FISHERY MANAGEMENT INVESTIGATIONS

IDAHO DEPARTMENT OF FISH AND GAME

FISHERIES MANAGEMENT ANNUAL REPORT

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SALMON REGION 2013

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ALPINE LAKES

ABSTRACT

Salmon Regional fisheries staff coordinated with Mackay Fish Hatchery and Sawtooth Flying Service to stock 69 alpine lakes with fish in 2013. A total of 43 lakes were stocked with Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi*, 10 lakes with Golden Trout *O. mykiss aguabonita*, nine lakes with Arctic Grayling *Thymallus arcticus*, and seven lakes with triploid Rainbow Trout *O. mykiss*. Lakes were stocked with a combination of fixed-wing aircraft, horseback, or backpacking between June 26 and September 11, 2013.

Fisheries staff surveyed 32 alpine lakes during 2013. Fish were observed in 20 (63%) of the lakes sampled. Westslope Cutthroat Trout were found in 14 lakes, Rainbow Trout were found in five lakes, apparent Cutthroat x Rainbow Trout hybrids were found in eight lakes, Golden Trout were found in four lakes, and Eastern Brook Trout *Salvelinus fontinalis* and tiger muskellunge *Esox masquinongy x Esox lucius* were found in one lake.

Amphibians were found in 17 (53%) of surveyed lakes in 2013. Of the 12 fishless lakes we surveyed, amphibians were found in 10. Amphibians also occurred sympatrically with fish in seven (22%) of the surveyed lakes. Columbia Spotted Frogs *Rana luteiventris* were found in seven fishless lakes, and Western Long-toed Salamanders *Ambystoma macrodactylum* were found in six fishless lakes. Columbia Spotted Frogs occurred sympatrically with fish in seven lakes and Western Long-toed Salamanders occurred sympatrically with fish in one lake. We did not find any Western Toads *Bufo boreas* during alpine lake surveys in 2013.

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INTRODUCTION

The Salmon Region of the Idaho Department of Fish and Game (IDFG) has approximately 1,000 alpine lakes within its borders. Alpine lakes in the Salmon Region 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. Regional alpine lake elevations range from 1,970 m to almost 3,000 m. Anglers using alpine lakes have consistently expressed the highest level of satisfaction with their fishing experience (IDFG Fisheries Management Plan 2013-2018). 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 alpine lakes that are located in national forest, designated wilderness, and national recreation areas are 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).

Of the over 1,000 Salmon Region alpine lakes, 197 are requested to be stocked on a three-year rotation with either Arctic Grayling *Thymallus arcticus*, Golden Trout *Oncorhynchus aquabonita*, triploid Rainbow Trout *O. mykiss*, or Westslope Cutthroat Trout *O. clarkii lewisi* fry. The stocking rotations provide diverse alpine lake fishing opportunities, and ensure persistence of fish populations in alpine lakes over long-term periods. Stocking rotation A includes 59 alpine lakes, rotation B is comprised of 77 lakes, and rotation C has 61 lakes. The stocking schedule for rotations A, B, and C for 2013 through 2022 are shown in Table 1.

OBJECTIVES

Alpine Lake Stocking

1. Maintain viable and diverse alpine 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 alpine lakes in a cost effective manner by evaluating stocking successes and future needs with alpine lake surveys.

Mountain Lake Surveys

1. Assess the current status of alpine lake fish and amphibian populations in the Salmon Region using standard alpine lake surveys.

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

STUDY AREA AND METHODS

Alpine Lake Stocking

The Salmon Region stocked 69 high alpine lakes in the Salmon-Challis National Forest (SCNF), Sawtooth National Recreation Area (SNRA), and Sawtooth Wilderness Area (SWA) in 2013 (Table 2). Lakes were stocked with Arctic Grayling, Golden Trout, Rainbow Trout, and Westslope Cutthroat Trout fry (~75 mm TL). Rainbow Trout eyed eggs obtained from Troutlodge Fish Hatchery in Sumner, Washington were reared at IDFG's Mackay Fish Hatchery to fry stage. Cabinet Gorge Fish Hatchery contributed Westslope Cutthroat Trout eyed eggs that were also reared at Mackay Fish Hatchery to the fry stage. Arctic Grayling broodstock were spawned at Meadow Lake, Wyoming, and eggs were incubated and reared at IDFG's Ashton Fish Hatchery until alevins were able to feed, then transferred to Mackay Fish Hatchery. Golden Trout stock originated at Story Fish Hatchery in Story, Wyoming and eyed eggs were transferred and reared at Mackay Fish Hatchery before release. Regional stocking of fry into alpine lakes follows a three-year rotation with each lake usually receiving fish once every three years. Salmon Region fisheries biologists use the nomenclature rotations A, B, and C to describe rotations on which lakes are to be stocked each year. Alpine lakes included in rotations A, B, and C can be found in Appendix A. Rotational stocking information included each lake's IDFG catalog number, species and number of fish stocked, latitude-longitude concatenation identification (LLID), and the lake's location in WGS84 datum. The 2013 stocking followed Rotation C.

Beginning in 2012, IDFG contracted aerial alpine lake stocking with Sawtooth Flying Service based in McCall, Idaho. We provided the contracting company with the list of alpine lakes to be stocked annually based on the annual rotation. Each stocking rotation includes 59 to 77 lakes and usually requires multiple flights and/or days to complete. Flights are typically conducted in late August and early September. The Sawtooth Flying Service pilot and one-person crew carry GPS coordinates to reference each lake as well as physical maps with the location and best flight route of lakes to be stocked during each rotation. Previous annual stockings by IDFG staff determined the most efficient flight plan to use when conducting aerial stocking. Flight routes for each rotation were refined in recent years to minimize flight time and fuel costs. Further details of regional aerial stocking methodology were reported in Flinders et al. (2013).

Mountain Lake Surveys

Many of the lakes (~35%) we surveyed in 2013 were selected because they were previously reported to support naturally reproducing populations of fish. Survey results at Finger #2, Kelly, MF Little Timber #1, Marten, Mill Creek Reservoir, Mystery #1, Spruce Gulch, and the four Terrace Lakes in 2002, 1975, 2008, 1980, 2005, 1994, 1994, 1994, and 1994, respectively, resulted in removing these lakes from the stocking rotation. We visited these lakes in 2013 to assess whether natural reproduction was sufficient to maintain quality fishing opportunities. We consider quality fishing as containing multiple age classes and producing a catch rate of at least 1 fish per hour. We also surveyed several lakes that had been stocked more recently to determine whether they were currently providing quality fishing opportunities as a result of stocking.

Regional fisheries personnel completed 32 alpine lake surveys by angling and/or gill netting in 2013. Lakes were located in the Lemhi, Yankee Fork and Middle Fork Salmon River drainages, Challis and Slate creeks, and in the Bighorn Crags and Sawtooth Basin areas.

Regional survey crews documented fish presence, species present, relative abundance, and CPUE (fish per hour) for angling and/or gillnetting. For gill-netted lakes, we set one experimental sinking net (36 m x 1.8 m, composed of six panels of 10.0, 12.5, 18.5, 25.0, 33.0, and 38.0 mm bar mesh) overnight for 12 to 14 hours. Fish captured were measured to the nearest mm total length (TL), and weighed in grams (g). Fish spawning potential of each lake's inlet and outlet was visually assessed, along with total spawning area (m^2) available, and the presence of fry and fingerlings was noted to determine whether natural reproduction was occurring in the lake. Physical characteristics of the lake, surrounding geology and general plant species presence, weather conditions at the time of survey, and access (km) by trail and cross-country travel were also recorded. The shoreline area was visually inspected for campsites, fire rings, and other signs of human use. We used Bahls (1992) campsite impact rating as none, low (1-4), moderate (5-7) or high (>7) according to assess the relative amount of human use at each lake. Amphibian surveys were conducted using a modification of the timed visual encounter survey (VES) (Crump and Scott, 1994). The main deviation from the VES methodology was that the survey crew performed a full perimeter search without accounting for various habitat types. Amphibian genetic samples were taken when possible. Survey data were entered into the statewide lakes database for future analysis.

RESULTS AND DISCUSSION

Mountain Lake Stocking

In 2013, Mackay Fish Hatchery personnel supervised the stocking of 64 alpine lakes (Table 2) by aircraft in the SCNF, SNRA, and SWA on four dates: August 21, and September 1, 9, and 11. Forty lakes were aerially stocked with Westslope Cutthroat Trout fry, ten lakes with Golden Trout fry, nine lakes with Arctic Grayling fry, and five lakes received Troutlodge triploid Rainbow Trout fry. An additional five lakes were stocked by backpacking (2) and horseback (3).

Flight costs totaled $6,724 in 2013, reflecting an average cost of $103.45 per lake. In comparison, 72 lakes were stocked in 2012 for a total cost of $6,643 with an average cost of $92.26 per lake.

Mountain Lake Surveys

We conducted 32 alpine lake surveys in the SCNF and SNRA during summer and fall 2013. Fisheries personnel angled and/or gillnetted fish in 20 (63%) of 32 lakes sampled this year (Table 3). Westslope Cutthroat Trout were found in 14 lakes, Rainbow Trout were found in five lakes, apparent Cutthroat x Rainbow Trout hybrids were found in eight lakes, Golden Trout were found in four lakes, Eastern Brook Trout were found in two lakes, and tiger muskellunge *Esox masquinongy x Esox lucius* were found in one lake (Spruce Gulch Lake)(Table 3).

The majority of fish bearing lakes surveyed in 2013 seemed to be supporting naturally reproducing populations with multiple age classes present, and catch rates well above our desired rate of at least 1 fish per hour (Table 3). For those lakes (Arrastra #1 and #2, Finger #2 and #3, Heart, Kelly, MF Little Timber #1, Mill, Mystery #1 through #3, and Terrace #1 through #4) no management changes are proposed. However, we have found a few cases that warrant management changes which are discussed below.

Marten Lake was last stocked in 1967 with Cutthroat Trout, and those fish have continued to sustain a naturally reproducing population within the lake. However, angling CPUE at Marten Lake in 2013 (0.25 fish per hour) was well below our desired metric of 1 fish per hour. Our 2013 surveys found the trail to Marten Lake was heavily used with four large campsites at the lake. Due to the potential for moderate to high angler use, and extremely low catch rates, additional stocking is recommended to help boost catch rates and meet perceived angling demand. Additionally, we collected Brook Trout in Marten Lake, which had not been previously documented. Two dead Brook Trout adults were found on the shoreline and several Brook Trout fingerlings were caught in a dip net in the littoral area around the lake. The presence of Brook Trout has likely contributed to the decline of the lakes Cutthroat Trout population. Brook Trout commonly displace Cutthroat Trout, and stocking Cutthroat Trout may be needed to sustain this species in Marten Lake without further management action to reduce Brook Trout.

Spruce Gulch Lake supports a naturally reproducing population of Brook Trout that originated from stocking events in the 1930s and 1940s. In 2007, biologists stocked 439 tiger muskellunge in the lake as part of a research project to eradicate the Brook Trout. As of 2013, Brook Trout are still present in the lake at moderate abundance (CPUE = 1 fish/hr), and tiger muskellunge are still present as well (visually observed in 2013). In order to completely eliminate Brook Trout from Spruce Gulch Lake, additional eradication efforts will be necessary.

Five of the lakes we surveyed in 2013 are still on our current stocking rotation: Castle Lake #1, Golden Trout Lake, Hoodoo Lake, Mystery Lake #3, and Welcome Lake. These five lakes were surveyed to determine whether our current stocking practices are maintaining quality fishing. Castle Lake #1, Golden Trout Lake, and Welcome Lake are achieving those objectives. However, Hoodoo Lake was fishless in 2013, and our gill netting CPUE at Mystery Lake #3 was fairly low (0.9 fish/hr). Hoodoo Lake was last stocked in 2011, and the 2013 survey noted poor spawning potential and little human-use. However, the last time Hoodoo was surveyed (2007) multiple age classes of fish were detected. Hoodoo Lake may have therefore been subjected to winter kill between these periods, and should be stocked again on the next rotation and re-surveyed to determine whether or not stocking should be discontinued. Although gill netting CPUE was lower than we would like at Mystery Lake #3, the lake should be re-surveyed to verify low abundance persists before management changes take place.

Amphibians were found in 17 lakes in 2013 (Table 4). We observed amphibians in seven fish-bearing lakes and ten fishless lakes. Columbia Spotted Frogs were found in seven fishless lakes, and occurred sympatrically with fish in seven lakes. Western Long-toed Salamanders were found in six fishless lakes, and occurred sympatrically with fish in only one lake.

The Salmon region’s alpine lake strategy involves determining the most efficient use of stocking resources to provide diverse backcountry angling opportunities with high angler satisfaction. The results of our 2013 surveys indicated high catch rates and a diverse size structure of trout in a number of lakes (Table 4). Results from this year’s surveys also identified two lakes where stocking should be discontinued. Survey information on the satisfaction of backcountry anglers in the region would help guide alpine lake management in the future.

MANAGEMENT RECOMMENDATIONS

1. Add Marten Lake to a three-year stocking rotation to prevent Brook Trout from becoming the dominant fish species. Re-evaluate in 2018, after the next stocking event.

2. Explore alternative eradication methods for Spruce Gulch Lake to eliminate the Brook Trout population. Stock with Cutthroat Trout on a rotational basis once eradication objectives are met.

3. Conduct alpine lake surveys extensively throughout the region on a drainage by drainage basis to help us prioritize regional alpine lake management including stocking strategies and regulation changes.

4. Conduct alpine lake angler use and angler satisfaction surveys in the region to better prioritize alpine lake management strategies.

5. Continue to work with regional fisheries managers throughout the state to develop a statewide Mountain Lake Fish Management Plan.

Table 1. Salmon Region alpine lake stocking rotations A, B, and C by year for 2013 through 2022.

	Stocking Rotation Sequence		
	A	B	C
Year			2013
of	2014	2015	2016
Stocking	2017	2018	2019
	2020	2021	2022

Table 2. Alpine lakes stocked in the Salmon Region in 2013.

Lake name	Species[a]	No. fish stocked	Stocking method
Alpine	GN	3,850	Plane
Alpine Creek #15	GRA	927	Plane
Basin Creek #5	WCT	1,129	Plane
Bear Valley #3	WCT	150	Backpack
Big Clear Creek	GN	1,030	Plane
Birdbill	WCT	512	Plane
Broncho	WCT	743	Plane
Buck Creek #4	GRA	238	Plane
Cabin Creek #3	WCT	615	Plane
Cabin Creek #4	WCT	102	Plane
Cabin Creek #7	WCT	205	Plane
Cabin Creek Peak #1	WCT	148	Plane
China #3	GN	368	Plane
Crater	GN	736	Plane
Devils	WCT	343	Plane
Everson	WCT	1,500	Backpack
Finger #3	WCT	472	Plane
Glacier	GN	294	Plane
Golden Trout	GN	957	Plane
Gooseneck	GN	221	Plane
Harbor	WCT	3,587	Plane
Heart	WCT	1,666	Plane
Hidden	WCT	1,128	Plane
Knapp #14	GRA	250	Plane
Knapp #7	WCT	198	Plane
Line	WCT	359	Plane
Lola #2	WCT	500	Plane
Lola #3	WCT	500	Plane
Loon Creek #11	WCT	171	Plane
Loon Creek #13	WCT	229	Plane
Loon Creek #15	WCT	171	Plane
Loon Creek #3	WCT	148	Plane
Lost Packer	RBT	1,028	Plane
McNutt	WCT	414	Plane
Middle Fork Hat Creek #3	RBT	1,031	Horseback
Middle Fork Hat Creek #4	RBT	437	Horseback
Middle Fork Hat Creek #5	WCT	1,087	Horseback
Mystery #1	GN	515	Plane
Mystery #2	GN	1,030	Plane
Nez Perce	GRA	250	Plane

Lake name	Species[a]	No. fish stocked	Stocking method
North Fork East Fork Reynolds #2	WCT	1,307	Plane
North Fork East Fork Reynolds #4	WCT	999	Plane
Paragon	WCT	267	Plane
Park Fork Creek	WCT	300	Plane
Pass	GN	387	Plane
Patterson Creek #1	WCT	129	Plane
Patterson Creek #2	WCT	200	Plane
Puddin Mountain #1	RBT	504	Plane
Puddin Mountain #10	WCT	267	Plane
Puddin Mountain #15	WCT	676	Plane
Puddin Mountain #2	RBT	504	Plane
Puddin Mountain #5	RBT	998	Plane
Puddin Mountain #6	RBT	998	Plane
Rainbow	GRA	255	Plane
Ramshorn	WCT	346	Plane
Right Fork Big Eightmile	WCT	143	Plane
Rocky	WCT	457	Plane
Seafoam #6	GRA	602	Plane
Ship Island #5	WCT	1,006	Plane
Ship Island #7	WCT	330	Plane
South Fork Moyer Creek	GRA	226	Plane
Tango #4	WCT	667	Plane
Tango #5	WCT	247	Plane
Tango #6	WCT	889	Plane
U P	WCT	1,006	Plane
Upper Redfish #1	GRA	1,221	Plane
Vanity #13	GRA	255	Plane
Welcome	WCT	1,226	Plane
Wilson	WCT	1,006	Plane

[a] GN=Golden Trout, GRA=Grayling, RBT=Rainbow Trout, and WCT=Westslope Cutthroat Trout.

Table 3. Spawning potential, human use, stocking history, fish presence, amphibian presence, fish catch rate and size range for alpine lakes surveyed in the Salmon Region in 2013.

Lake name	Survey date	Spawning potential	Bahls impact rating	Last stocked	Fish species observed[a]	Amphibian species observed[b]	Survey type	CPUE (fish/hr)	Mean size (range) (mm TL)
Arrastra Creek #1	7/20	High	Low	Never	WCT, WCTxRBT	None	Angling	9.5	211 (129- 301)
Arrastra Creek #2	7/20	High	Low	Never	WCT, WCTxRBT	CSF	Angling	24.5	204 (130- 270)
Castle Lake #1	7/18	Low	Low	2011	WCT	CSF	Angling	19	284 (190- 361)
Castle Lake #2	7/18	None	None	1999	None	WLTS	Angling	--	--
							Gillnetting	--	
F 82 Lake	9/12	None	None	Never	None	WLTS	Angling	--	--
							Gillnetting	--	
Finger Lake #1	8/28	None	None	Never	None	CSF	Gillnetting	--	--
Finger Lake #2	8/28	High	Low	1997	RBT	CSF and WLTS	Gillnetting	1.4	260 (145- 425)
Finger Lake #3	8/28	None	Low	1997	WCT	None	Gillnetting	1	403 (270- 498)
Golden Trout Lake	7/17	High	Low	2013	WCT. GN	None	Angling	5.3	195 (113- 310)
Heart Lake	7/18	Low	Low	2008	WCT, WCTxRBT	None	Angling	3.5	206 (140- 309)
Hindman Lake #2	8/7	None	None	1997	None	CSF	Angling	--	--
Hindman Lake #3	8/7	None	None	1995	None	CSF	Angling	--	--
Hoodoo Lake	8/16	None	Low	2011	None	WLTS	Angling	--	--
Kelly Lake	9/11	High	Low	1996	WCT, RBT	None	Angling	2.3	239 (160- 300)
Marten Lake	9/11	Medium	Low	1967	WCT, EBT	CSF	Angling	0.3	280
Middle Fork Little Timber #1	9/13	High	Low	1998	WCT	None	Angling	10	252 (110-360)
Middle Fork Little Timber # 1A	9/13	None	None	Never	None	None	Visual	--	--
Mill Creek Reservoir #1	8/27	High	Moderate	1998	RBT	None	Angling	3.7	203 (100- 262)
Mystery Lake #1	7/12	High	Low	2001	GN	None	Angling	2.4	186 (115- 240)
							Gillnetting	4.2	212 (125-330)
Mystery Lake #2	7/10	High	Low	1996	GN, WCT	None	Gillnetting	2.1	275 (177- 330)
Mystery Lake #3	7/10	High	None	2011	GN, WCT	None	Gillnetting	0.9	190 (130- 250)
Mystery Lake #4	7/11	None	None	Never	None	None	Visual	--	--
Silver Creek Lake	7/20	Low	None	Never	None	CSF and WLTS	Angling	--	--
Spruce Gulch Lake	9/12	Low	Low	2007[c]	EBT, TM	None	Angling	1.0	205 (170- 235)
Terrace Lake #1	7/19	High	None	1998	RBT, WCTxRBT	CSF	Angling	2.5	299 (231- 375)

Lake name	Survey date	Spawning potential	Bahls impact rating	Last stocked	Fish species observed[a]	Amphibian species observed[b]	Survey type	CPUE (fish/hr)	Mean size (range) (mm TL)
Terrace Lake #2	7/19	High	Low	1998	WCT, WCTxRBT	CSF	Angling	3.0	285 (197- 365)
Terrace Lake #3	7/18	High	Low	1998	WCT, WCTxRBT	None	Angling	4.3	191 (157- 241)
Terrace Lake #4	7/19	High	Low	1998	RBT, WCTxRBT	None	Angling	3.0	317 (280- 356)
Trap Cr Lake #3	9/11	None	None	Never	None	CSF and WLTS	Visual	--	--
Trap Cr Lake #3A	9/11	None	None	Never	None	CSF	Visual	--	--
Valley Creek Lake #1	8/8	None	Low	Never	None	CSF and WLTS	Angling	--	--
Welcome Lake	7/18	Medium	Low	2013	WCT, WCTxRBT	CSF	Angling	8.9	181 (109- 260)

[a] WCT=Westslope Cutthroat Trout, RBT=Rainbow Trout, WCTxRBT= Apparent Cutthroat x Rainbow Trout hybrid, GN=Golden Trout, TM=Tiger muskellunge, and EBT=Brook Trout.

[b] CSF-Columbia Spotted Frog and WLTS=Western Long-toed Salamander.

[c] Tiger muskellunge stocked in 2007

LOWLAND LAKES AND RESERVOIRS

EVALUATING CONDITION OF HATCHERY TROUT AFTER WINTER HOLDOVER

ABSTRACT

Iron, Meadow, Wallace, and Yellowjacket lakes were sampled in the spring of 2013 using standard lowland lake experimental gill nets to estimate the relative abundance, condition, and size structure of hatchery trout that survived over winter.

Thirty one gill net hours at Iron Lake shortly after ice-off in June resulted in capturing eight Rainbow Trout *Oncorhynchus mykiss* and 27 Westslope Cutthroat Trout *O. clarkii lewisi*, for a total catch-per-unit-effort (CPUE) of 1.1 fish/hr. Angling catch rates were higher, with eight hours of angling producing seven Rainbow Trout and 11 Cutthroat Trout for a CPUE of 2.3 fish/hr. Westslope Cutthroat Trout <230 mm TL were in excellent condition (W_r = 112), while the condition of larger fish (>230 mm) was poor (W_r = 69).

At Meadow Lake, 40 gill net hours resulted in capturing 80 Westslope Cutthroat Trout and 18 Rainbow Trout, for a total CPUE of 2.4 fish/hr. Relative weights of Westslope Cutthroat Trout and Rainbow Trout in Meadow Lake this spring were 84 and 73, respectively.

At Wallace Lake, 45 gill net hours resulted in capturing 22 Rainbow Trout, for a CPUE of 0.5 fish/hr. In 2013, the mean W_r of Rainbow Trout in Wallace Lake was 67, which was substantially lower than in 2005 (W_r = 93). Minnow trapping in August captured 101 Redside Shiners *Richardsonius balteatus* at Wallace Lake, measuring 57 – 141 mm TL. We suspect Redside Shiner densities may be negatively affecting condition of Rainbow Trout.

Gill netting at Yellowjacket Lake in 2013 collected 20 Rainbow Trout and 15 Westslope Cutthroat Trout, for a combined CPUE for 0.73 fish/hr. Average W_r values for Rainbow Trout and Westslope Cutthroat Trout in Yellowjacket Lake were 100 and 119, respectively, suggesting excellent body condition of overwintering trout.

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INTRODUCTION

Winter survival of hatchery trout stocked in popular lowland lakes and reservoirs is important for maintaining a diverse size structure (i.e. multiple age classes) of fish available to anglers. Iron, Meadow, Wallace, and Yellowjacket lakes are four of the most popular lowland lake fisheries in the Salmon region, and all four lakes are stocked annually. Iron Lake currently receives over 5,000 Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* fry and 2,000 catchable-sized (200 – 280 mm) triploid Rainbow Trout *O. mykiss* each year. Meadow Lake receives over 4,000 Westslope Cutthroat Trout fry and 4,000 catchable triploid Rainbow Trout each year. Wallace Lake receives just under 2,000 Westslope Cutthroat Trout fry and around 2,000 catchable Rainbow Trout each year. Yellowjacket Lake is stocked with approximately 6,000 Westslope Cutthroat Trout fry each year. All four lakes fall under general bag and possession limits for the Salmon region and are open to angling all year. During the summer 2012, anglers expressed concerns that the condition of trout that survive over winter in these four lakes was poor. In Wallace Lake in particular, anglers reported catching abundant numbers of Redside Shiners *Richardsonius balteatus* and very few Rainbow Trout. In response to angler concerns, we sampled all four lakes with standard lowland lake experimental gill nets in the spring 2013 to assess the relative abundance and condition of trout in these lakes. Additionally, we used minnow traps to sample the Redside Shiner population in Wallace Lake.

OBJECTIVES

1. Evaluate relative abundance, condition, and size structure of hatchery Westslope Cutthroat Trout and/or Rainbow Trout in Iron, Meadow, Wallace, and Yellowjacket lakes in the spring from the fall/winter holdover.

2. Document the size structure of Redside Shiner in Wallace Lake.

STUDY AREA AND METHODS

Iron Lake

Iron Lake (Iron Lake #2) (WGS datum: 44.90680°N, -114.19459°W) is a cirque lake located in south-central Lemhi County at the southern end of SCNF Road #20, commonly called the Salmon River Mountain or Salmon Ridge Road, about 38 km southwest of the town of Salmon. The lake is situated at 2,685 m in elevation with a surface area of 6.6 ha. The lake is a popular fishery in summer months due to its eight-site campground and relatively easy access. Iron Lake has been stocked annually since 1968 (with the exception of 1984) with Rainbow Trout and Cutthroat Trout.

A two-person regional fisheries crew sampled the lake on shortly after ice off June 18-19, 2013 using a combination of angling and gill nets. Fisheries staff angled for four hours on June 18, but did not obtain the desired minimum 20-fish sample. The crew set one pair of standard lowland lake experimental gill nets, one sinking and one floating (46 m x 2 m, with six panels consisting of 19, 25, 32, 38, 51, and 64 mm bar mesh), overnight to capture additional fish. Catch-per-unit-effort (CPUE) was calculated as the number of fish caught divided by the total hours of the set. Fish were identified to species, measured (mm TL), and weighed (g). Fish were also examined for signs of disease or other physical abnormalities. Rainbow Trout length and weight data were used to calculate relative weights (W_r) using formulas developed by Murphy and Willis (1996). An amphibian survey was also conducted using a modification of the timed visual encounter survey (VES) methodology of the lake's shoreline perimeter (Crump and Scott, 1994). The main deviation from the VES methodology was that the survey crew performed a full perimeter search without accounting for various habitat types.

Meadow Lake

Meadow Lake (Meadow Creek Lake) (WGS84 datum: 44.43196° N, -113.31548° W) is a cirque lake at the head of Meadow Lake Creek, about 5 km southwest of the town of Gilmore and 31 km south-southwest of the nearest inhabited town, Leadore, Idaho. The lake is approximately 6.5 ha at 2,787 m in elevation. It is a popular fishing destination that includes an 18-site US Forest Service campground. Meadow Lake has no inlet but its outlet, Meadow Lake Creek, flows into Texas Creek, a tributary of the Lemhi River. Meadow Lake has been stocked annually since 1967 (with the exception of 2003) with Rainbow Trout and/or Cutthroat Trout. A creel survey conducted in 1988 estimated 4,547 hours of angler effort, with a catch rate of approximately 0.75 fish/hr (Lukens and Davis, 1989). No gill net surveys have occurred at Meadow Lake prior to 2013.

A regional fisheries crew sampled Meadow Lake on June 11, 2013 after most of the ice was off the lake using three floating lowland lake experimental gill nets (46 m x 2 m, with six panels consisting of 19, 25, 32, 38, 51, and 64 mm bar mesh). Since approximately one-half of the lake was still covered with ice, the nets were on the northern half of the lake in open water. Nets were deployed in the evening and fished overnight, and removed the following morning.

Wallace Lake

Wallace Lake (WGS84 datum: 45.24692°N, -114.00499°W) is a small 2.7 ha lake located about 12 km northwest of the town of Salmon. Situated at 2,471 m in elevation, the lake is accessible by a four-wheel-drive road and includes a developed campground and small boat ramp. While there is no inlet, the outlet drains into Wallace Creek, a tributary of the Salmon River. The lake was classified as having low natural spawning potential for trout in 1978 (Jeppson and Ball 1979), and has been stocked annually with either Rainbow Trout or Cutthroat Trout since 1968. A 1988 creel survey at Wallace estimated 2,805 hours of angler effort, with a catch rate of 0.44 fish/hr (Lukens and Davis, 1989). In 2005 Redside Shiners were first detected in Wallace Lake (Esselman et al. 2007). The last gill net survey at Wallace Lake, conducted in 2005, confirmed that Redside Shiners were more abundant than Rainbow Trout (CPUE = 0.92 Shiners/ hour versus 0.01 Trout/ hour).

To sample the entire fish community in Wallace Lake in 2013, we set three standard lowland lake experimental gill nets (Lamansky and Meyer, 2012) on June 11, and three minnow trap nets (38 cm L x 24 cm W x 26 cm H; 3 cm opening; 2 mm x 4 mm mesh size) in August. Minnow traps were each baited with canned tuna meat and deployed about 200 m apart along the shoreline at a depth of about 1 m. Nets were fished 15 to 30 minutes and then removed.

Yellowjacket Lake

Yellowjacket Lake (Yellowjacket Lake #2) (WGS84 datum: 45.06774°N, -114.55219°W) is a 2.7 ha cirque lake located in the SCNF approximately 53 km west of the town of Salmon, Idaho. At 2,422 m in elevation, the lake and its seven-site campground serve as a popular trailhead staging area adjacent to the Frank Church River of No Return Wilderness and the

Bighorn Crags. Rainbow Trout were stocked annually in the lake as catchables from 1968 until 1996, with two additional stockings of Rainbow Trout fry added in 1999 and 2003. Introductory stockings of Cutthroat Trout fry were made in 1996 and 1998 with 500 and 620 fry, respectively. Beginning in 2010, IDFG increased stocking efforts at Yellowjacket Lake to an average of 6,300 Westslope Cutthroat Trout fry annually. A 1988 creel survey estimated 1,990 hours of angler effort with a catch rate of 0.54 fish/hr, and 54% return-to-creel for the approximately 1,997 Rainbow Trout stocked that year (Lukens and Davis, 1989). Yellowjacket Lake was last surveyed with gill nets in 2009.

A regional fisheries crew surveyed the lake on June 19, 2013 using three sinking Swedish backpacking gill nets (36 m x 1.8 m, composed of six panels of 10.0, 12.5, 18.5, 25.0, 33.0, and 38.0 mm bar mesh). The nets were fished overnight and removed the next morning. An amphibian survey was also conducted during the lake sampling effort.

RESULTS AND DISCUSSION

Iron Lake

We caught seven Rainbow Trout and 11 Westslope Cutthroat Trout during eight hours of angling effort at Iron Lake on June 18, 2013. Unable to collect the desired 20-fish representative sample by angling, fisheries staff deployed two gill nets overnight for 15.4 hours each, capturing 35 more fish comprised of eight Rainbows and 27 Westslope Cutthroat Trout. Total CPUE for gill nets and angling was 1.1 fish/hr, and 2.3 fish/hr, respectively. Rainbow Trout from both sampling events ranged in length from 210-310 mm, with a mean of 267 mm TL (SE $\pm$ 7.7).Westslope Cutthroat Trout TL ranged from 128-300 mm with a mean of 214 mm (SE $\pm$ 8.9) (Figure 1). Overall, mean W_r of Westslope Cutthroat Trout was 95, indicating good body condition. However, only Westslope Cutthroat Trout less than 230 mm showed high relative weight values (avg. Wr = 112), while Westslope Cutthroat Trout larger than 230 mm TL showed much poorer condition (avg. Wr = 69) (Figure 2). Rainbow Trout body condition was poor as well, averaging 56. We did not capture any smaller Rainbow Trout (< 210 mm TL) in 2013.

In comparison, our 2009 gill net survey resulted in capturing a minimum of five Cutthroat Trout and 75 Rainbow Trout. The 2009 crew lost approximately half of the fish out of their canoe that year, so we are unable to calculate a CPUE value. Rainbow Trout ranged in TL from 190 to 350 mm (mean 272 mm $\pm$ 3.2 SE) and Westslope Cutthroat Trout ranged from 280 to 310 mm TL (mean 282 mm $\pm$ 14.8 SE) in 2009. Relative weight for Rainbow Trout averaged 75 in 2009, and Westslope Cutthroat Trout relative weight averaged 97. None of the Westslope Cutthroat Trout caught in 2009 exhibited the poor relative weight values observed in 2013, and all of the fish caught in 2009 were larger than 280 mm TL.

From 2005 to 2009, we stocked approximately 2,000 catchable Rainbow Trout per year and 1,250 Cutthroat Trout fry/fingerlings every third year into Iron Lake. Since 2009, we have increased Cutthroat stocking to approximately 5,000 fry per year. The increased stocking of Westslope Cutthroat Trout seems to have resulted in an increased abundance of adult fish in the lake. Even though relative weight values are low, this lake likely sees most of its use from day trip anglers and we feel should be managed more for high catch rates than for large size. We recommend the current stocking plan continue. However, examination of current return-to-creel rates may help us determine whether stocking rates could be reduced without affecting catch rates.

Meadow Lake

We captured 18 Rainbow Trout and 80 Westslope Cutthroat Trout in 41 gill net hours at Meadow Lake on June 11-12, 2013. Catch-per-unit-effort was 2.4 fish/hr for all trout combined. Westslope Cutthroat Trout ranged in TL from 152-364 mm with a mean of 237 mm (SE $\pm$ 5.3) and Rainbow Trout ranged in TL from 167-320 mm and averaged 280 mm (SE $\pm$ 8.0) (Figure 3).

Mean W_r of Westslope Cutthroat Trout and Rainbow Trout were 84 and 73, respectively (Figure 4). Meadow Lake is a very popular put-and-take fishery and typically receives high fishing pressure during peak summer months. Larger fish (>350 mm TL) observed in the 2013 sampling indicates adequate forage was available through the winter with good growth exhibited for both species.

Over the last five years, we have stocked approximately 20,272 catchable Rainbow Trout and 16,872 Cutthroat Trout fry into Meadow Lake. In 2013, 83 percent of our gill net catch was Westslope Cutthroat Trout. The 2013 gill net survey results indicate good survival and growth of Westslope Cutthroat Trout, and indicate a higher abundance of Westslope Cutthroat Trout than Rainbow Trout. However, further studies are warranted to determine how these two species return-to-creel.

Wallace Lake

We collected a total of 22 Rainbow Trout and one Redside Shiner during 45.1 gill net hours at Wallace Lake on June 11-12, 2013. Total CPUE for trout during gill net sampling was 0.5 fish/hr. Rainbow Trout ranged in TL from 258 to 324 mm with a mean of 284 mm (SE $\pm$ 3.9) (Figure 5). Relative weights for Rainbow trout in 2013 ranged from 53 to 77.

The June 2005 gill net survey resulted in capturing 83 fish, comprised of seven Rainbow Trout and 76 Redside Shiners, for a salmonid CPUE of 0.1 fish/hr (Esselman et al. 2007), compared to 0.5 fish/hr in 2013. Similar to our 2013 findings, Rainbow Trout TL ranged from 250-286 mm and averaged 272 mm in 2005 (Figure 5). Eighty-two Rainbow mortalities were observed in a walking survey of the lake's perimeter during the 2005 sampling event. The surveyors noted that the observed mortalities were likely a small percentage of the total salmonid kill, but the entire fish kill was not quantified. Although CPUE for Rainbow Trout in 2013 was five times higher than in 2005, trout condition and abundance remains poor. Average relative weight (Wr = 67) in 2013 was much lower than in 2005 (W_r = 93) (Figure 5), and the current condition of the Rainbow Trout population in Wallace appears to be inadequate for maintaining a quality put-and-take fishery.

Minnow trapping for a combined 1.5 hours on August 14, 2013 captured 101 Redside Shiners in three traps, for a CPUE of 67.3 fish/hr. Redside Shiner ranged in TL from 57-141 mm with a mean of 86 mm (Figure 6). By comparison, Redside Shiners collected by gillnetting in 2005 ranged in TL from 90-156 mm with a mean of 113 mm. Although the two methods of collecting Redside Shiner differed between years, making abundance and size structure comparisons difficult, competition from Redside Shiners is likely having an impact on the abundance of forage available to Rainbow Trout. Zooplankton sampling in 2013 indicated the quality and abundance of forage in the lake is not adequate for maintaining a trout population (see "Zooplankton Quality Monitoring and Evaluation" section of this report).

We do not believe Redside Shiners are native to Wallace Lake, as Rainbow Trout were the only documented species present in the lake during early years of management (Jeppson and

Ball, 1979). Redside Shiners were first documented by Fish and Game staff in Wallace in 2005 (Esselman et al. 2007). Redside Shiner fry feed on small planktonic organisms, but then switch to a diet of mostly terrestrial insects and eggs by their second year in direct competition with trout fingerlings for food and space (Simpson and Wallace, 1978). While Redside Shiners usually school and feed in shallow water by day in warmer months, at night they may disperse and feed over a much wider range. Shiners are likely successfully competing with Rainbow Trout for forage resources in Wallace Lake at this time. Further investigation is warranted to quantify the abundance of Redside Shiners in Wallace Lake and their impact to the Rainbow Trout population. We suggest continued monitoring to determine the population status of Redside Shiners, along with annual zooplankton monitoring to assess forage availability. Additionally, consideration should be given to stocking piscivorous predators into Wallace Lake as one option to reduce Redside Shiner abundance and increase forage availability for Rainbow Trout.

Yellowjacket Lake

We collected 20 Rainbow Trout and 15 Westslope Cutthroat Trout during 48 combined gill netting hours at Yellowjacket Lake in 2013 (CPUE = 0.73 fish/hr). Rainbow Trout ranged in TL from 136 to 315 mm and averaged 201 mm (SE $\pm$ 10.6) while Westslope Cutthroat Trout measured from 149 to 358 mm TL and averaged 205 mm (SE $\pm$ 15.2)(Figure 7). Mean W_r for Rainbow Trout and Westslope Cutthroat Trout were 100 and 119, respectively.

Relative fish abundance in 2013 (0.73 fish/hr) was similar to that found during gill netting in 2009, which resulted in capturing three Cutthroat Trout and 17 Rainbow Trout, for a CPUE of 0.65 fish/hr (Curet et al. 2010). Cutthroat Trout ranged 215 to 260 mm (mean 241 mm, $\pm$ 13.6 SE) and Rainbow Trout ranged 135 to 304 mm (mean 229 mm, $\pm$ 13.4 SE) in 2009, which was similar to what we found in 2013. However, fish condition seemed to have improved from 2009 to 2013 (2009 W_r: WCT=92, RBT=85).

Given the last stocking of Rainbow Trout in Yellowjacket Lake occurred in 2003, the presence of multiple age classes of Rainbow Trout in our 2013 survey indicates that natural reproduction is occurring. Prior to the 2010-2013 Cutthroat Trout stockings, IDFG had only stocked Cutthroat Trout in the lake twice, in 1996 and 1998, with a total of 1,120 fry. The current stocking rate of Cutthroat Trout fry (approximately 6,000 fry each year) appears to be sufficient in diversifying the anglers catch at a relative low cost and should be continued. As Rainbow Trout are currently naturally reproducing, we do not see a current need to resume stocking Rainbow Trout in Yellowjacket Lake.

MANAGEMENT RECOMMENDATIONS

1. Monitor Rainbow Trout condition in Iron Lake concurrently with ZQI monitoring to determine if fish condition improves and if food is a limiting factor. Collect biological samples to analyze for disease/parasites if poor condition persists.

2. Monitor the Rainbow Trout and Cutthroat Trout population in Meadow Lake and Iron Lake periodically to assess population size structure and determine stocking levels that will maintain adequate abundances and sizes of trout. Conduct an angler exploitation study to determine any differences in return-to-creel ratios for Rainbow Trout and Cutthroat Trout, which will dictate future stocking of both species.

3. Determine the viability of introducing a highly pisciverous fish species into Wallace Lake, such as Tiger Trout *Salmo trutta x Salvelinus fontinalis*, to prey upon Redside Shiners and reduce their abundance.

4. Develop methods to assess Redside Shiner abundance and document the effects of predator introductions.

5. Monitor ZQI/ZPR indices in Wallace Lake once a Redside Shiner predator control program has been implemented to determine whether zooplankton forage becomes more available for stocked Rainbow Trout.

6. Monitor Yellowjacket Lake periodically (ever 2 to 5 years) to determine if current stocking levels of Cutthroat Trout and naturally reproducing Rainbow Trout are maintaining adequate abundances and sizes.

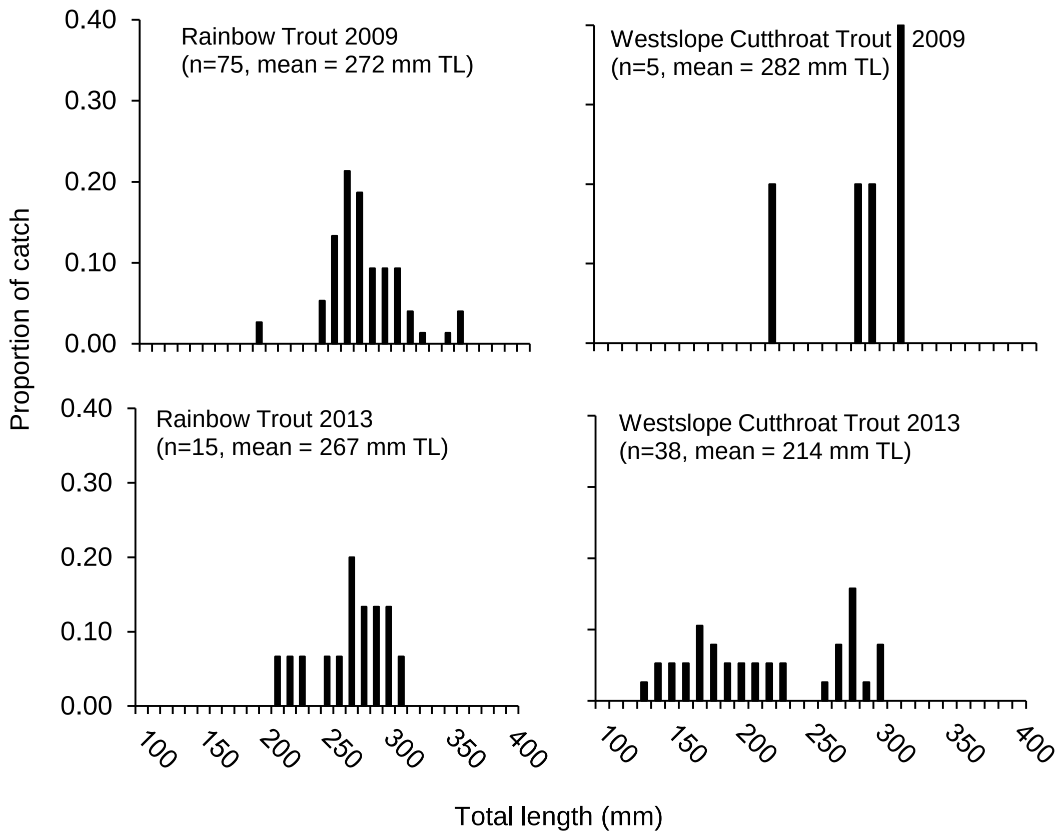

Figure 1. Length frequency histogram of Rainbow Trout and Westslope Cutthroat Trout collected in gill nets during August 2009 (top) and June 2013 (bottom) sampling at Iron Lake.

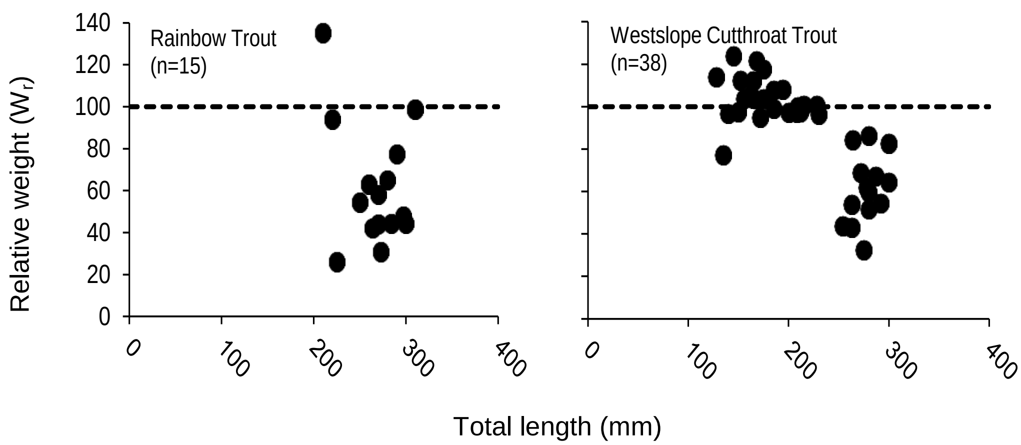

Figure 2. Rainbow Trout and Westslope Cutthroat Trout relative weights (W_r) by total length (TL) for Iron Lake in 2013.

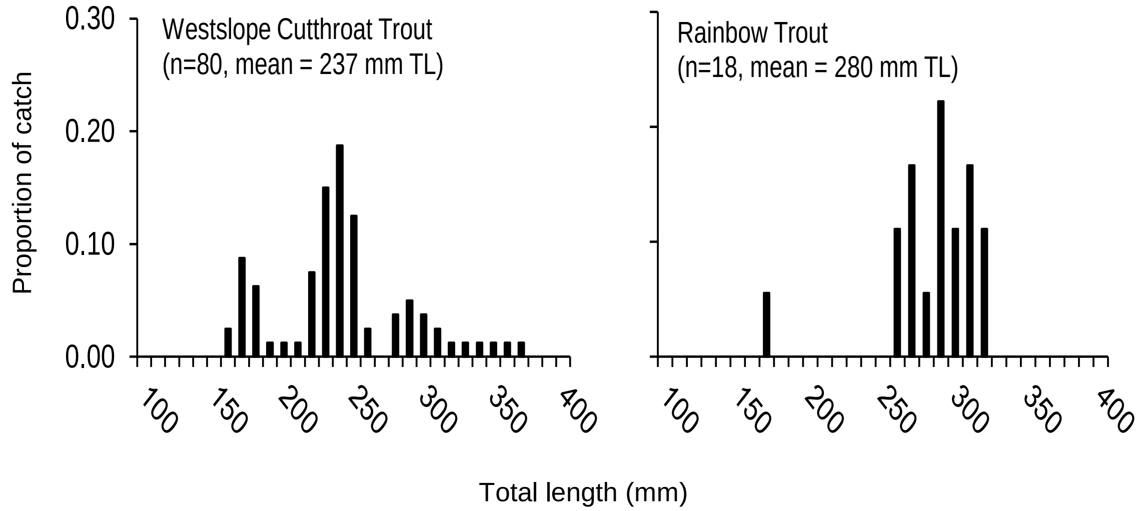

Figure 3. Length frequency histogram of Westslope Cutthroat Trout and Rainbow Trout collected in gill nets during June 2013 sampling at Meadow Lake.

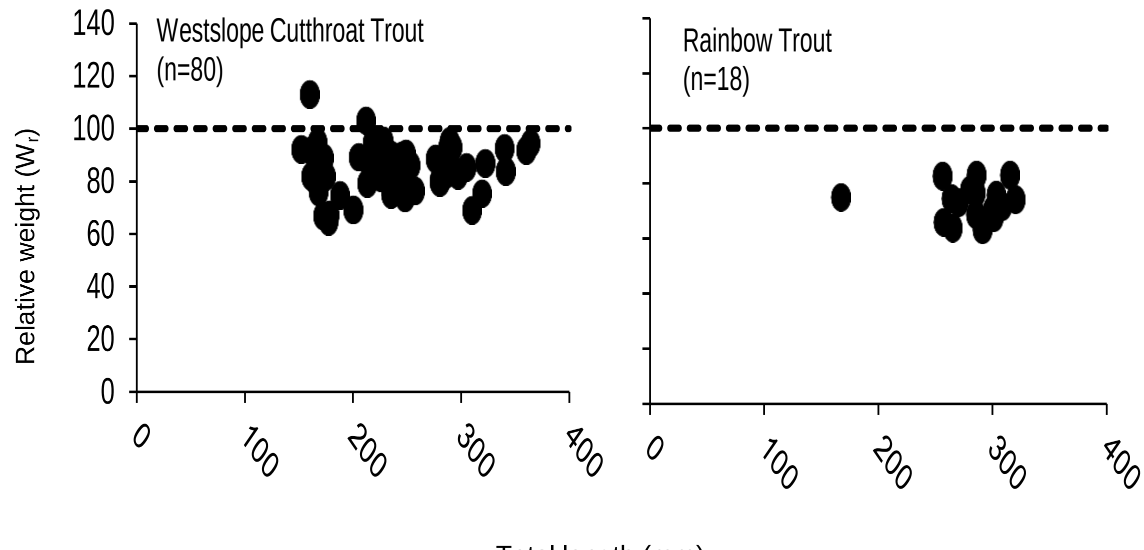

Figure 4. Westslope Cutthroat Trout and Rainbow Trout relative weights (W_r) by total length (TL) for Meadow Lake in 2013.

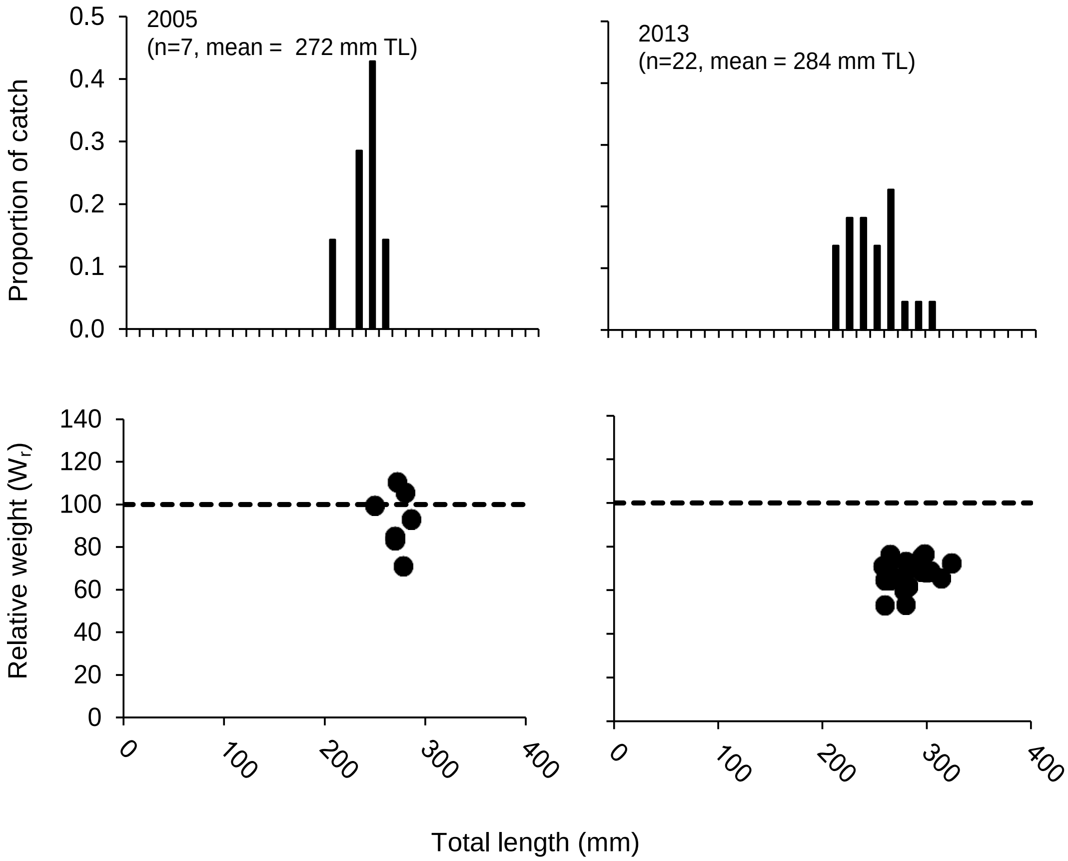

Figure 5. Length frequency histogram (top) and relative weight (W_r) by total length (TL) (bottom) for Rainbow Trout sampled at Wallace Lake in June 2005 and 2013.

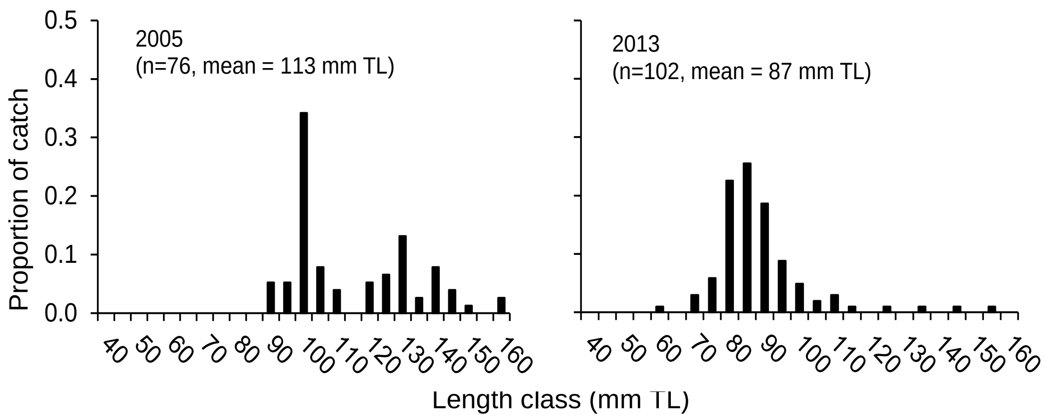

Figure 6. Length frequency histogram of Redside Shiners collected in gill nets in June 2005 and in minnow traps in August 2013 at Wallace Lake.

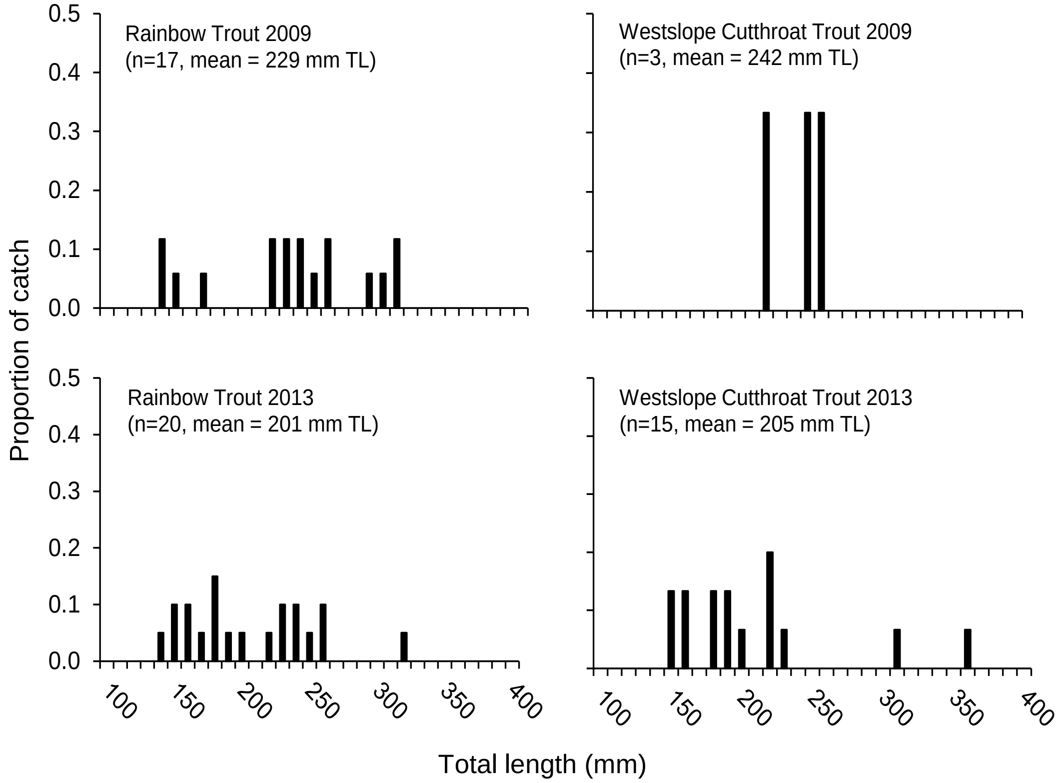

Figure 7. Length frequency histogram of Rainbow Trout (left) and Westlope Cutthroat Trout (right) collected in gill nets during August 2009 and June 2013 sampling at Yellowjacket Lake.

ZOOPLANKTON QUALITY MONITORING AND EVALUATION

ABSTRACT

Regional fisheries staff sampled zooplankton in August 2013 to determine forage availability for trout in three of the region's most popular lowland lakes: Herd, Jimmy Smith, and Wallace lakes. Three sites were sampled at each of the three 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 2.42, the highest index value for 10 sample periods at Herd Lake and the highest value ever recorded for all regional lowland lakes sampled in the Salmon Region to date. Mean ZQI at Jimmy Smith Lake was 1.97 in 2013, compared to a mean ZQI of 2.02 in 2012. These are the highest values recorded in 10 sampling periods at Jimmy Smith Lake. Mean ZQI and ZPR at Wallace Lake in 2013 was 0.0 for both, indicating extremely low zooplankton abundance.

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INTRODUCTION

Herd and Jimmy Smith lakes, in the East Fork Salmon River drainage, are two popular lowland lake fisheries in the Salmon Region where Rainbow Trout *Oncorhynchus mykiss* populations are maintained through natural reproduction. Previous study has indicated that maximum fish size in each of the two lakes is controlled by an overabundance of fish (Brimmer et al. 2003), likely competing for forage and space. In an effort to produce larger fish, IDFG has attempted to reduce the Rainbow Trout population and thereby reduce competition for food resources in both lakes, through various methods. IDFG stocked Tiger Muskellenge *Esox masquinongy x Esox lucius* in Herd Lake in 2006. Next daily trout bag limits were increased in 2011 from six fish to 25 fish per day, in both Herd and Jimmy Smith lakes. In the early 2000s, IDFG began measuring zooplankton abundance in both lakes. Forage resources appeared to be very limited during the early years of monitoring, but zooplankton increased dramatically in 2012, suggesting either an increase in zooplankton production or a decrease in consumption by trout. We continue monitoring the plankton abundance in both lakes to assess the abundance and quality of forage available to Rainbow Trout in those lakes.

In Wallace Lake, gill net sampling in 2005 indicated the lake was being overrun with Redside Shiner *Richardsonius balteatus* that may have been negatively affecting survival and growth of stocked Rainbow Trout. A gill net set in June 2005 captured 83 fish, comprised of seven Rainbow Trout and 76 Redside Shiners. Gillnets were fished for 82.1 hours and produced an extremely low capture rate for trout of 0.1 Rainbow Trout per hour. A winter kill event was also documented at this time (Esselman et al. 2007). We believe the observed poor growth and survival of Rainbow Trout in recent years in Wallace is a result of reduced forage availability due to competition between Redside Shiners and Rainbows.

Evaluating primary and secondary productivity in lowland lakes helps fisheries biologists and managers determine the 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). The abundance of large-bodied zooplankton in lakes is of particular interest, as they are a preferred food resource over smaller-bodied organisms. Traditionally, zooplankton productivity (abundance and species diversity) was measured by conducting vertical tows and identifying and enumerating individual organisms in the sample. However, these methods are very time consuming and require prior training to ensure accuracy of species identification. In the 1990s, the Idaho Department of Fish and Game adopted simplified methods for estimating zooplankton abundance (*see* Teuscher 1999) to arrive at appropriate fish stocking rates. These simplified methods require conducting zooplankton tows with three nets, with mesh sizes 153 µm, 500 µm, and 750 µm. The contents of each net are weighed and three indices are calculated to produce a Zooplankton Ration Index (ZPR) and Zooplankton Quality Index (ZQI). Total zooplankton production potential is calculated by weighing the contents of the 153 µm net. Zooplankton Ratio Index (ZPR- ratio of large-bodied to small-bodied zooplankton) is calculated by dividing the weight of the 750 µm sample by the weight of the 500 µm sample. The Zooplankton Quality Index (ZQI- relative abundance of large-bodied zooplankton) is calculated by dividing the sum of weights for the 500 µm and 750 µm samples by ZPR. The two primary plankton indices (ZPR and ZQI) are now used throughout the state as an index of zooplankton quality and abundance in lakes to help inform trout stocking densities.

OBJECTIVES

1. Monitor zooplankton quality index (ZQI) values in Herd, Jimmy Smith, and Wallace Lakes to determine whether zooplankton abundance and quality is sufficient for producing good growth of Rainbow Trout.

STUDY AREA AND METHODS

Herd Lake

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 landslide which blocked Lake Creek. The lake has a surface area of 6.7 ha. Gill netting efforts between 2001 and 2011 showed that average Rainbow Trout total length (TL) in Herd Lake rarely exceeded 200 mm. This was primarily the result of an overabundance of trout and a low abundance of forage (Brimmer et al. 2003). In an effort to improve the size structure of the lake's Rainbow Trout population, 72 tiger muskellunge were stocked in 2006. Additionally, the bag limit on Rainbow Trout was increased from six to 25 trout per day in 2011.

In 2013, we conducted zooplankton tows and calculated ZPR and ZQI to determine the current forage abundance and quality in Herd Lake. These simplified methods require conducting zooplankton tows with three nets, with mesh sizes 153 µm, 500 µm, and 750 µm. The contents of each net are weighed and three indices are calculated to produce a Zooplankton Ration Index (ZPR) and Zooplankton Quality Index (ZQI). Total zooplankton production potential is calculated by weighing the contents of the 153 µm net. Zooplankton Ratio Index (ZPR- ratio of large-bodied to small-bodied zooplankton) is calculated by dividing the weight of the 750 µm sample by the weight of the 500 µm sample. The Zooplankton Quality Index (ZQI- relative abundance of large-bodied zooplankton) is calculated by dividing the sum of weights for the 500 µm and 750 µm samples by ZPR. The two primary plankton indices (ZPR and ZQI) are now used throughout the state as an index of zooplankton quality and abundance in lakes to help inform trout stocking densities

Jimmy Smith Lake

Jimmy Smith Lake (WGS84 datum: 44.16907°N, -114.40249°W) is a landslide lake located in north central Custer County in the East Fork Salmon River drainage at 1,948 m elevation with a surface area of 26.0 ha. The lake has one outlet, Big Lake Creek, and three inlet streams: Jimmy Smith, Corral, and Big Lake creeks. The lake supports a naturally reproducing population of Rainbow Trout that likely originated from 184,600 Rainbow Trout stocked from IDFG's Mackay Fish Hatchery between 1927 and 1938. The lake has not been stocked since that time. Similar to Herd Lake, the size structure of Rainbow Trout in Jimmy Smith Lake was thought to be negatively impacted by an overabundance of fish and limited zooplankton in the early 2000's (Brimmer et al. 2003). Fishing regulations were changed in 2011 to increase bag limits from 6 trout to 25 trout per day in an effort to reduce trout density and improve growth rates and size structure.

Wallace Lake

Wallace Lake (WGS84 datum: 45.24692°N, -114.00499°W) is a small 2.7 ha lake located about 12 km northwest of the town of Salmon. Situated at 2,471 m in elevation, the lake includes a developed campground and small boat ramp. While there is no defined inlet, the outlet drains into Wallace Creek, a tributary of the Salmon River. The lake was classified as having no natural spawning potential in 1978 (Jeppson and Ball 1979), and has been stocked annually since 1968 (except 2000) due to its popularity and proximity to the city of Salmon. Rainbow Trout in Wallace Lake, as mentioned in the previous section of this report, have experienced growth limitations over the last decade, likely due to reduced forage availability caused by an abundance of Redside Shiners. Prior to 2013, zooplankton quality and abundance has not been studied in Wallace. We wanted to evaluate baseline ZPR/ZQI levels in Wallace in 2013 in order to track changes in forage availability concurrently with future management actions aimed at reducing Redside Shiner abundance to improve Rainbow Trout growth.

Plankton sampling

Zooplankton tow samples were collected at Herd Lake and Jimmy Smith Lake on August 15, 2013. Wallace Lake zooplankton were sampled on August 14, 2013. Zooplankton were sampled at three locations in each lake: near the inlet, mid-lake, and at the outlet following methods outlined by Teuscher (1999). Since Wallace Lake has no inlet, we substituted sampling near a 100 m tall rock slide on the lake's west side almost opposite the outlet. The fisheries crew deviated from Teuscher's methods in Herd and Jimmy Smith lakes by sampling the inlet site at 4.7 m depth. Samples were stored in 100% ethyl alcohol for eleven days, at which time ZQI values were analyzed using methodology developed by Yule (unpublished) and Teuscher (1999).

RESULTS AND DISCUSSION

Herd Lake

Herd Lake's average ZQI value of 2.42 in 2013 is the highest recorded value for this lake in 10 sample periods (Table 4). This year's ZPR and ZQI values (Figure 7) suggest an adequate abundance of quality zooplankton available for the lake's Rainbow Trout population (Table 5). The high quality and abundance of large-bodied zooplankton found in Herd Lake this year should have a positive effect on fish condition, growth, and survival going into 2014. Although zooplankton production (ZPR and ZQI) has increased since Rainbow Trout bag limits were changed (Figure 8), we felt that further population control measures should be attempted. To further reduce the abundance of Rainbow Trout, we stocked 75 tiger muskellunge in Herd Lake on June 24, 2013. They ranged in size from 210-410 mm TL with a mean TL of 329 mm at the time of stocking. These management efforts (i.e. bag limit increase and tiger muskellunge introduction) to reduce Rainbow Trout density should improve trout growth and size structure. Annual monitoring of the lake's Rainbow Trout population and zooplankton should continue in order to evaluate whether increased bag limits and tiger muskellunge stocking have improved Rainbow Trout growth and size structure.

Jimmy Smith Lake

The average ZQI value for Jimmy Smith Lake in 2013 was 1.97 (Table 4, Figure 7), suggesting unlikely forage competition. The 2013 value represents the second highest average ZQI value calculated for Jimmy Smith Lake in ten sample periods, with 2012 having the highest value of 2.02 (Figure 9). Much like Herd Lake, it appears that the abundance and quality of zooplankton in Jimmy Smith Lake has increased substantially in recent years. In 2011 we increased Rainbow Trout bag limits in Jimmy Smith from 6 fish per day to 25 fish per day. Increased angler harvest of Rainbow Trout as a result, may have decreased the number of fish in the lake and subsequently increased the amount of zooplankton available. Current creel information on angler use and effort is lacking at Jimmy Smith Lake, and the last population estimate was conducted in 2011. Estimates on annual harvest, in conjunction with a more recent Rainbow Trout population estimate and population size structure data, should allow us to determine whether the issue of overcrowding has been resolved and whether size structure has improved as a result. ZQI/ZPR monitoring should continue in Jimmy Smith annually to assess whether further actions need to be taken to ensure there is adequate forage available to produce larger Rainbow Trout and increase angler satisfaction.

Wallace Lake

Zooplankton sampling at Wallace in 2013 produced an average ZQI value of 0.01 and ZPR of 0.33 (Table 4, Figure 7). Although ZPR was 0.33 indicating quality food resources for stocking heavy densities of fingerlings according to Teuscher (1999), the abundance of forage resources are extremely limited as evidenced by the low ZQI value. At this point, Rainbow Trout stocking should be halted in Wallace Lake unless management action is taken to facilitate an increase in zooplankton abundance. Further management intervention is needed to reduce competition between Rainbow Trout and Redside Shiners to increase Rainbow Trout forage abundance to produce larger, healthier fish. Low catch rates, low relative weights, and the presence of only one year-class of Rainbow Trout observed in 2013 (see previous section "Evaluating Condition of Hatchery Trout after Winter Holdover" in this report for more details) further substantiate that forage availability may be a problem at Wallace Lake, resulting in poor Rainbow Trout survival and growth.

MANAGEMENT RECOMMENDATIONS

1. Continue to monitor forage quality and availability in Herd, Jimmy Smith, and Wallace lakes annually to evaluate management actions aimed at reducing competition and improving size structure of trout populations.

2. Evaluate the Rainbow Trout population, size structure and condition in Herd Lake in 2015 in response to introducing tiger muskellunge. Estimate survival of tiger muskellunge stocked in 2013 and determine whether additional stocking is needed.

3. Conduct a Rainbow Trout population estimate in Jimmy Smith Lake to quantify the population responses to increased bag limits put in place in 2011.

4. Determine the viability of introducing a highly piscivorous fish species such as tiger trout into Wallace Lake, to reduce Redside Shiners.

Table 4. Zooplankton quality index (ZQI) values and average zooplankton ratio (ZPR) values at Herd, Jimmy Smith, and Wallace lakes (SEs in parentheses), 2002-2013.

			ZQI sample location				ZPR sample location			
Lake	Year	Sample date	Inlet	Mid-lake	Outlet	ZQI average (SE)	Inlet	Mid-lake	Outlet	ZPR average (SE)
Herd	2002	8/27	0.01	0.01	--	0.01 (0.00)	--	--	--	0.04
	2003	7/31	0.01	0.01	--	0.01 (0.00)	0.03	0.08	--	0.05 (0.03)
	2004	8/9	--	0.07	0.00	0.04 (0.04)	--	0.04	0.00	0.02 (0.02)
	2006	8/24	0.01	0.02	--	0.02 (0.01)	0.11	0.17	--	0.14 (0.03)
	2007	8/24	--	1.30	1.26	1.28 (0.02)	0.54	0.46	--	0.50 (0.04)
	2008	8/29	--	1.13	0.82	0.98 (0.16)	1.03	1.02	--	1.02 (0.01)
	2009	8/31	0.20	0.20	0.26	0.22 (0.02)	0.21	0.38	0.48	0.36 (0.08)
	2011	8/26	0.04	0.08	0.02	0.05 (0.02)	0.14	0.21	0.13	0.16 (0.03)
	2012	8/17	0.54	0.96	3.38	1.63 (0.89)	0.28	0.41	0.62	0.44 (0.10)
	2013	8/15	0.92	2.67	3.66	2.42 (0.80)	0.67	0.86	1.29	0.94 (0.18)
Jimmy Smith	2002	8/19	--	0.00	0.00	0.00	--	0.00	0.00	0.00
	2003	8/1	0.10	0.20	--	0.20 (0.05)	0.10	0.10	--	0.10 (0.00)
	2004[a]	8/9	--	--	--	0.03	--	--	--	0.03
	2006	8/24	0.02	0.26	0.17	0.15 (0.07)	0.04	0.34	0.30	0.23 (0.09)
	2007	8/24	--	0.02	0.02	0.02 (0.00)	--	0.12	0.20	0.16 (0.04)
	2008	8/29	--	0.02	0.02	0.02 (0.00)	--	0.25	0.25	0.25 (0.00)
	2009	8/31	0.01	0.01	0.01	0.01 (0.00)	0.01	0.06	0.08	0.05 (0.02)
	2011	8/26	0.01	0.02	0.11	0.05 (0.03)	0.01	0.05	0.14	0.07 (0.04)
	2012	8/17	2.30	2.05	1.70	2.02 (0.17)	0.23	0.28	0.21	0.23 (0.02)
	2013	8/15	1.50	2.07	2.35	1.97 (0.25)	0.22	0.35	0.34	0.30 (0.04)
Wallace	2013	8/14	0.00	0.03	0.00	0.01 (0.01)	0.00	1.00	0.00	0.33 (0.33)

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

Table 5. Zooplankton ratio (ZPR) and zooplankton quality index (ZQI) ratings from Teuscher (1999).

ZPR >0.6	Stock heavy density fingerlings (150-300 per acre)
0.6 < ZPR => 0.25	Stock moderate density of fingerlings (75-150 per acre)
ZPR < 0.25	Stock less than 75 fingerlings per acre or catchables

ZQI > 0.60	Competition for food unlikely.
0.60 < ZQI > 0.10	Competition for food may be occurring.
ZQI < 0.10	Forage resources are limiting.

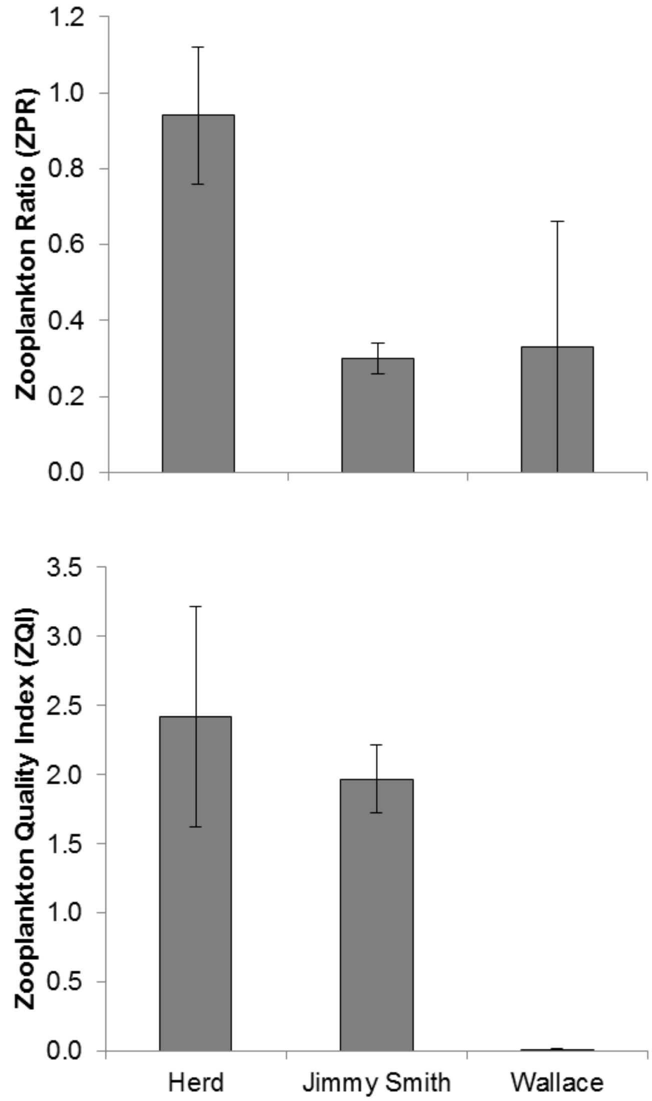

Figure 7. Zooplankton ratio (ZPR) and zooplankton quality index (ZQI) values for Herd, Jimmy Smith, and Wallace lakes sampled in 2013.

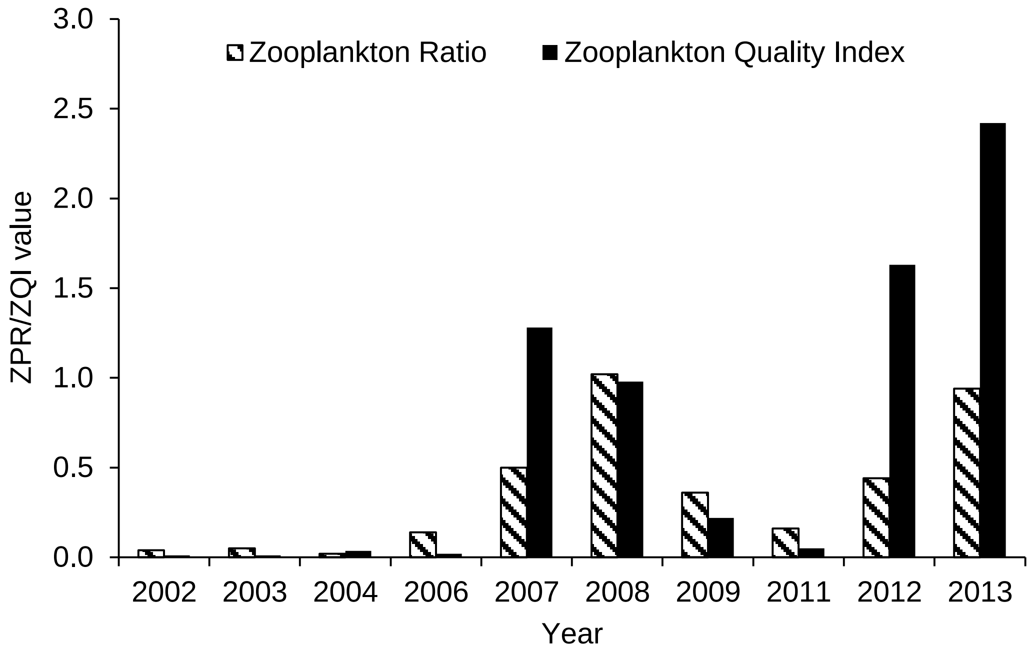

Figure 8. Zooplankton Ratio (ZPR) and Zooplankton Quality Indices (ZPI) for forage availability in Herd Lake, 2002 through 2013.

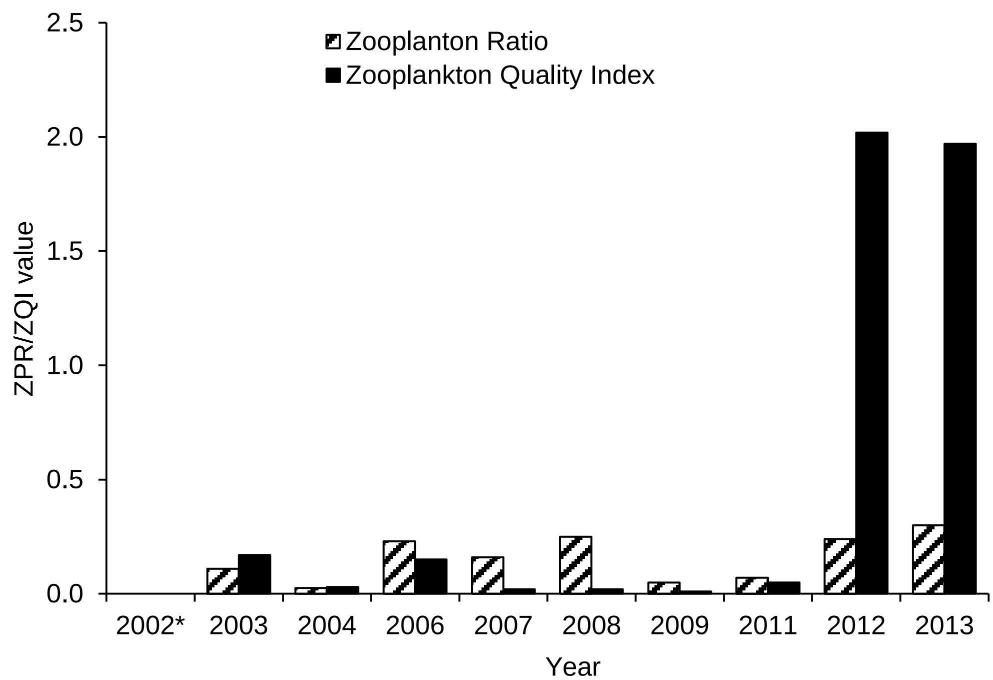

Figure 9. Zooplankton Ratio (ZPR) and Zooplankton Quality Indices (ZQI) for forage availability in Jimmy Smith Lake, 2002 through 2013. *ZPR/ZQI values for 2002 are 0.

CARLSON LAKE BROOK TROUT REDUCTION EFFORTS

ABSTRACT

In 2002 and 2006, tiger muskellunge *Esox masquinongy x Esox lucius* were introduced into Carlson Lake in an attempt to reduce the number of stunted Brook Trout *Salvelinus fontinalis* to improve the Brook Trout size structure. Carlson Lake has been regularly sampled since 2000 in order to monitor the effects of tiger muskellunge introduction on the size structure of the Brook Trout population. In 2013, Regional fisheries staff collected 825 Brook Trout in 172.5 gill netting hours, for a total CPUE of 4.78 fish/hr. In 2013, Brook Trout ranged in size from 150 to 292 mm TL with an average TL of 220 mm. Total length range and average values have not changed from the 2011 survey. The average W_r of Brook Trout sampled in 2013 was 75 compared to 89 in 2011 and 87 in 2009. A mark-recapture population estimate conducted prior to stocking tiger muskellunge in 2013 estimated 10,867 Brook Trout (95% C.I. 9,182-13,008) in Carlson Lake. Seventy Tiger muskellunge were introduced in Carlson Lake on June 14, 2013, representing the third stocking of the predator species at Carlson Lake.

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INTRODUCTION

Carlson Lake was first stocked with Eastern Brook Trout *Salvelinus fontinalis* in 1941, 1949, 1950, 1952, and 1955, with approximately 1,000 to 2,000 fish per year. An additional 2,685 Brook Trout were stocked in 1975, along with approximately 500 Rainbow Trout *Oncorhynchus mykiss*. In the earliest years that Brook Trout were present in Carlson Lake, anglers reported catching trophy sized fish weighing up to 1.4 kg (Curet et al. 2000). By 1975 however, anglers began voicing concerns that the lake was overpopulated and that poor condition and decreased size of Brook Trout had resulted. By 1981, average length for Brook Trout was around 230 mm, and fish were rarely found measuring in excess of 300 mm (Liter et al. 2000). Average length continued to decrease into the 1990s, at which time fisheries staff attempted to reduce the population and improve its size structure by introducing predatory Kamloops strain Rainbow Trout. This introduction failed, and intensive manual removal of Brook Trout followed. In 1997, IDFG attempted to reduce Brook Trout numbers by increasing the bag limit to 16 fish and improving fishing access to the lake. Additionally, from 1997 to 2001, regional fisheries staff removed 4,093 Brook Trout via gill-netting and explosives. Manual removal and increased bag limits proved unsuccessful in obtaining long-term results (Brimmer et al. 2006).

In 2002, 41 tiger muskellunge *Esox masquinongy x Esox lucius* were introduced into Carlson Lake in an attempt to reduce the Brook Trout population through direct predation. At the time of the first Tiger muskellunge introduction, the Brook Trout population was approximately 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, the Brook Trout population decreased to approximately 6,103 fish (95% C.I. 4,196-9,262), with an average length of 231 mm. The tiger muskellunge introductions seemed to be successful at improving Brook Trout population size structure and average body condition at that time. Average relative weight of Brook Trout in 2005 was significantly larger than in 2002, prior to the first tiger muskellunge introduction (Curet et al. 2008). In 2006, another 32 tiger muskellunge were stocked, and the Brook Trout population was again sampled. Brook Trout average total length in 2006 had already decreased 15 mm from the 2005 sampling ($p<0.01$). Sampling events in 2006, 2008, and 2009 produced relative weight values of 104, 88, and 87. However, average total length in 2009 was still only 234 mm. In 2011, fisheries managers requested additional tiger muskellunge for another stocking event. There was no work conducted on Carlson Lake in 2012.

OBJECTIVES

1. Conduct a population estimate and obtain a representative sample of lengths and weights for Brook Trout in Carlson Lake, to assess the whether introduced tiger muskellunge have improved Brook Trout size structure since last stocked seven years ago..

2. Stock additional tiger muskellunge to continue predation pressure on stunted Brook Trout, with the goal of improving Brook Trout size structure.

STUDY AREA AND METHODS

Carlson Lake (WGS84 datum: 44.28153°N, 113.75283°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.

We estimated the Brook Trout population in Carlson Lake using a using Peterson single make-recapture estimate. A regional fisheries crew marked Brook Trout on two sampling events on May 21-23 and June 18-20, and one recapture event on June 20-21, 2013. A seven-person fisheries crew angled for a combined total of six days to mark Brook Trout with an adipose fin clip. After the second marking effort ended on the afternoon of June 20, the fisheries crew deployed 12 standard experimental lowland lake gill nets (Lamansky and Meyer, 2012) (11 sinking, 1 floating) to recapture marked fish. Of the 11 sinking nets, six were placed with the small mesh-size at shore and 5 with the large mesh at shore. The single floating net had small mesh at shore. During the time the nets were fished overnight, they were checked about every six hours to potentially lessen mortality of previously stocked tiger muskellunge. Live-captured tiger muskellunge were measured (mm TL) and released immediately. Nets were also pulled away from the littoral areas of the lake to fish overnight, to reduce the number of Tiger muskellunge caught. This exercise proved to be effective. All nets were removed the following morning. Captured Brook Trout were measured (mm TL), weighed (g), and examined for adipose clip marks. Tiger muskellunge mortalities were measured, weighed, and otoliths were extracted for later analysis. Brook Trout length and weight data were used to calculate relative weight (W_r) according to Murphy and Willis (1996). A Peterson single mark-recapture population estimate with the Chapman (1948) modification was used to estimate Brook Trout abundance in Carlson Lake (Ricker 1975):

$$\hat{N} = \frac{(n_1+1)(n_2+1)}{(m_2+1)} - 1$$

where n_1 = number caught and marked in first sampling period; n_2 = number caught in second sampling period; and m_2 = number of marked fish caught in the second sampling period.

Carlson Lake was stocked with an additional 70 tiger muskellunge on June 24, 2013. The tanker truck driver from Mackay Hatchery was able to transport the fish to the ridgeline above the lake, where regional fisheries staff then transferred the tiger muskellunge into 120-quart coolers strapped on the backs of two ATVs. Fisheries crew members shuttled about 15 tiger muskellunge per trip in the coolers down to the lake. Each tiger muskellunge was implanted with a PIT tag before release into the lake. Additionally, TL (mm) was measured from a 25-fish sample before release.

RESULTS AND DISCUSSION

The two marking events in May and June 2013 resulted in 1,499 adipose clipped Brook Trout in an estimated 301 hours of angling, for a CPUE of 4.98 fish/hr. During the recapture event, we collected 825 Brook Trout in 172.5 gill net hours, for a CPUE of 4.78 fish/hr (Table 6). Both catch-per-unit-effort values are the highest observed in Carlson Lake in more than a decade. Of the 825 fish caught during recapture netting, 113 were marked, and the total population size was estimated at 10,867 fish (95% C.I 9,182-13,008) (Figure 10). Brook Trout averaged 220 mm TL in 2013 and ranged in size from 150 to 292 mm TL in 2013 (Figure 11). The average weight in 2013 was 94.9 g and average Wr of 75 (Table 6).

Seven tiger muskellunge were also captured in gill nets during the recapture event in June. Six of the seven tiger muskellunge were released live from the nets with one mortality. The seven tiger muskellunge captured in 2013 ranged from 864-1,067 mm TL, in comparison to four tiger muskellunge captured in 2006 which ranged 710-770 mm TL.

The additional 70 tiger muskellunge stocked in Carlson Lake on June 24, 2013, ranged from 290-380 mm TL and averaged 333 mm TL, and represent the third stocking since 2002.

Results of our 2013 sampling event at Carlson Lake suggests the Brook Trout population may have increased in abundance since 2005, while average TL has remained relatively constant (Table 6). Our 2013 population estimate is nearly double the 2005 estimate of 6,103 (95% C.I. 4,196-9,262) (Figure 10). This year's data indicates we still have not yet achieved our desired outcome of improving the size structure of Brook Trout in Carlson Lake via population reduction through predation (Figure 11). It is possible that we have been stocking tiger muskellunge in Carlson Lake at too low a density to achieve our desired outcome. Our stocking density for the first two introductions was approximately half (16-20 fish/ha) the recommended stocking density (40 fish/ha) presented in Koenig et al. (2015). In addition, smaller tiger muskellunge stocked may suffer high predation rates from remaining large previously stocked individuals. Further investigation is warranted to track survival and growth of the tiger muskellunge stocked in 2013 and determine whether enough of them survived to impact the Brook Trout population. If introduced tiger muskellunge continue to be insufficient for improving the Brook Trout size distribution in Carlson Lake, other actions such as introducing sterile Trojan male Brook Trout, or physical removal through netting should be considered

MANAGEMENT RECOMMENDATIONS

1. Monitor changes in Brook Trout abundance and size structure over the next several years to determine whether alternative strategies (other than predator introduction) need to be tested to improve population size structure.

2. Confirm survival of 2013 class of tiger muskellunge via intensive trap netting.

Table 6. Summary of Brook Trout sampling efforts in Carlson Lake between 1998 and 2013.

Year	Sample dates	Total # fish	Length range (mm)	Mean 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 and 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

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

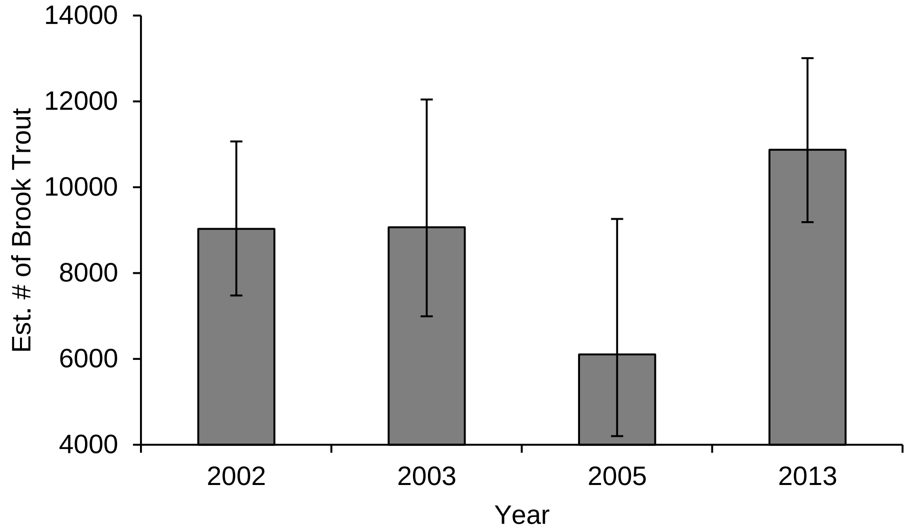

Figure 10. Peterson population estimates (error bars represent 95% CI’s) across years of Brook Trout sampling in Carlson Lake.

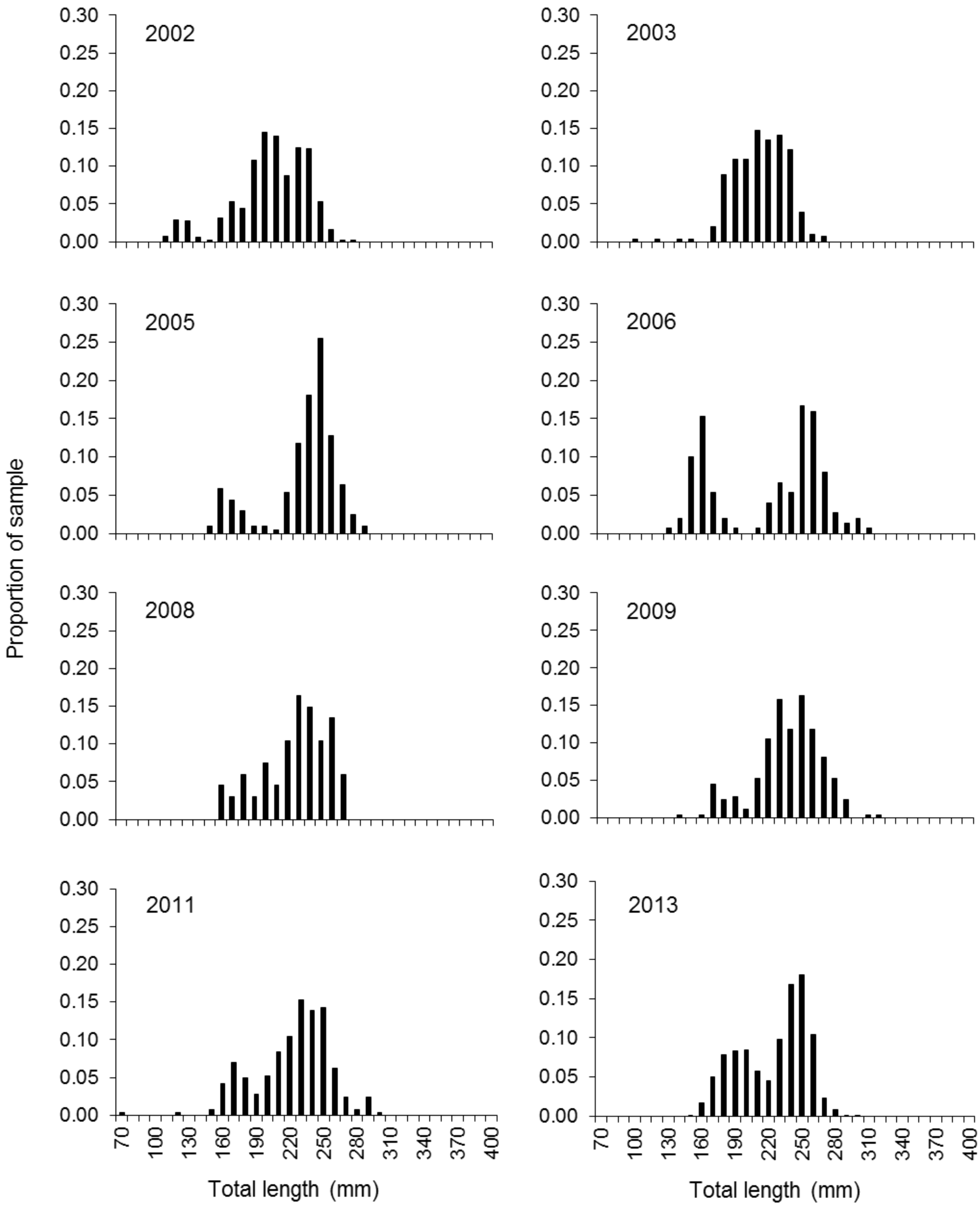

Figure 11. Length frequency histogram of Brook Trout collected in gillnets at Carlson Lake in 2002-2013.

MOSQUITO FLAT RESERVOIR – REMOTE CREEL SURVEY

ABSTRACT

We estimated angler effort on Mosquito Flat Reservoir in 2013 using remote trail cameras. Cameras were programmed to take one photo per hour, thus one angler counted in a photo represents one angler hour. Four cameras recorded 595 shore anglers and 374 boat anglers in 162 total days of operation from May to July, for a combined total of 969 angler hours. A wildfire just west of the reservoir closed access to the area and interrupted the camera test for almost two months (July 20 – September 13). We resumed the test with two cameras in the fall, which recorded 108 shore and 2 boat anglers in 84 days of operation during September and October.

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INTRODUCTION

Mosquito Flat Reservoir was constructed in 1949 and 1950 on Challis Creek as an irrigation reservoir for water users in Challis. The dam is 16.8 m high and 137 m long, and holds 986,784 m^3 (800 acre feet) of water at maximum pool (16.2 surface hectares). Mosquito Flat Reservoir also serves as a popular recreational fishery. In 1978, IDFG estimated angler use at 1,500 angler days per year, from June through August, when the reservoir held water (Ball and Jeppson, 1980). The reservoir was typically drained from September to May during those years. It was estimated at the time that if a minimum pool level was maintained in the reservoir throughout the year, the value of the fishery would increase by 50%. In 1984, 28% of the reservoir's volume was donated to IDFG for maintenance of fish populations (Liter and Lukens 1994). To date, the 28% minimum pool is reserved for fish habitat and survival. This minimum pool represents 273,833 m^3 (222 acre-feet) with a surface area of 8.5 ha. The Mosquito Flat Water Users maintain the other 72% of the reservoir. Since 1984, Mosquito Flat has been stocked with diploid Rainbow Trout *Oncorhynchus mykiss* from a variety of strains as well as triploid Hayspur (IDFG) and Troutlodge Kamloops Rainbow Trout. Additionally, A-run and B-run Steelhead (anadromous *O. mykiss*), Bull Trout *Salvelinus confluentus*, and Westslope Cutthroat Trout *O. clarkii* have also been introduced. Brook Trout *S. fontinalis* have also been documented in the reservoir, having apparently migrated downstream from the Challis Creek Lakes (Liter and Lukens 1994). In the past 10 years, an average of 5,200 catchable sterile Rainbow Trout were stocked annually, and the reservoir is maintained as a put-and-take fishery. The current fishing pressure and value of Mosquito Flat Reservoir as a fishery is unknown, as no creel data has been collected since 1988. In this study, we experimented with using automated trail cameras to estimate angler effort during the 2013 fishing seasons. Trail cameras can remotely collect basic recreational use information and may serve as highly cost effective alternative to a traditional creel census.

OBJECTIVES

1. Evaluate using trail cameras near strategic angler access locations at Mosquito Flat Reservoir to estimate angler effort.

2. Estimate harvest rates and total catch of hatchery Rainbow Trout for 2013.

STUDY AREA AND METHODS

Mosquito Flat Reservoir (WGS84 datum: 44.51902^o N, -114.43566^o W) is located on Challis Creek approximately 20 km from the town of Challis at 2,114 m in elevation . At full pool, the reservoir stores 986,784 m^3 (800 acre feet) of water with a surface area of 16.2 ha. The reservoir is a popular local fishery due to its proximity to the city of Challis. The Salmon-Challis National Forest (SCNF) maintains an 11-site campground and day-use picnic area along the reservoir's east-southeast shore.

In May and June 2013, we monitored angling use at the reservoir by installing four remote trail cameras along the shore. We selected camera locations that were near assumed angler access areas and provided coverage of almost all of the reservoir's surface area with minimal overlap between camera view angles (Figure 12). We were unable to keep the cameras deployed during the summer due to a wildfire in the area. We repeated the test in the fall using two remote cameras that could cover the same area as all four in the spring. Cameras were programmed to record one photograph during daylight hours at one hour intervals.

We examined each digital photo to identify anglers actively fishing or boating. We manually enlarged each photo by 33-60% to accurately count the number of people fishing. When in doubt, we used a conservative number if we weren't sure in our identification. Vehicles, camp and boat trailers, and unattended boats were not counted. Only people actively fishing were counted. Due to limitations in camera resolution, some observed shapes could not be positively identified as anglers and were not counted. Likewise, when only the shape of a boat was visible on the water, we counted only one angler per boat. To estimate angler effort we summed the total number of anglers counted on camera, which translated directly into hours of effort since the cameras took one photo every hour.

We estimated total catch and harvest of hatchery Rainbow Trout using uniquely number t-bar anchor tags. We tagged approximately 10% (n = 398) of the 4,013 Rainbow Trout stocked in the reservoir in 2013 before release. Anglers that caught tagged fish were able to report the tagged fish through the Department's internet site or the toll free phone number printed on the tags. Exploitation and total catch were corrected for angler tag reporting rate and tag loss rate using both the 2013 statewide average reporting (39.3%) and statewide average shed rates (18%) according the methods and data presented in Meyer et al. (2012). Once returns are corrected, total catch is calculated as a percentage of the total tag release that was either harvested or caught and released (J. Cassinelli, IDFG, personal communication). We multiplied the angler reporting rates for caught and harvested fish by the number of Rainbow Trout stocked in summer and fall 2013 to determine the total catch and total harvest. We then divided the total number of Rainbow Trout caught by the total effort (described above) to estimate catch per hour.

RESULTS AND DISCUSSION

Analysis of over 4,000 photographs taken by remote trail cameras deployed at Mosquito Flat Reservoir during May, June, and July 2013 showed a minimum count of 595 shore anglers and 374 boat anglers. The total estimated angler effort was 969 hours during the spring/summer study period (Table 7). We repeated the camera test in fall 2013, installing two cameras on September 13, one on each end of the reservoir (location numbers five and six [Figure 12]). These two cameras were operational for 42 days each and were removed on October 24 before winter weather made retrieval too difficult. We noted that angler use pattern appeared to shift toward mid-day hours and consisted almost totally of shore fishing. We analyzed 1,406 photos from the fall period and counted a total of 108 shore anglers and 2 boat anglers (Table 7). In the fall we estimated total angler effort at 110 hours for boat and shore anglers. Analysis of camera five photos revealed a total of three anglers: two boat and one shore, respectively. Camera six detected 107 shore anglers and zero boats. The highest shore angler use hours in our fall sampling interval were 1300-1359 h and 1400-1459 h, with 30 and 25 anglers counted, respectively (Figure 13). While we did a better job of programming one-hour photo intervals during the fall, our placement of camera five resulted in two blind spots on the south and west shorelines (Figure 12). Additionally, late afternoon glare on the water rendered about 20 photos from camera five difficult to detect angler presence. The total angler effort for the spring/summer and fall periods was 1,079 hours.

Cameras were set to record one photo per hour, but this pattern was not consistent in the resulting images. At times, movement by anglers or animals close to the camera activated the shutter. Other times, a camera skipped the one-hour set and the next photo was taken more than 90 minutes later. We concede that camera placement resulted in wide viewing angles that overlapped the reservoir's surface area and likely resulted in some double-counted anglers. However, cameras were installed to emphasize different fishing areas at the reservoir and we believe the number of double-counts was probably not excessive. For example, camera one focused mainly on the southeast shore and boat ramp. Southeast shore anglers were easily seen in photos while most shore anglers at the boat ramp were too far away to distinguish individually. However, shore anglers at or near the boat ramp were discernible in camera three's photos. One of the four cameras used in the spring/summer survey period, camera two, malfunctioned and its data was not used.

We intended to operate all four cameras throughout the summer and fall to capture a complete open-water season. However, on July 20, 2013 a wildfire (Lodgepole Fire) ignited west of the reservoir. On July 21, the Salmon-Challis National Forest closed public access to the reservoir, campground, and all area roads. We were allowed special access to the reservoir on July 25 to retrieve our four cameras. Hence, we stopped angler counts on July 20, 2013, the last full day before the closure. Cameras one, three, and four were operational for 62, 38, and 62 days, respectively. Cameras one and four were deployed May 20 and camera three was deployed June 15.

Shore angler use during the spring/summer period appeared to be associated with easily accessible areas. Anglers were mostly observed using the shoreline on both sides of the boat ramp, the boat ramp itself, and the shoreline extending to the southeast and south end of the reservoir where it's possible to drive or walk easily. Only one shore angler was observed along the west side of the reservoir in our photos. Presumably anglers might have considered access too difficult or too far from a road to use the west shore of the reservoir. However, we did observe two anglers on ATVs pass by camera one at the south end of the reservoir headed east, so we assume there was limited angler use on the western shore that was not captured by camera three. The highest number of shore anglers were detected during the hours of 1200 to 1700, with the noontime hour (1200-1259 h) recording the greatest number of anglers (n = 80) (Figure 13).

Boat anglers appeared to use the entire reservoir during the May-July period. We observed a variety of crafts from float tubes and other single-person watercraft to drift boats and motor boats of various horsepower. Hours with the greatest detected boat use were 1500-1559 h, 1000-1059 h and 1100-1159 h with 46, 45 and 45 anglers counted, respectively (Figure 13). Since the goal of our camera study this year was to detect a level of angler use and not angler harvest, we feel that the cameras provided a good representation of angler use locations and daylight fishing periods. We suggest that future camera placement should avoid excessive overlap viewing area, especially at the boat ramp. Additionally, we need to program camera settings to take photos at more consistent intervals that will allow us to calculate angler effort estimates with higher accuracy.

Over the course of one year post-stocking date, 35 fish were reportedly harvested, with another four fish reportedly released. The estimated total catch and total harvest of all fish stocked in 2013 was 1,227 ± 265 (catch rate 30.6%) and 1,103 ± 249 (harvest rate 27.5%)

respectively (J. Cassinelli, IDFG, personal communication). Assuming the catch rate for fish stocked in 2013 during the entire 1 year period post-stocking is representative of catch rates during the period we operated remote creel cameras, we estimated catch per hour at Mosquito Flat Reservoir to be approximately 1.1 fish/hour. We consider trout catch rates over 1.0 to be sufficient for providing a quality angling experience.

We feel our estimates of angler effort and catch during 2013 is lower than average, since access to the reservoir was shut down during the peak summer fishing season, from July 21st through the beginning of September. Repeating the remote creel and tagging study during a typical year when access to the reservoir is open for the entire ice-free season should result in higher angler effort and total catch estimates. Given that effort and total catch were likely low in 2013 due to limited access during the summer, we consider a 30.6% return-to-creel and catch rates of 1.1 fish/hr to be satisfactory. Trail cameras appear to be sufficient for providing useful angler effort data. If we can maintain a catch rate over 1.0 fish/hour at Mosquito Flat during an average year, we would consider it a quality trout fishery.

MANAGEMENT RECOMMENDATIONS

1. Continue to work cooperatively with the Mosquito Flat Water Users to ensure the reservoir is maintained at the minimum 28% pool volume.

2. Repeat the 2013 angler use and exploitation study at Mosquito Flat and expand to other put-and-take fisheries in the region to evaluate angler effort and catch rates to adjust management strategies and stocking rates.

Table 7. Angler hours counted during the spring/summer period (May 20 to July 21) and fall period (Sept 13 to Oct 24) that trail cameras were deployed at Mosquito Flat Reservoir in 2013. Angler hours are split by the time period in which they were counted.

	Spring/summer period		Fall period	
Time period	Total boat hours	Total shore hours	Total boat hours	Total shore hours
0700-0759	5	0	0	0
0800-0859	8	2	0	0
0900-0959	30	11	1	0
1000-1059	45	25	0	0
1100-1159	45	48	0	6
1200-1259	24	80	0	6
1300-1359	31	75	0	16
1400-1459	35	52	0	16
1500-1559	46	76	0	30
1600-1659	42	72	0	25
1700-1759	27	39	0	9
1800-1859	21	42	0	0
1900-1959	8	32	1	0
2000-2059	5	23	0	0
2100-2159	2	18	0	0
Total	374	595	2	108

Figure 12. Mosquito Flat Reservoir near Challis, Idaho, with locations of remote trail cameras used in 2013. Cameras operated during spring and summer 2013 are shown as numbers 1 to 4. Cameras used during fall 2013 are numbered 5 and 6. The inlet is at the bottom of the photo, and the dam and outlet are at the top of the photo.

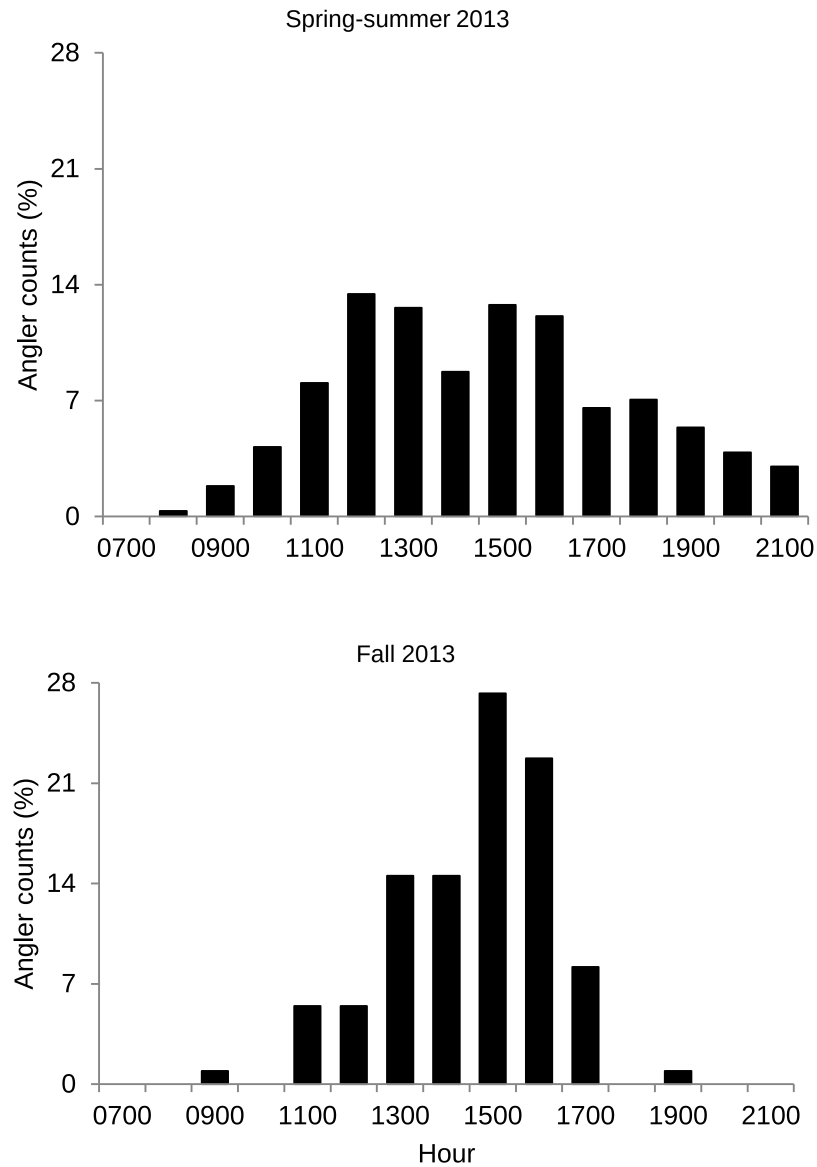

Figure 13. Percent of anglers counted per hour from remote creel counts at Mosquito Flat Reservoir by sample periods in 2013.

WILLIAMS LAKE RAINBOW TROUT EGG TAKE

ABSTRACT

As part of an ongoing project since 1997, we spawned Rainbow Trout *Oncorhynchus mykiss* collected from Lake Creek, the inlet to Williams Lake, in response to property owner and angler concerns that stocking is necessary to increase the lake's fish population. On May 8, 2013, 12 female and 12 male Rainbow Trout from Lake Creek were collected and spawned. Regional IDFG volunteer Ken John monitored fertilized eggs for almost six weeks until they reached "button up" stage. A total of 27,000 fry were released into Lake Creek on June 17, 2013.

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INTRODUCTION

Rainbow Trout *Oncorhynchus mykiss* and Bull Trout *Salvelinus confluentus* are the only known fish species present in Williams Lake. In the early 1960s, IDFG managed the lake as a put-and-grow Rainbow Trout fishery, stocking approximately 100,000 – 120,000 fingerlings annually. In 1984, we discontinued stocking and now manage Williams Lake as a wild trout fishery. In the mid to late 1990s, anglers reported a decline in catch rates at the lake. In the late 1990s, local homeowners and anglers suggested that increased fish stocking from an outside source was needed to maintain the health and vigor of Rainbow Trout in the lake. In 1997, regional fisheries biologists began a small egg take operation to address the concern of those groups. Each year, spawning adults are collected in Lake Creek, the lake's major spawning inlet, and eggs and sperm are taken for a small-scale hatchery operation located on the outlet of the lake. Eggs are incubated and hatched, and fry are reared until release in July. This project results in approximately 20,000 to 50,000 fry being released into Lake Creek each year.

OBJECTIVES

1. Continue spawning Rainbow Trout and releasing progeny back into the lake to address local concerns that stocking is necessary to maintain an adequate fishery.

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 spawning tributary inlet at Williams Lake on May 8, 2013. 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 semen from 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 IDFG volunteer Ken John tended to the fertilized eggs for almost six weeks until "button up". Fry were then released back into the location where adults were collected in June.

RESULTS AND DISCUSSION

On May 8, 2013, 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 (Jamie Mitchell, IDFG, personal communication). Regional IDFG cooperator Ken John tended the fertilized eggs for almost six weeks until "button up." At an estimated 75% egg to fry survival rate (Jamie Mitchell, IDFG, personal communication) approximately 27,000 fry were released into Lake Creek on June 17, 2013.

The annual egg take event at Williams Lake has evolved into 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".

MANAGEMENT RECOMMENDATIONS

1. Continue Rainbow Trout egg take operation in Lake Creek annually, and explore ways to integrate other aquatic education programs and get more volunteers involved. One option may be to develop a "Trout in the Classroom" field trip to Williams Lake on the egg take day in May, which would involve approximately 60 fourth grade students per year.

FISH COMPOSITION IN YELLOWBELLY LAKE

ABSTRACT

We gill netted Yellowbelly Lake in June 2013 to assess fish composition and relative abundance. Non-game fish outnumbered salmonids this year, with Largescale Sucker *Catastomus macrocheilus* and Northern Pikeminnow *Ptychocheilus oregonensis* comprising 94% (*n* = 105) of the sample, while only seven salmonids (four Brook Trout *Salvelinus fontinalis* and three Bull Trout *S. confluentus*) were captured.

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INTRODUCTION

Yellowbelly Lake has historically been dominated by non-game fish species, and was chemically treated in 1960 with Toxaphene to eradicate those fish and create a trout fishery (Jeppson and Ball, 1979). At the same time, a migration barrier was installed on the outlet to prevent re-colonization of undesirable fish species. After the initial chemical treatment, the lake remained toxic to fish until about 1963, at which time IDFG first began stocking Cutthroat Trout *Oncorhynchus clarkii* to establish a quality trout fishery. The lake was stocked with over 400,000 Cutthroat Trout fry between 1963 and 1978 (IDFG historical stocking cards), at which time a gill netting survey was conducted to assess the fish community composition. Only one Cutthroat Trout was captured in the gill netting survey in 1978. Three Eastern Brook Trout *Salvelinus fontinalis*, one Redside Shiner *Richardsonius balteatus*, and 27 Largescale Suckers *Catastomus machrocheilus* comprised the remainder of the catch (Jeppson and Ball, 1979). Since Cutthroat Trout were the only fish species known to have been stocked in Yellowbelly by IDFG, it was presumed that Brook Trout likely colonized the lake from alpine lakes located higher in the drainage. Cutthroat Trout were again stocked in 1986, and Golden Trout *Oncorhynchus mykiss aguabonita* were stocked in 1987, but the lake remained dominated by non-game fish through the late 1980s. In 1990, the lake was again chemically treated with rotenone to remove the entire fish community (Schrader and Lukens, 1992). The 1990 rotenone treatment removed all fish in the lake, and IDFG began stocking Cutthroat Trout again in 1992. Additionally, the outlet barrier was removed in 2000 by Sawtooth National Recreation Area personel to re-establish connectivity with the mainstem Salmon River (Curet et al. 2011). After the rehabilitation projects, gill netting surveys continued to produce more non-game fish species (i.e. Northern Pikeminnow *Ptychocheilus oregonensis*, Redside Shiner, and various sucker species *Catastomus* spp.) than salmonids, with the exception of 2001 when Brook Trout were the most abundant species encountered (Brimmer et al. 2003). The main goal was to establish a Cutthroat Trout population in Yellowbelly Lake to create a catch-and-release alpine lake fishery in the Stanley area to meet public demands, and to provide a source of broodstock in the area to enhance native Westslope Cutthroat Trout populations (Schrader and Lukens, 1992). Each chemical treatment event was unsuccessful in producing the desired outcomes. Since 2009, IDFG has stocked an average 50,000 Cutthroat Trout fry per year in an effort to increase salmonid production in the lake. The goal of this study was to collect current information about the fish community in Yellowbelly Lake and determined if trout stocking efforts are effective.

OBJECTIVES

1. Survey the fish population in Yellowbelly Lake to assess whether the increased number of Westslope Cutthroat Trout stocked annually in recent years has been effective at boosting the salmonid population.

STUDY AREA AND METHODS

Yellowbelly Lake (WGS84 datum: 44.00050^{o}N, -114.87677^{o}W) is an oligotrophic lake located in southern Custer County at 2,157 m elevation. The lake has 77.9 ha of surface area, a maximum depth of 24.5 m, and 8.4 km of shoreline. The principle in-flow is provided by Yellowbelly Lake Creek. Documented fish species in the lake are Brook Trout, Westslope Cutthroat Trout, Rainbow Trout, Bull Trout, Redside Shiner, Northern Pikeminnow, and sucker (various species).

We surveyed Yellowbelly Lake on June 11-12, 2013 using eight standard lowland lake experimental variable mesh gill nets (Lamansky and Meyer, 2012). Gill nets were deployed on the late afternoon of June 11 and fished overnight. Three nets (one sinking, two floating) were set perpendicular to shore while five other nets (three sinking, two floating) were placed in the pelagic zone targeting salmonids. Nets were checked every hour for the first two hours to minimize mortality to Bull Trout, but water conditions became dangerous and nets were left to fish for the rest of the night and removed the next morning. Fish were identified to species, measured (mm TL), and weighed (g). Genetic fin clip samples were taken from selected salmonids, placed in vials containing 100% ethyl alcohol, and stored at the Salmon Region office for later analysis.

RESULTS AND DISCUSSION

We collected a total of 112 fish during an overnight gill net set in Yellowbelly Lake on June 11-12, 2013 (Table 8). For the eighth consecutive sampling period at the lake, non-game fish comprised the bulk of the catch (94%). In total, we captured 97 Largescale Suckers, eight Northern Pikeminnow, four Brook Trout and three Bull Trout. No Cutthroat or Rainbow Trout were captured. Brook Trout ranged in length from 175 to 215 mm TL and averaged 195 mm, while Bull Trout ranged from 293 to 347 mm TL and averaged 322 mm.

Nets were fished a total of 131.2 hours in 2013 and had an average of 0.9 fish caught per hour. This year's catch rate matches the CPUE of 2009, which is the lowest catch rate recorded in the lake's twelve sample periods. The three gill nets set close to shore in 2013 captured a total of 64 fish while the five pelagic zone gill nets captured 48 fish. Two of the five pelagic zone nets did not catch any fish. The proportion of salmonids caught during gill netting at Yellowbelly for all sample intervals has ranged from a high of 59% in 2001 to a low of 3% in 1961 (Table 8). We collected genetic samples from all three Bull Trout in 2013; one Bull Trout (347 mm TL) was released while the other two were mortalities. Interestingly, one Bull Trout mortality had a Redside Shiner as part of its stomach contents. Shiners were last caught during gill net activities in 1978. Likely, Redside Shiners have been present during previous sampling efforts, but haven't been detected due to net mesh sizes and placement of our experimental gill nets.

From 2002 to 2006, between 1,200 and 6,600 Westslope Cutthroat Trout fry were stocked annually in Yellowbelly Lake. These stockings were apparently unsuccessful in establishing a Westslope Cutthroat Trout population. Since the barrier removal at the lake's outlet in 2000, nine gill net efforts between 2001 to 2013 produced a total of 215 (13%) salmonids while non-salmonid fish totaled 1,452 (Table 8). Of the 215 salmonids sampled, Cutthroat Trout comprised 13% (n = 27) of the salmonid species observed. The low number of Cutthroat Trout adults observed during gill netting may have been due to the relatively low numbers of Westslope Cutthroat Trout fry available for stocking and/or inconsistent past stocking patterns. The goal of establishing a Westslope Cutthroat fishery in a drainage and lake system dominated by non-salmonids and non-native Brook Trout has not been achieved. In 2013, we stocked 1,477 adult Rainbow Trout on June 20, in an attempt to determine if an adfluvial strain of Rainbow Trout may be more successful than Cutthroat Trout in Yellowbelly Lake. The adult Rainbows originated from Williams Lake stock and were part of an unsuccessful broodstock program initiated in 2011 at IDFG's Hayspur Fish Hatchery (Curet et al. 2013).

MANAGEMENT RECOMMENDATIONS

1. Monitor fish composition in Yellowbelly to determine if increased stocking efforts for Westslope Cutthroat Trout since 2009, and the introduction of Rainbow Trout in 2013, were successful at increasing the abundance of trout in the lake.

2. Explore the feasibility of an intensive live trapping effort at Yellowbelly Lake (e.g. Merwin traps) to remove undesirable non-game fish while continuing to stock Rainbow and Cutthroat Trout at the current rate.

Table 8. Summary of Yellowbelly Lake gillnetting efforts between 1961 and 2013.

Sample year	Total catch	Salmonid species[a]						Total salmonids (%)	Non-game species[b]			Total gill-net hours	Fish/ hour (CPUE)
		HRBT	CT	CTxRBT	EBT	BU	MWF		SUC	NPM	RSS		
1961	57	0	0	0	0	2	3	5 (3.0)	43	9	0	--	--
1978	58	0	1	0	4	0	0	5 (9.0)	50	1	2	--	--
1986	86	0	0	0	11	0	0	11 (12.8)	75	0	0	--	--
2001	96	0	1	0	56	0	0	57 (59.0)	39	0	0	70.4	1.4
2004	384	9	4	4	36	0	0	53 (14.0)	304	27	0	123.5	3.1
2005	239	0	5	0	20	12	0	37 (16.0)	167	35	0	141.8	1.7
2006	157	0	3	0	6	0	0	9 (6.0)	129	19	0	160.7	1.0
2007	163	3	5	0	8	1	0	17 (10.4)	127	19	0	64.9	2.5
2009	106	0	2	0	3	8	0	13 (12.0)	72	21	0	123.5	0.9
2010	176	0	5	0	3	7	0	15 (8.5)	119	42	0	161.4	1.1
2011	234	1	2	0	4	4	0	11 (4.7)	186	37	0	80.1	2.9
2013	112	0	0	0	4	3	0	7 (6.3)	97	8	0	131.2	0.9

[a] Salmonids: HRBT = Hatchery Rainbow Trout, CT = Cutthroat Trout, CTxRBT = Apparent Cutthroat x Rainbow Trout hybrid, EBT = Eastern Brook Trout, BU = Bull trout, and MWF = Mountain Whitefish.
[b] Non-game species: SUC = Sucker (various species), NPM = Northern Pikeminnow, and RSS = Redside Shiner.

RIVERS AND STREAMS

WILD TROUT POPULATION MONITORING

ABSTRACT

Regional fisheries staff conducted redd counts for resident Rainbow Trout *Oncorhynchus mykiss* and Bull Trout *Salvelinus confluentus* populations as part of an annual trend monitoring program. In 2013, we counted 281 Rainbow Trout redds in Big Springs Creek and 49 redds in the Lemhi River. During Bull Trout redd count surveys in 2013, we counted two redds in Alpine Creek, 28 redds in Fishhook Creek, 21 redds in Fourth of July Creek, 119 redds in Bear Valley Creek, 34 redds in East Fork Hayden Creek, and 14 redds in the main stem of Hayden Creek.

Weirs were operated at 14 locations throughout the Salmon Region in 2013 for various purposes (i.e. broodstock collection at hatcheries and spawner escapement into tributaries). Although weirs were mainly operated to collect anadromous fish data, resident salmonids encountered at the fish weirs were also enumerated. During 2013, Pahsimeroi Fish Hatchery personnel trapped 142 resident Rainbow Trout and eight Bull Trout. The East Fork Salmon River weir trapped 323 Bull Trout, three Westslope Cutthroat Trout *Oncorhynchus clarki lewisi*, and one Rainbow Trout. The Redfish Lake Creek trap caught 251 Bull Trout, and the Sawtooth weir trapped 60 Bull Trout, 26 Westslope Cutthroat Trout, and 18 Rainbow Trout in 2013. Bull Trout weirs operated in Hayden Creek and Bear Valley Creek in the fall 2013 trapped 92 Bull Trout. Anadromous fish weirs were operated in eight Lemhi River tributaries in the spring caught seven fluvial/resident Rainbow Trout.

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INTRODUCTION

Rainbow and Bull Trout Redd Count Monitoring

Salmon regional fisheries staff conduct redd counts for resident and fluvial populations of Rainbow Trout *Oncorhynchus mykiss* and Bull Trout *Salvelinus confluentus* in nine streams throughout the upper Salmon River basin annually. In 1994, IDFG began surveying Rainbow Trout redds on Big Springs Creek, a tributary to the upper Lemhi River near Leadore, to establish a baseline trend dataset. In 1997, regional fisheries staff established an additional annual Rainbow Trout redd count transect area on the upper Lemhi River for that population. Although we are reluctant to infer any direct relationships with spawner abundance, numerous habitat improvement projects, changes in water-use practices, alterations in land management practices, and fisheries regulations changes have occurred in the basin in the last decade that have likely benefited resident salmonid populations.

In 1998, regional fisheries staff began conducting redd counts for Bull Trout population monitoring in selected streams in the region. Standardized Bull Trout redd count surveys were initiated on Alpine and Fishhook Creeks in the Sawtooth valley that year. Bear Valley Creek and East Fork Hayden Creek, in the Lemhi River drainage, were added as Bull Trout trend monitoring sites in 2002. In 2003, IDFG staff added a transect on Fourth of July Creek in the Stanley basin to our trend monitoring program, and Upper Hayden Creek in the Lemhi River drainage was added in 2006.

In the late 2000's, regional fisheries staff and Nampa research staff re-evaluated the Bull Trout trend monitoring transects and determined that additional spawning was taking place outside of those areas. In 2007, an additional site was added on Bear Valley Creek, in 2008 a new site was added on Fishhook Creek, and a new site was added on Alpine Creek in 2011. In upper Hayden Creek, the trend transect was moved altogether in 2010, when fisheries staff determined that the transect was too low in the drainage and that most Bull Trout spawning took place much higher in the drainage. The trend transect was moved up higher in the drainage and the "historical" transect was no longer counted at that point.

Resident Fish Capture at Weirs

Pahsimeroi, East Fork, Redfish Lake Creek, and Sawtooth Weirs and Traps

Resident salmonids and other fish species are encountered at the Pahsimeroi River, East Fork Salmon River, Redfish Lake Creek, and Sawtooth Fish Hatchery weirs as part of routine annual Steelhead (anadromous Rainbow Trout), Chinook Salmon *Oncorhychus tshawytscha*, and Sockeye Salmon *Oncorhynchus nerka* trapping activities. Hatchery weirs operated to capture anadromous broodstock often capture larger-sized resident/fluvial salmonids as well, which are enumerated by hatchery staff and released upstream of the weirs. Picket spacing at each weir, timing of weir operation, and the location of each weir affects the number, species, and minimum size of resident fish trapped at each weir.

Lemhi River Basin Steelhead Weirs and Hayden Creek Bull Trout Weirs

In the spring of 2013, regional fisheries staff operated eight fish weirs in the Lemhi River drainage to capture migrating Steelhead and resident/fluvial Westslope Cutthroat Trout and Rainbow Trout. Messner et al. *(in press*) documents those findings in detail, but trout numbers will also be reported here. Two additional weirs were operated during the fall migration season for 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. The objective of the 2013 Bull Trout weirs was to obtain tissue samples for genetic inventory and deploy PIT tags for future monitoring of the populations and their migration patterns utilizing the numerous PIT tag arrays already in place in the basin.

OBJECTIVES

1. Monitor trends in spawner abundance of resident and fluvial salmonids in the region by conducting annual redd counts and operating fish weirs in priority tributaries.

2. Enumerate, measure, and collect biological data for resident salmonids captured at 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^{o}N, -113.39917^{o}W, and end: 44.72855^{o}N, -113.43430^{o}W, and the Neibaur transect is approximately 4.5 km long, located at Start: 44.70047^{o}N, -113.38436^{o}W, and end: 44.70896^{o}N, -113.39917^{o}W (Figure 14).

Redd counts are usually conducted during the last week of April or the first week of May using visual ground count methods, with two fisheries staff assigned to each transect. 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 3, 2013.

Lemhi River

The Lemhi River is a tributary of the Salmon River, flowing approximately 100 km from its headwaters near Leadore, Idaho to its confluence located at Salmon, Idaho. The upper

Lemhi River redd count trend site 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 14). The Lemhi River resident/fluvial Rainbow Trout redd count trend transect was established in 1997.

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. Redd counts on the Lemhi River are also "single pass" counts, and were conducted on May 3, 2013.

Bull Trout Redd Count Monitoring

Alpine Creek

Alpine Creek is a tributary of Alturas Lake Creek, which flows into Alturas Lake, located approximately 35 km south of Stanley, Idaho. Two trend transects are walked on Alpine Creek annually. The original 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 15). In 2011, a second transect was created in response to an absence of Bull Trout redds in the existing Alpine Creek trend transect in 2008 and 2009. Fisheries staff with IDFG's sockeye recovery program 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 newer 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 15). The new trend transect begins 0.7 km above the mouth of Alpine Creek, compared to the older transect, which started 2.9 km above the mouth. Both transects contain low gradient meadow sections, as well as high gradient canyon sections. The older transect drops 20 m in elevation and the new transect drops 39 m in elevation over the surveyed distance.

Two visual ground counts are conducted annually about two weeks apart on Alpine Creek. Surveys on both Alpine Creek transects were conducted August 29 and September 11, 2013. For each transect, all redds in progress or completed redds were counted during the first survey and flagged for identification. 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.

Fishhook Creek

Fishhook Creek is a tributary of Redfish Lake, located approximately 10 km south of Stanley, Idaho. Two trend transects are walked on Fishhook Creek annually. The older 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 16). The newer 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 16). The newer trend transect in Fishhook Creek was established after survey crews in Fishhook observed Bull Trout spawning below the trend transect site in 2006 and 2007 (K. Plaster, IDFG, personal communication).

Two visual ground counts are conducted annually about two weeks apart on each of two Fishhook Creek transects. Redd count surveys on Fishhook Creek in the older trend transect were conducted August 28 and September 11, 2013, and redd count surveys on the newer transect were conducted August 30 and September 11, 2013. For each transect, all redds in progress or completed redds were counted during the first survey and flagged for identification. 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.

Fourth of July Creek

Fourth of July Creek is a tributary of the Salmon River, located approximately 28 km south (upstream) of Stanley, Idaho. One single visual ground count is conducted on Fourth of July Creek annually. The trend transect is approximately 5 km long, located at (WGS84 datum) Start: 44.04112^{o}N, -114.75831^{o}W, and end: 44.05039^{o}N, -114.69165^{o}W (Figure 17). The trend transect was established in 2003.

Salmon Region fisheries staff conducted the Fourth of July Creek Bull Trout redd count on September 5, 2013 using visual ground count methods. 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, with the confluence approximately 45 km south of Salmon, Idaho. The trend transect on upper Hayden Creek is approximately 2.5 km long, located at (WGS84 datum) Start: 44.70624^{o}N, -113.73430^{o}W, and end: 44.70533^{o}N, -113.75771^{o}W (Figure 18).The trend transect currently walked on upper Hayden Creek is not the original transect established in 2006. The 2006 transect produced single digit Bull Trout redd counts each year between 2006 and 2009, and in 2010 the trend transect site was moved upstream to the current location, because staff determined the bulk of spawning activity was not encompassed within the former trend transect (M. Biggs, IDFG, personal communication).

The upper Hayden Creek trend transect is walked twice annually, approximately one week apart, to visually count fluvial and resident Bull Trout redds. Redd counts in 2013 were conducted on September 12 and 19. 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 visually measured smaller in size were considered to be those of resident Bull Trout. For each transect, all redds in progress or completed redds were counted during the first survey and flagged for identification. 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, located approximately 60 km south of Salmon, Idaho. Two trend transects are walked on Bear Valley Creek annually. The older Bear Valley trend transect (established in 2002) meanders through a meadow section and begins at WGS84 datum coordinates of 44.77624°N, -113.74259°W, and ends at 44.78332°N, -113.75496°W (Figure 18). It is approximately 1.7 km long. In 2007, a second redd count 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 18). 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. In 2013, redd counts on the older Bear Valley Creek transect were conducted September 6, 13, and 20, and the newer transect was surveyed on September 13 and 24. 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 visually measured smaller in size were considered to be those of resident Bull Trout. For each transect, all redds in progress or completed redds were counted during the first survey and flagged for identification. On the second and third (if needed) survey 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 is approximately 15 km upstream from Hayden Creek's confluence with the Lemhi River. A single-pass visual ground count is conducted annually on the East Fork Hayden Creek trend transect to enumerate Bull Trout redds. The trend transect (established in 2002) is approximately 1.5 km long and consists mainly of meadow habitat and is located at (WGS84 datum) start: 44.72984°N, -113.67145°W, and end: 44.72438°N, -113.66671°W (Figure 18). The East Fork Hayden Creek trend transect was established in 2002.

Resident Bull Trout redd counts on East Fork Hayden Creek were conducted September 13 and 24, 2013 using visual ground count methods. All redds in progress or completed redds were counted during the first survey and flagged for identification. 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

Pahsimeroi, East Fork, Redfish Lake Creek, and Sawtooth Weirs and Traps

Fish weirs at the Pahsimeroi and Sawtooth Fish Hatcheries are located on-site (Figure 19). Picket spacing at the Pahsimeroi and Sawtooth weirs is approximately 3.8 cm and 3.2 cm, respectively, so resident salmonids smaller than approximately 30 cm are likely not captured (Morgan Fife personal communication). The East Fork Salmon River and Redfish Lake Creek facilities are operated remotely (Figure 19).

The Pahsimeroi weir was operated from February 5 to May 15 in 2013 for trapping Steelhead adults for broodstock collection. Although the Pahsimeroi weir is also operated for Chinook broodstock collection during the summer, resident fish numbers collected during that time are not presented here.

The Sawtooth weir was operated from March 24 to May 2 for Steelhead collected in 2013, and from June 10 to September 6 for Chinook broodstock collection. Resident fish numbers presented here were collected during both trapping periods.

The East Fork Salmon River satellite facility was operated from March 27 to May 18 for Steelhead collection and from June 13 to September 21 for Chinook collection in 2013. Resident fish numbers presented here were collected during both trapping periods.

From 1999 through 2006, the Redfish Lake Creek trap was usually operated from early June to mid- to late-September. Beginning in 2007, IDFG's Sockeye recovery team extended the end of the trapping season to mid-October to capture late migrants. The trap was run from July 6 to October 23 in 2013.

Steelhead Weirs in the Lemhi River Drainage

Steelhead weirs were operated in the spring of 2013 on Agency, Big Timber, Bohannon, Canyon, Hayden, Kenney, Sandy/Pratt, and Wimpey creeks (Figure 20). Exact weir locations and other information on study sites can be found in the 'Adult Steelhead and Fluvial Trout Movement, Lemhi River Basin' Report for 2012 and 2013 (Messner et al. *in press*).

Steelhead weirs were operated in the Lemhi River tributaries from approximately March 18 to June 10 in 2013. Weirs were not run uninterrupted during the trapping period, as spring runoff forced removal of the weirs for intermittent periods.

Upper Hayden Creek and Bear Valley Creek Bull Trout Weirs

The upper Hayden Creek weir was located at a camping pullout on National Forest Land at 44.758920°N, -113.713258°W, and the Bear Valley Creek weir was located along the Bear Valley Creek road at 44.771662°N, -113.721696°W (Figure 21). Weir locations were chosen for upper Hayden Creek and Bear Valley Creek based on channel morphology and ease of access. The weirs were deployed between July 10 and July 12, and operated as upstream weirs until August 19. On August 19, fisheries staff believed the upstream migrations were complete, and trap boxes were rotated to capture downstream migrating fish. Weirs were run as downstream weirs until they were removed on September 30, 2013. 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. A tissue sample for genetic analysis was also obtained from a subsample of 24 fish from upper Hayden Creek and eight fish from Bear Valley Creek.

RESULTS AND DISCUSSION

Rainbow Trout Redd Count Monitoring

Big Springs Creek and Lemhi River

Fisheries staff observed 281 Rainbow Trout redds in Big Springs Creek and 49 Rainbow Trout redds in the upper Lemhi River in 2013, for a total of 330 redds (Table 9; Figure 22). On Big Springs Creek, 159 redds were counted in the historic Neibauer Ranch transect while 122 redds were observed in the Tyler Ranch transect (Figure 22). 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 22). Although redd numbers in Big Springs Creek were slightly lower than in 2012, the total number of redds counted in all three transects in 2013 was well above the previous five and ten year averages (224 $\pm$ 37 and 221 $\pm$ 22, respectively). Numerous habitat improvement projects, tributary reconnects, 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 transects suggests restoration and conservation activities are benefiting the resident Rainbow Trout population in the Lemhi River. Further investigation and monitoring is warranted, and these transects will continue to be monitored annually.

Bull Trout Redd Count Monitoring

Alpine Creek

In the older Alpine Creek trend transect, we counted one redd and observed three adult Bull Trout in 2013 (Table 10; Figure 23). Prior to 2013, no Bull Trout had been observed in the older trend area in the last five years. In the newer trend transect (established in 2011) two Bull Trout redds were observed in 2013. Not more than four Bull Trout redds have been observed in that reach in any given year (Figure 23).

The cause for low numbers of Bull Trout redds observed in Alpine Creek in the last six years is unknown. From 2000 to 2007, redd observers counted an average 14.4 redds per year (SE $\pm$1.8) in the older trend transect. The fact that we have not observed more than four redds a year in Alpine Creek since 2007 leads us to believe we are either missing spawning activity (geographically or temporally) or the spawning population has declined considerably. Further investigation is warranted to determine the cause of reduced redd counts in Alpine Creek over the last six years.

Fishhook Creek

Fifteen redds were observed in the older trend transect in Fishhook Creek in 2013, and 13 redds were counted in the newer transect (Table 10; Figure 24). Redd counts in the older transect have ranged from 11 to 26 (average 17.7 redds SE $\pm$ 1.2) since 1998 when the monitoring program was initiated. In the newer Fishhook Creek transect, the number of redds counted in 2013 was slightly higher than the previous five year average of 10.4 redds per year

(SE ± 1.2). Bull Trout redd numbers in Fishhook Creek have remained relatively consistent over the last 16 years, indicating a stable population.

Fourth of July Creek

Fisheries staff counted 21 completed Bull Trout redds in the Fourth of July Creek trend transect in 2013; less than half of the previous ten years average (44.7 ± 5.1 SE) (Table 10). The 2013 crews noted that there was little to no high water scouring along the creek banks, and noticeable embedded substrate, numerous silt bars, and depositional areas indicating a shift in channel morphology (P. Murphy, IDFG, personal communication). With 11 years of redd surveys completed in Fourth of July Creek, a pattern seems to be developing (Figure 25). In IDFG's initial redd count year, 2003, fisheries staff counted 16 redds, representing a low count year. This was followed by four high count years in 2004 to 2007 with 33 to 71 redds per year observed, followed by a low count year of 26 redds in 2008. From 2009 to 2012, fisheries staff observed 50 to 56 redds per year, and now, in 2013, another low year of 21 redds were observed. These numbers may represent seasonal variation or may be an indicator of a spawning pattern within the drainage, where a weak age class is present. Redd count surveys over the next 10 years will either substantiate this supposition or not.

Bear Valley Creek

Regional fisheries staff counted 41 fluvial Bull Trout redds in the older Bear Valley Creek trend transect in 2013 (Table 11). The trend of Bull Trout redds counted in this transect has been generally stable, averaging 34.4 redds per year (SE ± 2.0) for the 12 sample periods since monitoring began (Figure 26). In the newer trend transect, 78 Bull Trout redds were counted in 2013 (Table 11). The total number of redds observed upstream in the new trend transect has varied from a low of 21 to a high of 115 during eight survey years (Figure 26). 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 34 Bull Trout redds were observed in the East Fork Hayden Creek trend transect in 2013 (Table 11; Figure 27). The Bull Trout redd count this year was only slightly below the previous 10-year average of 44.4 redds (SE ± 4.0). 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 57 adult Bull Trout observed during this year's redd count surveys.

Hayden Creek

Fourteen Bull Trout redds were counted in the Hayden Creek trend site in 2013 (Table 11; Figure 28). The 2013 count produced the lowest number of redds observed since trend monitoring began in 2005. Fisheries staff in eight previous years observed both fluvial and resident-sized Bull Trout spawning in Hayden Creek, but no fluvial Bull Trout were observed at the time of our survey in 2013, which may help explain the lower number of redds observed.

Resident Fish Capture at Weirs

Pahsimeroi Hatchery Trap

In 2013, 142 resident Rainbow Trout were captured at the Pahsimeroi trap, representing the second highest count to date (Table 12). The average number of Rainbow Trout encountered at the Pahsimeroi trap has more than doubled in recent years (Figure 29), from an average of 43 fish (SE ± 4.4) between 1991 and 2009, to an average of 123 fish (SE ± 9.7) between 2010 and 2013. Recent habitat improvement projects and tributary reconnections in the Pahsimeroi River basin may have improved and/or increased the amount of spawning habitat in the system. Further study is warranted in order to determine whether fish are utilizing recently reconnected tributaries and/or improved habitats.

Sixty-nine percent of Rainbow Trout encountered at the Pahsimeroi trap during the spring of 2013 were female. Picket spacing at the Pahsimeroi weir likely favors passage of resident male Rainbow Trout upriver through the weir while inhibiting female movement. The skewed sex ratio observed in 2013 is consistent with data from previous years.

Seven Bull Trout were encountered at the Pahsimeroi trap in 2013. The first Bull Trout recorded at the Pahsimeroi Hatchery weir was in 2004 (Table 12). Since that time, their numbers have ranged from 0 to 8 fish per year and have remained in the single digits over the past 10-year period.

East Fork Salmon River Satellite Facility Trap

Trapping operations at the East Fork Satellite Facility in 2013 captured 323 Bull Trout, three Westslope Cutthroat Trout, one Rainbow Trout, and 261 Mountain Whitefish *Prosopium williamsoni* (Table 13). The data suggests that Bull Trout numbers have increased substantially over the last two decades (Figure 30). The East Fork facility was not operated between 1998 and 2003, but prior to that hiatus Bull Trout spawner abundance averaged 48 fish (SE ±13.2) between 1984 and 1998. More recently, Bull Trout spawner abundance has averaged 235 fish SE (±16.1) between 2004 and 2013. In the late 1990's numerous fish screens were re-designed and replaced in the East Fork Salmon River basin (Patrick Murphy, IDFG, personal communication). We speculate that improved fish screening has reduced entrainment of downstream migrating fish in diversion ditches over the last decade, thereby increasing survival of both adults and juveniles.

The number of Mountain Whitefish also appears to be increasing with 261 observed in 2013 (Table 13). The number of Mountain Whitefish counted at the East Fork facility has stayed in the three digit range for the past four years and has ranged from 91 to 359 fish per year since 2004. The number of Westslope Cutthroat Trout and Rainbow Trout encountered at the East Fork trap has remained relatively stable in recent years. Three Westslope Cutthroat Trout and one Rainbow Trout were trapped at the facility in 2013.

Sawtooth Hatchery Trap

Sawtooth Fish Hatchery personnel encountered 60 Bull Trout, 23 Westslope Cutthroat Trout, 18 Rainbow Trout, three apparent Cutthroat Trout x Rainbow Trout hybrids, 15 Mountain Whitefish, 21 Suckers, and one Northern Pikeminnow during Steelhead and Chinook Salmon trapping periods in 2013 (Table 14). The number of Bull Trout encountered at the Sawtooth weir this year was well above the 10-year average of 37 fish (Table 14; Figure 31). Cutthroat Trout and Rainbow Trout numbers showed modest increases this year compared to counts of six and nine, respectively, in 2012 (Table 14; Figure 32). Fifteen Mountain Whitefish were collected in 2013 compared to four in 2012 (Table 14). While counts of resident salmonids increased in 2013 when compared to 2011 and 2012, variable trapping dates make trend comparisons of individual species encountered at the trap difficult. Fisheries staff also collected 46 Sockeye Salmon *O. nerka* below the Sawtooth weir and trap in September 2013 (Table 14). In the past two years, the number of adult Sockeye Salmon captured at the Sawtooth trap has decreased as IDFG's Snake River Sockeye Salmon Captive Broodstock Program completes its shift of Sockeye releases to their historical range in Alturas, Pettit, and Redfish lakes in the Stanley basin.

Redfish Lake Creek Trap

At the Redfish Lake Creek trap, 251 Bull Trout, 221 Sockeye Salmon, four Chinook Salmon, 14 Mountain Whitefish, 315 Northern Pikeminnow, and 848 Suckers (var. spp.) were captured during the 2013 trapping season (Table 15). The total number of Bull Trout tripled this year compared to 2012 while the number of Sockeye Salmon doubled as well from 2012 (Table). The number of Bull Trout encountered at the trap has shown a generally increasing trend since operations began in 1999 (Figure 33). Non-salmonid counts also showed increased numbers in 2013 when compared to 2011 and 2012 (Table 15).

The increasing trends in abundance for both salmonids and non-salmonid fish likely reflect the growth of the Sockeye program and a lengthened trapping period since 2007. Prior to 2007 when low numbers of adult Sockeye were returning, the trap was typically pulled in late September or early October. In 2007, trap technicians began operating the trap through the end of October. Increased numbers of Bull Trout encountered are a result of Bull Trout migrating into Redfish Lake to overwinter (Schoby and Curet 2007).

Lemhi River Basin Steelhead Weirs

Seven fluvial Rainbow Trout were captured and PIT tagged at Lemhi River tributary weirs in 2013. For a detailed, comprehensive report of this project, see the 'Adult Steelhead and Fluvial Trout Movement, Lemhi River Basin, Idaho' Report for 2012 and 2013 (Messner et al. *unpublished*).

Upper Hayden Creek and Bear Valley Creek Bull Trout Weirs

Fifty seven Bull Trout were captured at the upper Hayden Creek weir and 34 Bull Trout were captured at the Bear Valley Creek weir in August and September, 2013. None of the 57 Bull Trout captured at the upper Hayden Creek weir contained PIT tags, thus received a tag before release (Table 16). Five Bull Trout captured in Bear Valley Creek contained PIT tags from previous marking events and the remaining 29 fish were implanted with PIT tags at capture (Table 16). Mean fork length (FL ± 1 SE) of Bull Trout captured at the upper Hayden Creek weir was 413 ± 9.7 SE and ranged between 220mm - 604mm. Mean FL (SE ± 1) of Bull Trout captured at the Bear Valley Creek weir was 494 ± 12.6 SE and ranged between 378mm - 665mm. Twenty-four tissue samples were collected from the upper Hayden Creek Bull Trout and eight were collected from the Bear Valley Creek fish for future genetic analysis.

Our weirs did not trap any Bull Trout at either Hayden Creek or Bear Valley Creek through the end of July and into mid-August while attempting to capture upstream migrants. On August 19 we rotated the trap boxes and weir panels on both weirs to face upstream, to trap Bull Trout as they migrated out of spawning areas. The first Bull Trout captured in the upstream-facing weirs was on August 19 at the upper Hayden Creek weir. Over the next month, eight Bull Trout were trapped in upper Hayden Creek and four were trapped in Bear Valley Creek. On September 19, weir operators counted 31 Bull Trout in pools upstream of the Hayden weir and 35 upstream of the Bear Valley weir. Over the following week, four Bull Trout were trapped in upper Hayden Creek and two were trapped in Bear Valley Creek. On September 25, weir operators gathered seine nets and additional fisheries staff to seine fish out of pools above the weir. Staff started with the seine nets approximately 100m upstream of each weir and walked the nets down to the weirs, crowding fish into an area approximately 5m x 5m. Thirty-nine Bull Trout were captured and processed during the event at upper Hayden, and 25 were captured and processed at Bear Valley Creek.

In the future, staff should consider making changes to the weir design to minimize fish avoiding the trap box and gathering in pools above the weir, or the seining event will be necessary every year. The Bull Trout weirs and seining events allowed us to deploy PIT tags into 86 previously untagged fish, which will enable us to monitor Bull Trout growth and movement throughout the Lemhi River and upper Salmon River basin in future years. The Lemhi River Basin currently has nearly 20 PIT tag arrays operating throughout various tributaries and the main-stem river. 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 fish, thereby showing annual growth for various life stages.

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.

3. Annually monitor numbers of resident trout trapped at hatchery and remote weir facilities throughout the region, and use the opportunity to collect biological data and implant PIT tags for further study.

4. Increase trout population monitoring in the region using PIT tags, radio telemetry, and electrofishing to determine patterns of seasonal use of the main-stem Salmon River and its tributaries.

Table 9. Summary of resident Rainbow Trout redds counted in the upper Lemhi River and Big Springs Creek (BSC) transects, 1994 to 2013.

Year	BSC Neibaur Ranch	BSC 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

Table 10. Bull trout redds counted in tributaries of the upper Salmon River in the Sawtooth National Recreation Area.

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	1	2
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
Fourth of July	2003	16	--	16
	2004	33	--	33
	2005	41	--	41
	2006	71	--	71

Stream	Year	Older transect redds	Newer transect redds	Total redds
Fourth of July	2007	49	--	49
	2008	26	--	26
	2009	50	--	50
	2010	56	--	56
	2011	51	--	51
	2012	54	--	54
	2013	21	--	21

Table 11. Bull trout redds counted in Hayden Creek and tributaries of Hayden Creek in the Lemhi River basin.

Stream	Year	Older transect redds	Newer transect redds	Total redds
Bear Valley Cr	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
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
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

Table 12. Summary of resident trout encountered at the Pahsimeroi Fish Hatchery during spring Steelhead trapping, 1991 to 2013.

		# resident Rainbow Trout				
Year	Trapping dates	Males	Females	Total	# Bull Trout	Other salmonids[a]
1991	02/13-05/15	--	--	81	0	0
1992	02/07-04/30	--	--	55	0	0
1993	02/19-05/04	7	36	43	0	0
1994	02/15-05/06	10	17	27	0	0
1995	02/20-05/16	11	17	28	0	0
1996	03/01-05/25	5	23	28	0	0
1997	03/01-05/09	1	7	8	0	0
1998	03/01-05/08	8	17	25	0	0
1999	02/19-05/03	7	17	24	0	0
2000	02/25-05/01	10	27	37	0	0
2001	03/01-03/17	27	41	68	0	0
2002	03/01-05/05	19	43	62	0	0
2003	02/28-05/02	9	31	40	0	0
2004	03/05-04/29	11	39	50	1	0
2005	03/02-05/12	4	50	54	1	1 CTxRBT
2006	03/03-04/26	13	29	42	0	1 CT[b]
2007	03/09-05/27	5	23	28	0	1 CT[b], 1 EBT
2008	02/27-05/21	14	62	76	5	1 RBT sex unknown, 1 EBT
2009	02/20-05/21	16	34	50	0	0
2010	02/22-05/13	43	101	144	1	5 MWF
2011	02/23-05/10	20	86	106	8	1 RBT sex unknown
2012	02/22-05/21	25	93	118	8	0
2013	02/25-05/15	42	93	142[c]	7	0

[a] CTxRBT = Apparent Cutthroat Trout x Rainbow Trout hybrid, CT = Westslope Cutthroat Trout, EBT = Brook Trout, RBT = Rainbow Trout, and MWF = Mountain Whitefish.

[b] Encountered outside range of Steelhead trapping dates.

[c] Rainbow Trout total includes 7 unknown-sex Rainbows.

Table 13. Salmonid and non-game species encountered during steelhead (spring) and Chinook salmon trapping (summer-fall) seasons at the East Fork Satellite Facility, 1984 to 2013.

		Salmonid and non-game species[a]						
Year	Trapping dates	BU	CT	RBT	EBT	MWF	SUC	Total
1984	06/20-08/07[b]	49	3	316	0	1,872	0	2,240
1985	03/15-05/22, 06/11-09/04	--	--	--	--	--	--	--
1986	03/17-04/27, 05/27-09/09	119	0	0	0	49	0	168
1987	03/12-04/30, 05/11-09/03	12	0	0	0	60	0	72
1988	03/15-05/02, 06/01-09/01	0	1	0	0	677	0	678
1989	03/20-05/03, 06/07-09/07	37	0	3	3	200	0	243
1990	03/22-04/30, 06/04-09/14	2	0	0	0	0	0	2
1991	03/01-05/10, 06/03-09/05	89	0	0	0	0	0	89
1992	03/18–5/02, 06/01-09/08	73	0	0	0	0	0	73
1993	03/30-05/12, 06/18-09/06	27	1	0	0	0	0	28
1994	04/05-05/04, 06/06-09/08	61	0	0	0	0	0	61
1995	04/04-05/01, 07/27-08/31	17	0	0	0	0	0	17
1996	03/22-05/10, 06/25-08/30	175	0	1	0	63	0	239
1997	03/28-05/25, 07/08-09/08	13	0	1	0	4	0	18
1998[c]	04/06-05/11	1	1	1	0	117	0	120
1999[c]	04/02-05/03	0	0	2	0	29	0	31
2000[c]	03/29-05/03	0	1	1	1	108	0	111
2001[c]	03/23-05/11	--	--	--	--	--	0	--
2002[c]	03/26-05/21	0	12	4	0	150	0	166
2003[c]	03/25-05/09	0	2	4	0	0	0	6
2004	03/29-04/25, 05/11-09/10	175	8	5	0	359	0	547
2005	03/23-05/17, 06/07-08/30	235	11	1	0	194	0	441
2006	03/23-05/18, 06/21-09/26	262	1	2	0	122	0	387
2007	03/15-05/08, 06/04-09/28	228	6[d]	5	0	91	0	330
2008	03/24-05/14,	168	5[d]	2	0	128	2	305

Year	Trapping dates	Salmonid and non-game species[a]						
		BU	CT	RBT	EBT	MWF	SUC	Total
	06/04-09/24							
2009	03/20-05/12, 06/10-09/21	200	7[d]	0	0	98	0	305
2010	03/25-05/13, 06/11-09/21	209	2	7	0	225	0	446[e]
2011	03/29-05/10, 06/11-09/21	251	1[d]	7	0	187	3	451[f]
2012	03/27-05/15, 06/14-09/21	303	8[d]	2	0	239	0	552
2013	03/27-05/18, 06/13-09/21	323	3	1	0	261	0	588

[a] BU = Bull Trout, CT = Westslope Cutthroat Trout; RBT = Rainbow Trout, EBT = Eastern Brook Trout, MWF = Mountain Whitefish, and SUC = Sucker (various species).

[b] Trap not operated for Steelhead.

[c] Trap not operated for Chinook Salmon.

[d] One apparent Cutthroat/Rainbow hybrid trout encountered.

[e] Total includes two Sockeye Salmon and one wild/natural Steelhead encountered during Chinook Salmon trapping season.

[f] Total includes two wild/natural Steelhead smolts encountered during Chinook Salmon trapping season.

Table 14. Salmonid and non-game fish encountered during steelhead (spring) and Chinook salmon (summer fall) trapping seasons at Sawtooth Fish Hatchery, 1984 to 2013.

		Salmonid and non-game species[a]							
Year	Trapping dates	BU	CT	RBT	EBT	MWF	SOCK	SUC	Total
1984	07/07-09/06[b]	1	0	0	0	0	0	0	1
1985	03/14-05/15, 06/14-09/15	--	--	--	--	--	--	--	--
1986	03/13-04/23, 06/20-09/09	3	0	0	0	0		0	3
1987	03/07-05/01, 05/13-09/08	--	--	--	--	--	--	--	--
1988	03/03-05/03, 05/23-09/06	--	--	--	--	--	--	--	--
1989	03/13-05/03, 06/07-09/11	--	--	--	--	--	--	--	--
1990	03/02-05/07, 05/21-09/14	7	0	0	0	1	0	0	8
1991	02/28-05/14, 06/07-09/15	17	0	0	0	0	0	0	17
1992	03/02-04/30, 05/28-09/18	24	0	0	0	0	0	0	24
1993	03/18-05/12, 06/18-09/06	5	0	0	0	0	0	0	5
1994	03/16-05/09, 05/31-10/26	38	0	0	0	0	0	0	38
1995	03/15-05/10, 06/12-09/06	6	0	0	0	0	0	0	6
1996	03/20-05/13, 06/20-09/11	4	1	1	0	9	0	226	241
1997	03/20-05/12, 06/16-09/04	5	0	6	0	1	0	116	11
1998	03/23-05/08, 06/10-09/14	4	4	5	0	12	0	252	277
1999	03/23-05/06, 06/28-09/07	8	4	10	0	34	7[d]	97	160
2000	03/20-05/04, 05/30-09/25	27	1	3	0	1	138	0	170
2001	03/19-05/03, 05/24-09/14	31	0	0	0	0	11	0	42
2002	03/20-05/02, 05/28-09/09	23	0	3	0	8	14	26	74
2003	03/28-05/05, 06/12-09/09	29	0	2	0	1	1	8	41
2004	03/15-04/29, 05/25-09/15	8	0	2	0	5	23	14	52
2005	03/25-05/05, 06/05-09/19	33	1	2	0	15	4	5	60
2006	03/27-05/01, 06/19-09-15	25	3	18	0	35	3	0	84
2007	03/15-05/01, 05/25-09/11	72	13	27	0	8	3	189	312
2008	03/19-05/06, 06/11-09/17	18	13	10	0	20	218	1,089	1,365
2009	03/19-05/07, 06/24-10/16	24	10[c]	8	0	6	249	170	467
2010	03/23-05/04, 05/27-09/16	76	13	24	0	71	652	741	1,577[e]
2011	03/24-05/05, 07/10-09/09	30	13	15	0	7	590	10	667[f]
2012	03/21-05/03, 06/21-10/18	21	8[c]	9	0	4	136	129	313[g]
2013	03/24-05/02, 06/10-09/06	60	26[h]	18	0	15	46	21	183[i]

[a] BU = Bull trout, CT = Westslope Cutthroat Trout; RBT = Rainbow Trout, EBT = Brook Trout, MWF = Mountain Whitefish, SOCK=Sockeye Salmon, and SUC = Sucker.
[b] Trap not operated for Steelhead.
[c] Includes 2 apparent Cutthroat x Rainbow hybrid trout.
[d] First year of reporting Sockeye Salmon incidental to Chinook Salmon trapping.
[e] Total includes 2 wild/natural Chinook Salmon smolts encountered during Steelhead trapping season.
[f] Total includes 1 wild/natural Chinook salmon smolt encountered during Chinook trapping season and 1 wild/natural Steelhead smolt.
[g] Total includes 1 Sockeye Salmon smolt, 2 wild/natural Steelhead smolts, and 3 Northern Pikeminnow.
[h] Includes 3 apparent Cutthroat x Rainbow hybrid trout.
[I] Total includes 1 Northern Pikeminnow.

Table 15. Salmonid and non-game fish encountered during sockeye salmon trapping at Redfish Lake Creek temporary weir, 1999 to 2013.

		Salmonid and non-game species[a]						
Year	Trapping dates	BU	SOCK	CK	MWF	NPM	SUC	Total
1999	7/15-9/14	10	6	2	0	1	87	106
2000	7/5-9/23	1	43	1	0	1	21	67
2001	6/26-9/9	1	15	2	0	0	10	28
2002	7/15-10/11	7	10	2	0	1	18	28
2003	7/10-9/25	12	2	4	0	16	65	89
2004	7/13-9/13	6	1	4	0	0	6	17
2005	6/30-9/21	6	2	4	0	4	54	70
2006	7/7-10/3	3	1	2	0	0	4	10
2007	7/3-10/22	29	1	8	2	33	207	280
2008	7/9-10/22	96	432	2	2	76	338	946
2009	7/6-10/20	72	584	1	1	263	250	1,171
2010	7/10-10/12	187	652	4	1	111	368	1,323
2011	7/22-10/14	113	542	4	0	242	463	1,364
2012	7/13-10/17	82	107	1	0	213	482	885
2013	7/6-10/23	251	221	4	14	315	848	1,653

[a] BU = Bull Trout, SOCK = Sockeye Salmon; CK = Chinook Salmon, MWF = Mountain Whitefish, NPM = Northern Pikeminnow, and SUC = Sucker (various species).

Table 16. Bull Trout captured in Bear Valley and Hayden Creek weirs in the fall, 2013.

Stream	TL (mm)	Wt (g)	PIT tag deployed	Recaptured PIT tag
Bear Valley Creek	532	1188	3D9.1C2D57A825	
	590	2014	3D9.1C2D5873D6	
	505	1520		3D9.1C2D577DC0
	550	1674		3D9.1C2D587061
	427	560	3D9.1C2D58842A	
	582	1594	3D9.1C2D5879B9	
	491	904	3D9.1C2D57006E	
	447	748	3D9.1C2D5700A4	
	390	616	3D9.1C2D579DBC	
	665	2535	3D9.1C2D570635	
	645	2530		3D9.1C2C44AB5D
	485	1050		3D9.1C2C2ACCAE
	442	810	3D9.1C2D587ADD	
	590	1820	3D9.1C2D57B21E	
	425	694	3D9.1C2D57B3E1	
	452	860	3D9.1C2D579DD0	
	472	997	3D9.1C2D57AC8B	
	485	1134	3D9.1C2D577DC8	
	425	624	3D9.1C2D57ABC3	
	430	800		3D9.1C2D570350
	420	728	3D9.1C2D5862F5	
	450	888	3D9.1C2D5705BB	
	570	1808	3D9.1C2D57A624	
	435	798	3D9.1C2D57B051	
	475	1016	3D9.1C2D585EB2	
	378	500	3D9.1C2D58ED48	
	466	840	3D9.1C2D579F98	
	504	1126	3D9.1C2D577C60	
	566	1690	3D9.1C2D57DAFB	
	490	1178	3D9.1C2D588BC4	
	422	730	3D9.1C2D570A02	
	588	1770	3D9.1C2D588B9C	
	579	1672	3D9.1C2D57A485	
	445	768	3D9.1C2D579E9E	
Upper Hayden Creek				
	490	992	3D9.1C2D57725F	
	419	776	3D9.1C2D57B071	
	220	102	3D9.1C2D56FCE1	
	428	620	3D9.1C2D585EC0	

Stream	TL (mm)	Wt (g)	PIT tag deployed	Recaptured PIT tag
Upper Hayden	421	712	3D9.1C2D57AA88	
	412	526	3D9.1C2D57A6D3	
	425	742	3D9.1C2D57B071	
	268	180	3D9.1C2D57AD9C	
	381	448	3D9.1C2D56FC99	
	276	196	3D9.1C2D57AB9E	
	357	370	3D9.1C2D57B40B	
	356	326	3D9.1C2D57A6DA	
	410	722	3D9.1C2D588459	
	415	672	3D9.1C2D57107F	
	448	826	3D9.1C2D586AC3	
	419	602	3D9.1C2D570BA4	
	438	672	3D9.1C2D56F9AA	
	427	554	3D9.1C2D58FEED	
	447	640	3D9.1C2D58ECC3	
	604	1634	3D9.1C2D588C15	
	464	834	3D9.1C2D58EA0E	
	381	438	3D9.1C2D586311	
	380	412	3D9.1C2D588931	
	410	604	3D9.1C2D586E9B	
	452	620	3D9.1C2D576964	
	445	714	3D9.1C2D570F1F	
	360	422	3D9.1C2D58EE55	
	537	1294	3D9.1C2D57A0F8	
	390	486	3D9.1C2D57EBD2	
	394	392	3D9.1C2D57E8CE	
	444	694	3D9.1C2D576D02	
	362	396	3D9.1C2D5704AA	
	280	182	3D9.1C2D57A39F	
	475	814	3D9.1C2D57AAAA	
	450	712	3D9.1C2D57AFA9	
	452	650	3D9.1C2D586E6D	
	432	634	3D9.1C2D588B46	
	432	622	3D9.1C2D56D1E1	
	488	988	3D9.1C2D570DAB	
	528	1342	3D9.1C2D587275	
	452	774	3D9.1C2D586A89	
	540	1184	3D9.1C2D587090	
	319	278	3D9.1C2D570268	
	357	374	3D9.1C2D586E63	
	436	572	3D9.1C2D577626	

Stream	TL (mm)	Wt (g)	PIT tag deployed	Recaptured PIT tag
Upper Hayden	422	604	3D9.1C2D57B3D1	
	474	810	3D9.1C2D58697C	
	391	526	3D9.1C2D57B38E	
	360	336	3D9.1C2D588F22	
	489	924	3D9.1C2D578006	
	534	1174	3D9.1C2D570393	
	372	360	3D9.1C2D58F0EF	
	475	1000	3D9.1C2D57057E	
	409	586	3D9.1C2D58726A	
	293	210	3D9.1C2D57A434	
	334	304	3D9.1C2D570E38	
	290	228	3D9.1C2D588F28	

Figure 14. Rainbow Trout redd count trend transect boundaries for Big Springs Creek and Lemhi River, near Leadore, Idaho.

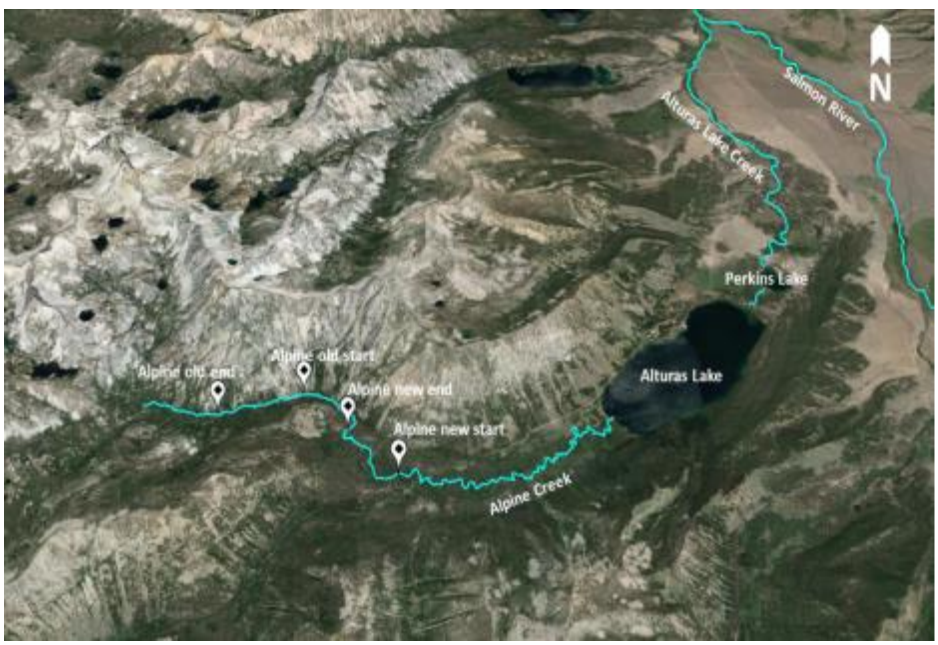

Figure 15. Bull Trout redd count trend transect boundaries for Alpine Creek, near Stanley, Idaho.

Figure 16. Bull Trout redd count trend transect boundaries for Fishhook Creek, near Stanley, Idaho.

Figure 17. Bull Trout redd count trend transect boundaries for Fourth of July Creek, near Stanley, Idaho.

Figure 18. Bull Trout redd count trend transect boundaries in Bear Valley, Hayden, and East Fork Hayden Creeks, near Tendoy, Idaho.

Figure 19. Site locations for Pahsimeroi and Sawtooth Hatchery weirs, Redfish Lake Creek Sockeye weir, and East Fork Salmon River Chinook Salmon weir, in relation to nearby cities.

Figure 20. Approximate locations of eight Steelhead weirs operated in the Lemhi River basin in the spring, 2013.

Figure 21. Approximate locations of Bull Trout weirs operated in the Hayden Creek drainage in the fall, 2013.

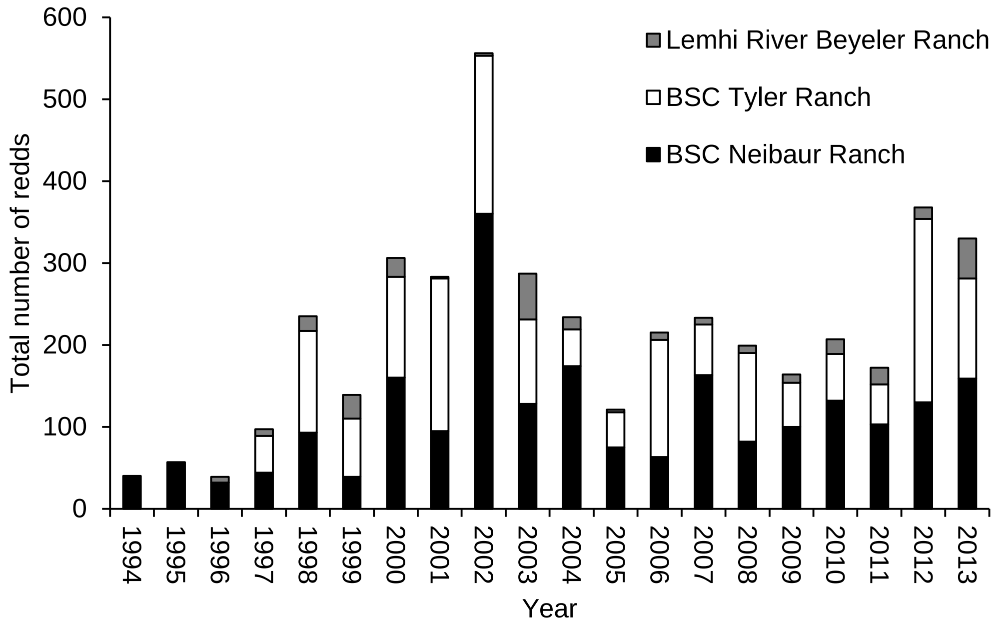

Figure 22. Resident Rainbow Trout redds counted during ground surveys in the upper Lemhi River (Beyeler Ranch) and Big Springs Creek (Neibaur and Tyler ranches), 1994 to 2013.

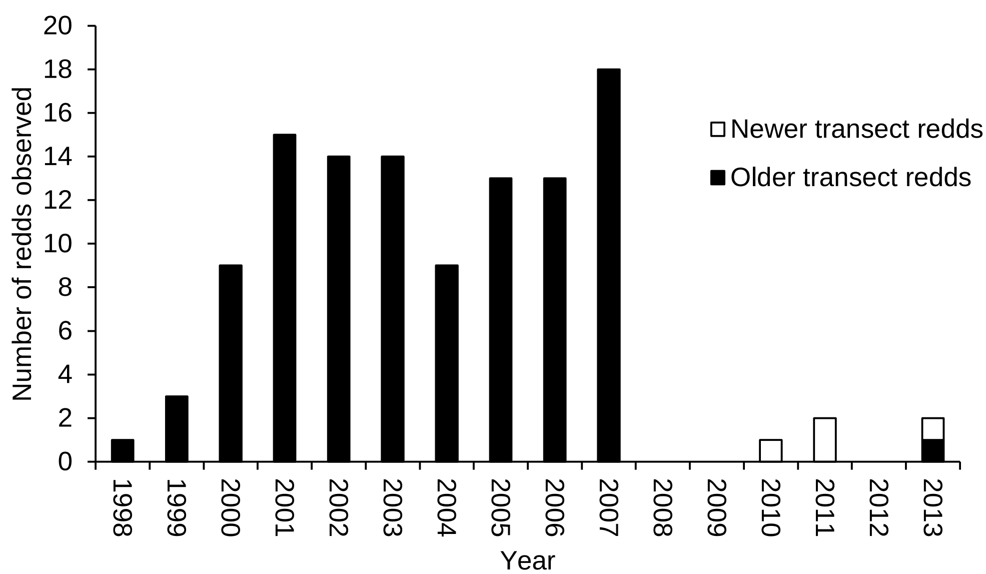

Figure 23. Number of Bull Trout redds counted in both survey transects on Alpine Creek, 1998 to 2013.

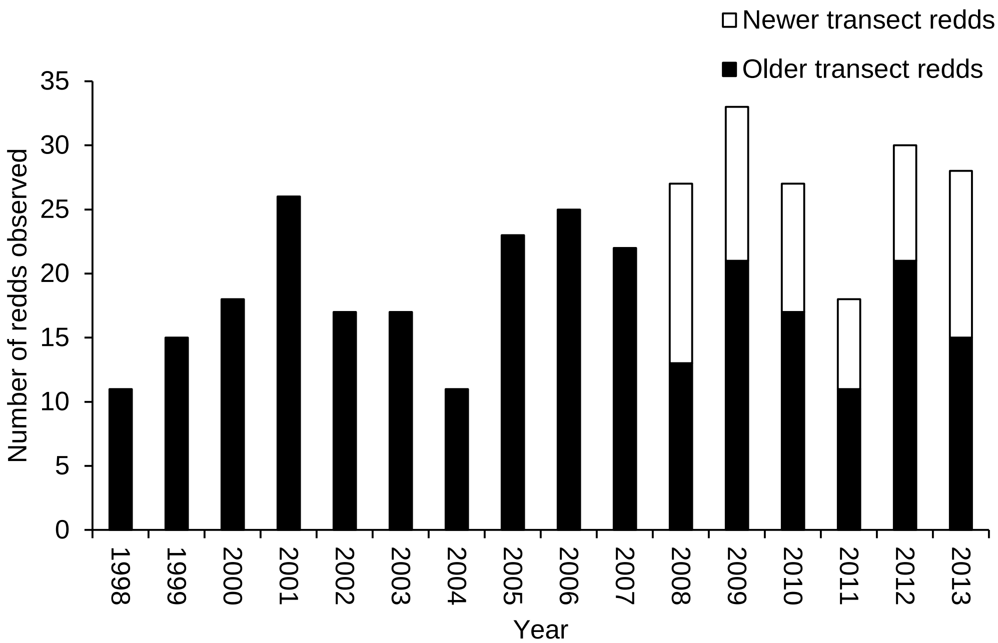

Figure 24. Number of Bull Trout redds counted in both transects on Fishhook Creek, 1998 to 2013.

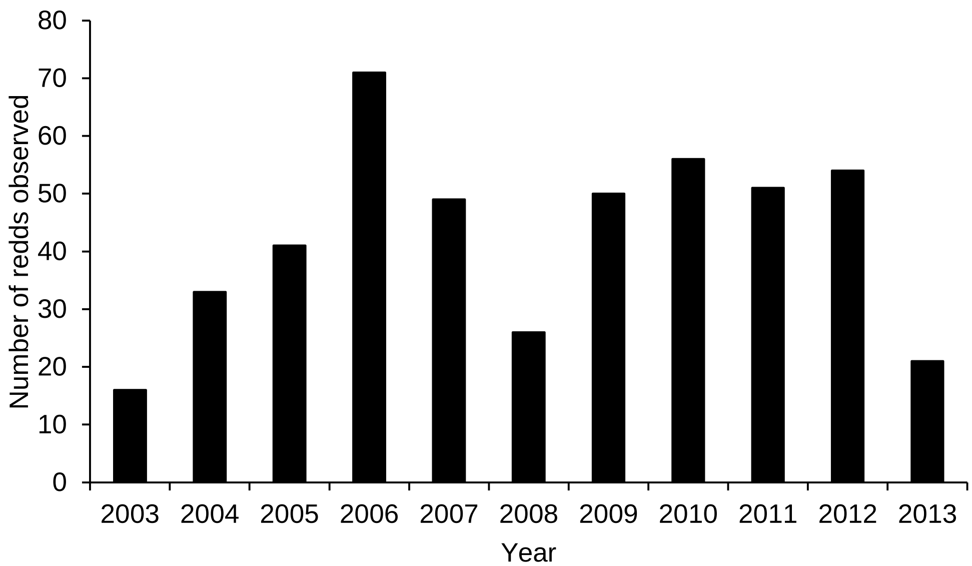

Figure 25. Number of Bull Trout redds counted on Fourth of July Creek, 2003 to 2013.

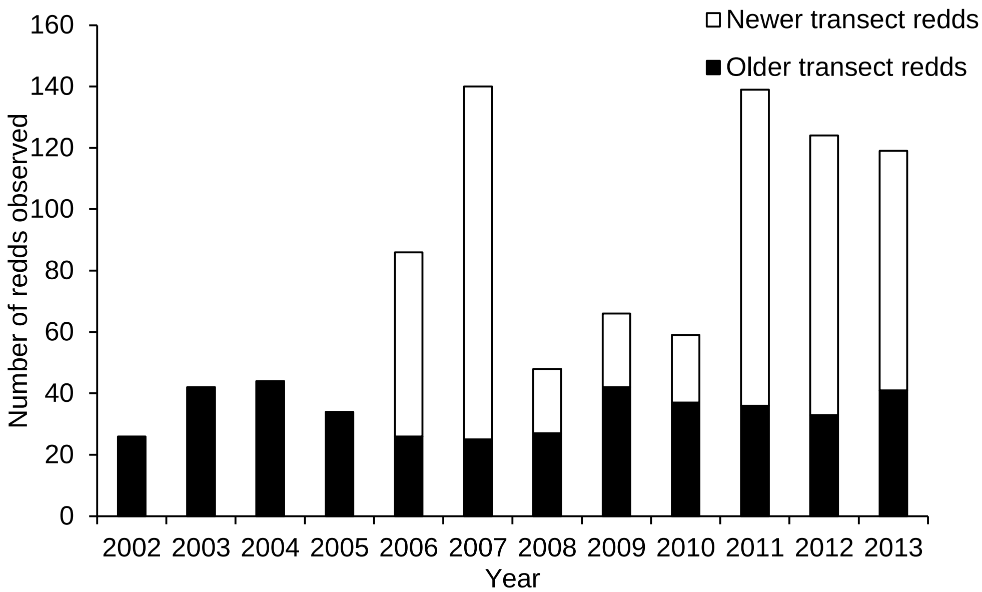

Figure 26. Number of Bull Trout redds observed in Bear Valley Creek transects, 2002 to 2013.

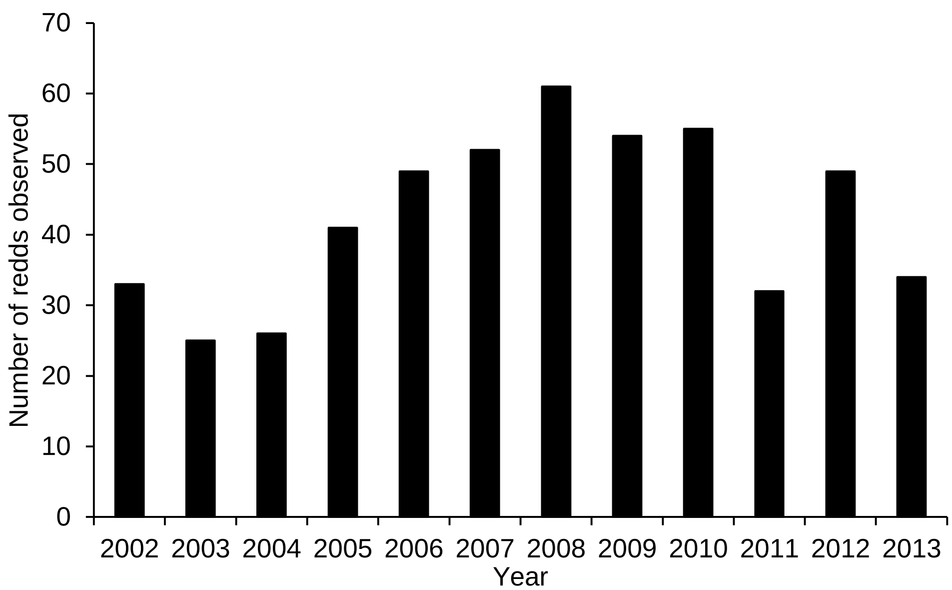

Figure 27. Number of Bull Trout redds observed in East Fork Hayden Creek, 2002 to 2013.

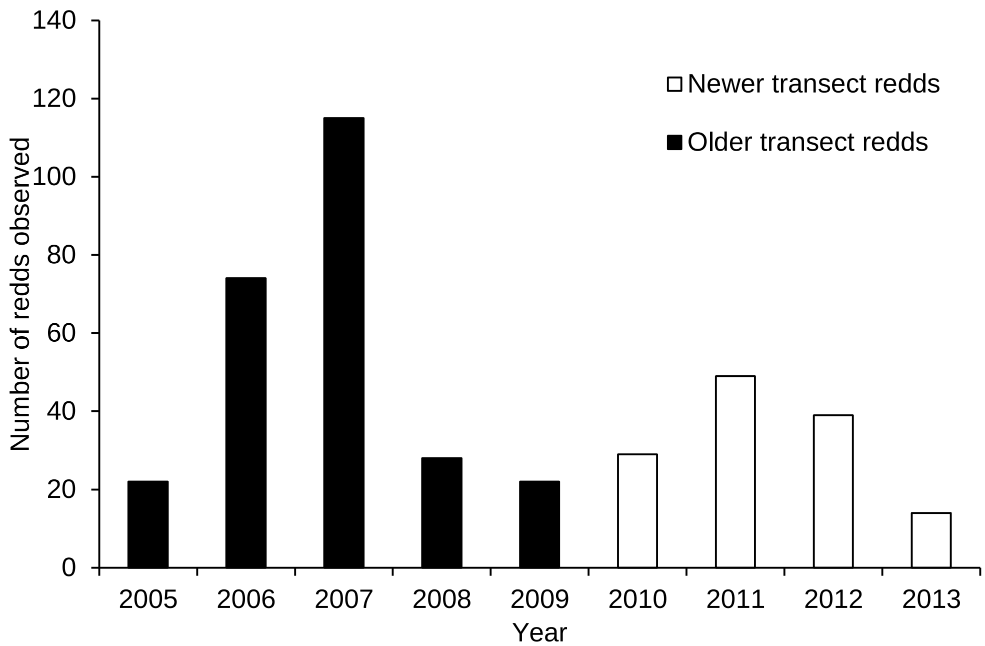

Figure 28. Number of Bull Trout redds observed in Hayden Creek, 2005 to 2013.

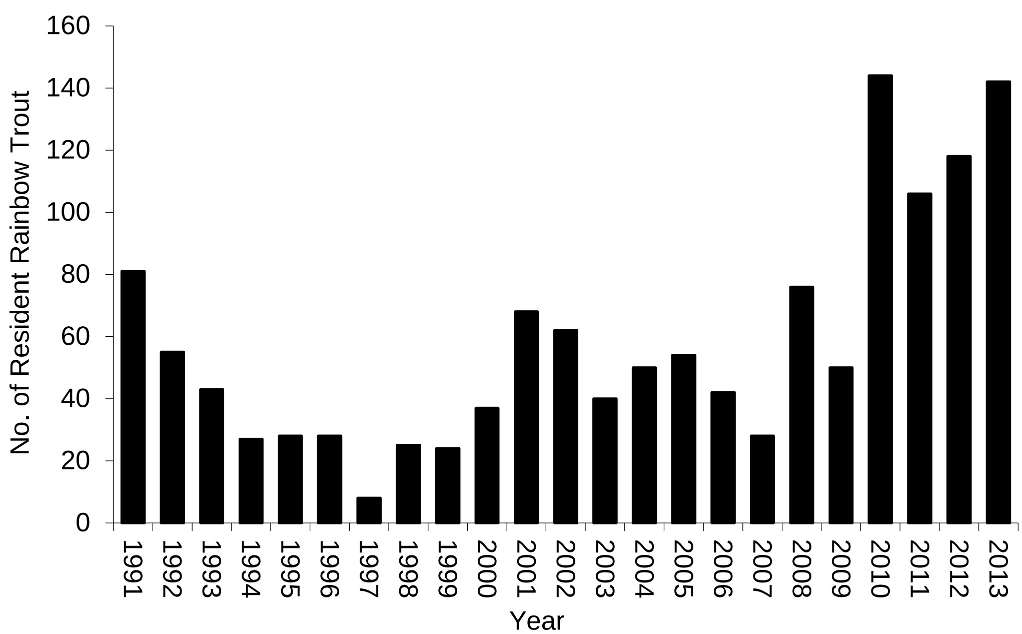

Figure 29. Count of resident Rainbow Trout encountered at the Pahsimeroi Fish Hatchery during spring Steelhead trapping seasons, 1991 to 2013.

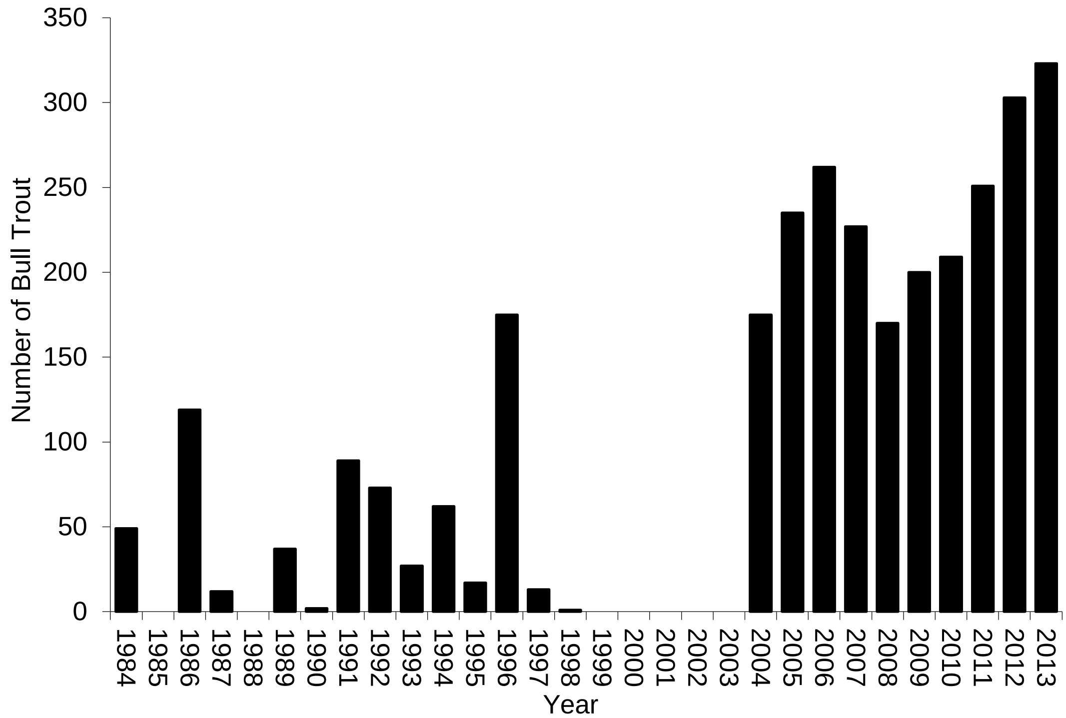

Figure 30. Annual count of Bull Trout collected at the East Fork Satellite Facility during steelhead and Chinook Salmon trapping seasons, 1984 to 2013.

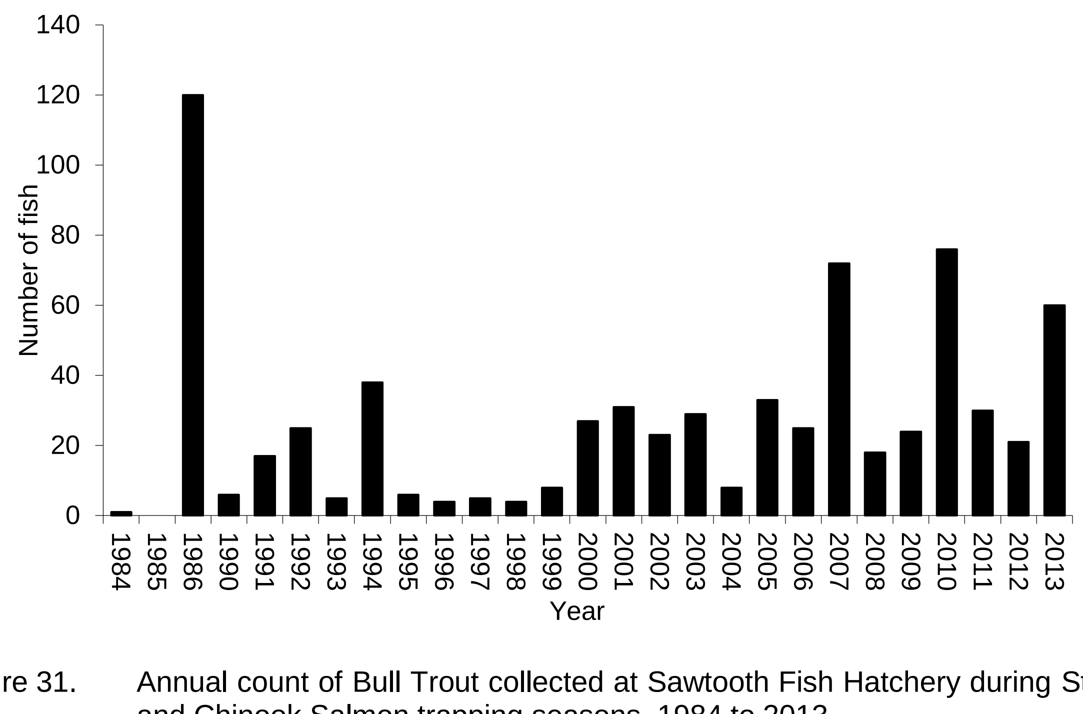

Figure 31. Annual count of Bull Trout collected at Sawtooth Fish Hatchery during Steelhead and Chinook Salmon trapping seasons, 1984 to 2013.

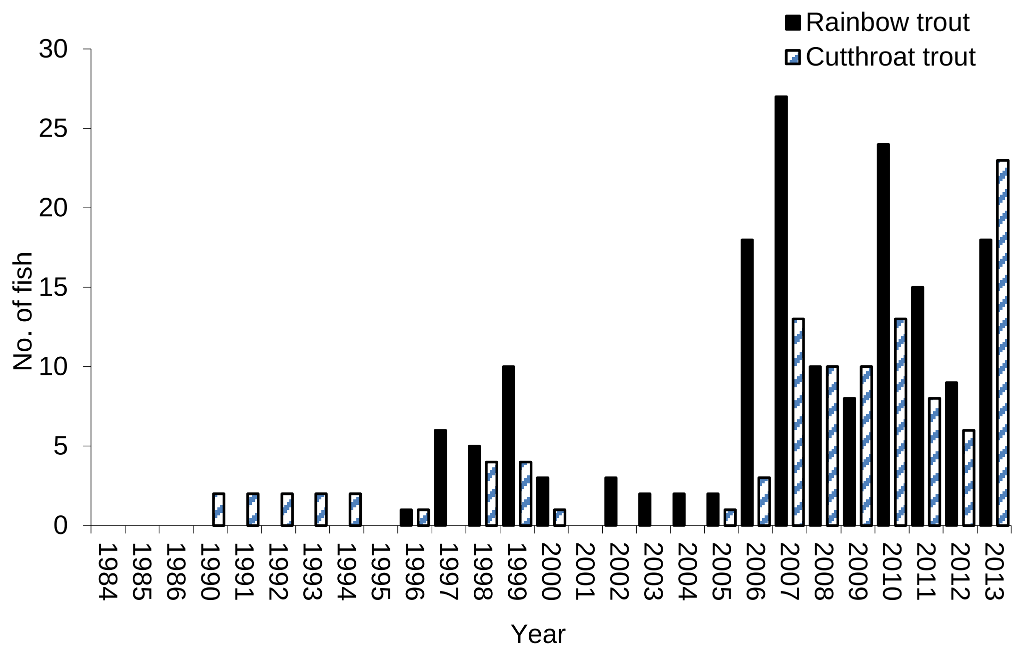

Figure 32. Annual count of Rainbow and Cutthroat Trout collected at Sawtooth Fish Hatchery during Steelhead and Chinook Salmon trapping seasons, 1984 to 2013.

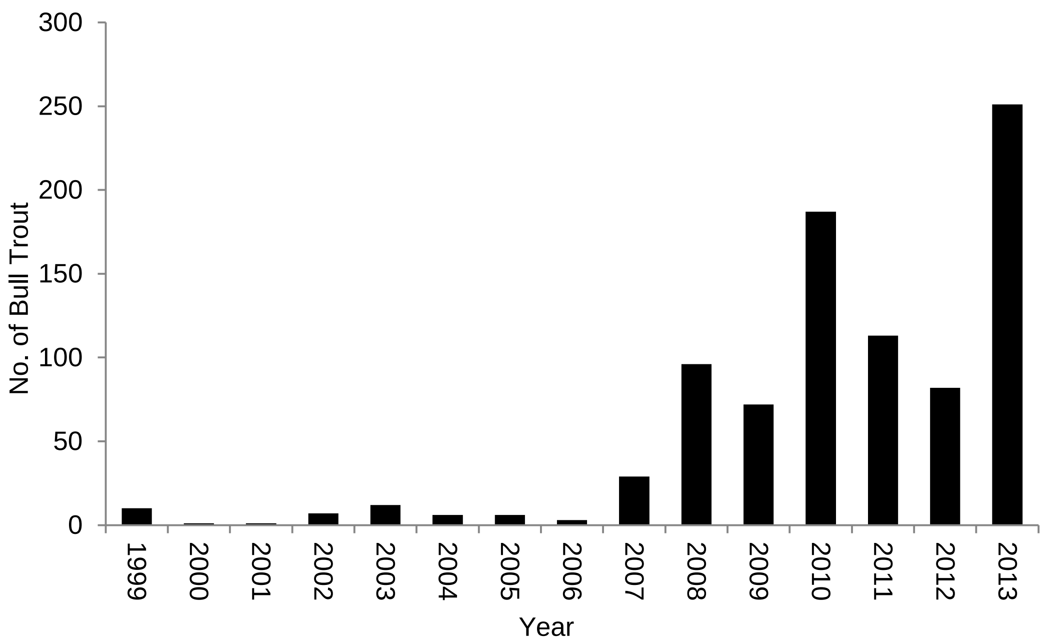

Figure 33. Number of Bull Trout encountered at the Redfish Lake Creek trap, 1999 to 2013

MIDDLE FORK SALMON RIVER THERMAL REFUGIA STUDY

ABSTRACT

In July 2012 and 2013, we evaluated whether salmonid densities differed in the main-stem Middle Fork Salmon River (MFSR) above and below tributaries (i.e. plumes), to understand the importance of cold water input as thermal refugia for fishes. A total of 37 sites were surveyed in 2013. Of the sites surveyed, 26 (70%) contained higher salmonid densities in the plumes than in the main-stem above the tributary. Plumes averaged 1.7°C (SE$\pm$0.3) cooler than the main-stem MFSR, and the temperature difference between plumes and the main-stem became more pronounced at lower elevation, as expected. We did not observe a longitudinal increase in the total number of salmonids utilizing plume habitats downriver as water temperatures in the main-stem increased. However, we did observe increased preferential use of plume habitats by Rainbow Trout/Steelhead *Oncorhynchus mykiss* along the downstream gradient. Identifying and understanding the importance of cold water input as potential refugia for salmonids during higher summer water temperatures may help direct future habitat restoration efforts aimed at stream connectivity.

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INTRODUCTION

In the Upper Salmon River subbasin, tributary streams provide cold-water input to larger, warmer main-stem rivers during summer months. Cold water pockets can develop where colder tributaries and warmer main-stem rivers converge. The presence of these cold water pockets may be important for salmonid persistence and survival in larger main-stem rivers, particularly when water temperatures in main-stem rivers increase during summer months. Elevated stream temperatures during summer months can negatively affect metabolic rates and sometimes cause direct mortality to salmonids (Brett 1979). Ebersole et al. (2001) found that 10 - 40% of Rainbow Trout *Oncorhynchus mykiss* sampled in their study reaches in the Snake River drainage were congregated in small pockets of colder water during warm summer months, where tributaries converge with the main-stem. These pockets are also known as “thermal plumes”, and when used by fish to avoid undesirable thermal conditions are known as “thermal refugia”.

Salmonids may behaviorally thermo-regulate by moving to thermal refugia when temperatures approach sub-lethal or lethal levels. However, many tributaries in the Upper Salmon River basin are impacted by water withdrawals, thus limiting the cold water inputs available to main-stem rivers. We continued a study from 2012 that investigated the importance of thermal refugia in an intact wilderness river system, the Middle Fork Salmon River (MFSR). The goal of this study was to determine if salmonid densities differed significantly above and below tributary confluences (i.e. main-stem vs. plumes).

OBJECTIVES

1. Determine the importance of thermal refugia in tributary plumes for salmonids in the main-stem Middle Fork Salmon River.

STUDY AREA AND METHODS

During July 22 to 29, 2013, we surveyed 37 tributary plume sites along the wilderness section of the Middle Fork Salmon River via snorkeling to evaluate salmonid utilization of plume habitats. For this study, the MFSR was divided into three strata: Upper, Middle, and Lower. The Upper strata extended from Sulphur Creek downstream to Pungo Creek, the Middle strata included those tributaries from Little Soldier Creek to Big Bear Creek, and the Lower strata encompassed selected tributaries from Sheep Creek to Goat Creek. In 2013, 14 sites were identified in the Upper strata, 11 in the Middle strata, and 12 in the Lower (Figure 34). Each survey site consisted of a 50 m reach above each tributary (termed “above plume”) and a 50 m reach below each tributary (termed the “plume”). One snorkeler counted fish while moving upstream in each reach, approximately 1 m out from the bank. All salmonids were identified to species, counted, and their total length estimated to the nearest 25 mm length group. Chinook salmon *Oncorhynchus tshawytscha* parr were assigned an age (i.e. age 0 or age 1) based on total length. Non-salmonids were noted if present. Visibility was estimated at each site by suspending a sighting object in the water column and allowing the snorkeler to drift downriver until the object was unidentifiable.

Water temperature was measured at each site in order to determine thermal differences between the plume and the main-stem river. Temperature was measured above the tributary confluence, in the tributary confluence, and at 1 m, 10 m, 20 m, 30 m, 40 m, and 50 m below the tributary confluence, within 1 m of the bank.

We used paired t-tests to detect any significant differences in salmonid densities above and below tributary mouths (α = 0.05). We also used the same tests to determine whether the temperature difference between the main-stem river and the thermal plumes at each site, and within each strata, were significantly different.

RESULTS AND DISCUSSION

Snorkelers observed a total of 614 fish at the 37 study sites in 2013, of which 92% (n = 562) were comprised of Westslope Cutthroat Trout *O. clarkia lewisi*, Rainbow Trout/Steelhead, and Chinook Salmon (Table 17). The remaining 8% included Bull Trout *Salvelinus confluentus*, Mountain Whitefish *Prosopium williamsoni*, trout fry (various spp.), Northern Pikeminnow *Ptychochelius oregonensis*, and Suckers (*Catastomus* spp.).

Water temperature (± SE) in tributary plumes averaged 1.7°C (±0.3) cooler than the main-stem MFSR above the plumes, with a range from 0°C to 6°C colder (Table 18; Figure 35). Water temperature in tributary plumes was significantly lower than in the main-stem river above the plumes in all three strata (i.e. upper, middle, and lower) (p=0.04, df = 6, p<0.01, df = 13, p<0.01, df = 13, respectively), and that difference was most pronounced in the lowest strata (*diff* = -1.6, -0.9, -2.6, respectively) (Figure 36). As expected, these results indicate that the importance of thermal plume habitats may increase as elevation decreases, and the difference in water temperature between the main-stem and thermal plumes becomes more pronounced.

The main objective of our study was to evaluate whether fish densities differed significantly above and below tributaries (i.e. main-stem vs. plumes) in the MFSR. Although 70% (n = 26) of the 37 sites surveyed contained higher salmonid densities in tributary plumes than in the main-stem river above the plumes (Table 19; Figure 37), paired t-test results indicated the difference was not statistically significant, whether across the entire river reach ($p = 0.10$), or when broken up into the upper, middle, and lower strata ($p = 0.09$, $p = 0.21$, $p = 0.09$, respectively) (Figure 38). However, we found that Rainbow Trout/Steelhead and Westslope Cutthroat Trout did show some statistically significant preference for tributary plume habitat. Across the entire river reach, the two species together were observed at higher densities within thermal plumes, than above the plumes ($p = 0.02$). Although Westslope Cutthroat Trout did not show any increased use of thermal refugia in the lower reaches of the river, we found that Rainbow Trout showed a higher preference for tributary plume habitat in the lower strata (p = 0.03), than in the upper and middle strata ($p = 0.68$ and p = 0.11, respectively), and that the difference became more pronounced lower in the system. These results indicate that thermal refugia may not be utilized in the same way for all salmonid species in the MFSR, but that for certain species (e.g. Rainbow Trout/Steelhead) thermal refugia is very important, and becomes more important as main-stem river temperatures rise.

Research shows that water temperatures exceeding 25°C can be lethal for Rainbow Trout/Steelhead. As water temperatures approach these lethal limits, Rainbow Trout/Steelhead have been observed utilizing cold water input from tributaries, ground seeps, and springs (Matthews and Berg 1997). In the MFSR, we observed a more pronounced preference of tributary plume habitats by Rainbow Trout/Steelhead along an elevation gradient, as the difference in temperature between plume habitats and the main-stem became more pronounced. In the lower strata of our study reach, the difference in temperature between the main-stem river and thermal plumes was 2.6°C, compared to only 1.6°C in the upper strata. Main-stem temperatures in the lower strata of our study averaged only 17.5°C, but were found to be as high as 20°C at some sites. Rainbow Trout/Steelhead experience increased metabolic demands at higher temperatures, which could be reduced by utilizing cold-water thermal refugia at tributary mouths.

This study highlights the importance of cold-water tributary inputs in large, warmer main-stem rivers, especially as differences in temperature becomes more pronounced. In 2013, flows in the MFSR were among the lowest reported in 10 years (Figure 39), which may have affected our results. Lower flows in the MFSR in 2013 likely represented lower flows within the tributaries we surveyed. Reduced tributary flows would make plume habitat less available to salmonids, but we still saw preferred utilization of those habitats by certain species. Low flow years may exacerbate temperature differences between tributary and main-stem habitats. While low flows could make plume habitat more important for salmonids seeking thermal refugia, the availability of such key habitat is greatly reduced. The reduced flows in 2013 may have affected our ability to detect the importance of thermal refugia for salmonid species other than Rainbow Trout/Steelhead and Westslope Cutthroat Trout, by reducing the size and carrying capacity of thermal plumes in the system. In any case, identifying and understanding the importance of thermal plumes as refugia for salmonids in an unaltered system like the MFSR can help resource managers understand the importance of reconnecting tributaries to main-stem rivers in altered systems, where flows have been dramatically decreased or disconnected due to anthropogenic effects. The results of this study should help guide future habitat restoration efforts aimed at stream reconnections in altered systems.

MANAGEMENT RECOMMENDATIONS

1. Continue using the Middle Fork Salmon River system as a guide to understanding how biological organisms and processes should function under ideal conditions.

Table 17. Numbers of fish observed during snorkeling in tributary plumes and above plume sites in the main-stem Middle Fork Salmon River, 2013. Tributaries are listed in sequence as encountered downriver of Boundary Creek. Shading represents strata breaks for Upper, Middle, and Lower.

		Westslope Cutthroat Trout Total length (mm)					Rainbow Trout/Steelhead Total length (mm)					Chinook Salmon			Other species[a]					
Tributary	Strata	75-150	150-230	230-300	>300	Total	75-150	150-230	230-300	>300	Total	Age 0	Age 1	Total	BU	MWF	NPM	SUC	Trout fry	Total fish
Sulphur	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulphur	Plume	0	0	0	0	0	2	0	0	0	2	4	0	4	0	1	0	0	0	7
Elkhorn	Above plume	20	4	0	0	24	0	1	0	0	1	14	0	14	0	0	0	0	0	39
Elkhorn	Plume	4	8	12	9	33	2	0	0	0	2	90	0	90	4	0	0	0	0	129
Deer Horn	Above plume	0	0	0	0	0	6	0	0	0	6	7	0	7	0	0	0	0	0	13
Deer Horn	Plume	0	1	0	0	1	2	0	0	0	2	0	2	2	0	0	0	0	0	5
Greyhound	Above plume	0	0	0	0	0	4	0	0	0	4	8	0	8	0	0	0	0	0	12
Greyhound	Plume	0	6	7	4	17	3	0	0	0	3	2	0	2	0	0	0	0	0	22
Dome	Above plume	0	0	2	0	2	0	1	0	0	1	8	0	8	0	0	0	0	0	11[a]
Dome	Plume	0	1	3	0	4	3	2	0	0	5	15	0	15	0	0	0	0	0	24
Artillery	Above plume	0	0	0	0	0	1	3	0	0	4	7	0	7	0	1	0	0	0	12
Artillery	Plume	0	0	2	0	2	5	3	0	0	8	19	0	19	0	0	0	0	0	29
Rapid River	Above plume	0	0	0	0	0	0	0	0	0	0	4	0	4	0	3	0	0	0	7
Rapid River	Plume	0	1	0	0	1	2	0	0	0	2	8	1	9	0	0	0	0	0	12
Pistol	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pistol	Plume	0	0	1	0	1	0	1	0	0	1	9	0	9	0	0	0	0	0	10
Cow	Above plume	0	0	0	2	2	2	0	0	0	2	30	0	30	0	0	0	0	0	34
Cow	Plume	0	0	0	0	0	0	0	0	0	0	15	0	15	0	0	0	P[b]	0	15
Garden	Above plume	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1
Garden	Plume	0	0	0	0	0	0	1	0	0	1	12	0	12	0	1	0	0	0	14
Indian	Above plume	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	4
Indian	Plume	0	1	2	2	5	0	1	0	0	1	6	0	6	0	2	0	0	0	14
Pungo	Above plume	0	1	0	0	1	2	0	0	0	2	2	0	2	0	0	0	0	0	5
Pungo	Plume	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	P	0	2
Little Soldier	Above plume	0	0	3	1	4	0	0	0	0	0	0	0	0	0	1	0	0	0	5
Little Soldier	Plume	0	0	1	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	3
Marble	Above plume	0	0	0	0	0	1	0	0	0	1	3	0	3	0	1	0	0	0	4
Marble	Plume	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	2
Cougar	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cougar	Plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mahoney	Above plume	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Tributary	Strata	Westslope Cutthroat Trout: Total length (mm) 75-150	150-230	230-300	>300	Total	Rainbow Trout/Steelhead: Total length (mm) 75-150	150-230	230-300	>300	Total	Chinook Salmon: Age 0	Age 1	Total	Other species[a]: BU	MWF	NPM	SUC	Trout fry	Total fish
Mahoney	Plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Pine	Above plume	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	2
Pine	Plume	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	1	4
White	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White	Plume	0	0	0	0	0	0	1	0	0	1	10	0	10	0	0	0	P	0	11
Loon	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loon	Plume	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	1	0	0	3
Norton	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Norton	Plume	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	2
Cub	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cub	Plume	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Camas	Above plume	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	2
Camas	Plume	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	2	0	0	4
Big Bear	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Bear	Plume	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1
Sheep	Above plume	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	P	0	1
Sheep	Plume	0	1	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Warm Springs	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Warm Springs	Plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Brush	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brush	Plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	P	0	P
Soldier	Above plume	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Soldier	Plume	0	2	9	8	19	0	2	0	0	2	0	0	0	2	1	0	0	0	24
Wilson	Above plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Wilson	Plume	0	0	5	2	7	0	1	0	0	1	0	0	0	1	0	0	0	0	9
Bobtail	Above plume	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bobtail	Plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waterfall	Above plume	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Waterfall	Plume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Big	Above plume	0	0	0	0	0	2	1	0	0	3	0	0	0	0	0	0	0	0	3
Big	Plume	0	0	0	0	0	3	2	0	0	5	2	1	3	0	3	0	0	0	11
Golden	Above plume	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	2
Golden	Plume	0	0	1	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	3
Papoose	Above plume	0	2	1	2	5	0	0	0	0	0	0	0	0	0	0	0	P	0	5

		Westslope Cutthroat Trout					Rainbow Trout/Steelhead					Chinook Salmon			Other species[a]					
		Total length (mm) 75-150	150-230	230-300	>300	Total	Total length (mm) 75-150	150-230	230-300	>300	Total									
Tributary	Strata											Age 0	Age 1	Total	BU	MWF	NPM	SUC	Trout fry	Total fish
Papoose	Plume	0	0	1	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	3
Ship Island	Above plume	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	2
Ship Island	Plume	0	3	7	2	12	0	0	0	0	0	9	0	9	0	0	0	0	0	21
Stoddard	Above plume	0	0	0	0	0	0	2	0	0	2	1	0	1	0	1	0	0	0	3
Stoddard	Plume	0	0	1	1	2	2	2	0	0	4	2	0	2	0	0	0	0	0	8
Roaring	Above plume	0	1	1	0	2	0	0	0	0	0	2	0	2	1	3	0	0	0	8
Roaring	Plume	0	0	2	0	2	0	1	0	0	1	1	0	1	3	1	0	0	1	9
Goat	Above plume	0	1	0	0	1	0	2	0	0	2	0	0	0	0	1	0	0	0	4
Goat	Plume	0	0	4	1	5	1	0	0	0	1	1	0	1	1	1	0	0	0	9
Total		24	36	72	44	176	43	32	0	0	75	307	4	311	15	33	2	-	2	614

[a] Mussels observed.
[b] P = Species present but not enumerated.

Table 18. Middle Fork Salmon River tributary plume study: snorkeling direction (upstream or downstream), water temperatures in above plume sites and degree difference in plumes, and visibility measurements in 37 snorkeling sites surveyed in 2013. Shading represents strata breaks of upper, middle, and lower river sections.

	Water temperature (^oC)		Visibility (m)	
Tributary	Above plume	Temperature difference in plume	Above plume	Plume
Sulphur	14.0	-0.5	3.1	2.6
Elkhorn	16.0	-1.0	2.0	2.0
Deer Horn	18.5	-1.0	1.6	2.1
Greyhound	14.0	-2.5	2.7	1.9
Dome	15.0	-1.0	2.4	3.1
Artillery	17.0	-2.0	3.6	3.4
Rapid River	18.0	-3.0	3.1	3.5
Pistol	17.0	-1.0	3.1	3.8
Cow	17.0	0.0	2.8	2.1
Garden	18.0	0.0	2.8	3.2
Indian	20.0	-1.0	2.7	2.7
Pungo	19.0	-6.0	3.0	3.0
Little Soldier	15.0	-2.0	2.8	3.1
Marble	16.0	+0.5	2.6	2.4
Cougar	17.5	-1.0	2.5	2.5
Mahoney	17.0	-1.0	2.8	2.5
Pine	16.0	-1.5	2.8	2.5
White	18.0	0.0	2.6	2.6
Loon	19.0	-1.0	2.9	1.3
Norton	19.0	-1.0	2.0	2.3
Cub	19.0	-1.0	2.9	2.7
Camas	18.0	-2.0	3.3	3.3
Big Bear	17.0	-0.5	2.1	3.0
Sheep	17.0	0.0	2.9	3.0
Warm Springs	17.0	-1.0	2.0	2.0
Brush	18.0	-3.0	2.5	3.2
Soldier	19.5	-4.0	2.1	2.2
Wilson	20.0	-4.0	2.1	3.5
Bobtail	17.5	-2.5	1.7	2.0
Waterfall	18.5	-1.5	2.0	2.3
Big	19.0	-1.5	2.4	2.5
Golden	17.0	-1.0	2.0	2.2
Papoose	19.0	-1.5	2.0	2.3
Ship Island	19.0	-2.0	2.2	2.2
Stoddard	17.5	-1.0	2.0	1.7
Roaring	17.0	-5.0	2.9	2.9
Goat	18.0	-6.0	2.7	2.9

Table 19. Salmonid densities in snorkeling surveys of tributary within and above tributary plumesin the main-stem Middle Fork Salmon River, 2013. Shading represents strata breaks of upper, middle, and lower river sections.

		Species and densities in plume[a]						Species and densities above plume					
Tributary	River km[b]	WCT	RBT/SH	CK	BU	MWF	Total	WCT	RBT/SH	CK	BU	MWF	Total
Sulphur	150.1	0.0	0.8	1.5	0.0	0.4	2.7	0.0	0.0	0.0	0.0	0.0	0.0
Elkhorn	139.2	33.0	2.0	90.0	4.0	0.0	129.0	24.0	1.0	14.0	0.0	0.0	39.0
Deer Horn	136.0	0.5	1.0	1.0	0.0	0.0	2.4	0.0	3.8	4.4	0.0	0.0	8.1
Greyhound	127.5	22.9	4.1	2.7	0.0	0.0	29.7	0.0	4.6	9.3	0.0	0.0	13.9
Dome	127.4	2.8	3.5	10.5	0.0	0.0	16.8	0.0	1.5	11.9	0.0	0.0	16.4
Artillery	123.7	0.6	2.4	5.6	0.0	0.0	8.5	0.0	1.1	1.9	0.0	0.3	3.3
Rapid River	123.2	0.3	0.6	2.6	0.0	0.0	3.4	0.0	0.0	1.3	0.0	1.0	2.3
Pistol	117.1	0.3	0.3	2.6	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0
Cow	116.0	0.0	0.0	7.1	0.0	0.0	7.1	0.7	0.7	10.7	0.0	0.0	12.1
Garden	114.4	0.0	0.3	3.8	0.0	0.3	4.4	0.0	0.0	0.4	0.0	0.4	0.7
Indian	109.6	1.9	0.4	2.2	0.0	0.7	5.2	0.0	0.0	1.5	0.0	0.0	1.5
Pungo	107.5	0.3	0.0	0.3	0.0	0.0	0.7	0.3	0.7	0.7	0.0	0.0	1.7
Little Soldier	101.9	0.5	0.5	0.0	0.0	0.5	1.6	2.4	0.0	0.0	0.0	0.6	3.0
Marble	100.5	0.5	0.5	0.0	0.0	0.0	1.0	0.0	0.5	1.4	0.0	0.5	2.4
Cougar	87.2	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Mahoney	85.6	0.0	0.0	0.0	0.0	0.8	0.8	0.4	0.0	0.0	0.0	0.0	0.4
Pine	81.9	1.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.8	0.0	0.0	0.8
White	76.0	0.0	1.0	9.6	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0
Loon	72.8	0.0	0.0	2.4	0.0	1.2	3.6	0.0	0.0	0.0	0.0	0.0	0.0
Norton	70.1	0.6	0.0	0.6	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.7	0.7
Cub	66.9	0.4	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Camas	56.3	0.9	0.0	0.0	0.0	0.9	1.7	0.0	0.0	1.0	0.0	1.0	2.0
Big Bear	53.6	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Sheep	48.8	1.3	0.0	0.0	0.0	0.0	1.3	0.3	0.0	0.0	0.0	0.0	0.3

Tributary	River km[b]	Species and densities in plume[a]						Species and densities above plume					
		WCT	RBT/SH	CK	BU	MWF	Total	WCT	RBT/SH	CK	BU	MWF	Total
Warm Springs	48.3	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Brush	47.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soldier	37.6	8.6	0.9	0.0	1.8	0.5	11.8	1.0	0.0	0.0	0.0	0.0	1.0
Wilson	37.1	2.0	0.3	0.0	0.3	0.0	2.6	0.5	0.0	0.0	0.0	1.0	0.5
Bobtail	31.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.6
Waterfall	29.4	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5
Big	28.8	0.0	2.0	1.2	0.0	1.2	4.4	0.0	1.3	0.0	0.0	0.0	1.3
Golden	21.8	1.5	1.5	0.0	0.0	1.5	4.6	1.7	0.0	1.7	0.0	0.0	3.3
Papoose	19.0	1.5	0.7	0.7	0.0	0.0	2.9	4.2	0.0	0.0	0.0	0.0	4.2
Ship Island	18.9	5.5	0.0	4.1	0.0	0.0	9.6	0.0	0.0	0.5	0.5	0.0	0.9
Stoddard	9.6	1.2	2.4	1.2	0.0	0.0	4.7	0.0	1.0	0.5	0.0	0.5	2.0
Roaring	6.2	0.9	0.4	0.4	1.3	0.4	3.5	1.7	0.0	1.7	0.9	2.6	6.9
Goat	1.9	1.7	0.0	0.3	0.3	0.3	3.1	0.4	0.7	0.0	0.0	0.4	1.48

WCT = Westslope cutthroat trout, RBT/SH = Rainbow trout/steelhead, CK = Chinook salmon, BU = Bull trout, and MWF = Mountain whitefish.

[b] River km readings begin at 0 km at the mouth of Middle Fork Salmon River and accrue moving upstream.

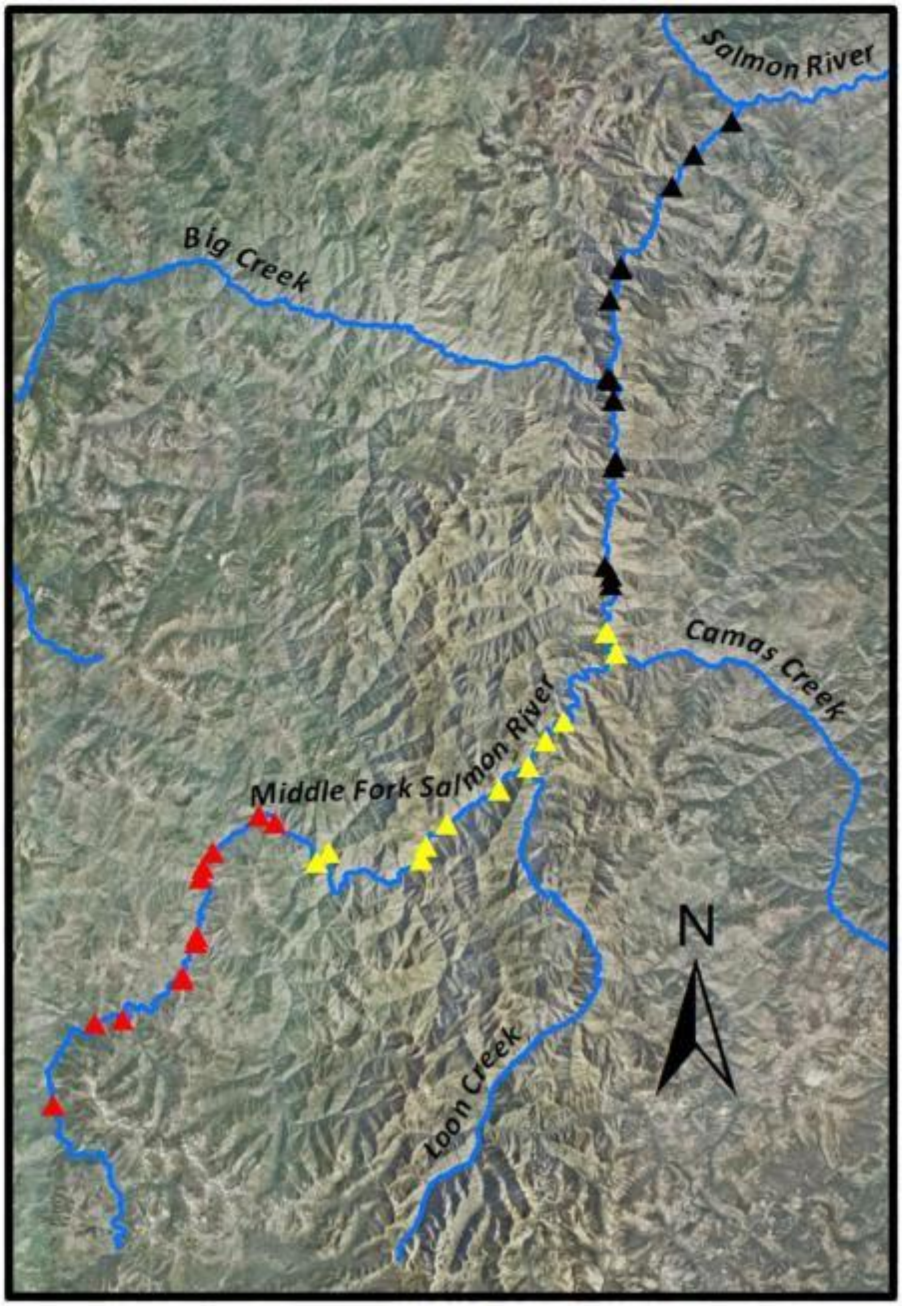

Figure 34. Plume and above plume sites sampled in the MFSR via snorkeling in 2013. Sites were divided into three river strata: upper (red triangles), middle (yellow triangles), and lower (black triangles).

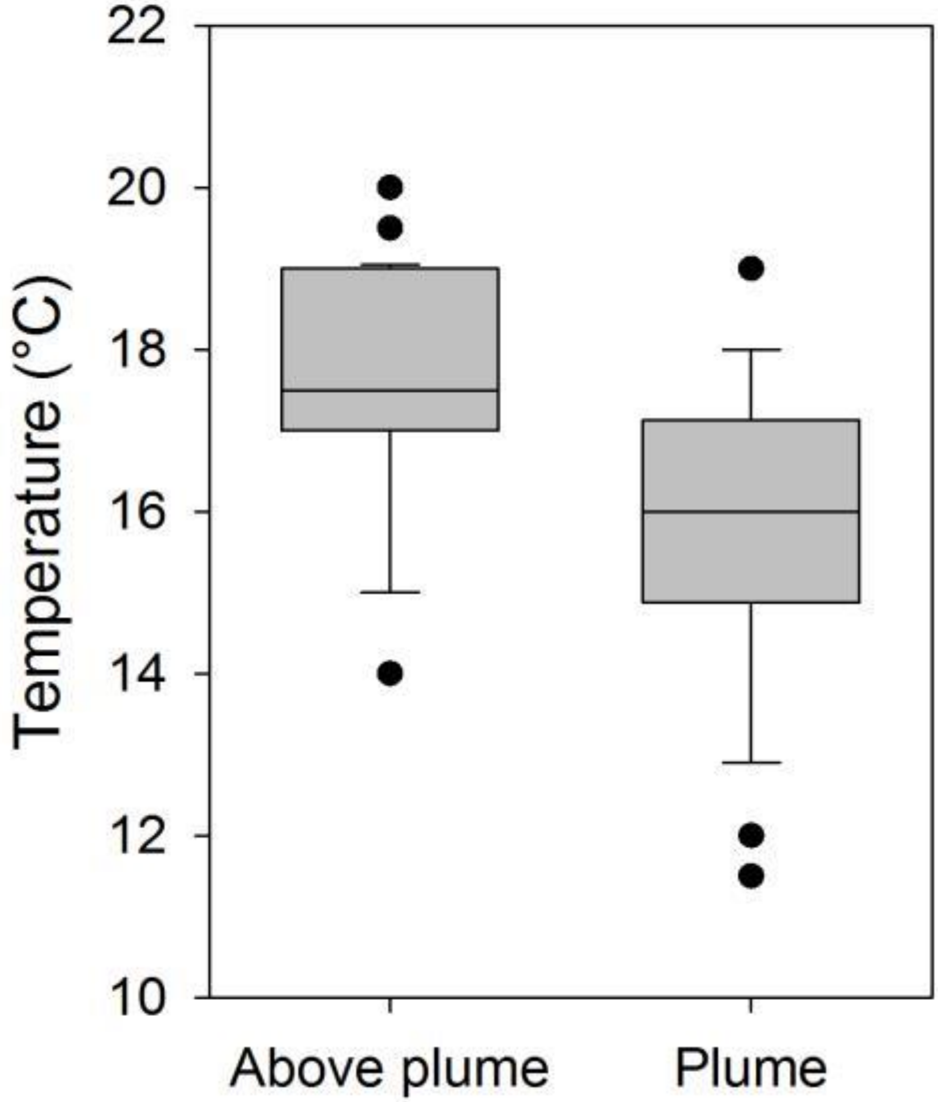

Figure 35. Boxplots of water temperatures (°C) above plume (e.g. main-stem) and within plume habitats surveyed in the Middle Fork Salmon River in July 2013.

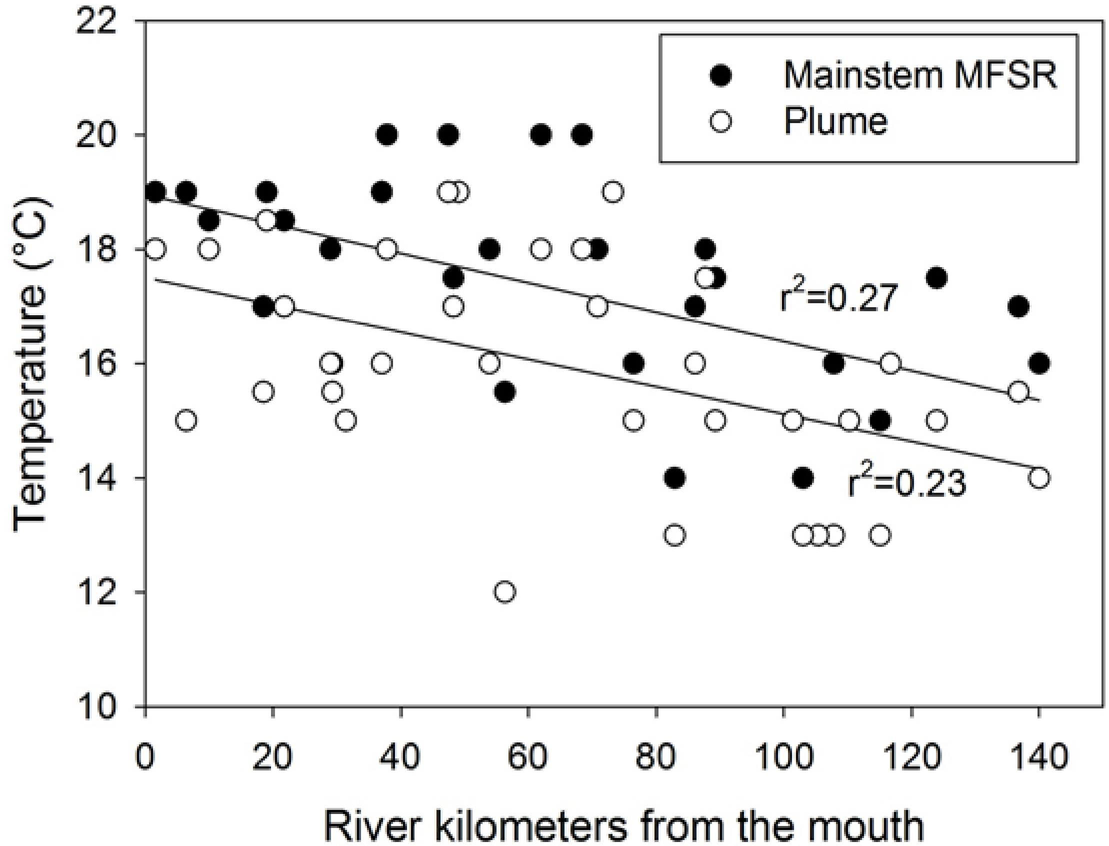

Figure 36. Comparison of water temperature differences recorded at 37 selected plume and main-stem sites in the Middle Fork Salmon River, 2013, starting from the lowest downriver site at Goat Creek to the highest upriver site at Sulphur Creek. Each of the 37 sites are paired with the main-stem (above plume) data points directly above their corresponding plume data points.

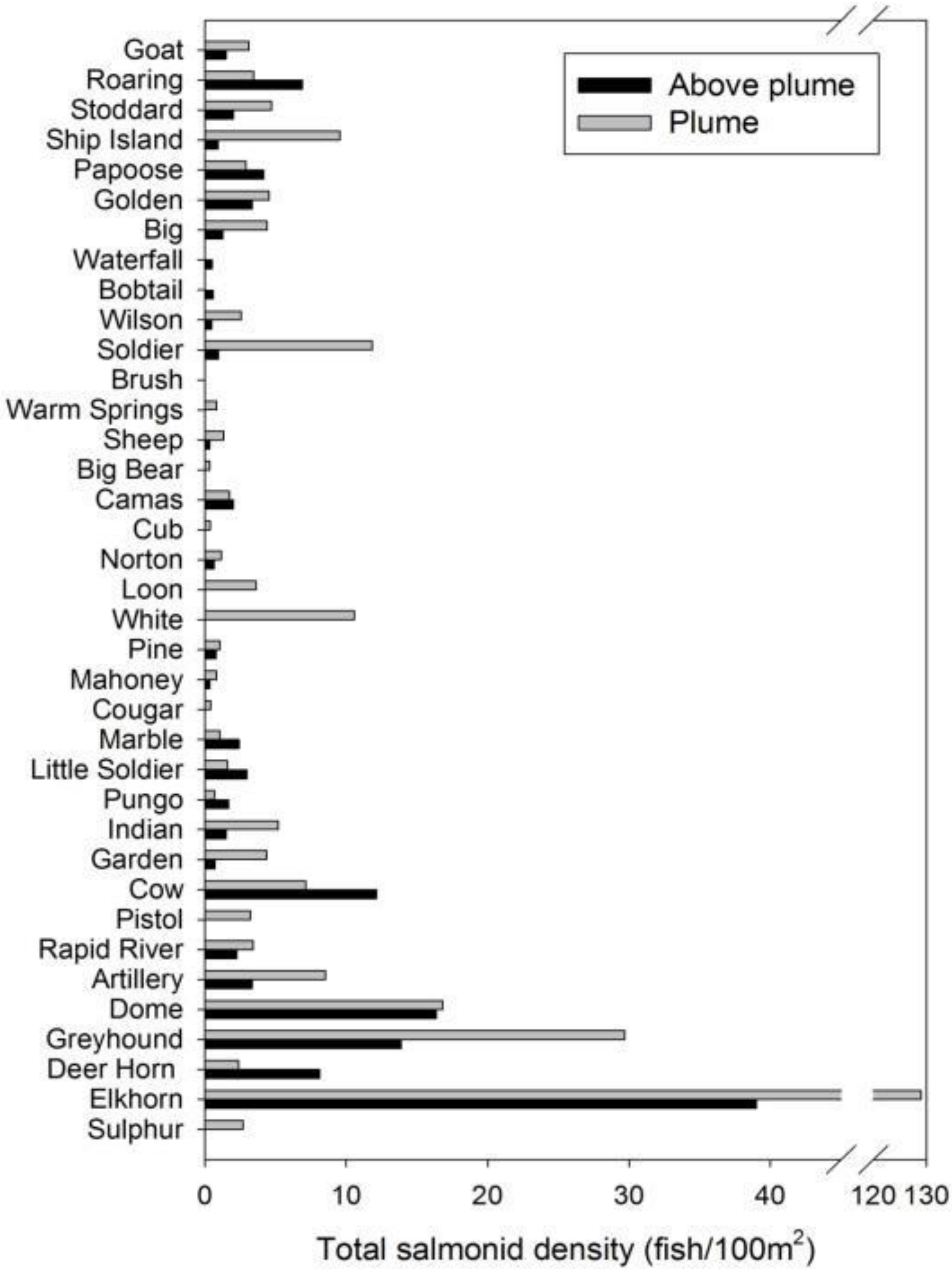

Figure 37. Densities of salmonids (fish/100m^2) in the main-stem Middle Fork Salmon River above tributary plumes and in plumes observed via snorkeling in 2013, starting from the lowest downriver site at Goat Creek (near the mouth of the Middle Fork) to the highest upriver site at Sulphur Creek (near Boundary Creek).

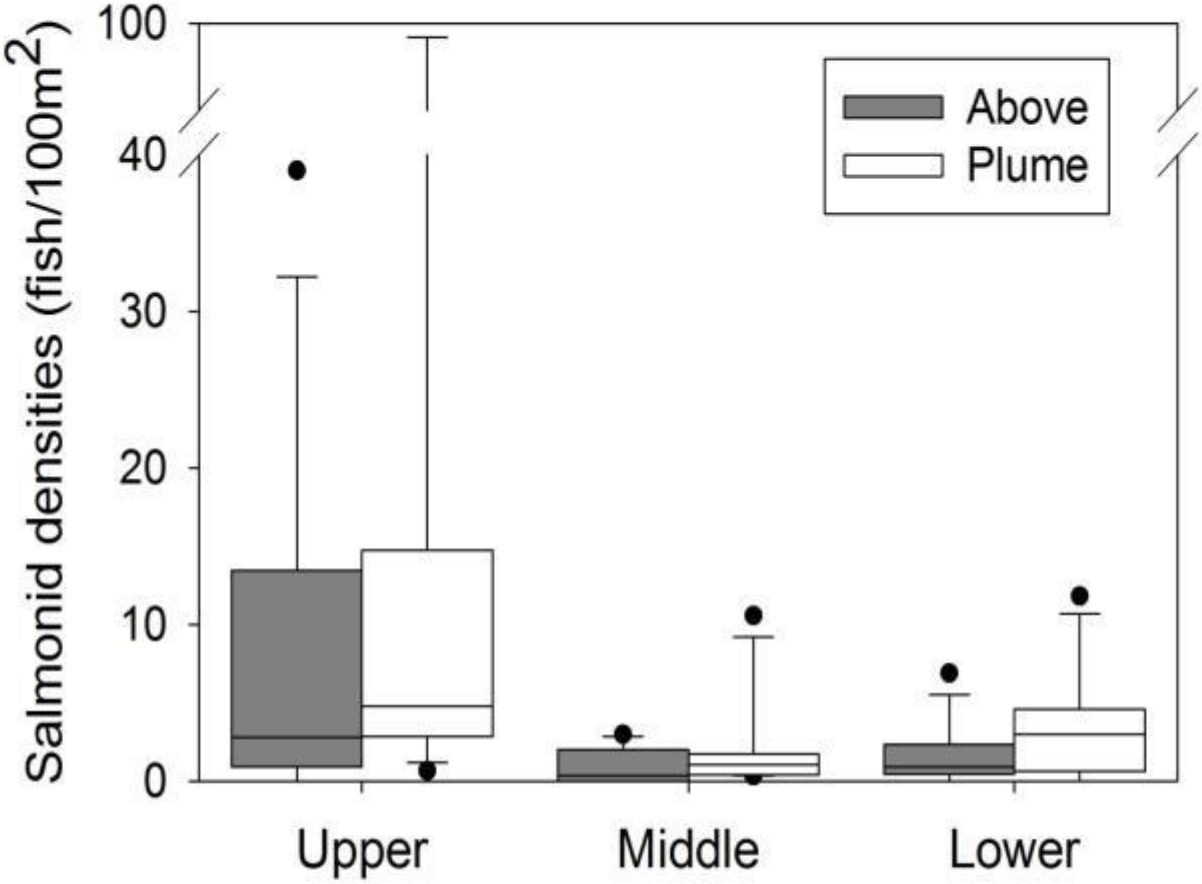

Figure 38. Boxplot comparisons of salmonid densities (fish/100m^2) in three river strata of the main-stem Middle Fork Salmon River in above plume (main-stem) and in plumes at 37 selected sites, 2013.

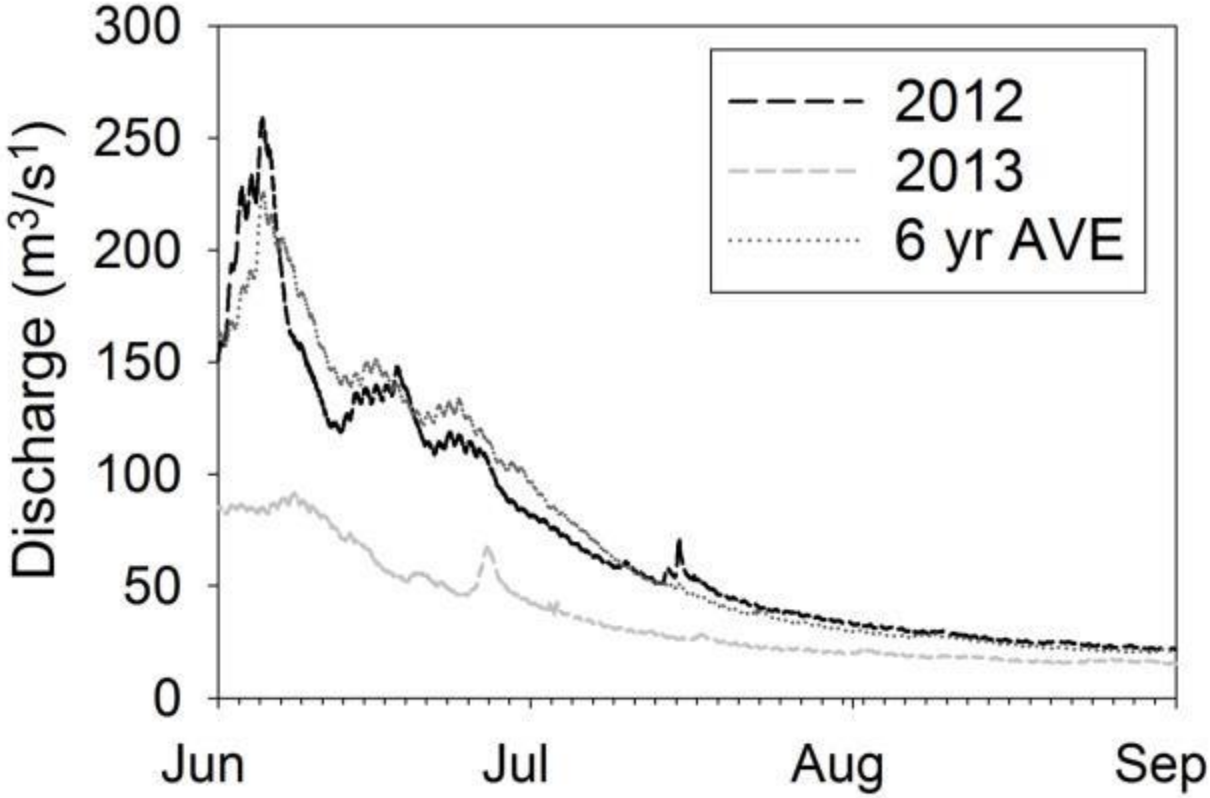

Figure 39. Summer discharge (m^3/s) recorded by the U.S. Geological Survey's Middle Fork Lodge gage in the Middle Fork Salmon River for 2012 and 2013 along with the 6-year running average flow.

PUBLIC OUTREACH, TECHNICAL ASSISTANCE, AND ANGLER RECRUITMENT AND RETENTION

ABSTRACT

During 2013, Salmon regional fisheries staff held three public fishing events for approximately 262 participants, taught ten classroom fish biology lessons in three local schools to approximately 80 students, received approximately 113 hours of assistance from volunteers on various projects, and received an estimated $4,700 in donations from local businesses, in the form of tackle, prizes, and cash donations for our annual “Free fishing day” events.

Salmon regional fisheries staff provided technical assistance to a number of staff from other agencies and other disciplines in our own agency in 2013. Technical assistance was provided in the form of fulfilling data requests, providing input for various project proposals and subsequent project assessments, and participating in interagency collaboration through various habitat and conservation forums.

To increase public awareness of the value of fisheries habitat and to increase and maintain participation in fishing, staff participated in angler informational meetings, a week-long county fair display, and numerous radio presentations on the local station, KSRA. Regional fisheries staff also responded to approximately 500 public calls to the regional office, seeking basic information on fishing opportunities, techniques, regulations, and area specifics.

Authors:

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Marsha White, Regional Fisheries Technician

Greg Schoby, Regional Fisheries Manager

INTRODUCTION

Each year, the Salmon Region fisheries office conducts an array of public outreach programs designed to initiate and involve the public in fishing and fisheries-related matters, collaborates with state and federal agencies and private landowners on fisheries projects that encompass overlapping physical and jurisdictional boundaries, and responds to a multitude of informational requests from the public, county, state, and federal government offices, other non-governmental offices, and tribal entities.

OBJECTIVES

1. Provide angler and aquatic education programs to the public to increase awareness of the value of habitat to the fisheries resource and to increase and maintain participation in fishing.

2. Provide angling opportunities to the public through fishing clinics and derbies targeted at young anglers, and by the maintenance and/or development of new fishing waters and angler access.

3. Provide technical assistance regarding fisheries related issues, concerns, and recommendations to state and federal governments, and private parties contemplating projects with the potential to affect fish and fish habitat.

METHODS

We conducted fishing clinics for experienced and first time anglers, presented fisheries related topics at various public forums including a booth and display at the week-long Lemhi County Fair. We also presented “Trout in the Classroom” programs in the Salmon and Leadore school districts.

Regional fisheries staff crafted news releases for radio and print media on various fisheries related topics, including fishing techniques, fish life histories, fish habitat, and fishing water restoration endeavors.

We responded, as time permitted, to most requests for data, expertise, and recommendations from non-government organizations, private individuals, state, federal, and tribal entities. Project staff attended meetings, conducted field inspections, and generated responses as appropriate.

RESULTS AND DISCUSSION

In 2013, regional fisheries staff taught “Trout in the Classroom” lessons to five different classes in the Salmon region, for a total of 22 hours in the classroom. In total, ten different fish biology lessons were taught in three local schools to approximately 80 students. Additionally, regional biologists volunteered approximately four hours of time working with an estimated 37 local boy scouts to help them work towards merit badges in natural resource disciplines. We also held three public fishing events for approximately 262 participants, which included a “Free fishing day" event in Salmon, attended by an estimated 82 participants, a "Free fishing day" event in Challis, attended by an estimated 121 participants, and an ice fishing clinic held in Salmon, attended by an estimated 59 participants. Local businesses throughout the region donated tackle and prizes for these events with an overall estimated value of around $4,700. Other educational activities that regional staff participated in, included spawning Rainbow Trout at Williams Lake (10 participants for approximately 3 hours each), and a weeklong fair booth at the Lemhi County Fair where regional staff answered questions from the public regarding resources in our area. Additionally, local volunteers donated approximately 113 of assistance to regional staff in 2013, working on various projects throughout the region.

Regional fisheries staff responded to numerous technical assistance requests for assistance or comments on water, habitat, and fisheries-related matters in 2013 (Appendix B). Project personnel usually contacted agencies and private landowners by telephone. Commonly, we responded to projects requiring technical assistance by meeting with the applicant on-site, determining the nature of the situation, and sending written or verbal comments to the appropriate agency. Due to the remoteness of the Salmon Region, we were often the only governmental agency representative available to conduct on-site inspections that required adequate experience regarding fish populations, including species occupancy, trends, timing, and life stage use.

Every year, we respond to numerous inquiries from the public (via telephone, letter, and in person) about when, where, and how to participate in regional fishing opportunities, ranging from steelhead and Chinook salmon angling to alpine lake fishing. Regional biologists field an estimated 500 phone calls per year at the regional office relating to this subject matter. Fisheries staff also generate news releases a few times throughout the year regarding topics such as Steelhead and Salmon fishing, ice fishing techniques, alpine lake status and accessibility, and safety while in the field.

MANAGEMENT RECOMMENDATIONS

1. Continue public presentations, press releases, and educational outreach to encourage an environmentally literate citizenry that takes an active role in natural resource stewardship.

2. Introduce more youth to fishing by continuing to offer fishing clinics and derbies, and developing public fishing waters and access throughout the Region.

3. Technical guidance on issues involving fisheries resources in the Salmon Region should be continued to assist in maintaining and enhancing fisheries resources in the region.

Appendix B. Summary of entities requesting technical assistance on water and fishery-related subjects to the Salmon Region during 2013.

Entity
U.S. Army Corps of Engineers
Idaho Department of Water Resources
Idaho Department of Lands
U.S.D.A. Forest Service
Idaho Department of Environmental Quality
U.S. Fish and Wildlife Service
Idaho Governor's Office of Species Conservation
N.O.A.A. (N.M.F.S.)
Shoshone-Bannock Indian Tribe
The Nature Conservancy
U,S, Bureau of Reclamation
Private consultants
Idaho Outfitters and Guides Licensing Board
Mining Companies
Idaho Department of Transportation
City of Salmon
Freedom of Information Act
Attorney General's Office
Lemhi County
Custer County
Bureau of Land Management
Upper Salmon Basin Model Watershed Project
Northwest Power Planning Council
Private landowners

CREEL INVESTIGATIONS

UPPER SALMON RIVER STEELHEAD FISHERY, FALL 2012 - SPRING 2013

ABSTRACT

A modified roving creel was conducted on the upper Salmon River to collect a variety of angler catch and biological data. We conducted angler interviews to record and recover steelhead *Oncorhynchus mykiss* coded-wire tags, collect angler effort and catch, and identified angler use and distribution using vehicle and boat trailer counts. We also collected parental-based genetic tag samples, and used a standard roving creel to estimate harvest of steelhead and resident fish in river location codes 16 and 17 during the fall and spring seasons, respectively.

Creel personnel conducted 10,083 angler interviews and checked 1,503 steelhead for marks during run year 2012. Steelhead catch was greatest in river location code 16 in the fall (10 hrs/fish caught) and in river location code 15 in the spring (12 hrs/fish caught). Overall, river location code 16 had the greatest catch rate (11 hrs/fish caught) for run year 2012. River flows above average during the latter part of October and early November may have hampered catch rates and harvest during the fall fishery. The extensive wild fires during the summer of 2012 in the Stanley area and downriver from North Fork impacted the fall fishery by increasing sediment inputs and reducing water clarity after extensive rains, yet had little effect on the spring fishery. Angler access to the fishery was not restricted during the wildfires of 2012.

A total of 704 steelhead parental-based genetically tagged samples were collected during the spring fishery. In the future, genetic samples will be collected proportionally to the anticipated harvest in each river location code or combination of location codes as identified by Headquarters Fisheries Bureau staff. A total of 5,832 angler vehicle and boat trailer GPS waypoints were collected during the spring fishery to assess angler use and distribution throughout the upper Salmon River basin.

For river location code 16, estimated harvest of steelhead during the combined months of October and November was 1,055 fish compared to the estimated state wide harvest phone survey value of 850 fish. For river location code 17, estimated harvest of steelhead during the combined months of March and April was 830 fish compared to the estimated state wide harvest phone survey value of 670 fish.

In addition to steelhead, anglers released 137 and 91 Westslope Cutthroat Trout *O. clarkii lewisi* in river location codes 16 and 17, respectively. Anglers also released 27 and 99 Bull Trout *Salvelinus confluentus* greater than 30 cm in total length in river location codes 16 and 17, respectively. Gear selection possibly played a role in the low numbers of small bull trout released by anglers. An angler reported the release of a Brook Trout *S. fontinalis* in river location code 17 that expanded to an estimated harvest of 7 fish.

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INTRODUCTION

The upper Salmon River fall steelhead *Oncorhynchus mykiss* harvest season opened on September 1, 2012. On March 31, 2013, the fishery closed from the Lake Creek Bridge in river location code 13 upstream to Long Tom Creek, approximately three-quarters of a mile upstream of the confluence with the Middle Fork Salmon River. Upstream of Long Tom Creek, the steelhead fishery remained open on the upper Salmon River until April 30, 2013.

During the fall and spring fishery, the daily limit for hatchery steelhead with clipped adipose fins was 3 fish with 9 fish in possession and a total of 20 fish for the season. Angler participation on the upper Salmon River was minimal during the catch-and-release portion of the fishery that opened on August 1, 2012. Based on field observations, angler pressure increased to a level that warranted creel interviews by the first week of October. In spring, creel activities began the last week of February because of poor road conditions and low angler participation prior to that time.

A modified roving creel was conducted on the upper Salmon River to collect a variety of angler catch and biological data as part of IDFG's Harvest Management Program (funded by the Lower Snake River Compensation Plan and Idaho Power). We conducted angler interviews to record and recover steelhead *Oncorhynchus mykiss* coded-wire tags, collect angler effort and catch, and identified angler use and distribution using vehicle and boat trailer counts. We also collected parental-based genetic tag samples, and used a standard roving creel to estimate harvest of steelhead and resident fish in river location codes 16 and 17 during the fall and spring seasons, respectively.

OBJECTIVES

1. Assist with the development and implementation of a hatchery steelhead fishery for the upper Salmon River.

2. Collect angler effort, catch and harvest data (for ESA reporting purposes) and provide up-to-date reports to anglers.

3. Collect parental-based genetic samples and coded-wire tags from harvested fish to evaluate various juvenile steelhead release strategies.

4. Develop expanded estimated harvest of both steelhead and resident fish species from roving creel data to compare to statewide harvest estimates.

5. Create geo-referenced maps of angling areas and access sites to assess angler use and distribution.

STUDY AREA AND METHODS

Two roving creel surveys with differing primary objectives and interview methods were used during the fall and spring steelhead seasons. The first survey was a modified roving creel survey conducted to obtain angler trip catch rate information, collect parental-based tagging (PBT) genetic samples (spring only), and to collect coded-wire tags (CWTs) from steelhead snouts. Catch rate information was disseminated weekly to newspapers, local websites, the IDFG website and various interested parties. The roving creel survey was conducted in river location codes 14-17 during the fall season and in river location codes 14-16, 18, and 19 during the spring season.

The second steelhead creel survey used a traditional roving creel designed to collect daily angler data that would be expanded to estimate effort and catch on a monthly basis. Fisheries Bureau staff requested a roving creel derived harvest estimate for certain river location codes to compare harvest estimates between roving creel census and the traditional statewide phone survey. The second roving creel used methods from past Chinook Salmon seasons and are described in the 2012 Salmon Region Fishery Management Annual Report (Flinders et al. 2013). Biological data collected during the second roving creel survey was the same as described above. Additionally, estimated catch was calculated for resident fish species. The second roving creel survey method was used only in river location codes 16 and 17 during the fall and spring seasons, respectively.

In fall, creel clerks scanned harvested steelhead for CWT during angler interviews. In spring, creel clerks collected PBT genetic samples from harvested steelhead and scanned fish for CWT. Anglers were randomly selected by creel clerks from 60 river subsections of approximately 1.8 km in length between Corn Creek and the Lemhi River and 30 subsections of approximately 4 km in length between the Pahsimeroi River and the Sawtooth Fish Hatchery weir. In spring, genetic sample subsections were not developed for river location code 17 because of complexities associated with the expanded harvest roving creel conducted on that portion of the river. Every harvested steelhead encountered by creel personnel in river locations codes 14-19 was sampled for PBT and scanned for CWT.

During spring creel census, staff collected GPS waypoints of angler vehicles and boat trailer locations to assess angler distribution and seasonal changes in effort. Locations of vehicles and boat trailers were recorded during the second angler count in river location code 15. Vehicle and trailer locations were recorded mid-day in river location codes 18 and 19. Vehicle and trailer locations were recorded in conjunction with interviews in river location codes 14 and 15. GPS location data were transferred to ArcMap 10.1 (Environmental Systems Research Institute, Redlands, California 2012) to assess angler distribution and use throughout river sections.

RESULTS AND DISCUSSION

In fall, the first steelhead harvested by anglers in river location codes 14-16 occurred during the first week in October (Figure 40). The first steelhead kept by anglers in river location code 17 wasn’t detected in the creel until the last week in October.

In the Stanley area, Basin Creek was heavily burned by wild fires during the summer of 2012. Fall rain storms produced ash laden runoff in the upper Salmon River burned areas that negatively influenced fishing conditions on the entire upper Salmon River for short durations of time. Additionally, above average river flows created difficult fishing conditions in river location codes 14-19 during mid-October and early November (Figure 41).

In spring, creel personnel checked anglers for steelhead beginning mid-February in river location codes 14 - 17 and immediately checked small numbers of fish. Additionally, a third creel person worked in river location codes 18 and 19 beginning the third week of February and checked small numbers of fish. Above average warm weather resulted in early low elevation gradual snow melt and consequently, did not create turbid water and poor fishing conditions during the spring fishery as observed in the fall fishery. In March, water clarity issues, probably associated with run-off from burned areas may have caused anglers to prematurely move upriver from the canyon below Shoup. The Salmon River Deadwater ice jam went out on March 8.

Based on unexpanded creel data, the best catch per unit effort during the fall fishery (10 hrs/fish caught) occurred in river location code 16 (Table 20), while the best catch per unit effort during the spring fishery (12 hrs/fish caught) occurred in river location code 15 (Table 21). Creel personnel conducted 10,083 angler interviews and checked 1,503 steelhead for marks during run year 2012 (Table 22). During run year 2012, anglers experienced the highest catch rates (11hrs/fish caught and 20 hrs/fish harvested) in river location code 16.

Fishery harvest sample rates (percent of harvest examined by creel clerks) in Salmon Region river location codes ranged from less than 1% to 28.8% during run year 2012 (Table 23). Sample rates in river location codes 16 and 17 (where expanded harvest roving creel occurred) ranged from 20% to 28.8%. As in the past, it remained difficult to sample harvested fish in river location codes 14, 17, and 18 during periods of low angler effort. A technician was assigned to work in close proximity to the Corn Creek jet boat ramp to improve harvested fish sample rates in river location code 14. A trailer parked at the Corn Creek campground provided staff housing during October and the first part of November. After the first part of November, the trailer was moved to Indianola because of snow and ice covered roads. The strategy proved successful as harvested fish sample rates improved compared to previous years for river location code 14 (Curet et al. 2013; Flinders et al. 2013).

Roving creel census estimates of steelhead harvest were higher than for statewide phone survey results. Estimated steelhead harvest from the creel census and phone surveys in river location code 16 during the months of October and November was 1,055 and 850 fish, respectively (Tables 23 and 24). Creel census harvest estimates of steelhead in river location code 17 during the months of March and April was 830 fish, compared to 670 fish from the phone survey. In both river location codes 16 and 17, anglers caught 2.7 adipose-clipped hatchery steelhead for every non-adipose fin clipped steelhead released. In river location code 16, the majority of effort was comprised of boat anglers, while the majority of effort in river location code 17 was comprised of bank anglers.

Mountain Whitefish *Prosopium williamsoni* were the only resident game fish species that incurred any appreciable amount of estimated harvest during the steelhead fishery based on the expanded creel survey conducted in river location codes 16 and 17 (Table 25). Anglers released 137 and 91 Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* in river location codes 16 and 17, respectively. Additionally, anglers released 27 and 99 Bull Trout *Salvelinus confluentus* greater than 30 cm in total length in river location codes 16 and 17, respectively. Only 9 Bull Trout less than 30 cm were released in combined river location codes 16 and 17. However, the low number of small Bull Trout released by anglers was possibly due to gear type selection and the type of baits or lures used by anglers to catch larger fish. In river location code 17, an angler reported the release of a brook trout that expanded to an estimated harvest of 7 fish.

A total of 704 steelhead PBT samples were collected during the spring fishery (Table 26). The number of genetic samples collected in each river location code was dependent on the number of fish checked for marks. In the future, genetic samples will be collected proportionally to the anticipated harvest in each river location code or combination of location codes as identified by Headquarters Fisheries Bureau staff. For a detailed discussion regarding the purpose of PBT and CWT collection see Warren et al. 2015.

The spring 2013 steelhead fishery was the first season the Salmon Region Harvest Management Program collected angler vehicle and boat trailer GPS information. A total of 5,832 angler vehicle and boat trailer GPS waypoints were collected during the spring fishery (Table 27). Approximately 20% of the waypoints consisted of boat trailers. River location codes 16 and 18 contained nearly equal amounts of vehicle and boat trailer waypoints, corroborating our observation of higher usage by boat anglers in section 16 (as described in Curet et al. 2013). The waypoints in river location codes 15 and 19 were comprised of less than 8% boat trailers, suggesting much higher usage shoreline anglers. In future years, waypoint location data sets should contain enough seasonal use information regarding where and how anglers use the river to prioritize access site development and juvenile fish release locations.

MANAGEMENT RECOMMENDATIONS

1. Estimate steelhead harvest with roving creel surveys to validate harvest estimates generated by the statewide steelhead phone survey and help improve future statewide estimates.

2. Collect steelhead parental-based genetic tag samples in the creel to evaluate various juvenile steelhead release strategies and their subsequent return to creel.

3. Create geo-referenced based maps of angling areas, angler densities, and access sites to assess angler use and distribution.

4. Provide up-to-date creel results to anglers through various media outlets such as newspaper, radio, and the internet.

Table 20. Summary of steelhead unexpanded creel data (Salmon River location codes 14 through 17), fall 2012.

Location code	Anglers	Hours	Hrs/ angler	Steelhead kept	Steelhead released Hatchery	Steelhead released Wild[a]	Total catch	Hrs/ caught	Hrs/ kept	Total hatchery CPUE[b]
14	812	5,716	7.0	138	25	306	469	13	41	0.029
15	3,041	11,689	3.8	499	91	341	931	13	23	0.050
16	957	4,388	4.6	232	68	123	423	10	19	0.068
17	117	458	3.9	20	9	13	42	11	23	0.063
Total	4,927	22,251	4.5	889	193	783	1,865	12	25	0.049

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

Table 21. Summary of steelhead unexpanded creel data (Salmon River location codes 14 through 19), spring 2013.

Location code	Anglers	Hours	Hrs/ angler	Steelhead kept	Steelhead released Hatchery	Steelhead released Wild[a]	Total catch	Hrs/ caught	Hrs/ kept	Total hatchery CPUE[b]
14	219	1,341	6.1	24	10	49	83	16	56	0.025
15	1,218	6,405	5.3	284	104	167	555	12	23	0.061
16	469	2,332	5.0	101	23	59	183	13	23	0.053
17	1,702	6,609	3.9	221	52	74	347	19	30	0.041
18	403	2,105	5.2	29	47	35	111	19	73	0.036
19	1,145	7,579	6.6	218	173	170	561	14	35	0.052
Total	5,156	26,371	5.1	877	409	554	1,840	14	30	0.049

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

Table 22. Summary of unexpanded creel data from the upper Salmon River steelhead fishery, fall 2012 and spring 2013.

					Steelhead released			No. snouts in creel					
Location code	Anglers	Hours	Hrs/ angler	Steelhead kept	Hatchery	Wild[a]	Total catch	Checked for marks	CWT[b] taken	CWT not taken	Hrs/ caught	Hrs/ kept	Total hatchery CPUE[c]
14	1,031	7,057	6.8	162	35	355	552	141	17	1	13	44	0.028
15	4,259	18,094	4.2	783	195	508	1,486	672	128	3	12	23	0.054
16	1,426	6,720	4.7	333	91	182	606	293	39	3	11	20	0.063
17	1,819	7,068	3.9	241	61	87	389	214	29	0	18	29	0.043
18	403	2,105	5.2	29	47	35	111	20	7	0	19	73	0.036
19	1,145	7,579	6.6	218	173	170	561	163	28	4	14	35	0.052
Total	10,083	48,623	4.8	1766	602	1,337	3,705	1,503	248	11	13	28	0.049

[a] Includes hatchery-produced steelhead with intact adipose fins
[b] Coded-wire tag
[c] Catch per Unit of Effort (fish per hour)

Table 23. Estimated state wide steelhead harvest (SWH) and sample rates (percent [%] of estimated steelhead harvest examined by creel clerks) by river location code and month for the upper Salmon River, 2012 - 2013.

		Fishery statistics by month								
River section	Statistics	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
	Fish checked for marks	--	18	91	--	--	15	4	--	128
14	SWH estimate[a]	0	151	367	123	84	177	425	8[b]	1,327
	Sample rate	--	11.9	24.8	--	--	8.5	0.9	--	9.6
	Fish checked for marks	--	108	318	--	--	27	219	--	672
15	SWH estimate	0	920	1,638	134	25	159	1,288	17	4,181
	Sample rate	--	11.7	19.4	--	--	17.0	17.0	--	16.1
	Fish checked for marks	--	65	151	--	--	27	49	1	293
16	SWH estimate	11	325	525	134	89	280	466	155	1,985
	Sample rate	--	20.0	28.8	--	--	9.6	10.5	0.6	14.8
	Fish checked for marks	--	2	13	--	--	37	79	83	214
17	SWH estimate	0	76	133	10	8	250	302	368	1,147
	Sample rate	--	2.6	9.8	--	--	14.8	26.2	22.6	18.7
	Fish checked for marks	--	--	--	--	--	1	17	2	20
18	SWH estimate	0	0	0	0	8	13	313	64	398
	Sample rate	--	--	--	--	--	7.7	5.4	3.1	5.0
	Fish checked for marks	--	--	--	--	--	1	87	75	163
19	SWH estimate	0	45	78	0	0	21	729	1,008	1,881
	Sample rate	--	--	--	--	--	--	11.9	7.4	8.7

[a] Estimated harvest data from State Wide Harvest Survey, Thomas J. McArthur, IDFG (unpublished)

[b] Outside of legal fishing season and not included in calculations

Table 24. Summary of estimated steelhead harvested, fish released, success rates, and angler effort by location code for the upper Salmon River fishery, fall 2012 and spring 2013.

			No. steelhead released			Angler hours			Hours/steelhead	
Location code	Month	Harvest	Ad-clipped adults	Non-Ad-clipped adults	Total caught	Boat	Bank	Total	Caught	Kept
16	October	256	112	138	506	6,578	1,965	8,543	17	33
16	November	799	201	411	1,411	6,358	2,861	9,219	7	12
16	Fall (total)	1,055	313	549	1,917	12,936	4,826	17,762	9	17
17	March	531	97	230	858	6,204	15,714	21,918	26	41
17	April	476	160	85	721	3,662	7,737	11,399	16	24
17	Spring (total)	1,007	257	315	1,579	9,866	23,451	33,317	21	33

Table 25. Summary of estimated by-catch of resident fish in Salmon River location codes 16 and 17 during the fall season and spring season steelhead fishery, 2012- 2013.

Fish species	Location code	Steelhead angler by-catch	
		Harvested	Released
Wild Rainbow Trout	16 (fall)	0	51
	17 (spring)	0	101
Hatchery steelhead smolts	16 (fall)	0	0
	17 (spring)	0	264
Cutthroat Trout	16 (fall)	0	137
	17 (spring)	0	91
Mountain Whitefish	16 (fall)	0	0
	17 (spring)	34	217
Brook Trout	16 (fall)	0	0
	17 (spring)	0	7
Sucker spp	16 (fall)	0	59
	17 (spring)	5	914
Northern Pikeminnow	16 (fall)	0	15
	17 (spring)	0	67
Bull Trout < 30 cm	16 (fall)	0	5
	17 (spring)	0	4
Bull Trout > 30 cm	16 (fall)	0	27
	17 (spring)	0	99

Table 26. Number of steelhead parental-based genetically tagged samples collected from the spring fishery, 2013.

River location code	February	March	April	Total
14	15	3	0	18
15	27	204	0	231
16	27	49	1	77
17	37	79	83	199
18	1	17	2	20
19	1	83	75	159
Total	108	435	161	704

Table 27. Number of GPS waypoints of angler vehicles and boat trailers collected during the spring steelhead fishery, 2013.

	Number of Waypoints		
River location code	Vehicles	Boat trailers	Total
14	197	67	264
15	1,499	124	1,623
16	344	300	644
17	902	361	1,263
18	405	329	734
19	1,290	14	1,304
Total	4,637	1,195	5,832

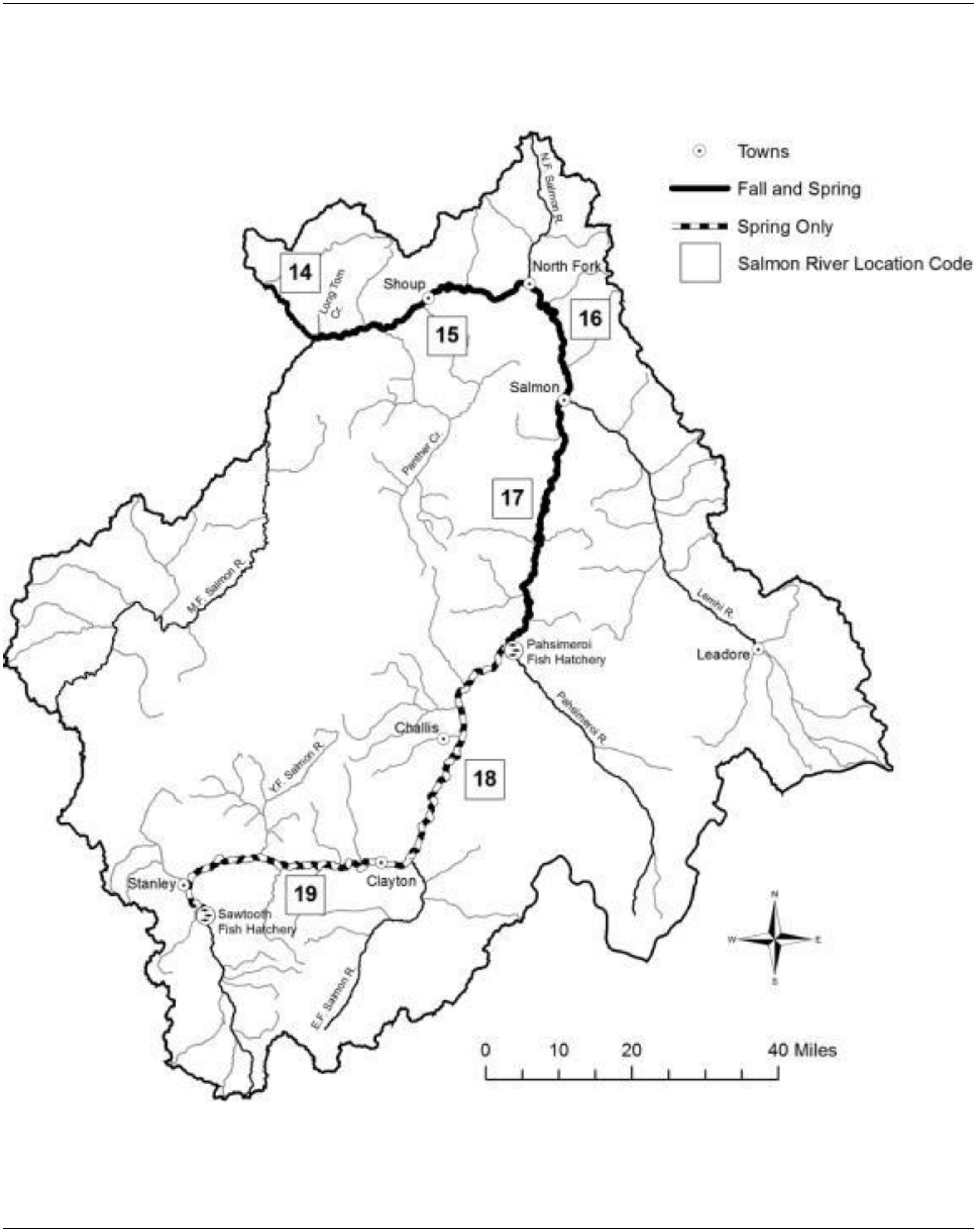

Figure 40. Map of the upper Salmon River IDFG steelhead fishery and associated river location codes, fall 2012 and spring 2013.

Figure 41. Salmon River discharge as measured by the USGS gauge station, Salmon, Idaho, fall 2012

LITERATURE CITED

Bahls, P. 1992. A Survey Methodology for High Mountain Lakes, High Lake Fisheries Project 1991. Nez Perce National Forest, U. S. Forest Service, Grangeville, Idaho, and Idaho Fish and Game, Boise, Idaho.

Ball, K. and P. Jeppson. 1980. Federal Aid to Fish and Wildlife Restoration, Regional Fishery Management Investigations, Project F-71-R-4, Job 6, Job Performance Report, Idaho Department of Fish and Game, Boise.

Brett, J. R. 1979. Energetic Factors and Growth. In: Hoar, W.S., Randall, D.J. & Brett, J.R., eds. Fish physiology, volume 8. New York: Academic Press. 599-675.

Brimmer, A., K. Andrews, B. Esselman, and T. Curet. 2003. Federal Aid in Fish Restoration, Regional Fishery Management Investigations, Salmon Region 2001. Idaho Department of Fish and Game, Boise.

Brimmer, A., T. Curet, B. Esselman, and K. Andrews. 2006. Federal Aid in Fish Restoration, Regional Fishery Management Investigations, Salmon Region 2003. Idaho Department of Fish and Game, Boise.

Chapman, D. G. 1948. A mathematical study of confidence limits of salmon populations calculated by sample tag ratios. International Pacific Salmon Fishery Commission, Bulletin 2: 67-85.

Crump, M.L., N.J. Scott, Jr. 1994. Visual Encounter Surveys in Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Smithsonian Institution Press, Washington, DC.

Curet, T., M. Larkin, R. Newman, S. Meyer, and S. Kish. 2000. Fishery Management Annual Report, Salmon Region 1999. Idaho Department of Fish and Game, Boise.

Curet, T., B. Esselman, M. White, A. Brimmer. 2008. Fishery Management Annual Report, Salmon Region 2006. Idaho Department of Fish and Game, Boise.

Curet, T., B. Esselman, and M. White. 2010. Fishery Management Investigations, Salmon Region 2009. Idaho Department of Fish and Game, Boise.

Curet, T., B. Esselman, M. White, J. Hansen, and B. Buechel. 2011. Fishery Management Investigations, Salmon Region 2010. Idaho Department of Fish and Game, Boise.

Curet, T., B. Esselman, M. White, M. Biggs, J. Hansen, and B. Beller. 2013. Fishery Management Investigations, Salmon Region 2011. Idaho Department of Fish and Game, Boise.

Ebersole, J.L., W.J. Liss, and C.A. Frissell. 2001. Relationship Between Stream Temperature, Thermal Refugia and Rainbow Trout *Oncorhynchus mykiss* Abundance in Arid-land Streams in the Northwestern United States. Ecology of Freshwater Fish 10:1-10.

Esselman, B., M. White, T. Curet, and A. Brimmer. 2007. Federal Aid in Fish Restoration, Regional Fishery Management Investigations, Salmon Region 2005. Idaho Department of Fish and Game, Boise.

Flinders, J., J. Hansen, M. White, B. Beller, and T. Curet. 2013. Fishery Management Investigations, Salmon Region 2012. Idaho Department of Fish and Game, Boise.

Idaho Department of Fish and Game. 2013. Fisheries Management Plan 2013 – 2018. Boise.

Idaho Department of Fish and Game historical fish stocking website, Salmon Region, all fish stocking information (since 1967): http://fishandgame, idaho.gov/public/fish/stocking/speciesByDate.cfm?region=7 (December 2013, January 2014)

Jeppson, P. and K. Ball. 1979. Federal Aid to Fish and Wildlife Restoration, Regional Fishery Management Investigations, Job Performance Report, Project F-71-R-3, Idaho Department of Fish and Game, Boise.

Lamansky, J. and K. A. Meyer. 2012. Standard Fish Sampling Protocol for Lowland Lakes and Reservoirs in Idaho. Idaho Department of Fish and Game, Boise.

Koenig, M. K., K. A. Meyer, J. R. Kozfkay, J. M. Dupont, and E. B. Schriever. 2015. Evaluating the Ability of Tiger Muskellunge to Eradicate Brook Trout in Idaho Alpine Lakes. North American Journal of Fisheries Management 35:659-670.

Liter, M. and J. R. Lukens. 1994. Federal Aid in Fish Restoration, Regional Fishery Management Investigations,Job Performance Report, Project F-71-R-17, Idaho Department of Fish and Game, Boise.

Liter, M., T. Curet, and M. Larkin. 2000. Federal Aid in Fish Restoration, Regional Fishery Management Investigations, 1997 Job Performance Report, Project F-71-R-22, Idaho Department of Fish and Game, Boise.

Lukens, J. R. and J. A. Davis. 1989. Federal Aid to Fish and Wildlife Restoration, Regional Fishery Management Investigations, Project F-71-R-13, Job 6 (SAL), Job Performance Report, Idaho Department of Fish and Game, Boise.

Matthews, K.R. and N.H. Berg. 1997. Rainbow Trout Responses to Water Temperature and Dissolved Oxygen Stress in Two Southern California Stream Pools. Journal of Fish Biology 50:50-67.

Messner, J., M. Belnap, M. Pumfery, M. White, J. Flinders, T. Curet, G. Schoby, and M. Green. *In press*. Adult Steelhead and Fluvial Trout Movement, Lemhi River Basin, Idaho. Idaho Department of Fish and Game, Boise.

Meyer, K. A., F. S. Elle, T. Lamansky, E. R. J. M. Mamer, and A. E. Butts. 2012. A reward-recovery study to estimate tagged fish reporting rates by Idaho anglers. North American Journal of Fisheries Management 32:696-703.

Murphy, B.R. and D.W. Willis. 1996. Fisheries Techniques Second Edition, p. 462. Special Project of the Education Section, American Fisheries Society, Bethesda, Maryland.

Ricker, W. E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Fisheries Research Board of Canada, Bulletin 191. Ottawa, Canada.

Schoby, G.P. and T. Curet. 2007. Seasonal Migrations of Bull Trout, Westslope Cutthroat Trout, and Rainbow Trout in the Upper Salmon River Basin, Idaho. IDFG Report #07-12. Idaho Department of Fish and Game, Boise.

Schrader, W. C., and J. R. Lukens. 1992. Regional Fishery Management Investigations. Federal Aid in Fish Restoration F-71-R-15, Job 6 (SAL), Job Performance Report, Idaho Department of Fish and Game, Boise.

Simpson, J.C. and R.L. Wallace. 1978. Fishes of Idaho. University Press of Idaho, Moscow.

Teuscher, D. 1999. Federal Aid in Fish Restoration. Grant F-73-R-21, Hatchery trout evaluations, Job Performance Report, Subproject #2: Zooplankton quality index. Idaho Department of Fish and Game, Boise.

Warren, C., S. Rosenberger, F. Bohlen, and C. Stiefel. 2015. 2013 Calendar Year Hatchery Steelhead Report: IPC and LSRCP Monoitoring and Evaluation Programs for the State of Idaho. IDFG Report Number 15-08.

Appendix A. Stocking rotation (A, B, C), location, land management area, and number of fish to be stocked for alpine lakes in the Salmon Region..

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**
<u>Rotation C</u>:						
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

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