT

Minnow trapping surveys were conducted at Wallace Lake in June, August, and September, 2014 to describe the size structure and relative abundance of the lake's Redside Shiner *Richardsonius balteatus* population, prior to proposed Tiger Trout *Salmo trutta x Salvelinus fontinalis* introduction in the spring 2015. Zooplankton samples were also collected in August 2014 to collect baseline forage information prior to Tiger Trout introduction. Data collected at Wallace Lake in 2014 will be used to evaluate the effects of Tiger Trout introduction on the Redside Shiner population (i.e. size structure and relative abundance) and forage quality and abundance.

Minnow trapping captured 647 Shiners during four hours of trapping in June, 178 Shiners during four hours of trapping in August, and 1,818 Shiners during 9.25 hours of trapping in September, for catch-per-unit-effort values of 2.7 fish/min, 0.7 fish/min, and 3.3 fish/min, respectively. Mean total zooplankton biomass in August, 2014 was 0.70 g/m, and ZPR and ZQI were 0.00, suggesting little to no available forage in the lake.

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HISTORY AND INTRODUCTION

Wallace Lake is a popular put-and-take fishery in the Salmon area. The lake was first stocked in 1968 with Rainbow Trout *Oncorhynchus mykiss*. In 1978, Wallace Lake was classified as having low natural spawning potential for trout (Jeppson and Ball 1979), and has been stocked with approximately 1,000 to 2,000 Rainbow Trout or Cutthroat Trout *Oncorhynchus clarkii,* annually, ever since, to sustain the fishery. Due to its close proximity to the town of Salmon, and relatively easy access via maintained USFS roads, Wallace Lake receives a fair amount of angling pressure during summer months. However, the fishery receives little to no use from December through May, when access is limited and the lake surface is covered with ice. A 1988 creel survey at Wallace Lake estimated 2,805 hours of angler effort between June 1 and September 5, with an average catch rate of 0.44 fish/hr (Lukens and Davis 1989).

Rainbow Trout and Cutthroat Trout were the only fish species present in Wallace Lake until the early 2000's, when Redside Shiners *Richardsonius balteatus* were first detected (Esselman et al. 2007). The source of Redside Shiner colonization is unknown (i.e. introduction or immigration), but since then, Redside Shiners have become the most dominant fish species in the lake. Redside Shiners made up 92% of the catch composition during gill net sampling in June, 2005. Gillnets were fished for 82.1 hours and captured 76 Redside Shiners and only seven Rainbow Trout.

The colonization and increase in abundance of Redside Shiners in Wallace Lake coincided with a period of observed poor growth and survival of stocked catchable Rainbow Trout in the lake. Presumably, Redside Shiners in Wallace Lake compete for forage resources with stocked Rainbow Trout. Relative weights of the seven Rainbow Trout collected in 2005 averaged 92.5, but by 2013, Rainbow Trout relative weights averaged only 67.3 (Messner et al. *in press*). Forage resources appeared to be extremely limited in Wallace Lake by 2013, prompting regional biologists to propose the introduction of Tiger Trout *Salmo trutta x Salvelinus fontinalis* to reduce Redside Shiner abundance and increase zooplankton quality and availability for Rainbow Trout.

Tiger Trout eyed eggs were secured by Mackay Hatchery in 2013, where they were reared until large enough to stock in Wallace Lake, which is anticipated for spring 2015. In order to quantify the effects of Tiger Trout introduction in Wallace Lake, we began monitoring relative abundance and size structure of Redside Shiners, as well as estimating the quality and abundance of zooplankton in the lake, in 2013. Data collected in 2014 will add to baseline information used for detecting changes in the biological community in Wallace Lake, related to the introduction of Tiger Trout in spring 2015.

OBJECTIVES

1. Assess size structure of the Redside Shiner population in Wallace Lake at different times of the year to determine the most suitable time for Tiger Trout introduction.

2. Quantify Redside Shiner abundance, prior to predator introduction, to detect responses to the introduction in 2015.

3. Monitor quality and abundance of zooplankton in Wallace Lake, to determine if Tiger Trout introduction can increase forage production via a reduction in Redside Shiner abundance.

STUDY AREA

Wallace Lake (WGS84 datum: 45.24692°N, -114.00499°W) is a small 2.7 ha lake located about 12 km northwest of the city of Salmon. Situated at 2,471 m in elevation, the lake is accessible by a four-wheel-drive road and includes a developed 12-site campground with picnic tables and fire rings, restrooms, and small boat ramp. While there is no formal inlet, the outlet drains into Wallace Creek, a tributary of the Salmon River. The lake has been stocked annually with either Rainbow Trout or Cutthroat Trout since 1968, and was classified as having low natural spawning potential for trout in 1978 (Jeppson and Ball 1979). A 1988 creel survey at Wallace Lake estimated 2,805 hours of angler effort, with a catch rate of 0.44 fish/hr (Lukens and Davis 1989). In the early 2000's Redside Shiners were first detected (Esselman, et al. 2007), and have since become the dominant fish species in Wallace Lake.

METHODS

Promar collapsible minnow traps (38 cm L x 24 cm W x 26 cm H, with a 3 cm opening and 2 mm x 4 mm mesh size) baited with canned tuna in oil were used for trapping Redside Shiners in 2014. Four minnow traps were deployed at Wallace Lake on June 10, 2014 and two traps were deployed on August 19, 2014 to determine the size structure of the Redside Shiner community at those times of the year. Traps were fished for a combined four hours on both occasions before they were removed. Redside Shiners were enumerated, measured (mm TL), and weighed (g).

In an effort to obtain quantifiable information prior to Tiger Trout introduction, to assess changes related to the introduction, 9 clusters of three minnow traps each were deployed uniformly around the lake perimeter on September 11, 2014 to collect Redside Shiners (Table 7, Figure 17). Testing done in late August showed that a single trap could become saturated with Redside Shiners in as little as 20 minutes, but three traps fastened together did not become saturated with fish after the typical trapping time passed. Clusters were set in the littoral area of the lake, approximately 2-3 m away from shore at an average depth of 1 m. The trap clusters were fished for approximately one hour and removed. A subsample of approximately 50 Shiners were enumerated, measured (TL mm) and weighted (g) from each cluster to estimate the total number of Shiners in each trap, and all traps were weighed to determine the total biomass in each. Total weights were then divided by average Redside Shiner weight to arrive at an estimated abundance. Precise start and stop times were recorded to estimate catch-per-unit-effort (fish per minute). Information collected from minnow trapping was used to quantify Redside Shiner relative abundance and size structure for later comparisons.

Zooplankton sampling was conducted at Wallace Lake at two locations on August 19, 2014. The lake is only 2.7 ha in size and does not have a well-defined inlet, so we only sampled near the outlet and at mid-lake (no sampling near the inlet). We performed three vertical tows, using Wisconsin-style plankton nets with mesh sizes 153µm, 500µm, and 750µm, at each location following methods outlined in Teuscher (1999). Samples were stored in 100% ethyl alcohol for thirteen days, at which time contents were weighed and zooplankton ratio index (ZPR) and zooplankton quality index (ZQI) were calculated using the methods outlined in Teuscher (1999).

RESULTS AND DISCUSSION

We captured 647 Redside Shiners in four hours of effort in June, 178 Redside Shiners in four hours of effort in August, and 1,818 Redside Shiners in the 9 trap clusters during 9.25

hours of combined trapping time in September. Combined catch-per-unit-effort values for each sampling period were 2.7 fish per minute, 0.7 fish per minute, and 3.3 fish per minute, respectively (Table 8). Shiner length averaged 93 mm TL (SE ± 0.01) in June, 83 mm TL (SE ± 0.02) in August, and 89 mm TL (SE ± 0.01) in September (Table 8). In September, the number of Redside Shiners captured per cluster site ranged from 68 to 358 (Table 9). Individual cluster CPUEs ranged from 1.1 to 6.0 fish per minute (Table 9).

Mean total zooplankton biomass sampled in 2014 (weight of 153 µm net/depth sampled) was 0.70 g/m and ZPR and ZQI indices were 0.00 and 0.00, respectively (Table 10). By comparison, in 2013, mean total zooplankton biomass was 0.48 g/m and ZPR and ZQI values were 0.33 and 0.00, respectively (Table 10). The inlet area was not sampled in 2014 due to inadequate lake depth.

Redside Shiner size structure information collected at different times of the year in 2013 and 2014 was analyzed to determine whether there is an adequate size class present for piscivory by larger size Tiger Trout (>~260 mm TL) during summer months in Wallace Lake. Prey size for Tiger Trout can average approximately 28% Tiger Trout body size (~73 mm prey for 260 mm Tiger Trout), although it can be as high as 50% Tiger Trout body size (Winters 2014). However, Tiger Trout sometimes do not switch to piscivory until they reach a larger size (~340mm TL [Winters 2014]). The Tiger Trout introduction in Wallace Lake is arranged for May 2015, when Tiger Trout at Mackay Hatchery are expected to average approximately 280 mm TL. We found an adequate abundance of Redside Shiners < 100 mm TL in June, August, and September, 2014 (Figure 18) suggesting Tiger Trout will have consumable prey available to them if they are delivered at or above the expected length in spring, 2015. In summer months, piscivory can account for up to 80% of the diet for Tiger Trout >350 mm TL (Winters 2014). Therefore, reduced abundance and resulting changes in size structure of the Redside Shiner population in Wallace Lake will be assessed over the next several years to determine the biological community's response to Tiger Trout introduction in 2015.

ZPR and ZQI values calculated in 2013 and 2014 show a lack of adequate forage for stocked catchable trout in Wallace Lake (Teuscher 1999). If Tiger Trout introduction is successful at reducing abundance of Redside Shiners, we would also expect to see an increase in the amount of zooplankton forage present in the lake in subsequent fall sampling events. These indices will serve as baseline data to help quantify the effects of Tiger Trout introduction on the biological community in Wallace Lake in the spring of 2015. Relative abundance estimates (catch-per-unit-effort) and size structure information for Redside Shiners collected up to this point may not be comparable with one another due to differing sample methods (i.e. gill net versus minnow trap) and amount of effort. However, the sampling design established in September, 2014 is meant to serve as a repeatable design that, when done for future events, can be useful in quantifying changes to Redside Shiner community as a result of Tiger Trout introduction.

MANAGEMENT RECOMMENDATIONS

1. Stock Tiger Trout in 2015 to reduce Redside Shiner abundance and improve zooplankton quality and abundance.

2. Monitor angler effort, catch, and harvest for Tiger Trout in 2015.

3. Continue sampling the Redside Shiner population in Wallace Lake, using the methods developed in September 2014, to quantify the effects of Tiger Trout introduction.

4. Continue zooplankton sampling in Wallace Lake annually to help determine the effectiveness of using Tiger Trout to reduce Redside Shiner abundance and increase zooplankton quality and abundance in the lake.

Table 7. Minnow trap cluster locations (WGS84)(±3m) used for Wallace Lake Redside Shiner trapping, 9/11/2015.

	Location (WGS84)	
Cluster No.	Latitude °N	Longitude °W
1	45.24627498	-114.00484100
2	45.24596804	-114.00467399
3	45.24570501	-114.00516098
4	45.24545900	-114.00614603
5	45.24542397	-114.00746903
6	45.24593703	-114.00725797
7	45.24650901	-114.00701104
8	45.24698996	-114.00608903
9	45.24695601	-114.00522301

Table 8. Summary statistics from Wallace Lake sampling, 2005-2014, including Redside Shiner relative abundance (CPUE), total length statistics (TL) (mm), and condition factor (K).

			Total Length (mm)			Condition Factor (K)		
	n	CPUE (fish/min)	Min	Max	Mean (SE)	Min	Max	Mean (SE)
Jun 2005[a]	76	0.02	90	156	113 (2.09)	1.10	2.14	1.45 (0.02)
Aug 2013	101	1.12	57	141	86 (1.21)	0.50	1.08	0.77 (0.01)
Jun 2014	480	2.70	73	156	93 (0.48)	0.41	1.59	0.88 (0.01)
Aug 2014	178	0.74	41	140	83 (1.10)	0.35	1.46	0.82 (0.01)
Sep 2014	457	3.28	45	149	89 (0.75)	0.44	1.32	0.86 (0.00)

[a] Shiners were collected during gill netting in 2005, and minnow traps all other years.

Table 9. Trap effort, number of fish caught, mean weight, catch-per-unit-effort (CPUE) and Redside Shiner (RSS) length/weight statistics by trap cluster from Wallace Lake, September 11, 2014.

			Cluster Totals		RSS length/weight statistics			
Cluster No.	Effort (minutes)	No. RSS	Mean weight (g)	CPUE (RSS/minute)	Sample size	Mean TL (mm)	Mean weight (g)	Mean condition factor (K)
1	60	358	7.2	6.0	49	93	7.6	0.88
2	61	270	4.4	4.4	50	85	5.4	0.85
3	64	130	6.2	2.0	50	85	5.3	0.83
4	65	134	7.7	2.1	43	90	7.4	0.90
5	65	127	6.9	2.0	50	92	7.4	0.87
6	62	68	5.8	1.1	51	78	4.5	0.88
7	59	208	7.9	3.5	50	98	8.5	0.85
8	59	240	7.7	4.1	50	97	8.0	0.83
9	60	283	6.0	4.7	64	86	5.7	0.84
Total	555	1818	6.7	3.3	457	89	6.6	0.86

Table 10. Zooplankton biomass, zooplankton quality index (ZQI), and zooplankton ratio (ZPR) at Wallace Lake during sampling in August, 2013 and 2014.

	ZQI				ZPR				
Sample Date	Inlet	Mid-lake	Outlet	ZQI Average	Inlet	Mid-lake	Outlet	ZPR Average	Avg. Total Biomass (g/m)
8/14/2013	0.00	0.02	0.00	0.01	0.00	1.00	0.00	0.33	0.48
8/19/2014	--	0.00	0.00	0.00	--	0.00	0.00	0.00	0.70

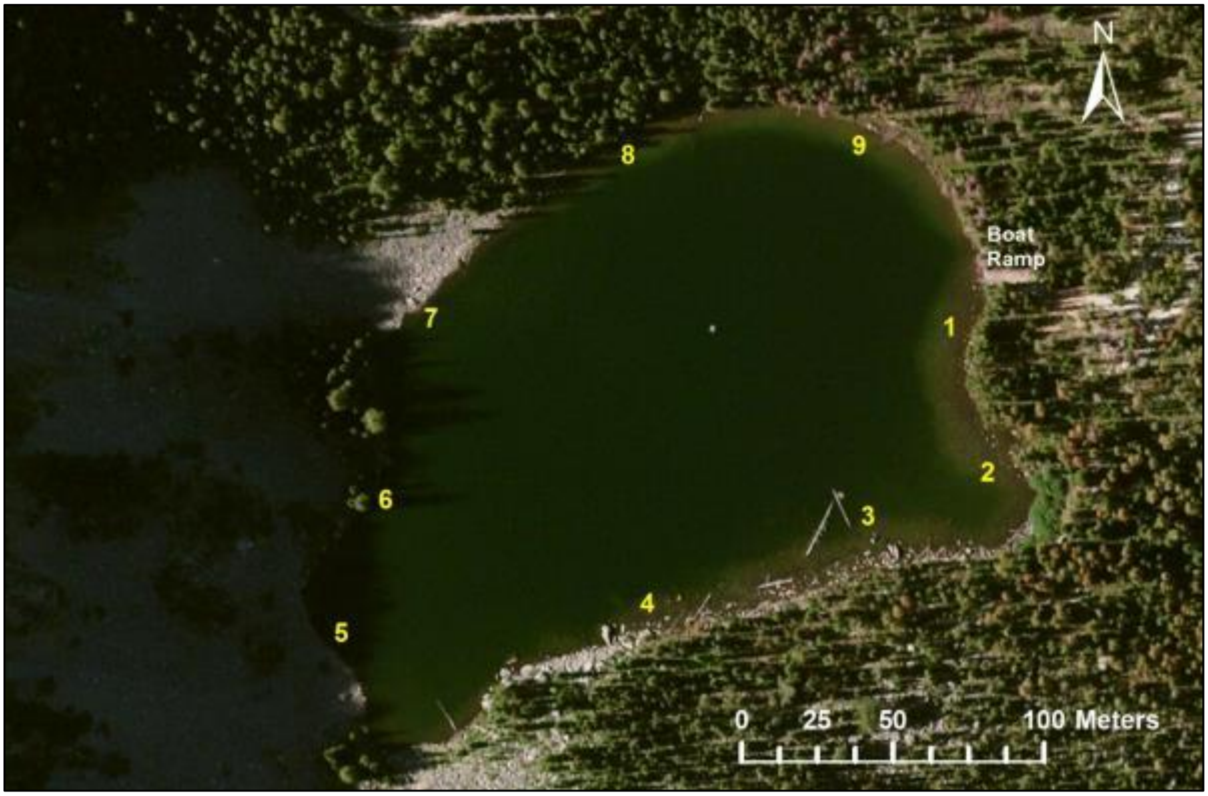

Figure 17. Locations (±3.0m) of minnow trap clusters and boat ramp shore access used for Wallace Lake Redside Shiner trapping on 9/11/2015. Specific coordinates are displayed in Table 1.

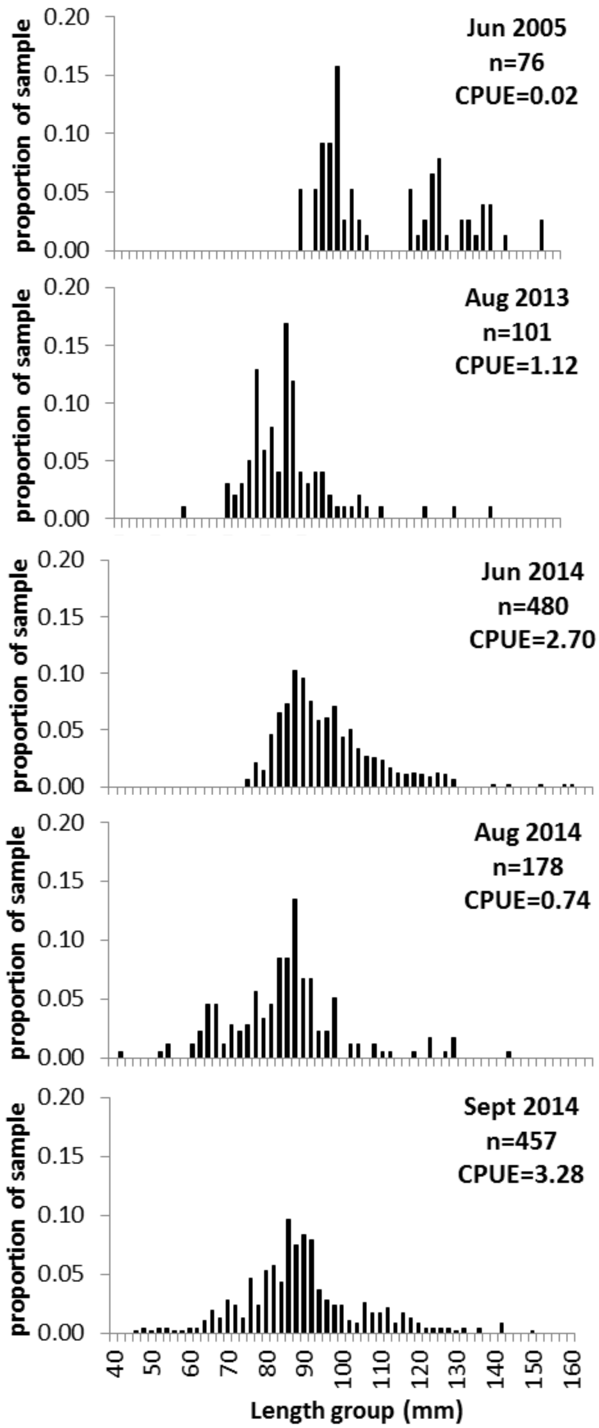

Figure 18. Size structure of Redside Shiner population in Wallace Lake during sampling efforts from June 2005 to September 2014. Catch-per-unit-effort (CPUE) = number of fish caught per minute of sampling. Shiners were collected during gill netting in 2005, and minnow traps all other years.

LOWLAND LAKES AND RESERVOIRS

CARLSON LAKE FISHERY MONITORING

ABSTRACT

Carlson Lake was sampled on June 25, 2014 to determine relative abundance and size and age structure information for the lake's Brook Trout *Salvelinus fontinalis* population. Thirty-five Brook Trout were captured during 3.5 hours of combined angling for a total catch-per-unit-effort of 10 fish/hour. Brook Trout captured ranged in size from 184 to 287 mm TL, and averaged 226 mm TL in 2014. Brook Trout size structure in Carlson Lake has not shown sustained improvement since Tiger Muskellunge *Esox masquinongy x Esox lucius* were first introduced in 2002. Over the last twelve years since the initial Tiger Muskellunge introduction, average Brook Trout length has ranged from 200 to 234 mm TL. The largest size Brook Trout encountered since Tiger Muskellunge introduction was 312 mm TL, observed in 2009, three years after the second Tiger Muskellunge introduction. In 2013, 70 Tiger Muskellunge were stocked into Carlson Lake, which marked the third Tiger Muskellunge stocking since 2002. The 2002 and 2006 stocking events consisted of 41 and 32 Tiger Muskellunge, respectively. Our 2014 survey results do not indicate a substantial reduction in Brook Trout abundance or an increase in Brook Trout size since the Tiger Muskellunge introduction in 2013.

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HISTORY AND INTRODUCTION

Eastern Brook Trout *Salvelinus fontinalis* were stocked in Carlson Lake in the 1940's and 1950's, and again in 1975. Approximately 500 Rainbow Trout *Oncorhynchus mykiss* were also stocked in the lake in 1975, but that introduction was apparently unsuccessful. In the earliest years of the Brook Trout fishery in Carlson Lake, anglers reported catching trophy sized fish weighing up to 1.4 kg (Curet et al. 2000). By 1975 however, anglers voiced concerns that the lake was overpopulated, and Brook Trout size and condition was poor. By 1981, mean Brook Trout total length was around 230 mm and fish were rarely found measuring in excess of 300 mm (Liter et al. 2000b). Mean length found during subsequent sampling events continued to decrease into the 1990s, at which time fisheries staff attempted to reduce population abundance to improve Brook Trout size structure by introducing predatory Kamloops Rainbow Trout. This introduction failed as well, and intensive manual removal of Brook Trout followed. In 1997, IDFG increased the daily bag limit to 16 fish and improved fishing access to the lake, in hopes of encouraging more angler harvest. Regional fisheries staff also manually removed 4,093 Brook Trout through the use of gill nets and other means between 1997 and 2001. Manual removal and increased bag limits proved unsuccessful in obtaining long-term improvements to Brook Trout size structure in Carlson Lake (Brimmer et al. 2006).

In 2002, 41 Tiger Muskellunge *Esox masquinongy x Esox lucius* were introduced into Carlson Lake, to prey upon Brook Trout and reduce their abundance. At the time of the first Tiger Muskellunge introduction, Brook Trout abundance was estimated at 9,024 fish (95% C.I. 7,474-11,064), with a mean TL of 201 mm. Three years after Tiger Muskellunge introduction, in 2005, Brook Trout abundance apparently decreased to 6,103 fish (95% C.I. 4,196-9,262), and average TL increased to 231 mm. Catch-per-unit-effort also decreased from 3.7 fish/hr in 2002 to 1.6 fish/hr in 2005 (Esselman et al. 2007). Tiger Muskellunge introduction was seemingly successful at improving Brook Trout population size structure and average body condition for the first few years after introduction. Mean relative weight of Brook Trout in 2005 (98.5) was significantly larger than in 2002 (89.6), prior to the first Tiger Muskellunge introduction (Curet et al. 2008), and mean length for all age classes increased as well (Esselman et al. 2007). In 2006, another 32 Tiger Muskellunge were stocked, and the Brook Trout population was subsequently monitored. Sampling events in 2006, 2008, and 2009 suggested a decreasing trend in size and body condition of Brook Trout, opposite of what was expected. Relative weight values were 104, 88, and 87, respectively (Curet et al. 2010). Mean Brook Trout total length decreased to 234 mm in 2009 and to 220 mm in 2013. In 2013, Brook Trout population abundance was estimated at 10,867 fish (95% C.I. 9,182-13,008), the highest estimated abundance since monitoring began. Tiger Muskellunge were stocked for the third time in 2013 (n=70).

OBJECTIVES

1. Assess relative abundance and size structure of the Brook Trout population in Carlson Lake.

2. Collect otoliths to assess age and growth of the Brook Trout population. Compare to pre-Tiger Muskellunge introduction years.

STUDY AREA AND METHODS

Carlson Lake (WGS84 datum: 44.28153^{o}N, 113.75283^{o}W) is a sub-alpine lake approximately two hectares in size located in the Pahsimeroi River drainage at 2,438 m in elevation. Subterranean flow from the lake drains into Double Springs Creek, a tributary of the Pahsimeroi River.

A crew angled the lake for a total of 3.5 hours (combined effort) on June 25, 2014 to estimate relative abundance (CPUE), describe size structure, and collect otoliths for age determination from the Brook Trout population. Fish were measured (TL mm), weighed (g), and otoliths were taken from a representative sample of the population (~3-5 per 10 mm size class). Otoliths were cleaned of debris and mucus, and stored in dry vials for later analysis. Otoliths were mounted in epoxy and sectioned using an isometric saw (Beamish 1979, Casselman 1983), and sections were mounted on microscope slides and digitized under 25x to 40x magnification. Digital images were read by two independent technicians and if independent readers were not in agreement on an age, a referee session with a third reader was used to determine an age for the otolith. Age and growth analysis results are not yet available, and will be reported in the 2015 annual fisheries management report.

RESULTS AND DISCUSSION

Thirty-five Brook Trout were caught during a combined 3.5 hours of angling on June 25, 2014, for a CPUE of 10 fish/hour (Table 11). Brook Trout caught during angling in 2014 averaged 226 mm TL (SE $\pm$ 0.9) and ranged from 184 mm TL to 287 mm TL (Table 11, Figure 19). Relative weight averaged 80 (SE $\pm$ 0.3) and ranged from 56 to 96.

Results of 2014 sampling showed similar population size structure to 2013 (Table 11, Figure 19). Although Brook Trout abundance in Carlson Lake seemed to decrease initially after Tiger Muskellunge introduction in 2002, more recently their abundance has apparently increased. The initial reduction in Brook Trout abundance likely increased average Brook Trout size (mean TL) and condition (average Wr) in the mid-2000's (Table 11, Figure 20), but we have seen very little or no improvement since then.

We are unsure as to whether recent Tiger Muskellunge introductions (in 2006 and 2013) were successful at establishing an adequate predator population to control Brook Trout abundance. Carline et al. (1986) suggested stocked Tiger Muskellunge <250 mm TL are greatly susceptible to predation mortality, which is approximately the size we stocked fish at in 2006 and 2013. In 2006, Tiger Muskellunge from the 2002 stocking event averaged 735 mm TL (range: 710 – 770 mm TL) and in 2013, Tiger Muskellunge caught in gill nets averaged 933 mm TL (range: 864 - 1067 mm TL) (Messner et al. *in press*). The presence of larger Tiger Muskellunge during the 2006 and 2013 stocking events may have decreased the likelihood that Tiger Muskellunge stocked during subsequent introductions could become established.

MANAGEMENT RECOMMENDATIONS

1. Use trap nets at Carlson Lake in 2015 to determine if Tiger Muskellunge stocked in 2006 and 2013 are present, and collect otoliths from larger Tiger Muskellunge to determine age/time of stocking.

2. Monitor abundance and size/age structure of Brook Trout in 2015 to determine whether further management action is needed to reduce Brook Trout abundance and improve size structure.

Table 11. Summary of Brook Trout sampling efforts in Carlson Lake between 1998 and 2014.

Year	Sample dates	Total no. fish	Length range (mm)	Average total length (mm)	Average weight (g)	Average relative weight	Total gill-net hours	Fish/net hour (CPUE)	Population estimate
1998	5/22-23	818	120-292	196	--	--	488.3	1.7	--
1999	5/27-29	1,151	112-300	198	--	--	386.1	3.0	--
2000	10/08-09	665	108-270	191	--	--	270.9	2.5	--
2002[a]	6/13-14	546	109-276	200	77	84	147.8	3.7	9,024
2003	6/13-14	562	96-270	209	78	65	416.9	1.4	9,063
2004[b]	6/15-16	48	156-251	224	96	86	60.5[b]	0.8	--
2005	6/22-24	599	145-290	231	127	89	369.5	1.6	6,103
2006[a]	6/19-20	150	127-301	216	130	104	64.8	2.3	--
2008[c]	7/22-23 8/14-15	67	154-270	225	115	88	20.5[c]	3.3	--
2009	7/07-08	246	136-312	234	129	87	151.7	1.6	--
2011	7/06-07	287	70-291	218	102	89	132.7	2.2	--
2013[a]	6/20-21	825	150-292	220	95	75	172.5	4.8	10,867
2014[c]	6/25	35	184-287	226	107	80	3.5[c]	10.0	--

[a] Tiger muskellunge introduction years.
[b] Hoop net survey.
[c] Hook and line survey.

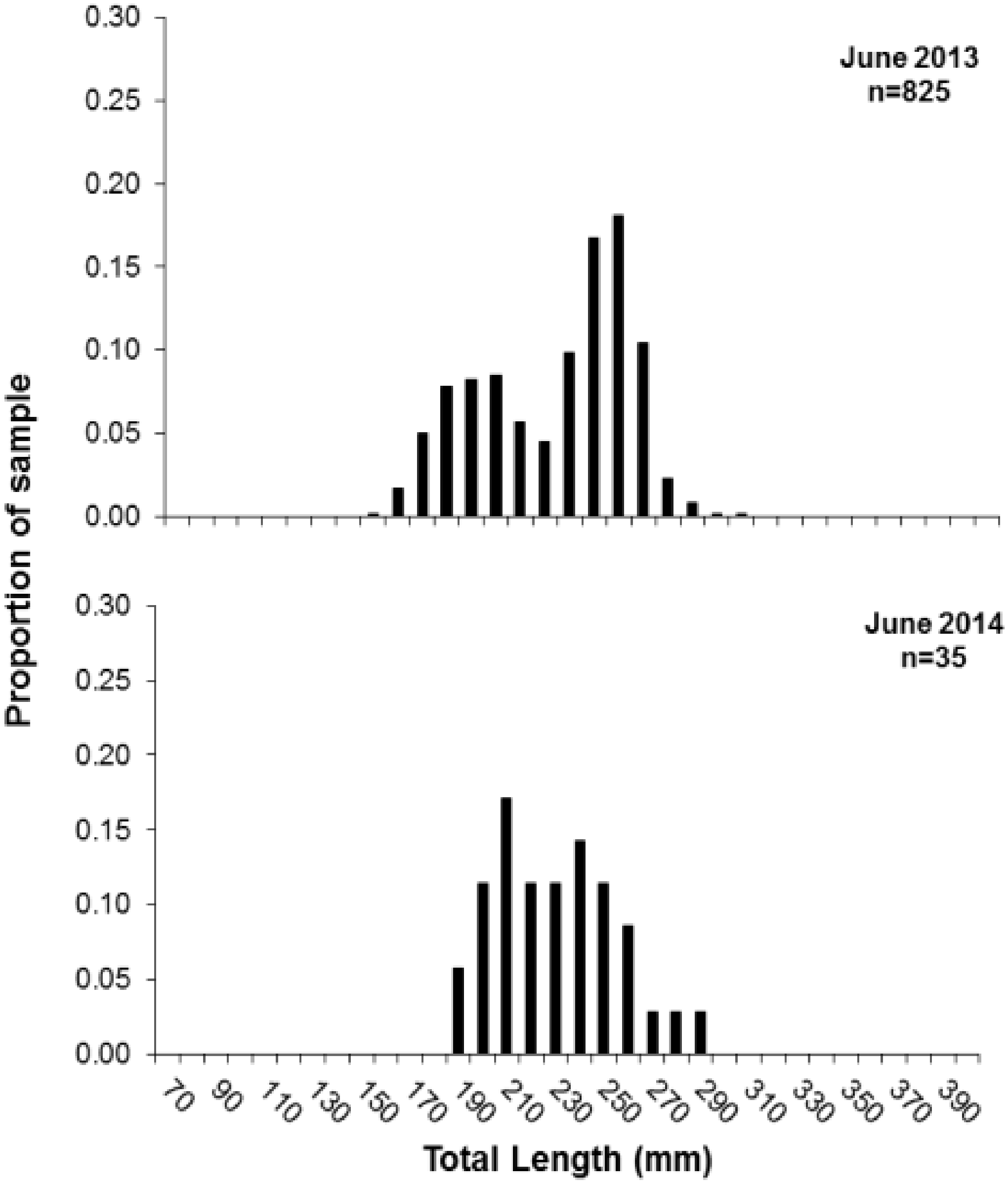

Figure 19. Size structure of the Brook Trout population in Carlson Lake, determined via gill netting on June 21, 2013 and angling surveys on June 25, 2014.

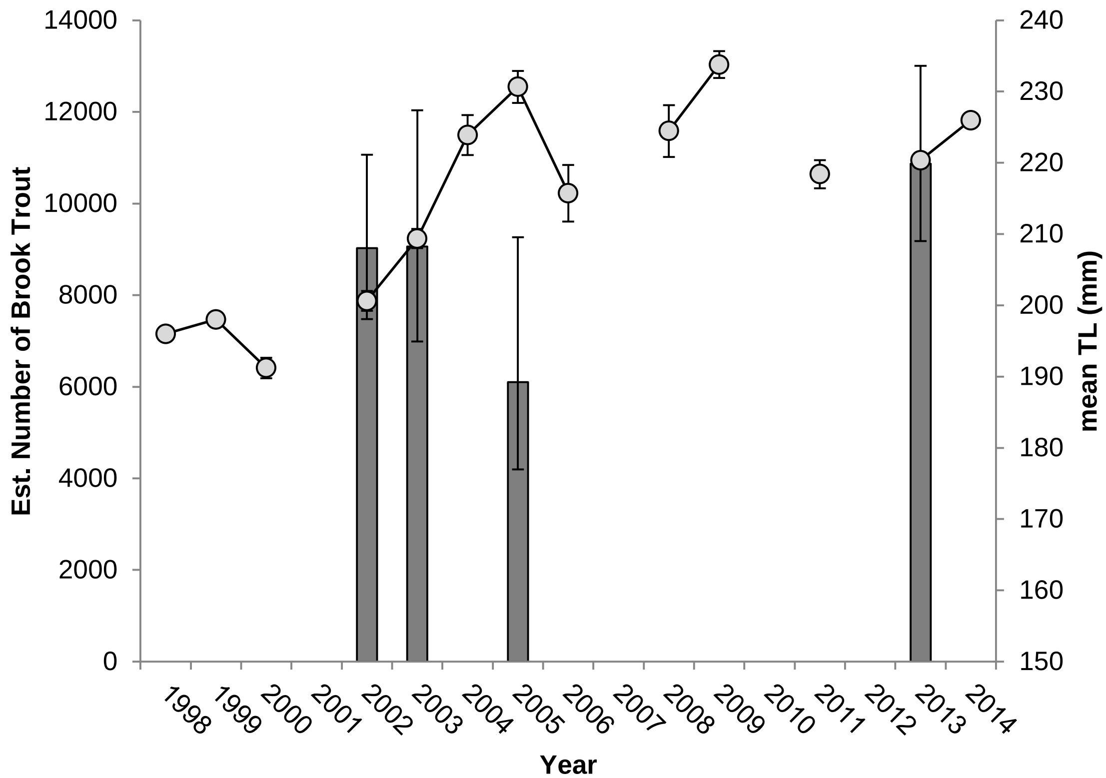

Figure 20. Estimated population abundance (gray bars) and mean total length (circles) of Brook Trout sampled at Carlson Lake, 1998 to 2014. Error bars represent 95% confidence intervals.

LOWLAND LAKES AND RESERVOIRS

WILLIAMS LAKE AND HERD LAKE ZOOPLANKTON MONITORING

ABSTRACT

Regional fisheries staff conducted zooplankton sampling in August 2014 to determine the amount available for trout consumption in two lowland lakes: Herd Lake and Williams Lake. Three sites were sampled at each of the two lakes: near the inlet, mid lake, and near the outlet. Zooplankton Ratio (ZPR) and Zooplankton Quality Index (ZQI) were calculated for each lake to determine the quality and abundance of zooplankton present. The average zooplankton quality index (ZQI) for Herd Lake was 0.87, and Williams Lake had an average ZQI of 0.72 in 2014. Although ZQI values in both lakes were lower in 2014 than in other recent years, values above 0.60 suggest adequate forage for trout, with little to no competition for forage resources.

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Jordan Messner, Regional Fisheries Biologist

INTRODUCTION

Evaluating forage quality and abundance in lakes allows fisheries managers to determine the fishery potential of each lake. Measures of zooplankton productivity can be used to predict fish yield and growth, and can also help determine stocking densities (Teuscher 1999). Simplified methods for assessing zooplankton quality and abundance (ZPR and ZQI) have been adopted by IDFG biologists for monitoring fish forage in lakes throughout the state (see Messner et al. *in press* for more detailed background).

STUDY AREAS AND METHODS

Herd Lake (WGS84 datum: 44.08921˚N, 114.17364˚W) is located in the East Fork Salmon River drainage in Custer County at 2,187 m elevation and was formed by a prehistoric landslide which blocked Lake Creek. The lake has a surface area of 6.7 ha and supports a self-sustaining population of Rainbow Trout *Oncorhychus mykiss* that spawn in Lake Creek. Gill netting efforts between 2001 and 2011 showed that average Rainbow Trout length in Herd Lake rarely exceeded 250 mm TL (Curet et al. 2013), which was considered a result of an overabundance of fish and resulting competition for forage (Brimmer et al. 2003). In an effort to reduce Rainbow Trout abundance and improve size structure, 72 tiger muskellunge were stocked in 2006 and the bag limit on Rainbow Trout was increased from six to 25 trout per day in 2011. IDFG has been monitoring zooplankton quality and abundance since 2002 in Herd Lake.

Williams Lake (WGS84 datum: 45.01636°N, 113.97434°W) is located approximately 19 km south of Salmon, Idaho. The lake is 73 ha in size and sits at 1,600 m in elevation in the Lake Creek drainage of the upper Salmon River basin. Maximum depth is 56 m and mean depth is 23 m. The lake's inlet, Lake Creek, provides the majority of its water input and is a major spawning tributary for the lake's Rainbow Trout and Bull Trout *Salvelinus confluentus* populations. Water quality degradation in the late 1980s and early 1990s, attributed to increased nutrient input from eroded sediments in the watershed and leaching of septic systems, caused concern over the health of the lake's fish population (Liter et al. 2000a). Early assessments found that winter dissolved oxygen concentrations can fall below 5 mg/L within 2-4 m of the surface, and within 8 m of the surface in summer (Liter et al. 2000a). Nutrient input issues caused by leaching septic fields have been addressed in the last two decades, but the lake still experiences extremely low dissolved oxygen values below the epilimnion, making the lower depths of the lake uninhabitable to fish. Williams Lake is a mesotrophic lake that currently serves as a quality fishery in the Salmon area, and generally receives most of its angling pressure during ice-free months. Since 2000, IDFG has been monitoring zooplankton quality and abundance in the lake in order to determine whether forage is a limiting factor affecting fish growth and survival.

Zooplankton samples were collected at Herd Lake on August 20, 2014, and at Williams Lake on August 18, 2014. Tows were conducted near the inlet, mid-lake, and at the outlet following methods outlined by Teuscher (1999). Tows were conducted from a depth of 4.6 m in Herd Lake and from 9.1 m in Williams Lake. Samples were stored in 100% ethyl alcohol for eleven days, at which time zooplankton samples were analyzed using methodology developed by Yule (unpublished) and Teuscher (1999). Total zooplankton biomass (all zooplankton) at each site is quantified by weighing the dried contents of the 153 µm net. The zooplankton ratio index (ZPR) is the ratio of preferred to useable zooplankton, and is calculated by dividing the dried weight of the 750 µm sample (preferred) by the dried weight of the 500 µm sample (useable). The zooplankton quality index (ZQI) is the index of overall abundance and size ratios, and is calculated by dividing the sum of weights for the 500 µm and 750 µm samples by ZPR.

Average total biomass, ZPR, and ZQI are calculated for each lake by averaging across the three sampling locations at each lake.

RESULTS AND DISCUSSION

Average total zooplankton biomass at Herd Lake in 2014 was 2.82 g/m. ZQI was 0.87 and ZPR was 0.49. Compared to previous years, zooplankton quality and abundance in Herd Lake in 2014 was slightly above average (Table 12, Figure 21).

ZQI and ZPR values greater than 0.60 are considered indicative of abundant and high quality forage, with a low likelihood of competition for forage resources (Teuscher 1999). ZQI and ZPR values in that range have been observed during two periods since 2001; 2007 and 2008 following the first introduction of Tiger Muskellunge, and 2012 to present following increased bag limits. The persistence of ZQI values greater than 0.60 for the last several years, as well as increased overall zooplankton production, should theoretically result in improved growth and size structure of the Rainbow Trout population in Herd Lake. However, Rainbow Trout size structure did not show any improvement from 2001 to 2011, even though above average ZQI, ZPR, and total biomass values were observed from 2007 to 2009, after Tiger Muskie introduction (Curet et al. 2013). Unfortunately, abundance and size structure of the Rainbow Trout population at Herd Lake has not been monitored in detail since 2011. Further study is necessary to determine whether the recent increase in zooplankton production at Herd Lake has improved Rainbow Trout growth.

Average total zooplankton biomass at Williams Lake on August 18, 2014 was 1.20 g/m. ZQI and ZPR values were both 0.72. Zooplankton quality and abundance in Williams Lake has remained relatively stable over the last 11 sampling periods, since monitoring began in 2000 (Table 13, Figure 22). These results suggest there is an abundance of quality forage available to planktivorous fish in Williams in 2014, and competition for forage is very unlikely.

MANAGEMENT RECOMMENDATIONS

1. Quantify Rainbow Trout relative abundance, size structure, and condition in Herd Lake in 2015 to determine how the population responded to increased zooplankton production and quality since 2011.

2. Continue monitoring zooplankton quality and abundance in Herd and Williams lakes annually to help guide and inform fisheries management actions.

Table 12. Zooplankton ratio (ZPR) and quality index (ZQI) values for Herd Lake, 2002 to 2014.

	2002	2003	2004	2006	2007	2008	2009	2011	2012	2013	2014	Average
Sample Date	8/27	7/31	8/9	8/24	8/24	8/29	8/31	8/26	8/17	8/15	8/20	--
Total biomass	1.34	1.34	--	0.95	3.21	0.86	1.36	1.02	4.23	1.94	2.82	1.91
ZPR	0.05	0.05	0.02	0.14	0.50	1.02	0.36	0.16	0.44	0.94	0.49	0.38
ZQI	0.01	0.01	0.04	0.02	1.28	0.98	0.22	0.05	1.63	2.42	0.87	0.68

Table 13. Zooplankton ratio (ZPR) and quality index (ZQI) values for Williams Lake, 2000 to 2014.

	2000	2001	2002	2003	2005	2008	2009	2010	2011	2012	2014	Average
Sample Date	8/22	8/13	8/19	8/19	8/17	8/18	8/31	8/31	8/19	8/13	8/18	--
Total biomass	1.12	1.83	1.60	0.28	0.50	1.00	1.10	0.70	1.10	2.00	1.20	1.13
ZPR	0.86	0.65	0.69	1.55	0.71	0.80	0.52	0.62	0.53	0.61	0.72	0.75
ZQI	0.67	0.92	0.66	0.72	0.56	0.73	0.70	0.23	0.61	1.20	0.72	0.70

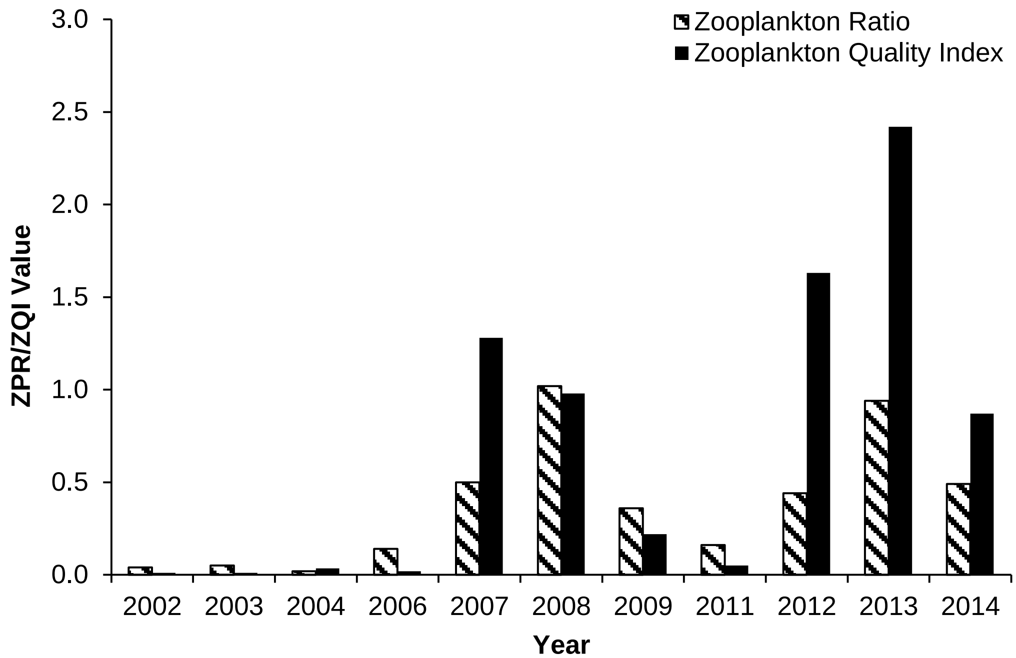

Figure 21. Zooplankton ratio (ZPR) and quality index (ZQI) calculated for Herd Lake, 2002 - 2014.

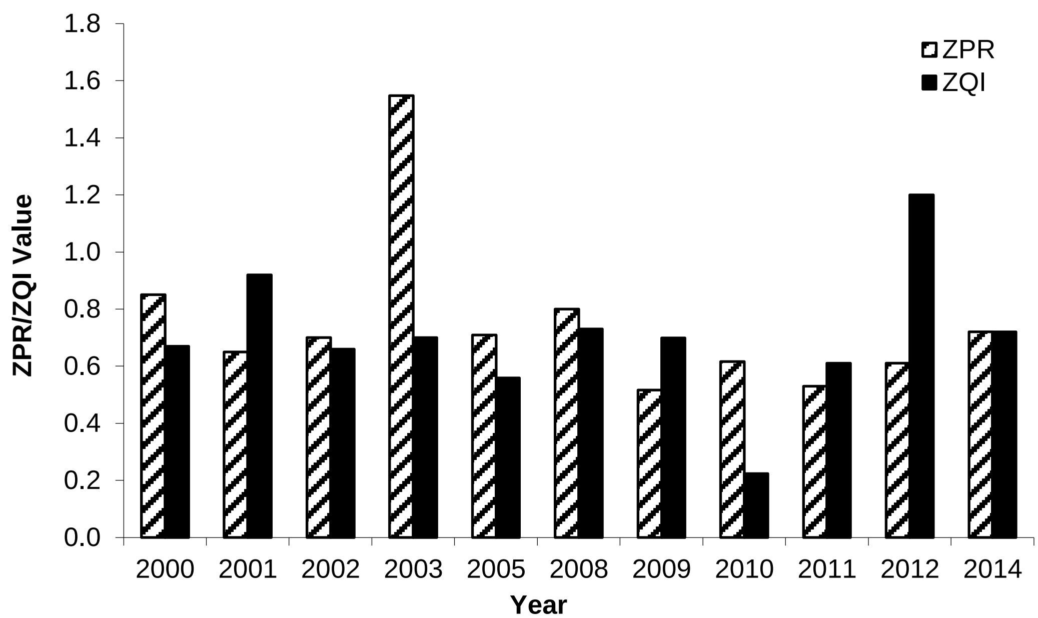

Figure 22. Zooplankton ratio (ZPR) and quality index (ZQI) calculated for Williams Lake, 2000 - 2014.

LOWLAND LAKES AND RESERVOIRS

WILLIAMS LAKE EGG TAKE PROGRAM

ABSTRACT

In 2014 we collected and spawned eggs from Rainbow Trout *Oncorhychus mykiss*, from Lake Creek, the inlet to Williams Lake, with the help and assistance of local homeowners, volunteers, and anglers. On May 12, 2014, 12 female and 12 male Rainbow Trout from Lake Creek were collected and spawned. Local homeowner/volunteer Ken John monitored and tended to the eggs in an incubation station on the outlet to the lake until approximately 27,000 fry were released back into Lake Creek in July. Although this project was initiated in response to angler concerns that hatchery supplementation was necessary in the 1990's, it has since become an annual educational activity to get local homeowners, anglers, and kids involved in the fishery and regional fisheries management.

Authors:

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Greg Schoby, Regional Fisheries Manager

INTRODUCTION

Rainbow Trout *Oncorhynchus mykiss* and Bull Trout *Salvelinus confluentus* are the only fish species confirmed present in Williams Lake (Redside Shiners *Richardsonius balteatus* have been reported but not confirmed [T. Curet, IDFG, personal communication]). In the early-1960's, the lake was managed as a put-and-grow Rainbow Trout fishery, with approximately 100,000 to 120,000 fingerlings stocked annually during the mid-1960's. In 1984 stocking was discontinued, and in the mid 1990's the public expressed concerns that hatchery supplementation was necessary at the lake. To alleviate those concerns, regional fisheries biologists began a small egg take, incubation, and rearing operation in 1997 in Lake Creek, the lake's major spawning inlet. Although Williams Lake functions as a wild Rainbow Trout fishery with no influence from stocking, each year spawning adults are collected in the lake inlet and eggs are stripped, fertilized, and incubated and reared in the lake outlet for 6 to 8 weeks before release. Eggs are tended by local homeowners, and fry are released in the lake inlet in July. This project results in approximately 20,000 to 50,000 fry being released into Lake Creek each year.

OBJECTIVES

1. Increase public involvement in regional fisheries management and educate local volunteers regarding fish spawning/rearing practices and fish life history/population dynamics.

STUDY AREA AND METHODS

Williams Lake (WGS84 datum: 45.01643°N, -113.97619°W) is an early eutrophic lake located at 1,600 m elevation, in central Lemhi County, approximately 19km SW of Salmon, ID. The lake has a surface area of 72.8 ha, a maximum depth of 58 m, and a mean depth of 23 m. The principle in-flow is provided by Lake Creek, the major spawning tributary at the lake, with other water sources originating from springs and intermittent streams. The lake supports a naturally reproducing Rainbow Trout population that includes trophy sized fish (>400 mm TL). Bull Trout are the only other fish species recorded inhabiting the lake. Posted boundary signs at the mouth of Lake Creek and in nearby campgrounds explain that fishing is prohibited in Lake Creek during Rainbow Trout spawning season. Fishing in Lake Creek is open from July 1 until November 30.

We collected spawning adult Rainbow Trout from Lake Creek, the major spawning inlet at Williams Lake, on May 12, 2014. Twelve local volunteers assisted three biologists with electrofishing an approximately 200 m section of the stream. Fish were netted and transferred with buckets to aerated coolers and separated by sex. Ripe fish were selected and two to four at a time were placed in a cooler with MS-222 anesthetic to make handling and spawning easier. Unripe fish were returned immediately to the stream. Our objective was to collect eggs from twelve females. Ripe fish were rinsed before being used to spawn and eggs were taken from one female at a time and placed in a stainless steel bowl. Eggs for each separate female were fertilized using one to two ripe males at random. All fish were returned to the stream after recovery in an aerated cooler. After water hardening, the eggs were transferred in buckets to an incubation box on Lake Creek, below the lake, where regional volunteer Ken John tended to the fertilized eggs until fry were ready to be released back into the inlet in July.

RESULTS AND DISCUSSION

On May 12, 2014, 12 female and 12 male Rainbow Trout from Lake Creek were collected and spawned. Twelve volunteers from the local community assisted IDFG staff with egg collection. We estimated approximately 36,000 eggs were stripped from the 12 female Rainbow Trout, based on an average fecundity of 3,000 eggs per female (J. Mitchell, IDFG, personal communication). Regional IDFG cooperator Ken John tended the fertilized eggs for almost six weeks. At an estimated 75% egg to fry survival rate (J. Mitchell, IDFG, personal communication) approximately 27,000 fry were released into Lake Creek in July, 2014.

The annual egg take event at Williams Lake has evolved into somewhat of a public relations activity over the years. Methods to assess whether or not the activity has a quantitative effect on Rainbow Trout abundance in the lake would likely be very expensive and time consuming. Volunteers attend and assist with both the egg take operation in May as well as the fry release in June, and we believe therein lies the greatest value of the activity. In order to gain the most benefit out of this event, we would like to get more volunteers involved and perhaps integrate other aquatic education programs, such as “Trout in the Classroom”. In 2014, we explored the possibility of taking approximately 60 fourth graders from Pioneer Elementary School in Salmon to the spawning event as part of our ‘Trout in the Classroom’ program. The Salmon School District administrators denied our request, stating that “the road to Williams Lake is too dangerous for the school bus to travel”. We will continue the annual Williams Lake spawning and rearing activity as long as there is public interest/ involvement.

MANAGEMENT RECOMMENDATIONS

1. Continue Rainbow Trout egg take operation in Lake Creek annually, and explore alternative ways to integrate other aquatic education programs and get more volunteers involved.

2. If public interest/ involvement declines, re-evaluate whether the activity should be continued.

RIVERS AND STREAMS

WILD TROUT TRENDS IN ABUNDANCE –STREAMS

ABSTRACT

Regional fisheries staff conducted redd count surveys for resident Rainbow Trout *Oncorhychus mykiss* and Bull Trout *Salvelinus confluentus* populations in 2014, as part of an annual trend monitoring program. In spring, we counted 465 Rainbow Trout redds in Big Springs Creek and 93 in the Lemhi River. During Bull Trout redd count surveys in fall 2014, we counted four redds in Alpine Creek, 14 redds in Fishhook Creek, 85 redds in Fourth of July Creek, 200 redds in Bear Valley Creek, 23 redds in East Fork Hayden Creek, and 29 redds in the main stem of Hayden Creek. Compared to surveys in 2013, the number of Rainbow Trout redds counted in the Lemhi River and Big Springs Creek in 2014 increased, and the number of Bull Trout redds counted in 2014 increased in all transects except Fishhook Creek and East Fork Hayden Creek.

Regional staff operated three temporary picket weirs in the spring to collect spawning Steelhead in Salmon River tributaries, and two weirs in the fall to collect Bull Trout in the upper Hayden Creek drainage. Steelhead weirs operated on Salmon River tributaries (Carmen Creek, Tower Creek, and Fourth of July Creek) in the spring caught only two Rainbow Trout. Bull Trout weirs operated in upper Hayden Creek and Bear Valley Creek in the fall 2014 trapped 27 Bull Trout.

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INTRODUCTION

Rainbow and Bull Trout Redd Count Monitoring

The Salmon Region conducts redd counts for resident and fluvial populations of Rainbow Trout *Oncorhychus mykiss* and Bull Trout *Salvelinus confluentus* in nine streams throughout the upper Salmon River basin on an annual basis, to monitor spawning escapement trends. In 1994, the region began counting redds for resident and fluvial Rainbow Trout in Big Springs Creek, a tributary to the upper Lemhi River near Leadore. In 1997, we established another redd count transect for Rainbow Trout on the upper Lemhi River, just above the confluence with Big Springs Creek, to capture more of the redd production in that area. Redd count monitoring for Rainbow Trout on these transects occurs annually and provides a general index of spawner abundance over time. Numerous habitat improvement projects, changes in water-use practices, alterations in land management practices, and fisheries regulation changes have occurred in the upper Lemhi River basin in the last decade that have likely benefited resident fish populations.

Bull Trout were listed as threatened under the Endangered Species Act (ESA) on June 10, 1998. That fall, the region established its first trend transects for enumerating Bull Trout redds. Trend transects were established on Alpine and Fishhook Creeks in the Sawtooth Basin, near Stanley that year. Trend transects were then established on Bear Valley Creek and East Fork Hayden Creek in the Lemhi River drainage in 2002, on Fourth of July Creek in the Stanley basin in 2003, and on Upper Hayden Creek in the Lemhi River drainage in 2006.

As additional redd production areas have been located (outside of established transect boundaries), new trend transects have been added to encompass as much spawning production as possible. New transects were added to account for additional productivity on Bear Valley Creek in 2007, on Fishhook Creek in 2008, and on Alpine Creek in 2011. In upper Hayden Creek, the trend transect was moved altogether in 2010, when staff determined the existing transect was too low in the drainage and most Bull Trout spawning occurred much higher.

Resident Fish Capture at Weirs

In the spring of 2014, we operated temporary picket weirs on three upper Salmon River tributaries (Carmen Creek, Tower Creek, and Fourth of July Creek) to estimate Steelhead and resident trout spawning escapement (Belnap et al. *in press*). Two additional weirs were operated during the fall season to capture migrating Bull Trout in upper Hayden Creek and Bear Valley Creek, a tributary of Hayden Creek. Both streams are important spawning areas for resident and fluvial Bull Trout in the Lemhi River drainage.

OBJECTIVES

1. Maintain trend monitoring datasets for spawning resident and fluvial trout in the region by continuing annual redd counts and operating fish weirs in priority tributaries.

2. Enumerate, measure, and collect biological data for resident salmonids captured at temporary fish weirs, and implant with PIT tags to help further our understanding of fish movement, distribution, abundance, and life history characteristics in the basin

STUDY AREA AND METHODS

Rainbow Trout Redd Count Monitoring

Big Springs Creek

Big Springs Creek is a tributary to the Lemhi River, located approximately 8 km north of Leadore, Idaho. Two trend transects (Tyler transect and Neibaur transect) are walked on Big Springs Creek annually. The Big Springs transects were the first resident/fluvial Rainbow Trout redd count trend transects established in the region, in 1994. The Tyler transect is approximately 3.4 km long, located at (WGS84 datum) Start: 44.70896°N, -113.39917°W, and end: 44.72855°N, -113.43430°W, and the Neibaur transect is approximately 4.5 km long, located at Start: 44.70047°N, -113.38436°W, and end: 44.70896°N, -113.39917°W (Figure 23).

Redd counts are usually conducted during the last week of April or the first week of May. Redd counts on Big Springs Creek are "single pass" counts, meaning redds are enumerated on a single occasion and are not flagged. Redd counts on Big Springs Creek were conducted on May 2 in 2014.

Lemhi River

The Lemhi River flows approximately 100 km from its headwaters near Leadore, Idaho to its confluence with the Salmon River at Salmon, Idaho. The upper Lemhi River redd count trend transect was established in 1997 and includes a 3 km section of Lemhi River flowing through the property known as the Merrill Beyeler Ranch from the fence line 100 meters upstream of the upper water gap to the lower fenced boundary (Start: 44.68689°N, -113.36273°W, and end: 44.69945°N, -113.37074°W) (Figure 23).

Redd counts are usually conducted during the last week of April or the first week of May, at the same time and using the same methods as for Big Springs Creek (single pass). Redd counts were conducted on May 2, 2014.

Bull Trout Redd Count Monitoring

Alpine Creek

Alpine Creek is a tributary to Alturas Lake Creek, which flows into Alturas Lake in the Sawtooth basin, approximately 35 km south of Stanley, Idaho. Two trend transects are walked annually on Alpine Creek. The original (upper) transect was established in 1998, and is approximately 1.5 km long, located at (WGS84 datum) start: 43.90705°N, -114.93078°W, and end: 43.90357°N, -114.94457°W (Figure 24). In 2010, a second (lower) transect was created because no Bull Trout redds were found in the existing transect in 2008 and 2009. Biologists surveyed a lower portion of Alpine Creek to determine whether spawning was occurring outside of the existing trend transect and established this downstream area as a new trend transect site (K. Plaster, IDFG, personal communication). The lower Alpine Creek transect (established in 2011) is approximately 1.5 km long, located at (WGS84 datum) start: 43.89707°N, -114.91327°W, and end: 43.90245°N, -114.92246°W (Figure 24). The lower trend transect begins 0.7 km above the mouth of Alpine Creek, compared to the upper transect, which started 2.9 km above the mouth. Both transects contain low gradient meadow sections, as well as high gradient canyon sections. The upper transect drops 20 m in elevation over 1.5 km and the lower transect drops 39 m in elevation over 1.5 km.

Two visual ground counts are conducted annually, about two weeks apart, on both transects in Alpine Creek. Surveys in 2014 were conducted August 29 and September 12. For each transect, all redds in progress or completed redds were counted during the first survey and flagged. On the second surveys, additional completed redds were counted and included with the number of flagged redds to provide a total number of redds.

Fishhook Creek

Fishhook Creek is a tributary of Redfish Lake in the Sawtooth basin, approximately 10 km south of Stanley, Idaho. Two trend transects are walked on Fishhook Creek annually. The older (upper) trend transect was established in 1998, and is approximately 1 km long, located at (WGS84 datum) start: 44.13706°N, -114.96703°W and end: 44.13472°N, -114.97622°W (Figure 25). The newer (lower) transect was established in 2008, and is approximately 3.5 km long, located at start: 44.14882°N, -114.93716°W, and end: 44.13992°N, -114.96205°W (Figure 25). The lower trend transect in Fishhook Creek was established after survey crews observed Bull Trout spawning below the original (upper) trend transect in 2006 and 2007 (K. Plaster, IDFG, personal communication).

Two visual ground counts are conducted annually, about two weeks apart, on each of the two Fishhook Creek transects. Redd count surveys on Fishhook Creek were conducted August 29 and September 10 in 2014. For each transect, all redds in progress or completed redds were counted during the first survey and flagged. On the second surveys, additional completed redds were counted and included with the number of flagged redds to provide a total number of redds.

Fourth of July Creek

Fourth of July Creek is a tributary of the upper Salmon River in the Sawtooth basin, located approximately 28 km south of Stanley, Idaho. One single visual ground count is conducted on Fourth of July Creek annually. The Fourth of July Creek trend transect was established in 2003, and is approximately 5 km long, located at (WGS84 datum) start: 44.04112°N, -114.75831°W, and end: 44.05039°N, -114.69165°W (Figure 26).

Fisheries staff conducted a redd count survey for Bull Trout in Fourth of July Creek on September 9 in 2014. Redd counts on Fourth of July Creek are “single pass” counts, meaning redds are enumerated on a single occasion and are not flagged.

Hayden Creek

Hayden Creek is the largest tributary to the Lemhi River, which join approximately 45 km south of Salmon, Idaho. The Bull Trout redd count trend transect we survey on upper Hayden Creek is approximately 2.5 km long, and is located at (WGS84 datum) start: 44.70624°N, -113.73430°W, and end: 44.70533°N, -113.75771°W (Figure 27). The trend transect currently surveyed on upper Hayden Creek is not the same that was established in 2006. The older transect produced single digit Bull Trout redd counts each year between 2006 and 2009, and in 2010 trend transect boundaries were moved upstream to the current location to encompass the bulk of spawning activity (M. Biggs, IDFG, personal communication).

Both fluvial and resident forms of Bull Trout are found in upper Hayden Creek during redd count surveys. The upper Hayden Creek trend transect is walked twice annually, approximately one week apart, to visually count fluvial and resident Bull Trout redds. In 2014, three pass counts were conducted. Redd counts in 2014 were conducted on September 16, 23, and 30. Since fluvial Bull Trout are larger in size than residents, fluvial Bull Trout redds were classified as redds equal to or greater than 0.4 m by 0.6 m in diameter while redds smaller in size were considered those of resident Bull Trout. For each transect, all redds in progress or completed redds were counted during the first survey and flagged. On the second survey in each transect, additional completed redds were counted and included with the number of flagged redds to provide a total number of redds

Bear Valley Creek

Bear Valley Creek is a tributary of Hayden Creek in the Lemhi River drainage, located approximately 60 km south of Salmon, Idaho. Two trend transects are walked annually on Bear Valley Creek to enumerate Bull Trout redds. The older (lower) Bear Valley trend transect (established in 2002) is 1.7 km long and meanders through a large meadow at WGS84 datum coordinates of 44.77624°N, -113.74259°W, and ends at 44.78332°N, -113.75496°W (Figure 27). In 2007, a second redd count transect (upper transect) was added on Bear Valley Creek to include a reach beginning at the mouth of Wright Creek, continuing upstream 4.7 km, and ending about 1.2 km downstream of the mouth of Buck Creek (WGS84 datum, start: 44.78332°N, -113.75496°W and end: 44.79685°N, -113.80820°W) (Figure 27). This upper transect is approximately 5 km long and begins immediately above the older trend transect site.

Two to three visual ground counts are conducted annually about one week apart on the Bear Valley Creek transects. A third pass is only conducted when the ratio of live fish to redds is greater than one on the second pass. In 2014, counts were conducted on September 17, 24, and October 1. Both fluvial and resident Bull Trout life histories are found in Bear Valley Creek. Since fluvial Bull Trout are larger in size than residents, fluvial Bull Trout redds were classified as redds equal to or greater than 0.4 m by 0.6 m in diameter while redds that were smaller in size were considered those of resident Bull Trout. For each transect, all redds in progress or completed redds were counted during the first survey and flagged. On the second and third passes in each transect, additional completed redds were counted and included with the number of flagged redds to provide a total number of redds.

East Fork Hayden Creek

East Fork Hayden Creek is a tributary of Hayden Creek in the Lemhi River drainage. The confluence of the East Fork Hayden Creek and Hayden Creek is located approximately 15 km upstream from Hayden Creek's confluence with the Lemhi River. A single-pass redd count is conducted annually on the East Fork Hayden Creek trend transect to enumerate resident Bull Trout redds. Bull Trout that spawn in the East Fork Hayden Creek exhibit a resident life history strategy only (i.e. no fluvial form). The East Fork Hayden Creek trend transect (established in 2002) is approximately 1.5 km long and consists mainly of meadow habitat, located at (WGS84 datum) start: 44.72984°N, -113.67145°W, and end: 44.72438°N, -113.66671°W (Figure 27).

Bull Trout redd counts on East Fork Hayden Creek in 2014 were conducted September 16 and 23. All redds in progress or completed redds were counted during the first survey and flagged. On the second survey, additional completed redds were counted and included with the number of flagged redds to provide a total number of redds.

Weir Locations

Steelhead Weirs in Salmon River Tributaries

Steelhead weirs were operated in the spring of 2014 on Carmen, Tower, and Fourth of July Creeks (Figure 28). See Belnap et al. *in press* for more details about Steelhead weir operations. The Carmen Creek weir is located on private property (WGS84 datum: 45.24634°N, -113.89253°W) approximately 0.74 km above the mouth of Carmen Creek. The Tower Creek weir is located under the Highway 93 N bridge on Tower Creek (WGS84 datum: 45.32062°N, -113.90343°W) approximately 0.45 km above the mouth of Tower Creek. The Fourth of July Creek weir is located under the Highway 93 N bridge on Fourth of July Creek (WGS84 datum: 45.36871°N, -113.94316°W) approximately 30 m above the mouth of Fourth of July Creek.

The Steelhead weir on Carmen Creek was operated from March 20 to May 17 in 2014, the weir on Tower Creek was operated from March 21 to May 18, 2014, and the weir on Fourth of July Creek was operated from March 21 to May 18, 2014. Weirs were run uninterrupted during the trapping periods in 2014.

The temporary picket weirs used for capturing Steelhead in upper Salmon River tributaries are not effective at estimating resident fish spawning escapement due to timing of weir operation and picket spacing that targets larger fish. However, the weirs were effective at capturing larger resident and fluvial trout during operational periods, which allowed us to determine the onset of trout spawning migration in these tributaries, as well as deploy PIT tags to examine further movement throughout the upper Salmon River basin.

Upper Hayden Creek and Bear Valley Creek Bull Trout Weirs

The upper Hayden Creek Bull Trout weir was located at a camping pullout on National Forest Land at 44.758920°N, -113.713258°W, and the Bear Valley Creek Bull Trout weir was located along the Bear Valley Creek road at 44.771662°N, -113.721696°W (Figure 29). Weir locations were chosen for upper Hayden Creek and Bear Valley Creek based on channel morphology and ease of access. The weirs were deployed on September 10, and operated until October 6 at both locations. Weirs were operated strictly as downstream weirs in 2014, to capture post-spawn Bull Trout on their outmigration. Weirs were checked and cleaned daily while in operation. Captured fish were anaesthetized in MS-222, weighed (g) and measured (FL mm), and scanned for PIT tags; fish that did not already have a PIT tag were implanted with one before release. All 12mm PIT tags were injected in the dorsal sinus and the fish were scanned before release to confirm the tag ID. A tissue sample for genetic analysis was also obtained from a subsample of fish from upper Hayden Creek and Bear Valley Creek.

RESULTS AND DISCUSSION

Rainbow Trout Redd Count Monitoring

Big Springs Creek and Lemhi River

Fisheries staff observed 465 Rainbow Trout redds in Big Springs Creek and 93 Rainbow Trout redds in the upper Lemhi River in 2014, for a total of 558 redds (Table 1; Figure 30). On Big Springs Creek, 185 redds were counted in the historic Neibaur Ranch transect while 280 redds were observed in the Tyler Ranch transect (Table 14). The total number of redds counted in the Lemhi River and Big Springs Creek has fluctuated annually over the last several decades but appears to be showing an overall increasing trend in the last three years (Figure 30). The total number of redds counted in all three transects in 2014 was the highest count on record. Numerous habitat improvement projects, tributary reconnections, and changes in land-use practices over the last several decades in the upper Lemhi River focused on improving overall conditions for both anadromous and resident fish in the basin. An overall increasing trend in the number of Rainbow Trout redds observed in the three trend counts suggests a realized benefit to the resident Rainbow Trout population in the Lemhi River from those restoration and conservation activities. Further investigation and monitoring is warranted, and these transects will continue to be monitored annually.

Bull Trout Redd Count Monitoring

Alpine Creek

In the upper Alpine Creek trend transect, we counted four Bull Trout redds in 2014 (Table 15, Figure 31). Prior to 2013, no Bull Trout redds or live fish had been observed in the upper trend area in five years. Only one redd was counted in the upper transect in 2013. The four redds counted in 2014 represented the highest count in that transect since 2007. In the lower trend transect (established in 2010), no Bull Trout redds were observed in 2014. Not more than two Bull Trout redds have been observed in that reach since the transect was established (Figure 31).

The cause for low numbers of Bull Trout redds observed in Alpine Creek in the last seven years is unknown. From 2000 to 2007, an average of 14.4 redds per year ($\pm$ 1.8) were observed in the upper trend transect. The fact that we have not observed more than four redds in a given year in Alpine Creek since 2007 leads us to believe we are either missing spawning activity (geographically or temporally) or spawning escapement has been greatly reduced by factors that are currently unknown. Further investigation is warranted to determine the cause of reduced redd numbers in Alpine Creek over the last seven years.

Fishhook Creek

Six Bull Trout redds were observed in the upper trend transect in Fishhook Creek in 2014, and eight redds were counted in the lower transect (Table 15, Figure 32). Although this year's counts were among the lowest observed during 17 years of sampling, Bull Trout redd numbers in Fishhook Creek have remained relatively consistent over the years, indicating a stable population.

Fourth of July Creek

Staff counted 85 completed Bull Trout redds in the Fourth of July Creek trend transect in 2014; nearly double the previous ten years average (45.2 $\pm$ 4.8) (Table 15). With 12 years of Bull Trout redd survey data collected in Fourth of July Creek, a pattern seems to suggest the presence of several relatively weak age classes of spawners, every five years (Figure 33). 2003 was a low count year, followed by four higher count years in 2004 to 2007, another low count year in 2008, four more higher count years from 2009 to 2012, and in 2013 we saw another low year, with only 21 redds observed. Consistent with this pattern, 2014 was a high count year. Redd count surveys over the next 10 years may help us better understand this trend.

Bear Valley Creek

Regional fisheries staff counted 66 Bull Trout redds in the older Bear Valley Creek trend transect in 2014 (Table 16). The trend of Bull Trout redds counted in this transect has been generally stable for the 13 sample periods since monitoring began in 2002 (Figure 34). The 2014 count is the highest count on record in this transect. In the newer trend transect, 134 Bull Trout redds were counted in 2014, also the highest on record (Table 16). The total number of redds observed upstream in the new trend transect has varied from a low of 21 to a new high of 134 during nine survey years (Figure 34). In general, the Bull Trout population appears to be stable in Bear Valley Creek. Redd count surveys will be conducted annually on both trend transects to continue monitoring trends in spawner abundance.

East Fork Hayden Creek

A total of 23 resident Bull Trout redds were observed in the East Fork Hayden Creek trend transect in 2014 (Table 16, Figure 35). The Bull Trout redd count this year was nearly half the previous 10-year average of 45.3 redds (± 3.6). The survey crew conducted two count days this year instead of one count conducted annually in 2011 and 2012. Fisheries staff noted a total of 40 live resident Bull Trout observed during this year’s redd count surveys.

Hayden Creek

Twenty-nine Bull Trout redds were counted in the upper Hayden Creek trend site in 2014 (Table 16, Figure 36). The 2014 count was double the number of redds counted in 2013 (n=14), but was still below the long-term average (*n*=44). In 2013, fisheries staff did not observe any fluvial-size Bull Trout in the Hayden Creek transect, but two fluvial fish were observed in 2014.

Resident Fish Capture at Weirs

Salmon River Tributaries Steelhead Weirs

Two Rainbow Trout were captured and PIT tagged at Salmon River tributary weirs in 2014. Both Rainbow Trout caught in 2014 were captured at the Carmen Creek weir. By comparison, the Carmen Creek weir caught one fluvial Rainbow Trout in 2010 and one in 2009, and the Tower Creek weir caught one fluvial Rainbow Trout in 2010 (Table 17). Both Rainbow Trout caught at Carmen in 2014 were males, measuring 285 mm and 325 mm TL.

More than likely, true spawner abundance in these tributaries is higher than the observed numbers of fish we have captured during three years of Steelhead trapping. Picket spacing on the weirs likely allows smaller resident fish to pass through during trapping periods, and forced removal of the weirs due to high water in the spring (i.e. May) may result in missing later migrating fish.

Upper Hayden Creek and Bear Valley Creek Bull Trout Weirs

Twelve Bull Trout were captured at the upper Hayden Creek weir and 15 Bull Trout were captured at the Bear Valley Creek weir in September and October, 2014 (Table 18). Bull Trout captured at the upper Hayden Creek weir measured between 270mm - 588mm FL (mean $\pm$ 1SE = 411 $\pm$ 30.9). Bull Trout captured at the Bear Valley Creek weir ranged between 287mm - 630mm FL (mean $\pm$ 1SE = 506 $\pm$ 19.4). Twelve tissue samples were collected from the upper Hayden Creek Bull Trout and eleven were collected from the Bear Valley Creek fish for future genetic analysis.

Bull Trout weirs allowed us to deploy PIT tags into 15 previously untagged fish which, in addition to 86 newly tagged fish in the weirs in 2013, will enable us to monitor Bull Trout growth and movement throughout the Lemhi River and upper Salmon River basin in future years (Table 18). Although we feel we may have missed a large proportion of spawning Bull Trout in 2014, we should be able to refine our trapping period to capture the peak of migration in future years, using timing information gathered at PIT tag arrays throughout the basin. The Lemhi River Basin currently has nearly 20 PIT tag arrays operating throughout various tributaries and the main stem river (J. Diluccia, IDFG, personal communication). Data collected from those arrays will help fisheries managers better understand the seasonal movements of resident and fluvial fish in the basin. Further, annual sampling events throughout the basin will allow us to obtain interval length and weight data for individual PIT tagged fish, thereby providing annual growth information for various life stages of fish.

MANAGEMENT RECOMMENDATIONS

1. Continue monitoring trends in spawner abundance for resident trout populations in designated trend transects, as well as seek additional trend monitoring locations as opportunities are presented and/or needs arise.

2. Determine whether Bull Trout are spawning outside of currently established trend monitoring transects in Alpine Creek, to account for lost productivity.

3. Increase resident trout population monitoring in the region through the use of PIT tagging, radio tagging, and electrofishing to determine patterns of seasonal use in the main stem Salmon River and its tributaries.

Table 14. Summary of resident Rainbow Trout redds counted in the upper Lemhi River and Big Springs Creek (BSC) transects, 1994 - 2014.

Year	Big Springs Creek Neibaur Ranch	Big Springs Creek Tyler Ranch	Lemhi River Beyeler Ranch	Total
1994	--	--	--	40
1995	57	--	--	57
1996	32	--	7	39
1997	44	45	8	97
1998	93	124	18	235
1999	39	71	29	139
2000	160	123	23	306
2001	95	186	2	283
2002	360	193	3	556
2003	128	103	56	287
2004	174	45	15	234
2005	75	43	3	121
2006	63	143	9	215
2007	163	62	8	233
2008	82	108	9	199
2009	100	54	10	164
2010	132	57	18	207
2011	103	49	20	172
2012	130	224	14	368
2013	159	122	49	330
2014	185	280	93	558

Table 15. Bull trout redds counted in tributaries of the upper Salmon River in the Sawtooth National Recreation Area, 1998 - 2014.

Stream	Year	Older transect redds	Newer transect redds	Total redds
Alpine Creek	1998	1	--	1
	1999	3	--	3
	2000	9	--	9
	2001	15	--	15
	2002	14	--	14
	2003	14	--	14
	2004	9	--	9
	2005	13	--	13
	2006	13	--	13
	2007	18	--	18
	2008	0	--	0
	2009	0	--	0
	2010	0	1	1
	2011	0	2	2
	2012	0	0	0
	2013	1	2	3
	2014	4	0	4
Fishhook Creek	1998	11	--	11
	1999	15	--	15
	2000	18	--	18
	2001	26	--	26
	2002	17	--	17
	2003	17	--	17
	2004	11	--	11
	2005	23	--	23
	2006	25	--	25
	2007	22	--	22
	2008	13	14	27
	2009	21	12	33
	2010	17	10	27
	2011	11	7	18
	2012	21	9	30
	2013	15	13	28
	2014	6	8	14
Fourth of July Creek	2003	16	--	16
	2004	33	--	33
	2005	41	--	41
	2006	71	--	71
	2007	49	--	49

Stream	Year	Older transect redds	Newer transect redds	Total redds
Fourth of July Creek	2008	26	--	26
	2009	50	--	50
	2010	56	--	56
	2011	51	--	51
	2012	54	--	54
	2013	21	--	21
	2014	85	--	85

Table 16. Bull trout redds counted in the Hayden Creek drainage in the Lemhi River basin, 2002 - 2014.

Stream	Year	Older transect redds	Newer transect redds	Total redds
Bear Valley Creek	2002	26	--	26
	2003	42	--	42
	2004	44	--	44
	2005	34	--	34
	2006	26	60	86
	2007	25	115	140
	2008	27	21	48
	2009	42	24	66
	2010	37	22	59
	2011	36	103	139
	2012	33	91	124
	2013	41	78	119
	2014	66	134	200
East Fork Hayden Creek	2002	33	--	33
	2003	25	--	25
	2004	26	--	26
	2005	41	--	41
	2006	49	--	49
	2007	52	--	52
	2008	61	--	61
	2009	54	--	54
	2010	55	--	55
	2011	32	--	32
	2012	49	--	49
	2013	34	--	34
	2014	23	--	23
Hayden Creek	2005	22	--	22
	2006	74	--	74
	2007	115	--	115
	2008	28	--	28
	2009	22	--	22
	2010	--	29	29
	2011	--	49	49
	2012	--	39	39
	2013	--	14	14
	2014	--	29	29

Table 17. Number of Rainbow Trout caught at Salmon River tributary weirs in 2009, 2010, and 2014.

Operation Year	Carmen Weir		Tower Weir		4th of July Weir	
	Male	Female	Male	Female	Male	Female
2009	1	0	0	0	0	0
2010	1	0	1	0	0	0
2014	2	0	0	0	0	0

Table 18. Bull Trout captured in Bear Valley and Hayden Creek weirs in the fall, 2014.

Stream	TL (mm)	Wt (g)	PIT tag deployed	Recaptured PIT tag
Bear Valley Creek	502	1215	3D9.1C2D57A86E	
	478	916	3D9.1C2D57D916	
	630	2329	3D9.1C2D57EBA1	
	550	1445	3D9.1C2D56DA4C	
	535	1490		3D9.1C2D576962
	513	1200		3D9.1C2D56FC93
	539	1398	3D9.1C2D57697A	
	500	1150		3D9.1C2D58EE6F
	485	1136		3D9.1C2D57ECDE
	508	1108	3D9.1C2D5769C6	
	590	1762		3D9.1C2D57A624
	287	212	3D9.1C2D57E158	
	520	1118		3D9.1C2D588BC4
	451	862		3D9.1C2D57AE4B
	503	994		3D9.1C2D592807
Upper Hayden Creek				
	426	674	3D9.1C2D57D80E	
	355	367		3D9.1C2D587450
	474	757	3D9.1C2D5704C8	
	395	523	3D9.1C2D57E85A	
	350	363	3D9.1C2D5707DE	
	330	312	mortality	
	325	356		3D9.1C2D587E7B
	588	1735	3D9.1C2D58E874	
	535	1363	3D9.1C2D57D547	
	570	1664	3D9.1C2D57E0EF	
	270	147	3D9.1C2D56DA68	
	317	274		3D9.1C2D56D2A5

Figure 23. Rainbow Trout redd count trend transect boundaries for Big Springs Creek and Lemhi River, near Leadore, Idaho.

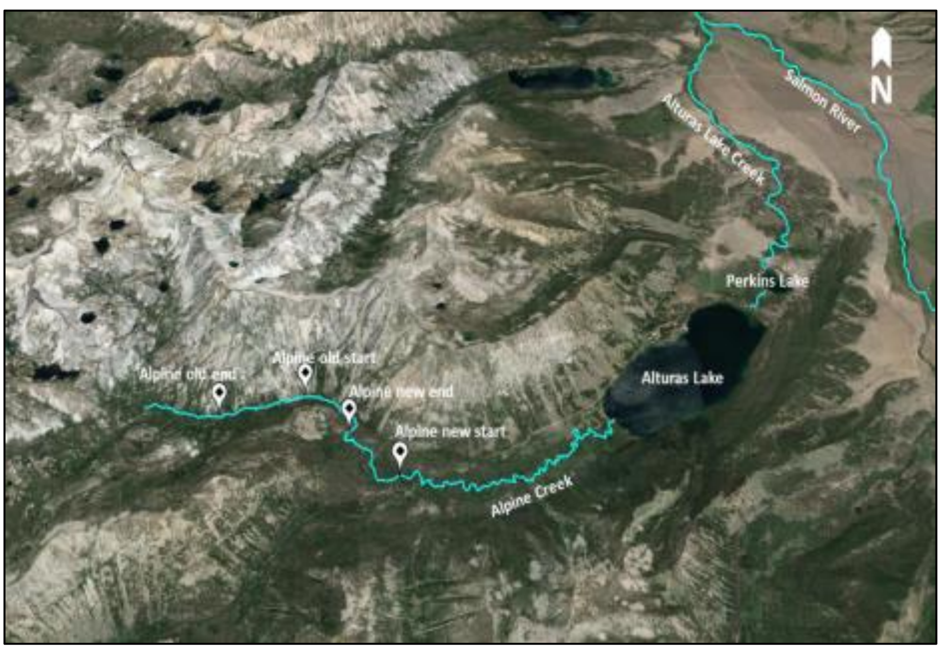

Figure 24. Bull Trout redd count trend transect boundaries for Alpine Creek, near Stanley, Idaho.

Figure 25. Bull Trout redd count trend transect boundaries for Fishhook Creek, near Stanley, Idaho.

Figure 26. Bull Trout redd count trend transect boundaries for Fourth of July Creek, near Stanley, Idaho.

Figure 27. Bull Trout redd count trend transect boundaries in Bear Valley, Hayden, and East Fork Hayden Creeks, near Tendoy, Idaho.

Figure 28. Approximate locations of three Steelhead weirs operated on Salmon River tributaries in the spring of 2014.

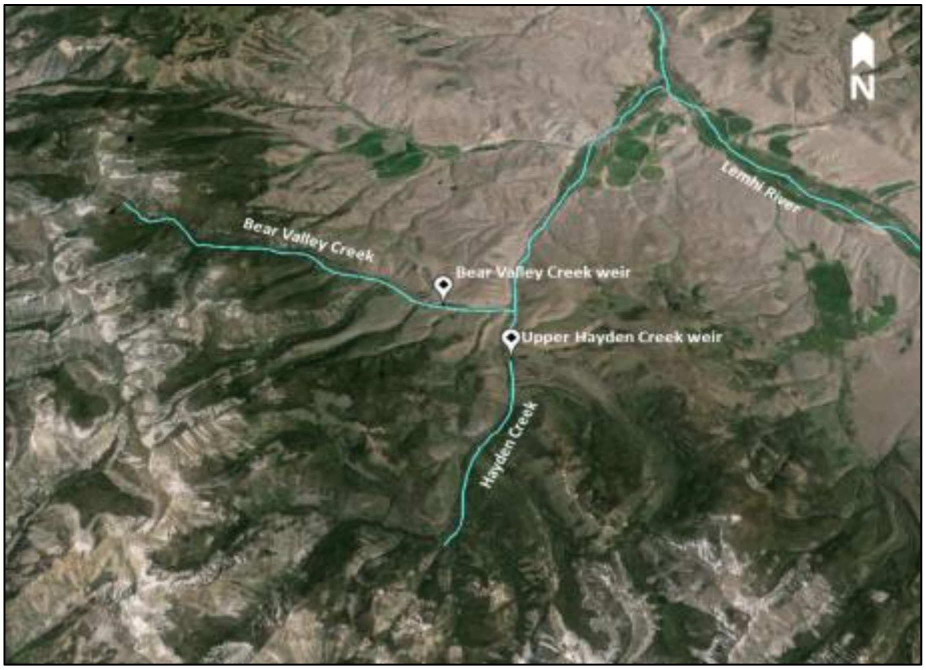

Figure 29. Approximate locations of Bull Trout weirs operated in the Hayden Creek drainage in the fall, 2014.

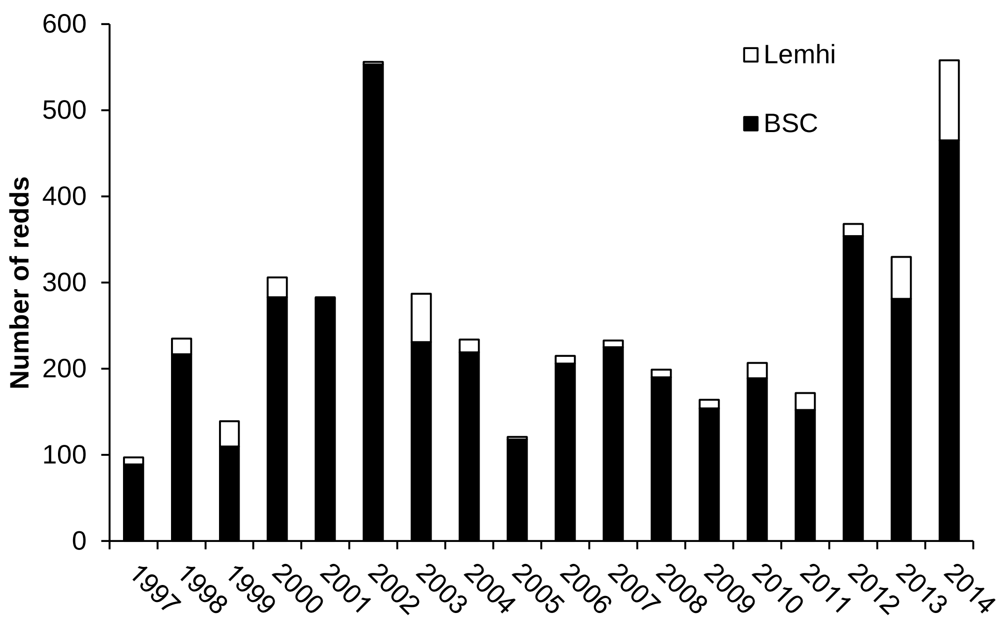

Figure 30. Resident Rainbow Trout redds counted during ground surveys in the upper Lemhi River (Beyeler Ranch) and Big Springs Creek (BSC) (Neibaur and Tyler ranches), 1997 - 2014.

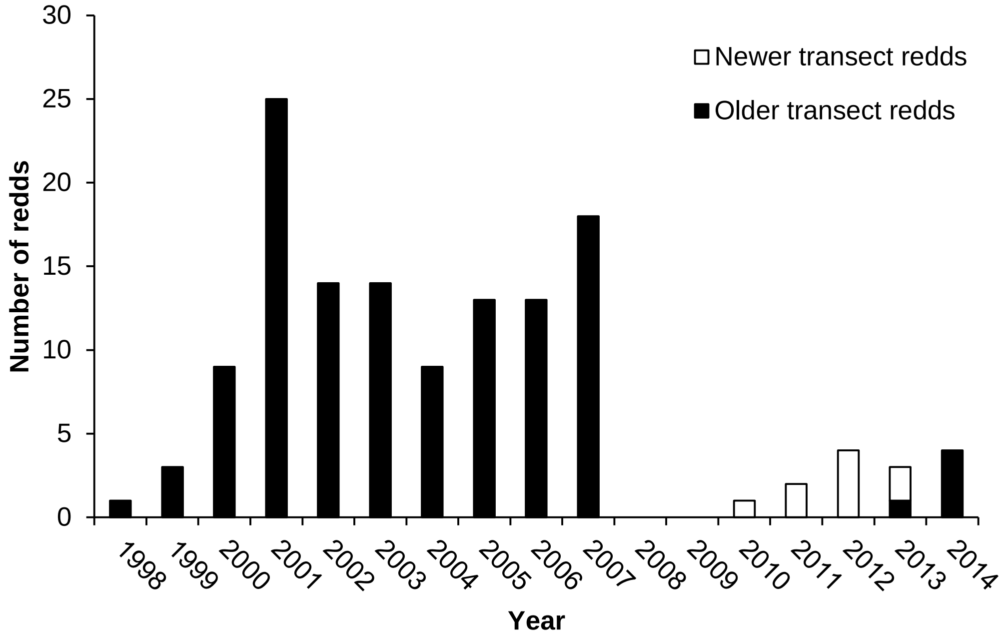

Figure 31. Number of Bull Trout redds counted in both survey transects on Alpine Creek, 1998 - 2014.

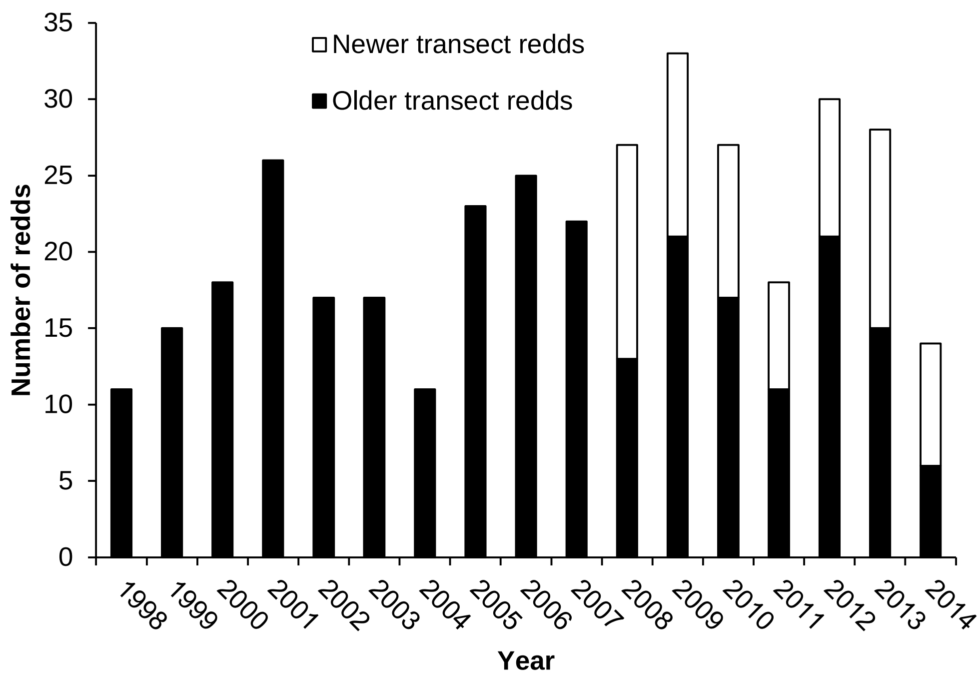

Figure 32. Number of Bull Trout redds counted in both transects on Fishhook Creek, 1998 - 2014.

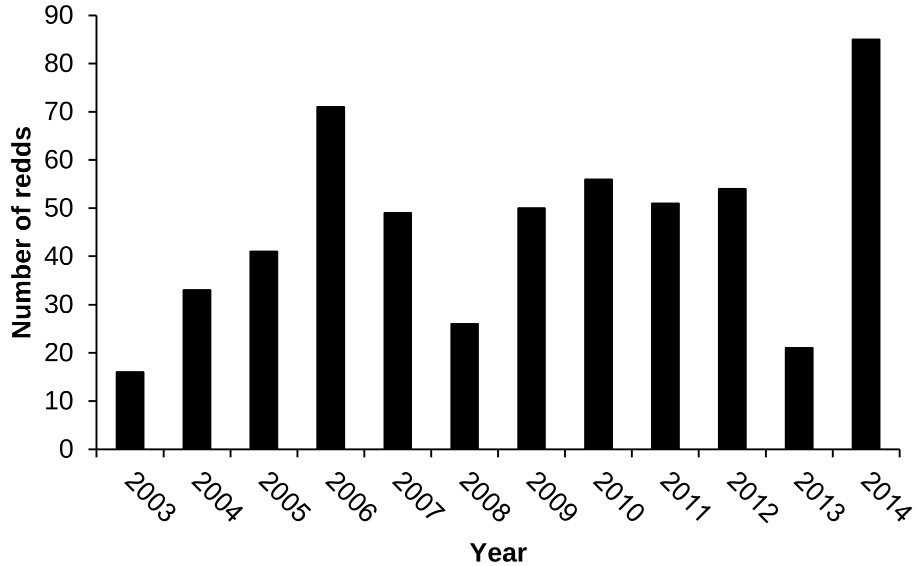

Figure 33. Number of Bull Trout redds counted on Fourth of July Creek, 2003 - 2014.

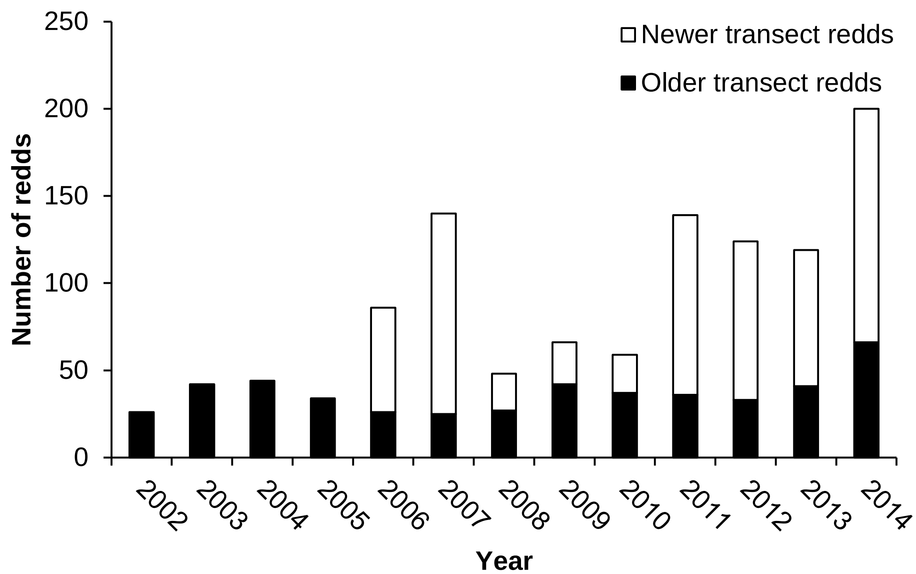

Figure 34. Number of Bull Trout redds observed in Bear Valley Creek transects, 2002 - 2014.

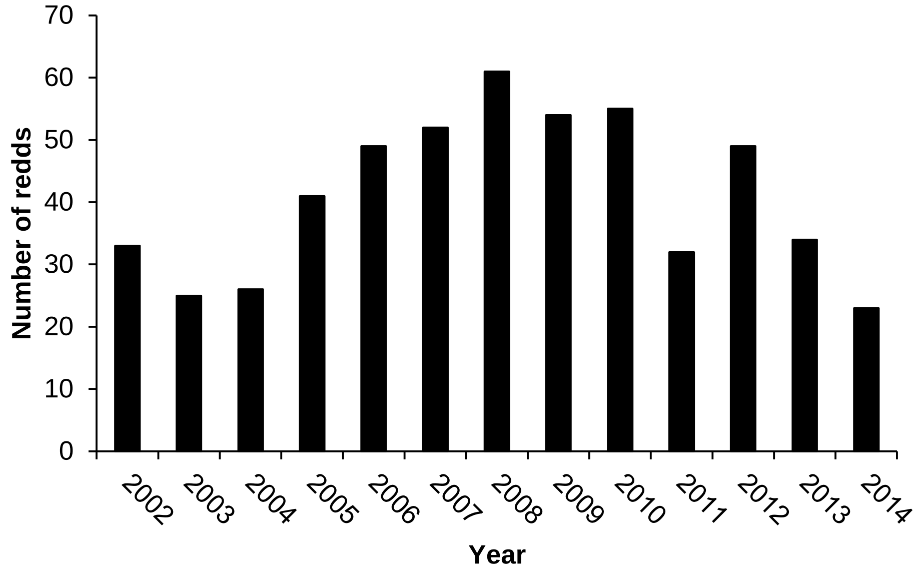

Figure 35. Number of Bull Trout redds observed in East Fork Hayden Creek, 2002 - 2014.

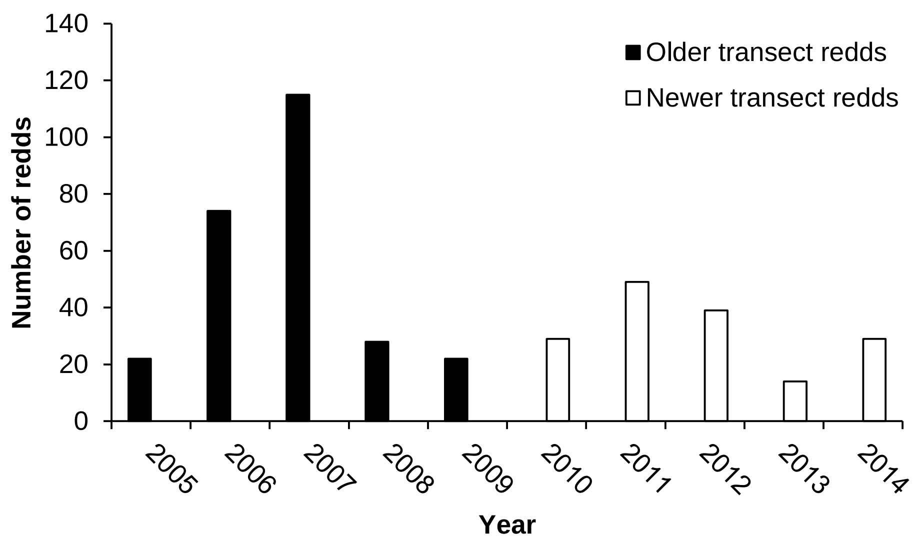

Figure 36. Number of Bull Trout redds observed in Hayden Creek, 2005 - 2014.

RIVERS AND STREAMS

MIDDLE FORK SALMON RIVER TREND MONITORING AND THERMAL REFUGIA STUDY

ABSTRACT

In July, 2014, fisheries staff floated the Middle Fork Salmon River wilderness corridor (~100 miles) for 8 days, snorkeling trend sites and collecting angling data to add to extensive trend monitoring datasets.

We snorkeled 39 trend monitoring transects in 2014 to determine fish species composition, size, abundance, and density. Thirty-two main stem Middle Fork Salmon River (MFSR) transects and seven tributary transects were snorkeled. For main stem transects surveyed in 2014 (n=32) (traditional and historical combined), Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* had an overall mean density of 1.3 fish/100 m^2 ($\pm$ 0.2), Rainbow Trout/Steelhead *O. mykiss* mean density was 0.9 fish/100 m^2 ($\pm$ 0.4), and juvenile Chinook Salmon *O. tshawytscha* mean density was 0.9 fish/100 m^2 ($\pm$ 0.4). In tributary transects surveyed in 2014 (n=7), Westslope Cutthroat Trout had an overall mean density of 2.0 fish/100 m^2 ($\pm$ 0.6), Rainbow Trout/Steelhead mean density was 1.5 fish/100 m^2 ($\pm$ 0.4), and juvenile Chinook Salmon mean density was 1.1 fish/100 m^2 ($\pm$ 0.6).

In 2014, 15% (n = 57) of the 378 Cutthroat observed during main stem snorkel surveys were greater than 300 mm TL, compared to 13% in 1971 (prior to catch-and-release regulations implemented in 1972). Thirty-three percent (n=55) of Cutthroat caught during angling surveys in 2014 were greater than 300 mm TL, compared to 20% in 1972. Average angler catch rate during surveys has remained relatively stable over the last seven years (2.8 to 5.8 fish/hr) and was 3.3 fish/hr in 2014. Cutthroat Trout accounted for 51% of the total angler catch and Rainbow Trout/Steelhead accounted for 42% in 2014.

Fisheries staff installed temperature data loggers in and near selected tributaries of the MFSR drainage in 2013 to monitor annual thermal variation between the main stem MFSR and tributary plumes. In 2014, staff attempted to recover the eight temperature loggers that were deployed, but were unable to recover three.

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INTRODUCTION

The earliest Middle Fork Salmon River (MFSR) fishery study, conducted in 1959 and 1960, evaluated the life history and seasonal movements of Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* (Mallet 1960, 1961). In the early 1970's, IDFG initiated studies to monitor MFSR Westslope Cutthroat Trout abundance and to evaluate recently imposed catch-and-release regulations on the main stem MFSR established by the IDFG Commission in 1972. For a summary of fisheries investigation on the Middle Fork Salmon River, see Mallet (2013).

A 1971 study established snorkeling transects to be surveyed periodically in the MFSR drainage for monitoring fish population trends (Corley 1972; Jeppson and Ball 1977, 1979). In Corley (1972), these transects are described as main stem historical (Corley) transects (*n* = 6). In 1981, additional main stem transects were established in order to monitor Steelhead *O. mykiss* populations on the MFSR (Thurow 1982, 1983, 1985). In 1985, IDFG added additional snorkel sites to enumerate Cutthroat Trout and Chinook Salmon *O. tshawytscha* abundance, and began estimating densities in MFSR and tributary trend transects (Reingold and Davis 1987, 1988; Lukens and Davis 1989; Davis et al. 1992; Schrader and Lukens 1992; Liter and Lukens 1994). The snorkel sites established since 1981 are known in this report as traditional main stem (*n* = 28) or traditional tributary (*n* = 10) transects. The Salmon Region has been snorkeling trend sites since 1971 and has been periodically monitoring trends in fish species composition and size structure caught during angling surveys in the MFSR since 1959. In 2008 we began recording effort (angling hours) to monitor angler catch rates during those surveys. The entire Middle Fork Salmon River drainage (with the exception of alpine lakes) is currently under catch-and-release regulations for trout.

In 2012 and 2013, regional staff initiated a study to assess the importance of cold water input as thermal refugia for fish in the Middle Fork Salmon River (Messner et al. *in press*). In 2013, regional staff deployed two to three temperature data loggers at each of three different tributary mouths in order to monitor annual thermal variation between tributary plumes and the MFSR. In 2014, we attempted to recover those temperature loggers and upload the data.

OBJECTIVES

1. Monitor Rainbow Trout/Steelhead, juvenile Chinook Salmon, and Westslope Cutthroat Trout densities within the MFSR and its tributaries to evaluate long-term trends in population status.

2. Monitor angling catch rates, particularly for Westslope Cutthroat Trout, to evaluate long-term trends in the quality of fishing along the wilderness corridor.

3. Collect baseline genetics information for all fish species (game and non-game) in the MFSR.

4. Collect otoliths from Westslope Cutthroat Trout in the MFSR main stem to evaluate age and growth of the population and compare to data collected prior to catch-and-release regulations.

5. Collect temperature data at selected tributary confluences to monitor annual thermal variation between the main stem MFSR and tributary plumes along an elevational gradient.

STUDY AREA AND METHODS

The Middle Fork Salmon River (MFSR) (Figure 37) is part of the Wild and Scenic Rivers System and flows through the Frank Church River of No Return Wilderness in central Idaho. The MFSR originates at the confluence of Bear Valley and Marsh creeks near Cape Horn Mountain. It flows 171 km to its confluence with the Salmon River, 92 km downstream from Salmon, Idaho. The MFSR is a major recreational river offering a wide variety of outdoor and back-country experiences. The number of people floating the river annually has increased substantially in the past 50 years, from 625 in 1962 to 10,601 in 2014. The U.S. Forest Service estimated total user days during the 2014 permit season on the MFSR (May 28-Sept. 3) to be 58,537 days (USFS website).

Snorkeling Transects

Transects in the main stem were snorkeled using techniques described by Thurow (1982). These sites were snorkeled using the 'corridor' method, where two snorkelers floated downstream with the current on opposite sides of the river for the length of each transect. Snorkelers remained as motionless as possible and drifted with the current. The area surveyed was estimated by multiplying the length snorkeled by the visible corridor (i.e. visibility times two). Visibility was measured at each site by suspending a sighting object in the water column and allowing the snorkeler to drift downriver until the object was unidentifiable. The snorkeler then moved upriver until the object reappeared clearly. The measured distance (m) between the object and the observer's facemask was the visibility.

Historical transects on the main stem MFSR were established prior to 1985 while traditional transects have only been snorkeled since 1985. Five of six MFSR historical (Corley) transects, 27 of 28 traditional main stem transects, and seven of 10 traditional tributary transects were snorkeled in 2014. Physical information on snorkel sites surveyed in 2014 is located in Appendices B, C, and D.

Angling Surveys

Project anglers used conventional fly-fishing and spin cast gear to sample fish on 152.5 km of the main stem MFSR from Boundary Creek to the confluence with the Salmon River. Anglers documented the exact amount of time fished, gear type used, and size and species of their catch. Fish were identified and measured to the nearest 10 mm TL. Three to five Westslope Cutthroat Trout from each 10 mm size class were sacrificed for otolith extraction and genetic samples were taken from all Mountain Whitefish and Bull Trout in 2014 before release. Catch-per-unit-effort (fish per hour) was assessed for each angler and as a group. Otoliths were cleaned, dried, and stored for later analysis.

Tributary Temperature Surveys

As part of a recent study initiated in 2012 (see Messner et al., *in press*), Tidbit temperature data loggers (Onset Computer Corporation, Bourne, MA) were deployed in 2013 at three tributaries of the MFSR to monitor annual thermal variation between the main stem MFSR and tributary plumes. One tributary from each of three strata (upper, middle, and lower) were chosen for monitoring; Elkhorn Creek (upper), Little Loon Creek (middle), and Goat Creek (lower). Data loggers were encased in PVC capsules and fastened to embedded boulders or bedrock using epoxy (Isaak et al. 2013). Data loggers were fixed approximately 10 m below and 25 m above each tributary, in the main stem river, and approximately 10 m up the tributaries in Little Loon and Goat Creeks. GPS coordinates and site photos were recorded to aid in retrieval of the units. Regional staff visited these sites in 2014 in order to recover the data loggers and upload the data.

RESULTS AND DISCUSSION

<u>Snorkeling Transects</u>

From July 16 to 23, IDFG personnel snorkeled 27 of 28 traditional main stem transects, five of six historical main stem (Corley) transects, and seven of 10 traditional tributary transects. Average densities for Cutthroat Trout, Rainbow Trout, and Chinook Salmon parr in traditional main stem MFSR transects were 1.4 fish/100 m^2 ($\pm$ 0.2), 1.0 fish/100 m^2 ($\pm$ 0.5), and 1.1 fish/100 m^2 ($\pm$ 0.4), respectively (Table 19). Average Bull Trout densities were 0.03 fish/100 m^2 ($\pm$ 0.02) and average Mountain Whitefish density was 1.1 fish/100 m^2 ($\pm$ 0.2) in traditional main stem transects (Table 19). No Brook Trout *Salvelinus fontinalis* were observed in traditional main stem transects in 2014. Average fish densities at the five historical main stem (Corley) sites snorkeled in 2014 were 1.2 fish/100 m^2 ($\pm$0.6) for Cutthroat Trout, 0.1 fish/100 m^2 ($\pm$0.0) for Rainbow Trout/Steelhead, 0.01 fish/100 m^2 ($\pm$ 0.0) for Brook Trout, and 0.6 fish/100 m^2 ($\pm$ 0.2) for Mountain Whitefish in 2014 (Table 19). No Bull Trout or Chinook Salmon parr were observed at the Corley sites in 2014. Average densities for all 32 main stem transects combined were 1.33 Cutthroat Trout/100 m^2, 1.04 Whitefish/100 m^2, 0.91 Chinook Salmon/100 m^2, 0.86 Rainbow Trout/Steelhead/100 m^2, 0.02 Bull Trout/100 m^2, and <0.01 Brook Trout/100 m^2. Trends in average densities for Cutthroat, Rainbow/Steelhead, Chinook Salmon parr, and Mountain Whitefish across all main stem sites (historical and traditional, combined) over the last seven years have tracked very similarly (Figure 38). The apparent link in population trends for all four species (resident and anadromous, alike) over several years suggests any changes in population abundance are likely influenced by environmental factors or other unknown factors that affect fish populations within a large geographical area (High et al. 2008).

In the seven traditional tributary transects we snorkeled in 2014, fish densities averaged 2.0 fish/100 m^2 ($\pm$0.6) for Westslope Cutthroat Trout, 1.5 fish/100 m^2 ($\pm$0.4) for Rainbow Trout/Steelhead, 1.1 fish/100 m^2 ($\pm$0.6) for Chinook Salmon parr, 0.1 fish/100 m^2 ($\pm$0.6) for Bull Trout, and 2.1 fish/100 m^2 ($\pm$0.6) for Mountain Whitefish (Table 19). No Brook Trout were observed in traditional tributary transects in 2014.

Prior to catch-and-release regulations, in 1971, the percent of Cutthroat greater than 300 mm TL observed during snorkel surveys was 13%. Since the implementation of catch-and-release regulations in 1972, the percentage of Westslope Cutthroat Trout <300 mm TL observed by snorkelers has ranged from 13% to 60%. In 2014, 15% (n = 57) of the 378 Cutthroat observed were greater than 300 mm TL in main stem MFSR transects (Figure 39).

Snorkeling transects in the main stem MFSR were established in 1971 and 1981 (Corley 1972; Thurow 1982) and likely represent one of the longest term trend data sets on Westslope

Cutthroat Trout. However, little has been done to evaluate what transects provide accurate trends in mimicking population abundance (High et al. 2008). Also, some transects are difficult and dangerous to snorkel during flow conditions over 2.5 feet on the Middle Fork Lodge gage. Survey counts conducted during high flows may represent inherent snorkeler bias since a snorkeler may not be able to accurately observe fish when challenged by difficult currents.

Angling Surveys

IDFG anglers caught 327 fish from the main stem MFSR during 2014 angling surveys (Table 20). Westslope Cutthroat Trout accounted for 51% (n = 167) of all salmonids caught, while Rainbow Trout/Steelhead accounted for another 42% (n = 137) (Table 21). Mountain Whitefish, Northern Pikeminnow *Ptychochelius oregonensis*, Suckers (various spp), Redside Shiner *Richardsonius balteatus*, Bull Trout, and hybrids accounted for the balance (7%) (Table 21). The proportion of each species caught during angling surveys was very similar in 2013 and 2014 (Figure 40). Likewise angler catch rates have been fairly consistent over the last several years (Table 20).

Prior to catch-and-release regulations going into effect in 1972, approximately 20% of the Westslope Cutthroat Trout caught by project anglers were over 300 mm TL. Since the regulation change, this proportion has fluctuated yearly, ranging from 26% to 53% (Figure 41). In 2014, the proportion of Westslope Cutthroat Trout larger than 300 mm TL caught by project anglers was 33% (n = 55). Recent annual fluctuation of this value could be attributed to a difference in angler skill level, gear type, sample timing, flow, and water clarity. However, this value has remained relatively stable since 2010 (Figure 41).

During angling on the main stem MFSR, genetic samples were taken from five Mountain Whitefish, two Bull Trout, four Northern Pikeminnow, three Largescale Suckers, two Redside Shiners, and three Western Toad larvae *Bufo boreas* (collected by hand from Hospital Bar hot springs) (Table 22). Otoliths were also extracted from 36 Westslope Cutthroat Trout for later analysis (Table 23). DNA and otolith samples were archived in the Regional office for analysis as funds become available.

Tributary Temperature Surveys

We attempted to relocate and retrieve data from eight temperature loggers, deployed in July 2013, during July 2014. We had a variety of issues with the collection of data (Table 24). Three of the data loggers could not be located in 2014. Epoxy from where the canisters had been located was evident at two sites. Deposition may have buried another, although attempts were made to dig down to the level of deployment and the canister was not located. One canister fell off in our hands while trying to open it. The data loggers and canisters were present at five sites and we used an Onset Shuttle to remotely download the data and redeploy four of the data loggers. However, when we attempted to upload the data back in the office the records had not been transferred onto the shuttle in the field.

In future attempts to deploy or retrieve the data the deployment of the canisters using the epoxy method should be tested in a location that can be revisited during different seasons to check on their status. The downloading of the data using the Onset Remote Shuttle should also be tested. In 2015, we recommend bringing all of the remaining data loggers back into the office for a hard download and to check the status of the battery life before determining if they should be redeployed.

MANAGEMENT RECOMMENDATIONS

1. Continue annual monitoring of Westslope Cutthroat Trout, Rainbow Trout/Steelhead, and juvenile Chinook Salmon in all 28 main stem sites, 10 tributary sites, and 6 historical main stem MFSR sites by snorkeling between the second week of July and the third week of August.

Table 19. Densities of salmonids (fish/100 m^2) observed during snorkel surveys in the MFSR drainage in 2014. Minimum and maximum densities of species in each snorkel site type (Corley, traditional, tributary) are shown in bold italics.

Site	Trout fry	Rainbow Trout/ Steelhead	Chinook Salmon parr	Cutthroat Trout	Bull Trout	Brook Trout	Whitefish
			Historical main stem sites (Corley)				
Mahoney	0.00	*0.21*	0.00	*3.47*	0.00	0.00	1.08
White Creek PB	0.00	0.00	0.00	0.79	0.00	*0.04*	0.41
Bernard Airstrip	0.00	0.16	0.00	0.83	0.00	0.00	*1.16*
Cliffside Pool	0.00	0.03	0.00	*0.20*	0.00	0.00	0.20
Hancock Pool	0.00	0.13	0.00	0.91	0.00	0.00	*0.13*
Mean	0.00	0.11	0.00	1.24	0.00	0.01	0.60
SE	0.00	0.04	0.00	0.57	0.00	0.01	0.22
			Traditional main stem sites				
Boundary	0.00	*11.76*	*7.48*	1.42	0.00	0.00	*4.27*
Gardell's	0.00	0.75	0.47	0.82	0.00	0.00	1.09
Velvet	0.00	4.05	2.70	3.51	0.00	0.00	0.81
Elkhorn	0.33	4.51	7.01	1.16	0.00	0.00	3.00
Sheepeater	0.35	0.93	0.00	0.35	0.00	0.00	0.58
Greyhound	0.00	0.00	0.21	0.65	0.00	0.00	0.65
Rapid R	0.00	2.09	1.44	*4.02*	*0.32*	0.00	2.73
Indian	0.00	0.42	2.03	3.22	0.07	0.00	2.38
Pungo	0.00	0.37	6.61	2.74	0.00	0.00	1.99
Marble Pool	0.00	0.54	0.06	3.33	0.00	0.00	2.06
Ski Jump	0.00	0.05	0.00	0.05	0.00	0.00	0.66
Lower Jackass	0.00	0.10	0.00	1.39	0.00	0.00	0.85
Cougar	0.00	0.00	0.00	1.38	0.27	0.00	0.83
Whitey Cox	0.00	0.00	0.00	2.70	0.00	0.00	0.51
Rock Island	0.00	0.10	0.00	0.97	0.00	0.00	*0.21*
Hospital Pool	0.00	0.00	0.00	0.00	0.00	0.00	0.34
Hospital Run	0.00	0.00	0.00	0.22	0.00	0.00	0.44
Tappan Pool	0.00	0.42	0.00	1.07	0.10	0.00	0.53
Flying B	0.00	0.00	0.00	0.69	0.00	0.00	0.69
Airstrip	0.00	0.26	0.00	1.06	0.00	0.00	0.66
Survey	0.00	0.16	0.00	1.50	0.00	0.00	1.50
Big Cr PB	0.00	0.15	0.00	1.05	0.00	0.00	1.42
Love Bar	0.00	0.00	0.00	0.83	0.00	0.00	0.50
Little Ouzel	0.00	0.00	0.00	0.31	0.00	0.00	0.47
Otter Bar	0.00	0.10	1.09	1.20	0.00	0.00	0.32
Goat Pool	0.00	0.11	0.00	0.46	0.00	0.00	0.69

Site	Trout fry	Rainbow Trout/ Steelhead	Chinook Salmon parr	Cutthroat Trout	Bull Trout	Brook Trout	Whitefish
			Traditional main stem sites (continued)				
Goat Run	0.00	0.00	0.00	0.27	0.00	0.00	0.27
Mean	0.03	1.00	1.08	1.35	0.03	0.00	1.13
SE	0.02	0.47	0.43	0.22	0.02	0.00	0.19
			Traditional tributary sites				
Camas L1	0.00	2.77	1.25	1.80	0.00	0.00	*5.41*
Indian Lower	*1.00*	1.43	0.85	0.28	0.00	0.00	0.28
Indian Upper	0.00	0.65	*4.56*	2.82	0.00	0.00	1.52
Loon L1-Bridge	0.00	0.96	0.00	*4.80*	*0.48*	0.00	3.84
Marble Lower	0.00	*0.65*	0.21	0.00	0.00	0.00	0.00
Pistol L1	0.00	0.95	0.00	3.50	0.31	0.00	3.50
Pistol L2	0.00	*3.12*	1.11	0.44	0.00	0.00	0.44
Mean	0.14	1.50	1.14	1.95	0.11	0.00	2.14
SE	0.13	0.36	0.56	0.64	0.07	0.00	0.74

Table 20. Summary of fish caught during angling surveys on the main stem MFSR, 1959 to 2014.

Year	WCT	RBT/ STHD	BUT	MWF	WCTx RBT	BUTx EBT	CHN	EBT	NPM	Sucker	RSS	Total No. of Fish	Total Hours of effort	CPUE
1959	143	112	11	0	0	0	0	0	0	0	0	266	UNK	n/a
1960	484	103	94	0	0	0	0	0	0	0	0	681	UNK	n/a
1969	166	0	0	0	0	0	0	0	0	0	0	166	UNK	n/a
1975	158	109	11	4	0	0	0	0	0	0	0	282	57.5	4.9
1976	75	14	2	2	0	0	0	0	0	0	0	93	UNK	n/a
1978	160	91	0	13	0	0	0	0	0	0	0	264	86.0	3.1
1979	139	112	0	0	0	0	0	0	0	0	0	251	UNK	n/a
1990	735	339	2	0	0	0	0	0	0	0	0	1076	UNK	n/a
1991	42	54	0	0	3	0	0	0	0	0	0	99	UNK	n/a
1992	42	53	0	1	0	0	0	0	0	2	0	98	UNK	n/a
1993	242	66	0	0	6	0	0	0	0	0	0	314	UNK	n/a
1999	182	132	0	0	8	0	0	0	0	0	0	322	UNK	n/a
2003	167	91	0	0	0	0	1	0	0	0	1	260	UNK	n/a
2004	243	184	1	0	0	0	1	0	1	0	0	430	UNK	n/a
2005	226	157	7	2	4	0	0	0	5	0	0	401	UNK	n/a
2007	264	253	2	6	1	0	0	0	16	0	0	542	UNK	n/a
2008	64	90	0	0	1	0	0	0	0	0	0	155	26.9	5.8
2009	340	230	2	4	8	0	0	1	14	0	2	601	166.0	3.6
2010	174	115	8	21	3	0	2	2	0	0	0	325	116.2	2.8
2011	109	47	0	6	0	0	0	0	0	0	0	162	42.0	3.9
2012	299	206	11	14	4	0	0	0	5	1	1	541	145.9	3.7
2013	200	195	1	6	1	1	3	0	9	0	0	416	102.0	4.1
2014	167	137	3	7	1	1	0	0	6	3	2	327	98.7	3.3

[a] Only WCT enumerated
WCT=Westslope Cutthroat Trout, RBT/STHD=Rainbow Trout/Steelhead, BUT=Bull Trout, MWF=Mountain Whitefish, CHN=Chinook Salmon, EBT=Eastern Brook Trout, NPM=Northern Pikeminnow, RSS=Redside Shiner.

Table 21. Percentage of each salmonid species represented in total catch during angling surveys on the main stem MFSR, 1959 to 2014. 1969 was omitted due to only enumerating WCT that year.

Year	WCT	RBT/STHD	BUT	EBT	MWF	CTxRBT	BUTxEBT
1959	54%	42%	4%	0%	0%	0%	0%
1960	71%	15%	14%	0%	0%	0%	0%
1975	56%	39%	4%	1%	0%	0%	0%
1976	81%	15%	2%	2%	0%	0%	0%
1978	61%	34%	0%	5%	0%	0%	0%
1979	55%	45%	0%	0%	0%	0%	0%
1990	68%	32%	0%	0%	0%	0%	0%
1991	42%	55%	0%	0%	3%	0%	0%
1992	43%	54%	0%	1%	0%	0%	0%
1993	77%	21%	0%	0%	2%	0%	0%
1999	57%	41%	0%	0%	2%	0%	0%
2003	64%	35%	0%	0%	0%	0%	0%
2004	57%	43%	0%	0%	0%	0%	0%
2005	56%	39%	2%	0%	1%	0%	0%
2007	49%	47%	0%	1%	0%	0%	0%
2008	41%	58%	0%	0%	1%	0%	0%
2009	57%	38%	0%	1%	1%	0%	0%
2010	54%	35%	2%	6%	1%	0%	1%
2011	67%	29%	0%	4%	0%	0%	0%
2012	55%	38%	2%	3%	1%	0%	0%
2013	48%	47%	0%	1%	0%	0%	1%
2014	51%	42%	1%	2%	0%	0%	0%
Mean	57%	38%	1%	1%	1%	0%	0%

WCT=Westslope Cutthroat Trout, RBT/STHD=Rainbow Trout/Steelhead, BUT=Bull Trout, MWF=Mountain Whitefish, CHN=Chinook Salmon, EBT=Eastern Brook Trout.

Table 22. Summary of genetics samples taken in the main stem MFSR in 2014.

MFSR Section	Species	TL (mm)
Gardell's Hole to Lake Creek	Mountain whitefish	292
	Mountain whitefish	318
	Bull trout	330
Lake Creek to Pungo Creek	Mountain whitefish	267
	Mountain whitefish	330
	Western toad larvae	--
	Western toad larvae	--
	Western toad larvae	--
Pungo to Pine Flat	Northern pikeminnow	381
	Large-scale sucker	483
	Mountain whitefish	305
	Bull trout	356
Pine Flat to Pool Camp	Northern pikeminnow	--
Pool Camp to Survey	Northern pikeminnow	356
	Northern pikeminnow	356
Survey to Cliffside	Large-scale sucker	406
Cliffside to Confluence take-out	Large-scale sucker	406
	Redside shiner	195
	Redside shiner	203

Table 23. Summary of otoliths collected from Westslope Cutthroat Trout (WCT) in the main stem MFSR, 2014.

Species	Length group (mm TL)	# otolith pairs taken
WCT	180-189	3
WCT	190-199	0
WCT	200-209	4
WCT	210-219	0
WCT	220-229	3
WCT	230-239	1
WCT	240-249	2
WCT	250-259	1
WCT	260-269	1
WCT	270-279	4
WCT	280-289	1
WCT	290-299	1
WCT	300-309	2
WCT	310-319	1
WCT	320-329	2
WCT	330-339	3
WCT	340-349	0
WCT	350-359	4
WCT	360-369	1
WCT	370-379	1
WCT	380-389	0
WCT	390-399	0
WCT	400-409	0
WCT	410-419	0
WCTxRBT	420-429	1
Total		36

Table 24. Status of temperature data loggers, deployed in 2013, when retrieved in 2014.

Location	Site	Status	Data
Elkhorn Creek	Upstream	Present- remote download	Failed to download in field
Elkhorn Creek	Downstream	Could not relocate- possibly buried under deposition	
Little Loon Creek	Upstream	Present- remote download	Failed to download in field
Little Loon Creek	Downstream	Canister missing- evidence of scar on rock	
Little Loon Creek	Tributary	Canister fell off in hand, Data logger brought back to office	Data saved on S drive: S:\Fishery\MFSR\2014
Goat Creek	Upstream	Canister missing-evidence of scar on rock	
Goat Creek	Downstream	Present-remote download	Failed to download in field
Goat Creek	Tributary	Present- remote download	Failed to download in field

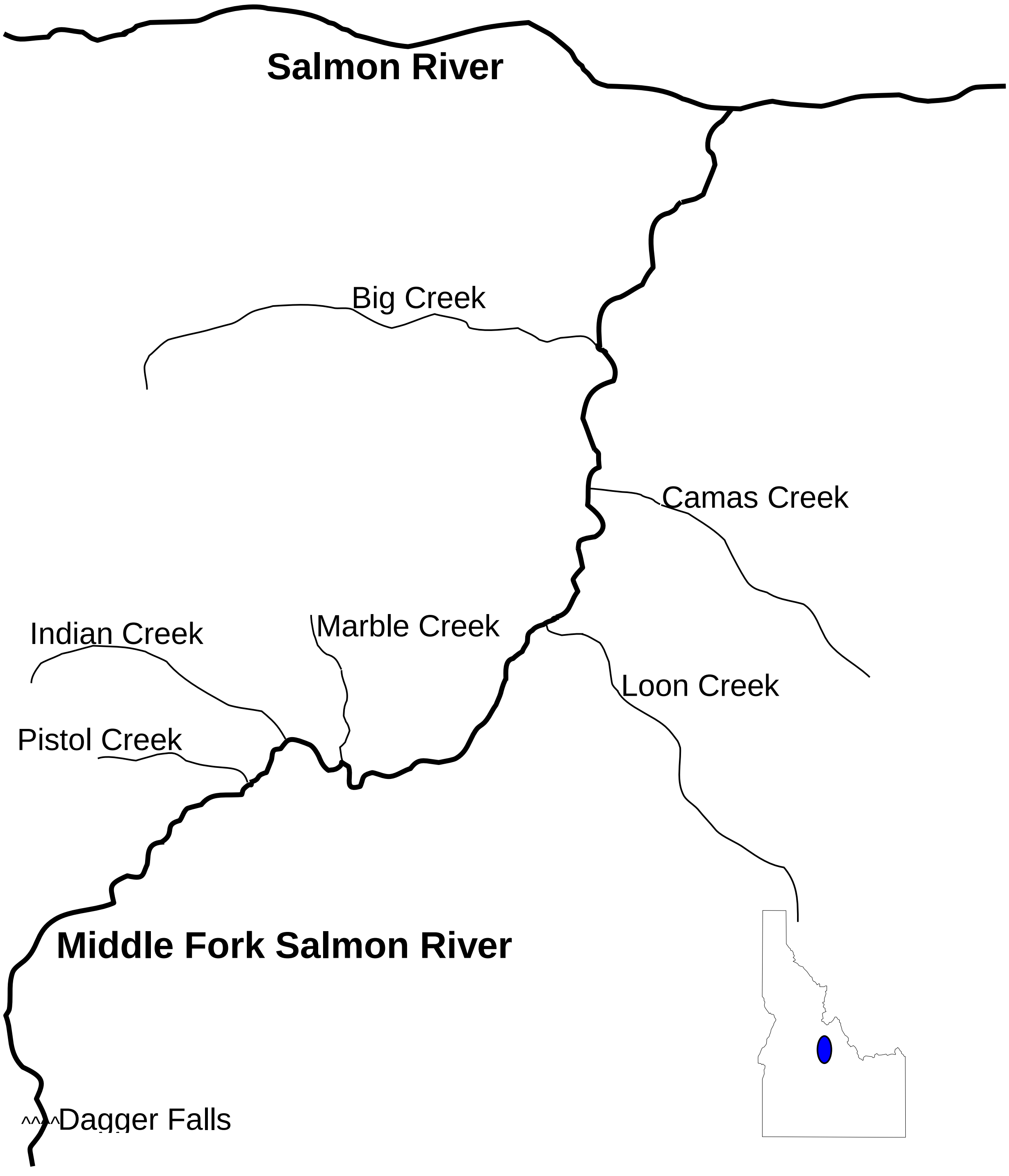

Figure 37. Middle Fork Salmon River and its major tributaries, Idaho.

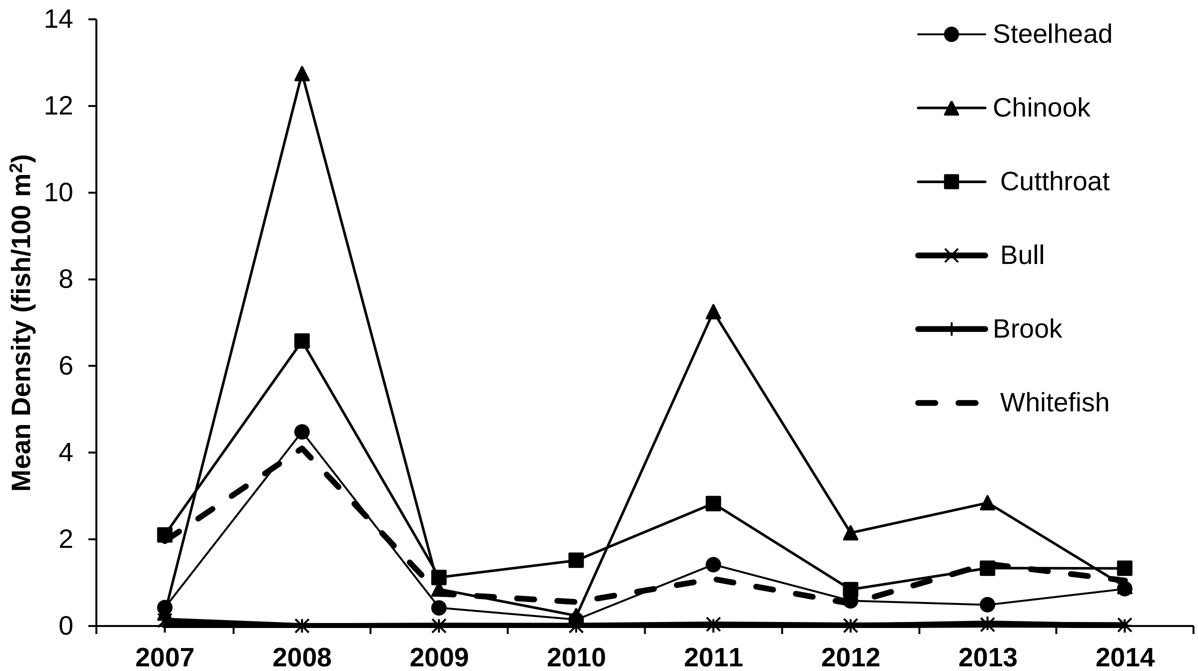

Figure 38. Average densities of salmonids observed in main stem MFSR snorkel transects (historical and traditional, combined), 2007 to 2014.

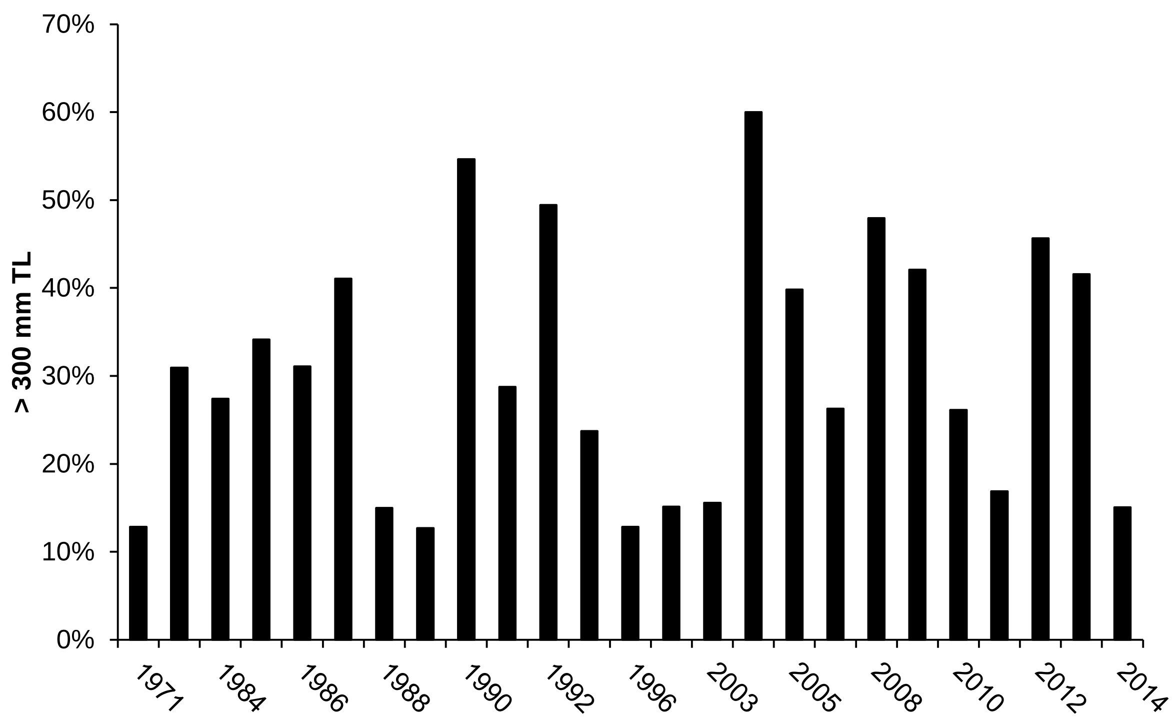

Figure 39. Percentage of Westslope Cutthroat Trout greater than 300 mm TL observed during snorkel surveys in the main stem MFSR, 1971 to 2014.

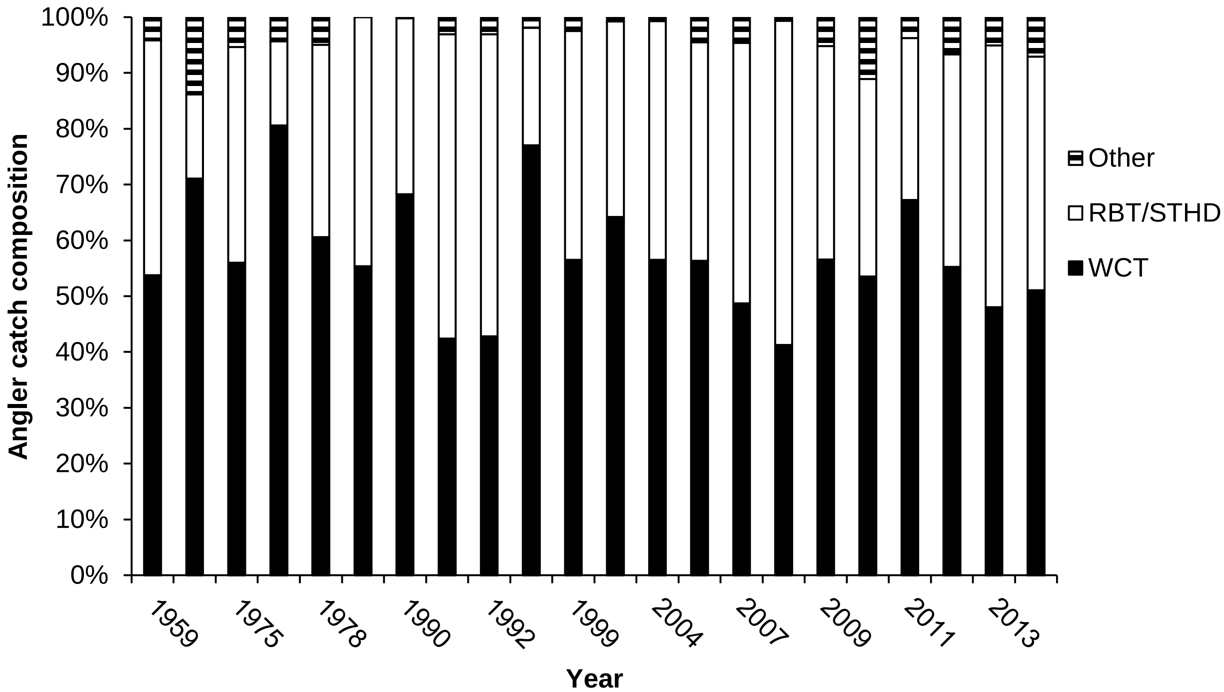

Figure 40. Percentage of Rainbow Trout/Steelhead, Westslope Cutthroat Trout, and other species representing total angler catch during angling surveys on the main stem MFSR, 1959 to 2014.

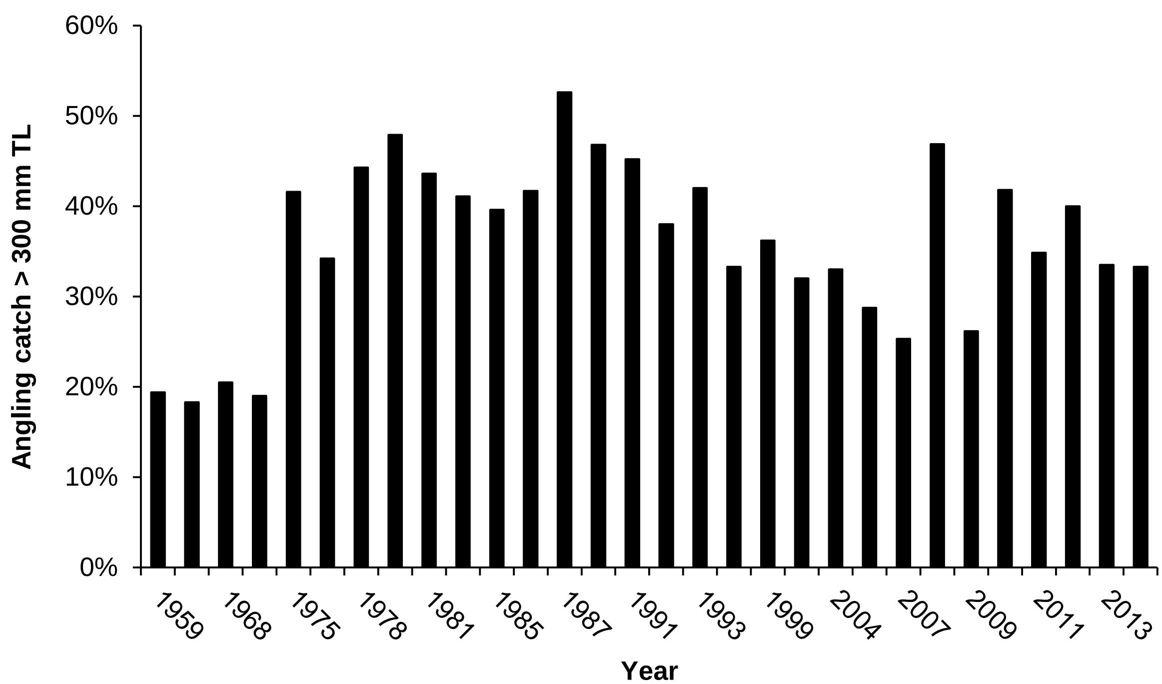

Figure 41. Percentage of Westslope Cutthroat Trout greater than 300 mm TL caught during angling on the main stem MFSR, 1959 to 2014.

Appendix B. Locations and area of main stem traditional transects, Middle Fork Salmon River, surveyed in 2014.

Transect name	River km[a]	Transect length (m)	Visibility (m)	Transect area (m^2)	Traditional species[b]
Boundary	0.9	61	2.3	910.8	SH
Gardells Hole	4.6	126	2.9	621.6	C2, CK
Velvet	8.8	37	2.5	1424.8	C2, CK
Elkhorn	14.1	68	2.2	800.8	SH
Sheepeater	21.3	102	2.1	1647.2	SH
Greyhound	25.8	99	2.3	1798.0	C2, CK
Rapid River	29.6	74	2.1	932.4	SH
Indian	40.8	137	2.6	360.0	SH
Pungo	45.1	77	2.6	460.0	C2, CK
Marble Pool	51.7	142	2.9	775.2	C2, CK
Skijump	52.3	155	2.9	927.2	SH
Lower Jackass	60.9	111	2.1	2400.0	C2, CK
Cougar	65.9	50	1.8	576.0	SH
Whitie Cox	74.9	102	1.9	448.8	C2, CK
Rock Island	75.2	122	1.9	931.6	SH
Hospital Pool	82.9	80	1.8	720.0	C2, CK
Hospital Run	84.3	66	1.7	748.0	SH
Tappan Pool	94.9	137	1.7	600.0	C2, CK
Flying B	106.6	75	2.4	600.0	C2, CK
Airstrip	108.6	110	1.7	1332.0	SH
Survey	119.0	75	2.0	600.0	SH
Big Creek Bridge	124.6	185	1.8	2880.0	C2, CK
Love Bar	127.0	100	1.5	626.4	SH
Little Ouzel	143.2	87	1.8	915.2	SH
Otter Bar	144.0	143	1.6	768.0	C2, CK
Goat Creek Pool	151.5	134	1.6	857.6	C2, CK
Goat Creek Run	151.8	122	2.2	1073.6	SH

[a] River km readings start at Dagger Falls.

[b] Traditional steelhead transects established in 1981: SH = Steelhead. Traditional Cutthroat Trout (C2) and Chinook Salmon (CK) transects established in 1985:

Appendix C. Locations and dimensions of main stem Middle Fork Salmon River historical (Corley 1972) transects surveyed in 2014.

Transect name	River location[a] (km)	Transect length (m)	Visibility (m)	Transect area (m^2)	Traditional species[a]
Mahoney Camp	67.4	50	2.3	561.2	SB,C2, CK
White Creek Pack Bridge	78.1	300	2.0	1461.6	SB,C2, CK
Bernard Airstrip	109.4	100	1.5	370.0	SB,C2
Cliffside Rapids Hole	141.3	300	2.4	598.4	SB,C2
Hancock Rapids Hole	147.0	120	1.6	856.8	C2

[a] River km reading begins at Dagger Falls.
[b] SB = Steelhead B-run, C2 = Westslope Cutthroat Trout, and CK = Chinook Salmon.

Appendix D. Locations and dimensions of Middle Fork Salmon River tributary transects surveyed in 2014.

Transect name	Transect location	Transect length (m)	Visibility (m)	Transect area (m^2)	Traditional species[a]
Pistol Creek Lower	125 m above pack bridge	28.0	1.2	720.0	SB,C2, CK
Pistol Creek Upper	100 m above lower site	40.0	2.3	699.2	SB,C2, CK
Indian Creek Lower	75 m above mouth	76.0	2.3	460.0	SB,C2, CK
Indian Creek Upper	300 m above mouth	50.0	1.0	208.0	SB,C2, CK
Marble Creek	Above pack bridge	64.0	1.8	460.8	SB,C2, CK
Loon Creek Lower	Below pack bridge	52.0	2.8	313.6	SB,C2, CK
Camas Creek Lower	Below pack bridge	75.0	2.8	448.0	SB,C2

[a] SB = Steelhead B-run, C2 = Westslope Cutthroat Trout, and CK = Chinook Salmon.

RIVERS AND STREAMS

SALMON REGION ANADROMOUS FISHERIES

ABSTRACT

Fisheries staff monitored anadromous fisheries in the upper Salmon River during the fall 2013 and spring 2014 for Steelhead *Oncorhynchus mykiss*, and from June 21 through July 27, 2014 for Chinook Salmon *O. tshawytscha*.

During the 2014 Chinook Salmon fishery, angler effort was estimated at 45,839 hours, anglers caught a total of 1,762 Chinook Salmon, and harvested a 719 Chinook Salmon throughout the fishery. Angler effort was highest in location codes 19 and 17 (near the Sawtooth Fish Hatchery and near Ellis, ID) with 20,313 and 14,624 hours of angler effort, respectively. The highest catch rate during the fishery was observed in location code 19 during the week of June 23, with 10 hours per fish caught, and 17 hours per fish kept.

In the fall 2013 Steelhead fishery, catch rate was highest in location code 15 at 12 hours per Steelhead caught, while location code 16 had the highest catch rate during spring 2014 at 7 hours per Steelhead caught. Overall, for both spring and fall fisheries in the upper Salmon River, Steelhead catch rate was 13 hours per fish caught, and 29 hours per fish kept.

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INTRODUCTION

This portion of the Salmon Region Fishery Management Annual Report summarizes Chinook Salmon and Steelhead fishery monitoring activities undertaken by the IDFG Region 7 Harvest Management Program (HMP). The HMP is funded by the Idaho Power Company (IPC) and the Lower Snake River Compensation Program (LSRCP). This report is organized by run year to aide in the assessment of harvest impacts on fish that return to Idaho in the same year. Consequently, Steelhead data is summarized by the fall 2013 and spring 2014 seasons.

UPPER SALMON RIVER CHINOOK SALMON

Fishery

A Chinook Salmon fishery for sport anglers opened on the upper Salmon River on June 21, 2014. The boundary for the fishery was described in regulations as “from the posted boundary approximately 100 yards upstream of the mouth of the North Fork Salmon River upstream to the posted boundary approximately 100 yards downstream of the weir and trap at Sawtooth Hatchery south of Stanley” (location codes 16 -19 [Figure 42]). Fishing hours were from 5:00am to 10:00pm Mountain Daylight time. Anglers were allowed to keep 4 salmon per day, of which only 2 could be adults. Anglers were allowed to have 12 salmon in possession, of which only 6 could be adults. The statewide season limit for adult Chinook Salmon was 20 fish. The Chinook Salmon season closed on July 19th on the portion of the Salmon River upstream from the confluence with the East Fork Salmon River (EFSR) after the harvest share was caught. The remaining portion of the fishery (location codes 16-18) closed on July 27th.

Hatchery Returns, Broodstock Needed, Estimated Run Size, Harvest Share, and Conversion Rates

Niebuhr and Lindenmuth (2014) and Garlie et al. (2014) reported a combined total of 2,360 adult and 1,119 jack hatchery Chinook Salmon returned to Sawtooth (SFH) and Pahsimeroi (PFH) Fish Hatchery traps (Table 25). Adipose fin intact integrated hatchery and natural origin Chinook Salmon adults and jacks comprised 33% of the combined SFH and PFH total returns and 39% of SFH returns. Both SFH and PFH met their combined total broodstock needs of 1,274 Chinook Salmon. The estimated adult Chinook Salmon hatchery fish run size at Lower Granite Dam was 2,588 (as of September 22nd). IDFG’s portion of the adult Chinook Salmon hatchery fish harvest share was 496 and 161 for SFH and PFH, respectively. After harvest, the combined adult hatchery Chinook Salmon conversion rate between Lower Granite Dam and upper Salmon River hatchery facilities was 91%. The high hatchery adult conversion rate suggests the run size at Lower Granite Dam was underestimated.

Passive Integrated Transponder (PIT) Array Timing

Two PIT-tag arrays were installed in the upper Salmon River during August and September, 2012. The first array was designated as “USE” and is located just downstream of the Eleven Mile boat ramp. The second was designated as “USI” and is located downstream of the Iron Creek mouth. Data presented in Table 26 and Figure 43 is from the USE array because the downstream array typically has better detection rates.

The first observation date for both PFH and SFH Chinook Salmon at the USE Salmon River 11 Mile PIT-tag array was June 20, 2014 (Table 26). The first observation date for hatchery fish was a day or two prior to the first observation date of naturally produced fish tagged near each respective fish hatchery. Chinook Salmon detected at the 11 Mile array included fish tagged in the John Day and Columbia Rivers. The first observation date of PIT-tagged Sockeye Salmon at the 11 Mile array was July 16, 2014.

Overall, the run timing of SFH Chinook Salmon at the 11 Mile array was earlier compared to PFH fish (Figure 43). There was a distinct separation regarding run timing for spring Chinook Salmon stock and summer Chinook Salmon stock at the 11 Mile array (Figure 43). Sockeye Salmon were prevalent in the upper Salmon River by mid-July.

Environmental Conditions

The Chinook Salmon fishery occurred during the descending curve of the Salmon River spring peak flow hydrograph (Figure 44). Based on field observations, river flow levels and water clarity were very conducive for salmon fishing. Daily water temperatures collected by creel clerks show temperatures at the beginning of the fishery were in the 13 - 16^{o}C range. By July, water temperatures were in the 16 – 21^{o}C range. The warmest water temperature recorded by clerks was 21^{o}C in the Deer Gulch area (location code 17).

Angler Raw Creel Data

Creel clerks interviewed 3,215 combined Chinook Salmon bank and boat anglers during the upper Salmon River fishery (Table 27). The proportion of interviews by access type (bank or boat) reflects angler preference for fishing different river location codes as described in Flinders et al. (2013). Road construction closures in river location code 19 (between East Fork Salmon River and Sawtooth Hatchery – see Figure 42) likely reduced the number of anglers interviewed by creel clerks during the fishery. As in previous fisheries, the low number of Chinook Salmon caught by anglers in location code 16 was not proportional to the amount of effort expended compared to other location codes within the fishery (Curet et al. 2011).

Angler Effort, Catch, and Harvest, and Disposition of Excess Broodstock

A roving creel was conducted during the upper Salmon River Chinook Salmon fishery to collect angler effort and catch data as described in Messner et al (*in press*). Estimated effort, harvest, and numbers of fish released were generated using the Creel Application Software (CAS) program.

Anglers caught Chinook Salmon in all river location codes on the opening weekend (Table 28). After opening weekend, Chinook Salmon fishing slowed downstream of Ellis (location codes 16 and 17) as indicated by low catch rates. Anglers spent 10% of their time fishing in location code 16, although less than 1% (6) of the adult hatchery fish harvested came from location code 16. Undoubtedly, the small run size of hatchery Chinook Salmon to PFH was at least partially responsible for poor angler success. Other unknown factors may be contributing to a declining trend in anadromous fish angler success downstream of Ellis in location code 17 (Curet et al 2013, Flinders et al 2013, Messner et al *in press*). Although the lower fishery boundary was established just upstream from the mouth of the North Fork, creel clerks did not observe anglers attempting to catch and release wild Chinook Salmon entering the North Fork Salmon River.

Peak Chinook Salmon harvest occurred during the week of June 30 in location codes 17 and 18, and during the week of July 7 in location codes 16 and 19 (Table 28). A total of 608 adult and 111 jack Chinook Salmon were harvested during the fishery. Anglers released 923 adult and 94 jack Chinook Salmon with intact adipose fins. Overall, there were 1.4 Chinook Salmon with intact adipose fins released for every Chinook Salmon harvested. Hours per fish kept dropped below the 20 hour threshold only once during the fishery (week of June 23 in location code 19).

PFH and SFH did not recycle fish during the course of the fishery. Of the Chinook Salmon in excess to broodstock needs, SFH distributed 574 Chinook Salmon carcasses and 215 live fish to the Shoshone-Bannock Tribe for ceremonial/subsistence purposes and Yankee Fork Salmon River outplants, respectively (Niebuhr and Lindenmuth 2014). Idaho food bank (East Idaho Community Action Partnership [EICAP]) accepted 254 Chinook Salmon. Chinook Salmon carcasses were not distributed to Idaho sport anglers.

Shoshone-Bannock Tribes harvested an estimated 208 adipose fin intact Chinook Salmon from the upper Salmon River, 21 from the EFSR, 14 from the Yankee Fork Salmon River, and 1 from Valley Creek (Kurt Tardy, personal communication 2014). Additionally, Shoshone - Bannock Tribes harvested an estimated 221 hatchery origin Chinook Salmon from the upper Salmon River. Nez Perce tribal members have not been documented fishing during the past several salmon fisheries (Curet et al. 2013, Flinders et al. 2013); however, IDFG creel staff reported Nez Perce tribal member salmon fishing activity in the upper Salmon River during the 2014 season. Nez Perce tribal member Joe Oatman (personal communication 2014) reported 4 adipose fin intact Chinook Salmon and 6 hatchery origin Chinook Salmon were harvested from the upper Salmon River during 2014. Additionally, Nez Perce tribal members harvested 1 hatchery origin Chinook Salmon from the Yankee Fork Salmon River.

Resident Fish Catch by Chinook Salmon Anglers and Trout Anglers

Creel clerks collected data from both Chinook Salmon anglers and trout anglers over the course of the fishery. Trout angler data was entered into a separate CAS program and estimated resident fish effort and catch were calculated. Resident fish by-catch from Chinook Salmon anglers was also calculated during the salmon fishery in conjunction with estimated Chinook Salmon harvest.

Anglers most commonly caught Northern Pikeminnow followed by Cutthroat Trout, Mountain Whitefish, and hatchery Rainbow Trout (Table 29). Anglers reported catching and releasing several Brook Trout in location code 18. Trout and Chinook Salmon anglers harvested 553 and 71 hatchery Rainbow Trout, respectively. The majority of resident trout catch and harvest occurred in location code 19, which is likely a function of angler density and proximity to stocking locations. However, the majority of Northern Pikeminnow were caught in location code 16, which may reflect a preference for the type of habitat found in the downstream portion of the fishery. Chinook Salmon anglers typically caught more Bull Trout and Northern Pikeminnow compared to trout anglers as also observed in the 2012 fishery (Flinders et al. 2012). The tendency for Chinook Salmon anglers to catch Bull Trout and Northern Pikeminnow may be related to the method of fishing (bottom fishing with bait) they use.

Data Collection from Harvested Chinook Salmon

During the fishery, creel personnel checked 130 harvested Chinook Salmon for marks. Creel clerks collected 12 Chinook Salmon snouts that contained coded-wire tags (CWT) and 116 parental-based tagged (PBT) genetic samples from angler harvested Chinook Salmon (Table 30). Creel clerks collected 2 Chinook Salmon snouts from location code 18 that were false positives (contained no CWT). Creel clerks did not collect PBT samples from fish that contained CWT to avoid duplication of effort in the fish identification process. Thus, the discrepancy between total fish checked for marks and the number of PBT samples collected is due to the number of fish that tested positively for CWT.

Angler Interview Distribution

Creel clerks recorded 1,147 Chinook Salmon angler interview locations with GPS units during the fishery to assess angler use and distribution throughout the Upper Salmon River Chinook Salmon fishery (Table 31). The data only portrays a general sense of angler densities throughout the fishery because 36% of interviewed anglers were georeferenced. Fewer interviews were collected from anglers who fished from boats because of the extended wait time required at ramps. Consequently, the proportion of bank anglers to boat anglers is skewed in favor of bank anglers (especially in location codes 16 and 18). Regardless, field observations show the majority of Chinook Salmon anglers preferred to fish from the bank during the upper Salmon River fishery.

In location code 16, anglers concentrated in the lower portion of the river. In location code 17, anglers clustered toward the middle and upper (below the hatchery) portion of the river. In location code 18, anglers grouped toward the upper portion of the location code by Deadman’s Hole. In location code 19, anglers were found in greater densities below the SFH and between the Yankee Fork Salmon River and Squaw Creek (Figure 45).

UPPER SALMON RIVER STEELHEAD

Fishery

The upper Salmon River Steelhead fishery opened to catch and release angling on August 1, 2013. The harvest portion of the fall fishery opened a month later on September 1, 2013 and continued through December 31, 2013. The spring fishery was open to harvest from January 1, 2014 until April 30, 2014, with the exception of a segment of river between the Lake Creek Bridge and Long Tom Creek (¾ of a mile upstream from the mouth of the Middle Fork Salmon River [MFSR]) which closed a month earlier on March 31, 2014 (Figure 42). The upstream boundary for the fishery was the posted boundary 100 yards downstream of the SFH weir. During both the fall and spring fisheries, anglers were allowed to harvest 3 Steelhead per day and have up to 9 Steelhead in possession. The statewide season limit was 20 Steelhead per angler.

Hatchery Returns, Broodstock Collection, and Conversion Rates

During spring of 2014, the SFH trapped a total of 2,338 adult A-run Steelhead, which consisted of 2,292 hatchery Steelhead and 46 natural origin Steelhead (Lindenmuth et al. 2014). At the EFSR satellite trapping facility, a total of 371 adult Steelhead were trapped for use in the East Fork Natural Program. Out of the 371 adults, 346 were determined to be hatchery fish, while 25 were natural origin. Both traps were able to collect enough broodstock to meet their brood year 2014 production goals (Table 32).

The PFH trapped a total of 6,119 adult A-run Steelhead, which consisted of 5,914 hatchery Steelhead and 205 natural origin Steelhead. Additionally, the PFH trapped 171 upper Salmon River B-run Steelhead. The broodstock goal of 1,076 A-run Steelhead was easily met, but the upper Salmon River B-run Steelhead return fell short of the desired 450 adults (Table 32).

After accounting for harvest, Steelhead conversion rates between LGD and upper Salmon River hatchery facilities varied across the four stocks. SFH Steelhead had the lowest conversion rate, with 19% of the estimated adults at LGD returning to the weir. The East Fork Natural Program converted at a rate of 36%. With conversion rates of 48% and 57% for the A-run and upper Salmon River B-run stocks, respectively, PFH stocks had the highest conversion rates in the Salmon Region.

Run Timing

The first run year 2013 adult Steelhead detected at the USE array crossed on November 1, 2013 and was from the Sawtooth Hatchery release site (Table 33). The first Pahsimeroi A-run adult Steelhead crossed over the array the following day on November 2, 2013, while the first upper Salmon River B-run Steelhead was not detected until March 24, 2014.

During the spring, there was approximately a two week difference in the run timing between the SFH and PFH stocks. Fifty percent of the detected SFH adults had passed over the USE array by March 18, 2014, while it took until April 3, 2014 for 50% of the detected PFH adults to cross (Figure 46). Overall, few fish from either stock made it upstream of Salmon during the fall of 2013. Approximately 3% of SFH detections and 4% of PFH detections occurred by December 31, 2013. This corresponds with the relatively low angler catch rates that were observed during the fall creel in location codes 16 and 17. Detection rates did not begin to increase until early March, when both stocks began crossing over the array in larger numbers.

Environmental Conditions

On October 1, 2013, the Salmon River discharge at the town of Salmon was approximately 300% of the 10 year average and flows remained above average through the first three weeks of the fishery (Figure 47). During this time, ash and sediment flowed down river from the Halstead fire burn area near Stanley and increased the river's turbidity. Increased flows, along with downstream river conditions likely contributed to the low angler catch rates observed in the first two weeks of October. The first recorded Steelhead harvest did not occur until mid-October when water levels returned to near the 10 year average. During November, river flows were near average and conditions were very conducive to Steelhead fishing.

During the spring fishery, the Salmon River had flows comparable to the 10 year average with the exception of the last two weeks of April when flows began to increase. Overall, spring flows were stable and no irregular river conditions capable of affecting Steelhead angler catch rates were observed.

Angler Raw Creel Data

Throughout the fall 2013 and spring 2014 upper Salmon River Steelhead fisheries, the primary creel method used was a modified roving creel survey conducted to collect Steelhead angler effort and catch rate data, snouts containing CWT, and PBT samples from harvested Steelhead as described in Flinders et al (2012) and Messner et al (*in press*). In the fall, creel was conducted during the months of October and November and in the spring during the months of February, March and April. The modified roving creel was conducted in location codes 14, 15, and 17 in the fall and 14-16, 18, and 19 in the spring. A traditional roving creel survey, used to estimate angler effort and harvest, was conducted in location code 16 during the fall, and in location code 17 during the spring (see below for more info). Each Monday during the fisheries, weekend catch rate data was distributed to the angling public through local websites and radio station, area newspapers, and the IDFG website. The fall creel ceased on November 25, 2013 due to limited angling activity brought about by subzero temperatures. In the spring, creel was conducted until the Steelhead fishery closed upstream of Long Tom Creek on April 30, 2014.

Creel clerks obtained 8,751 interviews during the course of the fall 2013 and spring 2014 seasons (Table 34). Out of those interviews, anglers reported a total catch of 3,423 Steelhead. The total catch was comprised of 1,509 Steelhead that were kept, 762 hatchery Steelhead that were released, and 1,151 Steelhead with intact adipose fins that were released. Forty five percent of the Steelhead kept came out of location code 15 (403 in fall and 279 in spring). The next highest Steelhead kept total was in location code 19, where 250 Steelhead were kept during the spring.

Angler raw effort during the fall season was highest in location code 15 (Table 34). Creel clerks recorded a total of 9,305 hours fished with the average angler reporting 4.1 hours fished per interview. In the spring, location code 19 had the highest recorded angler raw effort with 8,039 hours fished and the average angler reported fishing for 6.4 hours. Over the course of both seasons, location code 15 received the most recorded angler raw effort with a total of 14,088 hours fished.

Catch and harvest rates differed across location codes and between the fall 2013 and spring 2014 upper Salmon River Steelhead fisheries. The average catch rate for the upper Salmon River across all location codes was 13 hours per Steelhead, while the average harvest rate was 29 hours per Steelhead (Table 34). The best observed catch rate in fall 2013 was 12 hours per Steelhead caught in location code 15. During the spring, the best catch rate was observed in location code 16 and was 7 hours per Steelhead caught, which reflects the success that anglers have at the sewer hole (approximately a half mile downstream of the mouth of the Lemhi River). The sewer hole was fished regularly through the first week of April while effort in the rest of the location code 16 was low following the second week of March. This resulted in the sewer hole heavily influencing the average catch rate in the spring.

In all but one location code, the ratio of released Steelhead with intact adipose fins to caught hatchery Steelhead was less than one. The exception was found in location code 14 where the ratio of released Steelhead with intact adipose fins to caught hatchery Steelhead equaled 1.64. The reversal in the ratio has been observed in past run years as well. The ratio during the 2012 run year was 1.80 (Messner et al *in press*). For comparison, just upstream in location code 15, the ratio was 0.43. Undoubtedly, the MFSR natural origin Steelhead run impacts this ratio, but other factors such as fishing tactics, river depth, and the location of hatchery Steelhead release sites may also influence the ratio of released Steelhead with intact adipose fins to caught hatchery Steelhead.

Angler Effort, Catch, and Harvest, and Disposition of Excess Broodstock

The second creel method used during the fall and spring fisheries was a traditional roving creel designed to generate estimated angler effort and harvest based on daily, single party interviews as described in Flinders et al (2012) and Messner et al (*in press*). IDFG Fisheries Bureau staff requested a traditional roving creel be conducted in location code 16 to compare field generated estimated harvest to the remotely generated statewide harvest angler phone survey. During the spring fishery, location code 17 was chosen as the area for a similar comparison because the same type of creel was conducted there in the past (Messner et al *in press*). Creel was conducted in location code 16 during the months of October and November and in location code 17 for the months of March and April to estimate angler effort and Steelhead catch rates.

In location code 16, the estimated harvest in October was 121 Steelhead (Table 35). In November, estimated harvest increased to 343 Steelhead for a season total of 464 harvested Steelhead. These estimates were approximately half of estimates generated the prior year in the same location code despite a similar run size at LGD for upper Salmon River stocks (Messner et al *in press*). Release numbers followed a comparable pattern. Releases of Steelhead with intact adipose fins increased from an estimated 93 in October to 162 in

November. The average catch rate derived from these estimates was 21 hours per Steelhead, while the average harvest rate was 37 hours per Steelhead.

Estimates of angler effort within location code 16 showed that the majority of angling effort was out of boats. An estimated 4,380 hours of angler effort was spent from the bank, while 12,635 hours of effort were estimated to have been spent from boats (Table 35). Although some jet boats did use this area of the river, the majority of boats observed were drift boats. Creel personnel have noted an increase of fly fisherman within location code 16 over the past decade. To document and track these potential changes, beginning in spring 2015, creel clerks will record if interviewed anglers are fishing with gear, lure, or flies. Additionally, clerks will continue to document the number and location of drift and jet boat trailers present in the fishery each day.

In location code 17, total estimated harvest for the months of March and April 2014 was 1,068 Steelhead (Table 35). Harvest was very similar between the two months with 536 Steelhead harvested in March and 532 Steelhead harvested in April. Release numbers between the two months were also similar. Anglers were estimated to have released 147 Steelhead with intact adipose fins in March and 186 in April, for a season total of 333. Based on these estimates, the average catch rate was 17 hours per Steelhead caught and the average harvest rate was 30 hours per Steelhead kept.

Estimated angler effort for location code 17 showed roughly two-thirds of effort was from the bank. Anglers were estimated to have fished for 20,741 hours from the bank versus 11,556 hours from boats for a total effort of 32,297 hours (Table 35). The majority of both boat and bank effort was concentrated upstream of McKim Creek, with most anglers found downstream of the Pahsimeroi River confluence near the Ellis/Deer Gulch area.

PFH distributed a total of 1,680 Steelhead carcasses to the general public (Garlie et al. 2014). Additionally, 450, 405, and 943 Steelhead in excess to broodstock needs were distributed to the Shoshone Bannock Tribe, the Shoshone Paiute Tribe, and various charitable organizations, respectively. SFH distributed a total of 769 Steelhead carcasses to the general public (Lindenmuth et al. 2014). Additionally, the Shoshone Bannock Tribes received 600 Steelhead carcasses and various charitable organizations received 868 carcasses.

Steelhead Angler By-Catch of Resident Fish

Steelhead angler unexpanded by-catch is summarized in Table 36. Westslope Cutthroat Trout and Bull Trout were caught and released in all location codes during the 2013 run year. Approximately 60% of all recorded releases of Bull Trout longer than 12 inches occurred within location codes 14 and 15. Numbers were similar for Bull Trout less than 12 inches, with approximately 85% of total releases recorded in the same two location codes. For unknown reasons, the ratio of Bull Trout greater than 12 inches to bull trout less than 12 inches switched between seasons within location code 14. During fall, anglers released a higher proportion of small Bull Trout, while during the spring anglers released a much higher proportion of large Bull Trout. The seasonal change in Bull Trout proportions was not observed in other location codes.

Total Steelhead angler by-catch was estimated for location code 16 in the fall and location code 17 in the spring (Table 37). Hatchery Rainbow Trout were only reported caught in location code 17. A proportion of these were most likely Steelhead smolts that were released into the Salmon River in April which anglers then misidentified. Wild Rainbow Trout were more commonly found during the spring in location code 17. Anglers in location code 17 released an estimated 76 wild Rainbow Trout, while in the fall anglers released an estimated six wild Rainbow Trout in location code 16. The number of estimated releases for Cutthroat Trout was similar during both the fall and spring fisheries. An estimated 69 Cutthroat Trout were released within location code 16 and an estimated 41 were released within location code 17. Bull Trout releases were reported more often during the spring within location code 17.

Data Collection from Harvested Steelhead

During the fall and spring fisheries, creel personnel checked 1,097 harvested Steelhead for marks. Creel clerks collected 179 Steelhead snouts that contained coded-wire tags (CWT) and 583 parental-based tagged (PBT) genetic samples from angler harvested Steelhead (Table 38). Creel clerks collected PBT samples from fish that contained CWT during fall 2013, but did not collect PBT samples from fish that contained CWT during spring 2014 to avoid duplication of effort in the fish identification process

For Region 7, PBT sampling was stratified into 2 sub-areas. The first sub-area consisted of river location codes 14-17 and the second sub-area consisted of river location codes 18-19. The goal was to collect 186 PBT samples from each sub-area per season (with the exception of location codes 18-19 which isn't sampled in fall) based on a stratified sampling method proportional to angler harvest.

In October, every Steelhead was sampled for PBT as the fish arrived two weeks late compared to previous years (Curet et al 2013, Flinders et al 2013, Messner et al *in press*). In November, PBT sample rates were adjusted to every fifth fish. A total of 215 PBT samples were collected during the fall fishery and all samples were sent to the Eagle genetics laboratory.

In February, the only angler kept fish checked by creel clerks were found in location code 16. In location code 14, every Steelhead checked was sampled during March. In location code 15, 4 out of 5 fish checked were sampled during March and every fish was sampled in April due to low catch rates. In location code 16, every fish was PBT sampled and in location code 17 every other Steelhead was sampled during the spring season. In location codes 18 and 19, every Steelhead was PBT sampled during March and April due to large numbers of hatchery fish released by anglers. In spring, a total of 223 PBT samples were collected in location codes 14-17 and 143 PBT samples were collected in location codes 18 and 19. All PBT samples were sent to the Eagle genetics laboratory.

Steelhead Angler Distribution

During the 2013 run year, angler vehicle and boat trailer locations were recorded using GPS units in an effort to track changes to angler distribution throughout the fall and spring fisheries. This was accomplished by creating angler density maps with the use of ArcMap (ESRI, Redlands, CA). Additionally, the collected location data allowed for the evaluation of angler use, or non-use, of individual access areas or river areas. The results, separated by bank vehicles and boat trailers, are displayed below (Table 39; Figures 48 and 49).

The analysis does not include Monday through Thursday because of the random work schedule (varying weekdays off) associated with the roving creel implemented in location codes 16 and 17. In location codes 16 and 17, waypoint data was collected by permanent staff during the week if random days off for temporary employees included a Friday.

To collect the location data, creel clerks passed through their work areas once per day, typically near noon, and recorded waypoints at the approximate locations of all likely angler vehicles and boat trailers. No distribution data was collected upstream of the Pahsimeroi River during the fall due to low angler effort in the area. The data was then downloaded weekly at the regional office and compiled in ArcMap.

Over the course of several fisheries, the average weekend number of anglers per vehicle on the upper Salmon River was determined to be approximately 1.9, while the average number of anglers per drift boat was determined to be 2.2 (IDFG, unpublished files). The boat trailer data includes jet boat trailers with the exception of the Corn Creek boat ramp. Jet boats were not often observed on the upper Salmon River and appeared sporadically between North Fork and Challis.

Angler vehicle data from the fall fishery showed anglers concentrated primarily in location code 15. Approximately 58% of recorded vehicle and boat trailer waypoints were from location code 15 (Table 39). Within location code 15, bank vehicles accounted for approximately 73% of recorded waypoints and the area with the highest angler density was between the MFSR and Panther Creek (Figure 48). The next highest density area was near the United States Forest Service Spring Creek campground.

Angler density during the spring fishery was spread out across the entire upper Salmon River fishery because bank anglers followed the Steelhead run upriver as it progressed. During the spring, location code 19 had the highest number of bank vehicle waypoints recorded, while location code 15 had slightly less (Table 39). The areas with the highest bank angler densities were the “Narrows” between Panther Creek and Pine Creek, the Ellis/Deer Gulch area downstream of the Pahsimeroi River confluence, the Yankee Fork Salmon River confluence, and the Buckhorn Bridge area downstream of the SFH weir. Of these, the “Narrows” and the Yankee Fork confluence had the highest recorded angler densities. Bank angler density was the lowest in location code 17 between Camp Creek and the Colston access area (Figure 48).

In the fall fishery, location code 15 had the highest count of boat trailers (Table 39), while location code 16 had the greatest proportion of boat trailers (71%). Areas with the highest boat trailer densities were: Corn Creek, Poverty Flats, Cove Creek, and Deadwater upstream to the Carmen Bridge access area (Figure 49). The few boats observed upstream of Salmon floated from the Shoup Bridge ramp to Salmon’s Island Park ramp.

During the spring fishery, boat anglers were most prevalent in location codes 17 and 18 (Figure 49). The highest densities of boat trailers were observed near the Deer Gulch/Ellis area and upstream near the Watts Bridge and McNabb Point areas. Additionally, boat trailer densities were high throughout most of location code 16 during the month of March. Forty-seven percent of recorded waypoints in location code 18 were boat trailers - which was the largest proportion observed in the spring. Fewer boat anglers were observed downstream of North Fork compared to the fall fishery. In location code 19, boat anglers fishing for Steelhead were not documented upstream of the EFSR. Another area that received little boat use was the middle portion of location code 17 between the Eleven mile and Kilpatrick Day Use Areas (Figure 49). Contributing factors that could partially explain the area's low boat use are the angling public's unfamiliarity with the stretch, distance from the towns of Salmon and Challis, and a reluctance to float relatively long distances between developed boat ramps.

While evaluating the boat angler distribution data it was determined that seven river access sites with no developed boat ramps had received some of the highest levels of angler use. These sites were: Poverty Flat, Indianola, Fourth of July, upper McKim Creek, Cronks Canyon, and the Ellis North and South sites. Fourth of July is an IDFG owned access site. Poverty Flat and Indianola are under the management of the United States Forest Service. Upper McKim Creek and Ellis North are managed by Idaho Department of Lands, while Cronks Canyon and Ellis South are managed by the Bureau of Land Management.

In future fisheries, bank angler vehicle distribution data will not be recorded due to the amount of time required to collect it. Instead, the location of conducted interviews will be georeferenced. Georeferenced interview location data can be reviewed by creel staff for potential sources of sampling bias (oversampling some areas while under sampling elsewhere). Creel clerks will continue to collect waypoints of all Steelhead angler boat trailers to help managers determine which access areas receive the most use and where potential improvements can be made to benefit anglers.

Table 25. Chinook Salmon returns, broodstock needs, estimated hatchery adult run size at Lower Granite Dam (LGD), harvestable share, and conversion rates by hatchery, 2014.

	Hatchery Returns[a]										
Hatchery	Hatchery adults	Hatchery jacks[b]	Unclipped integrated adults	Unclipped natural adults	Unclipped integrated jacks	Unclipped natural jacks[b]	Hatchery return totals	Hatchery broodstock needed	Estimated hatchery adult run size at LGD[c]	Harvestable share[d]	LGD to hatchery conversion rate (%)[e]
Sawtooth	1,293	470	371	406	265	71	2,876	800	1,792	496	72
Pahsimeroi	1,067	649	0	554	0	65	2,335	474	796	161	134
Totals	2,360	1,119	371	960	265	136	5,211	1,274	2,588	657	91

[a] Data provided by Sawtooth and Pahsimeroi Hatcheries.
[b] Includes jills.
[c] Based on IDFG Lower Granite Dam September 22, 2014 spreadsheet.
[d] Estimated hatchery adult run size at Lower Granite Dam minus broodstock needs multiplied by .50 (shared with tribes on 50/50 basis).
[e] Returns of hatchery adults to facilities divided by estimated hatchery adult run size at Lower Granite Dam (expressed as a percent).

Table 26. Adult Chinook and Sockeye Salmon first observation PIT-tag detections at the Salmon River USE 11 Mile array, 2014. Pahsimeroi and Sawtooth Hatchery detections are shown in bold.

Release site	Mark site	Total number PIT tags detected	First observation date
Release Sites within Region 7			
BIGSPC - Big Springs Creek, Lemhi River Basin	BIGSPC	1	7/4/2014
HAYDNC - Hayden Creek, Lemhi River Basin	HAYDNC	1	6/28/2014
HERDC - Herd Creek	HERDC	1	6/20/2014
LEMHIR - Lemhi River	LEMHIR	1	7/4/2014
LEMHIW - Lemhi River Weir	LEMHIW	1	7/25/2014
PAHP - Pahsimeroi Pond	PAHH	34	6/20/2014
PAHTRP - Pahsimeroi River Trap	PAHTRP	10	6/21/2014
SALEFT - East Fork Salmon River Trap	SALEFT	2	6/17/2014
SALTRP - Salmon Trap	SALTRP	12	6/22/2014
SAWT - Sawtooth Hatchery	SAWT	24	6/20/2014
SAWTRP - Sawtooth Trap	SAWTRP	11	6/17/2014
VALEYC - Valley Creek	VALEYC	1	7/3/2014
YANKFK - Yankee Fork Salmon River	YANKFK	2	6/22/2014
YANKWF - West Fork Yankee Fork Salmon River	YANKWF	1	6/19/2014
Sockeye			
RLCTRP - Redfish Lake Creek Trap	OXBH	68	7/16/2014
	SAWT	34	7/18/2014
Release Sites Outside of Region 7			
BONAFF - BON - Adult Fish Facility	BONAFF	53	6/19/2014
COLR1 - Columbia River - mouth to Three Tree Point, WA	COLR1	2	6/22/2014
COLR3 - Columbia River - Lewis River to Bonneville Dam	BONAFF	15	6/23/2014
GERMC - Germany Creek, Lower Columbia River, WA	GERMC	1	7/3/2014
IHRTAL - IHR - Release into the tailrace within .5 km downstream of dam	LGR	1	6/25/2014
JDAR2 - John Day R. - North Fork John Day R. to headwaters	JDAR2	1	7/1/2014
LGRGWL - LGR - Release into Gatewell(s)	LGR	1	7/14/2014
LGRLDR - LGR - Release into the Adult Fish Ladder	LGRLDR	404	6/9/2014
LGRRBR - LGR - Release below with subsequent barge transport	LGR	11	6/20/2014
LGRRRR - LGR - Release below with subsequent return to the River	LGR	3	6/15/2014
SNAKE1 - Snake River - mouth to Palouse River	LMN	1	6/20/2014
SNAKE2 - Snake River - Palouse River to Clearwater River	LMN	1	6/17/2014
SNKTRP - Snake Trap	SNKTRP	4	6/13/2014

Table 27. Chinook Salmon angler unexpanded raw interview data from upper Salmon River fishery, 2014.

Location code	Access type	Number interviews	Hours fished	Hours/ interview	Chinook kept		Chinook released				Total catch
					Adults	Jacks	Hatchery adults	Hatchery jacks	Wild[a] adults	Wild[a] jacks	
16	Bank	344	820	2.4	0	0	0	0	6	0	6
	Boat	217	1,142	5.3	3	0	0	0	3	0	6
LC 16 Total		561	1,962	3.5	3	0	0	0	9	0	12
17	Bank	899	3,144	3.5	24	5	3	0	8	4	44
	Boat	208	1,281	6.2	3	0	0	0	4	2	9
LC 17 Total		1,107	4,424	4.0	27	5	3	0	12	6	53
18	Bank	562	1,600	2.8	37	5	0	0	46	8	96
	Boat	99	577	5.8	0	0	0	0	0	0	0
LC 18 Total		661	2,177	3.3	37	5	0	0	46	8	96
19	Bank	882	3,437	3.9	78	13	2	1	126	11	231
	Boat	4	22	5.5	0	0	0	0	0	0	0
LC 19 Total		886	3,459	3.9	78	13	2	1	126	11	231
All Location Codes (total)		3,215	12,023	3.7	145	23	5	1	193	25	392

[a] Includes hatchery-produced Chinook with intact adipose fins

Table 28. Summary of estimated fish harvested, angler effort, fish released, and angler success rates by week and location code for the upper Salmon River Chinook Salmon fisheries, 2014.

		Harvest						Releases								
Location code	Week of	Hatchery adult	Hatchery jack	Total kept	Boat hours	Bank hours	Total hours	Wild[a] adults	Wild[a] jacks	Hatchery adults	Hatchery jacks	Total released	Total caught	Hours per kept	Hours per caught	Hatchery CPUE[b]
16	6/21-6/22	2	0	2	819	377	1,196	9	0	0	0	9	11	598	109	0.002
	6/23	0	0	0	1,030	786	1,816	0	0	0	0	0	0	--	--	0.000
	6/30	0	0	0	513	318	831	8	0	0	0	8	8	--	104	0.000
	7/7	4	0	4	223	296	519	4	0	0	0	4	8	130	65	0.008
	7/14	0	0	0	34	115	149	0	0	0	0	0	0	--	--	0.000
	7/21	0	0	0	17	42	59	0	0	0	0	0	0	--	--	0.000
LC 16 Total		6	0	6	2,636	1,934	4,570	21	0	0	0	21	27	762	169	0.001
17	6/21-6/22	3	0	3	459	431	890	2	0	0	0	2	5	297	178	0.003
	6/23	18	4	22	1,373	1,871	3,244	3	0	0	0	3	25	147	130	0.007
	6/30	21	12	33	2,085	2,431	4,516	21	4	0	0	25	58	137	78	0.007
	7/7	16	0	16	2,249	1,507	3,756	2	8	5	0	15	31	235	121	0.006
	7/14	7	3	10	657	724	1,381	3	0	0	0	3	13	138	106	0.007
	7/21	8	2	10	227	610	837	5	2	3	0	10	20	84	42	0.016
LC 17 Total		73	21	94	7,050	7,574	14,624	36	14	8	0	48	132	156	111	0.007
18	6/21-6/22	5	0	5	125	289	414	0	0	0	0	0	5	83	83	0.012
	6/23	16	0	16	424	702	1,126	28	0	0	0	28	44	70	26	0.014
	6/30	53	15	68	765	1,581	2,346	62	12	0	0	74	142	35	17	0.029
	7/7	12	0	12	369	1,148	1,517	28	7	0	0	35	47	126	32	0.008
	7/14	6	0	6	172	336	508	9	0	0	0	9	15	85	34	0.012
	7/21	0	0	0	219	202	421	6	0	0	0	6	6	--	70	0.000
LC 18 Total		92	15	107	2,074	4,258	6,332	133	19	0	0	146	253	59	25	0.017
19	6/21-6/22	3	0	3	74	309	383	3	0	0	0	3	6	128	64	0.008
	6/23	99	6	105	94	1,646	1,740	65	3	3	0	71	176	17	10	0.062
	6/30	148	15	163	34	6,452	6,486	184	12	0	0	196	359	40	18	0.025
	7/7	132	46	178	48	6,944	6,992	214	22	6	0	242	420	39	17	0.026
	7/14	55	8	63	0	4,712	4,712	267	24	0	9	300	363	75	13	0.015
LC 19 Total		437	75	512	250	20,063	20,313	733	61	9	9	812	1,324	40	15	0.026
Total (all location codes)		608	111	719	12,010	33,829	45,839	923	94	17	9	1,043	1,762	64	26	0.016

[a] Includes hatchery-produced Chinook with intact adipose fins.
[b] Catch per Unit of Effort (fish per hour).

Table 29. Summary of estimated catch of resident trout by angler type in Salmon River location codes 16 through 19 during the Chinook Salmon fishery, 2014.

		Estimated catch by species											
Location code	Angler type	Steelhead smolt	Hatchery Rainbow Trout	Wild Rainbow Trout	Hatchery Steelhead	Cutthroat Trout	Bull Trout >12"	Bull Trout <12"	Brook Trout	Mountain Whitefish	Northern Pikeminnow	Sucker spp	Estimated angler effort (hours)
16	Chinook	0	4	5	0	8	12	4	0	40	574	115	4,570
	Trout	0	0	4	0	7	2	0	0	0	20	19	124
LC 16 Total		0	4	9	0	15	14	4	0	40	594	134	4,694
17	Chinook	0	16	26	0	8	2	0	0	44	310	68	14,624
	Trout	0	0	30	0	0	2	2	0	27	23	4	366
LC 17 Total		0	16	56	0	8	4	2	0	71	333	72	14,990
18	Chinook	0	8	15	0	22	13	18	3	31	62	133	6,332
	Trout	124	102	18	1	434	5	0	0	52	16	0	616
LC 18 Total		124	110	33	1	456	18	18	3	83	78	133	6,948
19	Chinook	0	71[a]	5	0	58	83	32	0	147	0	0	20,313
	Trout	8	553[b]	83	0	457	0	87	0	562	0	0	1,742
LC 19 Total		8	624	88	0	515	83	119	0	709	0	0	22,055
All Location Codes (total)		132	754	186	1	994	119	143	3	903	1,005	339	48,687

[a] Chinook anglers harvested three hatchery Rainbow Trout.
[b] Trout anglers harvested 38 hatchery Rainbow Trout.

Table 30. Number of coded-wire (CWT) and parental-based tag (PBT) samples collected, fish checked for marks, and estimated harvest by month from the upper Salmon River Chinook Salmon fishery, 2014.

Location code	Statistics	Fishery statistics by month		
		June	July	Total
16	CWT Taken	0	0	0
	CWT Not Taken	0	0	0
	PBT Samples Collected	1	2	3
	Fish Checked for Marks	1	2	3
	Harvest Estimate[a]	2	4	6
17	CWT Taken	0	6	6
	CWT Not Taken	0	0	0
	PBT Samples Collected	7	15	22
	Fish Checked for Marks	7	21	28
	Harvest Estimate[a]	32	62	94
18	CWT Taken	0	0	0[b]
	CWT Not Taken	0	0	0
	PBT Samples Collected	16	19	35
	Fish Checked for Marks	16	21	37
	Harvest Estimate[a]	35	72	107
19	CWT Taken	3	3	6
	CWT Not Taken	0	0	0
	PBT Samples Collected	18	38	56
	Fish Checked for Marks	21	41	62
	Harvest Estimate[a]	141	371	512
All Location Codes (total)	CWT Taken	3	9	12
	CWT Not Taken	0	0	0
	PBT Samples Collected	42	74	116
	Fish Checked for Marks	45	85	130
	Harvest Estimate[a]	210	509	719

[a] Harvest estimates produced using Creel Application Software (CAS)

[b] Two false positive CWT readings led to the collection of 2 Chinook Salmon snouts that did not contain a CWT

Table 31. Waypoints of Chinook Salmon anglers interviewed during the upper Salmon fishery, 2014.

	No. waypoints recorded		
Location code	Bank interviews	Boat interviews	Total
LC 16	114	14	128
LC 17	485	160	645
LC 18	173	3	176
LC 19	198	0	198
Total (all location codes)	970	177	1,147

Table 32. Steelhead trap totals, broodstock needs, estimated hatchery adult run size Lower Granite Dam (LGD), and conversion rates for upper Salmon River stocks.

Rearing facility[c]	Hatchery stock	Run size at LGD[a]	Hatchery trap totals[b]			Hatchery broodstock needed	LGD to hatchery conversion rate (%)
			Hatchery	Unclipped	Total		
HNFH	Sawtooth	11,784	2,292	46	2,338	714	19
	Yankee - Sawtooth	1,830	--	--	--	--	--
	EF Nat.	949	346	25	371	28	36
MVFH[d]	Pahsimeroi	5,495	--	--	--	--	--
	Sawtooth	1,157	--	--	--	--	--
	DWOR	343	--	--	--	--	--
	USALB	302	0	171	171	450	57
NISP	Pahsimeroi	12,308	5,914	205	6,119	1,076	48

[a] Based on IDFG Lower Granite Dam Adult Hatchery Steelhead Return Estimate spreadsheet, last updated on 6/14/2014.
[b] Data provided by Sawtooth and Pahsimeroi Hatcheries.
[c] Hagerman National Fish Hatchery (HNFH); Magic Valley Fish Hatchery (MVFH); Niagara Springs Fish Hatchery (NISP)
[d] With the exception of "USAL B", steelhead stocks from MVFH do not return to any trapping facilities.

Table 33. Adult Steelhead PIT-tag detections, by Release Site and first observation date, at the USE – Upper Salmon River array during the 2013 run year. Pahsimeroi and Sawtooth Hatchery detections are shown in bold.

Release site	Mark site	Total number PIT tags detected	First observation date
Release Sites within Region 7			
PAHTRP - Pahsimeroi R. Trap	MAVA	6	3/24/2014
	NISP	63	11/2/2013
	PAHTRP	3	11/4/2013
SALEFT - East Fork Salmon R. Trap	HAGE	27	3/1/2014
SALR3 - Salmon River - Middle Fork R. to Pahsimeroi R.	MAVA	13	3/15/2014
SALR4 - Salmon River - Pahsimeroi R. to headwaters	MAVA	6	2/14/2014
SAWT - Sawtooth Hatchery	HAGE	70	11/1/2013
SAWTRP - Sawtooth Trap	SAWTRP	1	4/10/2014
YANKFK - Yankee Fork Salmon R.	HAGE	13	2/16/2014
	YANKFK	1	3/25/2014
Release Sites Outside of Region 7			
BONAFF - BON - Adult Fish Facility	BONAFF	57	11/3/2013
COLR3 - Columbia R. - Lewis R. to Bonneville Dam	BONAFF	33	3/4/2014
	COLR3	59	11/10/2013
COLR4 - Columbia R. - Bonneville Dam to John Day Dam	JDA	1	3/28/2014
COLR5 - Columbia River - John Day Dam to Snake River	JDA	2	3/15/2014
KLICKR - Klickitat River	LYLFAT	5	3/16/2014
LGRLDR - LGR - Release into the Adult Fish Ladder	LGRLDR	274	2/14/2014
LGRRBR - LGR - Release below with subsequent Barge Transportation	LGR	10	2/12/2014
LGRRRR - LGR - Release below with subsequent Return to the River	LGR	15	3/4/2014
PRDLD1 - PRD - Release into the Left Bank Adult Fish Ladder	PRDLD1	29	3/11/2014
PROTAL - PRO - Release into the Tailrace	PRO	1	5/1/2014
SALTRP - Salmon Trap	SALTRP	7	3/21/2014
SNAKE1 - Snake River - mouth to Palouse River	LMN	1	4/10/2014
SNAKE2 - Snake River - Palouse River to Clearwater River	LMN	1	3/16/2014
SNKTRP - Snake Trap	SNKTRP	4	11/13/2013

Table 34. Summary of unexpanded Steelhead angler raw interview data from the upper Salmon River fishery, fall 2013 and spring 2014.

Location code	Season	Anglers	Hours	Hrs/ angler	Steelhead kept	Steelhead released		Total catch	Hrs/ caught	Hrs/ kept	Total hatchery CPUE[b]
						Hatchery	Wild[a]				
14	Fall	837	7,089	8.5	188	15	317	520	14	38	0.029
	Spring	149	703	4.7	8	6	47	61	12	88	0.020
LC 14 Total		986	7,792	7.9	196	21	364	581	13	40	0.028
15	Fall	2,257	9,305	4.1	403	117	228	748	12	23	0.056
	Spring	1,051	4,783	4.6	279	160	190	629	8	17	0.092
LC 15 Total		3,308	14,088	4.3	682	277	418	1,377	10	21	0.068
16	Fall	776	3,689	4.8	86	21	50	157	23	43	0.029
	Spring	462	1,797	3.9	93	101	65	259	7	19	0.108
LC 16 Total		1,238	5,486	4.4	179	122	115	416	13	31	0.055
17	Fall	83	354	4.3	9	4	2	15	24	39	0.037
	Spring	1,423	5,500	3.9	163	86	48	297	19	34	0.045
LC 17 Total		1,506	5,854	3.9	172	90	50	312	19	34	0.045
18	Fall	--	--	--	--	--	--	--	--	--	--
	Spring	458	2,279	5.0	30	33	34	97	23	76	0.028
LC 18 Total		458	2,279	5.0	30	33	34	97	23	76	0.028
19	Fall	--	--	--	--	--	--	--	--	--	--
	Spring	1,255	8,039	6.4	250	220	170	640	13	32	0.058
LC 19 Total		1,255	8,039	6.4	250	220	170	640	13	32	0.058
Total (all location codes)		8,751	43,537	5.0	1,509	763	1,151	3,423	13	29	0.052

[a] Includes hatchery-produced Steelhead with intact adipose fins.
[b] Catch per Unit of Effort (hours).

Table 35. Summary of estimated fish harvested, released, angler effort and angler success rates, by location code, for the upper Salmon River Steelhead fishery, fall 2013 and spring 2014.

Location code	Month	Harvest	Steelhead released		Total catch	Angler hours			Hours/Steelhead	
			Hatchery	Wild[a]		Boat	Bank	Total	Caught	Kept
16	October	121	17	93	231	6,179	1,826	8,005	35	66
	November	343	92	162	597	6,456	2,554	9,010	15	26
LC 16 Total (fall)		464	109	255	828	12,635	4,380	17,015	21	37
17	March	536	264	147	947	7,123	13,565	20,688	22	39
	April	532	287	186	1,005	4,433	7,176	11,609	12	22
LC 17 Total (spring)		1,068	551	333	1,952	11,556	20,741	32,297	17	30

[a] Includes hatchery-produced Steelhead with intact adipose fins.

Table 36. Recorded Unexpanded Steelhead angler by-catch of resident fish during the upper Salmon River Steelhead fisheries, fall 2013 and spring 2014.

		Catch by species								
Location code	Season	Steelhead Smolt	Hatchery Rainbow Trout	Wild Rainbow Trout	Cutthroat Trout	Bull Trout > 12"	Bull Trout < 12"	Mountain Whitefish	Northern Pikeminnow	Sucker spp
14	Fall[a]	--	--	--	--	9	24	--	--	--
	Spring	0	0	1	46	20	2	0	0	0
LC 14 Total		0	0	1	46	29	26	0	0	0
15	Fall[a]	--	--	--	--	23	10	--	--	--
	Spring	0	1	6	63	14	2	5	3	1
LC 15 Total		0	1	6	63	37	12	5	3	1
16	Fall[a]	--	--	--	--	5	0	--	--	--
	Spring	0	2	8	14	7	1	18	0	40
LC 16 Total		0	2	8	14	12	1	18	0	40
17	Fall[a]	--	--	--	--	0	0	--	--	--
	Spring	1	7	8	6	12	4	49	36	73
LC 17 Total		1	7	8	6	12	4	49	36	73
18	Fall	--	--	--	--	--	--	--	--	--
	Spring	0	0	1	37	6	1	34	0	14
LC 18 Total		0	0	1	37	6	1	34	0	14
19	Fall	--	--	--	--	--	--	--	--	--
	Spring	22	1	0	13	11	0	10	0	2
LC 19 Total		22	1	0	13	11	0	10	0	2
Total (all location codes)		23	11	24	179	107	44	116	39	130

[a] In Fall 2013 only Bull Trout by-catch information was recorded.

Table 37. Steelhead angler estimated fish by-catch during the upper Salmon River Steelhead fisheries, fall 2013 and spring 2014.

		Estimated catch by species								
Location code	Season	Steelhead Smolt	Hatchery Rainbow Trout	Wild Rainbow Trout	Cutthroat Trout	Bull Trout > 12 "	Bull Trout < 12"	Mountain Whitefish	Northern Pikeminnow	Sucker spp
16	Fall	0	0	6	69	30	0	15	3	0
17	Spring	8	38	76	41	65	17	334	255	411
Total (all location codes)		8	38	82	110	95	17	349	258	411

Table 38. Number of Steelhead coded-wire (CWT) and parental-based tag (PBT) samples collected, number of Steelhead checked for marks and statewide Steelhead harvest (SWH) estimates by river location code by month for the upper Salmon River, 2013-2014.

		Fishery statistics by month								
Location code	Statistics	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
14	CWT taken	--	6	10	--	--	--	0	--	16
	CWT not taken		0	0	--	--	--	0	--	0
	PBT samples collected	--	36	21	--	--	--	2	--	59
	Fish checked for marks	--	45	94	--	--	--	2	--	141
	SWH estimate[a]	0	376	1,016	16	26	43	49	44[b]	1,570
15	CWT taken	--	15	42	--	--	--	23	3	83
	CWT not taken	--	0	1	--	--	--	2	0	3
	PBT samples collected	--	63	52	--	--	--	95	10	220
	Fish checked for marks	--	65	260	--	--	--	131	13	469
	SWH estimate[a]	48	1,556	2,897	433	55	139	1,523	128	6,779
16	CWT taken	--	7	13	--	--	2	8	7	37
	CWT not taken	--	0	1	--	--	0	0	0	1
	PBT samples collected	--	25	15	--	--	3	39	15	97
	Fish checked for marks	--	25	59	--	--	5	49	23	161
	SWH estimate[a]	29	358	540	16	9	61	323	284	1,620
17	CWT taken	--	0	2	--	--	0	6	8	16
	CWT not taken	--	0	0	--	--	0	0	0	0
	PBT samples collected	--	1	4	--	--	4	26	29	64
	Fish checked for marks	--	1	4	--	--	9	59	70	143
	SWH estimate[a]	10	51	117	81	0	105	455	390	1,209
14-17 Subtotal	CWT taken	--	28	67	--	--	2	37	18	152
	CWT not taken	--	0	2	--	--	0	2	0	4
	PBT samples collected	--	125	92	--	--	7	162	54	440
	Fish checked for marks	--	186	530	--	--	14	637	106	914
	SWH estimate[a]	87	2,341	4,570	546	90	348	2,350	846	11,178
18	CWT taken	--	--	--	--	--	0	3	3	6
	CWT not taken	--	--	--	--	--	0	0	0	0
	PBT samples collected	--	--	--	--	--	--	6	10	16
	Fish checked for marks	--	--	--	--	--	--	11	13	24
	SWH estimate[a]	0	0	11	0	9	26	674	268	988
19	CWT taken	--	--	--	--	--	0	9	12	21
	CWT not taken	--	--	--	--	--	--	0	3	3
	PBT samples collected	--	--	--	--	--	--	54	73	127
	Fish checked for marks	--	--	--	--	--	--	70	89	159
	SWH estimate[a]	0	0	112	0	0	0	561	1,206	1,879

Table 38. (continued)

Location Code	Statistics	Fishery statistics by month								
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
18-19 Subtotal	CWT taken	--	--	--	--	--	0	12	15	27
	CWT not taken	--	--	--	--	--	0	0	3	3
	PBT samples collected	--	--	--	--	--	--	60	83	143
	Fish checked for marks	--	--	--	--	--	--	81	102	183
	SWH estimate[a]	0	0	123	0	9	26	1,235	1,474	2,867
All location codes (total)	CWT taken	--	28	67	--	--	2	49	33	179
	CWT not taken	--	0	2	--	--	0	2	3	7
	PBT samples collected	--	125	92	--	--	7	222	137	583
	Fish checked for marks	--	136	417	--	--	14	322	208	1,097
	SWH estimate[a]	87	2,341	4,693	546	99	374	3,585	2,320	14,045

[a] Estimated harvest data from State wide Harvest Survey, IDFG Boise Staff (unpublished).
[b] Outside of legal fishing season and not included in calculations.

Table 39. Number of bank vehicle and boat trailer waypoints collected (Friday through Sunday), separated by location code and by season during the upper Salmon River Steelhead fishery, fall 2013 and spring 2014.

Location code	Season	No. of waypoints recorded			% Bank	% Boat
		Bank vehicles	Boat trailers	Total		
LC 14	Fall	217	222	439	49%	51%
	Spring	58	35	93	62%	38%
LC 14 Total		275	257	532	52%	48%
LC 15	Fall	1,139	424	1563	73%	27%
	Spring	913	104	1017	90%	10%
LC 15 Total		2,052	528	2,580	80%	20%
LC 16	Fall	169	405	574	29%	71%
	Spring	235	161	396	59%	41%
LC 16 Total		404	566	970	42%	58%
LC 17	Fall	66	54	120	55%	45%
	Spring	621	300	921	67%	33%
LC 17 Total		687	354	1,041	66%	34%
LC 18	Fall	--	--	--	--	--
	Spring	263	234	497	53%	47%
LC 18 Total		263	234	497	53%	47%
LC 19	Fall	--	--	--	--	--
	Spring	1,010	0	1010	100%	0%
LC 19 Total		1,010	0	1,010	100%	0%
Total (all location codes)		4,691	1,939	6,630	71%	29%

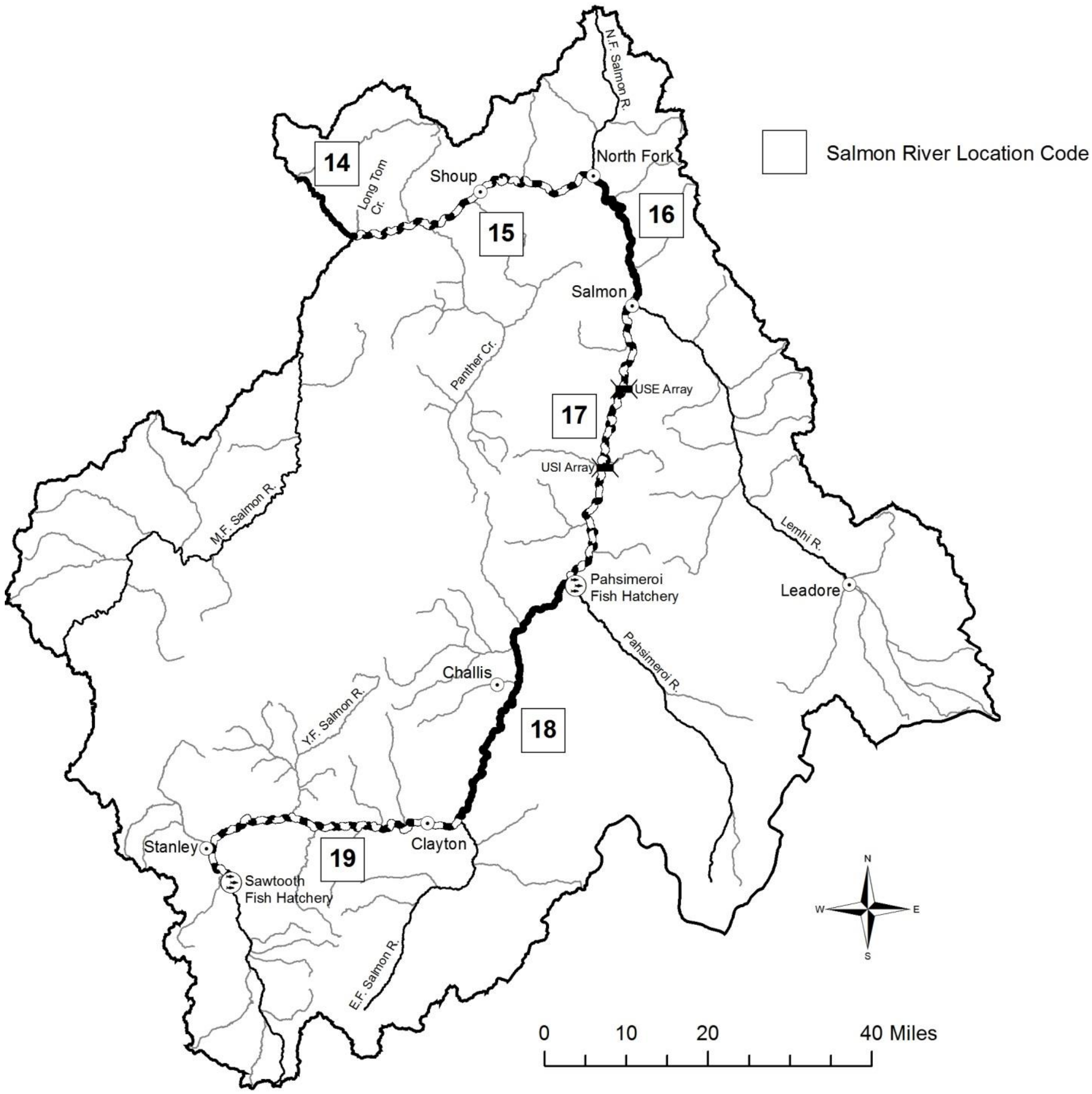

Figure 42. Map of upper Salmon River Chinook Salmon and Steelhead fishery areas by location code.

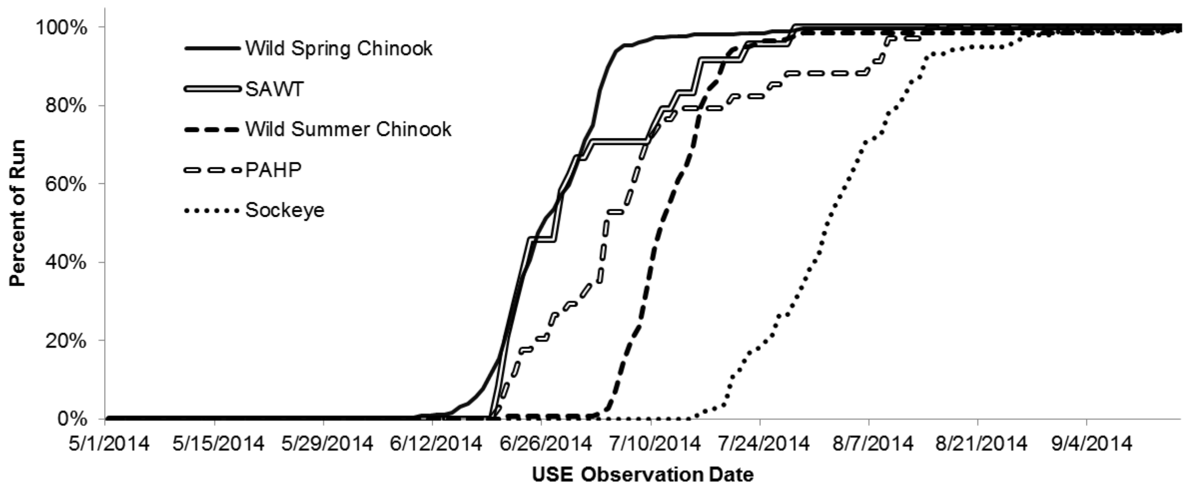

Figure 43. Run timing of Pahsimeroi and Sawtooth Fish Hatcheries PIT-tagged adult Chinook Salmon, adipose fin intact spring and summer Chinook Salmon, and adult Sockeye Salmon at the upper Salmon River 11 Mile array, 2014.

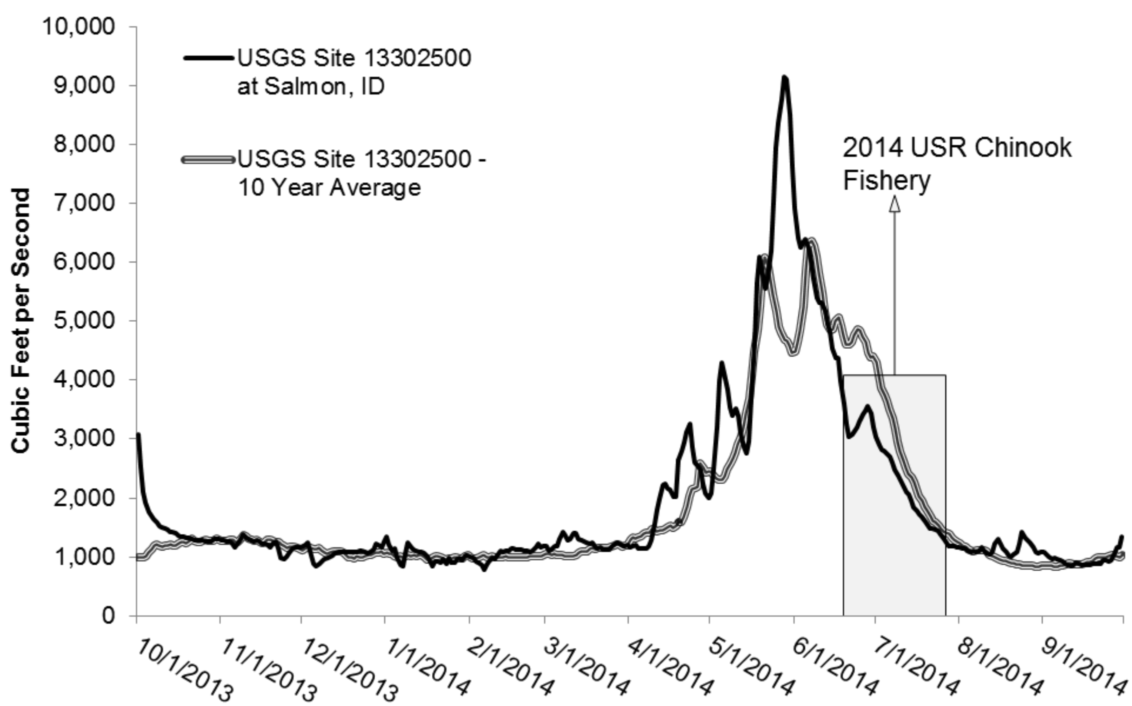

Figure 44. Salmon River mean daily discharge (cubic feet per second) at Salmon, Idaho, 2014.

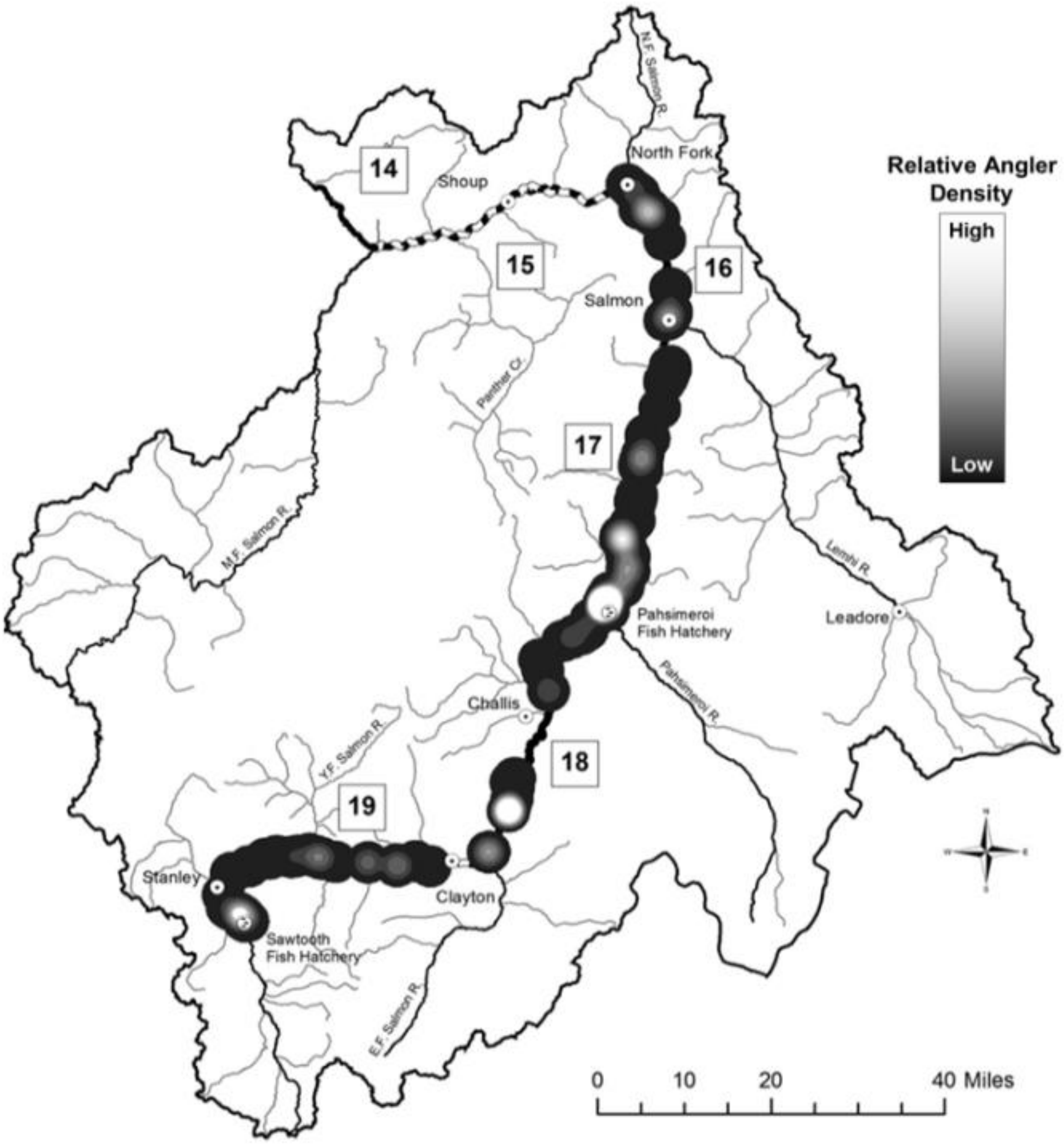

Figure 45. Relative Chinook Salmon angler densities in the upper Salmon River fishery based on interview waypoint locations, 2014.

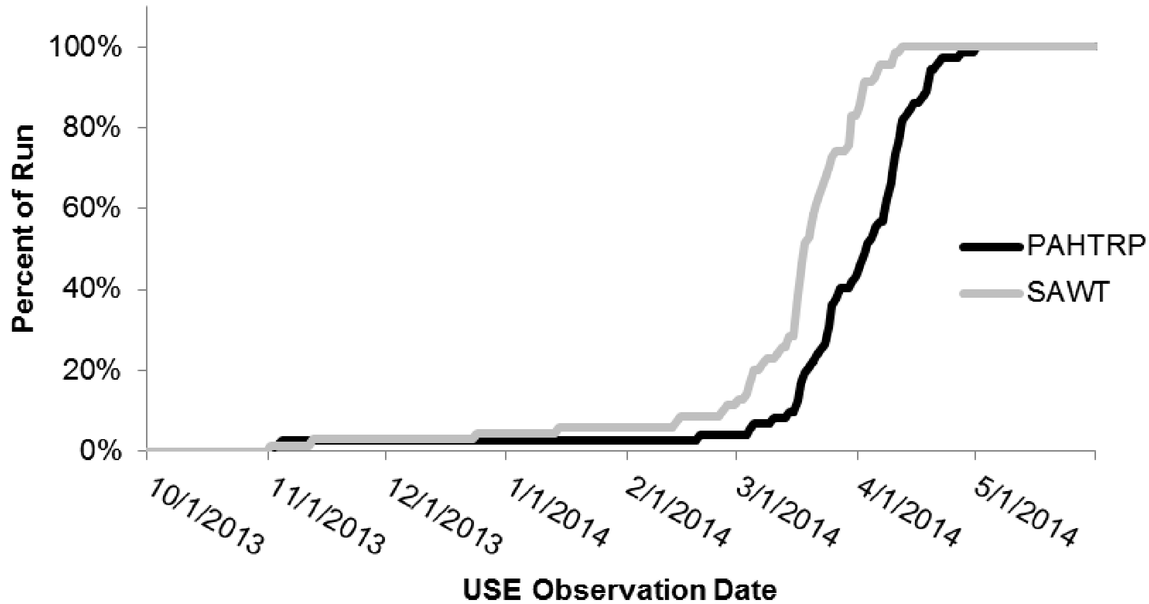

Figure 46. Adult Steelhead cumulative run timing, based on PIT tags, for Pahsimeroi and Sawtooth Hatchery stocks observed at Upper Salmon River USE PIT-tag Array during the 2013 run year.

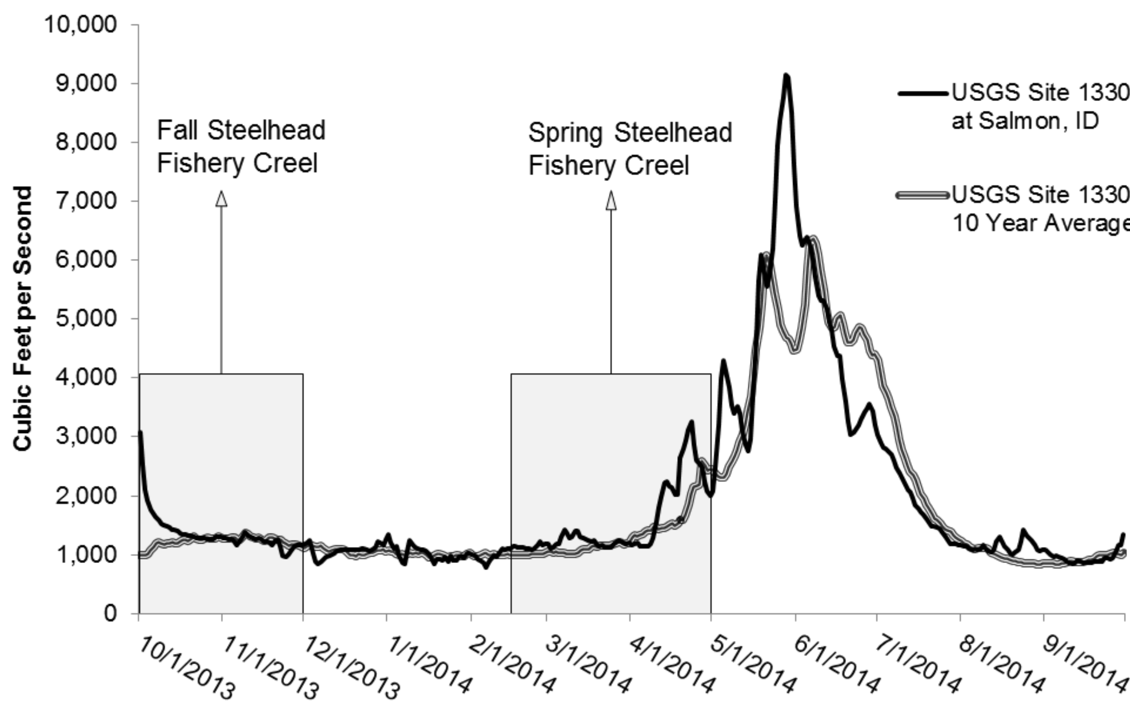

Figure 47. Salmon River mean daily discharge through the town of Salmon overlaid with the 10 year average and the timeframes of the fall and spring creel efforts.

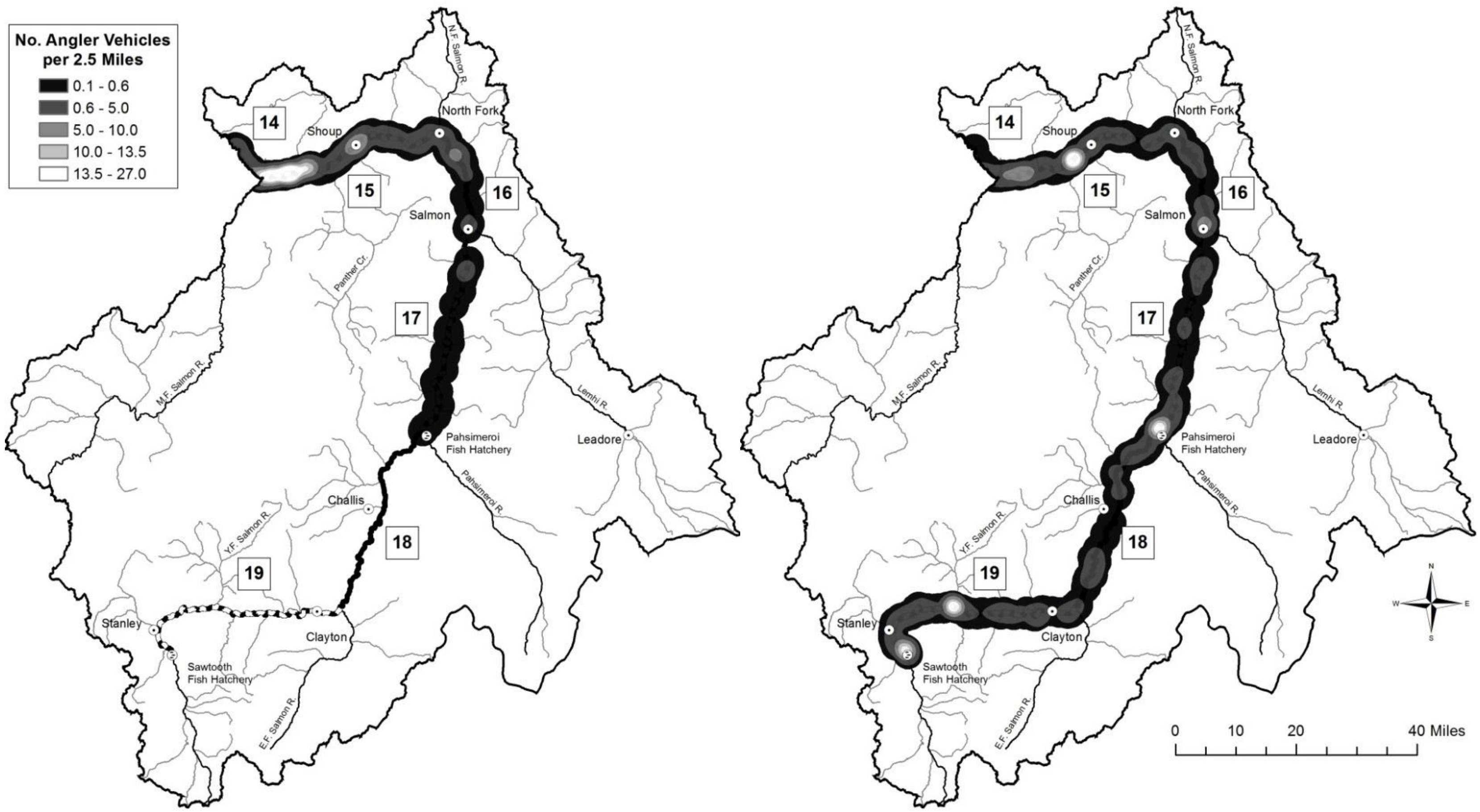

Figure 48. Angler vehicle density (Friday through Sunday) during the fall 2013 and spring 2014 Steelhead fisheries. Fall data is displayed on the left and spring data is on the right. Each vehicle represents an estimated 1.9 anglers.

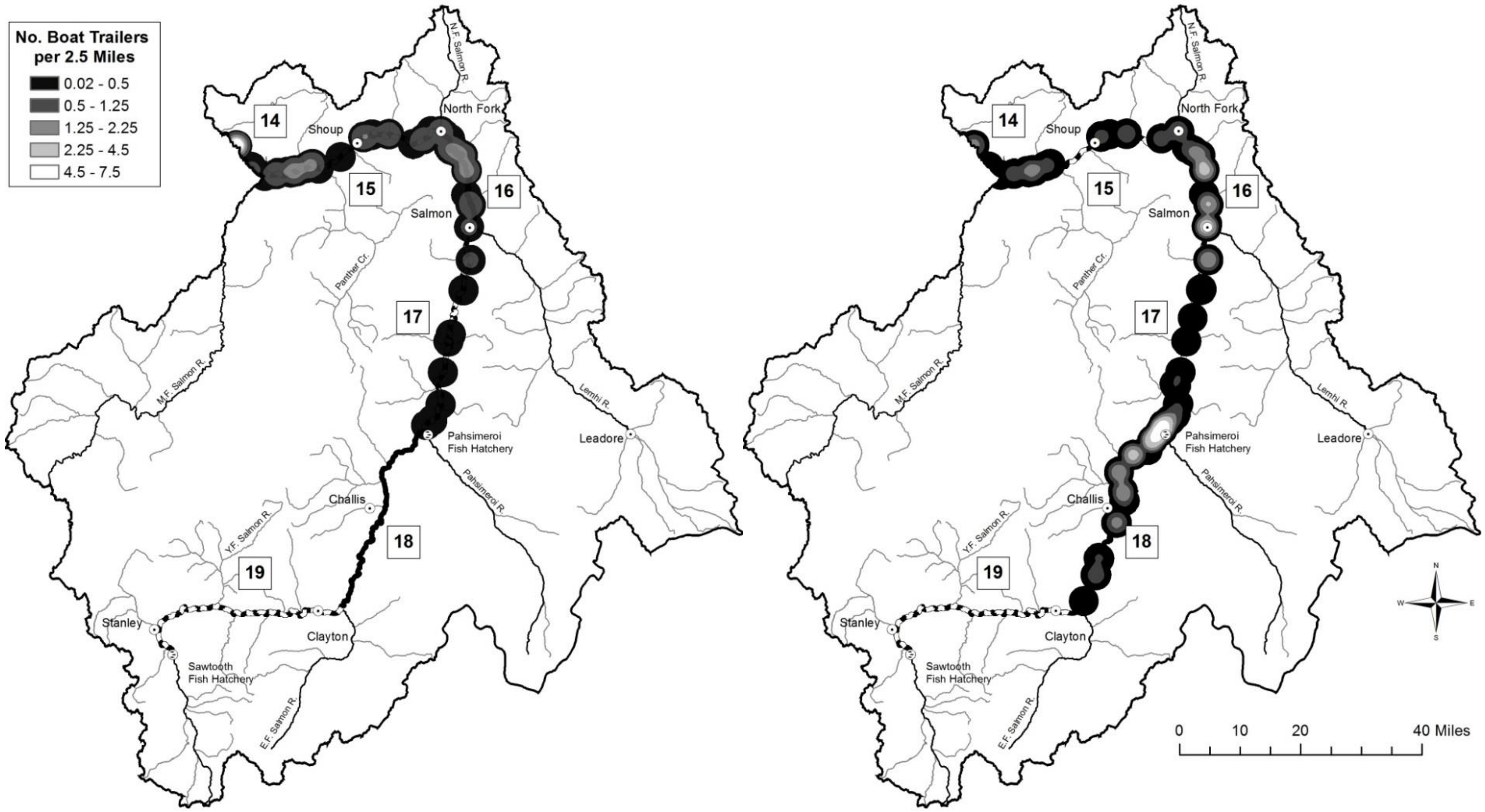

Figure 49. Angler boat trailer density (Friday through Sunday) during the fall 2013 and spring 2014 Steelhead fisheries. Fall data is displayed on the left and spring data is on the right. Each boat trailer represents an estimated 2.2 anglers.

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