FISHERY MANAGEMENT INVESTIGATIONS

IDAHO DEPARTMENT OF FISH AND GAME

FISHERIES MANAGEMENT ANNUAL REPORT

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SOUTHWEST REGION

2013

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IDFG 15-102
May 2015

Southwest Region – Nampa 2013 Annual Fishery Management Report

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DEVELOPMENT OF A CREEL INDEX TO ASSESS KOKANEE FISHERIES AT ARROWROCK AND LUCKY PEAK RESERVOIRS, IDAHO

ABSTRACT

Arrowrock and Lucky Peak reservoirs support Kokanee *Oncorhynchus nerka* and Rainbow Trout *Oncorhynchus mykiss* fisheries near the Boise, Idaho metropolitan area. Creel interviews were conducted with anglers leaving Arrowrock and Lucky Peak reservoirs in May 2013 in order to estimate catch rate and fish sizes. The goal of this survey was to develop indexes for the fishery that can inform management practices or improve understanding. Of the 535 anglers interviewed, 317 (59%) anglers had fished at Arrowrock Reservoir and the remaining 218 (41%) at Lucky Peak Reservoir. For anglers targeting Kokanee, catch rate was 0.47 fish/h and 0.65 fish/h at Lucky Peak Reservoir. The majority of Kokanee were caught during the weekend/holiday and early time periods at both reservoirs. Kokanee measured in the creel at Arrowrock Reservoir ranged from 232 to 597 mm, with an overall mean of 403 mm. At Lucky Peak Reservoir, Kokanee ranged from 180 to 505 mm, with a mean size of 339 mm. The proportion of anglers fishing Arrowrock Reservoir increased 57% from 2012 to 2013 as mean fish size in creel increased from 391 to 404 mm. This shift suggests that anglers found larger fish more desirable than higher catch rates. Hydroacoustics and mid-water trawling were also conducted in 2013 to investigate the utility in assessing Kokanee abundance or density. At both reservoirs, diverse species assemblages appear to limit the ability to assess certain age groups, most notably smaller fish. At Arrowrock Reservoir, overall mean fish density was 773 fish/ha and total pelagic abundance was 541,714 fish. At Lucky Peak Reservoir, mean fish density was 373 fish/ha and total pelagic abundance was 425,370 fish.

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INTRODUCTION

The Arrowrock and Lucky Peak reservoir Kokanee *Oncorhynchus nerka* fisheries are two of the most popular in the state and are experiencing a sizeable increase in angler interest. Arrowrock and Lucky Peak reservoirs are two impoundments on the Boise River approximately 10 km east of Boise (Figure 1). Recently, Arrowrock Reservoir has gained popularity as Idaho Department of Fish and Game (IDFG) has begun annually stocking Kokanee in 2009. The Arrowrock Reservoir Kokanee fishery is stocked with fingerling or fry Kokanee in the spring but known levels of entrainment from Anderson Ranch Reservoir and wild production likely contribute to the population as well. The current annual stocking request is 50,000 fish and this objective has been reached in 2012 and 2013 (Table 1). The Arrowrock Reservoir fishery has been thought to be maintained by a combination of natural recruitment and individuals entrained through Anderson Ranch Dam, which is upstream of the reservoir on the South Fork Boise River (SFBR). In 2013, the annual stocking request for Lucky Peak Reservoir is 250,000 fish which was a 50,000 fish increase from previous years.

Through the World Wide Web (WWW), information such as stocking history and regional management reports, have become more accessible and easier to distribute to anglers. In addition, communication amongst Kokanee anglers and IDFG has improved via online forums and social media. The IDFG Southwest Region has observed a dramatic increase in angler interest in the management of the Kokanee fisheries at these reservoirs, particularly inquiries into stocking rates. Currently, the default Lucky Peak Reservoir Kokanee fingerling request is 250,000 fish, or 70.2 fish/acre in May (Table 1). The default stocking request for Arrowrock Reservoir is 50,000 fish or 16.1 fish/acre in May. Annual variations in reported catch rates have led IDFG to examine if the cause of this variability may be attributed to size at stocking, timing of stocking, stocking density, or reservoir conditions. For example, in 2008 Lucky Peak Reservoir received nearly 200,000 fry from Cabinet Gorge State Fish Hatchery, although it received between 175,000 to 308,000 fingerlings the previous three years. Currently IDFG has a sense of which years have produced good fishing from angler reports but we do not have actual catch rate data. It is difficult to suggest or implement management changes without actual data on annual Kokanee size or angler catch rates for each year class.

Due to the growing popularity with anglers, IDFG recognizes the need to monitor the Kokanee fisheries in the reservoirs more quantitatively. Specifically, IDFG should more fully define Kokanee management goals for catch rates and size of fish at maturity. Additionally, obtaining a better understanding of how reservoir management, spawning conditions, and stocking affect survival and growth of individual year classes should greatly increase IDFG's ability to effectively manage these populations.

Catch rate and fish size in creel will help define the existing Kokanee fishery, understand what is biologically capable, and also determine what is acceptable or desirable to anglers. Annual catch rate and fish size information will also create indexes to relate back to stocking practices or reservoir environments.

MANAGEMENT GOAL

1. Provide and manage for attractive Kokanee fisheries in Arrowrock and Lucky Peak reservoirs. At Lucky Peak Reservoir, Kokanee size in creel should meet or exceed 355 mm in total length.

OBJECTIVE

1. Obtain a better understanding of how annual stocking rates and reservoir management influence resulting Kokanee fisheries at Arrowrock and Lucky Peak reservoirs.

METHODS

Angler Catch Rate And Fish Size

Creel information was collected by surveying anglers at a check station, similar to the access-access survey design described by Pollock et al. (1994). However, we did not conduct angler counts to estimate total effort. May was determined as an appropriate month because anecdotal observations and angler reports suggest that May and June are peak months for angling effort directed at Kokanee. Additionally, by conducting the survey in May we have the opportunity to directly target and interact with anglers as recreational boaters do not become a significant portion of reservoir users until after Memorial Day. We plan on implementing this survey as part of our annual work plan to monitor the fishery at Arrowrock and Lucky Peak reservoirs for the next several years. Our focus was on Kokanee and Rainbow Trout *Oncorhynchus mykiss,* but we collected data on all fish species reported.

Creel clerks were stationed at a single site to intercept anglers as they left the fisheries. The creel station was just east of state Highway 21 at Spring Shores Road turnoff (Figure 1). This creel station intercepted anglers from Spring Shores Marina, and Mack's Creek ramp, and Arrowrock Reservoir. In 2012, a creel station was also set up near the dam to intercept anglers at Turner Gulch for Lucky Peak Reservoir. This station was dropped in 2013 because less than 5% of interviews for Lucky Peak were collected at that station. During May 2013, 6 dates, with 3 days of both weekday and weekend/holiday sampling units were randomly selected. Two sampling periods were also used: (1) An early period (09:00-15:00 h) and (2) a late period (15:00-21:00 h).

Our focus was on completed fishing trips. Each interview or contact was assigned a unique interview number for that day, based on the numerical order by which anglers were contacted. We also recorded fishing license numbers, number of anglers in party, time fishing, target species, and species/number of fish that were harvested or released. Creel clerks were directed to obtain a catch rate per individual angler, although it may be difficult in trolling situations with multiple anglers. Fishing method, gear type, and total length (mm) and weight (g) of harvested fish were also being recorded. Mean catch rate, $\widehat{R_2}$, was estimated using the ratio of means (ROM), where trip interviews were considered complete:

$$\widehat{R_2} = \frac{\frac{\sum_{i=1}^{n} c_i}{n}}{\frac{\sum_{i=1}^{n} e_i}{n}}$$

where $\hat{R}$ is the mean catch rate in fish/angler hour, c_i is the number of fish caught during the trip, and e_i is the length of the trip in hours (equation $\widehat{R_2}$ from Pollock et al 1994).

When possible, all fish observed in the creel were measured and weighed except during periods of high traffic so as to not cause traffic issues or major inconveniences for anglers departing the reservoir. During high traffic periods, clerks collected all angler trip time and catch/harvest information, but may have foregone fish measurements.

Hydroacoustics

Hydroacoustic surveys were conducted to estimate Kokanee abundance and density. Multiple years of density information will allow managers to determine mature Kokanee size and density relationships for each reservoir. Six transects were sampled with hydroacoustics gear at Lucky Peak Reservoir on July 9, 2013 (Figure 1) and Arrowrock Reservoir on July 10, 2013 (Figure 2). Hydroacoustic estimates of fish densities, lengths, and vertical depth distributions were obtained with a Hydroacoustic Technology, Inc. (HTI) Model 241-2 split-beam digital echosounder. The 200 kHz sounder was equipped with a 15° vertically aimed transducer (down-looking) which was suspended at a 1-m depth using a retractable pole mount mounted on the port side of the boat. Boat speed during data collection ranged from 1 to 1.5 m/s. Sampling transects were determined prior to surveys and were followed using Global Positioning System (GPS) coordinates (Figure 1). Data were collected at a sampling rate of 10 pings/s and a transmit pulse width of 0.2 ms was used.

Thresholds were generally established so that targets larger than –60 dB along the acoustic axis were accepted for the down-looking transducer. Thresholds corresponded to a minimum size acceptance of 30 mm fish targets for the down-looking transducer (Love 1977). The bottom threshold was set at 2.0 V, and echoes within 1.5 to 2.0 m of the bottom were excluded from analysis (bottom window). However, in some instances, the bottom was tracked manually in efforts to detect fish closer to the bottom. In these instances, the bottom was manually traced using the returning echo strength and bottom editing functions within the software during fish tracking analyses.

Target tracking was used to classify returning echoes as fish and thus obtain fish density estimates. The discrete layer of fish suspended around the thermocline was considered Kokanee based on netting from previous surveys. Targets outside this layer, near the surface or bottom were excluded from analysis. This method combines individual echo returns that meet specific criteria and records them as individual fish. Following methods described by Teuscher (2001), fish tracking criteria included: 1) a minimum of three echoes with a minimum acceptable change in range between echoes of 0.2 m, 2) a maximum difference in returning echo strength of 10 dB, 3) maximum swimming velocity of 3 m/sec, and 4) mean target strength for a tracked fish between a size range of –20 and –60 dB. During the survey, data were collected and processed, and fish were tracked and recorded using the HTI software, Digital Echo Processor (DEP). However, because the default tracking parameters may allow gas bubbles, bottom or complex substrate to be counted as fish, we individually examined tracked fish using HTI's EchoScape software. The software allows the user to further examine individual echoes within a fish trace and thereby reduce errors associated with using the automatic tracking procedures, i.e., overestimating fish density. Kokanee measured in the May creel survey was used for target verification and targets outside of the suspended Kokanee layer were excluded from fish estimates.

Estimates of down-looking fish densities (>6 m deep) for each transect were obtained using a range weighting technique as described by Yule (2000). This method standardizes fish density estimates by accounting for expanding sampling volume with increasing range. Tracked fish are weighted back to a 1 m swath at the surface using the following formula:

$$F_w = \frac{1}{(2 * R * \tan(7.5°))}$$

where F_w is weighted fish,
R is range, and
7.5° equals half the nominal transducer beam width.

Fish densities (fish/m^2) for each transect were calculated by summing weighted fish and dividing that value by transect length (m).

Because the distribution of fish density estimates from transects was not normal, the geometric mean density was calculated for expansion to population estimates. The geometric mean and 90% confidence interval for density estimates was computed using methods described by Elliott (1983). A log(x+1) transformation was used because density estimates sometimes contained zero values. Total fish abundance was estimated by multiplying the geometric mean side-looking and down-looking fish density (fish/ha) by the surface area of the reservoir on the survey date and summing them together. The standard error for the total population estimate was calculated using the following equation (Elliot 1983):

$$SE = \sqrt{\frac{s^2{}_x}{n_x} + \frac{s^2{}_y}{n_y}}$$

where $s^2{}_x$ is the variance of x,
$s^2{}_y$ is the variance of y, and
n_x and n_y is the sample size of each estimate.

Ninety percent confidence intervals were calculated for population estimates using the methods described in Scheaffer et al. (1996). Regardless of transect length, each transect was considered a sample unit.

Only pelagic targets that were located within the Kokanee layer were included in density and abundance analysis. Abundance and density estimates were partitioned by size information collected from converted target strengths and the May creel survey. On May 1, 2013, approximately 50,160 Kokanee fry were stocked in Arrowrock Reservoir and 251,877 were stocked into Lucky Peak Reservoir. The mean length of stocked fish was 69 mm. Kokanee are known to spawn in the SFBR and MFBR but the extent to which natural reproduction contributes to the Arrowrock Reservoir Kokanee population is unknown. During analysis of hydroacoustics, it is assumed that wild age-0 Kokanee ranged from 30 to 80 mm. Hatchery age-0 Kokanee were assumed ranged between 81-130 mm at the time of the survey. Fish between 201 to 320 mm were considered age-1 and fish between 321-430 mm were considered age-2 Kokanee.

Mid-Water Trawling

Mid-water trawling was conducted to collect age-0 and age-1 Kokanee in Lucky Peak Reservoir for growth, survival, and size verification information on July 8, 2013. Trawling was not conducted at Arrowrock Reservoir because of low reservoir elevation. Mid-water trawling was conducted at night during the dark (new) moon on July 8, 2013. Trawling was performed in a stepped-oblique fashion as described by Rieman (1992) and Kline (1995) with the exception that the otter-boards were replaced by a fixed frame at the net mouth with a 4.5 m^2 opening. Six standardized transects approximately 1.5 km in length were starting points were randomly selected, beginning at the dam and continuing upstream to the Spring Shores area (Figure 1). The net was towed at 1.5 m/s with a 7.3 m boat.

Size at Maturity

Collecting and measuring spawning fish or carcasses in the tributaries provided size at maturity for Kokanee. Size at maturity indices, when calculated for individual year classes, can also be related back to stocking practices or environmental conditions within the reservoir. Size at maturity information collected from spawning fish can be compared to fish size observed in the creel to determine whether similar information can be obtained from May creel. If, after two or three years, minimal differences exist between size at maturity information collected from spawning fish and creel, efforts may be discontinued.

RESULTS

Angler Catch Rate And Fish Size

A total of 535 anglers were interviewed for catch information during May 2013. Of the anglers interviewed, 317 (59%) anglers had fished at Arrowrock Reservoir and the remaining 218 (41%) anglers had fished at Lucky Peak Reservoir. Average trip length of anglers fishing at Arrowrock and Lucky Peak reservoirs were 4.6 and 3.9 h, respectively. Primary target species for anglers was nearly identical at both reservoirs, with 69% of anglers targeting Kokanee and 22% targeting Rainbow Trout (Figure 3). Anglers indicating they had no preference were 7% at Arrowrock Reservoir and 5% at Lucky Peak Reservoir. Finally, anglers targeting Smallmouth Bass made up 1.3% and 4% of all anglers interviewed at Arrowrock and Lucky Peak reservoirs, respectively. A total of 190 (36%) anglers were interviewed during a weekday, while 345 (64%) anglers were interviewed during the weekend/holiday period (Figure 4).

On average, Kokanee anglers harvested 2.1 fish at Arrowrock Reservoir and 1.7 Kokanee at Lucky Peak Reservoir. Approximately 38% and 50% of Kokanee anglers were unsuccessful in harvesting fish at Arrowrock and Lucky Peak reservoirs, respectively (Figure 5). Conversely, 12% of Kokanee anglers harvested their bag limit at Arrowrock Reservoir and 11% at Lucky Peak Reservoir. At Arrowrock Reservoir, overall CPUE of Kokanee was 0.44 fish/h while CPUE at Lucky Peak Reservoir was 0.33 fish/h (Table 2). For anglers targeting Kokanee, catch rates were similar to overall catch rates at Arrowrock Reservoir (0.47 fish/h) but nearly doubled at Lucky Peak Reservoir (0.65 fish/h). The majority of Kokanee were caught during the weekend/holiday and early time periods at both reservoirs. Trolling and lures were the most successful method and gear type for Kokanee at both reservoirs (Figure 4). Kokanee measured in the creel at Arrowrock Reservoir ranged from 232 to 597 mm, with an overall mean of 403 mm (Figure 6). Two age classes were likely represented in the creel based on ages obtained from otoliths (Figure 8). At Lucky Peak Reservoir, fish ranged from 180 to 505 mm, with a mean size of 339 mm. Three year classes were represented in the creel at Lucky Peak Reservoir (Figure 8).

Catch rates for Rainbow Trout differed between reservoirs and angling methods. Anglers targeting Rainbow Trout harvested an average of 0.5 fish at Arrowrock Reservoir and one Rainbow Trout at Lucky Peak Reservoir. Approximately 77% and 62% of Rainbow Trout anglers were unsuccessful in harvesting fish at Arrowrock and Lucky Peak reservoirs, respectively (Figure 5). Only 4% of anglers harvested their bag limit of Rainbow Trout (six fish) at Arrowrock and Lucky Peak reservoirs. Rainbow Trout were caught at overall rates of 0.11 and 0.56 fish/h at Arrowrock and Lucky Peak reservoirs, respectively (Table 2). Anglers specifically targeting Rainbow Trout caught fish at a rate of 0.24 at Arrowrock Reservoir and 0.85 fish/h at and Lucky Peak Reservoir. Fish were primarily caught during the weekend/holiday (66%) at Arrowrock Reservoir and the weekday at Lucky Peak Reservoir (71%). Most Rainbow Trout anglers fished during the early time period at both reservoirs (Figure 7). Additionally, the majority of Rainbow Trout were caught by trolling. Rainbow Trout at Arrowrock Reservoir ranged from 261-401 mm with a mean of 337 mm, while fish from Lucky Peak Reservoir ranged from 152-387 mm with a mean of 297 mm (Figure 9).

Hydroacoustics

At Arrowrock Reservoir, fish densities ranged from 142 to 1,700 fish/ha between transects, with the highest densities occurring towards the dam (Table 3). Mean fish density for fish that would correspond with naturally produced Kokanee (30-80 mm) was 336 fish/ha. Mean fish density was 186 fish/ha for fish between 231-350 mm, which would correspond with recently stocked Kokanee. Overall mean fish density was 751 fish/ha. Total pelagic abundance was 526,091 fish.

At Lucky Peak Reservoir, fish densities among transects ranged from 62 to 358 fish/ha with the highest densities occurring towards the dam in the first three transects (Table 4). Mean fish density for fish between 131-200 mm, was 48 fish/ha. This size class should have included the stocked fish from May as they likely exceed 100 mm by July. Mean fish density was 37 fish/ha for fish between 201-320 mm and 26 fish/ha for fish between 321-430 mm. Overall mean fish density was 130 fish/ha. Total pelagic abundance was 147,880 fish.

Mid-Water Trawling

Mid-water trawling was conducted with hopes of being able to capture age-0 or age-1 Kokanee. A total of two Rainbow Trout, two Yellow Perch, and 20 unidentified larval fish were captured (Table 5). No Kokanee were captured presumably because of gear avoidance and low densities.

Size-At-Maturity

Unfortunately spawning fish were not collected at the confluence of Mores and Grimes creeks despite efforts. It is likely that a 2013 spawning migration was hindered by warm water temperatures and a low reservoir elevation.

Spawning fish from Arrowrock were not sampled in 2013 as well. The spawning migration in the SFBR was likely impacted by the debris and mudslides that occurred on September 12, 2013, following the Pony-Elk complex wildfires. Efforts to collect fish were prevented by area closures and high turbidity. It is also likely that low reservoir elevation had an effect on the number of fish entering the SFBR, MFBR, and NFBR tributaries. During fall weir operations conducted by USBR, two Kokanee were collected in the NFBR, whereas approximately 70 fish were collected in 2011 over the same period (Shawna Castle, USBR, personal communications).

DISCUSSION

The May 2013 creel survey provided useful estimates of catch rates and fish size for both Kokanee and Rainbow Trout at Arrowrock and Lucky Peak reservoirs. Catch rates and fish size should prove to be useful indices for monitoring the fisheries of both reservoirs.

The creel survey showed that catch rates and proportional effort can vary annually between the reservoirs based on catch rates and fish size. In 2013, six dates were surveyed, compared to eight in 2012. Despite the reduction in sampling effort, there were more anglers interviewed in 2013 (535 in 2013; 518 in 2012). We interviewed 117 more anglers that were fishing Arrowrock Reservoir in 2013 compared to 2012. Conversely, we interviewed 100 fewer Lucky Peak anglers in 2013 than in 2012.

The number of Kokanee anglers harvesting their bag limit of fish doubled from 6.4% to 12% at Arrowrock Reservoir and the percentage of unsuccessful anglers dropped from 58% to 38% between 2012 and 2013. Likewise, the percentage of anglers reaching their bag limit at Lucky Peak Reservoir increased from 8% to 11%. However, the proportion of unsuccessful anglers increased from 38% to 50%.

Overall Kokanee catch rates for anglers targeting Kokanee nearly doubled at Arrowrock Reservoir from 2012. The number of anglers fishing Arrowrock Reservoir increased 57% from 2012 to 2013 and mean fish size in creel increased from 391 to 404 mm. At Lucky Peak Reservoir, catch rates were similar between years for anglers targeting Kokanee (0.61 fish/h in 2012 and 0.65 fish/h in 2013). However, the number of interviewed anglers fishing Lucky Peak declined by 46% between 2012 and 2013. The mean size of Kokanee also decreased from 376 to 339 mm. In 2013, Kokanee anglers appear to have placed more importance on fish size rather than catch rates in determining which reservoir to fish.

Catch rates for anglers targeting Rainbow Trout increased slightly in Arrowrock Reservoir from 0.19 to 0.24 fish/h between 2012-2013. Rainbow Trout anglers decreased from 58% of the anglers interviewed in 2012 to 22% in 2013. Rainbow Trout in creel increased slightly from 324 to 337 between 2012 and 2013, respectively. In Lucky Peak Reservoir, catch rates increased over 14-fold, from 0.06 to 0.85 fish/h between 2012 and 2013. The percentage of total anglers who targeted Rainbow Trout grew by nearly 70%, from 13% to 22%, between 2012-2013. However, mean fish size decreased from 323 to 297 mm over the same period with recently stocked catchables making up most of the fish.

The overall goal of sampling the May creel is to identify and develop an indexes using the relationships between stocking size, density, catch rates, and fish size. Because the survey has been conducted only two years, it is still too early for investigating many of these relationships. In addition, environmental factors such as reservoir management may confound predictions. Regardless, the Kokanee fisheries that were predominately produced by the 2011 stocking events produced favorable fisheries in both size and catch rate. Continuing the May creel index through May 2015 will allow biologists to evaluate Arrowrock Reservoir for two years with the annual stocking objective of 50,000 advanced fingerlings. At Lucky Peak, this will allow us to examine the resulting fisheries from stocking 200,000 in 2012 and 250,000 (the annual objective) in 2013. Results from these comparisons will be in important step in determining future stocking objectives for both reservoirs.

The usefulness of hydroacoustics and mid-water trawling surveys in tracking Kokanee populations at both reservoirs is limited with only one year of data. At both reservoirs, diverse species assemblages appear to limit the ability to track certain age groups, most notably smaller fish. Target tracking was problematic because of the high densities of overlapping small fish in at least three transects in each reservoir (Tables 3-4). Density and abundance estimates for fish <90 mm were much higher than would be expected for Kokanee alone based on stocking numbers. Mid-water trawling failed to capture Kokanee and instead captured Rainbow Trout, Yellow Perch, and a number of larval fish. Hydroacoustic density and abundance estimates for the size groups that correspond to age-1 and age-2 Kokanee appear to be more reasonable. However, interpreting the utility of hydroacoustic results from a single estimate is difficult. Often multiple years of data are needed to build or understand relationships between density estimates, fish size, and catch rates.

Mid-water trawling does not appear to be a promising tool for Kokanee monitoring at Lucky Peak Reservoir. No Kokanee were captured presumably because of gear avoidance and low densities. At Deadwood Reservoir, the same sampling gear and boat rarely captured Kokanee exceeding 160 mm in trawls, but Kokanee densities were also nine times higher than Lucky Peak Reservoir (Butts et al. 2013). If reservoir elevation is high enough to allow trawling in June or July, attempts should be made to sample Arrowrock Reservoir. Mid-water trawling might still be useful in determining the level of natural reproduction from fish spawning in the MFBR and SFBR. Naturally produced age-0 Kokanee should still be susceptible to trawling gear if densities are sufficient to detect them.

The May creel index and length at maturity estimates will continue in 2014. Our ability to conduct hydroacoustic estimates will rely on costly equipment upgrades to the echosounder that are currently unlikely. However, continued evaluation of catch rates and fish size in creel should prove extremely useful through 2015. Both Arrowrock and Lucky Peak reservoirs received full Kokanee stocking requests of at least 50,000 and 250,000 fish, respectively, in 2013 and those fish will be well represented in the creel in 2015. Additionally, biologists may be able to identify reservoir management practices that result in poor survival or lower catch rates when individual year classes recruit to the fishery. Identifying environmental influences on the survival of stocked fish will allow managers to potentially adjust stocking numbers if certain reservoir management practices are identified. For example, if extended high-volume reservoir releases are identified as a factor for poor survival, managers may try to increase stocking numbers during years of normal to high snow pack.

MANANGEMENT RECOMMENDATIONS

1. Monitor Kokanee and Rainbow Trout stocking practices through annual May creel index through 2015.

2. Continue evaluation of hydroacoustics to monitor fish density if funding can be procured to update echosounder. Attempt mid-water trawling at Arrowrock Reservoir to evaluate natural reproduction if reservoir elevation allows.

Table 1. Stocking information for Kokanee in Arrowrock and Lucky Peak reservoirs, Idaho.

Water	Year	Date	No. Fish	Mean size (mm)	Fish/kg	Stocking density (fish/ha)	Stocking density (kg/ha)
Arrowrock Reservoir	2004	14-Jun	77,025	100	24.8	61	2.5
1,255 ha	2006	9-May	70,000	89	35.8	56	1.6
	2010	3-Jun	29,000	76	52.6	23	0.4
	2011	8-Jun	30,000	76	45.4	24	0.5
	2012	2-May	50,130	76	50.5	40	0.8
	2013	1-May	50,160	69	68.9	40	0.6
Lucky Peak Reservoir	2004	14-Jun	155,950	90	32.9	135	4.1
1,153 ha	2005	3-Jun	200,150	86	39.1	174	4.4
	2006	24-May	308,050	83	45.8	267	5.8
	2007	31-May	245,000	89	39.7	212	5.4
	2008	3-Jun	195,570	57	130.8	170	1.3
	2009	3-Jun	199,800	83	45.3	173	3.8
	2010	3-Jun	151,050	79	45.7	131	2.9
	2011	8-Jun	174,640	76	42.8	151	3.5
	2012	2-May	200,910	76	48.9	174	3.6
	2013	1-May	251,877	69	67.4	218	3.2

Table 2. Catch rates by various time periods, angling methods, and gear types for Kokanee and Rainbow Trout at Arrowrock and Lucky Peak reservoirs, Idaho.

	Kokanee (fish/h)		Rainbow trout (fish/h)	
	Arrowrock	Lucky Peak	Arrowrock	Lucky Peak
Weekday	0.44	0.33	0.11	0.56
Weekend/Hol	0.33	0.59	0.12	0.12
Early Period	0.39	0.56	0.12	0.19
Late Period	0.31	0.27	0.11	0.57
Shore	0.06	0.38	0.19	0.29
Still boat	0.02	0	0.02	1.03
Trolling boat	0.47	0.59	0.1	0.18
Lures	0.43	0.57	0.1	0.25
Bait	0.05	0.1	0.23	0.4
Kokanee targeted	0.47	0.65	-	-
Rainbow trout targeted	-	-	0.24	0.85
Overall	0.37	0.5	0.12	0.27

Table 3. Kokanee densities (number/ha) per transect and total abundance estimates calculated by arithmetic and geometric mean densities at Arrowrock Reservoir, Idaho on July 10, 2013.

		Fish densities (number / ha)						
Transect	**Transect length (m)**	**30-80 mm**	**81-130 mm**	**131-200 mm**	**201-320 mm**	**321-430 mm**	**>430 mm**	**Total**
1	911	36	22	23	12	30	18	142
2	914	271	119	57	18	7	2	474
3	944	339	270	115	49	46	28	846
4	979	471	444	216	62	19	19	1,229
5	925	921	506	201	49	10	13	1,700
6	940	978	252	90	92	52	42	1,506
	Arithmetic Mean (AM)	**503**	**269**	**117**	**47**	**27**	**20**	**983**
	90% CI (AM)	**121**	**60**	**25**	**10**	**6**	**4**	**195**
	Abundance (AM)	**352,147**	**188,225**	**81,971**	**32,752**	**19,094**	**14,206**	**688,394**
		± 84,559	**± 60,836**	**± 5,896**	**± 5,057**	**± 4,260**	**± 3,092**	**± 136,925**
	Geometric Mean (GM)	**336**	**186**	**92**	**38**	**21**	**16**	**751**
	90% CI (GM)	**219 to 515**	**123 to 280**	**68 to 124**	**29 to 50**	**16 to 29**	**11 to 22**	**538 to 1,048**
	Abundance (GM)	**235,373**	**130,144**	**64,510**	**26,511**	**15,052**	**10,863**	**526,091**
		153,507 to 360,700	**86,326 to 196,025**	**47,938 to 86,727**	**20,074 to 34,942**	**11,227 to 20,103**	**7,693 to 15,229**	**372,617 to 729,409**

Table 4. Kokanee densities (number/ha) per transect and total abundance estimates calculated by arithmetic and geometric mean densities at Lucky Peak Reservoir, Idaho on July 9, 2013.

		Fish densities (number / ha)				
Transect	**Transect length (m)**	**131-200 mm**	**201-320 mm**	**321-430 mm**	**>430 mm**	**Total**
1	1484	237	74	29	18	358
2	1292	80	71	42	27	221
3	1485	64	52	40	16	173
4	1499	24	17	14	7	62
5	2260	25	22	19	8	74
6	1494	15	24	22	14	75
	Arithmetic Mean (AM)	**74**	**43**	**28**	**15**	**160**
	90% CI (AM)	**27**	**8**	**4**	**2**	**37**
	Abundance (AM)	**84,791**	**49,369**	**31,600**	**17,263**	**183,024**
		± 30,815	**± 9,484**	**± 4,264**	**± 5,631**	**± 42,712**
	Geometric Mean (GM)	**48**	**37**	**26**	**14**	**130**
	90% CI (GM)	**66 to 136**	**29 to 46**	**22 to 30**	**24 to 34**	**101 to 167**
	Abundance (GM)	**54,533**	**41,961**	**29,315**	**15,717**	**147,880**
		38,038 to 77,971	**33,290 to 52,815**	**25,049 to 34,275**	**27,857 to 38,872**	**114,635 to 190,671**

Table 5. Numbers of fish by species captured during mid-water trawling at Lucky Peak Reservoir on July 8, 2013.

Transect	Distance (m)	Kokanee	Rainbow trout	Yellow Perch	Unidentified larval
1	1,484	-	-	-	8
2	1,292	-	-	-	12
3	1,485	-	-	-	-
4	1,499	-	-	-	-
5	2,260	-	2	2	-
6	1,494	-	-	-	-

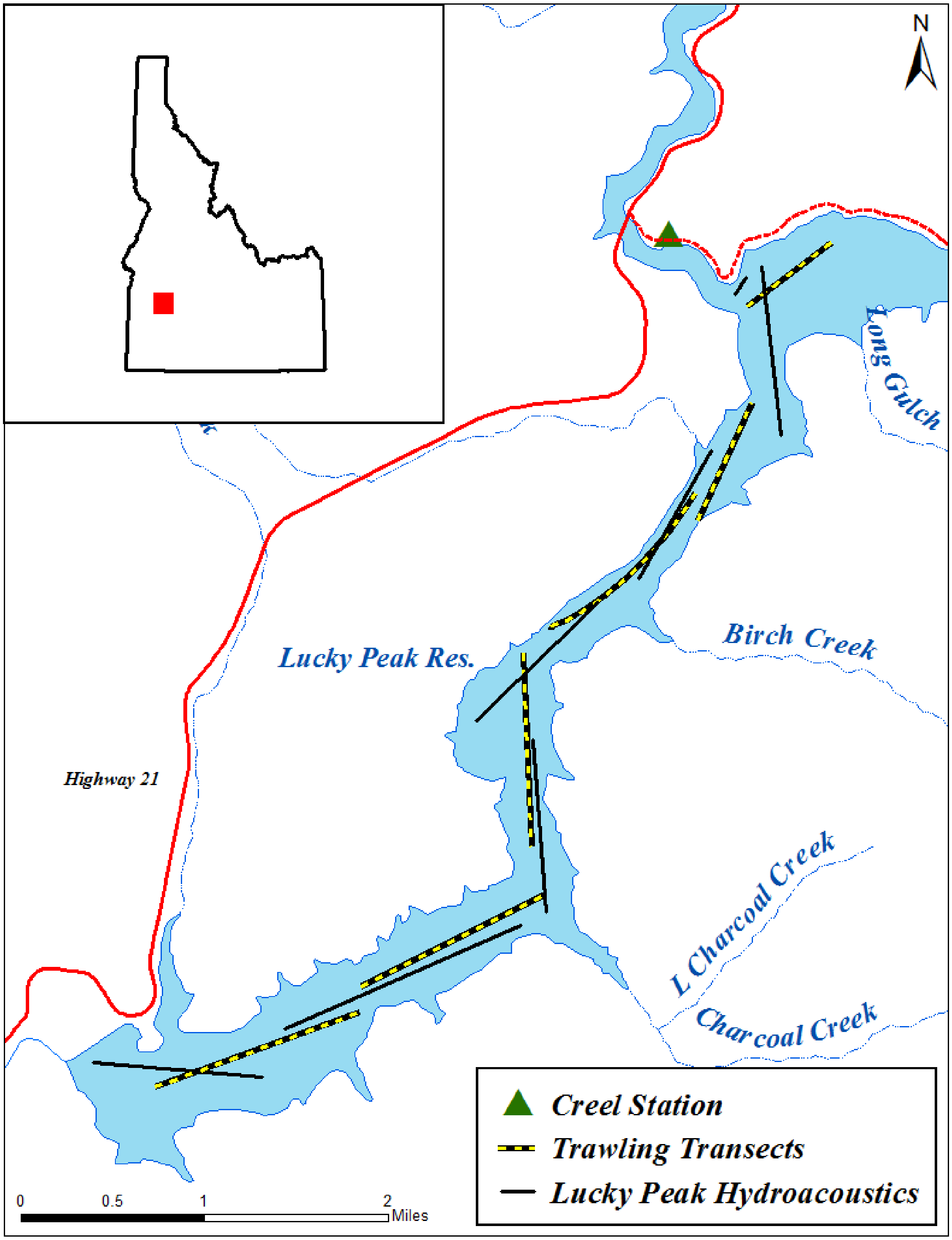

Figure 1. Map of Lucky Peak Reservoir, Idaho, with location of the creel station where clerks can intercept Lucky Peak and Arrowrock reservoir anglers, hydroacoustic, and mid-water trawling transects in 2013.

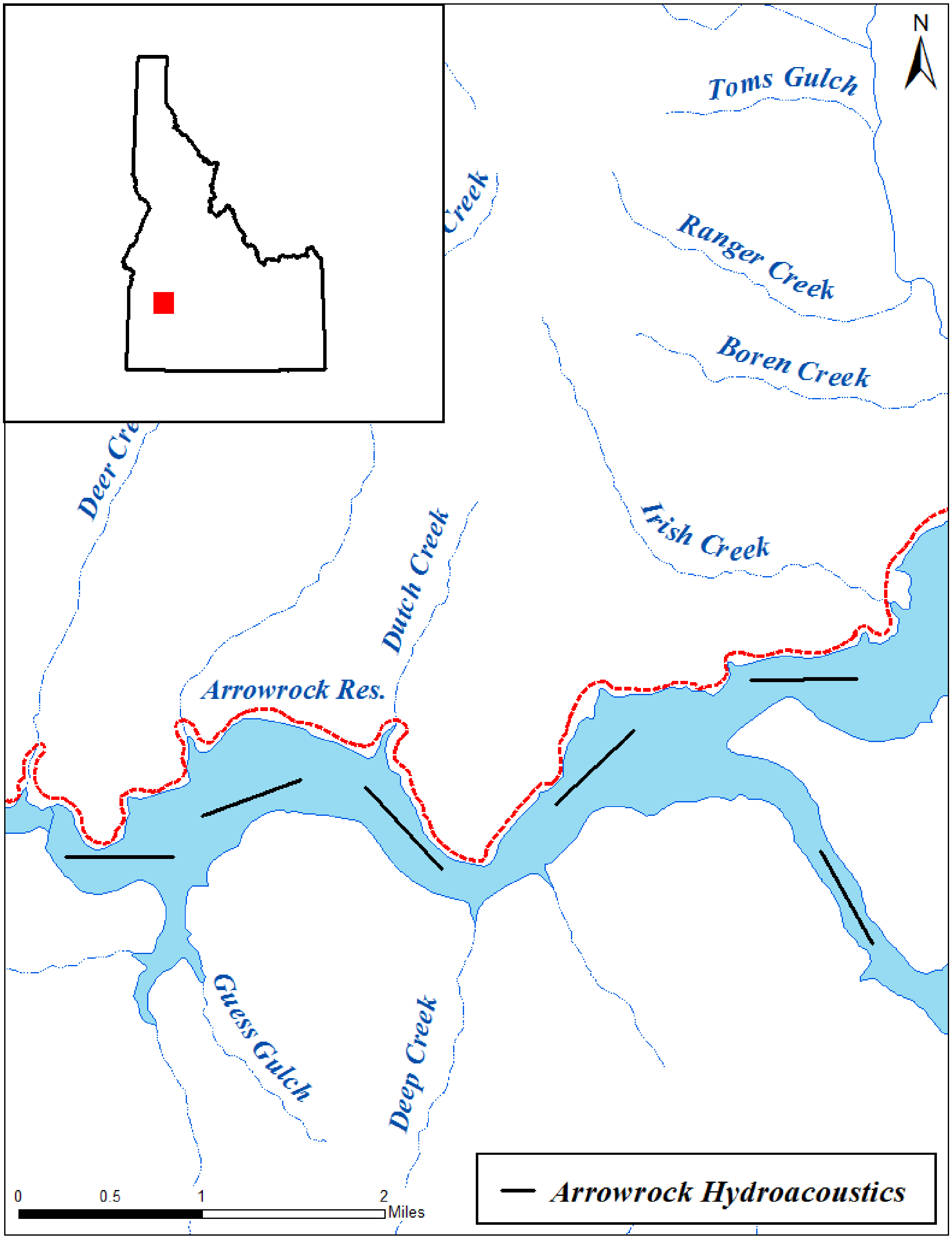

Figure 2. Map of Arrowrock Reservoir, Idaho and hydroacoustic transects in 2013.

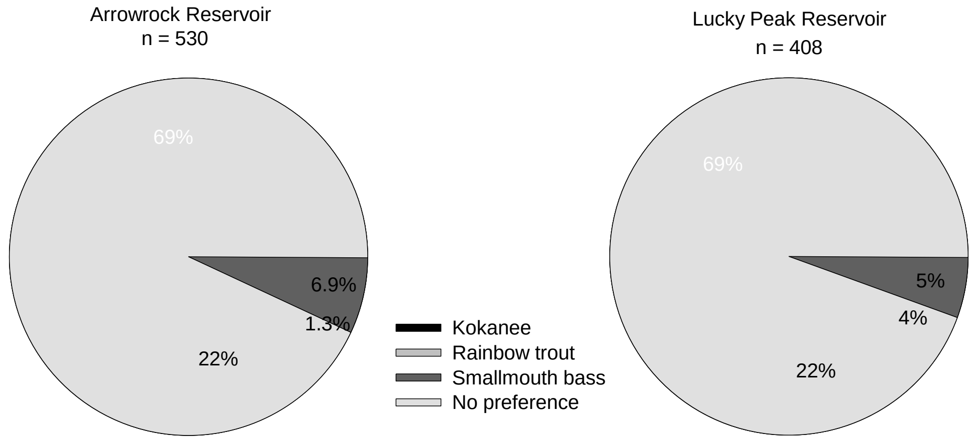

Figure 3. Proportion of targeted species by anglers fishing Arrowrock and Lucky Peak reservoirs in May 2013.

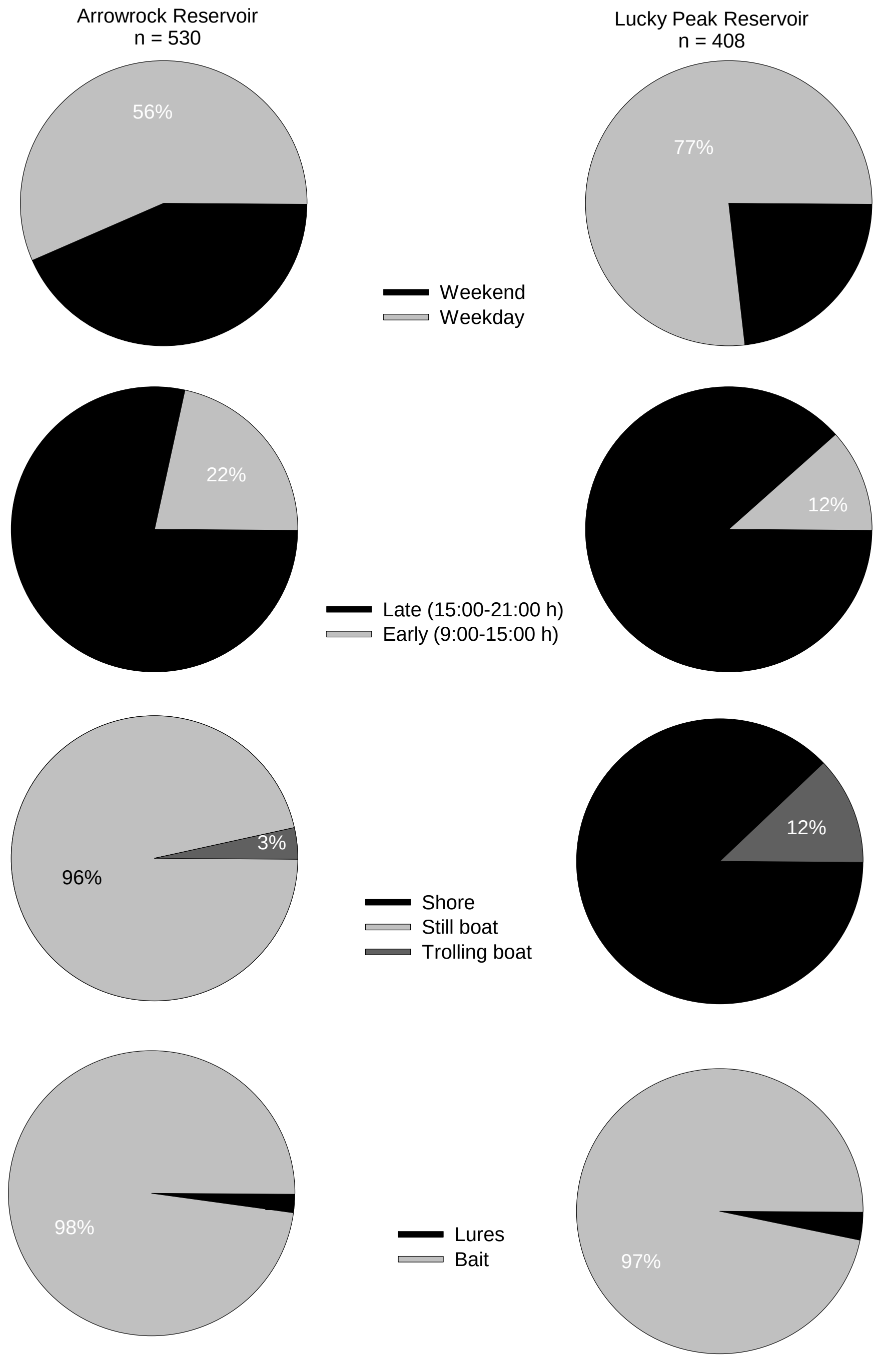

Figure 4. Proportion of Kokanee caught by various time periods, fishing methods and gear as reported by anglers at Arrowrock and Lucky Peak reservoirs in May 2013.

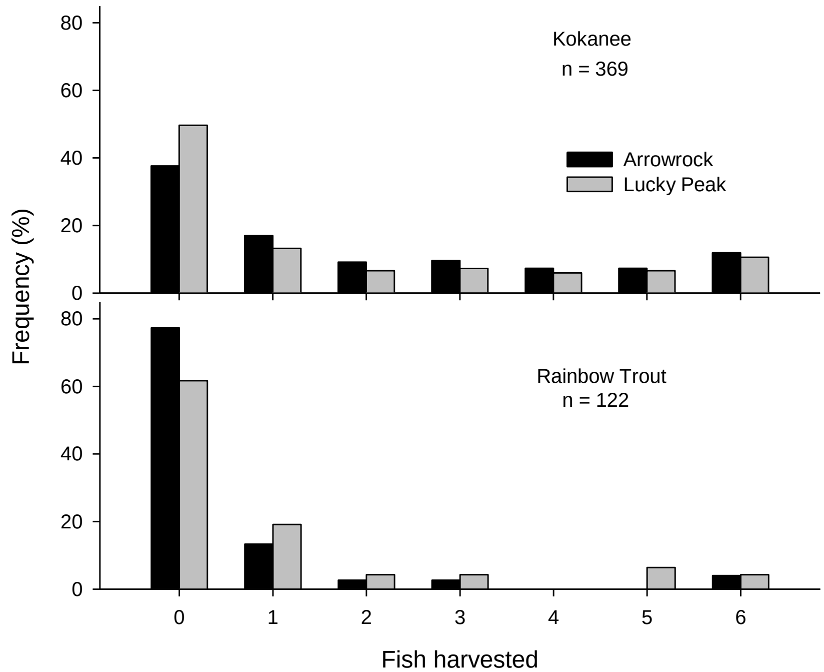

Figure 5. Distribution of fish harvested in a six fish creel limit for Kokanee and Rainbow Trout at Arrowrock and Lucky Peak reservoirs in 2013.

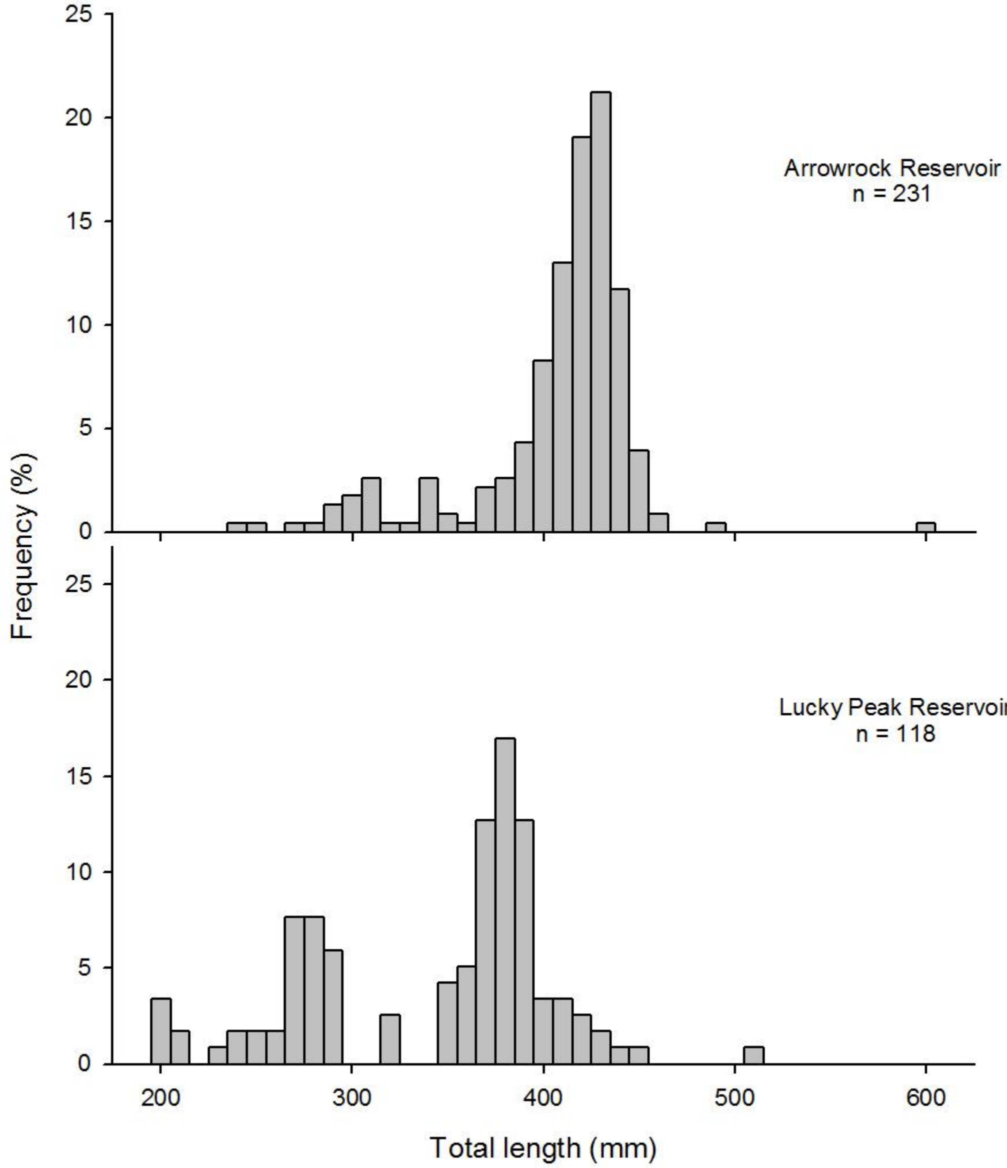

Figure 6. Length frequency distributions of Kokanee observed in the creel in May 2013 at Arrowrock and Lucky Peak reservoirs.

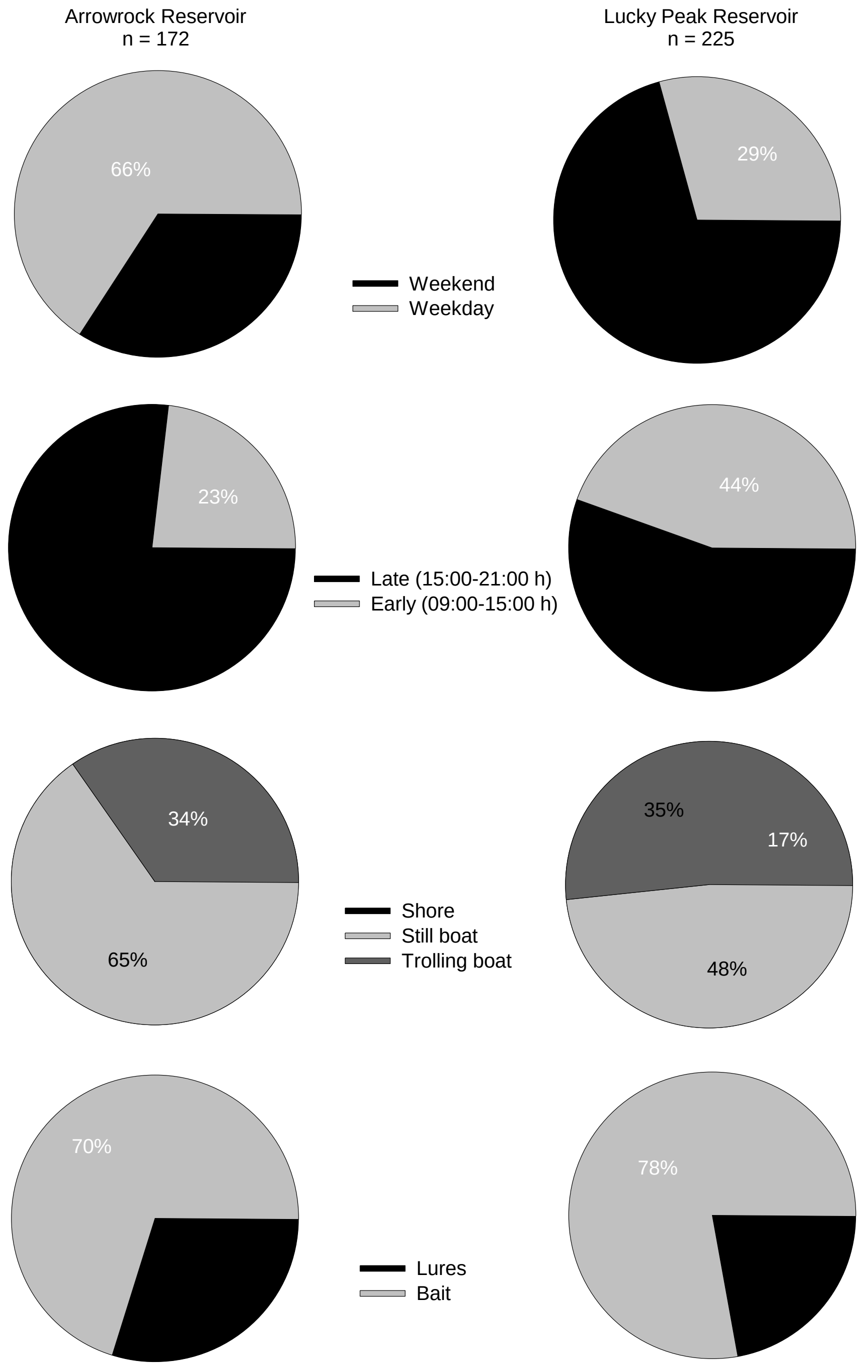

Figure 7. Proportion of Rainbow Trout caught by various time periods, fishing methods and gear as reported by anglers at Arrowrock and Lucky Peak reservoirs in May 2013.

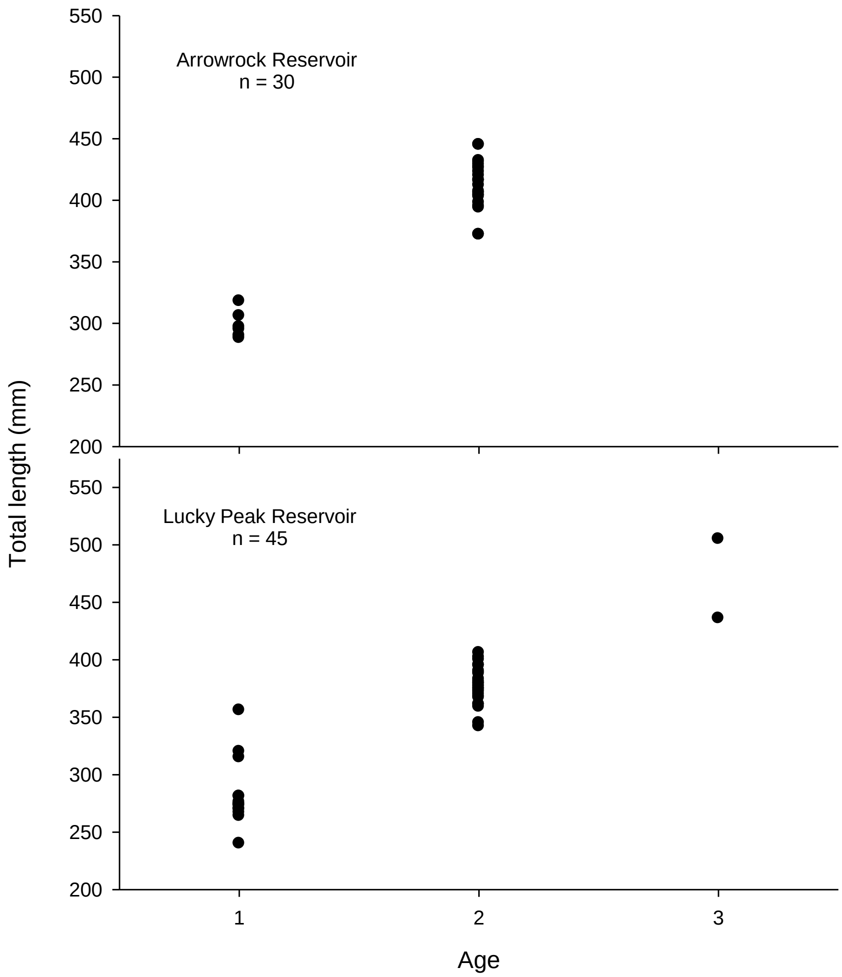

Figure 8. Length-at-age at time of capture for Kokanee in observed during a creel survey in May 2013 at Arrowrock and Lucky Peak reservoirs.

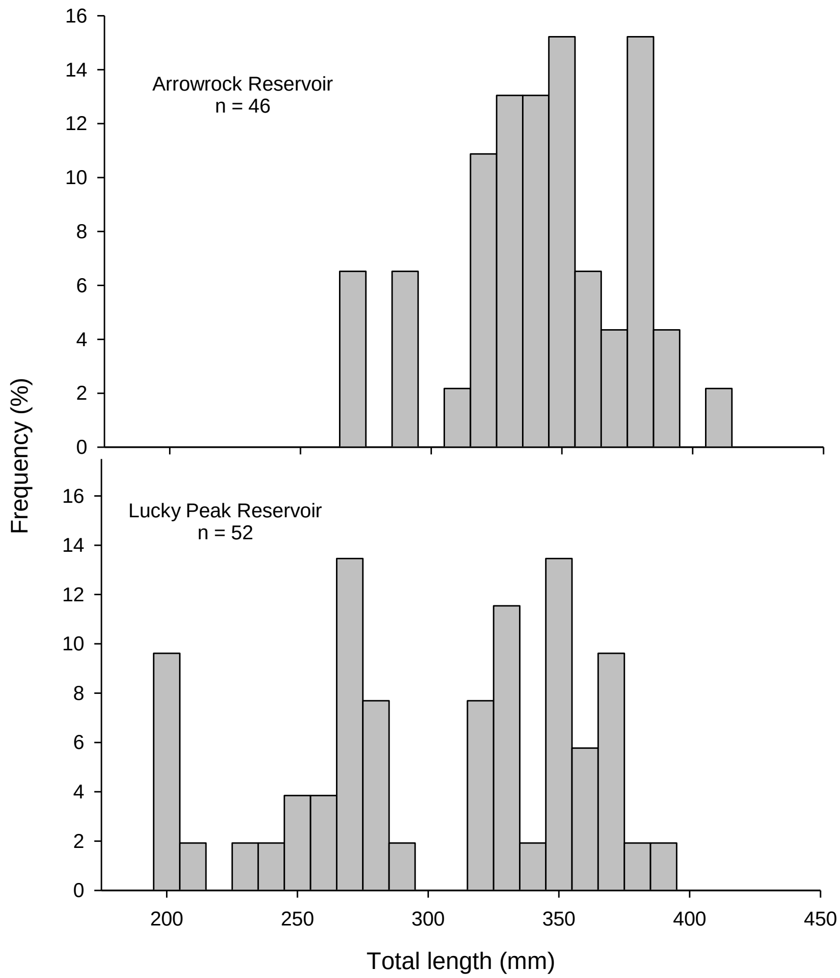

Figure 9. Length frequency distributions of Rainbow Trout observed in the creel in May 2013 at Arrowrock and Lucky Peak reservoirs.

FISH POPULATION ASSESSMENT IN BLACK CANYON RESERVOIR

ABSTRACT

The Bureau of Reclamation (BOR) is currently investigating the feasibility of installing an additional hydroelectric turbine at Black Canyon Reservoir. During the initial feasibility study, BOR drew the reservoir down in winter 2012/2013 (to ~2440' elevation) leaving only a minimum pool. Idaho Department of Fish and Game (IDFG) hypothesized that most fish species were likely extirpated from the reservoir as a result of the extremely low water levels and high turbidity present during the extended period of drawdown. In October 2013, we performed a lake survey to describe the fish community present following the drawdown. Despite collecting 17 species, the catch was primarily composed of Largescale Sucker *Catostomus macrocheilus*, Yellow Perch *Perca flavescens* and Northern Pikeminnow *Ptychocheilus oregonensis*. Largescale Sucker composed the majority of the biomass sampled in the reservoir (51.4%), followed by Yellow Perch and Northern Pikeminnow (9.7%). Despite only making up 17.3% of the biomass, Yellow Perch accounted for 55.5% of the total number of fish sampled. Few game fish were sampled in the reservoir, with size distributions dominated by a single juvenile year class. The proportion of Largemouth Bass *Micropterus salmoides* and Smallmouth Bass *Micropterus dolomieu* declined in the catch considerably from 7.2% and 6.2% in 1999 down to only 1.9% and 1.0% in 2013, respectively. Only two Smallmouth Bass of harvestable size (300 mm) were collected, while no legal sized Largemouth Bass were collected. Only one juvenile Channel Catfish *Ictalurus punctatus* was sampled, suggesting that translocation efforts to move adult catfish in 2011 and 2012 were negated by the reservoir drawdown. BOR may repeatedly draw Black Canyon Reservoir down in winter 2014/2015 and 2015/2016 as part of future construction activities. Should this occur, we anticipate additional negative impacts to the fish community. Because of slow growth rates, adult bass may not be found in the reservoir until 2020 if future drawdowns occur as scheduled.

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INTRODUCTION

Black Canyon Diversion Dam is a 183-foot concrete diversion dam located approximately 8 km upstream of Emmett, ID on the Payette River. The dam (associated reservoir) is operated by the Bureau of Reclamation (BOR) and provides diverted irrigation water via the Black Canyon Canal and the Emmett Irrigation District Canal. In addition to delivering irrigation water, the dam generates up to 10,000 kilowatts of electricity from two hydroelectric generators. Currently, the reservoir has a capacity of 31,200 acre-feet of water with a surface area of 1,100 acres. The dam was originally completed in 1924 and modified as recently as 1998.

Black Canyon Reservoir is currently managed as a general warmwater fishery. Previous trout stocking was discontinued because of poor return to anglers. Bass and panfish are the most popular game species for anglers, and several bass tournaments are held on the reservoir annually. More recently, IDFG translocated Channel Catfish *Ictalurus punctatus* in 2011 and 2012 to establish a self-sustaining population to provide additional fishing opportunities. The reservoir is an important local fishery to the nearby community of Emmett and the Treasure Valley and generated $124,468 in economic activity from 2,717 angler trips according to recent economic survey data.

BOR is currently in the process of investigating the feasibility for installing an additional hydroelectric turbine to generate additional electricity. In winter 2013/2013, BOR drew the reservoir down (to ~2440' elevation) for initial geologic studies and survey work, leaving only a minimum pool. At this low pool elevation, the reservoir became riverine and transported a large, though unquantified amount of sediment through the dam into the Payette River below. Large sediment deposits and dead fish were noted throughout the lower Payette River as a result. Idaho Department of Fish and Game (IDFG) hypothesized that most fish species were likely extirpated from the reservoir as a result of the extremely low water levels and high turbidity present during the extended period of drawdown. In October 2013, we performed a lake survey using standard sampling techniques to describe the fish community present in the fall after the drawdown event. This data is intended to provide a baseline of comparison for evaluating options to manage the fishery from this point forward.

OBJECTIVE

1. Evaluate the fish community in Black Canyon Reservoir following the 2012/2013 winter drawdown with a standard lowland lake survey.

METHODS

The fish community in Black Canyon Reservoir was sampled with standard IDFG lowland lake sampling gears during October 8 - 11, 2013 according to the methods outlined in IDFG 2012. Sampling was confined to the main pool of the reservoir from the dam upstream to Triangle Park, after which the reservoir is mostly filled with sediment and is becomes riverine (Figure 8). Sampling gear included: (1) paired gill nets, (2) trap nets, and (3) night electrofishing. Paired gill net sets included one floating and one sinking monofilament net. Nets were 46 m x 2 m long with six panels composed of 19, 25, 32, 38, 51, and 64-mm bar mesh. One floating and one sinking net, fished for one night, equaled one unit of gill net effort. Shoreline gill nets were set perpendicular to shore (5 units effort), while pelagic nets were set in open water, perpendicular to the long axis of the lake (3 units effort). Trap nets were configured with 15 m leads, 1 m x 2 m frames, crowfoot throats on the first and third of five loops, 19 mm bar mesh netting, and were treated with black tar. One trap net fished for one night equaled one unit of trap net effort. We chose 10 sites and fished trap nets at each site for 2 nights (20 units). Electrofishing was conducted along the shoreline at night using a Smith-Root electrofishing boat. Pulsed direct current was set at 120 pulses per second and a pulse width of 40, which yielded an output of 5 - 6 amps. Electrofishing was conducted at six different transects, with 10 minutes of shocking time within each transect for a total of one hour of electrofishing.

Sample sites for the various gear types were randomly selected throughout the reservoir. A shoreline sampling frame was developed by dividing the perimeter of the main pool into numbered transects, each 500 m long. Shoreline gill nets, trap nets, and electrofishing sites were then randomly selected from the total available shoreline transects. We developed a sampling frame for pelagic gill nets by overlaying a lat/long grid (spaced every 5 seconds) on a 1:24,000 scale USGS topographic map of the reservoir. Pelagic net sites were then randomly chosen from the available numbered grids.

Captured fish were identified to species, measured for total length (± 1 mm), and weighed (±1g for fish under 5,000 g or ± 10 g for fish greater than 5,000 g) with a digital scale. For fish that were not weighed, weight was estimated from collected data using length-weight regression equations by species (Guy and Brown 2007). Furthermore, for those fish not weighed or measured, estimated weights were used to calculate biomass estimates.

Relative weight (W_r) was calculated as an index of general body condition for selected species, where a value of 100 is considered average (Anderson and Neumann 1996). Values greater than 100 describe robust body condition, whereas values less than 80 indicate poor body condition and suggest poor foraging conditions. Standard weight values (W_s) needed to calculate W_r were obtained for most species using those presented in Simpkins and Hubert (1996). Standard weight equations for nongame fish were taken from Parker et al. (1995) for Northern Pikeminnow *Ptychocheilus oregonensis*, Bister et al. (2000) for Common Carp *Cyprinus carpio* and Brown Bullhead *Ameiurus nebulosus*, and Richter (2007) for Bridgelip Sucker *Catostomus columbianus* and Largescale Suckers *Catostomus macrocheilus*. Catch data were summarized as the number of fish caught per unit of effort (CPUE) and the weight in kg caught per unit effort (WPUE).

RESULTS

As of the fall 2013 sampling, the fish community in Black Canyon Reservoir was composed of 17 different species. Despite the large number of species, the catch was primarily composed of Largescale Sucker, Yellow Perch *Perca flavescens* and Northern Pikeminnow. Largescale Sucker composed the majority of the biomass sampled in the reservoir (51.4%), followed by Yellow Perch and Northern Pikeminnow (9.7%) (Figure 11). However, despite only making up 17.3% of the biomass, Yellow Perch accounted for 55.5% of the total number of fish sampled. Northern Pikeminnow and Brown Bullheads were the next most abundant fish captured. While we collected 11 different species of game fish, Yellow Perch was the only abundant species.

Electrofishing catch-per-unit-effort (CPUE) was highest for Yellow Perch, Largescale Sucker and Mountain Whitefish *Prosopium williamsoni* (Figure 12). Trap nets caught comparatively few species, which mainly consisted of Yellow Perch and Brown Bullhead. Similarly, gill net CPUE was again highest for Yellow Perch (33.13), Largescale Sucker (29.63), and Northern Pikeminnow (21.50). Species composition was similar between gill nets set in open water (pelagic) and those set along the shoreline, but catch rates were higher across most species in shoreline nets (Figure 10). Mountain Whitefish were one of the few species that were collected almost exclusively by electrofishing.

Relative weight (W_r) varied across fish species and was greatest for Black Crappie *Pomoxis nigromaculatus*, Largemouth Bass *Micropterus salmoides* and Smallmouth Bass *Micropterus dolomieu* (Figure 13), indicating good body condition for these species. Mountain Whitefish, Northern Pikeminnow and Rainbow Trout *Oncorhynchus mykiss* had lower W_r values (but varied widely), suggesting lower overall body condition.

Length distribution data showed very few adult game fish species present in the reservoir, while multiple year classes were present for some nongame native species like Bridgelip Sucker, Chiselmouth *Acrocheilus alutaceus*, Largescale Sucker and Northern Pikeminnow (Figure 14). The size distribution of most game fish species such as Largemouth Bass, Smallmouth Bass, Yellow Perch, Bluegill, Black Crappie, and Mountain Whitefish were dominated a single juvenile year class. Rainbow Trout showed a distinct distribution of 300-400 mm fish; probably a result of hatchery stocking in reservoirs upstream. Based on otolith samples, Smallmouth Bass collected were predominantly age-1 and age-2, with few adult fish, while only age-1 Largemouth Bass were collected (Figure 15). Regardless of size distribution, abundance of game species of primary angling interest (bass, panfish) was very low.

DISCUSSION

Fall sampling data indicated very few game fish currently in the reservoir. Of those present, the vast majority of the game fish community (and the fish community in general) is composed of Yellow Perch (Figure 11), most of which are small (< 160 mm), offering little in terms of quality angling (Figure 14). Length-frequency distributions indicated very few adult game fish were present (Figure 14), suggesting that most adults were extirpated during the draw down. The proportion of Largemouth Bass and Smallmouth Bass declined in the catch considerably from 7.2% and 6.2% in 1999 down to only 1.9% and 1.0% in 2013, respectively (Table 6). The small sizes of most game species suggests the reservoir is being recolonized by juvenile fish from upstream sources in the Payette River. Black Canyon Reservoir is managed under General Fishing Rules, which require a 12 in (305 mm) minimum size to harvest bass. Only two Smallmouth Bass of legal harvest size were collected, and no legal-sized Largemouth Bass were sampled (Figure 15). Given the current size distribution of Largemouth Bass in Black Canyon Reservoir, there would not be Largemouth Bass of harvestable size for a minimum of 3-4 years based on typical growth rates of nearby reservoirs (Richter et al. 2010). Future drawdown events are likely to increase the time needed to recover any bass fishing in the reservoir.

Rainbow Trout were some of the only adult-sized game fish present in the reservoir. We hypothesize these fish are unlikely to have survived the water quality conditions present during the 2012/2013 reservoir draw down. Rainbow Trout probably arrived in the reservoir from upstream sources more recently, as there is no current hatchery trout stocking in Black Canyon Reservoir. Both adipose-clipped Chinook Salmon *Oncorhynchus tshawytscha* and Kokanee Salmon *Oncorhynchus nerka* were also collected, suggesting entrainment from Cascade and Deadwood reservoirs upstream where these fish occur. Both Deadwood and Cascade reservoirs experienced very low water levels in summer 2013, a time when fish are commonly entrained through dams (Stober et al. 1983; Baldwin and Placeck 2002; McLellan et al. 2008). Therefore, we believe the adult Rainbow Trout sampled likely came from one of these two sources and were probably of hatchery origin.

As with previous sampling, Largescale Sucker and various cyprinid species composed the majority of the biomass of the fish caught. However, the proportion of suckers in the catch appears much lower, while the proportion of Yellow Perch increased. Black Canyon Reservoir was previously sampled in 1996 (Allen et al. 1999) and again in 2004 (Butts and Nelson 2006). The Allen et al. (1999) survey in 1996 included one hour of electrofishing, 2 pairs of shoreline gill nets and one trap net, so sampling effort was considerably lower. Butts and Nelson (2006) survey in 2004 was intended to verify species composition from a hydroacoustic survey, and used eight specialized net curtains set in pelagic areas of the reservoir. Comparing the percent composition of the catch is the most viable comparison across these surveys with different methods and effort. Largescale Sucker comprised the majority of the catch in both 1999 (53%) and 2004 (39%) by number, but only 16% in 2013 (Table 6). The proportion of Northern Pikeminnow also declined from 1999 (15%) and 2004 (13%) to only 5.7% in 2013. In contrast, the proportion of Yellow Perch in the catch increased considerably from 1999 (3%) and 2004 (17%) to 56% in 2013. At this time, it appears that the carp population in the reservoir is mainly composed of juveniles. All carp sampled were less than 250 mm total length, suggesting that adult carp were scarce, if not completely absent. The length-frequency distribution of carp suggests the population is comprised exclusively of young-of-the-year individuals, based on growth rate information from carp research in the Midwest (Sorensen, unpublished data). These data suggest that carp may have been extirpated during the reservoir draw down or were only present in low numbers. At this time, Common Carp appear to be colonizing the reservoir from sources in the Payette River or Squaw Creek.

BOR may draw Black Canyon Reservoir down again in winter 2014/2015 and 2015/2016 as part of future construction activities. Should this occur, we anticipate additional negative impacts to the fish community. Impacts to the fish community will likely be the same as experienced during the 2012/2013 event, and we would expect the fish community to look much as it does today. Popular sport fish like Largemouth and Smallmouth Bass will continue to decline. Growth rates for bass are slow enough that it takes 4-5 years to produce a 12” bass. Additionally, Smallmouth Bass do not reach sexual maturity until 3-4 years of age, so we expect progress in rebuilding the bass population to be very slow. With additional drawdowns, it is unlikely the sport fish community in the reservoir will rebuild itself until 4-5 years after the final drawdown, and perhaps longer. It might be 2020 before adult Largemouth Bass are again found in the reservoir if future drawdowns occur as scheduled.

MANAGEMENT RECOMMENDATIONS

1. Take no further actions to improve fishing at Black Canyon Reservoir until BOR has completed construction projects on Black Canyon Dam and future drawdowns are no longer anticipated.

2. After construction activities are completed, translocate adult Smallmouth Bass and Largemouth Bass to the reservoir to help rebuild bass fishing opportunities.

3. Monitor game fish abundance, size, and age structure to evaluate the success of translocation efforts.

Table 6. Comparison of fish community (percent composition by total numbers) between 1999 (Allen et al. 1999), 2004 (Butts and Nelson 2006) and current samples at Black Canyon Reservoir. Species names and abbreviations are included for reference in later figures.

Species	Abbreviation	Allen et al. 1996	Butts + Nelson 2006	Current 2013
Black Crappie	BCR	3.3%	1.0%	0.2%
Bluegill	BLG	0.3%		0.5%
Bridgelip Sucker	BLS	7.2%	1.0%	2.8%
Brown Bullhead	BBH	5.2%	2.0%	6.0%
Channel Catfish	CAT			0.0%
Chinook Salmon	CHA			0.1%
Chiselmouth	CSM	2.8%	9.0%	0.7%
Common Carp	CRP	1.8%	3.0%	3.2%
Kokanee Salmon	KOK			0.1%
Largemouth Bass	LMB	7.9%		1.9%
Largescale Sucker	LSS	38.6%	53.0%	16.3%
Mountain Whitefish	MWF			4.6%
Northern Pikeminnow	NPM	13.2%	15.0%	5.7%
Pumpkinseed	PKS	10.3%		
Rainbow Trout	RBT	0.1%		1.3%
Redside Shiner	RSS			
Smallmouth Bass	SMB	6.2%		1.0%
Yellow Perch	YLP	3.0%	17.0%	55.5%

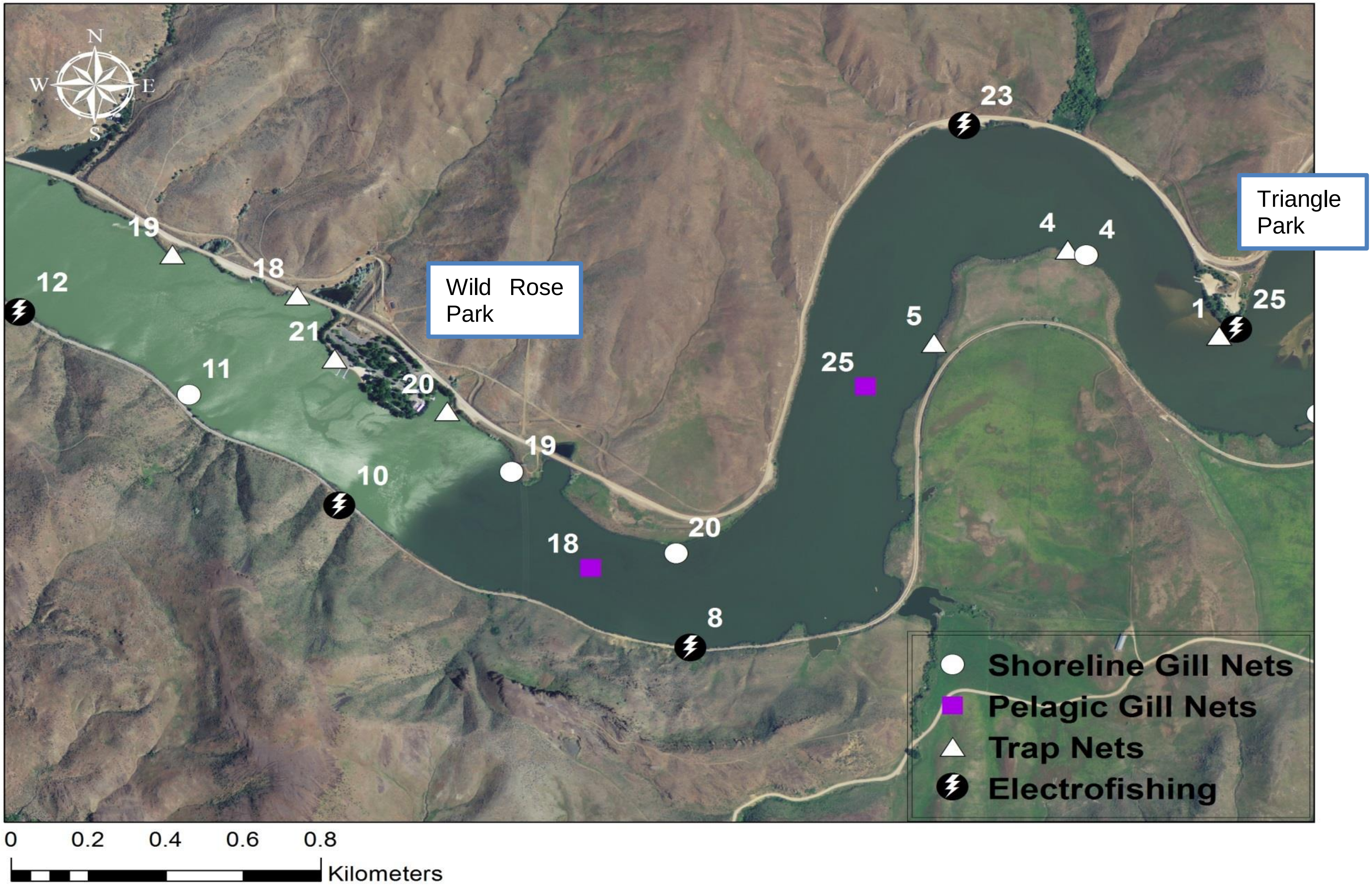


Figure 10. Fish sampling locations (site numbers) by gear type for Black Canyon Reservoir, fall 2013.

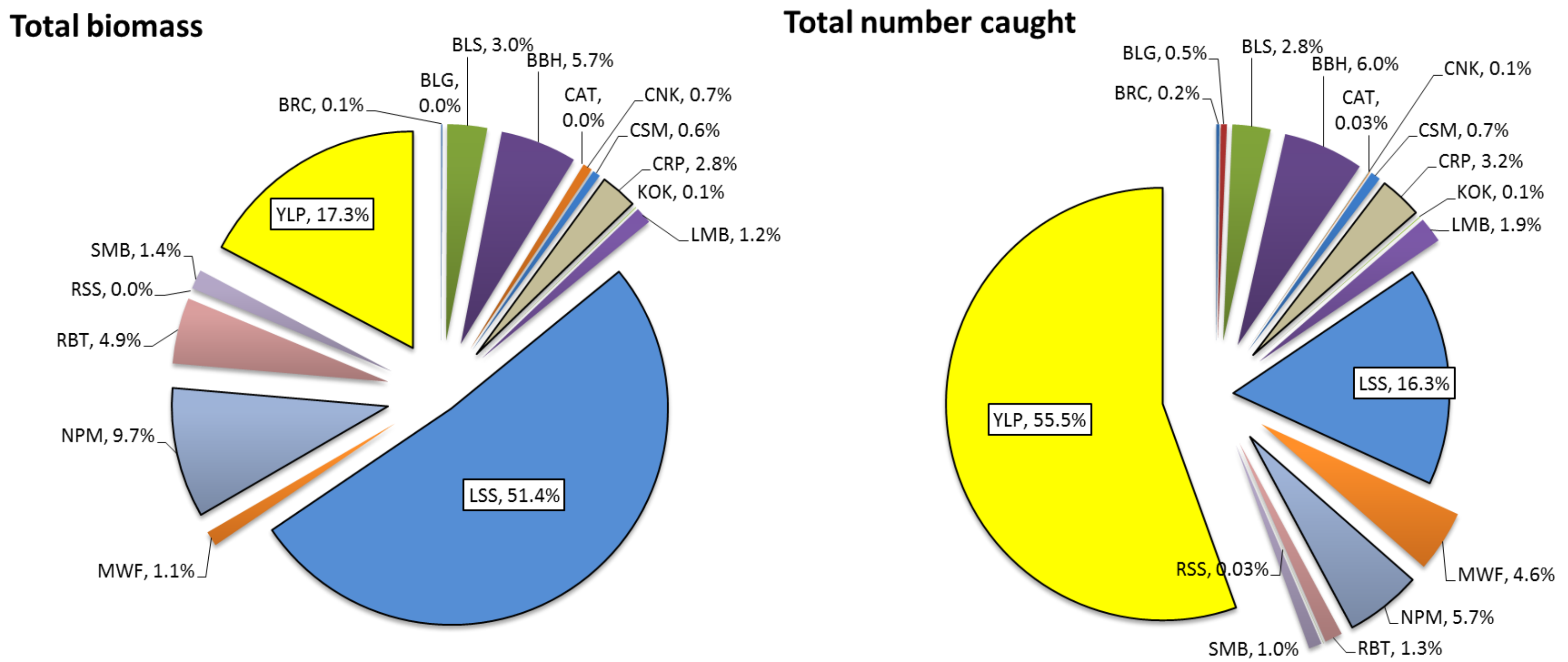


Figure 11. Percent composition of all fish species sampled by total biomass (left) and total number (right) from Black Canyon Reservoir in fall 2013 across all sampling methods. See Table 1 for species abbreviations.

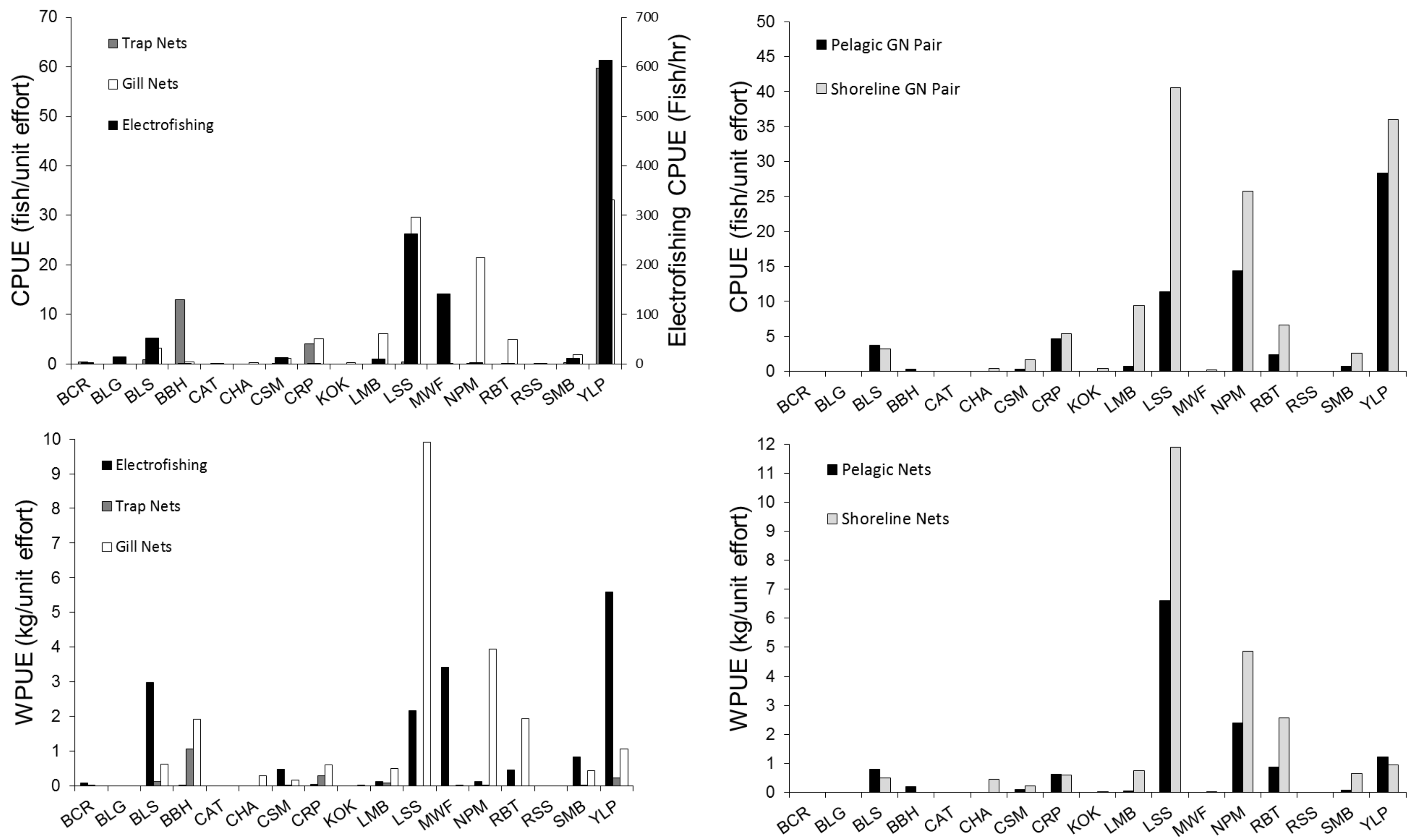


Figure 12. Mean catch per unit effort (CPUE, total fish) and weight per unit effort (WPUE, total kg of fish) by species and gear type collected in Black Canyon Reservoir in fall 2013. Not the secondary axis for electrofishing CPUE. One unit of gill net effort included one sinking and one floating net. Each unit of electrofishing was 6 transects of 10 minutes of shoreline electrofishing, summed together into one hour of effort. See Table 1 for species abbreviations.

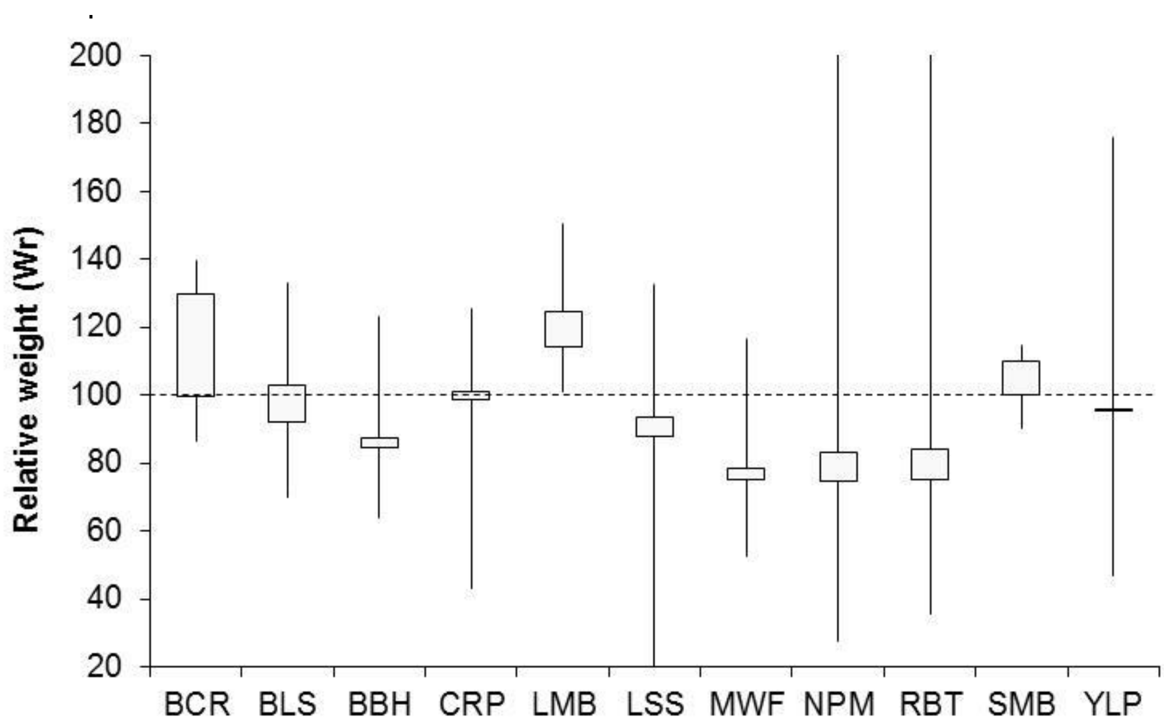


Figure 13. Relative weight (Wr) of selected fish species sampled from Black Canyon Reservoir in fall 2013. The top and bottom of boxes represent 75th and 25th percentiles, respectively. Error bars indicate maximum and minimum values. The horizontal dashed line indicates suggested optimal body condition value of 100. See Table 1 for species abbreviations.

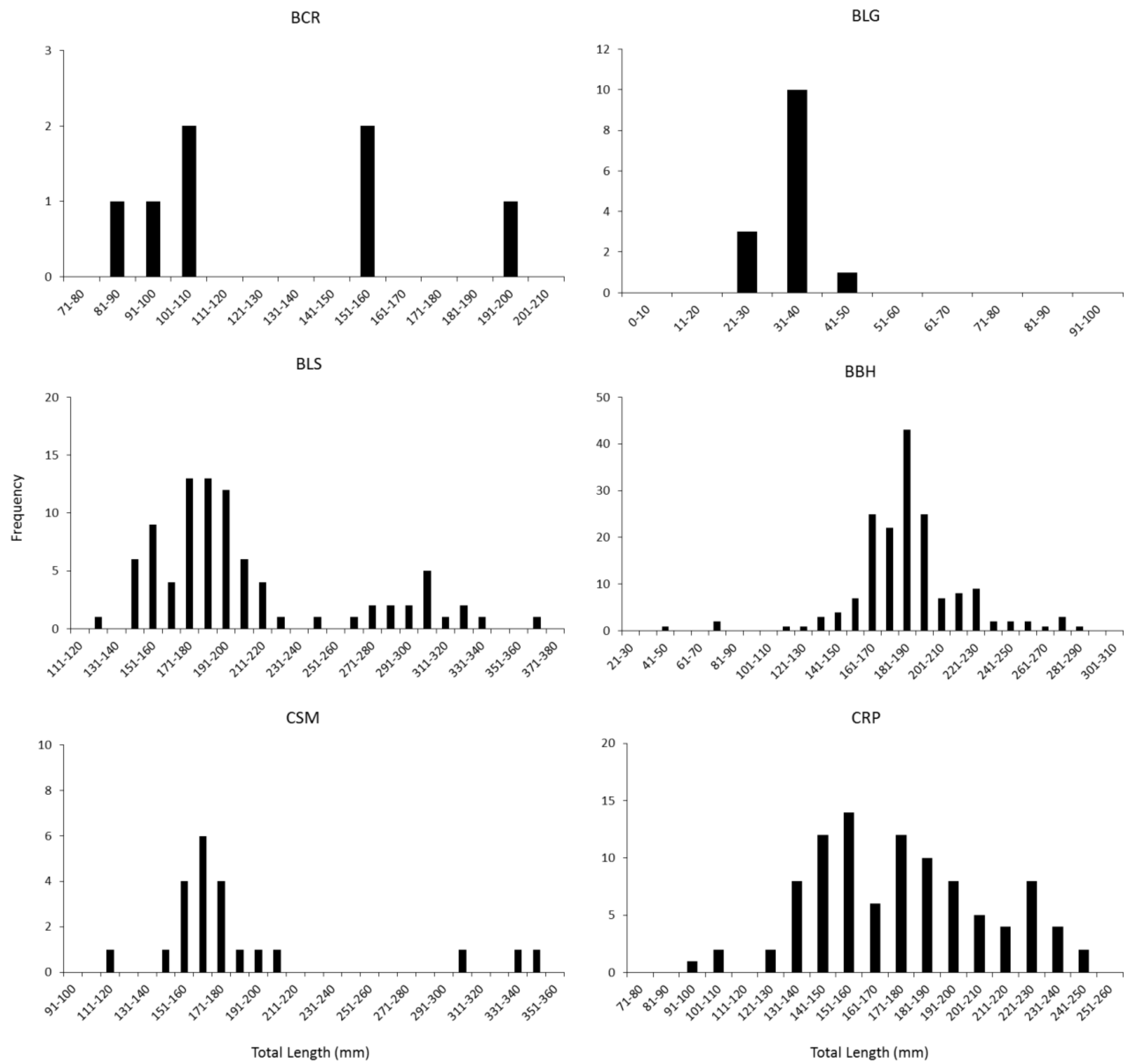
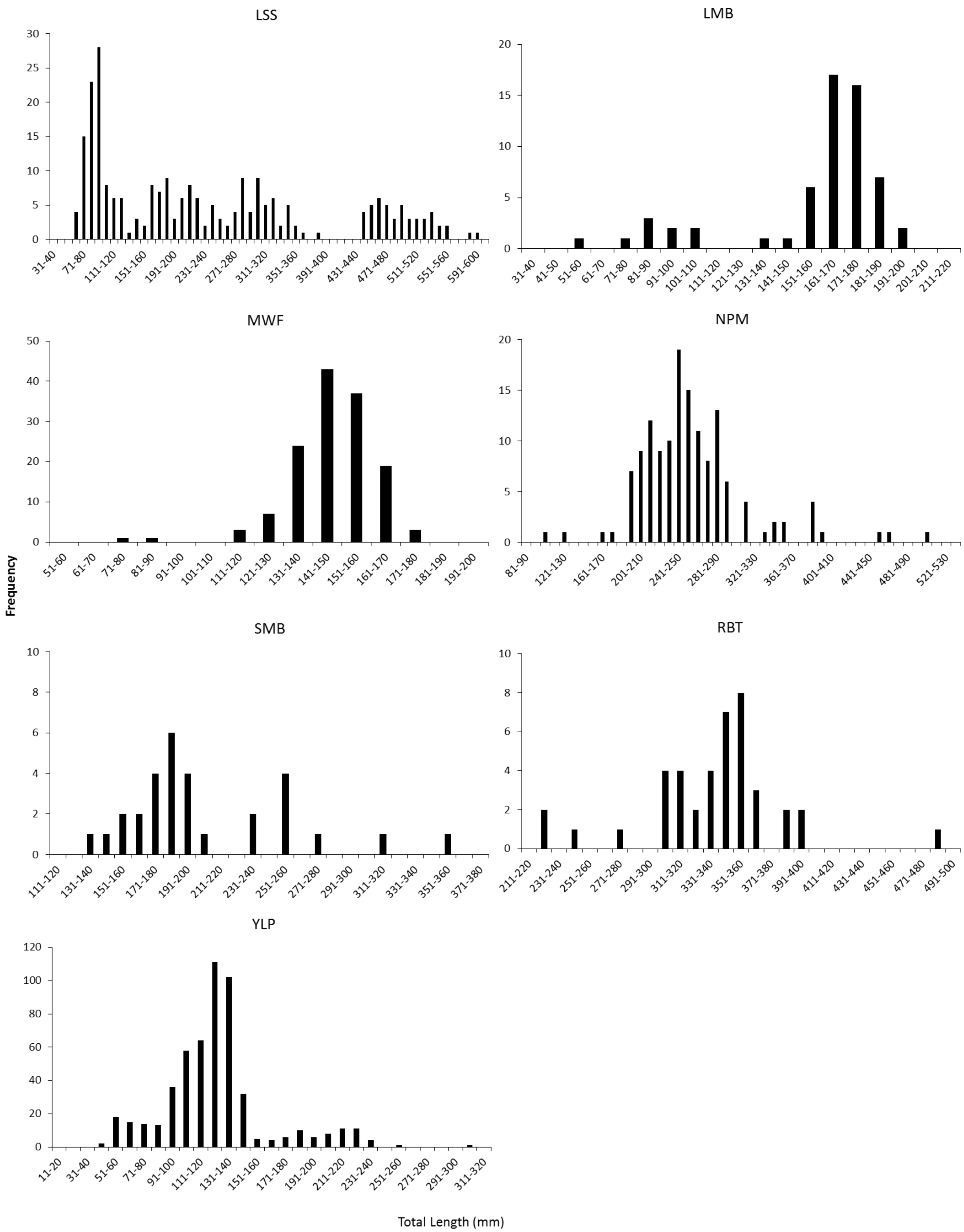


Figure 14. Length-frequency histograms by species for fish collected from Black Canyon Reservoir combined all cross all sampling methods in fall 2013. See Table 1 for species abbreviations.

Figure 14. Continued.



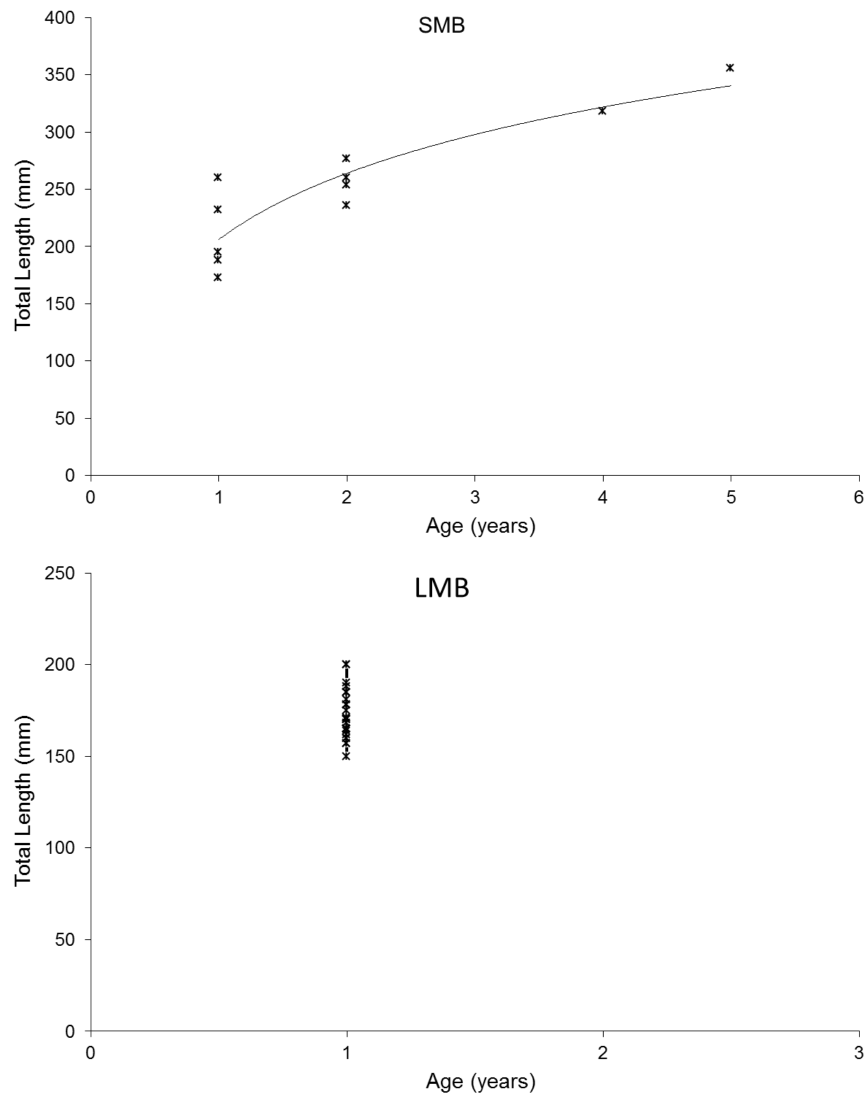


Figure 15. Length at age for Smallmouth (SMB, n = 11) and Largemouth (LMB, n = 31) bass in Black Canyon Reservoir based on otolith cross sections from samples collected in fall 2013.

DEADWOOD RESERVOIR MONITORING

ABSTRACT

Deadwood Reservoir provides an important Kokanee *Oncorhynchus nerka* fishery and is the primary source for early Kokanee eggs for the Idaho Department of Fish and Game (IDFG) hatchery system. To assess Kokanee population dynamics, fourteen hydroacoustic transects were surveyed at Deadwood Reservoir on July 8, 2013. Total mean Kokanee density was 1,881 (1,601 to 2,209) fish/ha. When expanded to a population estimate using the reservoir surface area (1,183 ha) on the survey date, total kokanee abundance was 2,225,537 (1,895,017 to 2,613,669). Age-0 Kokanee made up 63% of this total or 1,392,522 (1,205,162 to 1,608,981) fish. Overall abundance estimates and mature female lengths suggested that keeping the total population at roughly between 800,000 to 1 million fish (250 to 320 fish/ac) results in providing a quality Kokanee fishery in terms of both size and numbers and also appears optimal for easily meeting hatchery egg quotas. Escapement objectives were hampered in 2013 by the discovery that nearly 7,000 Kokanee had entered the Deadwood River, prior to weir installation. Previously, we estimated that to produce an age-0 year class of roughly 400,000 to 600,000 individuals, an approximate 4,000 to 7,000 females would need to be passed during the entire run. A total of 282 fish were captured during the pelagic lake survey on July 9-10, 2013 using four net curtains. Approximately 88% of the catch was Kokanee (n = 247), followed by Chinook Salmon *O. tshawytscha* (5%; n = 14). Mountain Whitefish, *Prosopium williamsoni* Westslope Cutthroat Trout *O. clarkia lewisi*, and Rainbow Trout *O. mykiss* were also captured. Fall Chinook Salmon continue to be growing quite well with the 2009 year class exceeding 700 mm within four years.

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INTRODUCTION

Deadwood Reservoir is a 1,260-ha impoundment located on the Deadwood River in Valley County, approximately 40 km southeast of Cascade, Idaho and 85 km northeast of Boise, Idaho (Figure 16). Deadwood Reservoir provides sport fishing opportunity for Kokanee *Oncorhynchus nerka,* Rainbow Trout *O. mykiss,* and Westslope Cutthroat Trout *O. clarki lewisi*. Bull Trout *Salvelinus confluentus* are present in Deadwood Reservoir at very low numbers. In addition, fall Chinook Salmon *O. tshawytscha*, have been stocked at low densities (4 fish/ha) beginning in 2009.

Over the last 10-12 years, the Kokanee population in Deadwood Reservoir has fluctuated drastically. Because Kokanee exhibit density-dependent growth, increased abundance resulted in a decline in mean length at maturity. Historically, this relationship has been especially evident at Deadwood Reservoir as the Kokanee population experiences relatively low angler pressure and has access to five tributaries with excellent spawning habitat. In addition, Deadwood Reservoir contained few piscivorous predators that are capable of exerting an impact upon the Kokanee population.

Deadwood Reservoir also serves as Idaho's primary egg source, providing early spawning Kokanee for stocking throughout the state. Annually, Deadwood Reservoir provides over 3 million eggs which are distributed across 15 waters statewide. The management goal for adult Kokanee at Deadwood Reservoir is an average length of 325 mm. Yet mean female Kokanee length observed at the spawning trap on the Deadwood River has varied from a low of 208 mm in 1992 to a high of 421 mm in 2003 with mean size decreasing since 2003. From 2006-2008, Idaho Department of Fish and Game (IDFG) sought to reduce the Kokanee population by limiting spawning escapement into a number of the surrounding tributaries (Kozfkay et al. 2010). The effectiveness of these efforts was variable due to high flow events that washed out the picket weirs. However, efforts in 2008 were considered successful, particularly in Trail Creek and the Deadwood River. The egg take operation at Deadwood Reservoir was discontinued for one year in 2009 to evaluate the South Fork Boise River (SFBR) weir location. Egg take operations at Deadwood Reservoir resumed in 2010 and are expected to remain there for the foreseeable future.

Weekly escapement objectives for the Deadwood River, established using annual hydroacoustic estimates and mean female fish length determined from gill net samples, could prove to be very beneficial for the management of the fishery. Current Kokanee population management activities include annual hydroacoustic surveys and limiting and monitoring escapement with weirs on both the Deadwood River and Trail Creek. In 2010 and 2011, Kokanee escapement was controlled successfully in the Deadwood River until the egg quota was met, after which the weirs were removed with an unknown number of prospective spawning Kokanee remaining. This practice could potentially alter the spawning run as the population is maintained by fish that passed after weir operations ceased for the year and keep densities higher than objectives. Management objectives for 2012 included the development of weekly escapement goals for female Kokanee and operation of the weir through the entire Kokanee run. This would allow weir operators to pass a certain number of females above the weir throughout the escapement period to maintain a Kokanee population while avoiding alteration of run timing by weir operations.

Additionally, IDFG re-instituted fall Chinook Salmon stocking in 2009 to function as both Kokanee population control and also to diversify the reservoir sport fishery. Fall Chinook

Salmon were historically stocked from 1995 through 1998 at densities of 1.6 to 3.7 fish/acre, but the program was discontinued over concerns of a declining Kokanee population. Stocking was resumed in 2009 to provide both a sport fishery and hopefully help control Kokanee numbers. IDFG annually stocks approximately 5,000-7,000 fall Chinook Salmon fingerlings, which equates to a stocking density of 1.6 to 2.3 fish/acre. Despite low stocking densities, biologists need to ensure the fall Chinook Salmon population do not expand to the point at which they would depress the Kokanee populations and management goals are not met. To monitor fall Chinook Salmon, curtain nets were used to collect fish to assess survival, growth, and diet. Additionally, redd counts were conducted on the Deadwood River in October 2012 to monitor population abundance. Fall Chinook redd counts were conducted previously between 2000 and 2001 to monitor population abundance but were discontinued as numbers waned.

METHODS

Hydroacoustics

Hydroacoustic estimates of fish densities, lengths, and vertical depth distributions were obtained with a Hydroacoustic Technology, Inc. (HTI) Model 241-2 split-beam digital echosounder on July 8, 2013. Hydroacoustic methodology and analysis is described in detail in Butts et al. (2011).

Net Curtains

The pelagic fish population in Deadwood Reservoir was assessed with two small-meshed and two larger-meshed net curtains during July 9-10, 2013. The target species for sampling gear were Kokanee and Chinook and therefore standard IDFG sampling protocol was not adopted, as it targets the littoral region. Net curtains were 49 m x 6 m and were suspended at various depths in the water column. The small mesh was comprised of 19, 25, 32, 38, 51, 76, and 102-mm stretch mesh, while the large-mesh net was comprised of 51, 57, 64, 76, 89, 102, 127, and 152-mm stretch mesh. Each curtain net, fished for one night, equaled one unit of gill net effort.

Captured fish were identified to species, measured for total length (± 1 mm), and weighed (±1g for fish under 5,000 g or ± 10 g for fish greater than 5,000 g) with a digital scale. Necropsies were conducted on all captured fall Chinook Salmon to assess sex, maturity, and diet. Otoliths were removed from Kokanee and Chinook for age-growth information. Catch data were summarized as the number of fish caught per unit of effort (CPUE) and the weight in kg caught per unit effort (WPUE).

Kokanee Salmon Stream Count

The Deadwood River and Trail Creek weirs were installed on August 14, 2013. A visual count was conducted the following day to assess the number of Kokanee that had entered the Deadwood River prior to the weir installation. One 2-person crew began at the confluence of Deer Creek and walked downstream while another crew walked upstream from the reservoir mouth. The total number of Kokanee were estimated visually and summarized.

Chinook Redd Count

The Deadwood River, from the confluence of Deer Creek downstream to the reservoir mouth (approximately 6-km), was surveyed on October 22, 2013 to index fall Chinook Salmon abundance. One 2-person crew began at the confluence of Deer Creek and walked downstream while another crew walked upstream from the reservoir mouth. All apparent redds and live or dead Chinook Salmon were enumerated. GPS coordinates of redds, fish, or carcasses were recorded.

RESULTS

Hydroacoustics

Twelve hydroacoustic transects were surveyed at Deadwood Reservoir on July 8, 2013 (Figure 16). Converted target strengths of fish ranged from 30 to 700 mm, and fish between 30 and 300 mm were assumed to be Kokanee (Figure 17).

Fish densities among transects ranged from 846 fish/ha to 3,156 fish/ha with the highest densities (2,323 fish/ha) of fish corresponding to age-0 fish (Table 7). Age-2 and older Kokanee displayed the lowest densities (153 fish/ha) among age classes. Overall, total mean Kokanee density was 1,881 (1,601 to 2,209) fish/ha. When expanded to a population estimate using the reservoir surface area (1,183 ha) on the survey date, a total Kokanee abundance was 2,225,537 (1,895,017 to 2,613,669). Age-0 Kokanee made up 63% of this total or 1,392,522 (1,205,162 to 1,608,981) fish. Population estimates for remaining age classes are reported in Table 7.

Between 2009 and 2011, estimated Kokanee abundance increased seven-fold, mostly due to the abundant age-0 year classes in 2010 and 2011 (Figure 18). Since 2011, hydroacoustic estimates suggested a 44% decrease in total Kokanee abundance. However, age-0 Kokanee production is still exceeding desired levels on an annual basis. Comparisons with historic numbers collected between 2009-2012 shows all size classes are still well above estimates prior to 2009. Benefits from extensive escapement control efforts conducted by IDFG during 2006-2008 disappeared rapidly as 2009-2010 year classes went either unchecked or were insufficiently suppressed.

A negative relationship between mean female length (mm) and fish density (fish/ha) was constructed using hydroacoustic estimates and mean female length at the Deadwood River weir during 2002-2012. The model predicts the management goal for Kokanee length is met or exceeded when fish densities $\leq$350 fish/ha (Figure 19; $r^2 = 0.57$, $P < 0.05$). This relationship may be considered when evaluating how many fish to pass through the weir during a spawning run based on the hydroacoustic estimate for that year.

Net Curtains

A total of 282 fish were captured during the pelagic lake survey on July 9-10, 2013 (Table 8). Approximately 88% of the catch was Kokanee (n = 247), followed by Chinook Salmon (5%; n = 14). Mountain Whitefish *Prosopium williamsoni*, Westslope cutthroat trout, and Rainbow Trout were also captured. CPUE and WPUE indices for combined species were 70.5 and 9.8, respectively (Table 8). Pelagic net curtains appeared to be more effective than IDFG standard lowland lake sampling gear at capturing Kokanee and Fall Chinook Salmon, the target species. In 2012, Kokanee only comprised approximately 15% of the catch during the lowland lake survey. Similarly, only 2% of the catch was Chinook Salmon in 2012.

The Kokanee captured in net curtains ranged from 91 to 255 mm (Figure 20) and were comprised of three age classes (ages 1-3; Figure 21). Younger fish (age-0) were not captured because available mesh sizes were too large. Kokanee CPUE was 62 fish and WPUE was 4.4 kg with net curtains. Larger fish were necropsied to determine sex and maturity, to assess mean length of females during the spawning run. From specimens collected in gillnets, we projected the average length of a mature female to be 260 mm.

Fourteen Fall Chinook Salmon were captured ranging from 320 to 784 mm, representing 3 age classes (2009-2011) as all fish were marked with an adipose clip (Figure 22). Four of fish were male, and one that was 580 mm was mature. Three females ≥700 mm were mature and should have spawned in the fall, and the remaining 7 females between 350 and 580 mm were immature. Ten of the 14 Chinook Salmon stomachs contained Kokanee. Kokanee appeared to be age-2 and 3 fish, based on length. The condition factors for Chinook Salmon ranged from 0.93 to 1.22, and all fish appeared quite healthy and to be growing well. Fall Chinook Salmon CPUE was 3.5 fish and WPUE was 3.6 kg with curtain nets.

Mountain Whitefish, Rainbow Trout, and Westslope Cutthroat Trout were also captured in net curtains and appear to be providing a valuable sport fishery at Deadwood Reservoir. Mountain Whitefish ranged from 225 to 376 mm and CPUE was 2.3. Rainbow Trout ranged from 258 to 574 mm, with a CPUE of 1.0; and, all fish caught in 2013 appeared to be of hatchery origin (Figure 20). Westslope Cutthroat Trout ranged from 125 to 315 mm and all fish appeared to be wild origin as these fish were last stocked as fry in 1998.

Changing from standard IDFG lowland lake sampling methodologies of trap nets and sinking and floating gill net combinations to pelagic net curtains resulted in higher catch rates of target species in less time. CPUE for Kokanee increased from 3.9 fish per net-night in 2012 to 62 fish in 2013 (Butts et al. 2013). Meanwhile, Chinook Salmon CPUE rose from 0.6 to 3.5 fish. Finally, the 2013 netting survey was conducted in a single evening, while the 2012 survey took three evenings to complete. However, overall species diversity and total catch declined with the change, particularly Rainbow and Cutthroat trout and Mountain Whitefish.

Kokanee Stream Count

An estimated 6,900 Kokanee were counted above the weir on August 15, 2013. The number of Kokanee was unexpectedly high for this time period, which was considered to be historically very early in the spawning run. Future weir installations should occur during the first week of August to ensure that the entire escapement is captured and controlled by the weirs. Additionally, as a result of this early spawn, only 50 females were passed beyond the weir on a weekly basis.

Chinook Salmon Redd Counts

A total of seven Fall Chinook Salmon redds were counted along 6 km of the mainstem Deadwood River in 2013 (Figure 16). Twelve live fish and one carcass were also counted during the survey. In 2012, approximately 12 km between Ross Creek and the Reservoir were surveyed and 13 redds were observed, with four of those being observed between Deer Creek and the reservoir. This suggests the spawning population is not increasing significantly, but annual monitoring should be continued. If spawner numbers increase dramatically, IDFG may wish to reduce or cease stocking Chinook Salmon in subsequent years or operate the Deadwood Reservoir weir longer to intercept and remove the fish.

DISCUSSION

Hydroacoustic evaluations of the Deadwood Reservoir Kokanee population suggest that that the population is responding slowly to control efforts implemented in 2010. Kokanee density is still very high and mean length of spawning females has declined to 255 mm. Despite aggressively controlling Kokanee escapement in 2012, 2013 production exceeded desired numbers, with the third largest year class of age-0 Kokanee on record. However, this may be explained by the discovery that a large number of spawning Kokanee entered the river prior to weir installation.

Annual monitoring shows how quickly the Deadwood Reservoir population can increase when control measures are not utilized, as in 2009. Currently, mean female Kokanee spawner length has been declining from approximately 340 mm in 2009 and 2010 to 255 mm in 2013, well under the management goal minimum length of 325 mm (Figure 22). Generally there appears to be a one year lag-time between detected population declines and a response in mean length, so mean length is expected to increase in 2014. In response to the increased Kokanee population over the last few years, IDFG personnel operated aggressive control measures at the Deadwood River and Trail Creek weirs since 2011.

Beginning in 2012, IDFG also attempted to manage escapement throughout the spawning run by passing 350-400 females above the weir each week. We arrived at these escapement estimates by projecting the number of spawners needed to produce an age-0 year class of 400,000 to 600,000 individuals. These numbers were assumed to likely double because spawning fish will be missed before and after weir operations and the potential for weir failure is always present. However, hydroacoustic estimates of age-0 fish in 2013 was nearly 1.4 million fish. As indicated by the visual spawner survey conducted after the weir was installed, a significant number of spawners are entering the river prior to normal weir installation. In fact, by missing numbers of early spawning Kokanee, weir operations may be influencing the natural timing of Kokanee escapement towards an earlier run. It should be noted that in years when the reservoir levels exceed 70%, the standard weir location is still inundated by standing water. Efforts will be made to install the weir earlier in the season when possible, and a stream count should be conducted annually to assess early escapement.

By operating the weir for the entire spawning run and by a consistent but limited number of individuals above the weir throughout the spawning run, IDFG should be able to continue aggressive control measures and egg collections without altering spawn timing. Overall Kokanee abundance estimates and spawning female lengths suggested that keeping the population roughly between 800,000 to 1 million fish provides a quality Kokanee fishery in terms of both size and numbers and also appears optimal for easily meeting egg take quotas for the hatchery system (Figure 19).

Curtain gill nets proved more useful that standardized gill net sets at capturing Kokanee and Chinook. Collecting Kokanee with gill nets was useful for determining mature female Kokanee lengths and thus escapement objectives for the upcoming spawning run in addition to size verification of hydroacoustic data.

Fall Chinook Salmon are growing quite well with the 2009 year class exceeding 700 mm within four years. Most age-4 fish were females. Females are not maturing until they exceed 700 mm. Most males are maturing at age-3 and older. Chinook Salmon that were examined in 2013 were feeding primarily on adult Kokanee. There are concerns that the Chinook Salmon population could exceed optimal predator-prey ratios and perhaps collapse the Kokanee population, so abundance should continue to be indexed through gill netting and redds counts in the fall. If the population is deemed to be beyond carrying capacity, control measures could be enacted by ceasing stocking or extending weir operations later into the fall to block spawning Fall Chinook Salmon.

MANAGEMENT RECOMMENDATIONS

1. Continue monitoring the Kokanee population in Deadwood Reservoir with hydroacoustics and sample pre-spawning fish to estimate mean length in 2014. Compare the number of 2013 age-0 Kokanee hydroacoustic estimates to projected escapement objectives.

2. Operate spawning weirs on the Deadwood River and Trail Creek to limit Kokanee escapement in both tributaries on an annual basis. Weir installation should occur at least the first week of August. Continue to develop and improve escapement goals and protocols.

3. Maintain annual stocking of 5,000 fall Chinook fingerling in spring or early summer. Continue to evaluate survival, growth, diet, and maturity of stocked Chinook Salmon during annual gill netting.

4. Continue monitoring natural recruitment of fall Chinook Salmon with October redd counts.

Table 7. Kokanee densities (number/ha) per transect and total abundance estimates calculated by arithmetic and geometric mean densities at Deadwood Reservoir, Idaho on July 8, 2013.

		Fish densities (number / ha)				
Transect	Transect length (m)	Age-0	Age-1	Age-2	Age-3	Total
1	535	666	79	47	53	846
2	427	713	175	119	85	1,092
3	600	818	256	103	102	1,278
4	441	1,203	280	119	109	1,711
5	248	1,520	530	283	338	2,671
6	424	993	401	166	292	1,853
7	396	2,024	648	184	296	3,152
8	409	2,323	504	209	120	3,156
9	1244	862	340	94	82	1,378
10	690	1,044	335	166	137	1,682
11	723	1,575	660	312	284	2,831
12	785	1,504	937	278	291	3,010
	Arithmetic Mean (AM)	**1,270**	**429**	**173**	**182**	**2,055**
	90% CI (AM)	**170**	**77**	**27**	**34**	**276**
	Abundance (AM)	**1,502,956**	**507,202**	**205,005**	**215,854**	**2,431,017**
		± 201,604	**± 91,492**	**± 31,864**	**± 40,786**	**± 326,797**
	Geometric Mean (GM)	**1,177**	**361**	**153**	**153**	**1,881**
	90% CI (GM)	**1,018 to 1,360**	**285 to 458**	**126 to 186**	**122 to 192**	**1,601 to 2,209**
	Abundance (GM)	**1,392,522**	**427,036**	**181,493**	**181,175**	**2,225,537**
		1,205,162 to 1,608,981	**336,859 to 541,269**	**149,463 to 220,332**	**144,402 to 227,235**	**1,895,017 to 2,613,669**

Table 8. Catch, catch per unit effort (CPUE), total biomass (kg) and weight per unit effort (WPUE) by species and gear type for the lowland lake survey conducted in Deadwood Reservoir, Idaho on July 9-10, 2013.

Species	Total Catch	Total CPUE	Total Weight	Total WPUE
Kokanee (Early Spawner)	247	61.8	17.4	4.4
Chinook Salmon	14	3.5	14.2	3.6
Rainbow Trout (Hatchery)	4	1.0	3.3	0.8
Westslope Cutthroat Trout	8	2.0	0.9	0.2
Mountain Whitefish	9	2.3	3.2	0.8
Total	282	70.5	39.1	9.8

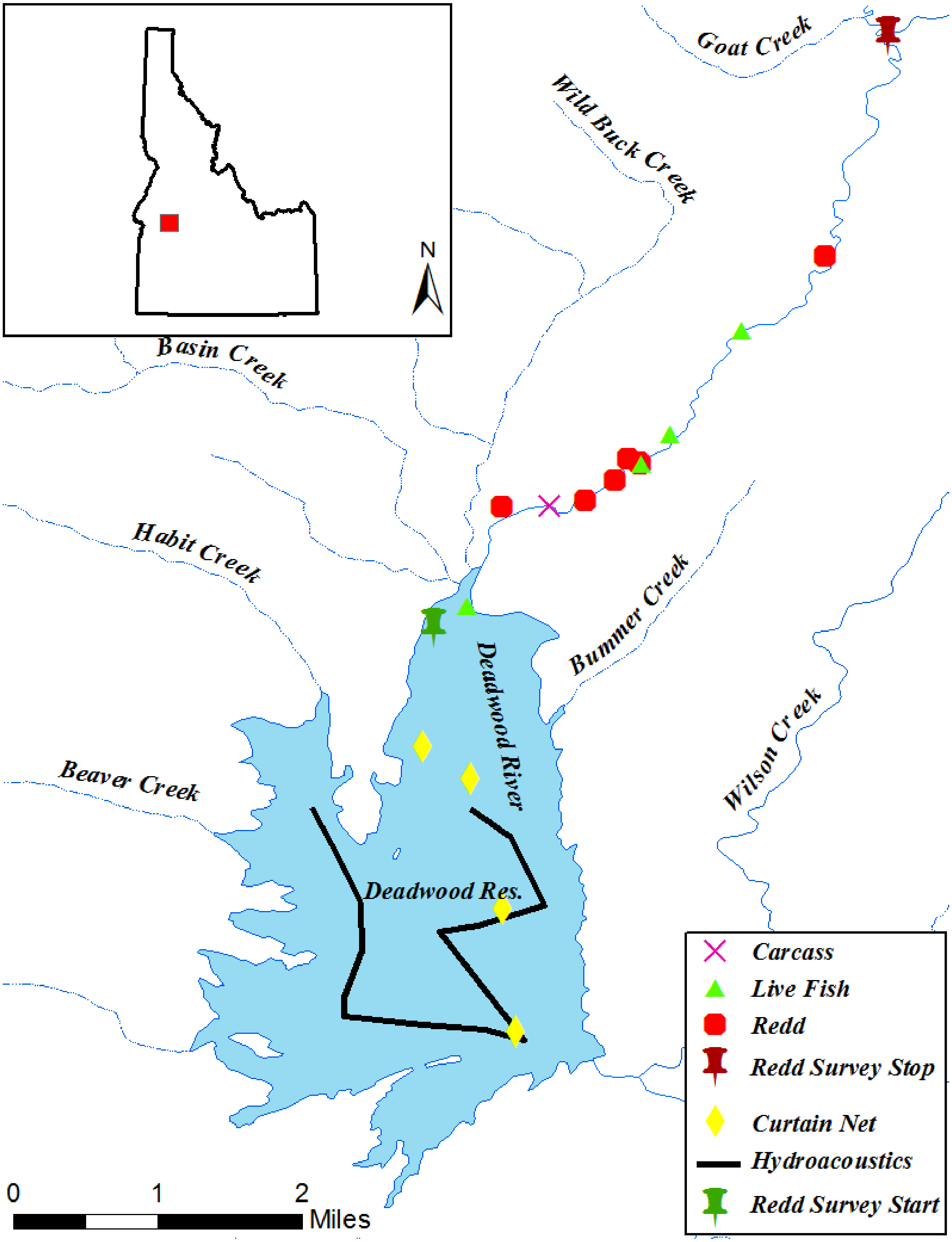

Figure 16. Map of Deadwood Reservoir, Idaho showing hydroacoustic transects, sampling gear locations, and red survey information during 2013.

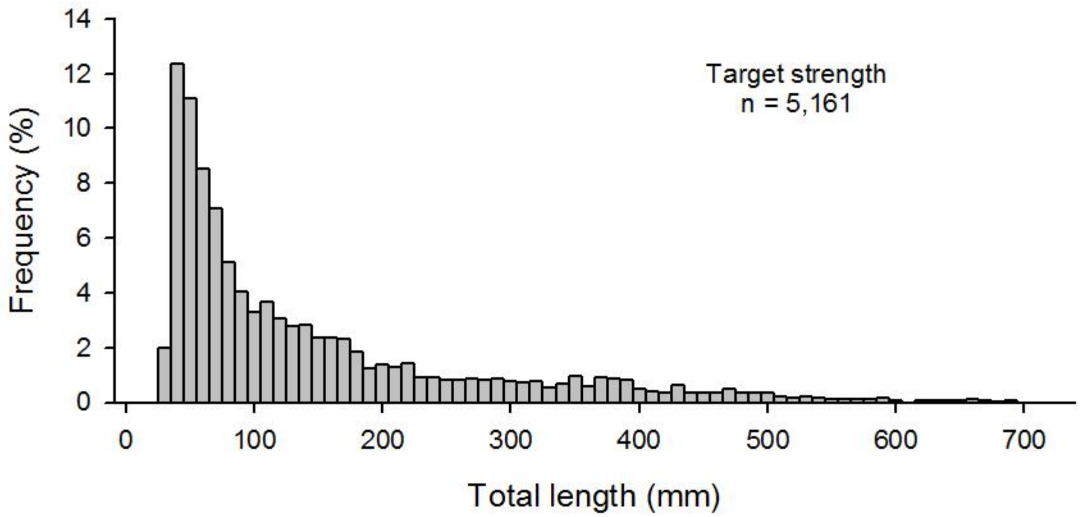

Figure 17. Length frequency of Kokanee as estimated by converted hydroacoustic target strengths at Deadwood Reservoir, Idaho on July 8, 2013.

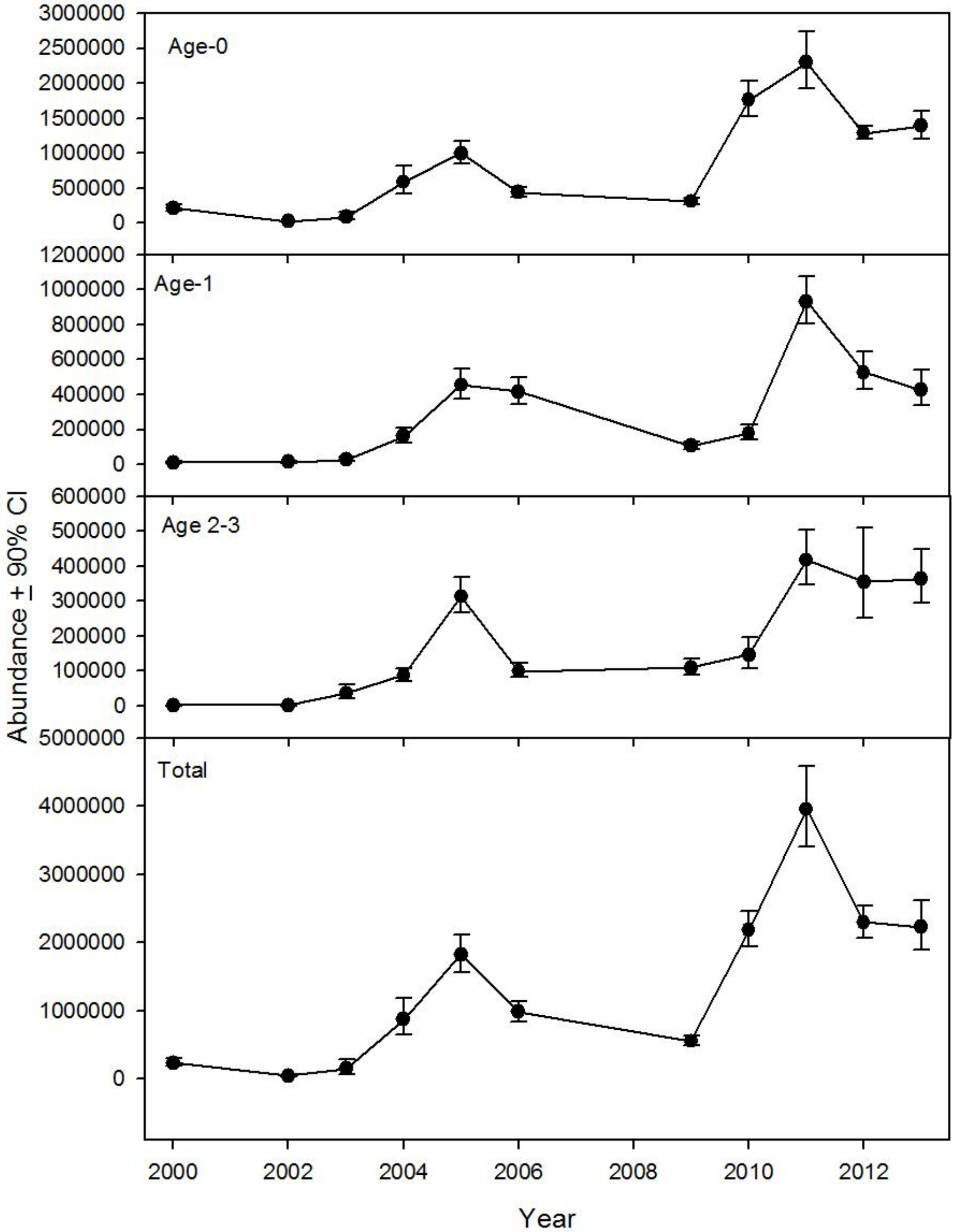

Figure 18. Comparison of Kokanee abundance estimates ± 90% CI for fish <100 mm (age-0), 100-200 mm (age-1), >200 mm (age 2+), and total fish as estimated from annual hydroacoustic surveys in 2000-2013 at Deadwood Reservoir, Idaho.

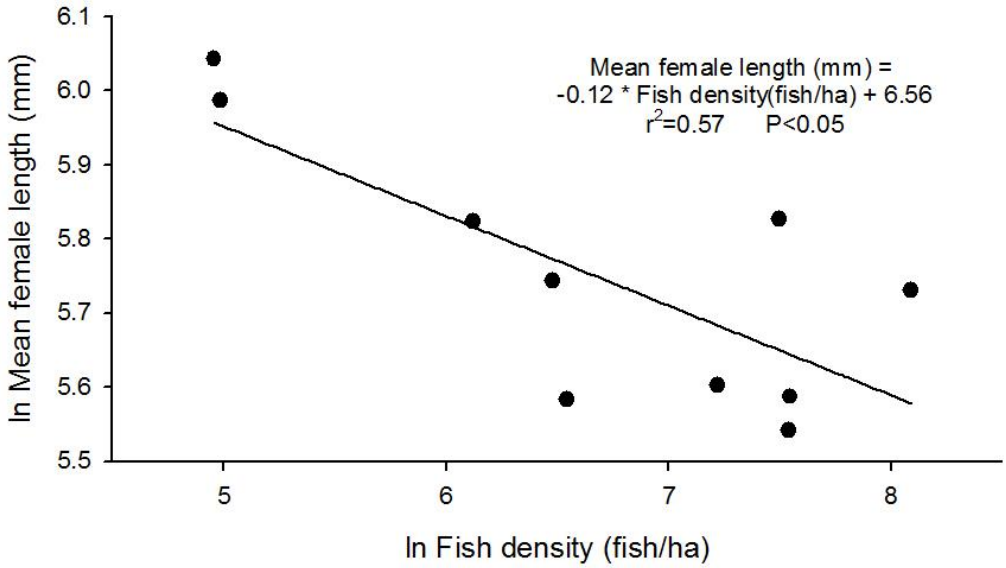

Figure 19. Density-length relationship for Kokanee at Deadwood Reservoir, Idaho. Fish density was estimated using summer hydroacoustic estimates while mean female length was obtained from weir data on Deadwood River.

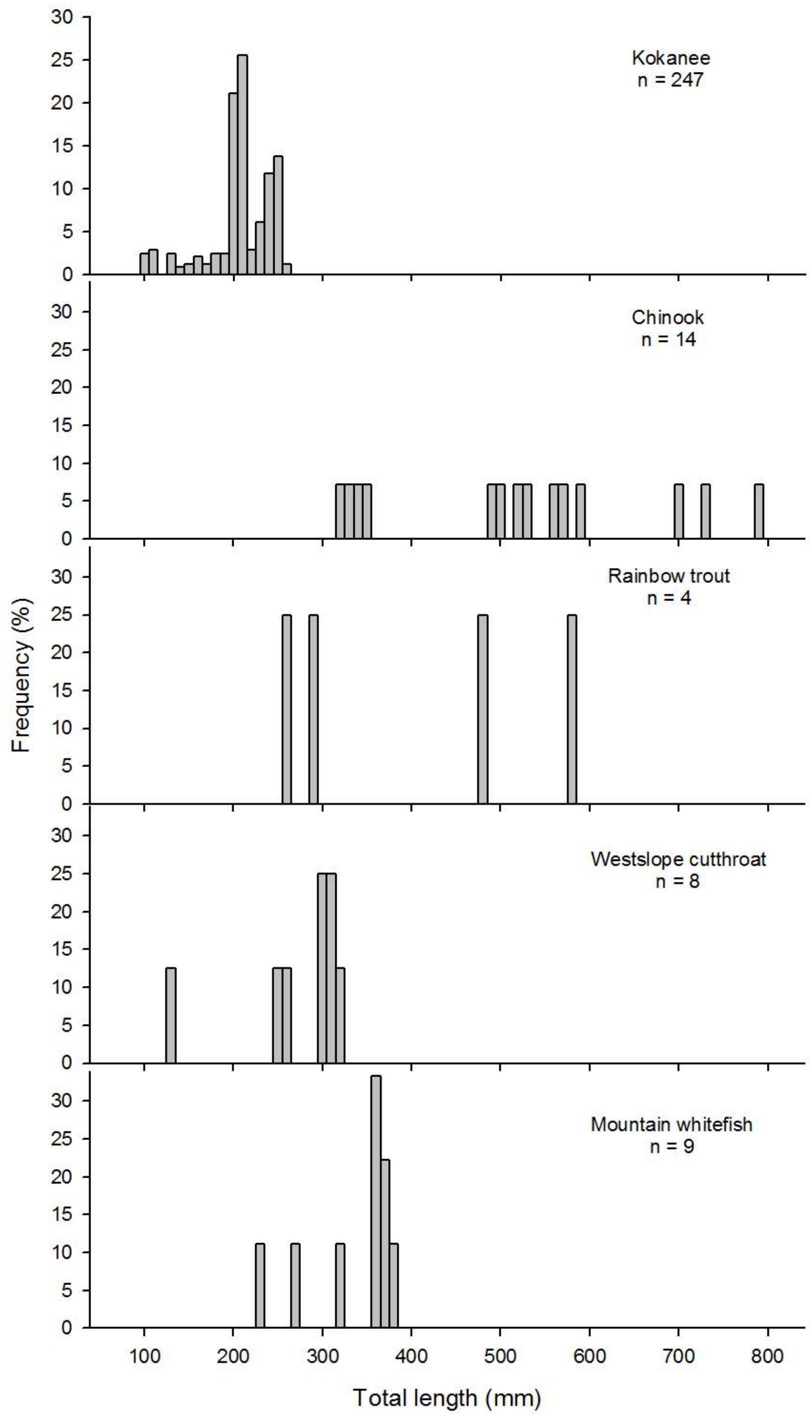

Figure 20. Length frequency and sample size of species captured in four net curtains during the lowland lake survey at Deadwood Reservoir, Idaho on July 9-10, 2013.

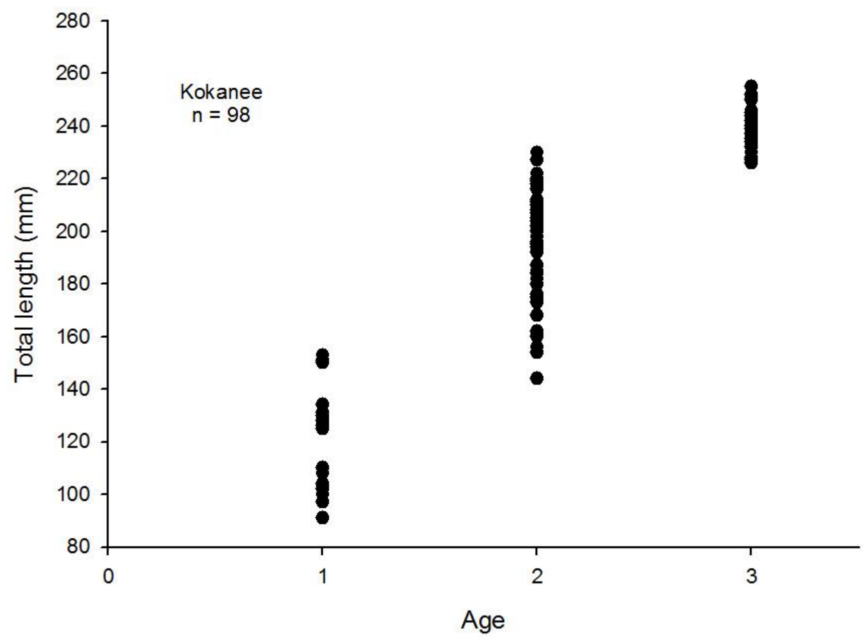

Figure 21. Length at age of Kokanee collected in four net curtains at Deadwood Reservoir during July 9-10 2013.

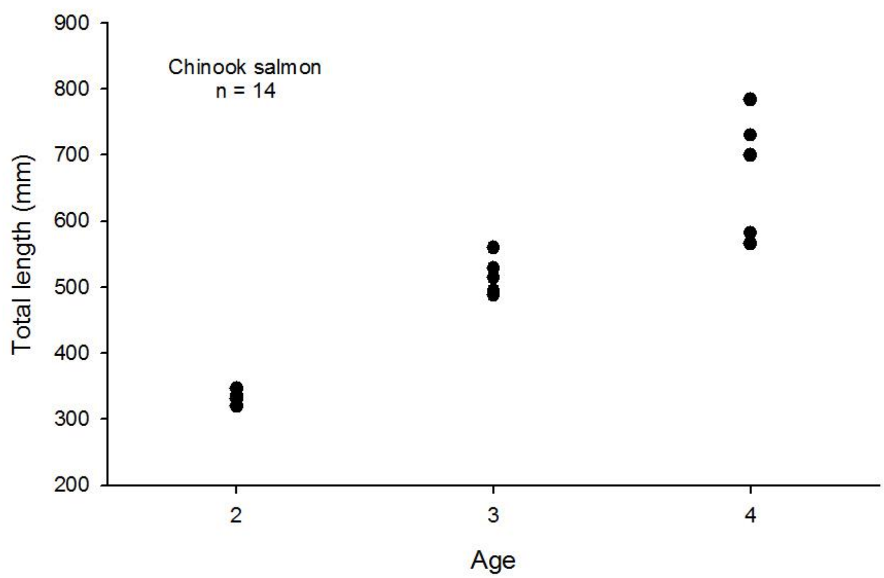

Figure 22. Length-at-age of Chinook Salmon collected in four net curtains at Deadwood Reservoir during July 9-10 2013.

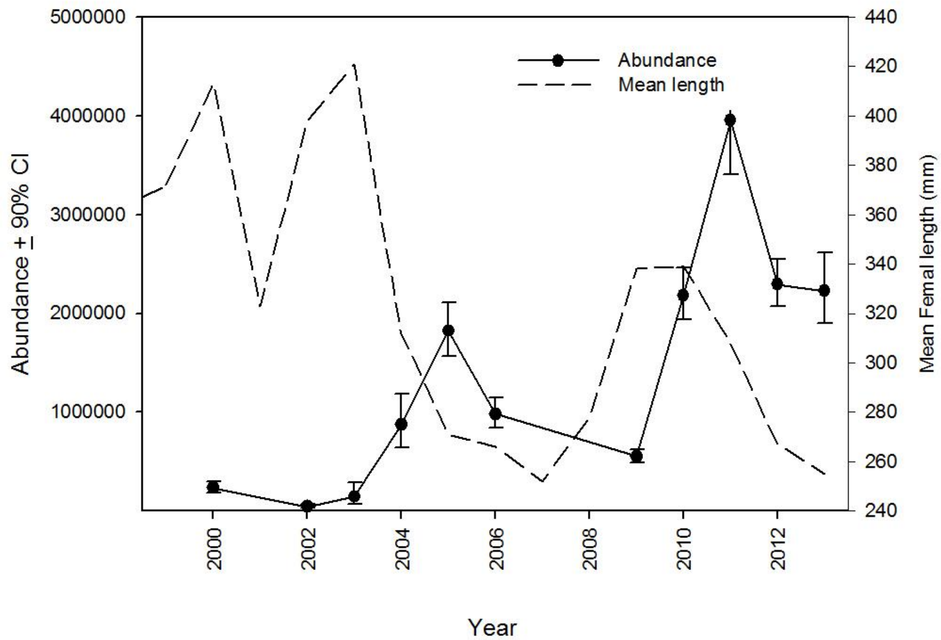

Figure 23. Trend data for 2000-2013 hydroacoustic abundance estimates and mean female total length (mm) collected at the Deadwood River trap from 1998-2013. The management goal for mean adult length is also shown.

LAHONTAN CUTTHROAT ASSESSMENT FOR THE RIDDLE LAKES

ABSTRACT

Idaho Department of Fish and Game (IDFG) maintains Lahontan Cutthroat Trout *Oncorhynchus clarkii henshawi* populations in four of the Riddle Lake reservoirs. IDFG began stocking Lahontan Cutthroat Trout in 1989 using fingerlings stocked in the fall, but changed to stocking smaller fry in the spring. Periodic sampling indicates the fisheries in these reservoirs have declined, potentially as a result switching to spring fry planting. We sampled the fish community in three of the Riddle lakes with standard IDFG gill nets and trap nets in 2013 to evaluate whether the Lahontan Cutthroat Trout population has improved since shifting back to fall fingerling planting. Cutthroat Trout abundance in the Riddle Lakes has declined from peaks observed during the 1994 and 1995 surveys, but appeared to be making some recovery in 2013. During 2013, a total of 41 Lahontan Cutthroat Trout were collected at Bybee Reservoir with a mean length of 343 mm. Catch of Cutthroat Trout catch declined substantially at Bybee Reservoir from 1995, but showed a slight increase in 2013. In Grasmere Reservoir, we collected 75 Lahontan Cutthroat Trout with a mean length of 355 mm. Catch rates in Grasmere Reservoir are still well below historic highs, but have improved since low catch in 2002. In Shoofly Reservoir, 41 Cutthroat Trout were collected, with a mean length of 390 mm. Cutthroat catch has continued to decline in Shoofly compared to historic levels. Switching from fall fingerling to spring fry plants after 1995 correlated to declines in abundance and size structure of Lahontan Cutthroat Trout, suggesting survival of stocked fish has declined dramatically, especially for small fish. These fisheries are primarily composed of age-3 and age-4 trout. Shoofly Reservoir and Grasmere reservoirs show very few age-2 fish corresponding to a 2011 fry stocking event, but show much stronger age-1 and age-3 year classes corresponding with the 2010 and 2012 fall fingerling plants. Increasing catch rates at these reservoirs corresponding with only 2 years of fall fingerling plants suggest the strategy is working. We recommend continuing to plant fall fingerlings when water conditions are suitable.

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INTRODUCTION

The Riddle area reservoirs include six irrigation reservoirs located on tributaries of the Owyhee River in southwest Idaho approximately 20 to 40 km north of the Nevada border. Idaho Department of Fish and Game (IDFG) maintains hatchery Lahontan Cutthroat Trout *Oncorhynchus clarkii henshawi* populations in four of the reservoirs, Bybee (28 ha), Grasmere (86 ha), Little Blue Creek (76 ha), and Shoofly (34 ha), through stocking. Trout stocked has been suspended in Blue Creek, Payne Creek, and Little Blue reservoirs due to poor water conditions (frequent dewatering) and very difficult access. Lahontan Cutthroat Trout (hereafter referred to as Cutthroat Trout) and Bridgelip Sucker *Catostomus columbianus* constitute the majority of the fish community, while Redside Shiner *Richardsonius balteatus*, and Bluegill *Lepomis macrochirus* (Shoofly Reservoir) are occasionally sampled as well. The four stocked reservoirs are capable of producing trophy sized Cutthroat Trout that may exceed 600 mm if adequate water levels and stocking are maintained over several years. Despite the trophy potential, fishing effort is low because of their remote nature and difficult access. These lakes have been managed under general fishing regulations since 1994.

IDFG began stocking Cutthroat Trout in 1989 using fingerlings stocked in the fall (Figure 24). This continued until 1992, when the stocking strategy changed to planting fry in June (Allen et al. 1998). Fry planted in June were thought to have poor survival, and results from 1999 sampling suggest the fisheries had declined in response to this change to stocking small fish. Stocking was again changed back to fall fingerlings in 2010 in an effort to improve the Riddle Lakes fisheries. This study aims to evaluate whether the return to stocking fall fingerlings has improved the cutthroat fishery in these reservoirs.

OBJECTIVES

1. Describe the relative abundance, and composition of the fish community in the four Riddle area reservoirs, including Bybee, Grasmere, Little Blue Creek, and Shoofly.

2. Evaluate whether changing back to fall-planted fingerling Cutthroat Trout have improved relative abundance or size structure, compared to historical data.

METHODS

We sampled the fish community in the Riddle lakes with standard IDFG gill nets and trap nets. Sampling gear included: (1) Gill nets – floating and sinking monofilament nets set in pairs, 46 m x 2 m, with six panels composed of 19, 25, 32, 38, 51, and 64 mm bar mesh. One floating and one sinking net, fished for one night, equaled one unit of gill net effort; (2) Trap nets – 15 m lead, 1 m x 2 m frame, crowfoot throats on the first and third of five loops, 19 mm bar mesh, treated black. One trap net fished for one night equaled one unit of trap net effort. Catch data were summarized as catch per unit effort by number (CPUE).

Captured fish were identified to species, measured (± 1 mm), and weighed (± 1 g) with a digital scale. We used a length-weight regression equation for each reservoir and species to estimate the weight of fish not weighed in the field. Proportional stock densities (PSD) were calculated for gamefish populations as outlined by Anderson and Neuman (1996) to describe length-frequency data. We calculated PSD using stock length fish as ≥200 mm, and quality length fish ≥350 mm. Also, Fulton condition factors (K) were calculated for each fish as an index of general body condition where a value of 1.0 is considered average. Values greater than 1.0

describe robust body condition, whereas values less than 1.0 indicate less than ideal foraging conditions.

RESULTS

Bybee Reservoir

During 2013, a total of 148 fish were sampled. Two units of gillnet effort were expended sampling Bybee Reservoir, but trap nets were not used because of time constraints (Table 9). Forty four Cutthroat Trout, 103 Bridgelip Sucker, and one Redside Shiner were collected. Gill net CPUE was 22.0 fish/unit for Cutthroat Trout and 51.5 fish/unit for Bridgelip Sucker.

Cutthroat Trout catch declined substantially from 1995, but showed a slight increase in 2013 (Figure 25). Gill net CPUE increased from a low of 8.5 (2006) to 22.0 fish in 2013, with a corresponding strong year class (280-360 mm) in the length distribution (Figure 27). This year class probably resulted from excellent survival of trout stocked in 2010 and 2011.

Mean length and weight (shown with 90% confidence intervals in parentheses) for Lahontan Cutthroat Trout was 343 mm (± 17) and 404 g (± 74), respectively. Proportional stock density was 35, calculated from 43 stock length fish (≥200 mm) and 15 quality length fish (≥350 mm). Average condition, K, was 0.88 and showed no trend across lengths. Total length of Cutthroat Trout has stayed relatively constant, but was smaller than the large average size of fish in 1999 (Figure 27).

Catch of Bridgelip Sucker appears highly variable since sampling started in 1995. CPUE of sucker was over 50 fish/unit in 2013, similar to high catch rates in 1999 (Figure 26).

Grasmere Reservoir

During 2013, a total of 97 fish were sampled from Grasmere Reservoir from a total effort of four units (Table 9). Forty one Cutthroat Trout, 10 Bridgelip Sucker, and four Redside Shiner were sampled with gill nets, whereas 34 Cutthroat Trout and eight Bridgelip Sucker were captured with trap nets. Gill net CPUE was 20.5 fish/unit for Cutthroat Trout, 4.5 fish/unit for Bridgelip Sucker, and 2.0 fish/unit for Redside Shiner. Trap net CPUE was 17.0 fish/unit for Cutthroat Trout and 4.0 fish/unit for Bridgelip Sucker (Figure 28, 29).

For both gears combined, mean length and weight for Cutthroat Trout in Grasmere Reservoir was 355 mm (±25) and 528 g (±80). Proportional stock density was 89, calculated from 52 stock length fish (≥200 mm) and 46 quality length fish (≥350 mm). Average condition, K, was 0.88 and showed no trend across lengths. Length frequency histograms from each of the four previous survey years indicated a general decline Cutthroat Trout catch rates (Figure 30). A wide range of lengths were sampled during the initial survey in 1995. Subsequent samples show poor survival of stocked fish. However, 2013 sampling indicted survival of young fish, very low survival of fish 230-330 mm, and high survival of older fish, reflecting both the lack of stocking in 2011 (Figure 24), and the improved survival of fall fingerling stocking from 2010 and 2012 (Figure 30). Maximum total length of fish in Grasmere Reservoir has also increased since 1999, with several individuals over 500 mm total length sampled.

Other than in 1999, catch of Bridgelip Sucker in Grasmere Reservoir has been generally low. The 2013 survey displayed a marginal increase in Bridgelip Sucker CPUE for both gears (Figure 29), but catch rates remain low.

Little Blue Creek Reservoir

We did not sample Little Blue Creek Reservoir in 2013 because of continued low water conditions. We anticipate the fishery here has suffered significantly as a result of low water, and IDFG has discontinued stocking until conditions improve.

Shoofly Reservoir

During 2013, a total of 41 fish were sampled from Shoofly Reservoir from a total effort of four units (Table 9). Unlike previous years, trap nets were more effective than gill nets in 2013. Fourteen Cutthroat Trout were sampled with gill nets (7.0 fish/unit), whereas 23 Cutthroat Trout (11.5 fish/unit) and four Bluegill (2 fish/unit) were sampled with trap nets. No Bridgelip Sucker have been sampled from Shoofly Reservoir during the last surveys.

For both gears combined, mean length and weight for Cutthroat Trout was 390 mm (± 32) and 631 g (± 101). Proportional stock density was 84, calculated from 32 stock length fish (≥200 mm) and 27 quality length fish (≥350 mm). Average condition, K, was 0.88, and showed no trend across lengths.

Length frequency histograms for the last six survey efforts have been highly variable, while size ranges have remained fairly constant. Histograms for 1993-1994 show good numbers of juvenile and adult sized Cutthroat Trout, with corresponding high CPUE of sampled fish. Surveys from 1999 and 2002 suggest poor survival at Shoofly Reservoir, with a rebound in 2006, presumably from high stocking rates in 2001 and 2002 (Figure 31). Length and catch rates in 2013 may reflect the low stocking rates from 2008-2012.

Body condition of Cutthroat Trout among all three lakes sampled was very similar. In fact, Cutthroat Trout stocked in Bybee, Shoofly and Grasmere show very similar length-weight relationships (Figure 33), suggesting growing conditions are similar between lakes. Additionally, length-at-age information shows very similar results, showing that most Cutthroat Trout reached similar lengths from age-3 to age-5 (Figure 34). However, we did not see any Cutthroat Trout older than age-5 in Shoofly, while trout up to age-7 were captured in Grasmere.

DISCUSSION

Cutthroat Trout abundance in the Riddle Lakes has declined from peaks observed during the 1994 and 1995 surveys, but appeared to be making some recovery in 2013. Relative abundance of Cutthroat Trout in Grasmere Reservoir has declined substantially since the mid-1990s. Comparing our last five surveys, gill net and trap net CPUE were highest during 1995 at 112.0 and 23.5 fish, respectively. CPUE for gill nets declined to a low of 13.0 in 2002 and has only slightly increased since. After 1995, trap net CPUE decreased and fluctuated between 3.0 and 9.0 fish, but increased to 21.0 fish in 2013 (Figure 28). Cutthroat Trout have declined in Shoofly Reservoir since the mid-1990s. Catch rates peaked in 1994 and 1995, with a rapid decline from 1999 to 2013. Gill net CPUE has declined from a high of 89.0 fish during 1994 to a low of 7.0 fish in 2013 (Figure 31). Bybee Reservoir, however, exhibited a slight increase in Cutthroat Trout catch from 2006 to 2013. The amount of sampling effort used to calculate abundance indices has varied across years and was low during some years. Low amounts of sampling effort could have biased CPUE indices especially from low effort years. Even if some sampling error was present, it is doubtful that it substantially changed the declining trend in Cutthroat Trout since the mid-1990s.

Trends in Bridgelip Sucker catch varied across Bybee and Grasmere Reservoirs. For Bybee Reservoir, Bridgelip Sucker CPUE was higher than all prior sampling years. CPUE increased drastically from 2.0 in 2006 to 52.0 in 2013, indicating a rebound in population abundance. For Grasmere Reservoir, Bridgelip Sucker CPUE was highest in 1995, but dropped in the following years. Sampling in 2013 exhibited low population abundance as well. During 1999, Cutthroat Trout populations declined and it appears Bridgelip Sucker abundance increased. In the latter surveys both populations remained at low levels possibly due to low water levels and poor water quality caused by persistent drought conditions.

Performance of spring fry planting has been highly variable, but poor overall in these reservoirs. Switching from fall fingerling to spring fry plants after 1995 shows declines in abundance and size structure of Cutthroat Trout, suggesting survival of stocked fish has declined dramatically especially, for small fish. Bybee, Grasmere and Shoofly reservoirs all show significant declines in CPUE after 1995 coinciding with the switch to spring fry stocking in 1993 (Figures 25, 28, 31). These fisheries are primarily composed of age-3 and age-4 Cutthroat Trout (Figure 34), suggesting the bulk of adult sized trout in these reservoirs in 1995 were likely from the last years of fall fingerling stocking in 1991-1992 (Figure 24).

From 2010 to 2013, stocking switched back and forth between spring fry and fall fingerlings (Figure 24), so this evaluation only has two years of fall fingerling stocking since 2010. Based on otolith age estimates, Bybee Reservoir in 2013 showed a strong year class of age-2 Cutthroat Trout, corresponding to the fry stocking fry in 2011. However, Shoofly Reservoir and Grasmere reservoirs shows very few age-2 fish for this same stocking event, but show much stronger age-1 and age-3 year classes corresponding with the 2010 and 2012 fall fingerling plants. Increasing catch rates at these reservoirs corresponding with only 2 years of fall fingerling plants suggest the strategy is working. The timing of fry plants in June coincides with increased metabolism in adult fish associated with recovering from spawning and increased water temperatures, so predation could be an issue. June fry plants may be soon followed by poor water quality over the late summer months. Fall planting prior to 1993 likely improved survival for stocked Cutthroat Trout by increasing their size and stocking during a time of better water quality. Fry plants may occasionally work in Bybee Reservoir, but on average, stocking larger fall fingerling is a much better strategy for the Riddle Lakes overall.

Bybee Reservoir was drained complete in winter to facilitate making repairs to the dam. As a result, the normal allocation of Cutthroat Trout were split between Grasmere and Shoofly reservoirs. Provided that water conditions continue supporting trout, we expect catch rates in 2016-2017 at these reservoirs to improve from the 2013 boost in stocking numbers. At this time, the future of Bybee Reservoir as a fishery is uncertain. The snowpack conditions are poor, and it is unknown whether the reservoir will fill enough to support fish by fall 2014. Stocking will be adjusted as conditions change.

MANAGEMENT RECOMMENDATIONS

1. Continue stocking Lahontan Cutthroat Trout as fall fingerling at the current densities.

2. Evaluate water conditions at Bybee Reservoir during 2014, following the drawdown during winter 2013/2014. Depending on reservoir levels, continue stocking fall fingerlings as usual.

3. Monitor Lahontan Cutthroat Trout catch rates in Bybee, Grasmere and Shoofly reservoirs in 2016.

Table 9. Historical and current gill net and trap net effort expended while sampling the Riddle Lakes.

	Effort by Survey Year								
Gill Net	**1993**	**1994**	**1995**	**1999**	**2002**	**2004**	**2005**	**2006**	**2013**
Bybee		1	1	1	1			2	2
Grasmere			1	1	2			1.5	2
Little Blue Creek	1	1	1	1	1	3	3	2	
Shoofly	1	1	1	1	1			2	2
Trap Net									
Bybee			2	1	2			4	
Grasmere			2	1	1			3	2
Little Blue Creek	2	2	2	1	1			4	
Shoofly	2		2	1	1			3	2

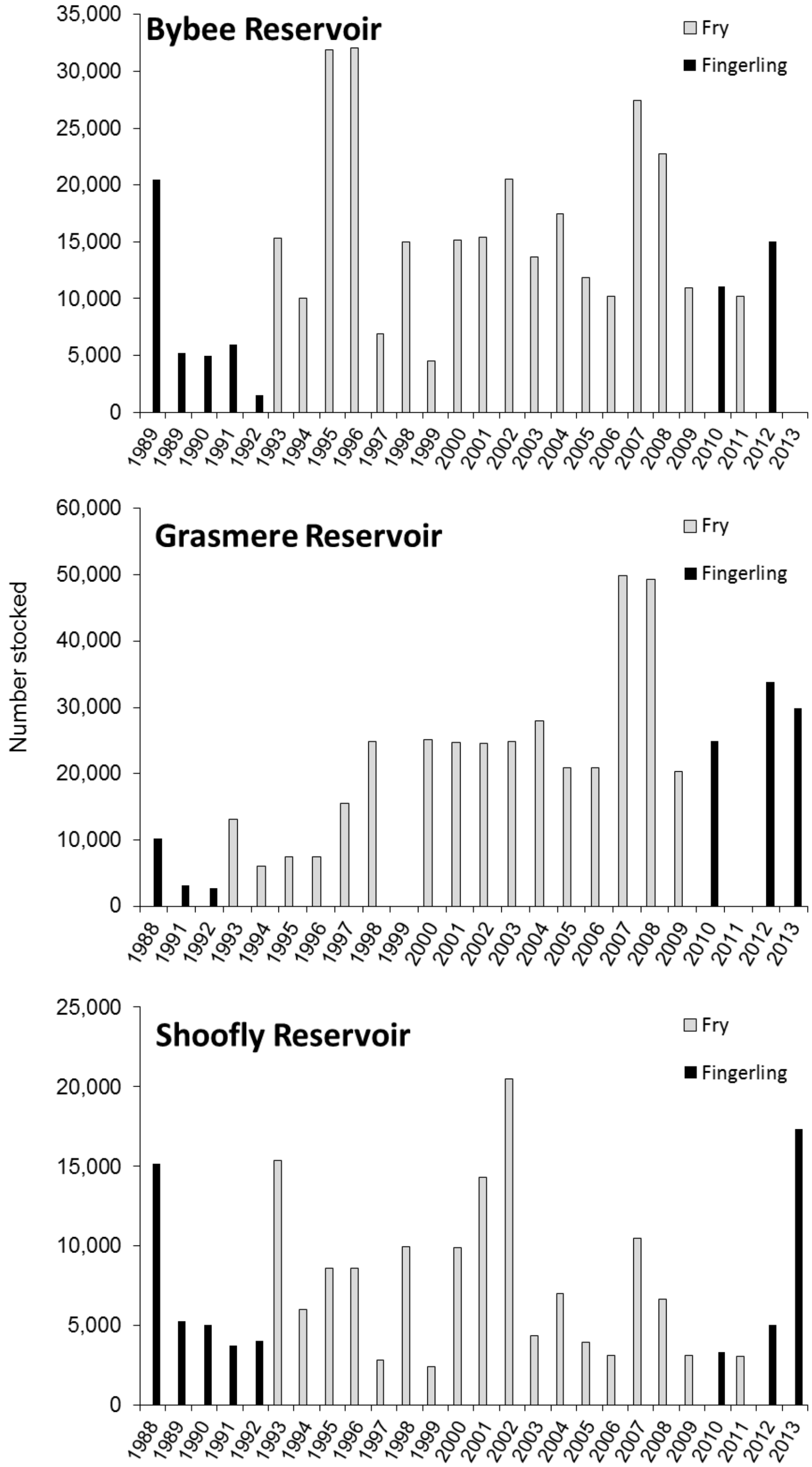

Figure 24. Historical numbers of Lahontan Cutthroat Trout (*Oncorhynchus clarkii henshawi*) stocked by size category in Bybee, Shoofly and Grasmere reservoirs since 1988.

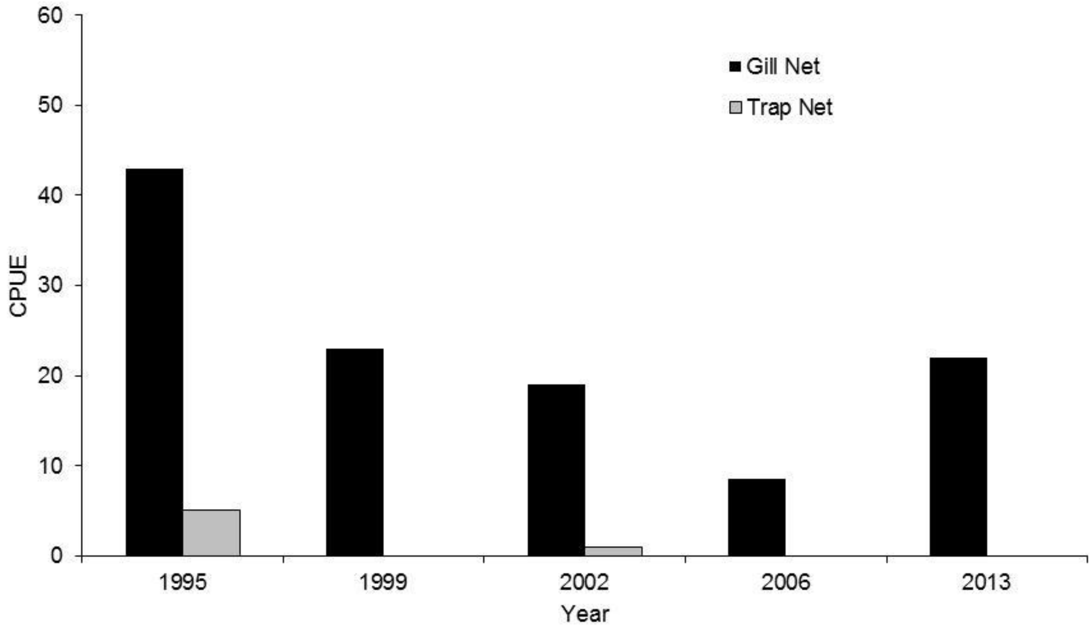

Figure 25. Catch per unit effort (CPUE) of Lahontan Cutthroat Trout for gill net and trap nets on Bybee Reservoir from 1995 to 2013. Note: trap nets were not used in 2013 survey.

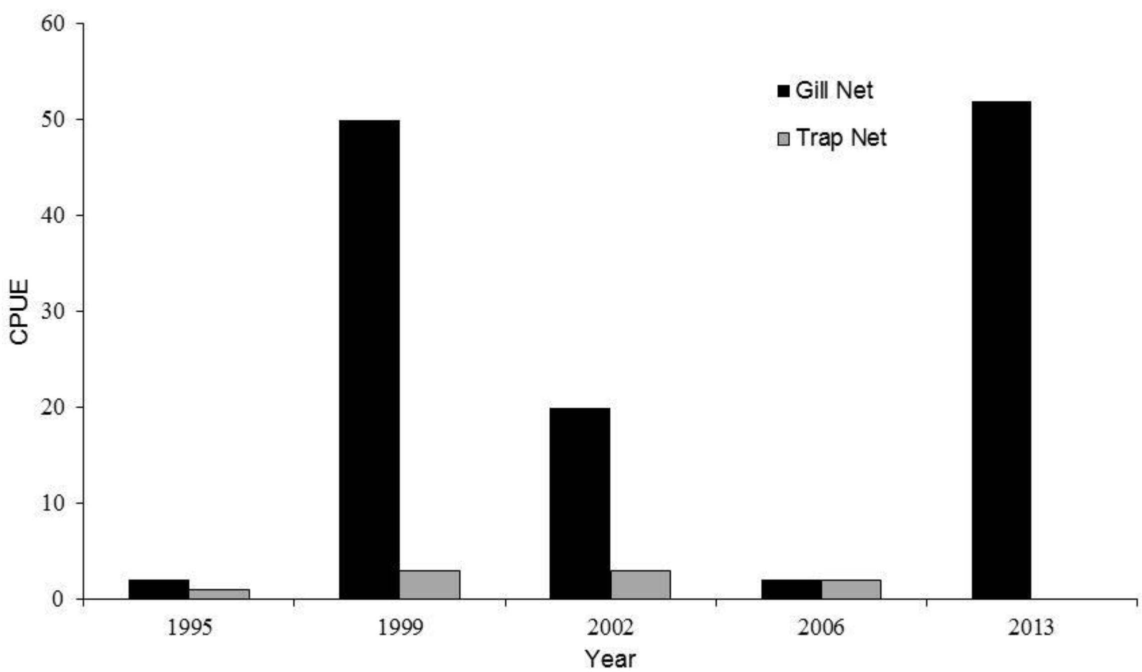

Figure 26. Catch per unit effort (CPUE) of Bridgelip Sucker for gill net and trap nets on Bybee Reservoir from 1995 to 2013. Note: trap nets were not used in 2013 survey.

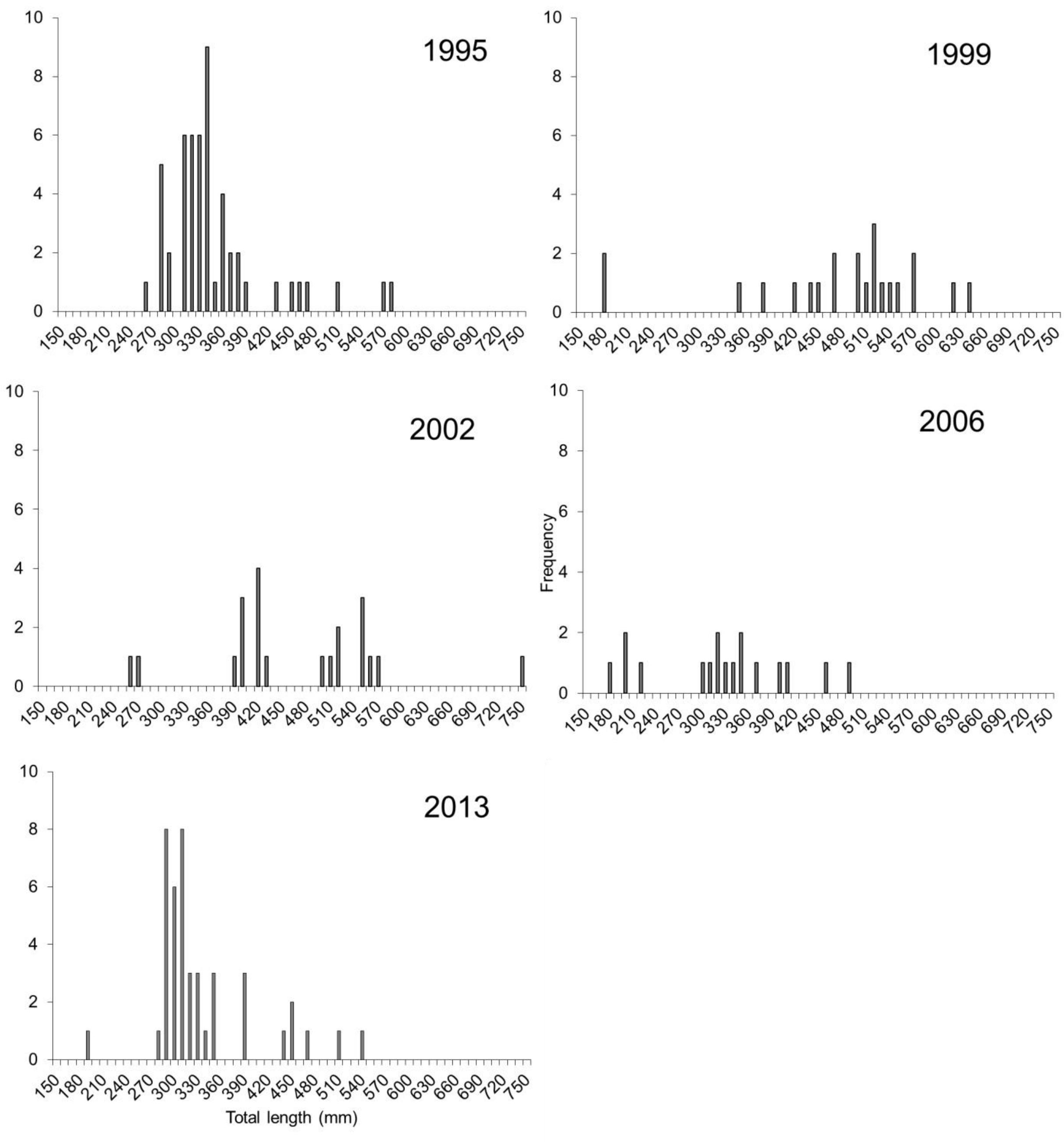

Figure 27. Length frequency histograms for Cutthroat Trout captured in gill nets and trap nets in Bybee Reservoir during 1995, 1999, 2002, 2006, and 2013 surveys. Note: trap nets were not used in 2013 survey. Age distribution and year of stocking are shown for 2013, which correspond to approximate age distribution based on length-at-age from Grasmere and Shoofly otolith samples.

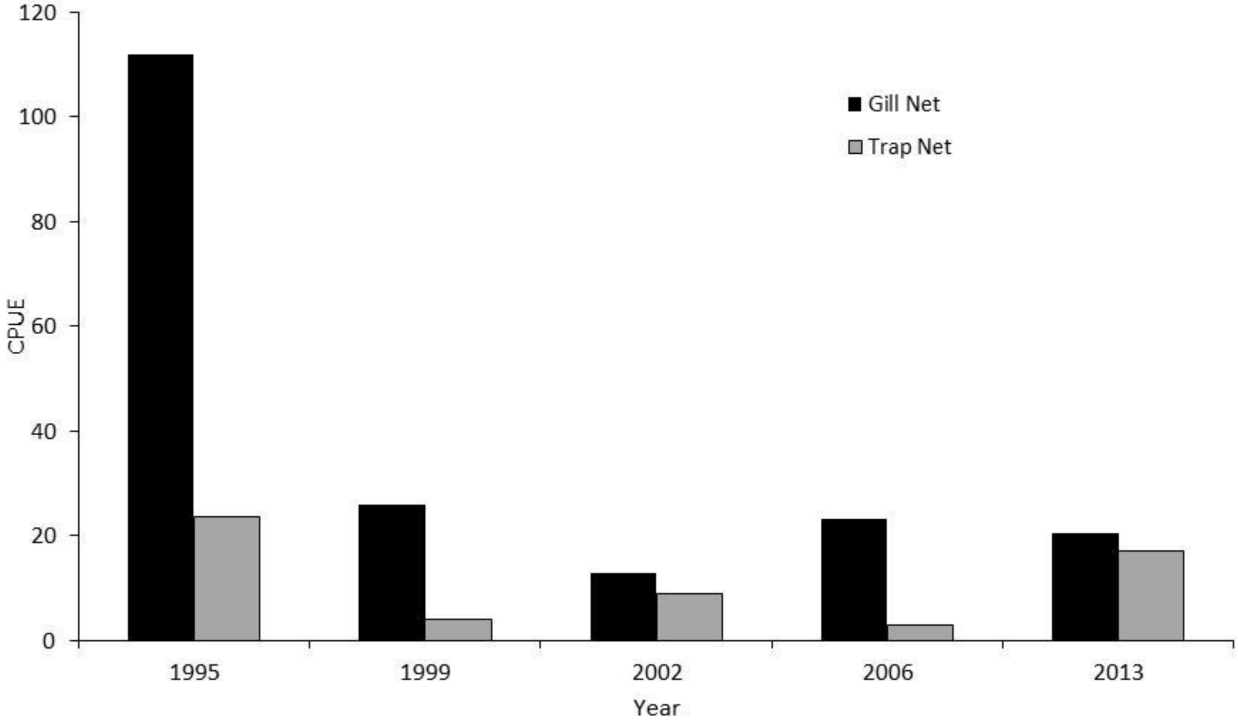

Figure 28. Catch-per-unit-effort (CPUE) of Lahontan Cutthroat Trout for gill net and trap nets on Grasmere Reservoir from 1995 to 2013.

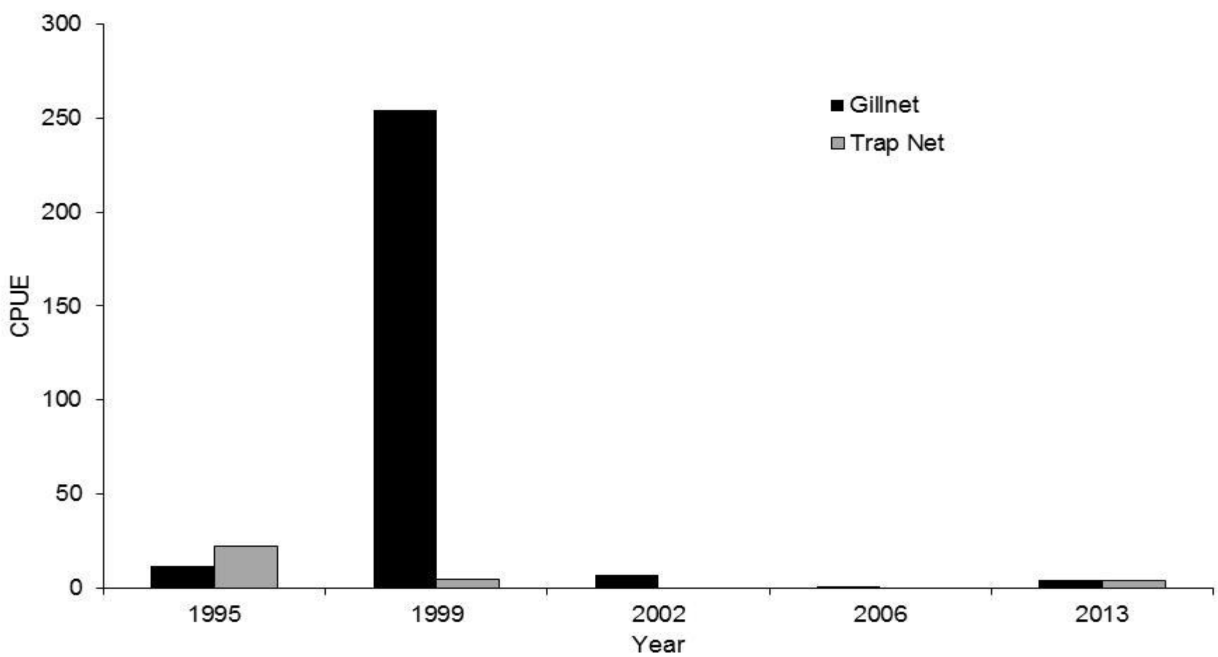

Figure 29. Catch-per-unit-effort (CPUE) of Bridgelip Sucker for gill net and trap nets on Grasmere Reservoir from 1995 to 2013.

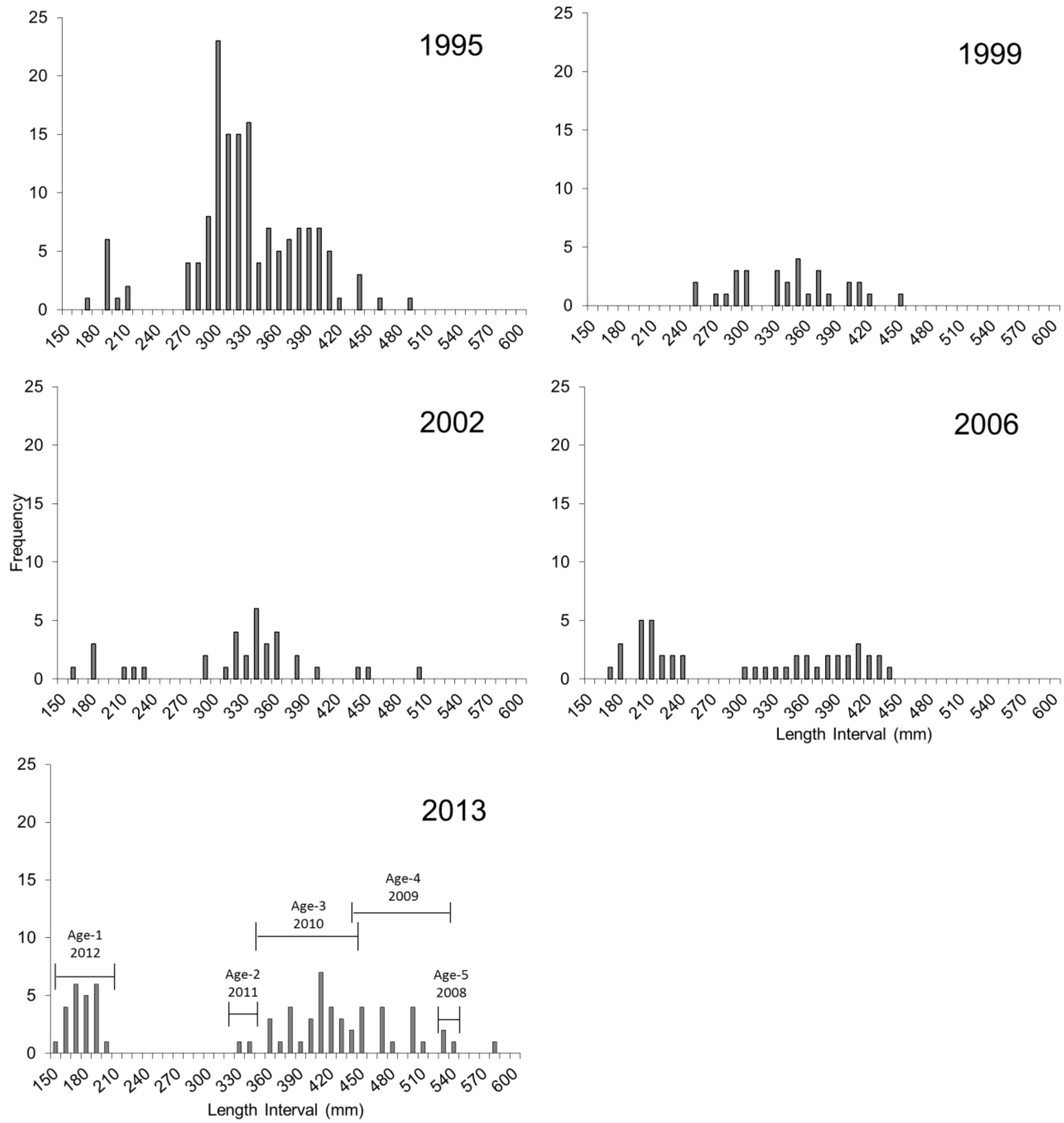

Figure 30. Length frequency histograms for Cutthroat Trout captured in gill nets and trap nets in Grasmere Reservoir during 1995, 1999, 2002, 2006, and 2013 surveys. Age distribution and year of stocking are shown for 2013, based on age estimates from otolith samples.

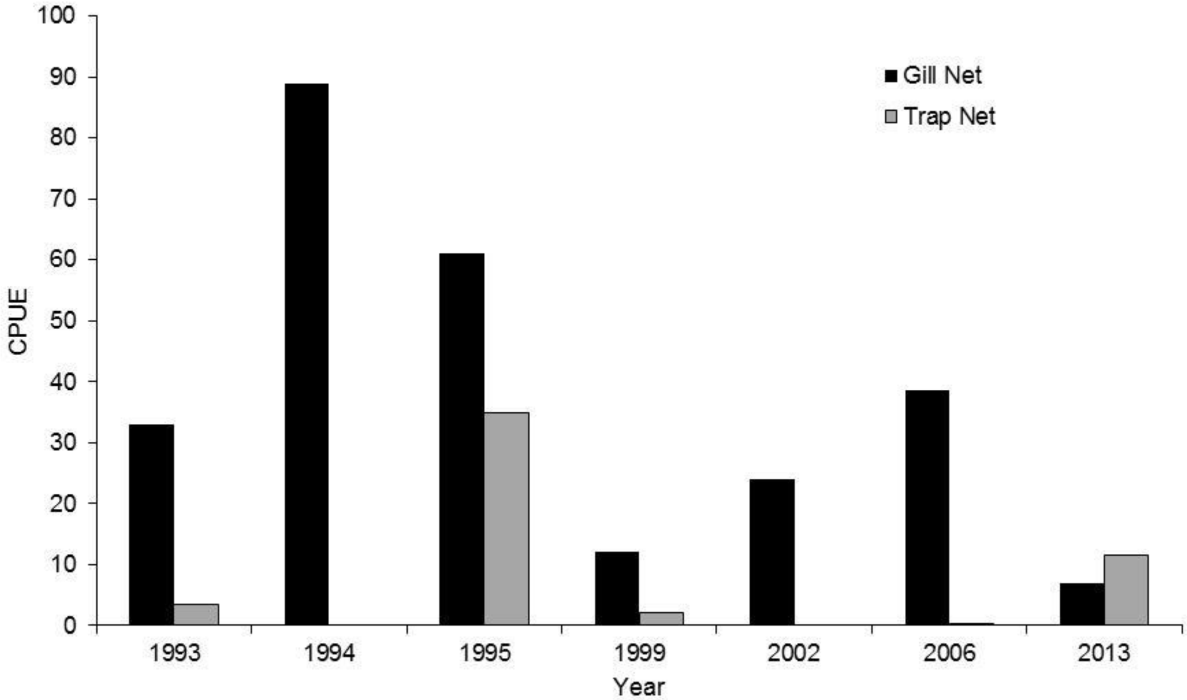

Figure 31. Catch-per-unit-effort (CPUE) of Cutthroat Trout for gill net and trap net sampling efforts expended on Shoofly Reservoir from 1993 to 2013.

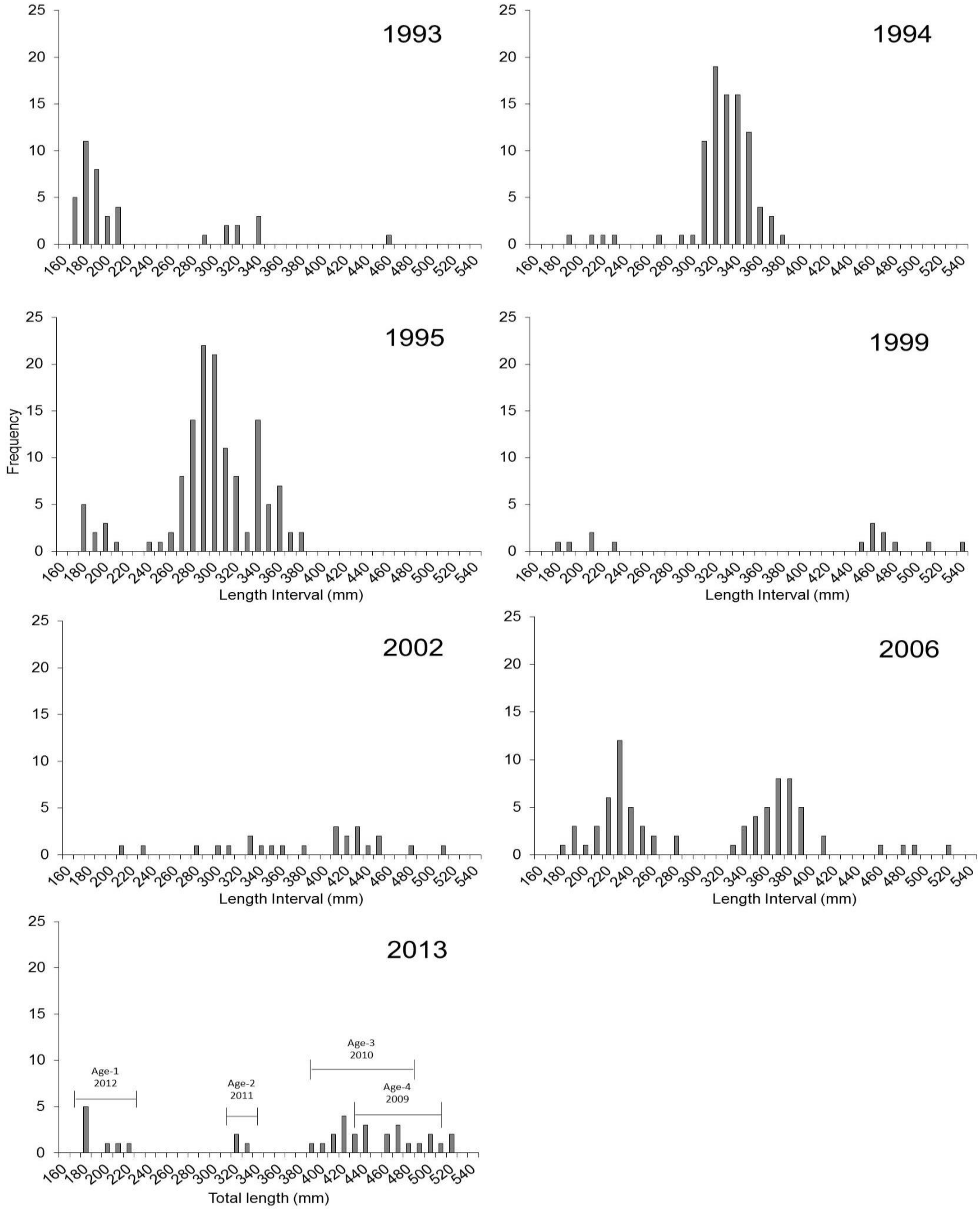

Figure 32. Length frequency histograms for Lahontan Cutthroat Trout captured in gill nets and trap nets in Shoofly Reservoir during 1993-95, 1999, 2002, 2006, and 2013 surveys. Age distribution and year of stocking are shown for 2013, based on age estimates from otolith samples.

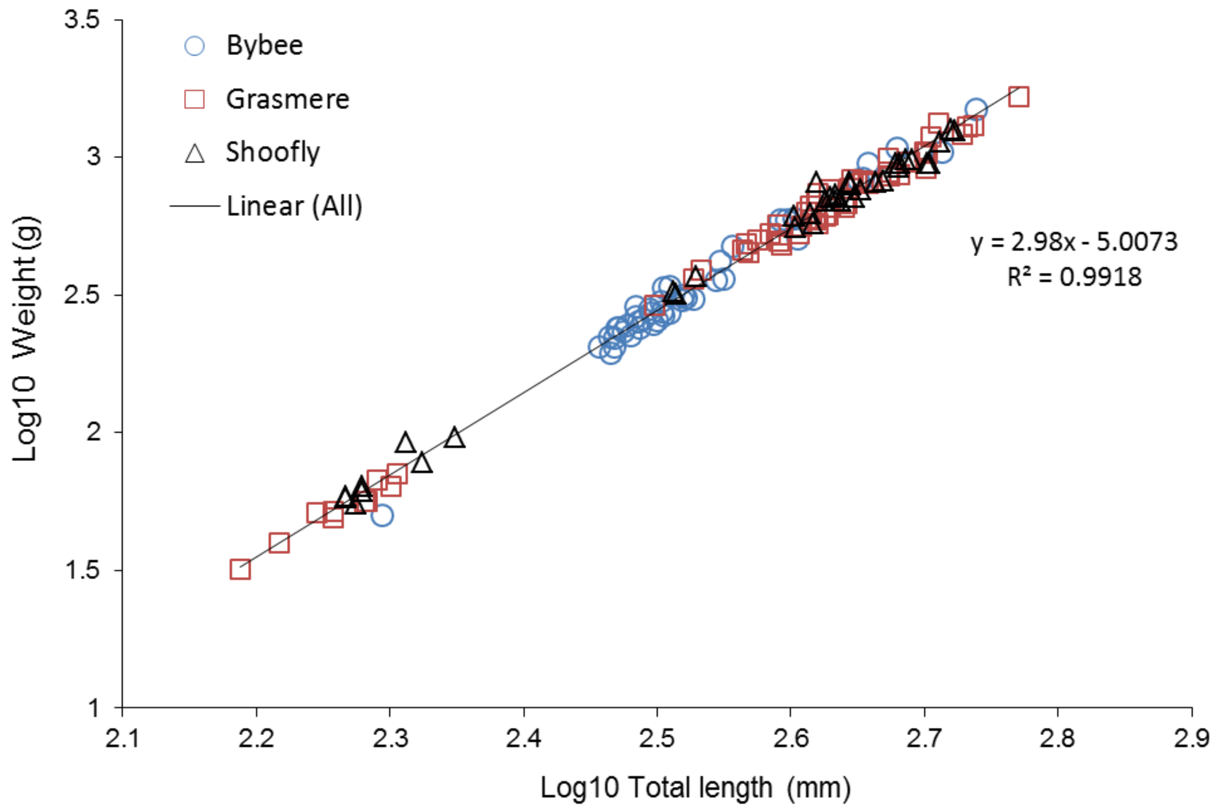

Figure 33. Length-weight relationship of Cutthroat Trout sampled from Bybee, Grasmere, and Shoofly Reservoirs in 2013.

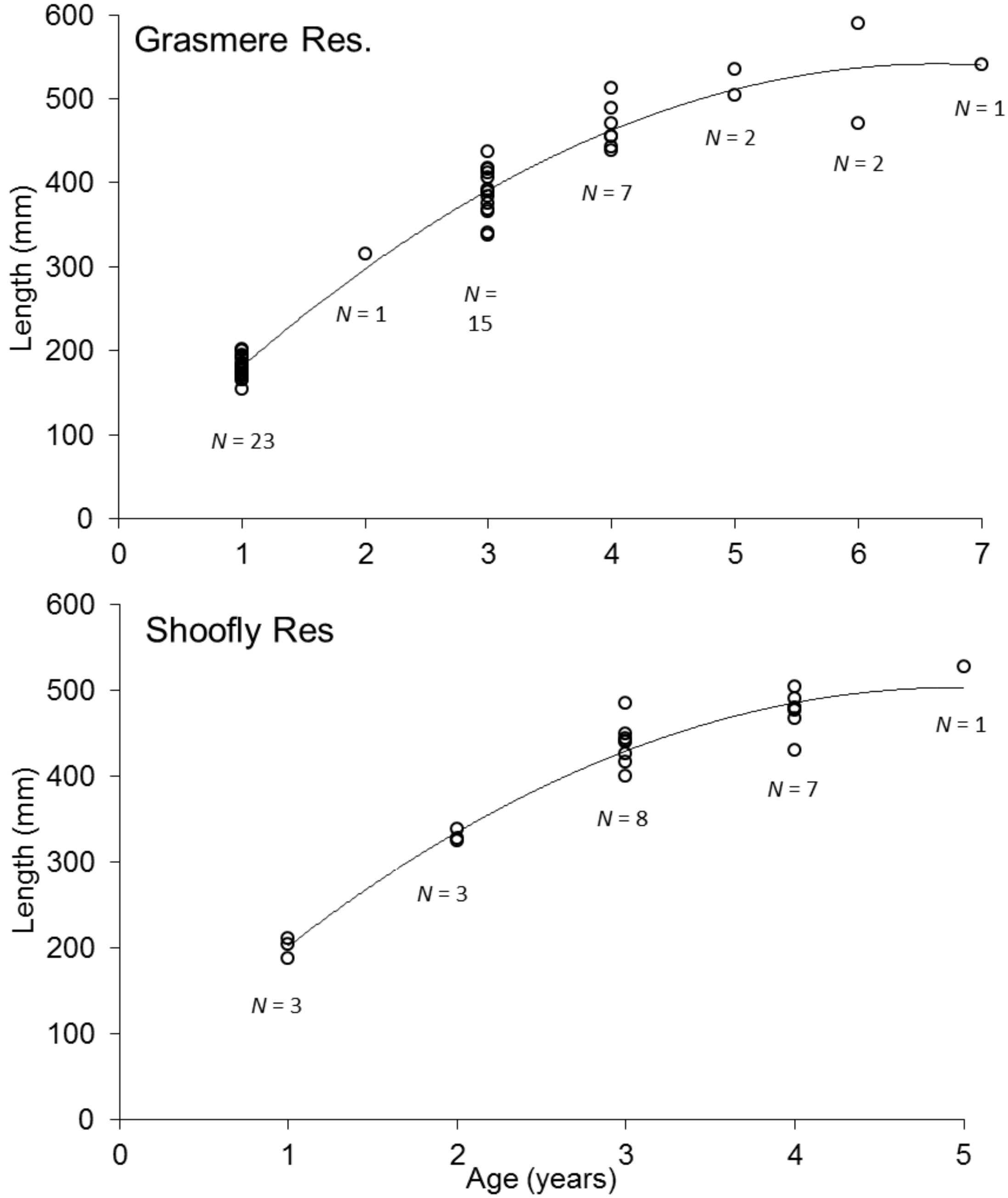

Figure 34. Length-at-age for Cutthroat Trout collected at Grasmere and Shoofly reservoirs in 2013. Fish ages were estimated based on sagittal otolith cross sections.

BLUEGILL, BASS AND CATFISH TRANSFERS TO ENCHANCE SUMMER FISHING IN COMMUNITY PONDS

ABSTRACT

The Southwest Region contain 39 small public community fishing ponds. These ponds offer a variety of angling options for both hatchery Rainbow Trout *Oncorhynchus mykiss*, and several warmwater species. Natural reproduction of bass and panfish is insufficient to meet angling demands, necessitating translocation from other waters to improve populations. In addition, IDFG transplanted Channel Catfish *Ictalurus punctatus* to improve summer fishing opportunities in several community fishing ponds throughout the Southwest Region. Southwest region personnel transferred several species of warmwater fish to 18 waters during 2013 to create new populations, bolster catch rates in existing fisheries, and to control nuisance aquatic plant populations. We transferred a total of 6,714 fish including: 4,799 Bluegill *Lepomis macrochirus*, 549 Channel Catfish *Lepomis macrochirus*, 102 Grass Carp *Ctenopharyngodon idella*, 520 Largemouth Bass *Micropterus salmoides*, and 784 Pumpkinseed *Lepomis gibbosus*. Future monitoring at receiving waters will evaluate whether transfers were successful at improving fishing in community ponds.

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INTRODUCTION

The Southwest Region contains over 30 small public community fishing ponds. These ponds offer a variety of angling options for both hatchery Rainbow Trout *Oncorhynchus*, and several warmwater species. Catchable-sized Rainbow Trout are usually stocked on a bi-weekly or monthly basis from September through June. Summer water temperatures in southwestern Idaho ponds usually exceed thermal limits for Rainbow Trout, requiring a stocking cessation during July and August, occasionally stretching into June and September during warm years (Hebdon et al. 2008). Unfortunately, stocking cessations coincide with peak fishing-effort periods. While trout are supplied regularly by Nampa Hatchery, warmwater fish populations depend on natural reproduction or transfers from other waters to maintain populations. These ponds receive significant angling pressure, and natural reproduction of bass and panfish may not sustain populations to meet angling demands. The Idaho Department of Fish and Game (IDFG) works to sustain populations of warmwater fish in community ponds by transplanting bass and panfish to bolster populations. Regional staff is interested in improving fisheries quality in the Southwest Region's urban ponds during summer peak effort periods by stocking Channel Catfish *Ictalurus punctatus.* Past studies have shown that transplanting adult catfish is a cost effective method to provide catfish opportunities in community ponds (Kozfkay et al. 2010).

In 2013, IDFG fisheries personnel transferred Bluegill *Lepomis macrochirus*, Channel Catfish *Ictalurus punctatus*, Largemouth Bass *Micropterus salmoides*, and Pumpkinseed *Lepomis gibbosus* to community fishing ponds and reservoirs throughout the Southwest Region Idaho to improve fishing opportunities. Also, two, new community park ponds in Boise, ID (Terry Day, Marianne Williams) were stocked with Bluegill and Largemouth Bass to establish self-sustaining warmwater fish communities. We also continued annual transfers of adult Channel Catfish to community fishing ponds to provide put and take fishing opportunities. Lastly, we purchased Grass Carp *Ctenopharyngodon idella* for weed control at only one pond in 2013.

OBJECTIVES

1. Continue providing Channel Catfish fishing opportunities in community ponds.
2. Transfer bass and panfish to improve warmwater fish populations in community ponds.
3. Control aquatic plants by purchasing and transferring Grass Carp where needed.

METHODS

Channel Catfish were collected on the Snake River from Walters Ferry to Nyssa, OR with boat mounted electrofishing gear. An aluminum jet boat with equipped with two boom-mounted anodes and a 5,000 watt generator was used. Output was controlled by a Smith Root VVP-15. Frequency was set at 80-120 pulses/ sec and a pulse width of 15, which yielded an output of 5-6 amps. Captured catfish were held in a 280-L livewell equipped with a re-circulating pump and supplemental oxygen. After approximately 75-100 catfish had been captured, they were placed in an 1,100-L fish transport trailer at a boat ramp. After several runs and the capture of 225-300 fish, fish were transplanted to local ponds.

Bass and panfish were collected with boat electrofishing gear. Source waters included public waters including Indian Creek Reservoir, Horseshoe Bend Pond, Crane Falls Reservoir, and the Snake River, while attempts were also made at CJ Strike Reservoir and Lake Lowell. We collected fish during daytime hours from May 16 to July 23, 2013 using a Smith Root electrofishing boat, a driftboat equipped with a Coeffelt VVP-15B, or a jet-powered electrofishing boat equipped with a Coeffelt VVP-15B. Pulsed direct current was produced by a 5,000 watt generator. Frequency was set at 120 pulses per second and a pulse width of 40, which yielded an output of 4-5 amps. After capture, fish were transferred to live cars and held until sufficient numbers were captured to fill a transport truck or trailer. Once loaded onto a fish transport tank, fish were supplied with supplemental oxygen at the rate of 2 liters/minute and transported as quickly as possible.

RESULTS AND DISCUSSION

During 2013, we captured and transferred a total of 6,714 fish including: 4,799 Bluegill, 549 Channel Catfish, 102 Grass Carp, 520 Largemouth Bass, and 784 Pumpkinseed. The fish species transferred to the 18 different ponds varied (Table 10). Ponds will be monitored in the future and stocked with additional fish if necessary. Also, we will continue transferring Channel Catfish to community fishing waters, as these fisheries have become popular with anglers and are cost effective. Distribution and allocation of fish will be modified based on tag returns, pond size, and fishing pressure.

In 2013, efforts to collect enough bass and panfish at CJ Strike Reservoir, Lake Lowell, Pacific Press Pond (private), and Crane Falls Reservoir were unsuccessful. Water conditions prevented launching the Smith-Root electrofishing boat, and we encountered low catch rates of bluegill at CJ Strike and Lake Lowell. In addition, we also had multiple equipment malfunctions and found the best combination for sampling small ponds was to use an aluminum drift boat and outboard motor set up for electrofishing. This setup allowed us to sample small ponds effectively without having to rely on launching our larger electrofishing boats.

Indian Creek Reservoir provided the bulk of warmwater fish transferred. Largemouth Bass, Bluegill and Pumpkinseed were abundant, indicating previous transfer efforts from 2011 and 2012 were successful. However, water levels have remained low since these last transfers, and this fishery has not met its potential under a higher reservoir pool. Mean total length of Largemouth Bass in Indian Creek (272 – 295 mm) suggests that the slot limit fishing regulation (none between 305 – 406) is not having the desired effect. The reservoir continues to maintain low pool elevation, increasing bass densities and decreasing growth rates. Additional future transfers could reduce densities and improve growth of the remaining bass, as we do not expect water conditions to improve.

MANAGEMENT RECOMMENDATIONS

1. Continue transferring Channel Catfish to community fishing waters.

2. Evaluate future transfers of Largemouth Bass with T-bar anchor tags to evaluate harvest rates and time to return in community ponds.

Table 10. Total number of Bluegill (BGL), Pumpkinseed (PKS), Channel Catfish (CAT), Largemouth Bass (LMB), and Grass Carp (GCP) captured and transferred to local waters during 2013.

Date	Collection Method	Receiving Water	Collecting Water	Species	Number	Mean weight (g)	Mean length (mm)
6/24/2013	Opaline Farms	Airport P.	Opaline Farms	GCP	62	422	337
5/17/2013	E-drift Boat	Beaches P.	Indian Creek Res.	BLG	237	42	124
5/17/2013	E-drift Boat	Beaches P.	Indian Creek Res.	LMB	59	377	272
5/17/2013	E-drift Boat	Beaches P.	Indian Creek Res.	PKS	10	33	114
5/16/2013	E-drift Boat	Beaches P.	Indian Creek Res.	BLG	678	38	116
5/16/2013	E-drift Boat	Beaches P.	Indian Creek Res.	PKS	168	43	117
5/16/2013	E-drift Boat	Beaches P.	Indian Creek Res.	LMB	37	542	295
7/19/2013	E-boat (Jet Sled)	Caldwell P. #2	Snake River	CAT	20	1814	
5/28/2013	E-boat (Jet Sled)	Caldwell P. #2	Snake River	CAT	20		
7/19/2013	E-boat (Jet Sled)	Caldwell P. #3	Snake River	CAT	15	1814	
5/28/2013	E-boat (Jet Sled)	Caldwell P. #3	Snake River	CAT	15		
7/19/2013	E-boat (Jet Sled)	Caldwell Rotary P.	Snake River	CAT	20	1814	
7/18/2013	E-boat (Jet Sled)	Caldwell Rotary P.	Snake River	CAT	20	1814	
5/28/2013	E-boat (Jet Sled)	Caldwell Rotary P.	Snake River	CAT	22		
7/18/2013	E-boat (Jet Sled)	Ed's P.	Snake River	CAT	15	1814	
5/29/2013	E-boat (Jet Sled)	Ed's P.	Snake River	CAT	20	1814	
7/18/2013	E-boat (Jet Sled)	Horseshoe Bend P.	Snake River	CAT	35	1814	
5/29/2013	E-boat (Jet Sled)	Horseshoe Bend P.	Snake River	CAT	42	1814	
7/3/2013	E-drift Boat	Kleiner P.	Indian Creek Res.	BLG	250	42	124
7/3/2013	E-drift Boat	Kleiner P.	Indian Creek Res.	LMB	25	377	272
6/4/2013	E-drift Boat	Kleiner P.	Indian Creek Res.	LMB	51		
6/4/2013	E-drift Boat	Kleiner P.	Indian Creek Res.	BLG	331		
6/4/2013	E-drift Boat	Kleiner P.	Indian Creek Res.	PKS	98		
7/3/2013	E-drift Boat	Marianne Williams P.	Indian Creek Res.	BLG	250	42	124
7/3/2013	E-drift Boat	Marianne Williams P.	Indian Creek Res.	LMB	25	377	272
6/5/2013	E-drift Boat	Marianne Williams P.	Indian Creek Res.	LMB	45	222	237
6/5/2013	E-drift Boat	Marianne Williams P.	Indian Creek Res.	BLG	301		
6/5/2013	E-drift Boat	Marianne Williams P.	Indian Creek Res.	PKS	100		
7/19/2013	E-boat (Jet Sled)	McDevitt P.	Snake River	CAT	20	1814	
5/28/2013	E-boat (Jet Sled)	McDevitt P.	Snake River	CAT	20		
5/17/2013	E-drift Boat	McDevitt P.	Indian Creek Res.	LMB	4	42	124
5/17/2013	E-drift Boat	McDevitt P.	Indian Creek Res.	BLG	526	377	272
5/17/2013	E-drift Boat	McDevitt P.	Indian Creek Res.	PKS	119	33	114
7/3/2013	E-drift Boat	Parkcenter P.	Indian Creek Res.	BLG	500	42	124
7/3/2013	E-drift Boat	Parkcenter P.	Indian Creek Res.	LMB	50	377	272
7/19/2013	E-boat (Jet Sled)	Parkcenter P.	Snake River	CAT	40	4lbs	
5/28/2013	E-boat (Jet Sled)	Parkcenter P.	Snake River	CAT	40		
6/4/2013	E-drift Boat	Parkcenter P.	Indian Creek Res.	LMB	80	264	256
6/4/2013	E-drift Boat	Parkcenter P.	Indian Creek Res.	BLG	704	48	124
6/4/2013	E-drift Boat	Parkcenter P.	Indian Creek Res.	PKS	213	38	113

Table 10. Continued.

Date	Collection Method	Receiving Water	Collecting Water	Species	Number	Mean weight (g)	Mean length (mm)
7/19/2013	E-boat (Jet Sled)	Quinns P.	Snake River	CAT	45	1814	
5/28/2013	E-boat (Jet Sled)	Quinns P.	Snake River	CAT	45		
7/19/2013	E-boat (Jet Sled)	Riverside P.	Snake River	CAT	20	1814	
5/29/2013	E-boat (Jet Sled)	Riverside P.	Snake River	CAT	20	1814	
7/18/2013	E-boat (Jet Sled)	Sawyers P.	Snake River	CAT	20	1814	
5/29/2013	E-boat (Jet Sled)	Sawyers P.	Snake River	CAT	35	1814	
7/3/2013	E-drift Boat	Settlers P.	Indian Creek Res.	BLG	250	42	124
7/3/2013	E-drift Boat	Settlers P.	Indian Creek Res.	LMB	25	377	272
6/4/2013	E-drift Boat	Settlers P.	Indian Creek Res.	LMB	48		
6/3/2013	E-drift Boat	Settlers P.	Indian Creek Res.	BLG	312	48	124
6/3/2013	E-drift Boat	Settlers P.	Indian Creek Res.	PKS	69	38	113
6/3/2013	E-drift Boat	Settlers P.	Indian Creek Res.	LMB	2	264	256
6/24/2013	from farm	Star Lane P.	from Farm	GCP	40	422	337
7/23/2013	E-Boat (Smith Root)	Terry Day P.	Horseshoe Bend P.	LMB	9		
7/23/2013	E-Boat (Smith Root)	Terry Day P.	Horseshoe Bend P.	BLG	410		
6/27/2013	E-boat	Terry Day P.	Crane Falls Res.	LMB	20		
6/27/2013	E-boat	Terry Day P.	Crane Falls Res.	BLG	20		
6/27/2013	E-boat	Terry Day P.	Crane Falls Res.	PKS	7		
7/15/2013	E-drift Boat	Terry Day P.	Indian Creek Res.	BLG	30		
7/15/2013	E-drift Boat	Terry Day P.	Indian Creek Res.	LMB	40		

HIGH MOUNTAIN LAKES SURVEYS

ABSTRACT

IDFG personnel surveyed 10 alpine lakes during August 2013 in the Southwest Region. Sampling effort in 2013 was curtailed by extensive wildfire activity across the region, limited our options for surveys. Surveys were located across the Bear Valley Creek, Canyon Creek (SF Payette) and Elk Creek watersheds (HUC 5). Most of the lakes in this area had either not been surveyed by IDFG, or had not been surveyed since 1996. Data describing fish and amphibian presence and habitat was collected at each site. Trout populations were found in four of the 10 lakes sampled, with Rainbow Trout *Oncorhynchus mykiss* occurring in three, and Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* in one lake. Amphibians were present in nine of the 10 lakes sampled, and were sympatric with trout in three lakes. Amphibian species composition varied between lakes and included Columbia Spotted Frog *Rana pretiosa*, Long-toed Salamander *Ambystoma macrodactylum*, Western Toad *Bufo boreas* and Sierran Tree Frog *Pseudacris regilla sierra.*

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OBJECTIVES

1. Describe the distribution, relative abundance, and species composition of fish and amphibian populations in high mountain lakes of the Southwest Region.

2. Adjust stocking where appropriate to more efficiently use hatchery resources and to conserve native fauna.

METHODS

Alpine lakes were surveyed during August 19-21, 2013. The lakes were located across three headwaters (HUC 5) including, Bear Valley Creek, Canyon Creek and Elk Creek (Table 11). These lakes were prioritized for sampling because they had either never been sampled, or no recent data were available. At each lake, we assessed fish and amphibian presence/absence, human use, and habitat characteristics. Unless visually observed, no fishing sampling occurred in shallow lakes and ponds without suitable fish habitat. In lakes with suitable fish habitat, fish were sampled either with hook/line, gill net, or both to collect species, total length (mm), and weight (g) information. Gill nets were floating experimental nets, measuring 46 m long by 1.5 m deep, with 19, 25, 30, 33, 38, and 48 mm bar mesh panels. When used, gill nets were set in the evening and fished overnight.

Habitat surveys consisted of collecting limnological and morphological data in individual lakes. Lake length was measured across the long axis of each lake using a laser rangefinder (Bushnell Yardage-Pro), and width measurements were recorded at ¼, ½, and ¾ distances along the length axis. Average depth was determined by taking cross-sectional measurements at three points along each width measurement transect using a hand-held sonar device (Strikemaster Polar Vision). Maximum depth was estimated as the greatest depth observed during the cross-sectional measurements. Surface water temperatures were recorded along the lake shore at one point. A visual assessment of salmonid spawning habitat availability in each lake and the inlets and outlets was determined based on substrate quality, flow, and gradient.

Visual amphibian surveys were conducted by walking the perimeter of each lake and noting the abundance and life stages of individual species. Life stages were classified as adult, juvenile, or larvae. Shoreline habitats adjacent to lakes, including areas under logs and rocks were also inspected to detect hidden amphibians.

Human use was evaluated based on general appearance of use, number and condition of campsites, number of fire rings, access trail condition and difficulty, and presence of litter. General levels of human use were categorized by IDFG personnel as rare, low, moderate, and high based on an overall visual assessment of the factors described above.

RESULTS AND DISCUSSION

IDFG personnel surveyed 10 alpine lakes during August 2013 in the Southwest Region. Sampling effort in 2013 was curtailed by extensive wildfire activity across the region, limited our options for surveys.

Bear Valley Creek – M. F. Salmon River

All five lakes surveyed contained water, but only four supported fish populations (Table 11). Rainbow Trout *Oncorhynchus mykiss* were found in only Cache Creek #3 and Lost lakes, despite no recent stocking and contrary to historical records of Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi* stocking (Table 11). These lakes apparently contain naturally reproducing trout populations, and do not warrant any stocking. Amphibians were found at all the lakes surveyed. Lost Lake and Cache Creek Lake #3 supported several species, despite the presence of Rainbow Trout (Table 12). These lakes had extensive shallow marsh habitats surrounding the lakes, which likely provided adequate refuge from trout predation. At Cache Creek Lake #3, all the Columbia Spotted Frogs *Rana pretiosa* were found in habitats adjacent to the main lake, away from direct contact with trout. Most of the Cache Creek lakes surveyed did not appear to have adequate habitat to support trout. Except for Cache Creek Lake #3, these lakes were too shallow to support trout, contained several species of amphibians, and future stocking should be avoided.

Elk Creek – M. F. Salmon River

Of the four lakes surveyed, only Bernard Lake contained suitable fish habitat, while the others were large, shallow ponds (Table 11). Bernard Lake is a large, deep lake which currently supports Westslope Cutthroat trout, with a mean total length over 350 mm, indicating a quality alpine fishery. This lake has a history of regular annual stocking, and continues to be stocked each year. Current management practices appear to be providing good fishing.

The Bear Skin Creek lakes and Bear Skin Pond were small, shallow ponds and did not appear to be suitable trout habitat. Four different species of amphibians were found at all the lakes surveyed, except Bernard Lake where Cutthroat Trout were present (Table 12).

Canyon Creek – S. F. Payette River

During 2013, we sampled only one lake in this watershed, Zumwalt Lake. The last record of stocking was Westslope Cutthroat Trout in 1990 (Table 11). However, the lake currently contains a population of Rainbow Trout, with an average total length of 206 mm. Based on the lack of stocking, we assume the trout population is currently naturally reproducing, and no stocking is currently warranted. Western Toad *Bufo boreas* was the only amphibian species present during the survey (Table 12).

MANAGEMENT RECOMMENDATION

1. Maintain lakes surveyed in 2013 that did not contain fish as fishless amphibian habitat and avoid future fish stocking in these areas.

Table 11. Physical characteristics, fish presence, mean fish total length (with 90% confidence intervals), amphibian presence and stocking history for alpine lakes surveyed in 2013. The last year of fish stocking (according to records back to 1967) are shown in parentheses.

Lake name	Elevation (m)	Area (ha)	Max depth (m)	Fish observed	Mean length (mm)	Stocking	Amphibians observed
Bear Valley Creek							
Cache Creek Lake #1	2323	1.57	1	-			CSF, WT
Cache Creek Lake #2	2337	0.39	0.4	-			LTS
Cache Creek Lake #3	2365	1.31	12	RBT	226 (± 31)	-	CSF
Cache Creek Lake #4	2369	0.54	2.5	-			LTS, WT
Lost Lake	2240	2.61	7	RBT	207 (± 10)	WCT (1993)[1]	CSF, LTS, WT
Canyon Creek-South Fork Payette River							
Zumwalt Lake	2188	1.56	8.53	RBT	206 (± 6)	WCT (1990)[1]	WT
Elk Creek							
Bear Skin Creek Lake #1	2249	0.40	0.5	-			CSF, STF
Bear Skin Creek Lake #2	2231	0.31		-			CSF, LTS, STF, WT
Bear Skin Pond	2107	1.92	0.3	-			CSF, LTS, WT
Bernard Lake	2204	7.06	28.34	WCT	352 (± 88)	WCT (2013)[2]	-

[1] Stocking discontinued

[2] Stocking rotation is every year

Table 12. Counts of amphibian species by life stage and fish presence for alpine lakes surveyed in August 2013.

	Columbia spotted frog			Long-toed salamander			Western toad			Sierran tree frog			Fish present
Lake name	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	
Bear Valley Creek													
Cache Creek Lake #1	-	-	20	-	-	-	-	-	20	-	-	-	NO
Cache Creek Lake #2	-	-	-	-	3	50	-	-	-	-	-	-	NO
Cache Creek Lake #3	5	-	-	-	-	-	-	-	-	-	-	-	YES
Cache Creek Lake #4	-	-	-	-	-	21	-	-	-	-	-	-	NO
Lost Lake	2	25	-	1	-	-	1	-	-	-	-	-	YES
Canyon Creek-South Fork Payette River													
Zumwalt Lake	-	-	-	-	-	-	-	250	100	-	-	-	YES
Elk Creek													
Bear Skin Creek Lake #1	1	2	-	-	-	-	-	-	-	1	5	-	NO
Bear Skin Creek Lake #2	1	20	-	2	-	-	1	-	-	1	-	-	NO
Bear Skin Pond	1	-	-	2	-	-	1	1	-	-	-	-	NO
Bernard Lake	-	-	-	-	-	-	-	-	-	-	-	-	YES

RETURN-TO-CREEL RATES OF CHANNEL CATFISH IN LAKE LOWELL

ABSTRACT

Lake Lowell is a 4,000 ha Bureau of Reclamation irrigation reservoir located 10 km southwest of Nampa, Idaho. Due to its' proximity to southwest Idaho's population center, Lake Lowell receives substantial fishing pressure for Largemouth Bass *Micropterus salmoides*, a variety of panfish species and Channel Catfish *Ictalurus punctatus*. The Idaho Department of Fish and Game (IDFG) stocks Channel Catfish at Lake Lowell yearly, with no current bag limits or size restrictions for catfish. The goal of this study was to describe the size structure and exploitation rates of Channel Catfish in Lake Lowell. We tagged and released 316 Channel Catfish during summer 2013. Mean total length of tagged Channel Catfish (shown with 90% confidence intervals) captured was 559 mm (± 8) with a minimum and maximum length of 244 mm and 845, respectively. Adjusted exploitation and total use of Channel Catfish were 8% and 13%, respectively based on 25 tags reported as of February 2014. We recommend continued releasing tagged Channel Catfish to improve the current sample size and monitor tag returns for several years.

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INTRODUCTION

Lake Lowell is a 4,000 hectare Bureau of Reclamation irrigation reservoir located 10 km southwest of Nampa, Idaho. The reservoir was built from 1906 to 1909 by forming four embankments around a naturally-occurring low lying area. Shortly thereafter, the lands surrounding the reservoir were incorporated into the National Wildlife Refuge system and continue to be managed by the U. S. Fish and Wildlife Service. Uniquely, no streams or rivers flow into the reservoir; instead, water is supplied by the New York Canal, which diverts water from the Boise River. The reservoir is fairly shallow with a maximum depth of 11 m. Much of the littoral zone is occupied by extensive beds of smartweed (*Polygonum* spp.).

Due to its' proximity to southwest Idaho's population center, Lake Lowell receives substantial fishing pressure. Largemouth Bass *Micropterus salmoides* receive the majority of the attention and several tournaments are held annually. Panfish fisheries (Black Crappie *Pomoxis nigromaculatus* , Bluegill *Lepomis macrochirus*, and Yellow Perch *Perca flavescens*) are also popular. However, these populations have fluctuated widely leading to inconsistent fishing. Lake Lowell is managed under general fishing regulations, except for Largemouth Bass and Smallmouth Bass *Micropterus dolomieu*. Bass are managed under a no-harvest regulation from January 1 thru June 30 and a 2 fish, 305-406 mm protected slot limit thereafter. Additionally, the USFWS restricts motor boat usage on the lake to the period between April 15 and September 30.

The Idaho Department of Fish and Game (IDFG) stocks Channel Catfish *Ictalurus punctatus* at Lake Lowell yearly. The annual stocking goal is 10,000 fish, but this number has varied from approximately 6,000 to 10,000 since 2003 (Table 13). Under the current general fishing regulations, there are no bag limits or size restrictions for Channel Catfish. Very little data currently exists to describe harvest rates for Channel Catfish at Lake Lowell, or whether current stocking programs are effective. This study aims to describe the size structure and harvest rates of Channel Catfish in Lake Lowell.

OBJECTIVE

1. Describe the size structure and exploitation rates of Channel Catfish in Lake Lowell.

METHODS

We collected Channel Catfish using tandem baited hoop nets as described by Michaletz and Sullivan (2002), and used successfully in northern Idaho waters (IDFG, unpublished data). Each set of hoop nets consisted of three nets set in tandem order attached bridle to cod end. An anchor was attached to the rear of the last net, and the front end of the first net to aid in stabilizing the series while fishing. Additional anchors were added between the middle and front net to prevent the nets from collapsing while removing fish. Each net series was baited with at least two mesh bags using commercially available soybean cake. We used model HN-16 hoop nets from Miller Net Company. Nets were constructed from 91 cm diameter hoops measuring approximately 3.4 m in length, made up of seven metal hoops constructed of #15 twine with 25.4 mm bar mesh, and equipped with 6 m bridles that separated consecutive nets. Two-fingered crow foot throats were attached to the second and fourth hoop. To prevent escapement from the cod end, the rear throat was narrowed with 25 mm rope. Nets were set along the north shore of Lake Lowell in each of three basins, along gently sloping shorelines in water depths of

2-4 meters (Figure 35). Nets were left to fish from 2-4 days at a time, after initial 24-hr sets showed low catch rates.

All Channel Catfish captured were weighed and measured for total length then tagged using Carlin dangler tags (Wydoski and Emery 1983) with stainless steel wire. Each Carlin dangler tag was threaded to the mid-point of a 200 mm piece of stainless steel wire. After the tag was positioned at the mid-point of the wire, we twisted the wire 5 times to lock it in place. A pair of hypodermic needles affixed to a wooden dowel, was inserted through the fish's body below and slightly posterior to the dorsal spine. The end of the tag wire was inserted through the hypodermic needles to pass through the fish. The needles were then removed, and the wire ends were twisted about five times on the opposite side of the fish and trimmed. Each tag included a unique identification number, the abbreviation IDFG, and the Tag-You're-It! tag reporting hotline phone number (1-866-258-0338). Anglers could report tagged fish caught using the phone number on the tag, or tag reporting portal was available on IDFG's website (https://fishandgame.idaho.gov/feedback/fish/forms/reportTaggedFishAngler.cfm). Length and weight of each tagged catfish was recorded prior to being released. Tagged fish were released in the middle of the lake away from trap sites to encourage random mixing and avoid repeated capture.

Proportional stock densities (PSD) were calculated outlined by Anderson and Neuman (1996), using 280 mm as "stock size" and 410 mm as "quality size". Relative weight, Wr, was calculated as an index of general fish body condition where a value of 100 is considered average. Values greater than 100 describe robust body condition, whereas values less than 100 indicate less than ideal foraging conditions.

Tag return data were queried from the Tag-You're-It! database in February 2014 so returns are current to February 1, 2014 for the purposes of this report. Adjusted exploitation and adjusted total use (harvest plus release) were calculated according to the methods in Meyer et al. (2010). There is no Channel Catfish specific tag reporting rate currently available, so we used a mean tag reporting rate of 53%, based on an overall average statewide reporting rate across all species (Meyer et al. 2010).

RESULTS

We tagged and released a total of 316 Channel Catfish during summer 2013. Fish were collected, tagged and released weekly from June 12 to July 22, 2013. The bulk of the tags were released in the east and mid-basin sections of the lake (Table 14). Sampling was discontinued in late summer as water quality degraded and lake levels became extremely low.

Mean total length of tagged Channel Catfish (shown with 90% confidence intervals) captured was 559 mm (± 8) with a minimum and maximum length of 244 mm and 845, respectively. The sample was composed primarily of large adult fish, with the median total length of 570 mm. This differed from previous sampling in 2006, when the mean total length of catfish was 427 mm (± 22), ranged from 240 – 720 mm, with a median of 381 mm (Figure 36). Mean weight of tagged Channel Catfish (shown with 90% confidence intervals) was 1885 g (± 88) with a minimum and maximum weight of 124 g and 5030 g, respectively. Mean PSD of Channel Catfish was 95, indicating the sample was primarily composed of "quality-sized" fish and larger (Figure 36). The mean relative weight (Wr) was 101 (± 3), indicating that tagged fish were in good body condition overall.

As of February 2014, a total of 25 tags were reported, with one having been found dead on the bank (24 live fish caught). Of the live fish reported, 15 were harvested (63 %), while 9 (37%) were released. When adjusted for the nonreward tag reporting rate, exploitation and total use of Channel Catfish were 8% and 13%, respectively (Table 2). Exploitation rates varied widely depending on where fish were tagged. Fish tagged in the mid-basin has the highest exploitation and total use at 14% and 21%, respectively. Of the 28 tags released in the west basin, none have yet to be reported (Table 14).

DISCUSSION

Based on the short duration that tags were available during 2013, exploitation and total use of 8% and 13% suggest that the current catfish stocking program is successful. Exploitation (14%) and total use (21%) rates were much higher for fish tagged in the middle basin than the lake-wide average. This may be related to well-developed shoreline fishing access in this part of the lake, allowing anglers more access to these fish. More time to collect tags for at least a year (or more) will be needed to more accurately assess this fishery. We expect exploitation rates for Channel Catfish tagged in 2013 to be much higher in 2014. Tagged fish were not available to anglers until June. The current exploitation rates do not include April, May and most of June, which are important months for catfish anglers. We expect higher exploitation next year as these tagged fish mix throughout the lake and are available to anglers in the spring months. Most tags were returned in July and August. Only two tags were returned in September, with none returned after September 23, 2013, suggesting few catfish were caught in the fall. Relative to Fernan, Hauser, Cocolalla, and Jewel lakes in northern Idaho, return-to-creel rates of in Lake Lowell were substantially higher. Exploitation rates in 2011 at Fernan Lake was estimated at 4%, and tag returns were near zero for all three of the other lakes (IDFG, unpublished data). However, exploitation rates at Lake Lowell fell within the range of those reported by Michaletz et al. (2008) in 14 small Missouri impoundments.

Compared to previous sampling on Lake Lowell in 2006, our 2013 sample contained a higher proportion of large catfish. The median total length from 2006 to 2013 changed from 381 mm and 570 mm, respectively. The 2006 sampling used a variety of gill nets with varying mesh sizes and trap nets, while in only baited hoop nets were used in 2013. It is possible that hoop nets may be biased towards catching only larger adult Channel Catfish, misrepresenting the size distribution in the lake. Michaletz and Sullivan (2002) found that hoop nets created unbiased length distributions for Channel Catfish except for fish shorter than 250 mm. Our results are very similar, as we caught very few fish in this size range, while gill nets did collect these smaller sizes in previous years (Figure 36). Hoop nets may not be effective for collecting hatchery Channel Catfish shortly after stocking, but should be effective at sampling them after they reach 300 mm. Our sample of 316 fish should be sufficient to describe the size structure of catfish vulnerable to hoop nets in Lake Lowell, based on a recommended sample size of 300 fish (Michaletz and Sullivan 2002).

Of the 316 Channel Catfish tagged, 15% (48) had adipose fin clips. All Channel Catfish stocked in 2005 and 2006 were marked with adipose fin clips. These fish are now 7-8 years old, suggesting they are surviving well. However, the 2006 stocking allotment was greater than most years (13,716), so this cohort of fish may present a strong year class of adipose-clipped catfish in Lake Lowell. Despite the high stocking rate from 2006, having 15% of the sample composed of 2 marked cohorts indicates these hatchery catfish are contributing significantly to the total catfish population in the lake, if not entirely. Knowing hatchery Channel Catfish will live at least 7-8 years (and likely much longer), tag returns should be monitored for several years after tagging. Given the longevity of these fish, tags may be returned several years after initial release.

MANAGEMENT RECOMMENDATIONS

1. Continue marking Channel Catfish in 2014 to increase the number of tags in Lake Lowell up to 500.

2. Continue collecting tag return data through 2016 to assess exploitation and total use of Channel Catfish over several years after tagging.

3. Continue stocking hatchery Channel Catfish when available. After several years of tag return data, reevaluate whether catfish stocking is cost effective.

Table 7. Total numbers of fingerling Channel Catfish stocked annually in Lake Lowell since 2003.

Stocking date	Total number
8/19/2003	9,063
7/7/2004	6,897
8/10/2005	5,955
7/19/2006	13,716
7/11/2007	7,828
7/16/2008	7,673
7/15/2009	9,434
7/14/2010	7,992
7/20/2011	10,000
6/12/2013	10,005

Table 14. Total tagged Channel Catfish released in summer 2013 and reported with adjust exploitation (harvest) and adjusted total use (harvest plus releases) for Lake Lowell through February 2014.

Release location	Tags released	Reported harvested	Reported released	Adj. exploitation	90% CI	Adj. total use	90% CI
East Basin	175	6	4	6%	5%	10%	6%
Mid Basin	113	9	5	14%	9%	21%	11%
West Basin	28	0	0	0	0	0	0
Overall	316	15	9	8%	4%	13%	6%

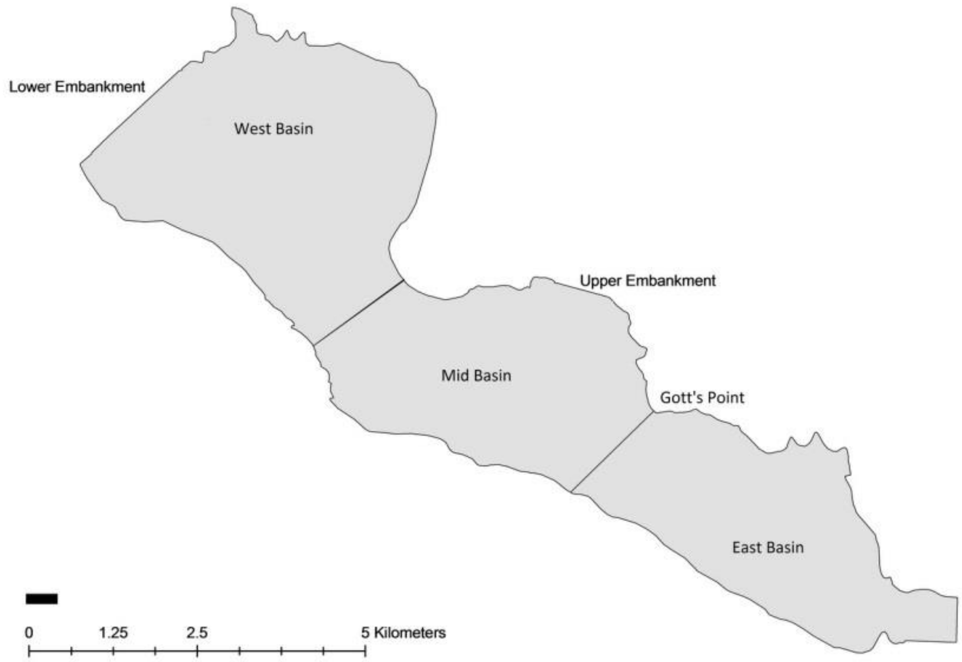

Figure 35. Lake Lowell outline and major divisions of West, Middle and East basins where hoop nets were used to collect and tag Channel Catfish in 2013.

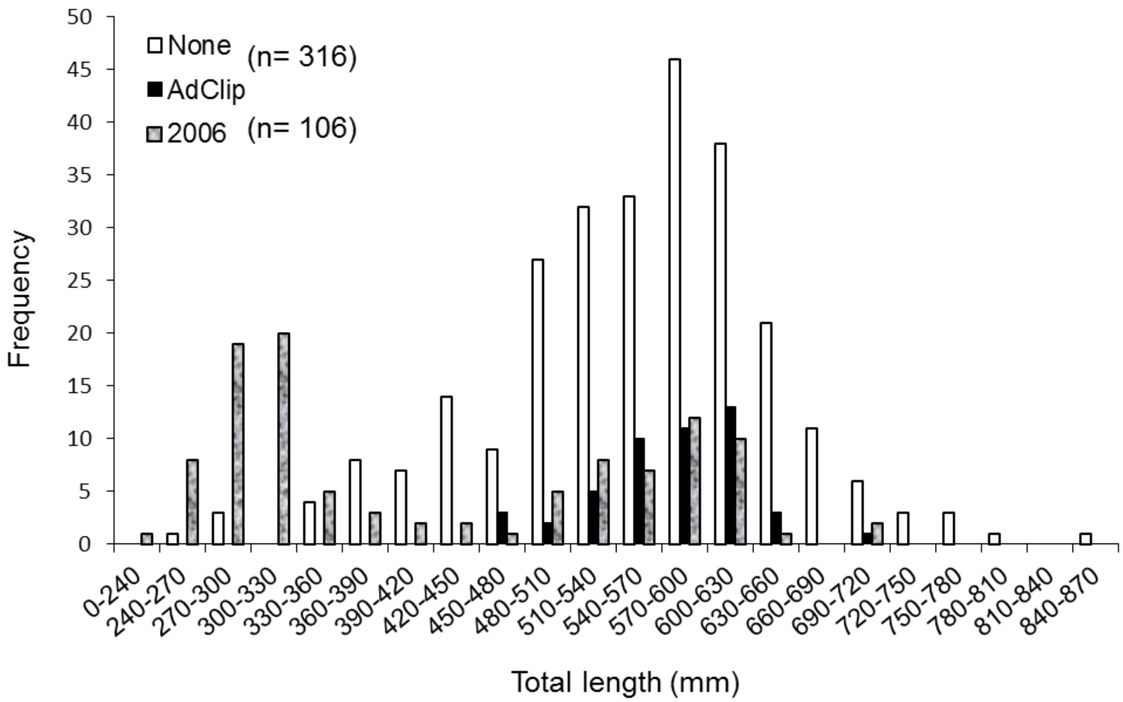

Figure 36. Length-frequency distribution of ad-clipped (black bars) and non-clipped (white bars) Channel Catfish collected with hoop nets, tagged, and released in Lake Lowell during 2013 (N= 316). Gray bars show the length distribution of Channel Catfish collected during previous surveys in 2006 (n = 106) using a combination of gill nets and trap nets.

ASSESSMENT OF ANGLER EFFORT AT CRANE FALLS RESERVOIR

ABSTRACT

We used assessment of digital images collected from trail cameras to estimate fishing effort at Crane Falls Reservoir. Total fishing effort was estimated to be 1,504 h. Shore fishing effort was 804 h, whereas boat fishing effort was 700 h. Total pelican use was 196 h. Total fishing effort was much reduced from past studies. During 1976 and 1995 (partial year), total effort was 18,000 and 13,601, respectively. In summary, current fishing effort is approximately 10% or less than levels expended during the 1970s and 1990s.

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INTRODUCTION

Crane Falls Reservoir is a 31 ha reservoir located 10 km north of Bruneau, Idaho on the south edge of the (inundated) Snake River. This reservoir has a complex management history due in part to illegal fish introductions, multiple fish renovations, water quality problems, and required water pumping to improve water quality (reviewed in Butts et al. 2013). Recent monitoring and management efforts have focused on assessing contemporary fish population abundances and assessing exploitation of stocked hatchery trout. During the winter of 2012 – 2013, the water pumping infrastructure collapsed due to age, dilapidation, and ice formation, necessitating costly repair. In order to justify whether expenditures of this magnitude ($70,000) would be warranted, we initiated an effort to estimate angler use patterns during 2012-2013.

MANAGEMENT GOALS

1. Provide a trophy Largemouth Bass and high yield bluegill fishing opportunity.
2. Provide a hatchery-supported Rainbow Trout fishery with catch rates exceeding 0.5 fish/hr.

OBJECTIVES

1. Estimate total annual angling effort (hours) at Crane Falls Reservoir.

METHODS

We estimated angler hours using digital images taken on automatic specific time intervals at Crane Falls Reservoir. We utilized two trail- or game-type cameras positioned to view as much of the reservoir as possible. Coverage was high, though this parameter was not estimated specifically. One camera was positioned on the ventilation pipe on top of the restroom, which is located on the south-east end of the lake. A second camera was placed on the south shore at the approximate mid-point of the lake, on the water pumping infrastructure. From May 22, 2012 to May 21, 2013, each camera was set to capture and record images simultaneously at hourly intervals during daylight hours only. No attempts were made to estimate night fishing effort. Images were downloaded on a monthly basis and transferred to a desktop computer. Afterwards, paired images were viewed concurrently to avoid double counting of individual anglers. Bank and boat anglers were counted separately. Although, not an initial objective of this effort, counts of American White Pelican *Pelecanus erythrorhynchos* individuals were also recorded. During a few intervals, no images were collected due to lens blockage or battery failure. We interpolated missing data by averaging counts from the same time period on the same day from the two preceding and two subsequent weeks. An average effort from these four data points was calculated and applied to hourly cells with missing data. For example, if Thursday morning data were missing, we utilized Thursday morning data from the previous two weeks and Thursday morning data from the two subsequent weeks to interpolate missing data.

RESULTS AND DISCUSSION

A total of 4,680 instantaneous counts (i.e. approximate # of daylight hours) were made (or interpolated) to estimate fishing effort and pelican use during 2012-2013. From these counts, total fishing effort was estimated to be 1,504 h. Shore fishing effort was 804 h, whereas boat fishing effort was 700 h. Total pelican use was 196 h. It is important to note that the fishing effort was likely underestimated, especially for shore bound anglers. There is a thick canopy of Russian olive *Elaeagnus angustifolia* along portions of Crane Falls Reservoir that makes counting shore bound anglers with this method difficult. We did not attempt to estimate this bias. However, cameras were positioned to minimize this bias and most of the high-use areas were viewable.

Total fishing effort was much reduced from past studies. During 1976, the IDFG commission directed more intense study of Crane Falls Reservoir specifically to assess the possibility of managing with a quality or trophy trout regulation. Investigations revealed relatively high effort (18,000 h; Mallet and Reid 1978). During 1995, a partial-year creel survey indicated that 13,601 h of fishing effort were expended from March through December (Allen et al. 1998). In summary, current fishing effort is approximately 10% or less than what was expanded during the 1970s and 1990s.

MANAGEMENT RECOMMENDATIONS

1. Repair the pump and associated infrastructure to begin improving water quality.

2. Monitor fish and fishing effort responses after appropriate pumping levels are implemented for several years.

CHEMICAL TREATMENT OF NUISANCE AQUATIC PLANTS IN SMALL WATERS

ABSTRACT

Excessive aquatic plant growth in [Emmett] Airport, Lowman, Sawyers, and Star Lane ponds was hampering boating and fishing opportunities. In order to maintain fisheries quality, we chemically treated overgrown areas of these waters with Navigate, a granular 2, 4 D, at application rates of 100-150 lbs/acre. Submerged aquatic plant abundance was reduced by mid-summer. Furthermore, we purchased and stocked Grass Carp *Ctenopharyngodon idella* into two ponds as a sole treatment method (Star Lane) or to curb plant re-growth and hopefully increase the interval (i.e. number of years) between chemical treatments (Airport). Effective long-term weed management will require vigilance and finding a balance between aquatic plant eradication and maintaining adequate amounts and types of aquatic plants for invertebrates and as cover for fish.

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INTRODUCTION

Idaho Department of Fish and Game's (IDFG) Southwest Region manages fisheries in about 36 publicly-accessible small ponds and reservoirs. Ponds receive significant fishing pressure and are an important resource for providing family-friendly fishing opportunities; and therefore, are thought to be important for angler recruitment and retention efforts. Excess plant growth, especially during the summer months, in some ponds may limit access or in extreme cases may totally preclude fishing. Furthermore, excess plant growth may create other problems such as high oxygen consumption during decomposition or may provide too much cover for juvenile fish, leading to high abundances and small average sizes. Excess plant growth was reducing fishing opportunities in all or portions of Airport, Lowman, and Sawyers, and Star Lane ponds. Eurasian Watermilfoil *Myriophyllum spicatum* was the predominant species present in Airport, Sawyers, and Star Lane ponds, whereas Northern Watermilfoil *Myriophyllum sibiricum* was the predominant species in Lowman Ponds. Regional personnel using financial assistance from the Idaho Department of Agriculture treated these waters with granular herbicides to reduce plant abundance. Furthermore, Grass Carp *Ctenopharyngodon idella* were stocked as a sole control method or to curb plant re-growth post chemical treatment. Target stocking rates were 25 fish per acre.

METHODS

We selected Navigate, a granular 2, 4 d, to treat these waters, based on past efficacy in nearby waters and low toxicity to fish. Recommended treatment levels were 100-150 lbs/surface acre for identified plant species. We used Idaho Fish and Game's GIS information to estimate surface acreage for areas with excess plant growth. On May 21, 2013, we treated nearly the entire surface area of Airport Pond with 950 lbs of Navigate. Also at Airport Pond, a total of 62 Grass Carp were released ($\bar{x}$ = 337 mm; 422 g), on June 24. At Lowman Ponds, we applied 300 lbs of Navigate to the entire area of each pond on May 22. No Grass Carp were stocked at Lowman ponds during 2013. On May 21, 2013, we applied 900 lbs of Navigate to a portion of the eastern portion (six acres) of the eastern pond in the Sawyers Pond complex. Treatment targeted excess plant growth that blocked the primary boat ramp and made fishing difficult from popular shore sites and docks. Lastly, a total of 40 Grass Carp were stocked in Star Lane Pond on June 24, 2013.

RESULTS AND DISCUSSION

Herbicide treatments were effective in Airport, Lowman, and Sawyers ponds. Based on visual estimates, over 90% of rooted submerged vegetation was killed. No significant plant re-growth occurred in treated areas prior to fall. At this time, we do not know how well stocked Grass Carp survived or whether Grass Carp are contributing to aquatic plant control. Despite the lack of survival estimates, it was apparent that at least some Grass Carp survived to the fall as Grass Carp, in good condition, were observed visually in near shore areas. Milfoil consumption and contribution of Grass Carp to nuisance plant management is not known at this time. Effective aquatic plant management in the coming years will require vigilance and finding a balance between plant eradication and maintaining aquatic plants for invertebrates and as juvenile fish cover.

MANAGEMENT RECOMMENDATIONS

1. Monitor plant mortality and re-growth in Airport, Lowman, Sawyers, and Star Lane ponds. Apply herbicide or stock Grass Carp on a semi-annual basis or as needed.

2. Monitor aquatic plant abundance in other waters that have a tendency to possess nuisance levels and initiate treatments where necessary.

3. Conduct multi-species mark-recapture population estimates at ponds in which Grass Carp have been stocked. Determine whether Grass Carp stocking densities and survival are adequate to control nuisance levels of aquatic plants.

RETURN-TO-CREEL AND TAGGING SUMMARY FOR SOUTHWEST REGION, 2011-2013

ABSTRACT

Idaho Department of Fish and Game (IDFG) hatcheries are integral to managing coldwater sportfishing opportunities in Idaho. Given the current economic climate for IDFG hatcheries, efforts must be made to ensure that hatchery programs remain efficient while producing quality trout fisheries for Idaho anglers. Here we summarize the results of the past three years of tag return data to describe return to creel of hatchery Rainbow Trout *Oncorhynchus mykiss* in the most-stocked waters of the Southwest Region. We released tagged Rainbow Trout throughout the Southwest Region to monitor harvest and release rates (return-to-creel) and days at large (days since release until caught) of hatchery Rainbow Trout. Between 2011 and 2013, we tagged and released 20,249 hatchery Rainbow Trout with non-reward tags throughout the Southwest Region. To date, over 2,800 having been returned by anglers. We estimated return to anglers of hatchery Rainbow Trout within one year of release. Across the 2011-2013 period, average exploitation (harvest) and total use (harvest + released) for Rainbow Trout in Region 3B community ponds was 43% and 58%, respectively. Across all community ponds, the median days at large until Rainbow Trout were caught was 25, but ranged from 3 to 57 days. Across the 2011-2013 periods, average exploitation and total use for Rainbow Trout in Region 3B lakes and reservoirs was 17% and 21%, respectively. For lakes and reservoirs, the median days at large for Rainbow Trout was 83, and ranged from 22 to 128 days. During this same period, average exploitation and total use for the Boise River was 23% and 40%, respectively, while the median days at large was 20 days.

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INTRODUCTION

Idaho Department of Fish and Game (IDFG) hatcheries are integral to managing coldwater sportfishing opportunities in Idaho. According to the 2014 stocking requests, the Southwest Region stocks approximately 295,750 “catchable” sized Rainbow Trout (8-11”) annually. Rainbow Trout are stocked in 49 different waters throughout the Southwest Region, including large reservoirs, rivers and small community ponds. Catchable-sized Rainbow Trout stocked in the Southwest Region are reared primarily at Nampa Hatchery (83%), with some coming from the Hagerman State Hatchery (17%). Current hatchery production capacity and funding are not increasing, while demand for hatchery catchable trout remains steady or is increasing. A comprehensive evaluation of hatchery catchable exploitation rates (i.e. return-to-creel) in Idaho’s predominant put-and-take fisheries began in 2011 under the Hatchery Trout Evaluation project (Nampa Research Office) and has spread to the Regional offices to improve the resolution of the data. Exploitation data for the Southwest Region hatchery trout fisheries could identify locations where catch objectives are met, and where stocking is not providing the intended benefit. This information was used to identify fishing quality and hatchery trout performance. To meet the increasing cost of producing hatchery Rainbow Trout, IDFG has decreased stocking in order to meet budgetary restrictions. Return to creel information is being used as the primary metric to inform decisions on how to prioritize how hatchery Rainbow Trout are distributed. Given the current economic climate for IDFG hatchery funding, efforts must be made to ensure that hatchery programs remain efficient while producing a quality product for Idaho anglers. In this chapter, we summarize the results of the past three years of tag return data to describe the return to creel of hatchery Rainbow Trout in the most-stocked waters of the Southwest Region.

OBJECTIVE

1. Summarize tagging effort and results describing catch of stocked Rainbow Trout in the Southwest Region from 2011 to 2013.

METHODS

Most of the data presented here was based on research studies by Koenig (2012) and Cassinelli and Koenig (2013). A detailed description of the methods used can be found in those reports. Hatchery Rainbow Trout were individually measured for total length (mm) and tagged using 70 mm (51 mm of tubing) fluorescent orange Floy® FD-68BC T-bar anchor tags treated with algaecide. Tagged fish were loaded onto hatchery stocking trucks along with the normal stocking load, allowed to mix, and were stocked as usual so that tag returns reflected normal stocking practices. We tried to distributed tags during spring and fall stocking events to capture the typical timing of stocking events and to more accurately characterize exploitation at these waters.

We calculated exploitation (fish harvested) and total use (harvested or caught but released) using tag return data according to the methods presented in Meyer et al. (2010) and Koenig (2012). For tags released in 2011, we used an average tag reporting rate of 48.9%. For tags released in 2012 and 2013, we used an average reporting rate of 38.2%, based on changes in tag reporting rate calculated from returns of $50 reward tags (Cassinelli and Koenig 2013). For this report, we calculated exploitation and total use for tags returned within 365 days of each release group for 2011, 2012 and 2013. Fish that were reported harvested only because they were tagged were not included. We calculated mean and median days at large (time until fish was caught or harvested) for all tags combined across release groups for each water body.

Therefore, mean days at large is presented for each water body as an average across all tags released and returned for 1 year since the date of release.

RESULTS

Between 2011 and 2013, approximately 14,810 tagged hatchery Rainbow Trout were released to collect data describing exploitation and total use across stocked waters of the Southwest Region. Tags were released in 27 waters, including 18 community ponds, two rivers, and seven reservoirs.

Across the 2011-2013 periods, average exploitation and total use for hatchery Rainbow Trout in Southwest Region community ponds was 43% and 58%, respectively. Days at large for stocked trout varied between community ponds, but trout were typically caught quickly after stocking (Figure 37-39). Across all community ponds and years, the median days at large was 25 days, but ranged from 3 to 57 days. For example, stocked trout were harvested quickly from Wilson Springs Pond and McDevitt Pond, but lasted much longer in Caldwell Rotary Pond (Figure 37). Trout were also caught quickly in Payette Greenbelt and Settlers pond, where the median days at large was only seven days.

Across the 2011-2013 periods, average exploitation and total use for Rainbow Trout in Region 3B lakes and reservoirs was 17% and 21%, respectively. For lakes and reservoirs, the median days at large for stocked Rainbow Trout was 83 days, but ranged from 22 to 128 days (Table 15). Days at large in lakes and reservoirs was much longer than community ponds, with most trout lasting several months before being caught (Figures 1-3).

During this same period, average exploitation and total use for the Boise River was 24% and 40%, respectively, while the median days at large was 20 days. Indian Creek showed similar results, with 24% exploitation and 45% total use, with the median days at large of 54 days (Table 15).

DISCUSSION

Longevity of stocked Rainbow Trout varied across different community ponds. For some ponds, the median days at large was 3-4 days (Wilson Springs, McDevitt ponds), indicating that most fish were caught quickly after stocking. These data suggest that patterns of catch and harvest may not be consistent between ponds, requiring ponds be managed individually for best results. Fishing regulations for Wilson Springs and McDevitt Ponds have subsequently been changed to a 2-trout limit to improve the length of time trout are available to anglers. Longevity of stocked trout in response to changes in fishing regulations at these ponds will be studied with tagged trout in 2014. Tag returns suggest stocked trout in Payette Greenbelt and Settlers pond are also caught quickly. As hatchery resources continue to be scarce, adopting a 2-trout limit at these ponds may improve the length of time that trout are available to anglers between stocking events.

Results from tag returns indicate good returns of hatchery Rainbow Trout at most lakes and reservoirs in the Southwest Region. Based on the tags released in 2012, returns from Arrowrock Reservoir indicate stocked Rainbow Trout are returning well to anglers. Data for Arrowrock are currently limited by the number of release groups. So far, only one release group has been at large for a full year (2012), so returns for 2013 are not yet fully complete. We expect returns for 2013 release groups to increase during the 2014 fishing season. We will have a better understanding of hatchery rainbow trout returns from Arrowrock Reservoir, as more tags are released by the Nampa Research Hatchery Trout Evaluation program. We recommend continuing to stock catchable Rainbow Trout in the fall. Our current spring stocking appears to be successful at Lucky Peak, Manns Creek and Sagehen reservoirs (Table 15). Harvest of stocked trout in these reservoirs is consistently over 25%, with total use often over 30%. Although returns may vary between seasons (Table 15), stocking appears to be providing good fishing based on tag return rates.

Mountain Home, Crane Falls and Succor Creek reservoirs had low returns of hatchery Rainbow Trout (10% or less, Table 15). These reservoirs have various water supply issues, which may explain poor returns. Mountain Home Reservoir suffers from irrigation-related draw down, but can provide good trout fishing when water conditions are favorable. Stocking should continue in years when water levels are expected to sustain trout for more than a few months. Return rates of stocked trout in Crane Falls Reservoir may be reduced as a result of high water alkalinity. The pump used to reduce alkalinity failed in winter 2012-2013, and alkalinity has subsequently increased, which may be affecting the performance of hatchery trout. Succor Creek Reservoir seems to consistently suffer from water withdrawal and very low angler use, which is reflected in the poor tag returns. Stocking here has already been discontinued.

Total use of hatchery Rainbow Trout in the Boise River was 49.9% on average, when January release groups were removed. Returns for January releases were consistently low, and January stocking has been canceled as a result. Otherwise, returns of hatchery trout in the Boise River are variable between months, but are usually strong and suggest a successful stocking program. Recently, IDFG began stocking Indian Creek near Kuna again in 2013. This is seasonal fishery dependent on irrigation flows. Average harvest and total use for April/June plants were 28% and 60%, respectively, suggesting spring stocking is very effective.

Tag reporting information suggests that hatchery Rainbow Trout from Arrowrock and Lucky Peak reservoirs are moving throughout the Boise River system. Two trout released in October 2012 in Arrowrock Reservoir were reported caught in the MF Boise River near the Willow Creek camp ground in summer 2013, while another from this same group was caught in Lucky Peak Reservoir in August 2013. A fourth fish stocked in May 2013 in Arrowrock Reservoir was caught in Lucky Peak Reservoir in November 2013, indicating some (unquantified) entrainment through Arrowrock Dam, and migration up the MF Boise River. Tagged Rainbow Trout stocked in Lucky Peak Reservoir have been caught below the dam as well. Two fish from the May 2012 stocking were caught in November 2013 below the reservoir, one in the New York Canal and one in the Boise River near the HW21 bridge. Two trout from the June 2013 stocking group were reported caught in the Boise River near Discovery Park and the HW21 bridge in October 2013. The total number of entrained fish is small compared to the total tags released, but they do indicate some low level of fish moving through Arrowrock and Lucky Peak dams, and moving into the Boise River above the reservoirs.

MANAGEMENT RECOMMENDATIONS

1. Continue stocking catchable Rainbow Trout in Indian Creek in spring.

2. Implement a 2-trout limit at Payette Greenbelt and Settler’s ponds to improve days at large of hatchery rainbow trout.

Table 15. Exploitation, total use (harvest and release), median, and mean days at large by water body and year. No reward tags were included. Days-at-large was summarized for each water body across all release groups by year.

Water Body	Tagging Date	NonRWD Released	Harvested	BT Harvested	Released	Adjusted exploitation	Adjusted total use	Mean D.A.L.	Median D.A.L.
Arrowrock R.	10/2/2012	398	33	3	0	20.9%	22.8%	162	176
Arrowrock R.	5/13/2013	458	9	1	3	4.9%	7.1%	44	37
Arrowrock R.	10/18/2013	713	16	2	1	5.6%	6.7%		
Big Trinity Lake	7/23/2013	100	0	0	0	0.0%	0.0%	-	-
Boise River	1/20/2011	160	1			1.2%	1.2%		
Boise River	7/26/2011	320	46	14	40	28.3%	61.5%	17	5
Boise River	10/18/2011	320	50	10	48	30.7%	66.4%		
Boise River	1/25/2012	423	5	0	5	3.0%	6.0%		
Boise River	7/2/2012	320	51	2	13	40.1%	51.9%	21	9
Boise River	10/11/2012	320	38	9	22	29.9%	54.3%		
Boise River	4/24/2013	200	14	0	7	17.6%	26.4%		
Boise River	6/19/2013	300	28	1	16	23.5%	37.8%	24	10
Boise River	8/12/2013	300	44	2	15	36.9%	51.2%		
Caldwell P.s #2	3/15/2012	36	6	0	0	42.0%	42.0%		
Caldwell P.s #2	6/4/2012	36	8	1	0	55.9%	62.9%	20	15
Caldwell P.s #2	10/12/2012	36	14	1	0	97.9%	104.9%		
Caldwell Rotary P.	4/6/2011	125	41	1	10	64.5%	81.9%	29	11
Caldwell Rotary P.	10/18/2011	125	29	4	6	45.7%	61.4%		
CJ Strike R.	5/30/2012	395	42	1	2	26.8%	28.7%	124	111
CJ Strike R.	10/25/2012	400	16	1	4	10.1%	13.2%		
Crane Falls R.	4/11/2012	200	16	1	4	20.1%	26.4%	36	28
Crane Falls R.	4/2/2013	200	2	0	0	2.5%	2.5%	36	36
Duff Lane P.	3/13/2013	25	3	0	0	30.2%	30.2%		
Duff Lane P.	4/10/2013	25	3	0	0	30.2%	30.2%	27	34
Duff Lane P.	5/20/2013	24	1	0	0	10.5%	10.5%		
Duff Lane P.	10/9/2013	25	0	0	0	0.0%	0.0%		
Eagle Island Park P.	4/6/2011	125	31	2	3	48.8%	56.7%	22	13
Eagle Island Park P.	10/19/2011	125	24	2	10	37.8%	56.7%		
Ed's P.	2/22/2012	25	9	0	0	90.6%	90.6%		
Ed's P.	5/9/2012	25	6	0	0	60.4%	60.4%	31	28
Ed's P.	10/10/2012	25	5	0	0	50.4%	50.4%		
Horseshoe Bend P.	4/19/2012	109	6	0	1	13.9%	16.2%	45	30
Horseshoe Bend P.	10/10/2012	125	10	3	2	20.1%	30.2%		
Indian Creek	4/11/2013	50	7	1	5	35.2%	65.5%		
Indian Creek	6/18/2013	50	4	1	6	20.1%	55.4%	48	51
Indian Creek	10/9/2013	50	3	0	0	15.1%	15.1%		
Kleiner P.	9/21/2012	10	6	0	1	151.1%	176.2%	75	58
Kleiner P.	4/25/2013	100	8	3	9	20.1%	50.4%	13	10
Lucky Peak R.	5/2/2012	600	70	15	8	29.4%	39.0%	110	71
Lucky Peak R.	5/3/2012	1199	47	5	17	9.9%	14.5%		
Lucky Peak R.	4/23/2013	800	68	7	14	21.4%	28.0%		
Lucky Peak R.	6/14/2013	399	57	5	3	36.0%	41.0%	79	60
Lucky Peak R.	6/18/2013	760	58	3	11	19.2%	23.9%		

Table 15. Continued.

Water Body	Tagging Date	NonRWD Released	Harvested	BT Harvested	Released	Adjusted exploitation	Adjusted total use	Mean D.A.L.	Median D.A.L.
Manns Creek R.	4/20/2011	793	19	4	2	4.7%	6.2%	100	88
Manns Creek R.	4/24/2012	800	90	8	5	28.3%	32.4%		
Manns Creek R.	5/15/2012	397	45	2	2	28.5%	31.1%	97	74
Manns Creek R.	10/16/2012	100	14	1	1	35.2%	40.3%		
Manns Creek R.	4/24/2013	300	36	2	3	30.2%	34.4%		
Manns Creek R.	5/20/2013	300	43	4	3	36.1%	42.0%	64	45
Manns Creek R.	10/2/2013	100	15	2	4	37.8%	52.9%		
McDevitt P.	4/6/2011	150	30	6	15	39.4%	66.9%	11	4
McDevitt P.	10/19/2011	125	17	1	5	26.8%	36.2%		
Mountain Home R.	10/12/2011	200	15	3	1	14.8%	18.7%	143	155
Mountain Home R.	5/9/2012	400	5	0	0	3.1%	3.1%	71	62
Parkcenter P.	2/14/2012	50	1	0	0	5.0%	5.0%		
Parkcenter P.	4/3/2012	50	6	1	6	30.2%	65.5%	22	15
Parkcenter P.	6/4/2012	50	6	1	1	30.2%	40.3%		
Parkcenter P.	10/12/2012	48	3	1	4	15.7%	42.0%		
Payette Greenbelt P.	4/10/2013	45	0	0	1	0.0%	5.6%		
Payette Greenbelt P.	5/20/2013	40	3	4	1	18.9%	50.4%	11	7
Payette Greenbelt P.	6/17/2013	44	6	0	0	34.3%	34.3%		
Payette Greenbelt P.	10/8/2013	45	6	0	2	33.6%	44.8%		
Quinn's P.	4/12/2013	50	2	0	0	10.1%	10.1%	30	30
Riverside P.	4/23/2013	70	10	0	2	36.0%	43.2%	19	11
Riverside P.	6/17/2013	50	12	0	0	60.4%	60.4%		
Sage Hen R.	6/8/2011	800	125	16	42	30.7%	45.0%	54	27
Sage Hen R.	5/23/2012	398	40	4	7	25.3%	32.3%		
Sage Hen R.	6/12/2012	700	63	7	11	22.7%	29.1%	82	45
Sage Hen R.	6/25/2012	400	32	0	6	20.1%	23.9%		
Sage Hen R.	5/21/2013	270	37	0	5	34.5%	39.2%	46	40
Sage Hen R.	7/15/2013	270	22	0	4	20.5%	24.2%		
Sawyers P.	2/22/2012	50	4	2	0	20.1%	30.2%		
Sawyers P.	4/19/2012	50	2	0	1	10.1%	15.1%	34	18
Sawyers P.	6/4/2012	50	2	0	2	10.1%	20.1%		
Sawyers P.	10/11/2012	50	3	0	1	15.1%	20.1%		
Settler's P.	4/12/2013	25	4	1	5	40.3%	100.7%	8	7
Succor Creek R.	5/23/2012	400	6	0	0	3.8%	3.8%	23	17
Ten Mile P.	4/23/2013	50	9	0	1	45.3%	50.4%		
Ten Mile P.	6/20/2013	25	9	1	0	90.6%	100.7%	25	9
Ten Mile P.	7/12/2013	48	6	0	0	31.5%	31.5%		
Ten Mile P.	7/31/2013	50	12	0	0	60.4%	60.4%		
Veteran's P.	4/11/2013	49	4	0	1	20.6%	25.7%	57	55
Wilson Springs P.	2/1/2011	199	90	5	12	89.0%	105.8%		
Wilson Springs P.	4/1/2011	200	63	1	11	62.0%	73.8%		
Wilson Springs P.	7/1/2011	99	20	9	12	39.8%	81.5%	6	2
Wilson Springs P.	8/1/2011	100	23	2	8	45.3%	64.9%		
Wilson Springs P.	10/1/2011	200	42	4	15	52.9%	76.8%		
Wilson Springs P.	2/1/2012	50	14	2	3	70.5%	95.7%		
Wilson Springs P.	4/20/2012	50	10	7	2	50.4%	95.7%	8	4
Wilson Springs P.	8/2/2012	50	12	0	1	60.4%	65.5%		
Wilson Springs P.	10/3/2012	50	10	0	5	50.4%	75.5%		
Wilson Springs P.	4/22/2013	80	14	1	10	44.1%	78.7%	6	4

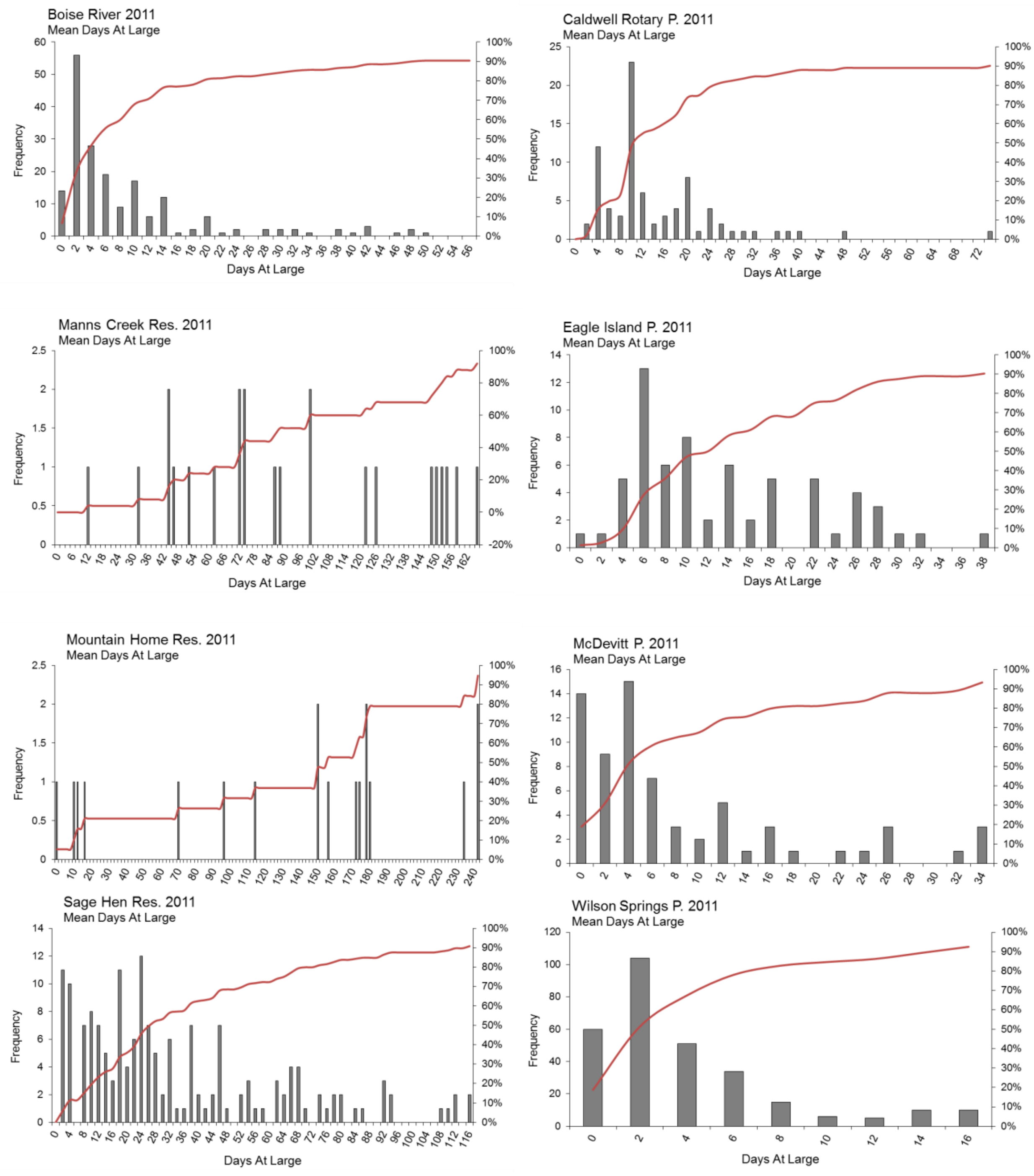


Figure 37. Mean days at large (black bars) and cumulative percent of tags returned (line) by water body for tagged hatchery Rainbow Trout released in 2011. Cumulative percent (secondary axis) refers to the percent of total tags returned, not the exploitation rate. Days at large are binned in groups of 2 days, with the label showing the minimum value (i.e. “4” is days 4-5).

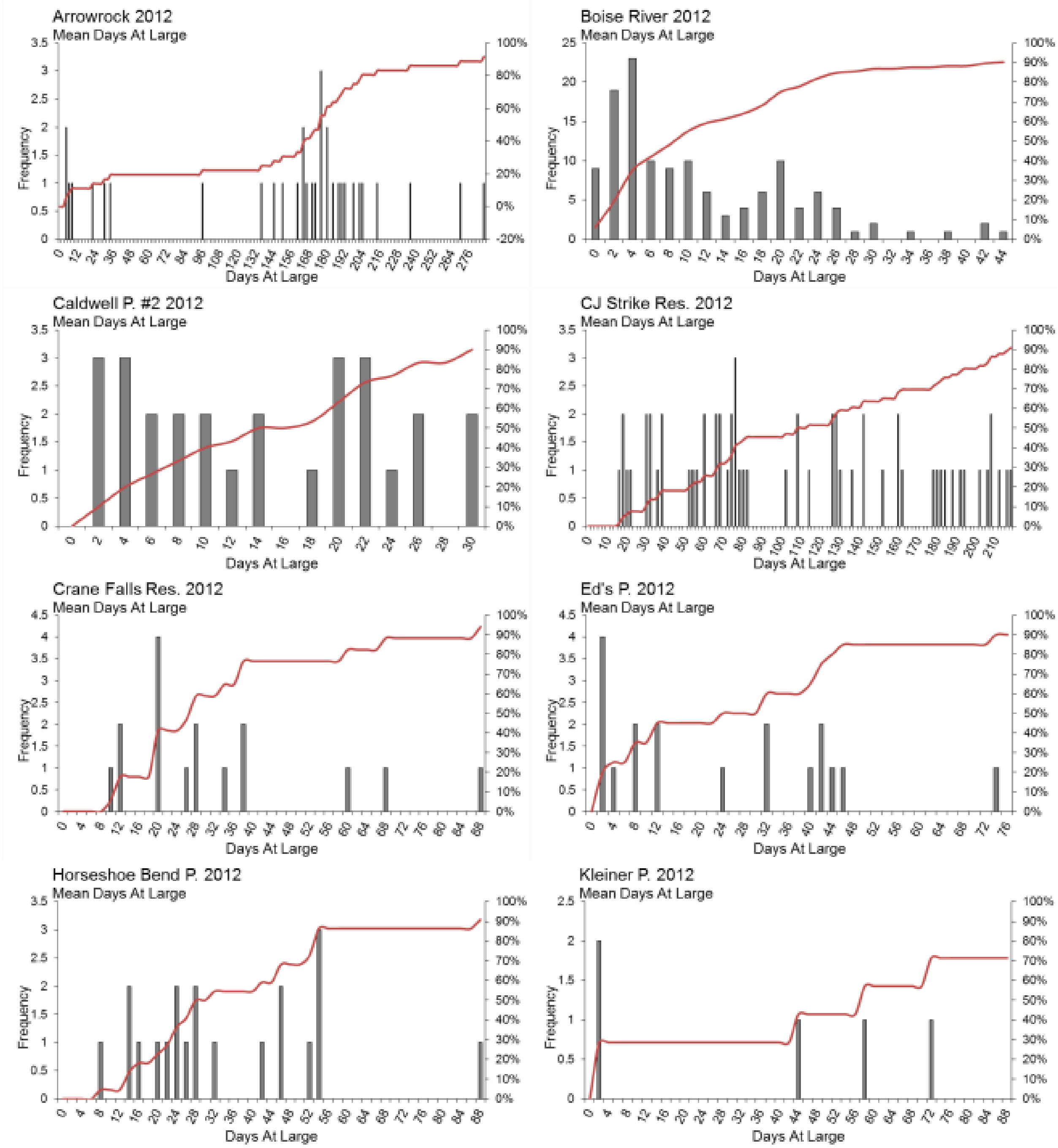
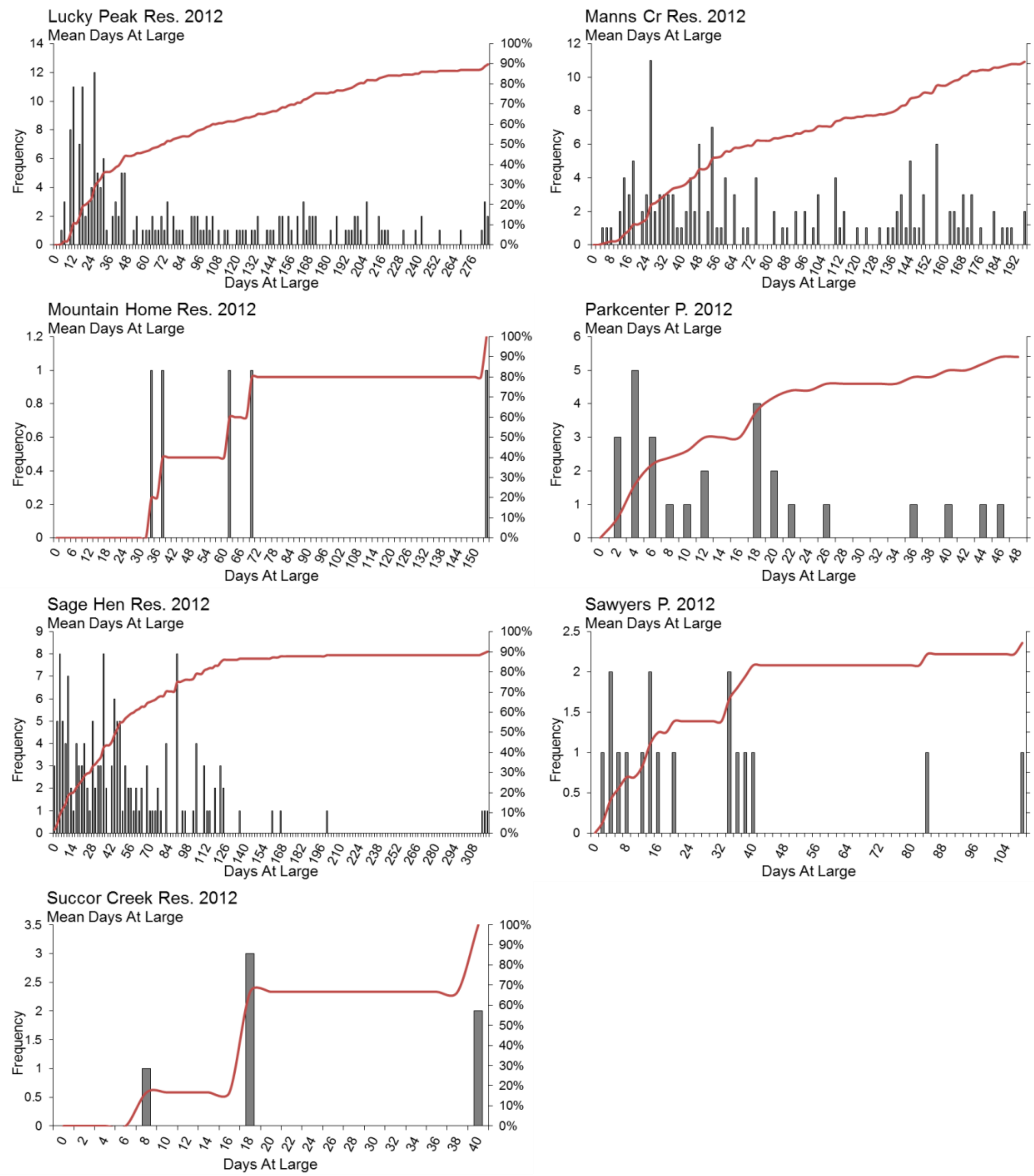


Figure 38. Mean days at large (black bars) and cumulative percent of tags returned (line) by water body for tagged hatchery Rainbow Trout released in 2012. Cumulative percent (secondary axis) refers to the percent of total tags returned, not the exploitation rate. Days at large are binned in groups of 2 days, with the label showing the minimum value (i.e. “4” is days 4-5).



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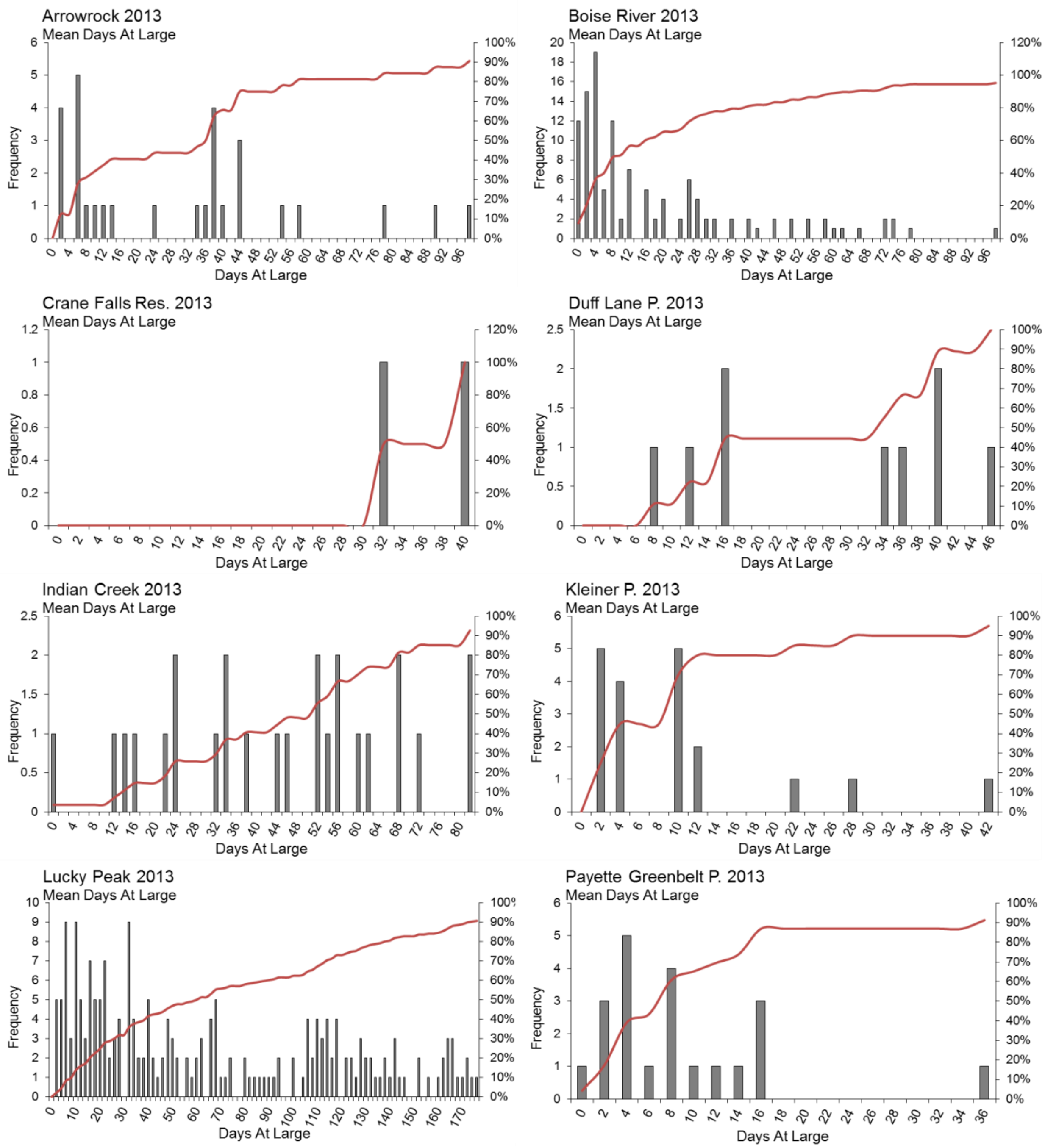

Figure 39. Mean days at large (black bars) and cumulative percent of tags returned (line) by water body for tagged hatchery Rainbow Trout released in 2013. Cumulative percent (secondary axis) refers to the percent of total tags returned, not the exploitation rate. Days at large are binned in groups of 2 days, with the label showing the minimum value (i.e. “4” is days 4-5).

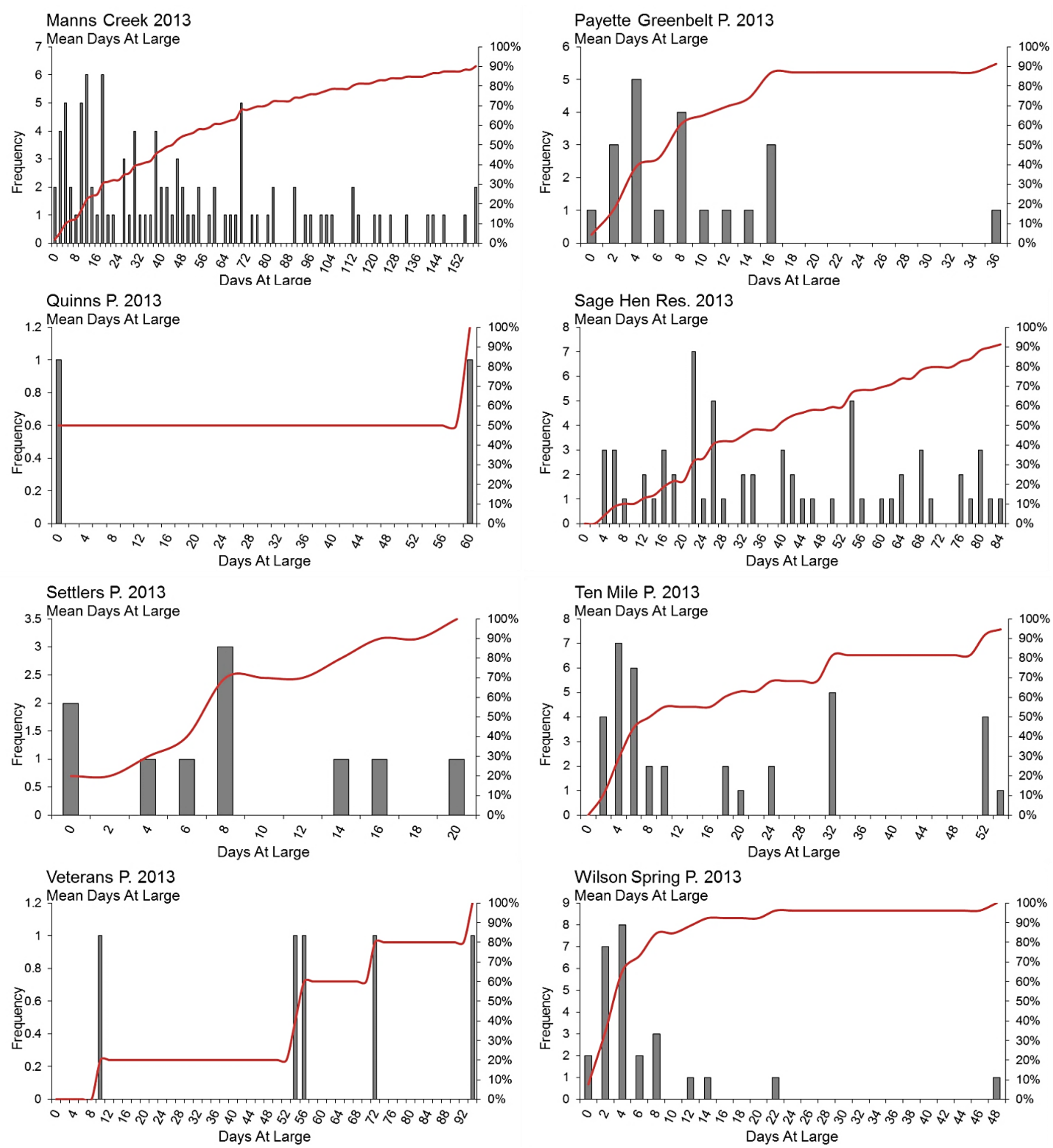

Figure 39. Continued.

ASSESSMENT OF LARVAL FISH PRODUCTION IN BROWNLEE AND CJ STRIKE RESERVOIRS

ABSTRACT

Regional staff sampled larval fish in Brownlee and CJ Strike reservoirs during 2013 to better understand factors affecting warm water fish recruitment, and to monitor trends in recruitment. Larval fish density was monitored using a horizontal Neuston trawl net near the waters' surface at 10 or 11 sites within each reservoir. Since 2005, average larval densities in Brownlee Reservoir during the week of maximum abundance have ranged from 5 to 264 Crappie/100 m^3, with an average of 75 Crappie/100 m^3 (n = 9). Densities during 2013 (10 Crappie/100 m^3) were well below the average (2005-2013). From 2005 to 2013, average larval densities in CJ Strike Reservoir during the week of maximum abundance have ranged from 1 to 57 Crappie/100 m^3, with an average of 16.4 crappie/100 m^3 (n = 9). Densities during 2013 (15.9 Crappie/100 m^3) were well above the densities documented during 2012 (3.6 crappie/100 m^3), and similar to average densities from previous years.

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INTRODUCTION

Fisheries for Black Crappie *Pomoxis nigromaculatus* and White Crappie *P. annularis*, Bluegill *Lepomis macrochirus*, and Yellow Perch *Perca flavescens* are popular among anglers in southwest Idaho when abundant. However, year-class strength for these vary widely between years, often leading to inconsistent fisheries. Year-class strength seems to be determined early at life stages, whether this occurs before or after the first winter is unknown. Fisheries personnel are interested in quantifying year-class strength before fish become vulnerable to anglers, so that anglers may be informed of potential fisheries quality. Monitoring larval fish densities with Neuston nets is one way to provide information on reproductive success and potential year-class strength, assuming recruitment isn't affected substantially by population bottlenecks at later life stages (e.g. survival during winter). Documenting years with low larval production could predict years of poor fishing two to three years later, when crappie would typically enter the fishery. Monitoring of year-class strength in Brownlee and CJ Strike reservoirs was conducted by IDFG's fisheries research personnel since 2005 as part of a statewide project. However, that project was discontinued by 2010, and Southwest Region staff have continued this work.

OBJECTIVES

1. Assess reproductive success of recreationally important warm-water fishes.

2. Determine abiotic factors that affect recruitment success

METHODS

Horizontal surface trawls were used to sample larval fish at 10 or 11 sites in Brownlee and CJ Strike reservoirs. Trawls were conducted throughout each of the reservoirs (Figure 40, 41) using a 1 m x 2 m x 4 m long Neuston net with 1.3 mm mesh. Trawling commenced at dusk and all sites were completed within three to four hours. Each trawl was 5 minutes in duration and we used a flow meter fitted to the net to estimate the volume of water sampled. The average water volume sampled was 394 and 255 m^3/tow at Brownlee and CJ Strike reservoirs, respectively. Trawls were made approximately bi-weekly beginning June 18 and ending July 17, 2013, which overlapped peaks of crappie production in previous years. Specimens were fixed in 10% formalin for 2 weeks then rinsed and stored in 70% ethanol. Sampled fish were viewed under a dissecting microscope, identified to species and measured for length. If the total number of larval fish exceeded 50 individuals, we randomly selected a subsample 50 individuals, identified and measured those, then counted the remainder and extrapolated to the whole sample.

RESULTS

Brownlee Reservoir

We conducted a total of 32 trawls across three sampling dates. Four species (or groups of species) were sampled including Bluegill, Channel Catfish, crappie *Pomoxis* spp., and Smallmouth Bass. Crappie were the most abundant group sampled, composing 100% of the identified fish on June 18, 95% on July 2, and 83% on July 16. Average density of Crappie was highest for July 2, our second sampling date (10 crappie/100 m^3). Site 10 had the highest density (65 Crappie/100 m^3) of any individual sample, which on July 2, the closest site to Brownlee Dam (Figure 42). During 2013, the highest density of larval fish were collected in the lower reservoir (sites 9-11), whereas lowest densities occurred in the upper reservoir (Figure 42). No larval Crappie were collected at sites 1, 2, and 4. Since 2005, average larval fish density in Brownlee Reservoir during the week of maximum abundance have ranged from 5 to 264 crappie/100 m^3 with an average of 75 crappie/100 m^3 (n = 9). Densities during 2013 (10 crappie/100 m^3) were well below the 2005-2013 average.

CJ Strike Reservoir

At CJ Strike Reservoir, we conducted 30 total trawls across three sampling dates. Bluegill, Largemouth Bass, Crappie, and Yellow Perch were all collected. During the first two sampling events, mean Crappie density was negligible (0 and 1 crappie/100 m^3 on June 19 and July 3, respectively), but increased to 16 crappie/100 m^3 on July 17. The highest count of larval crappie was collected on July 17 (648). Site 5 on the southern side of the main pool had the highest single density of larval Crappie (40 Crappie/100 m^3), which occurred on July 17 (Figure 43). For this sample, Crappie comprised 99% of the larval fish collected. From 2005 to 2013, average larval fish densities in CJ Strike Reservoir during the week of maximum abundance have ranged from 1 to 57 Crappie/100 m^3 with an average of 16.4 Crappie/100 m^3 (n = 9). Maximum laval fish densities during 2013 (15.9 Crappie/100 m^3) were similar to the long term average, but above those found recently in 2012 (3.6 Crappie/100 m^3).

DISCUSSION

Production of larval crappie in large reservoirs in the Southwest Region shows high spatial and temporal variation. Similar to 2012, larval fish production was again asynchronous among reservoirs during 2013. For instance, larval production in Brownlee Reservoir was well below average since monitoring began eight years ago (9 sample periods). During 2013, the majority of larval fish were collected in the lower reservoir near the dam. This was opposite from 2012 data, which suggested most of the larval fish were produced in the upper reservoir (Figure 42). The distribution of larval fish density suggests little recruitment occurred in the upper reservoir in 2013. Past data have shown crappie year class strength may be correlated to high densities of larval fish in the upper reservoir. It is possible that larval crappie produced in the lower reservoir suffer high entrainment rates, though it is difficult to substantiate this hypothesis. If true, Crappie recruitment may depend largely on production in the upstream portion of the reservoir, suggesting that 2013 may be a poor year for Crappie production.

Larval fish production in CJ Strike Reservoir during 2013 was near average for this system, but the distributional pattern was quite different from previous years. Typically, the highest densities of larval fish are found in the Bruneau Arm. However, samples here were at the low end of their expected range. In contrast, samples from the Main Pool and Snake Arm sites were much higher than previous years sampling in these areas. These observations are despite what were thought to be relatively good spawning conditions caused by high inflows from the Bruneau River. Given that previous strong year classes of Crappie were associated with high larval fish densities in the Bruneau Arm, we do not anticipate strong Crappie fishing from the 2013 Crappie production.

MANAGEMENT RECOMMENDATIONS

1. Collect age structure data from harvested Crappie at Brownlee and CJ Strike reservoirs.

2. Explore alternative methods to monitor Crappie year class strength, such as using otter trawls to document relative abundance of advanced age-0 and age-1 Crappie.

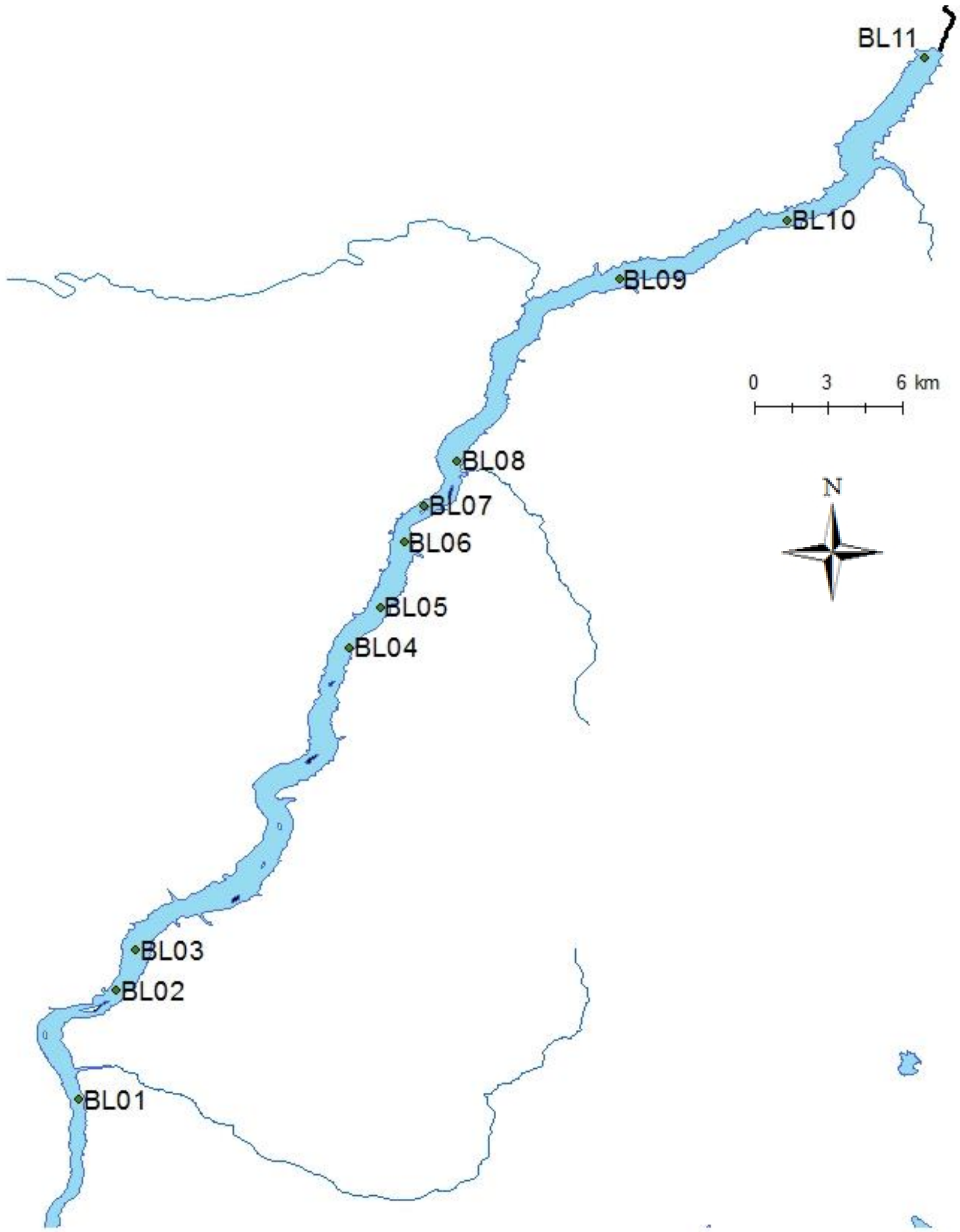

Figure 40. Location of 11 trawl sites used to index the abundance of larval fish in Brownlee Reservoir from 2005-2013.

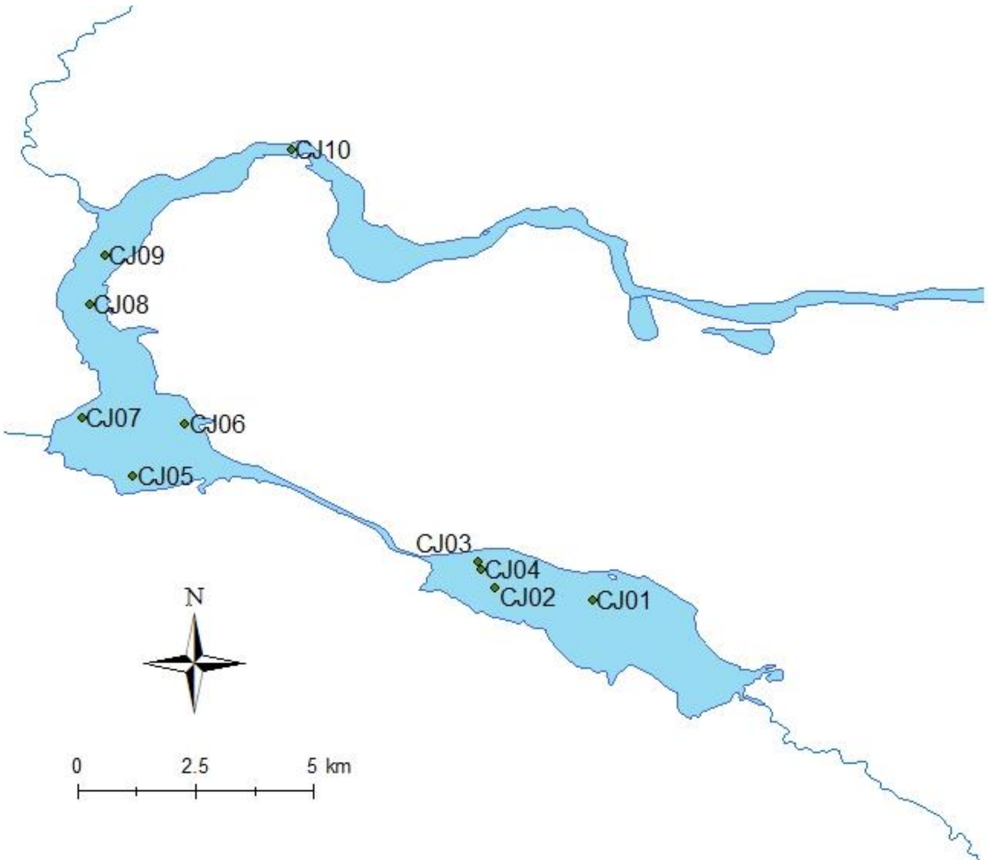

Figure 41. Location of 10 trawl sites used to index the abundance of larval fish in CJ Strike Reservoir from 2005-2013.

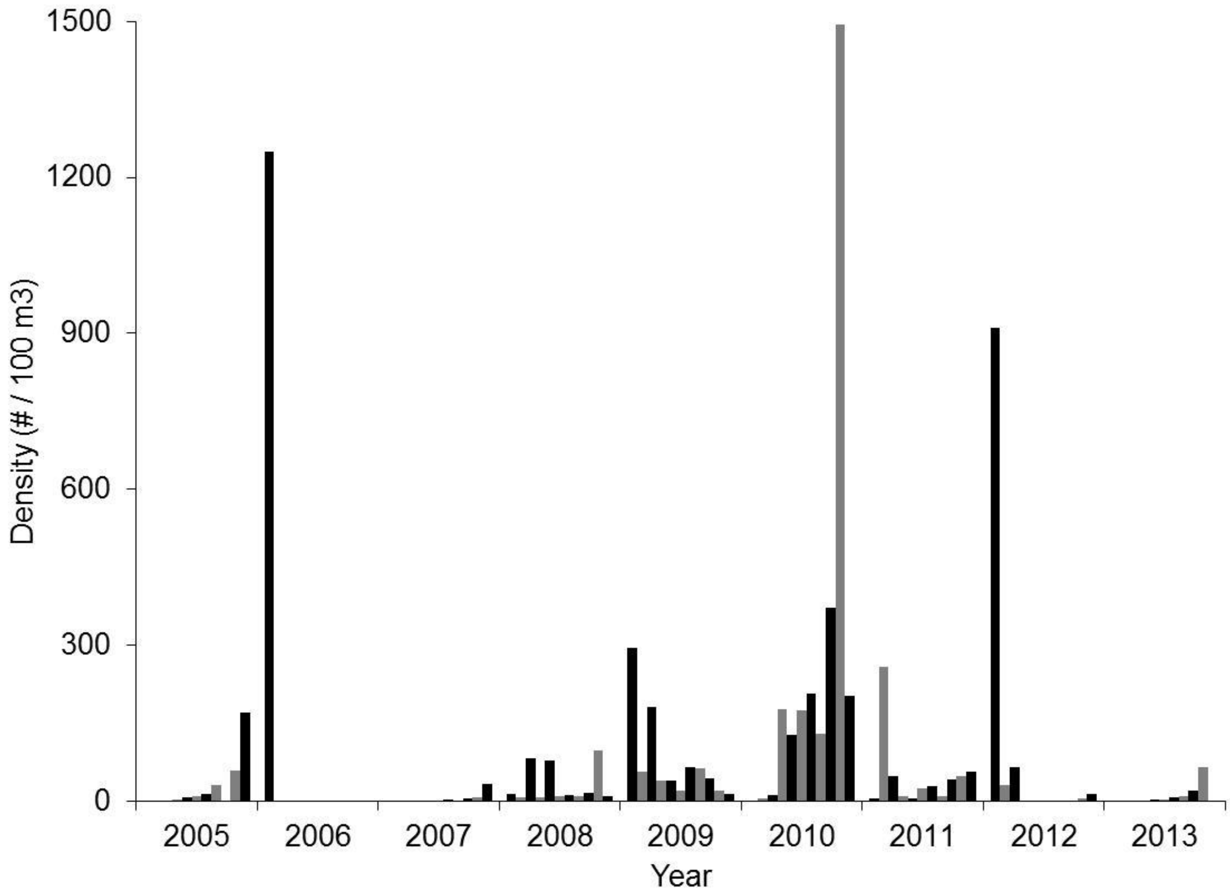

Figure 42. Densities of larval crappie (#/100 m^3) in Brownlee Reservoir during 2005 through 2013. Bars within each year represent 11 individual sites. Site 1 (upstream) through site 11 (near Brownlee Dam) are displayed from left to right within each year.

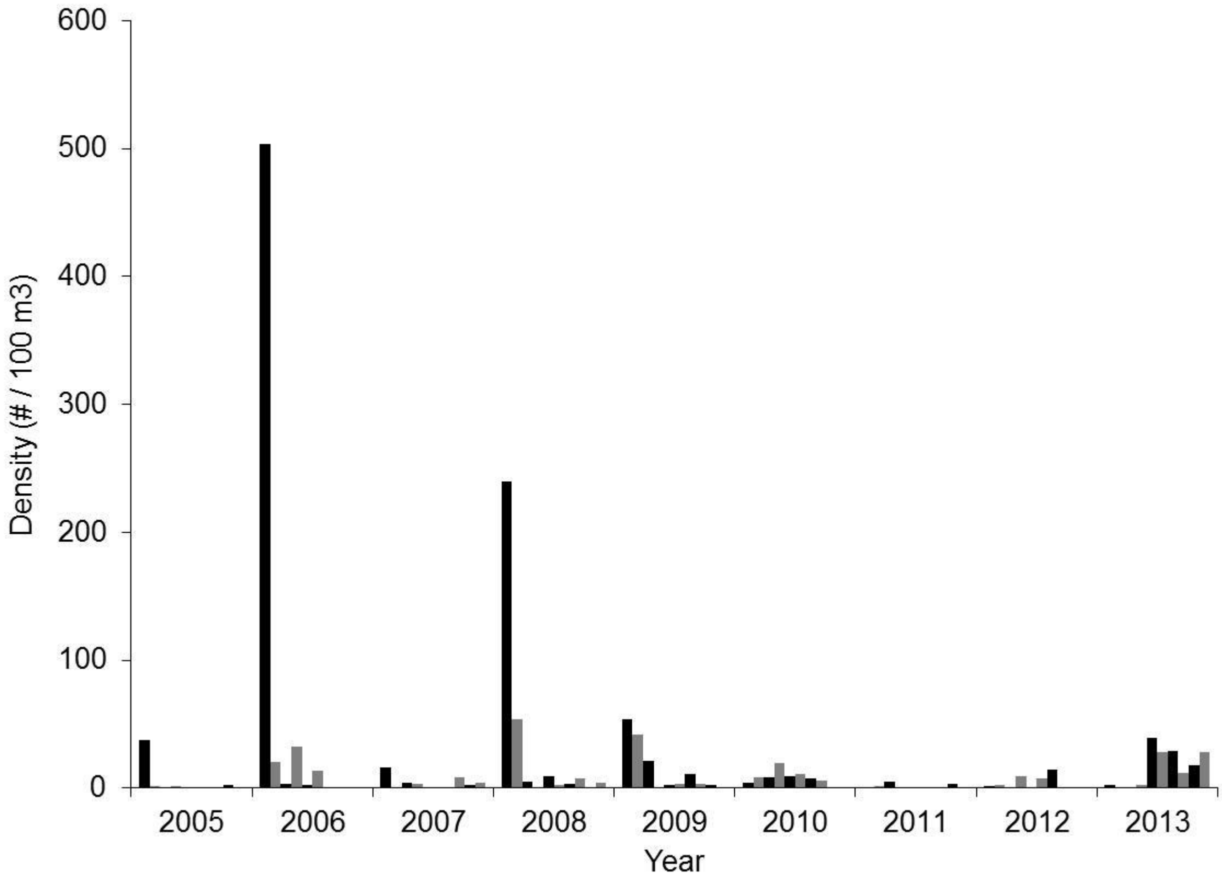

Figure 43. Densities of larval crappie (#/100 m^3) measured in CJ Strike Reservoir during 2005 through 2013. Bars within each year represent 10 individual sites. Sites 1 through 10 are displayed from left to right within each year.

RIVERS AND STREAMS INVESTIGATIONS

LOWER BOISE RIVER ELECTROFISHING SURVEY

ABSTRACT

The lower Boise River flows through the center of the Treasure Valley, including the Boise metropolitan area. In the upstream coldwater portion of the river from Lucky Peak Reservoir to Star, the fish community includes Rainbow Trout *Oncorhynchus mykiss*, Brown Trout *Salmo trutta,* Mountain Whitefish *Prosopium williamsoni*, sculpin *Cottus sp.* and several other species. Standardized monitoring sites were established in 2004 to estimate abundance and size structure of wild Rainbow Trout, Brown Trout, and Mountain Whitefish in the lower Boise River between Barber Park and the East Parkcenter Bridge. These sections are scheduled to be sampled every three years. Approximately 3.5 km of the lower Boise River was sampled in four sites with electrofishing gear in 2013. We captured 1,108 wild Rainbow Trout, 17 hatchery Rainbow Trout, 288 Brown Trout, 16 hatchery Brown Trout, and 755 Mountain Whitefish at four sites during the 2013 electrofishing survey. Rainbow Trout lengths ranged from 86 to 560 mm, with a mean of 209 mm across the sites. Wild Rainbow Trout abundance estimates were 2,426 $\pm$ 569 (90% CI) and 5,534 $\pm$ 3,173 for the middle and upper sites, respectively. Wild Rainbow Trout abundance estimates have stabilized after experiencing remarkable increases during the past two decades. Rainbow Trout density decreased slightly from 8.3 fish/100 m^2 in 2010 to 6.6 fish/100 m^2 in 2013.

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INTRODUCTION

The lower Boise River segment of the Boise River watershed begins at Lucky Peak Dam and continues for 103 km (64 mi) to its confluence with the Snake River near Parma, Idaho. The river flows through a variety of urban and agricultural settings and has been heavily affected by associated land and water uses (MacCoy 2004). Flows are regulated for both agricultural demands and flood control; while channel alteration has occurred throughout the system. Higher than natural flows generally occur between April and September (mean = 48 m^3/s) and lower than natural flows occur between October and March (mean = 14 m^3/s). Furthermore, there are approximately 28 diversions along the Boise River that supply water to various irrigation districts. There are approximately fourteen major water inputs to the Lower Boise River, including drains or tributaries, water treatment facilities, and irrigation returns. The surrounding land and water use practices have resulted in significant impacts on water quality and biological integrity from sediment, nutrient, and increased water temperature (MacCoy 2004). Fish and invertebrate composition of the river shifts from coldwater species communities in the upper segments above Glenwood Bridge, to a warmwater assemblage near Middleton and downstream to the Snake River.

The lower Boise River and its riparian corridor are largely valued for irrigation, recreation, and the inhabiting fish and wildlife. The Clean Water Act of 1977 and the resulting temperature and suspended sediment criteria acted as a catalyst for initiating water-quality improvements on the river. During the past 20-30 years, various agencies have attempted to address many of the water quality issues by improving agricultural and waste water practices.

The lower Boise River flows through the center of the Boise metropolitan area and the fishery experiences substantial angler pressure (Kozfkay et al. 2010). Species include Rainbow Trout *Oncorhynchus mykiss*, Brown Trout *Salmo trutta,* Mountain Whitefish *Prosopium williamsoni*, and sculpin *Cottus sp.* in the upstream coldwater portion of the river. The assemblage transitions to a warmwater community near Middleton, Idaho where Smallmouth Bass *Micropterus dolomieui*, Channel Catfish *Ictalurus punctatus*, and Common Carp *Cyprinus carpio* are found more frequently.

IDFG currently stocks approximately 40,000 catchable Rainbow Trout and 20,000 fingerling Brown Trout on an annual basis (Table 16). Rainbow Trout are stocked at 10 locations from Barber Park downstream to the Star Bridge. Annual exploitation on hatchery Rainbow Trout varies by location, from a low of 13% ± 9% in the Eagle North Channel location to 31% ± 11% at the Glenwood Bridge location (see regional return-to-creel summary chapter, this report). A year-long creel survey indicated that 33,056 h were expended from Barber Dam to Americana Bridge (Kozfkay et al. 2010). An estimated 20,704 (± 4,068) Rainbow Trout were caught, and the release rate of Rainbow Trout was 79%. Combining the 2007 population and creel survey estimates, annual exploitation of wild Rainbow Trout was approximately 5% of the population.

Standardized monitoring sites were established in 2004 to monitor populations of wild Rainbow Trout, Brown Trout, and Mountain Whitefish in the lower Boise River between Barber Park and the East Parkcenter Bridge. These sections are scheduled to be sampled every three years. Prior to 2004, non-standardized sampling efforts captured few wild trout and anecdotal information suggests that the number of wild Rainbow Trout *Oncorhynchus mykiss* and Brown Trout *Salmo trutta* in the river has improved over the last 20 years. Wild Rainbow Trout in particular has increased nearly seventeen-fold between 1994 and 2010 (Kozfkay et al. 2011).

The increase in wild trout abundance coincides with the establishment of minimum winter flows of 7 m^3/s in the mid-1980s. Wild trout populations were also likely enhanced by water quality improvements and an increase in catch-and-release practices over the same period.

METHODS

Trout and Mountain Whitefish populations in the lower Boise River have been monitored every three years since 2004 at two sites between Barber Park and the East Parkcenter Boulevard Bridge (Hebdon et al. 2009; Flatter et al. 2011). The upper site begins at the first diversion below Barber Park and continues down to the Loggers Creek diversion, less than 50 m upstream from the West Parkcenter Boulevard Bridge (Figure 44). The middle site starts at the Canal diversion and stops downstream at the first riffle downstream of the confluence of Heron Creek. This site is within the reach managed with quality trout regulations (2-trout bag limit, none less than 360 mm).

Additionally, IDFG added two single-pass sites to be sampled farther downstream on a rotating basis. In 2013, both the north and south channels of the Boise River near adjacent to Eagle Island State Park were sampled. Site length was determined from 1:24,000 km topographic maps. Approximately 3.5 km of the lower Boise River was sampled in four sites with electrofishing gear in 2013 (Figure 44). Site lengths ranged from 650 to 998 m (Table 17). Wetted widths were measured with a hand-held laser range finder (Leupold RX series). Site area was estimated by multiplying the mean width (n = 10) and site length. For braided channels mean width was measured across the river excluding any distances across islands.

We used mark-recapture techniques to estimate abundance of trout and Mountain Whitefish in the upper and middle trend sections while the Eagle North and South Channel sections were single passes for trout composition and size distributions. Fish were collected with a canoe electrofishing unit consisting of a 5.2 m Grumman aluminum canoe fitted with three mobile anodes connected to 15.2 m cables. Surveys conducted prior to 2013 utilized two mobile anodes. The canoe served as the cathode and carried the generator, Midwest Lake Electrofishing Systems (MLES) Infinity electrofisher, and a livewell for holding fish. Oxygen was introduced to the live well (2 L/min) through an air-stone. Pulsed direct current was produced by a 5,000 watt generator (Honda EG500X). Frequency was set at 25-30 pulses per second with a power output of 1,700-2,300 watts. Crews consisted of nine to twelve people. Three operators managed the mobile anodes, one person guided the canoe and operated the safety switch controlling the output, the remaining crew of four or five people were equipped with dip nets to capture stunned fish. Only trout and whitefish were placed in the livewell.

Marking and recapture runs were conducted with a single pass from upstream to downstream. The canoe was held upstream of the anode operators. Anodes were swept through the water or thrown across the stream and retrieved. Crews with dip nets walked backward facing upstream, while staying downstream of the anodes and capturing stunned fish. Fish were placed in the livewell and when the livewell was judged to be at capacity, the crew stopped at the nearest riffle to process fish.

The upper and middle sites on the lower Boise River were sampled between October 29 and November 5, 2013. Fish were identified, enumerated and measured for total length (mm) and weighed (g). Brown Trout were examined for clipped adipose fins, indicating hatchery origin, to gauge the success of the fingerling stocking program. Rainbow Trout, Mountain Whitefish and Brown Trout $\geq$100 mm were marked in the upper and middle sites on October 29 and 30, respectively. Estimates for Mountain Whitefish were only conducted in the upper site.

Nearly 100 Mountain Whitefish were collected in the south channel site to estimate size distribution. Fish were marked with a 7-mm diameter hole from a standard paper punch on the upper and lower section of the caudal fin and anal fin, corresponding to their capture reach. Fish were released 50 to 100 m upstream from the processing site to prevent downstream displacement or resampling. Recapture sampling was completed on November 4 and 5. During the recapture effort all whitefish and trout greater than 100 mm were captured and placed in the livewell. Fish were examined for marks on the caudal fin. All recaptured fish were measured for length (mm). The north and south channels of the Boise River near Eagle were sampled on November 13, 2013.

To account for size-selectivity of electrofishing gear, population estimates (*N*) were calculated using a maximum likelihood estimation to fit the recapture data. A capture probability function was calculated as

$$Eff = (exp(-5+\beta_1 L+ \beta_2 L^2)) /(1+ exp(-5+\beta_1 L+ \beta_2 L^2))$$

where *Eff* is the probability of capturing a fish of length L, and β_1 and β_2 are estimated parameters (MFWP 2004). Then *N* is estimated by length group where *M* is the number of fish marked by length group.

$$N = M / Eff$$

Population estimates were calculated for each reach and pooled for a comprehensive estimate expressed as # fish/100 m^2 for comparison to previous surveys. Trout population estimates ($\check{N}$) for surveys from which mark-recapture numbers were not adequate to use log-likelihood, were estimated using the modified Petersen equation for fish $\geq$100 mm

$$\check{N} = [((M+1)*(C+1)) / (R+1)] - 1$$

where *M* is the number of fish marked, *C* is the number of fish captured and *R* is the number of fish recaptured. Population estimates, length frequencies, and species composition were compared to results reported from prior surveys (Kozfkay et al. 2011; Hebdon et al 2009; Flatter et al. 2011; Allen et al. 2000).

To characterize the size distribution of Rainbow and Brown Trout captured during the survey and make trend comparisons between surveys, proportional size distribution (PSD) was calculated as

$$PSD - X = \frac{Number\ of\ fish\ \geq specified\ length}{Number\ of\ fish\ \geq 250\ mm} \times 100,$$

where *X* was calculated for 305, 356, and 406-mm fish (Neumann et al. 2012). A minimum stock length of 250 mm is recommended for Rainbow Trout in lotic environments, but was used for both species to simplify results (Simpkins and Hubert 1996).

RESULTS

We captured 1,108 wild Rainbow Trout, 17 hatchery Rainbow Trout, 288 Brown Trout, 16 hatchery Brown Trout, and 755 Mountain Whitefish at four sites during the 2013 electrofishing survey (Table 17). We estimated wild Rainbow Trout abundance as 2,426 + 569

(90% CI) in the middle site and 5,534 + 3,173 in the upper site. Hatchery Rainbow Trout comprised just a small proportion of the catch during the survey; and therefore, population estimates were not calculated (Table 17). Wild Rainbow Trout made up approximately 78% of the trout caught in the four sites (Table 17). Rainbow Trout lengths ranged from 86 to 560 mm, with a mean of 209 mm (Figure 45). Nearly 44% of all wild Rainbow Trout were captured in the south channel site despite it being a single pass and relatively short reach. Approximately 70% of these fish were less than 200 mm. PSD-305 mm and PSD-356 mm were highest at the upper and middle sites, and both sites were fairly similar (Figure 46). However, PSD-406 mm for was highest in the north channel and middle sites.

Brown Trout made up 20% of the trout captured in 2013 (Table 17). Brown Trout lengths ranged from 80 to 625 mm, with a mean of 192 mm (Figure 47). The north channel site yielded the highest catch of Brown Trout (n = 204). Brown Trout length in the north channel ranged from 85 to 353 mm with a majority of fish (91%) under 200 mm, suggesting the north channel is an important rearing area and possibly spawning area (Figure 47). We estimated abundance of wild Brown Trout to be 337 $\pm$ 39 (90% CI) in the middle site, but were unable to estimate abundance in the upper site due to limited sample size (Table 17). Hatchery Brown Trout were a small component of the population in 2013 (n = 16; Table 17).

Mountain Whitefish were the predominant fish collected in terms of numbers observed at all sites, but fish were only collected at the upper and south channel sites. Total lengths for Mountain Whitefish ranged between 130 to 490 mm, and size distribution at the two sites was similar (Figure 48). We estimated abundance of Mountain Whitefish in the upper site to be 5,534 $\pm$ 3,173.

DISCUSSION

Wild Rainbow Trout abundance has appeared to stabilize after experiencing remarkable increases during the past two decades. Density estimates decreased slightly from 8.3 fish/100 m^2 in 2010 to 6.6 fish/100 m^2 in 2013 (Table 18). Abundance estimates in the middle site showed a statistically insignificant decrease from 3,210 $\pm$ 2,093 to 2,426 $\pm$ 569 over the same period (Figure 50). Wild Rainbow Trout densities are still more than double that which were measured prior to 2010.

Rainbow Trout length structure has varied over time and location. Since 2004, the PSD for three length categories appears to be increasing, particularly in the upper and middle sections. Although Rainbow Trout densities declined slightly, PSD-305 mm increased from 33% to 51% between 2010 and 2013. PSD-356 mm and PSD-406 mm slightly increased as well.

Hatchery Rainbow Trout remained a very small proportion of the catch, despite stocking 200-500 hatchery trout on a monthly basis near the areas surveyed. This low abundance of hatchery Rainbow Trout can be attributed mainly to poor survival of stocked fish beyond 14 days (High and Meyer 2009). Additionally, stocked catchables in the Boise River experience a mean angler use rate of 26% (harvested plus released fish), which is relatively high for river environments in Idaho (Cassinelli and Koenig 2013).

Wild Brown Trout abundance appears to be slowly increasing over time and is much lower than Wild Rainbow Trout abundance (Figure X). Since 1994, wild Brown Trout density has increased from 0.09 to 0.9 fish/100 m2 (Table 18). More recently, wild Brown Trout density has increased from 0.2 fish/m2 in 2010 to 0.9 fish/m2 in 2013. Although the mark-recapture population estimate increased for Brown Trout in the upper section, it has a wide confidence interval because of a small sample size (n = 9).

One of the more interesting findings for Brown Trout was from the single-pass shocking in the North Channel of the Boise River. Over 70% of all Brown Trout captured in 2013 were collected in this site (Table 17). The majority of these fish (91%) were juvenile fish ($\leq$200 mm), suggesting the area functions as Brown Trout rearing habitat and possibly as a spawning area (Figure 47). Habitat characteristics such as slower velocities and an abundance of large woody debris within the channel likely make the area particularly suitable for rearing juvenile Brown Trout.

Since 2009, approximately 86,000 adipose-clipped hatchery Brown Trout have been stocked into the Boise River (Table 16). However, only 16 hatchery Brown Trout were captured during the 2013 survey, most of which, based on size distribution, appear to have been stocked in 2013. Our inability to detect fish stocked in previous years suggests there may be poor long-term survival of hatchery-reared Brown Trout. However, only a small percentage of the river is actually being sampled during our triennial surveys. Additionally, several factors may have negatively influenced the immediate survival of stocked fish in previous years. Nearly every year prior to stocking, Brown Trout reared at Nampa State Fish Hatchery have experienced a great deal of density-related mortality prior to stocking. This has often forced the stocking of fish during periods when fish are stressed or in poor health. Transportation mortality was particularly apparent during 2010, which has resulted in reducing hauling density in subsequent years. Additionally, during 2010-2012, stocking has occurred while river flow was high (40 m^3/s). By comparison, river flow was moderate (23 m^3/s) when fish were stocked in June 2013. Finally, the actual number of Brown Trout stocked in the Boise River has been consistently below the default requests. From 2009-2012, the default request was 20,000 fish. During that period, actual numbers stocked ranged from 6-25% below the stocking request due to the aforementioned hatchery mortality. In 2013, the default request was increased to 40,000 fish, although only half of that was actually stocked in 2013, as NSFH experienced a high mortality rate from egg to stocking. The Brown Trout program has been somewhat costly in terms of available hatchery space, and although it is very popular with anglers, it will need to be evaluated further. Hatchery and regional staff need to determine how to improve survival and consistency of the fish. Additional time is needed to determine if stocking hatchery Brown Trout will improve the fishery in the lower Boise River. Stocking hatchery Brown Trout will be eliminated if low in-hatchery and post-stocking survival continues.

In 2012, IDFG Southwest Region personnel obtained a new electrofishing control unit, the MLES Infinity. Based on anecdotal evidence of larger trout evading capture when anodes were on separate stream banks, a third anode was added to cover the middle of the stream. During 2012 South Fork Boise River estimates, capture efficiency drastically improved with the addition of a third anode as compared to previous surveys with two, particularly for fish $\geq$325 mm (Butts et al. 2013). Efficiency curves calculated for the 2010 and 2013 Lower Boise River surveys show that capture efficiency for Rainbow Trout has increased with the addition of a third probe and new electrofishing unit. Increases were noted for all length groups (Figure 51). Capture efficiency increased with fish length, particularly for fish $\geq$250 mm. In 2010, efficiency estimates plateaued at 250 mm while efficiency continued to increase with fish length in 2013. As with previous surveys, efficiency for smaller trout is due in part to differences in how intensely individual anode operators were sampling shoreline areas. Additionally, efficiency is also related to the number or tenacity of netters per anode. In 2013, during the marking run in the upper section, total numbers of fish marked were negatively affected by a number of inexperienced volunteer netters and a fair number of fish were missed. Both issues suggest areas for improvement to further standardize surveys in order to narrow confidence intervals around point estimates. Despite these concerns, estimates were corrected for capture efficiency and are reasonably precise for tracking trends in wild trout abundance in medium-sized rivers.

Wild Rainbow Trout population abundance plateaued in 2010 in the lower Boise River after over two decades of population increases. The remarkable increase in wild trout abundance coincided with the establishment of a minimum winter flow in the mid-1980s. Low winter flows have been shown to inhibit survival of juvenile trout in numerous systems (Hurst 2007; Mitro 2002). In addition, water quality has improved and catch-and-release practices have become more prevalent during the same period. Abundance appeared to decline slightly in 2013. There is no reason to suspect that this slight decline in abundance is more than normal fluctuation or sampling variation. A better understanding of the trout population dynamics in the lower Boise River would be improved by further examination of flows, identifying spawning and rearing location, as well as assessing entrainment in canals and the impacts of channel simplification.

MANAGEMENT RECOMMENDATIONS

1. Continue population monitoring in the upper and middle sections every three years.

2. Collect additional information to determine the contribution of hatchery Brown Trout to the overall population of Brown Trout.

3. Assess exploitation of wild trout throughout the Lower Boise using the Tag-You're-It Program.

Table 16. Numbers and strain of hatchery fish stocked in the Boise River, Idaho between 2009-2014.

Species (Hatchery strain)	2009	2010	2011	2012	2013	Total
Brown trout	15,010	18,713	16,785	15,000	20,413	85,921
Rainbow trout (Hayspur 2n)	-	-	-	-	5,026	5,026
Rainbow trout (Hayspur 3n)	5,881	5,480	-	8,568	6,587	26,516
Rainbow trout (Troutlodge 3n)	48,804	63,933	45,952	28,728	2,405	189,822
Rainbow trout (unspecified 2n)	-	-	-	-	20,674	20,674
Steelhead	1,665	1,000	999	550	200	4,414
Spring/Summer Chinook	959	400	-	-	369	1,728

Table 17. Numbers fish captured during electrofishing population surveys in the Boise River, Idaho during October 2013. Mark-recaptures population estimates were conducted in the upper and middle sites while single pass estimates were conducted in the north and south channels near Eagle Island State Park.

Section (Site length)	Species	No. Captured	No. Marked	No. Captured	No. Recaptured
Upper	Rainbow trout (wild)	118	117	108	5
(998 m)	Rainbow trout (hatchery)	6	6	5	1
	Brown trout (wild)	3	3	6	-
	Brown trout (hatchery)	6	6	5	-
	Mountain whitefish	523	492	145	35
Middle	Rainbow trout (wild)	241	239	99	15
(963 m)	Rainbow trout (hatchery)	4	4	2	-
	Brown trout (wild)	24	23	19	4
	Brown trout (hatchery)	3	3	2	-
North	Rainbow trout (wild)	42	-	-	-
Channel	Brown trout (wild)	204	-	-	-
(843 m)	Largemouth bass	15	-	-	-
	Black crappie	1	-	-	-
South	Rainbow trout (wild)	500	-	-	-
Channel	Brown trout (wild)	32	-	-	-
(650 m)	Mountain whitefish	87	-	-	-
	Largemouth bass	9	-	-	-

Table 18. Density estimates (fish/100m2) for wild Rainbow Trout, wild Brown Trout, and Mountain Whitefish in the middle section of the lower Boise River, 1994-2013.

	Density (fish/100m^2)		
Year	Rainbow Trout (wild)	Brown Trout	Mountain Whitefish
1994	0.47	0.09	0.8
2004	3.5	1.2	5.53
2007	3.3	0.6	8.15
2010	8.3	0.2	7.41
2013	6.6	0.9	9.1

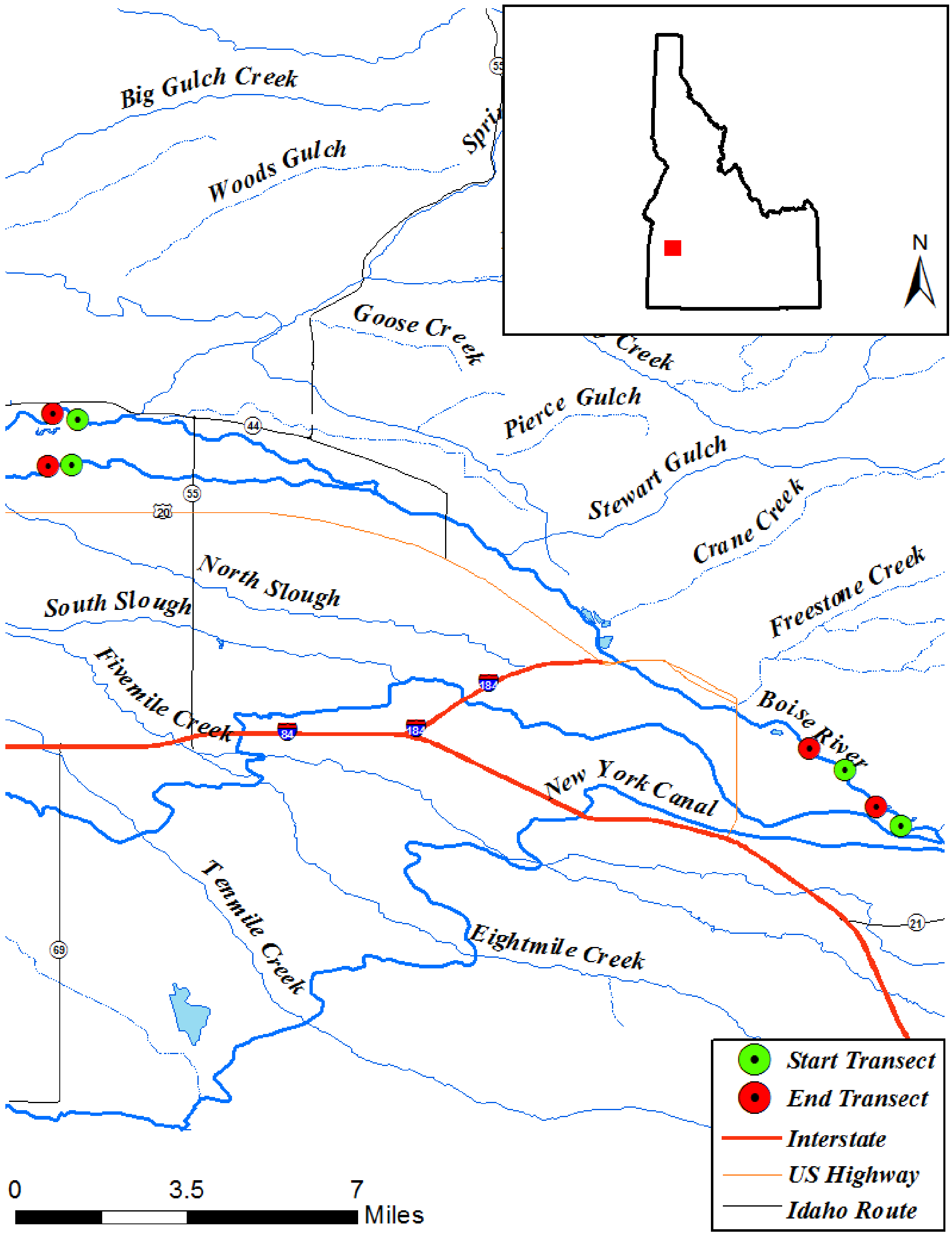

Figure 44. Map of the lower Boise River, Idaho sampling sites showing boundary sections for the 2013 upper, middle, North, and South channel sites.

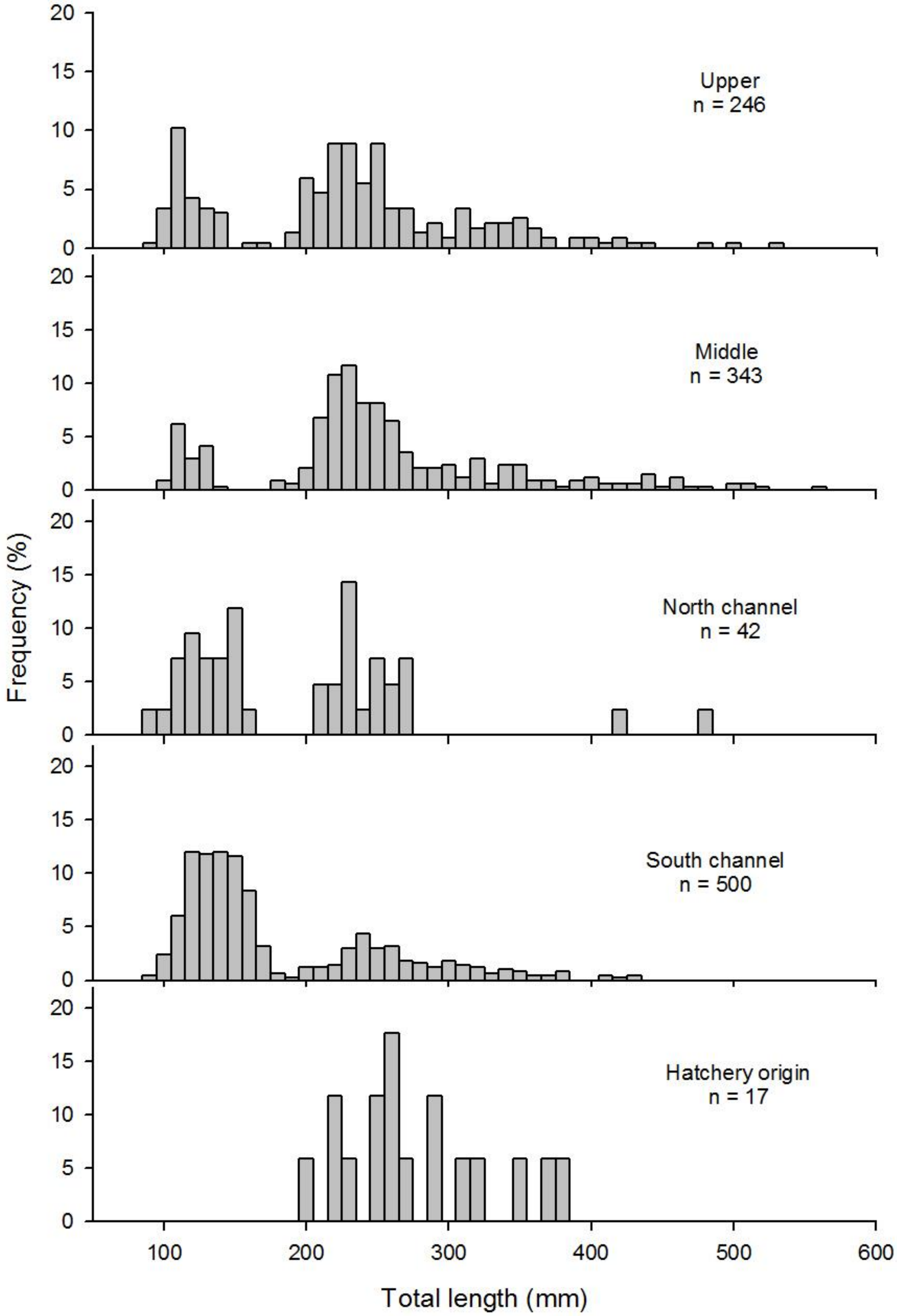

Figure 45. Length distribution of wild Rainbow Trout collected during the 2013 lower Boise River electrofishing survey at four sites.

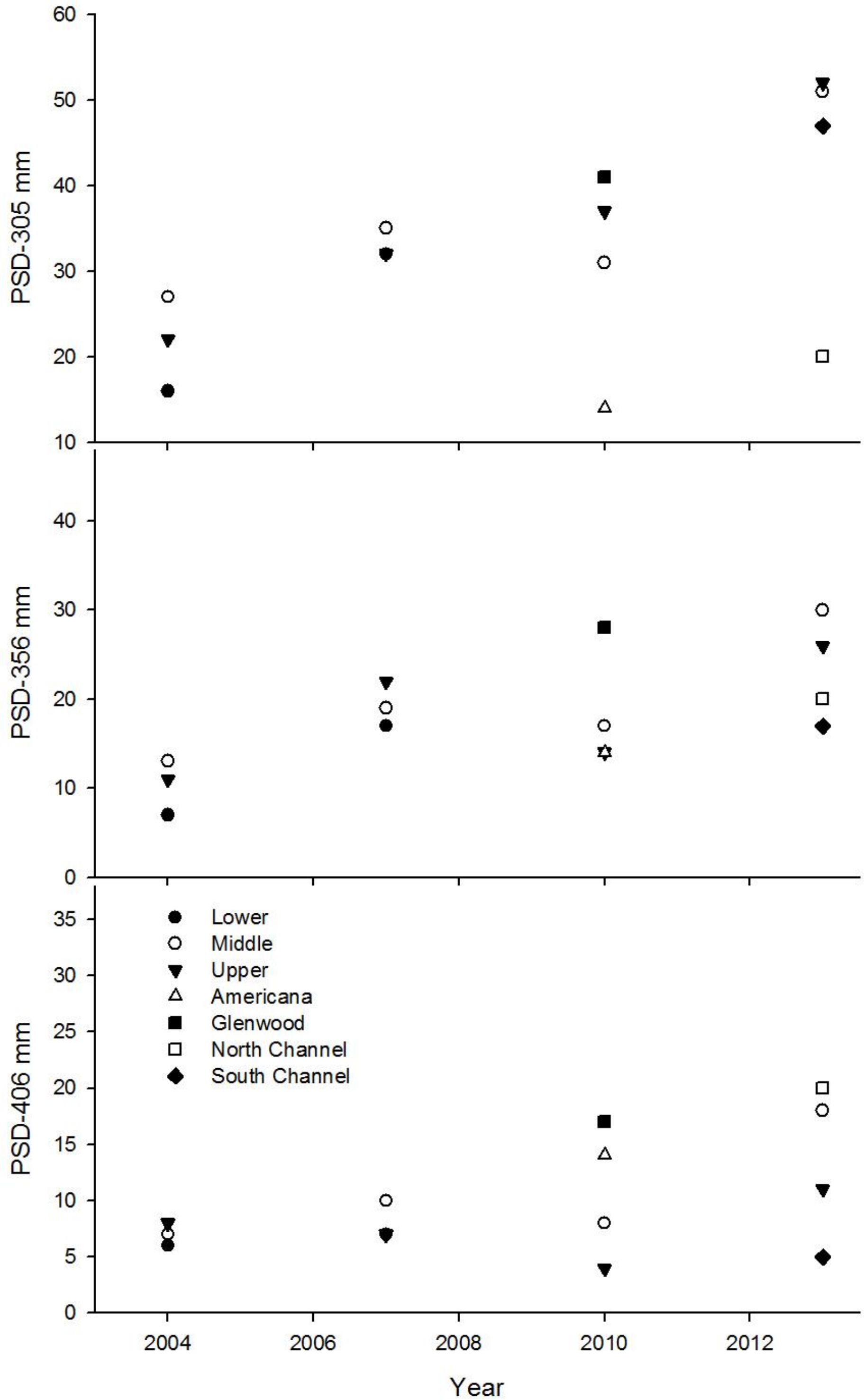

Figure 46. Proportional size distribution for wild Rainbow Trout in three size groups of fish and all sites sampled between 2004 and 2013. Rainbow Trout stock length was 250 mm.

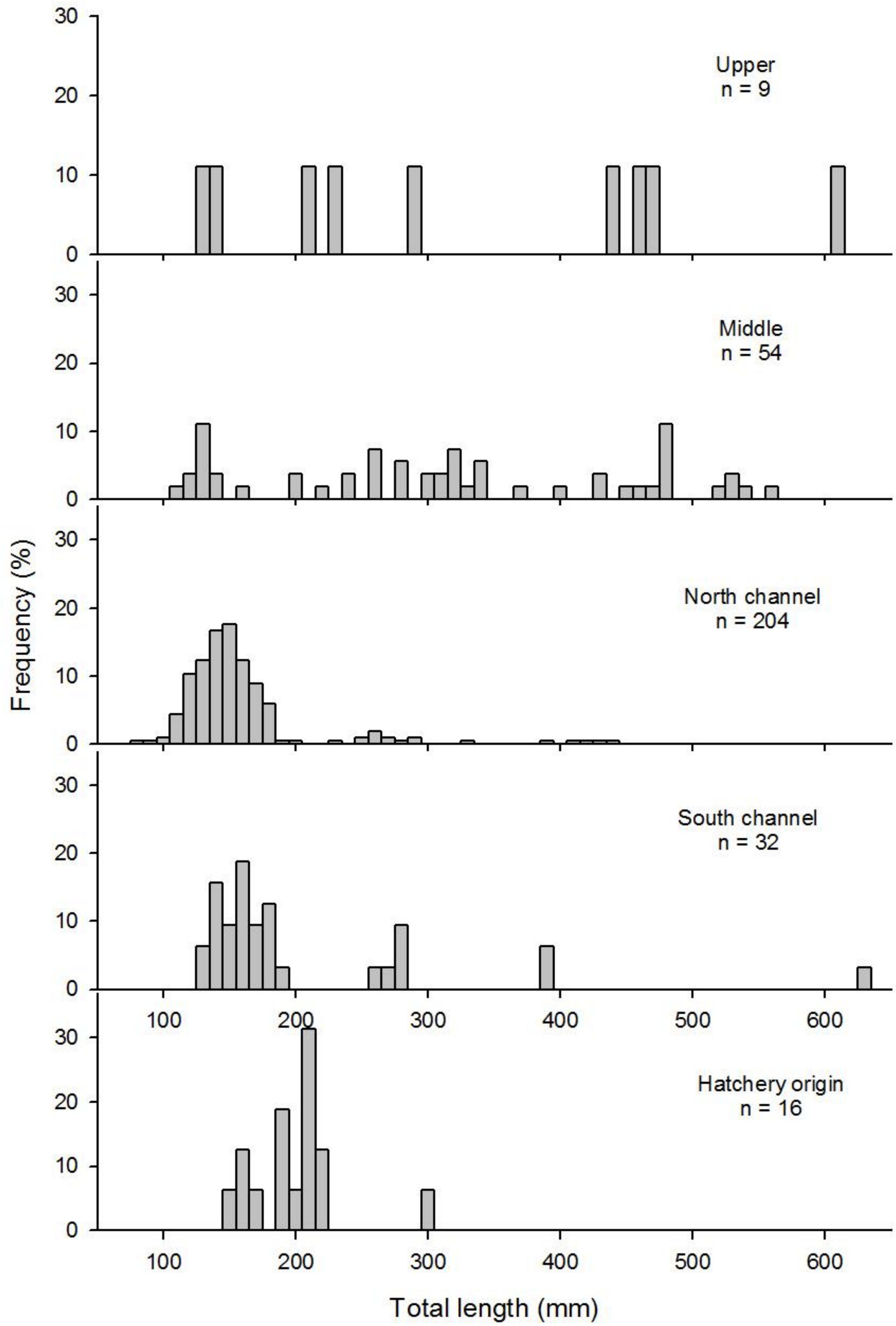

Figure 47. Length distribution of wild Brown Trout collected during the 2013 lower Boise River electrofishing survey at four sites.

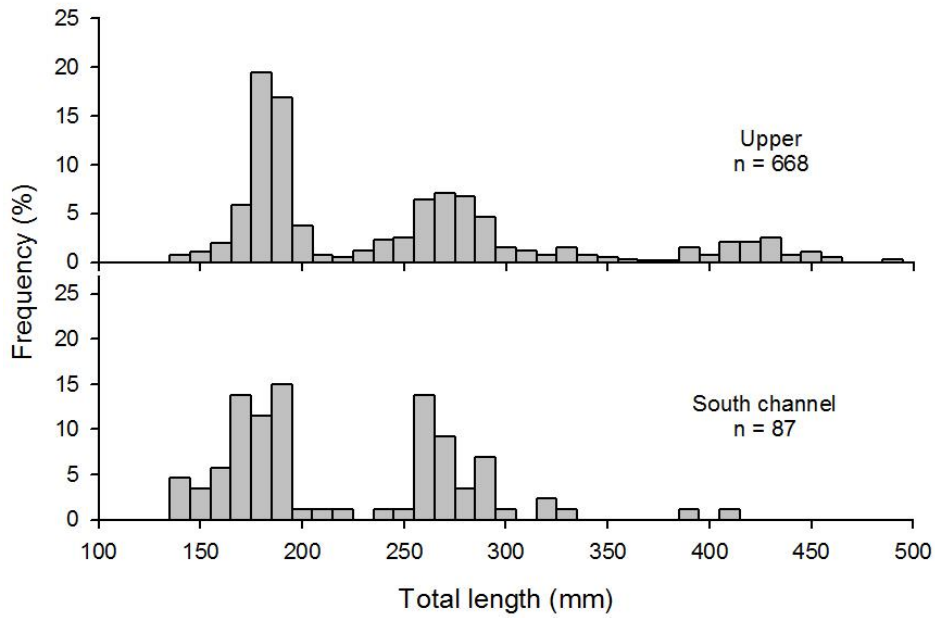

Figure 48. Length distribution of Mountain Whitefish collected during the 2013 lower Boise River electrofishing survey at four sites.

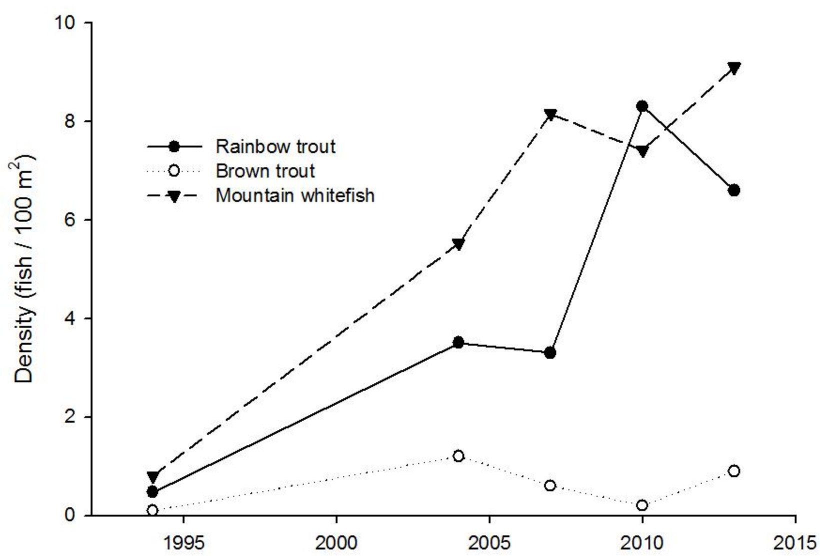

Figure 49. Density estimates for wild Rainbow Trout, Brown Trout, and Mountain Whitefish in the middle site of the lower Boise River 2004-2013. Error bars represent 90% CI for the population estimates.

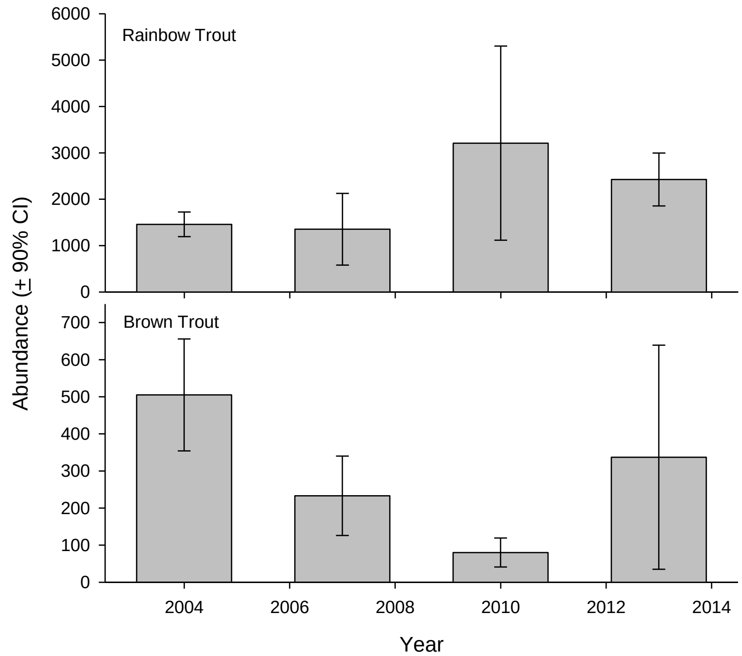

Figure 50. Abundance estimates for wild Rainbow Trout and Brown Trout, in the middle site of the lower Boise River 2004-2013. Error bars represent 90% CI for the population estimates.

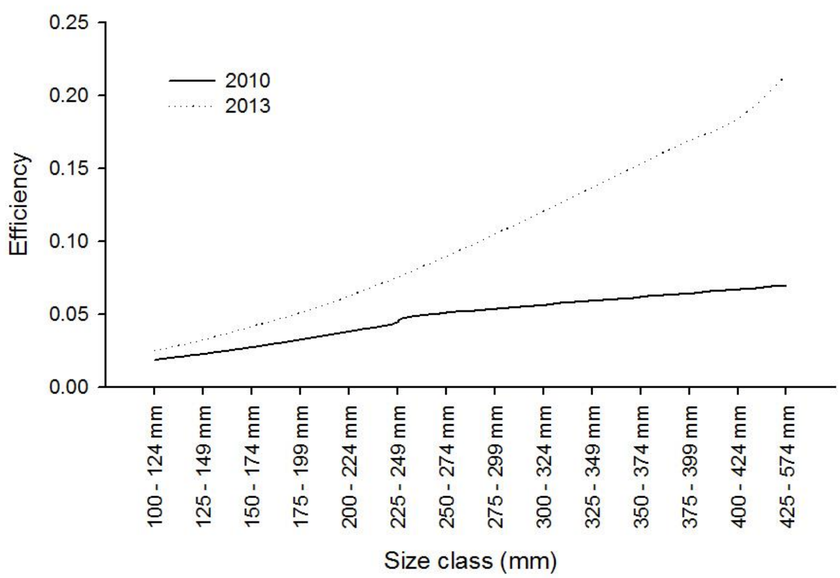

Figure 51. Capture efficiency curves for Rainbow Trout mark-recapture surveys in the middle site of Lower Boise during 2010 when two throw probes were used and 2012 when three throw probes were used.

SOUTH FORK BOISE RIVER PRODUCTION AND TRIBUTARY MONITORING

ABSTRACT

The South Fork Boise River (SFBR) below Anderson Ranch Dam is a nationally renowned tailwater fishery for Rainbow Trout (*Oncorhynchus mykiss*). Idaho Department of Fish and Game monitors the mainstem population every three years and the age-0 year class (production) on an annual basis in the fall. Additionally, efforts have been underway to sample and identify tributaries that serve as spawning and rearing habitat for the population. In August 2013, the Elk-Pony complex wildfire burned approximately 284,671 acres including along the SFBR below Anderson Ranch Dam and many of its tributaries. On September 12, 2013, following a rainstorm, large debris slides occurred in a number of the burned tributaries. These events covered the road and temporarily dammed the SFBR in a number of sections. The impacts from the slides were extensive in areas, and a large amount of sediment entered the mainstem SFBR. Efforts are underway to describe the impact to the fish populations and habitat. Furthermore, rehabilitation efforts are currently being planned and will take place over the next several years.

Rainbow Trout production at the SFBR is monitored through annual near shore electrofishing survey in October. Beginning in March 2013, spring sampling was added as a means of assessing overwinter survival of age-0 fish. On March 21, 2013 we collected 50 age-1 Rainbow Trout among the six sites ranging between 48-88 mm. These fish were age-0 fish during fall sampling. IDFG estimated overall mean age-1 density to be 0.3 ± 0.2 fish/m in March 2013. This is a marked decrease in density from the previous fall when 340 fish were captured and estimated density was 1.7 ± 1.9 fish/m. From these numbers, we estimate winter survival of age-0 fish to be approximately 15%. The 2013 age-0 year class density was assessed on October 16-17, 2013. The six original trend sites were sampled in addition to 33 additional sites that were added to better estimate over-winter survival. In the six trend sites, 104 Rainbow Trout were captured ranging and fry was measured at 0.6 ± 0.8 fish/m. In all 39 sites, age-0 was 0.4 ± 0.2 fish/m.

Two monitoring sites on Pierce Creek were sampled on July 23-24 2013. We collected 63 age-0 and two age-1 Rainbow Trout in the two Pierce Creek sites. In 2010, 23 age-0 and six age-1 fish were collected at the same sites. The upper site (2) in particular showed a nearly eight-fold increase in age-0 trout collected.

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INTRODUCTION

The South Fork Boise River below Anderson Ranch Dam (SFBR) is a nationally renowned tailwater trout fishery and was the first river section in Southwest Idaho to be managed under "Trophy Trout" regulations. This fishery is supported by a population of wild Rainbow Trout and Mountain Whitefish *Prosopium williamsoni*. Migratory Bull Trout *Salvelinus confluentus* are present at very low densities, and native nongame fish including Largescale Sucker *Catostomus macrocheilus*, Northern Pikeminnow *Ptychocheilus oregonensis* and sculpin *Cottus sp*. Redband Trout populations in the SFBR have been monitored above Danskin Bridge every three years since 1994 (Butts et al. 2011). Results suggest that Rainbow Trout populations in the SFBR have been relatively stable, but the relative paucity of trout in the 200 to 400 mm length range upstream of Danskin Bridge has puzzled biologists. A population survey in the canyon section downstream of Danskin Bridge in 2008 showed that Rainbow Trout between 250-400 mm were present in higher proportions than what was observed in the monitored section above (Kozfkay et al. 2010). The SFBR wild trout population is thought to be mainly supported through main-stem spawning of fish with little recruitment from tributaries, as migration barriers are known to be present on most tributaries with spawning habitat (Moore et al. 1979).

An irregular size structure along with a belief by some anglers that the SFBR lacked spawning habitat led many to express concerns that the river was recruitment limited. To address these concerns IDFG revisited fry sampling transects that were established in 1994 during a whirling disease research study. Biologists observed high densities of age-0 trout within the transects and visual observations of near-shore habitat throughout the tailwater reach suggest reproduction is not a limiting factor in the population. These studies have continued annually since 2009 and have been relatively stable between 2009-2012 with a mean fry index of 2.3 fish/m.

Recently, interest has increased in tributaries to the SFBR below Anderson Ranch Dam. Specifically, biologists wish to determine whether the tributaries currently have fish populations, contain spawning habitat, and whether tributary spawning and recruitment could be enhanced by removing migration barriers. Recent information on fish populations within these tributaries has not been collected. Moore et al. (1979) characterized the majority of the SFBR tributaries below Anderson Ranch and evaluated the presence of spawning trout and spawning habitat. However, changes in land use practices, roads, and climate over the past 30 years have likely altered conditions in these streams. In 2008, a number of SFBR tributaries were sampled by the United States Forest Service (USFS) for a genetic study on Rainbow and Redband Trout, but little or no population information was collected. More recently, IDFG personnel sampled several sites in Dixie, Granite, Pierce, Rock, and Rough creeks in 2010 (Kozfkay et al. 2010), with additional surveys in Bock, Cayuse, Cow, and Mennecke creeks in 2011 (Butts et al. 2013). In 2012 surveys were conducted on Trail, Rattlesnake, Little Rattlesnake and Cottonwood. Data describing the trout communities in tributaries to the SFBR will help guide conservation and restoration efforts in the future.

One such restoration effort was the Pierce Creek reconnection project completed in 2011. A culvert functioning as a barrier was removed, and replaced by a steel bridge, thereby opening up approximately 8 km of potential spawning and rearing habitat. Stream surveys were conducted in 2010, prior to the reconnection project, and those same sites will be monitored periodically to assess the resulting changes in the salmonid population in Pierce Creek.

During early August 2013, two lightning-caused wildfires merged forming what was called the Elk-Pony complex wildfires. Approximately 284,671 acres were burned including along the SFBR below Anderson Ranch Dam and many of its tributaries. Extensive loss of vegetation occurred in many of the tributary drainages but the damage in the riparian areas along the mainstem was less severe. Following a rainstorm event on September 12, 2013, a number of large debris slides occurred on at least six sites or tributaries. The main road (Forest Road 189) road was blown out or buried with mud and debris at a number of sites. Because of safety concerns, the USFS restricted public access to the area through the end of November. Debris slides or "blowouts" were documented, but not limited to, an unnamed drainage north of Reclamation Village, and also in the Dixie, Rough, Granite, and Pierce creek drainages (Figure 52). Some direct fish mortality was observed with these events. At the confluence of SFBR and Arrowrock Reservoir, approximately 400-600 fish, including Largescale Sucker, Mountain Whitefish, and Rainbow Trout, were observed floating in a mire of organic material and ash from the debris slides. Efforts are underway to describe the extent of the damage on fish populations and habitat. Furthermore, rehabilitation efforts are currently being planned and will take place over the next several years.

METHODS

Fry Monitoring

Rainbow Trout fry were sampled using a Smith Root Type VII backpack shocker in six long-term trend sites of the SFBR on March 21, 2013 (Figure 52). Four of the 33-m sites were monitored in 1996 by Elle (1997) to assess relative abundance of Rainbow Trout fry in relation to whirling disease and were resampled in 2009. Two additional sites were added in 2010 to correspond with redd sites that were being monitored by BOR.

During sampling, the area from the north shoreline out to approximately 4 m was sampled. A single, upstream electrofishing pass was completed at each site. All fish were identified, counted and measured for total length. Fry estimates and lengths were compared to those collected in previous years.

The sites have been generally used to assess fall abundance as an overall measure of production. However, additional sampling in the spring was conducted beginning in 2013 to address overwinter survival. Overwinter survival S_t was estimated as

$$S_t = \frac{N_t}{N_o}$$

where, N_o is the initial abundance in the fall and N_t is the abundance in the spring (Ricker 1975).

During fall 2013, 33 additional sites were randomly selected and added to the survey to better capture the variability of age-0 relative abundance and survival of age-0 trout in the roaded section of the mainstem. For trend purposes, only the six original sites were used for calculation of a mean fry index. However, all 39 sites will be used for future estimates of overwinter survival.

Tributary Surveys

Two sites on Pierce Creek were sampled in 2013 to evaluate presence, distribution and abundance of Rainbow Trout in comparison to 2010 (Figure 53). Sampling was conducted on July 23-24 2013.

In 2013, single-pass electrofishing was used to survey salmonids using a backpack electrofishing unit (Smith-Root Model 15-D) with pulsed DC. Depletion estimates were not conducted because miss-communication with crews regarding techniques with age-0 fish. Nongame fish and amphibian species were also recorded if observed. Fish were identified, enumerated, measured to the nearest millimeter (total length, TL) and weighed to the nearest gram, and released downstream of the study sites. Study sites were about 100 m in length. Sections of stream where vegetation was too thick to sample effectively were not included in the sample site. Because electrofishing is characteristically size selective (Sullivan 1956; Reynolds 1996), trout were separated into two length groups (<100 mm TL and $\geq$100 mm TL) and abundance estimates were calculated individually for each size group.

RESULTS AND DISCUSSION

Fry Monitoring

On March 21, 2013 we collected 50 age-1 Rainbow Trout among the six sites ranged between 48-88 mm (Figure 54). These fish were considered to be age-0 fish during fall sampling. IDFG estimated overall mean age-1 index to be 0.3 $\pm$ 0.2 fish / m in March 2013 (Figure 55). This is a marked decrease in density from the previous fall when 340 fish were captured and estimated density was 1.7 $\pm$ 1.9 fish/m (Butts et al. 2013). From these numbers, we estimate winter survival of age-0 fish to be approximately 15%.

The 2013 age-0 year class density and abundance was assessed on October 16-17, 2013. The six original trend sites were sampled in addition to 33 additional sites that were added to better estimate over-winter survival. In the six trend sites, 104 Rainbow Trout were captured and fry density was measured at 0.6 $\pm$ 0.8 fish/m. In all 39 sites, age-0 index was 0.4 $\pm$ 0.2 fish/m.

Annual fall age-0 Rainbow Trout density had appeared to be stable, averaging 2.3 $\pm$ 1.8 fish during 1996-2012 (Figure 56). However, the 2013 fall survey showed an approximate 75% decrease in density estimates. This decline can easily be attributed to debris and sediment flows that occurred beginning on September 12, 2013. The presence of age-0 trout and high numbers of sculpin that were observed during sampling was encouraging. However, approximately 1-3 cm of fine sediment covered and embedded the substrate in the near-shore areas that were sampled for age-0 abundance. This level of fine sediment had not been observed in these sections in any of the previous sampling efforts. Considering that age-0 trout utilize the interstitial spaces in gravel during cold winter temperatures, over-winter survival of age-0 fish between 2013-2014 is expected to be low.

Tributary Surveys

We collected 63 age-0 and two age-1 Rainbow Trout in the two Pierce Creek sites (Table 19). In 2010, 23 age-0 and six age-1 fish were collected at the same sites (Kozfkay et al. 2011). The upper site (2) in particular showed a nearly eight-fold increase in age-0 trout collected. This vast increase is likely due to cooperative fish passage improvements that were completed in 2012 where a culvert was replaced with a bridge. Unfortunately, Pierce Creek was one of the tributaries that incurred direct damage from the wildfire and a debris slide in fall 2013. Pierce Creek should be sampled again in the next 1-2 years to assess status and if spawning fish are utilizing the tributary.

MANAGEMENT RECOMMENDATIONS

1. Conduct mark-recapture estimates in the three trend sites during fall 2014 to assess effects of debris flows and fires on trout and whitefish populations. The monitoring, which occurs every three years, had previously been scheduled for 2015, but efforts should be moved up to address concerns.

2. Continue to use annual shoreline electrofishing to monitor spawning success, fry production, and overwinter survival; relate fry densities to adult abundance, flows, or other environmental variables as data becomes available.

3. Conduct tributary surveys to assess post-fire status and 2014 year class in Cayuse, Bock, Meinecke, Trail, and Pierce creeks.

Table 19. Dates and results from backpack electrofishing assessments that occurred on Pierce Creek, a tributary to the South Fork Boise River in 2010 and 2013. Depletion estimates were not conducted in 2013.

				< 100 mm			≥ 100 mm			Total		
Date	Site	Temp (°C)	Passes	n	Estimate	95% CI	n	Estimate	95% CI	n	Estimate	fish/100m^2
7/24/2013	1	-	1	10	-	-	1	-	-	11	-	-
7/23/2013	2	14.6	1	53	-	-	1	-	-	54	-	-
6/8/2010	1	15.2	3	17	19	12-26	3	3	2-4	20	22	12.1
6/23/2010	2	13.1	3	6	6	2-10	3	3	3-3	9	9	6

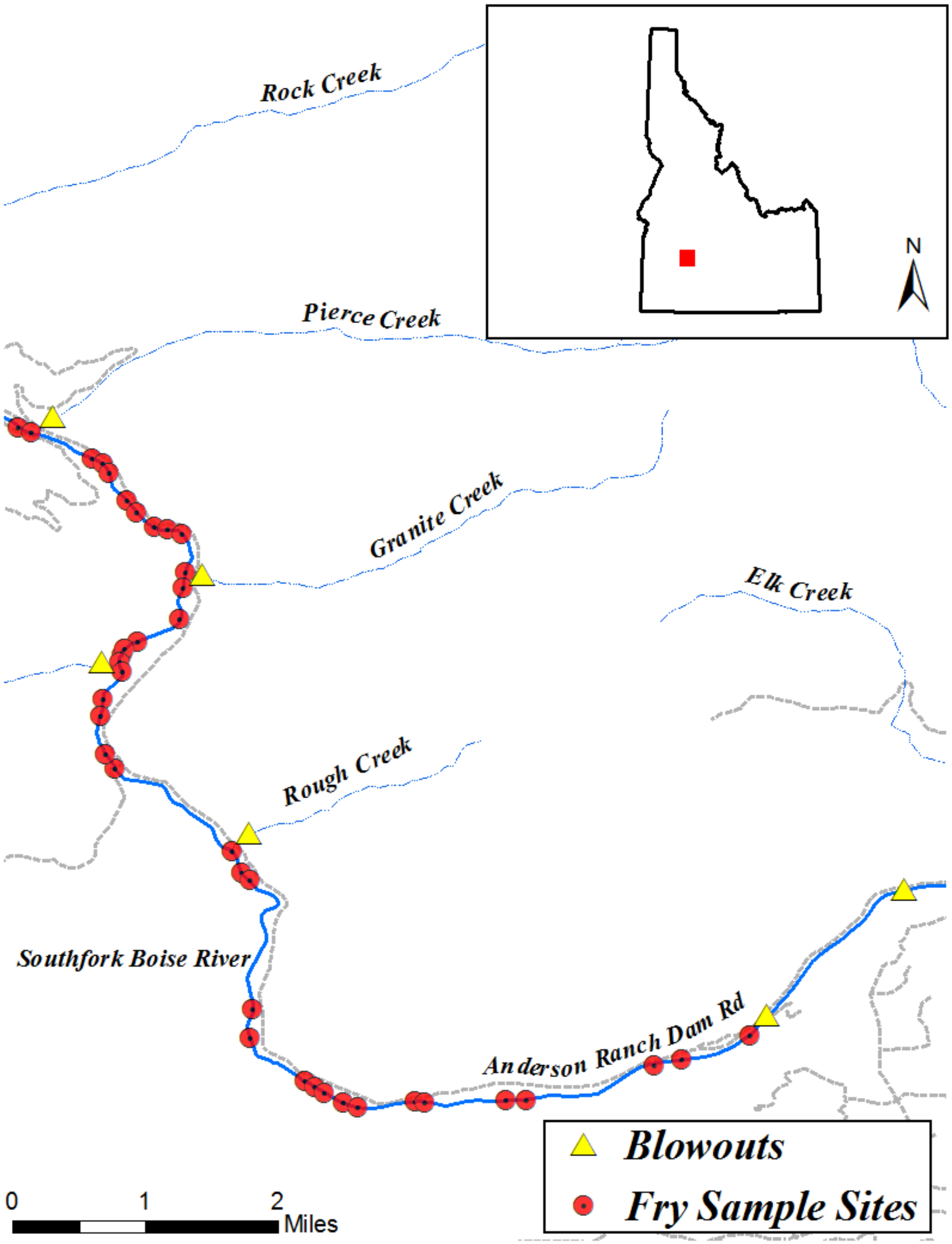

Figure 52. Map of South Fork Boise River, Idaho tailwater section showing location of major debris slides in September 2013, 2013 fry monitoring sites.

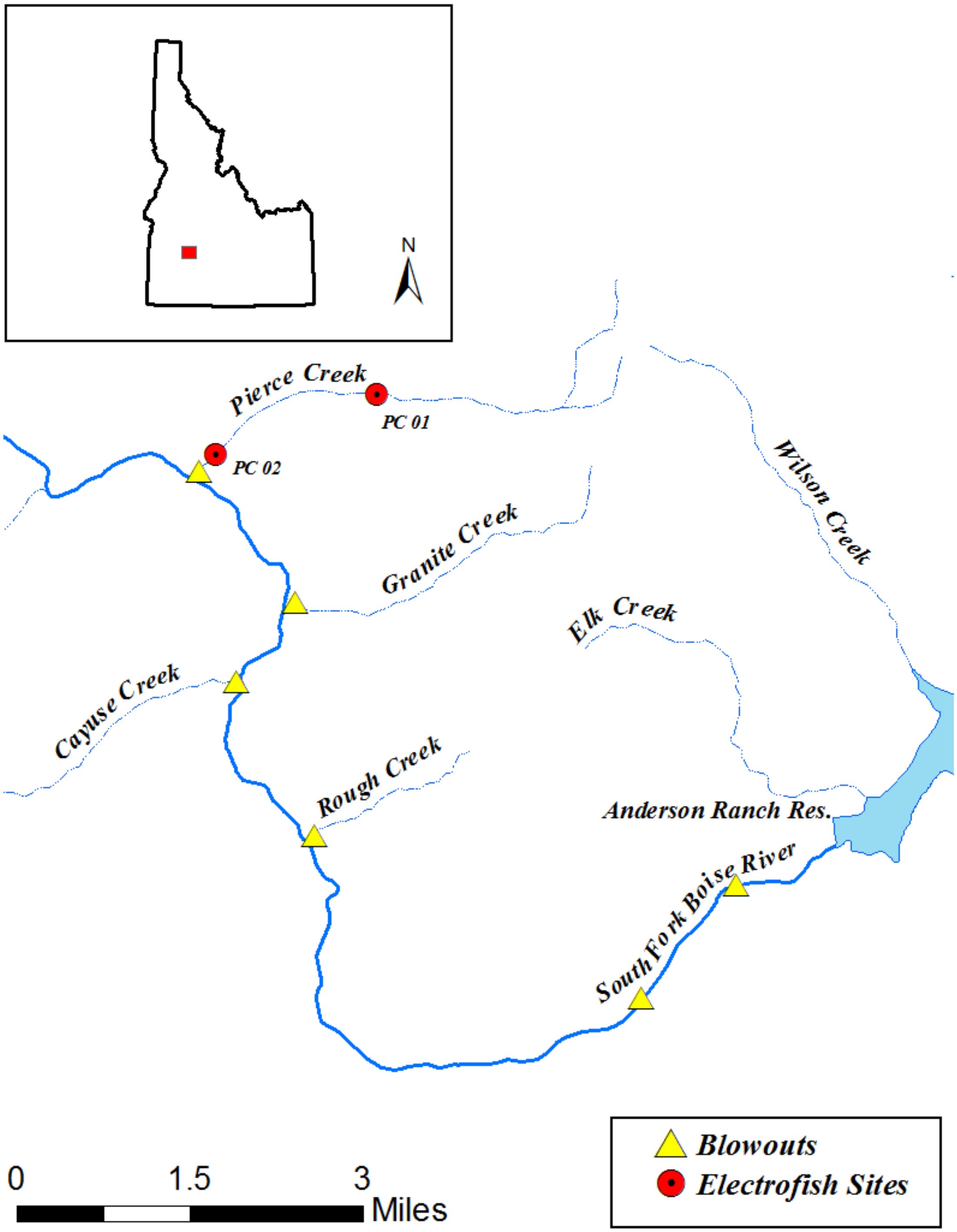

Figure 53. Map of South Fork Boise River, Idaho tailwater section showing sampling locations in Pierce Creek in July 2013 and major debris slides in September 2013.

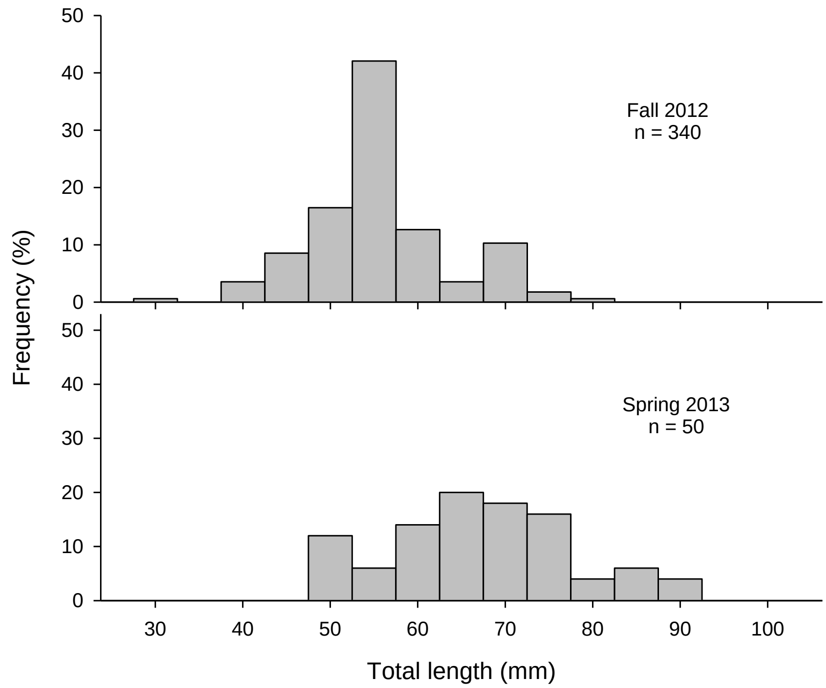

Figure 54. Length distributions of Rainbow Trout fry, calculated as proportion of total catch, during fry index surveys between October 2012 and March 2013 in the South Fork Boise River below Anderson Ranch Dam.

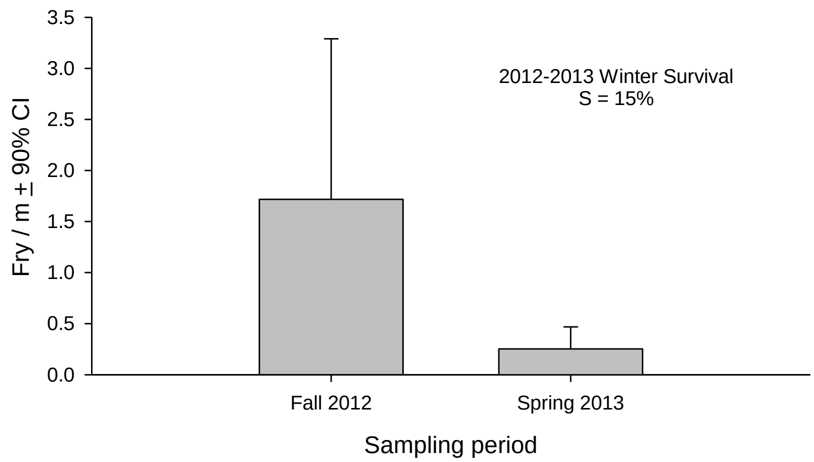

Figure 55. Comparison of mean Rainbow Trout fry collected at six 33-m long shoreline trend sections between fall 2012 and spring 2013 at the South Fork Boise River, Idaho. Overwinter survival was estimated at 15%.

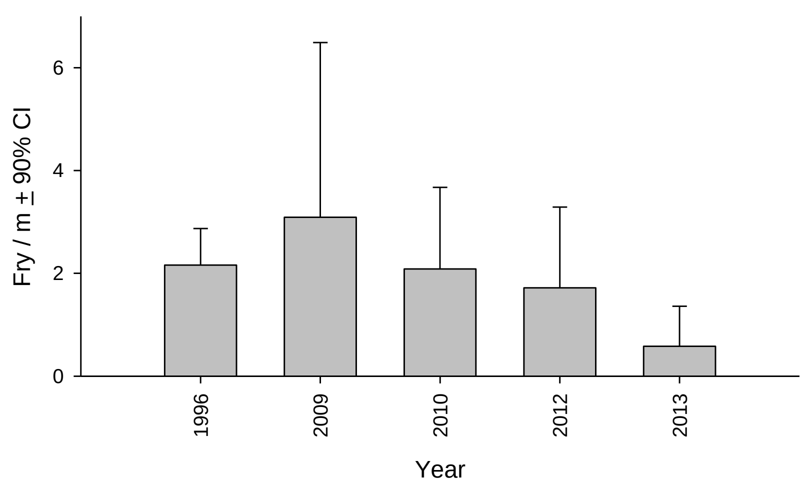

Figure 56. Comparison of mean Rainbow Trout collected at six 33-m long shoreline trend sections between 1996-2013 at the South Fork Boise River, Idaho.

LOWER PAYETTE RIVER FISH POPULATION SURVEYS

ABSTRACT

Very little fish population or creel data has been collected from the lower Payette River between Black Canyon Dam and the Snake River. Previous sampling was conducted in 2009 to collect basic fish community data throughout this lower reach. In 2013, we sampled the Payette River in response to the recent draw down of Black Canyon Dam and the associated sedimentation event below. Surveys were completed using the same methods, sites and sampling gear (boat electrofishing) as the 2009 sites, with the timing of the surveys as close as possible to 2009 dates. During the 2013 surveys, we collected 1,642 fish, comprising 17 different species. Mean CPUE (with 90% CI) of Mountain Whitefish *Prosopium williamsoni* declined from 144 (± 41) in 2009 to 104 (± 50) in 2013. The remainder of the catch mainly consisted of Largescale Sucker *Catostomus macrocheilus* (27%), Northern Pikeminnow *Ptychocheilus oregonensis* (15%), Smallmouth Bass *Micropterus dolomieu* (5%) and Chiselmouth *Acrocheilus alutaceus* (4%). The proportion of Smallmouth Bass in the catch decreased in 2013 from 15% (2009) to 7%, while the mean CPUE (fish/hr) decreased from 56 (± 14) in 2009 to 19 (± 13) in 2013. Smallmouth Bass CPUE declined in most sites, but decreased most noticeably in the upper and middle portions of the river, presumably from habitat changes resulting from the recent sedimentation event. Nongame species made up the bulk of the biomass collected, with Largescale Sucker (38%), Common Carp *Cyprinus carpio* (20%) and Northern Pikeminnow (19%) totaling about 77% of the biomass collected. Game fish including Mountain Whitefish, Smallmouth Bass and Channel Catfish *Ictalurus punctatus* comprised only 19% of the biomass sampled. The proportion of catfish in the total catch declined from 20% in 2009 to only 1.84% in 2013, while mean CPUE (fish/hr) declined from 15 (± 7) in 2009 to 6 (± 4) in 2013. The proportion of Northern Pikeminnow in the catch increased from 7% (2009) to 15% in 2013, with an associated increase in mean CPUE (fish/hr) from 27 (± 13) in 2009 to 52 (± 19) in 2013. Compared to 2009 surveys, the relative abundance of Mountain Whitefish, Smallmouth Bass and Channel Catfish have declined, while the relative abundance of Largescale Sucker and Northern Pikeminnow has increased, possibly from entrainment through Black Canyon Reservoir.

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INTRODUCTION

Historically, the lower Payette River acted as a migratory corridor for anadromous fish runs. Completion of Black Canyon Dam in 1924 extirpated these runs by blocking access to spawning areas. Additional dam construction downstream in the Snake River and subsequent fish introductions have fundamentally altered the fish community in the lower Payette River. Formerly, native salmonids, cyprinids, and catostomids were the most common species present. Presently, a large proportion of the fish community consists of non-native ictalurids, Smallmouth Bass *Micropterus dolomieu*, and Common Carp *Cyprinus carpio*, similar to other large rivers in Southwest Idaho. Until 2009, very little fish population or creel data had been collected from the lower Payette River. While some Rainbow Trout *Oncorhynchus mykiss* and Mountain Whitefish *Prosopium williamsoni* are present, sport fishing in the river focuses primarily on Smallmouth Bass and Channel Catfish *Ictalurus punctatus*. Angler reports indicate that Smallmouth Bass fishing has become popular with high catches possible. Due to the lack of information, we initiated an effort to gain a better understanding of the composition and distribution of fish within the lower Payette River.

Black Canyon Diversion Dam is a 183 foot concrete diversion dam located approximately 8 km upstream of Emmett, ID on the Payette River. The dam is operated by the Bureau of Reclamation (BOR) and provides diverted irrigation water via the Black Canyon Canal and the Emmett Irrigation District Canal, as well as up to 10,000 kilowatts of electricity. BOR is currently in the process of investigating the feasibility for installing an additional hydroelectric turbine to generate additional electricity. In winter 2013/2013, BOR drew the reservoir down (to ~2440' elevation) for initial geologic studies and survey work, leaving only a minimum pool. At this low pool elevation, the reservoir became riverine and transported a large, though unquantified amount of sediment through the dam into the Payette River below. Large sediment deposits and dead fish were noted throughout the lower Payette River as a result.

OBJECTIVES

1. Describe the distribution, relative abundance, and composition of the fish community, in the lower Payette River from Black Canyon Dam to its confluence with the Snake River.

2. Compare fish community data following the Black Canyon Reservoir drawdown and associated sedimentation of the lower Payette River in winter 2012/2013 from 2013 to 2009 data.

METHODS

We sampled the fish community in the lower Payette River between Black Canyon dam (rkm 62) and its confluence with the Snake River (rkm 0) during July 2013. We sampled fish at twelve non-randomly selected study sites within this reach, which were previously sampled in 2009. Sites contained readily identifiable landmarks, possessed diverse habitat types, and were well dispersed throughout the study area. These sites allowed relatively high catch rates for several species compared to simpler habitats and will allow trend monitoring for a wide variety of fish species across time.

Fish were sampled with boat mounted electrofishing gear. Pulsed direct current was produced by a 5,000 watt generator. Frequency was set at 80 or 120 pulses per second and a pulse width of 40, which yielded an output of 5 - 6 amps. One netter positioned on the bow of the boat captured as many fish as possible, except Common Carp and Largescale Sucker. For these species, we collected at least 10 individuals at each site and then counted the remainder without bringing them into the boat. At each site, one electrofishing pass was expended along or as near as possible to all river banks, including the banks of islands. Electrofishing effort ranged from 0.21 to 0.58 h/site with a mean effort of 0.38 ± 0.06 h. Surveys were conducted surveys during daylight hours of June 17 – July 8 while water flows were sufficient. During this period, mean daily river flow measured at the U.S. Geological Survey (USGS) gauging station at Emmett, ID ranged from 56 to 113 m^3/s.

Captured fish were identified to species, measured (± 1 mm), and weighed (±1 g for fish < 5,000 g or ± 10 g for fish > 5,000 g) with a digital scale. If weight was not collected, weight was estimated using a species-specific length-weight equation from pooled data from 2013. Data were log transformed and linear regression was used to allow estimation of weight. PSD were calculated to describe length-frequency data for game fish populations as outlined by Anderson and Neuman (1996). Also, Wr was calculated as an index of general fish body condition, for which a value of 100 is considered average. Values greater than 100 describe robust body condition, whereas values less than 100 indicate less than ideal foraging conditions. Electrofishing effort was converted to hours to standardize CPUE and weight in kg for WPUE indices. Confidence intervals were calculated using α = 0.10. All survey and individual fish data were stored in IDFG's standard stream survey database.

RESULTS AND DISCUSSION

During the 2013 surveys, we collected 1,642 fish, comprising 17 different species (Table 20). Five species of game fish were sampled including Mountain Whitefish, Smallmouth Bass, Channel Catfish, Flathead Catfish *Pylodictis olivaris,* and Largemouth Bass *Micropterus salmoides*. Catch of Largescale Sucker, *Catostomus macrocheilus,* and Northern Pikeminnow *Ptychocheilus oregonensis* increased relative to 2009, while catch rates of the primary game species including Mountain Whitefish, Smallmouth Bass, and Channel Catfish all declined.

In 2013, mean electrofishing catch rates (CPUE, fish/hr) for all species combined decreased to 348 (± 57), compared to 374 (± 60) in 2009. Average WPUE (kg/hr) for all species combined was 105 (± 16), compared to 139 (± 23) in 2009. Catch rates (CPUE, fish/hr) of the primary nongame species such as Largescale Sucker and Northern Pikeminnow showed slight increases, while catch rates of the primary game fish species including Mountain Whitefish, Smallmouth Bass, and Channel Catfish declined from previous surveys (Figure 58).

Similar to previous sampling in 2009, Mountain Whitefish were the most numerous species sampled. In 2013, Mountain Whitefish comprised 30% of the total catch, compared to 39% in 2009. Mean CPUE (with 90% CI) of Mountain Whitefish declined from 144 (± 41) in 2009 to 104 (± 50) in 2013. CPUE of whitefish across the 12 study sites appeared similar to 2009, except at the lower most sites, which showed slight declines compared to 2009 distribution (Figure 59). The remainder of the catch mainly consisted of Largescale Sucker (27%), Northern Pikeminnow (15%), Smallmouth Bass (5%) and Chiselmouth *Acrocheilus alutaceus* (4%). Other species included Bridgelip Sucker *Catostomus columbianus*, sculpin *Cottus sp*., Redside Shiner *Richardsonius balteatus*, and Longnose Dace *Rhinichthys cataractae* (Table 20). Nongame species made up the bulk of the biomass collected, with Largescale Sucker (38%), Common Carp (20%) and Northern Pikeminnow (19%) totaling about 77% of the biomass collected.

Game fish including Mountain Whitefish, Smallmouth Bass and Channel Catfish comprised only 19% of the biomass sampled (Table 21). The proportion of Smallmouth Bass in the catch decreased in 2013 from 15% (2009) to 7%, while the mean CPUE (fish/hr) decreased from 56 (± 14) in 2009 to 19 (± 13) in 2013, but decreased most noticeably in the upper and middle portions of the river. Catch rates of Smallmouth Bass were noticeably reduced at most sites until river kilometer 52 and lower (Figure 59). We assume this change in Smallmouth Bass abundance and distribution is related to habitat changes associated with the extensive fine sediment deposited in the upper portion of the river. We sampled a total of 95 Smallmouth Bass, with a mean length and weight of 177 (± 18) mm and 179 (± 51) g, respectively. PSD (proportional stock density) for smallmouth was 58, calculated from 18 quality fish (≥ 280 mm) and 31 stock (≥ 180 mm) sized fish. This is an increase from a PSD of 32 in 2009, indicating the proportion of smaller fish has declined. The mean relative weight (Wr) for Smallmouth Bass over 150 mm (n = 40) was 97, suggesting fish were in good body condition.

Catch of Channel Catfish noticeably declined compared to 2009. The proportion of catfish in the total catch declined from 20% in 2009 to only 1.84% in 2013, while mean CPUE (fish/hr) declined from 15 (± 7) in 2009 to 6 (± 4) in 2013. Similar to 2009 surveys, catfish CPUE showed an increasing trend downriver (Figure 59). Similar to Smallmouth Bass, Channel Catfish catch rates were noticeably reduced at upper sites closer to the dam, until river kilometer 39 and below (Figure 59).

The proportion of Largescale Sucker in the catch increased from 20% (2009) to 27% in 2013, concurrent with an increase in the mean CPUE (fish/hr) of 76 (± 31) to 95 (± 21) in the most recent 2013 survey. Largescale Sucker appeared to be well distributed throughout the river, with higher catch rates relative to previous surveys occurring in the middle section of the river (RM 32 to 21) (Figure 59). The proportion of Northern Pikeminnow in the catch increased from 7% (2009) to 15% in 2013, with an associated increase in mean CPUE (fish/hr) from 27 (± 13) in 2009 to 52 (± 19) in 2013. As with Largescale Sucker, most of the increase in catch rates of Northern Pikeminnow appeared over the middle portion of the river (Figure 59). These increased catch rates of sucker and Pikeminnow may be related to entrainment from the drawdown of Black Canyon Reservoir.

MANAGEMENT RECOMMENDATION

1. Continue monitoring the fish community in the Lower Payette River after modifications to Black Canyon Dam are completed to document responses to changing habitat conditions.

Table 20. Electrofishing catch per unit effort (fish/hr) for 12 sites on the lower Payette River during summer 2013. Species names were abbreviated as bluegill (BGL), Bridgelip Sucker (BLS), Brown bullhead (BBH), Channel Catfish (CAT), Chiselmouth (CSM), flathead catfish (FLT), Largemouth Bass (LMB), Largescale Sucker (LSS), Longnose Dace (LND), Mountain Whitefish (MWF), Northern Pikeminnow (NPM), sculpin (SCP), Redside Shiner (RSS), Smallmouth Bass (SMB), Speckled Dace (SCP), White Crappie (WCR) and Yellow Perch (YLP).

RiverKM	Site	Effort (hr)	BGL	BLS	BBH	CAT	CSM	CRP	FLT	LMB	LSS	LND	MWF	NPM	SCP	RSS	SMB	SPD	WCR	YLP
3.4	LP1	0.394	5.1	33.0	0.0	15.2	78.7	12.7	0.0	5.1	71.1	0.0	2.5	10.2	0.0	5.1	71.1	0.0	2.5	2.5
6.1	LP2	0.582	1.7	41.2	0.0	10.3	32.6	25.8	5.2	0.0	116.8	0.0	18.9	8.6	0.0	1.7	55.0	0.0	0.0	5.2
13.5	LP3	0.578	0.0	34.6	0.0	22.5	12.1	13.8	3.5	0.0	81.3	0.0	62.3	32.9	0.0	12.1	12.1	0.0	0.0	0.0
20	LP4	0.296	0.0	23.6	0.0	13.5	23.6	3.4	6.8	0.0	128.4	10.1	57.4	20.3	3.4	33.8	50.7	0.0	0.0	0.0
26.4	LP5	0.4136	0.0	4.8	0.0	12.1	14.5	36.3	0.0	0.0	36.3	19.3	302.2	77.4	0.0	4.8	4.8	0.0	0.0	19.3
34.4	LP6	0.451	0.0	6.7	0.0	0.0	35.5	4.4	0.0	0.0	144.1	0.0	266.1	57.6	2.2	37.7	2.2	0.0	0.0	0.0
38.9	LP7	0.4	0.0	0.0	0.0	0.0	25.0	15.0	0.0	0.0	125.0	5.0	87.5	120.0	0.0	10.0	15.0	0.0	0.0	0.0
43.1	LP8	0.413	0.0	4.8	0.0	0.0	9.7	4.8	0.0	0.0	58.1	14.5	169.5	113.8	7.3	4.8	7.3	0.0	0.0	2.4
52	LP9	0.291	0.0	0.0	0.0	3.4	3.4	10.3	0.0	0.0	48.1	0.0	68.7	68.7	0.0	0.0	0.0	0.0	0.0	0.0
55.8	LP10	0.32	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	59.4	21.9	121.9	40.6	6.3	9.4	0.0	6.3	0.0	0.0
58.1	LP11	0.208	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	153.8	9.6	72.1	33.7	4.8	0.0	0.0	0.0	0.0	0.0
60.7	LP12	0.22	0.0	4.5	4.5	0.0	0.0	18.2	0.0	0.0	122.7	0.0	22.7	45.5	9.1	0.0	4.5	0.0	0.0	13.6
	Average by Spp		**0.57**	**13.44**	**0.38**	**6.42**	**19.60**	**12.06**	**1.28**	**0.42**	**95.43**	**6.71**	**104.32**	**52.43**	**2.75**	**9.95**	**18.56**	**0.52**	**0.21**	**3.59**

Table 21. Electrofishing weight per unit effort (kg of fish/hr) for 12 sites on the lower Payette River during summer 2013. Species names were abbreviated as bluegill (BGL), Bridgelip Sucker (BLS), Brown bullhead (BBH), Channel Catfish (CAT), Chiselmouth (CSM), flathead catfish (FLT), Largemouth Bass (LMB), Largescale Sucker (LSS), Longnose Dace (LND), Mountain Whitefish (MWF), Northern Pikeminnow (NPM), sculpin (SCP), Redside Shiner (RSS), Smallmouth Bass (SMB), Speckled Dace (SCP), White Crappie (WCR) and Yellow Perch (YLP). Dashed lines indicated missing values where the species was not collected.

RiverKM	Site	Effort (hr)	BGL	BLS	BBH	CAT	CSM	CRP	FLT	LMB	LSS	LND	MWF	NPM	SCP	RSS	SMB	SPD	WCR	YLP
3.4	LP1	0.394	0.2	5.4	-	26.1	2.4	11.7	0.0	0.2	13.5	-	0.02	1.5	-	0.2	7.9	-	0.1	0.0
6.1	LP2	0.582	0.017	2.1	-	19.2	0.8	24.5	12.4	-	34.6	-	0.1	0.2	-	0.0	3.2	-	-	0.1
13.5	LP3	0.578	-	1.7	-	29.7	0.5	0.0	7.7	-	20.7	-	0.5	4.6	-	0.1	5.1	-	-	-
20	LP4	0.296	-	1.5	-	28.2	0.6	11.1	10.7	-	45.6	-	2.2	12.8	-	0.1	10.1	-	-	-
26.4	LP5	0.4136	-	0.0	-	23.3	0.8	19.1	-	-	35.7	-	6.4	10.9	-	0.0	1.6	-	-	0.9
34.4	LP6	0.451	-	0.3	-	0.0	0.6	9.7	-	-	36.2	0.0	9.8	14.3	-	0.3	0.0	-	-	-
38.9	LP7	0.4	-	0.0	-	0.0	1.1	45.0	-	-	49.2	-	2.9	33.5	0.0	0.1	10.3	-	-	-
43.1	LP8	0.413	-	0.2	-	0.0	0.4	14.3	-	-	44.6	-	13.4	50.9	-	0.0	3.0	-	-	0.1
52	LP9	0.291	-	0.0	-	8.9	0.1	40.4	-	-	42.8	0.0	4.1	46.9	0.0	-	-	-	-	-
55.8	LP10	0.32	-	0.1	-	-	-	-	-	-	47.2	-	8.2	14.5	-	0.1	-	0.0	-	-
58.1	LP11	0.208	-	0.2	-	-	-	0.0	-	-	57.8	-	10.3	25.6	-	-	-	-	-	-
60.7	LP12	0.22	-	0.3	1.3	-	-	70.3	-	-	52.7	0.0	2.2	25.5	-	-	0.3	-	-	0.3

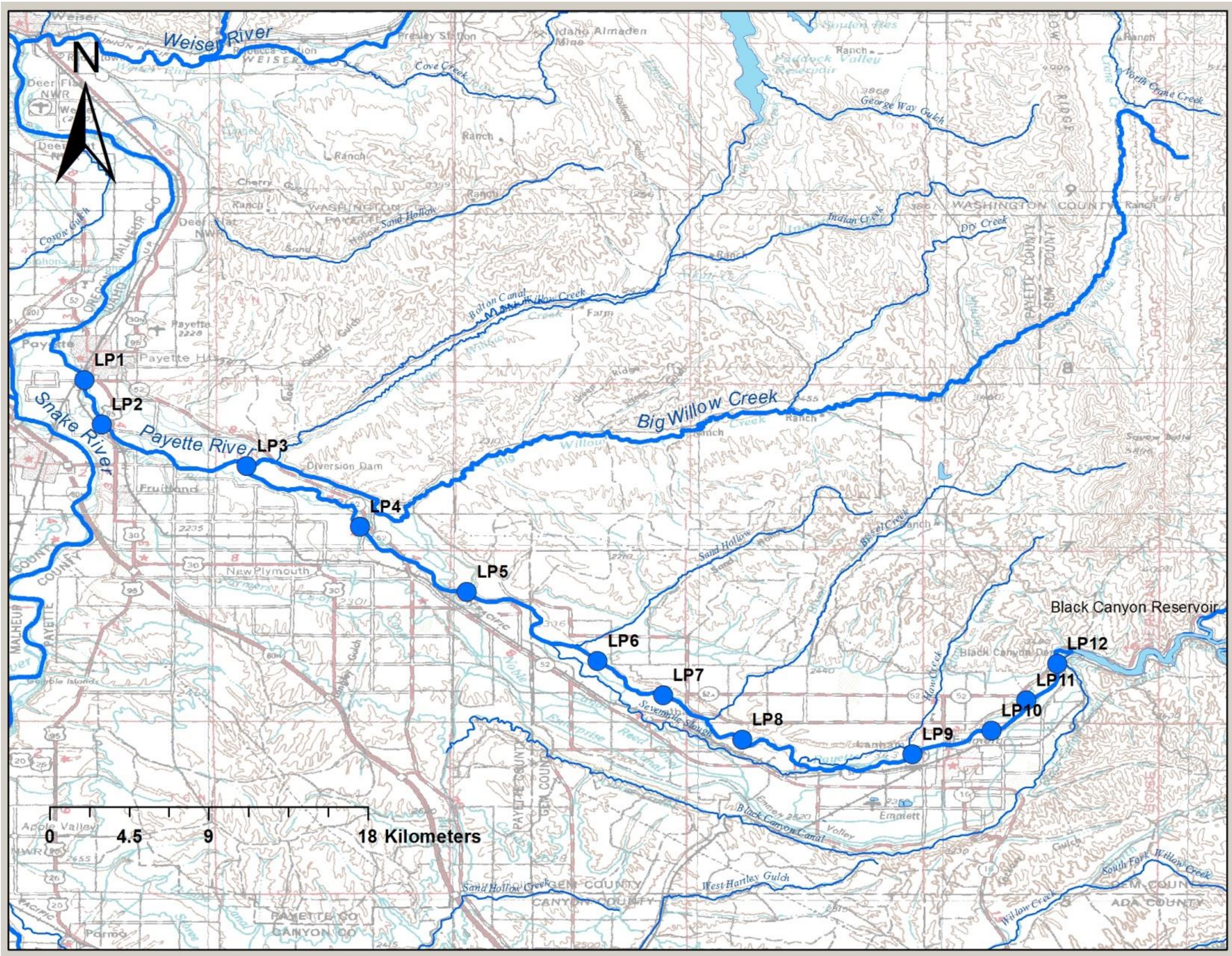

Figure 57. Electrofishing survey sites on the lower Payette River between Black Canyon Dam and the Snake River surveyed in 2009 and 2012.

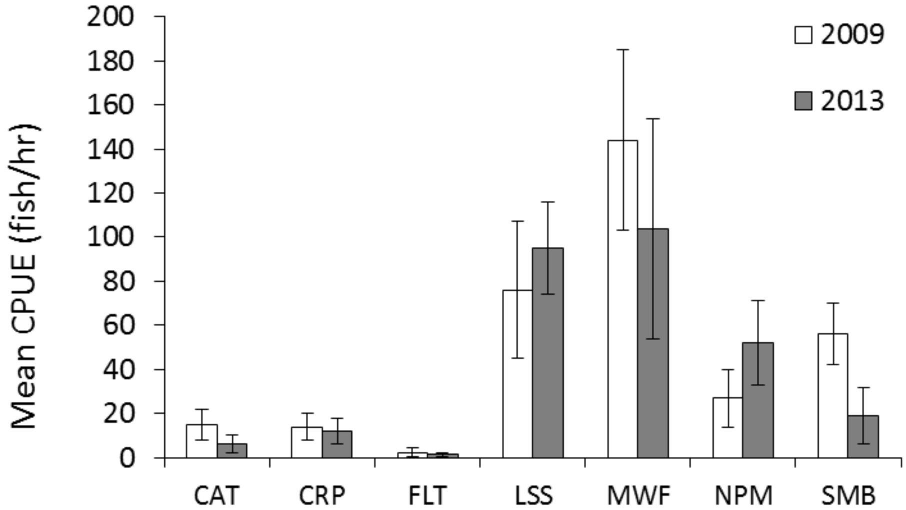

Figure 58. Mean CPUE (fish/hr) for Channel Catfish (CAT), Common Carp (CRP), Flathead Catfish (FLT), Largescale Sucker (LSS), Mountain Whitefish (MFW), Northern Pikeminnow (NPM), Smallmouth Bass (SMB) in the lower Payette River by river mile for 2009 and 2013 surveys. Error bars indicate 90% confidence intervals.

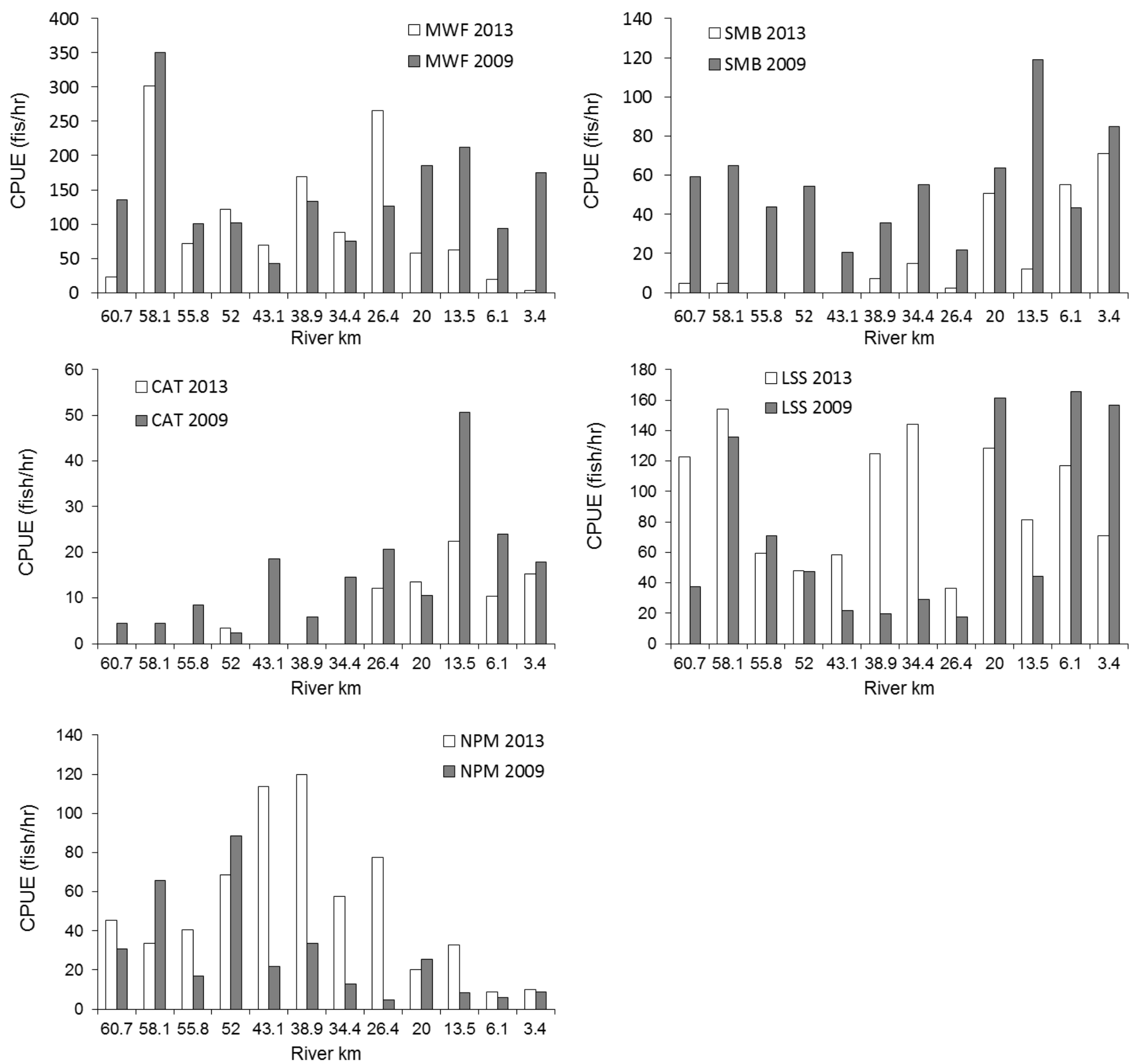

Figure 59. CPUE (fish/hr) effort for Mountain Whitefish (MFW), Smallmouth Bass (SMB), Channel Catfish (CAT), Largescale Sucker (LSS) and Northern Pikeminnow (NPM) in the lower Payette River by river kilometer for 2009 and 2013 surveys. The mouth of the Snake River is denoted by river kilometer zero.

MONITORING OF BULL TROUT AND REDBAND TROUT POPULATIONS IN TRIBUTARIES TO THE MIDDLE FORK BOISE RIVER

ABSTRACT

Six sites were sampled in 2013 in tributaries to the MFBR, including Sheep, Big Five, Pete, and Repeat creeks for the presence of Bull Trout *Salvelinus confluentas* and Redband Trout *Oncorhynchus mykiss gairdneri*. Pete Creek and Repeat Creek were sampled on August 6, 2013 while Big Five Creek and Sheep Creek were sampled on August 7, 2013. In the Bruneau River drainage, Sheep Creek and an unnamed tributary to Duncan Creek were sampled between July 30-31, 2013. Population estimates for Redband Trout were only calculated for the upper site at Sheep Creek where total density was 4.4 trout/100 m^2 (Table 23). Relative abundance was calculated as CPUE (trout/100 m^2) from fish collected during the first pass. Pete Creek contained the highest CPUE for Redband Trout $\leq$100 mm while Sheep, Big 5, and Pete creeks had similar capture rates of approximately 3 fish/100 m^2 for fish $\geq$100 mm. The 2013 electrofishing surveys conducted in the Middle Fork Boise River and Bruneau River drainages provided relative abundances of Redband Trout in a number of streams where current status was unknown. Three streams were identified as providing spawning and rearing habitat for Redband Trout in the MFBR system based on presence and size distribution. Furthermore, a resident Bull Trout was collected at the middle site in Sheep Creek, suggesting that additional surveys may be warranted to better describe status and abundance of Bull Trout within that tributary.

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INTRODUCTION

Redband Trout *Oncorhynchus mykiss gairdneri* are native to all major drainages in Southwest, Idaho. They have adapted across a wide range of stream habitats including high elevation montane streams and arid desert climates. Some controversy has existed regarding whether adaptation to these disparate habitats has led to speciation at some level. Recently, those Redband Trout that reside in desert locales were petitioned for listing under the ESA, under the assumption that they could be considered a separate sub species. The petition was denied. Since that time, additional research has indicated that only one species of resident stream dwelling Redband Trout may exist in Southwest Idaho (Cassinelli 2008). In 2011, a collaborative effort among multiple state and federal agencies called the Wild Native Trout Initiative (WNTI), sought to identify current status and distribution of Redband Trout in their native range of the Pacific Northwest, United States. Through this process, biologists were also able to identify portions of drainages where status was unknown or recent information was not available.

The Middle Fork Boise River (MFBR) is one of three major tributaries to the Boise River. The MFBR originates in the Sawtooth Mountains, and flows downstream to the confluence of Arrowrock Reservoir. Approximately 18 km upstream from Arrowrock, the North Fork Boise River (NFBR) joins the MFBR. The MFBR drainage has recently been designated as critical habitat for Bull Trout *Salvelinus confluentus* recovery by the U.S. Fish and Wildlife Service in September 2010. In addition to Bull Trout, the drainage is also home to Redband Trout *Oncorhynchus mykiss gairdneri,* Mountain Whitefish (*Prosopium williamsoni*), and sculpin *Cottus sp.,* and several other species. Hatchery Rainbow Trout (*Oncorhynchus mykiss*) are stocked at a number of campgrounds for a seasonal put and take fishery between Memorial Day and Labor Day. Between the NFBR confluence and Atlanta, Idaho, the stream is managed with quality trout objectives, where the Rainbow Trout limit is two, with none $\leq$14 inches. In addition, the use of bait and barbed hooks are restricted. Outside of this section, general fishing rules apply and the management goal is to manage for high catch rates of wild fish.

Both resident and migratory Bull Trout *Salvelinus confluentas* utilize the MFBR and its tributaries. Migratory fish (adfluvial and fluvial) winter in Arrowrock Reservoir or the South Fork Boise River (SFBR) and typically enter the lower MFBR in mid-May through early June and proceed to migrate upstream towards a number of higher elevation spawning tributaries in the North Fork Boise River (NFBR) and MFBR drainages (Flatter 2000). Spawning generally occurs in August and September, after which fish move back downstream to wintering areas.

A number of smaller tributaries to the MFBR have not been sampled in recent years and obtaining current information on the status of Bull Trout and Redband Trout would be useful. Therefore in 2013, IDFG began sampling tributaries where information on fish status was sparse, beginning at Arrowrock Reservoir with hopes of continuing upstream over the next several years.

METHODS

Six sites were sampled in 2013 in tributaries to the MFBR, including Sheep, Big Five, Pete, and Repeat creeks. Pete Creek and Repeat Creek were sampled on August 6, 2013 while

Big Five Creek and Sheep Creek were sampled on August 7, 2013 (Figure 60). In the Bruneau River drainage, Sheep Creek and an unnamed tributary to Duncan Creek were sampled between July 30-31, 2013 (Figure 61). Depletion estimates were not conducted at either site. All streams were sampled at base flow conditions to minimize changes in stream habitat and electrofishing efficiency.

Fish Sampling

At each site, we used depletion electrofishing to determine the abundance of salmonids, using 1-2 backpack electrofishers (Smith-Root Model 15-D) with pulsed DC. However, depletion estimates were not attempted when catch was limited to age-0 trout during the first pass. Nongame fish and amphibian species were also recorded if observed. Fish were identified, enumerated, measured to the nearest millimeter (total length, TL) and gram, and released downstream of the study sites. Fin clips were taken from all Redband and Bull trout collected during stream surveys in 2013 and stored in 90% EtOH for future genetic analysis. Block nets were installed at the upper and lower ends of the sites to prevent fish from leaving or entering a study site during the survey. When multiple passes were conducted, maximum-likelihood abundance and variance estimates were calculated with the MicroFish software package (Van Deventer 2006; Van Deventer and Platts 1989). When all trout were captured on the first pass, we estimated abundance to be the total catch. Because electrofishing is characteristically size selective (Sullivan 1956; Reynolds 1996), trout were separated into two length groups (<100 mm TL and ≥100 mm TL) and abundance estimates were calculated individually for each size group. Depletions were attempted only for salmonids, whereas relative abundance was recorded for all nongame fish and amphibian species. When depletion estimates were not conducted, relative abundance was estimated as catch per unit effort (CPUE), or the number of fish collected during the first pass divided by the area sampled. The CPUE was then expanded to 100 m^2 for standardization and comparison purposes.

Habitat Sampling

Various habitat measurements were recorded at 10 equally spaced transects within the sample site. Stream width was measured at each transect and depth (m) was measured at ¼, ½, and ¾ distance across the channel. The sum of these depth measurements was divided by four to account for zero depths at the stream margins for trapezoidal channels (Platts et al. 1983; Arend 1999). Wetted stream width (m) was calculated from the average of all transect measurements. In most cases stream temperature (°C) and conductivity (µS/cm) were measured at the bottom of a site with a calibrated hand-held meter accurate to ± 2%. Various other habitat measurements such as percent substrate composition, percent shading, and bank stability were measured but the results are not reported here.

RESULTS

In the MFBR drainage, a total of 70 Redband Trout were captured in Big Five, Pete, and Sheep creeks (Table 22). Repeat Creek was dry at the time of sampling. A single juvenile Bull Trout (239 mm) was collected in Sheep Creek at the middle site. Sculpin *sp.*and speckled dace were also captured. No adult migratory Bull Trout were captured during the 2013 sampling.

In the Bruneau River drainage, a total of 10 Redband Trout were collected in the unnamed tributary to Duncan Creek, while none were captured in Sheep Creek (Table 22). At Sheep Creek, catch was primarily Redside Shiner and Bridgelip Sucker.

Length distributions for Redband Trout in each stream were quite similar for fish in the MFBR drainage with fish ranging between 50 and 260 mm (Figure 62). Redband Trout in the unnamed tributary to Duncan Creek ranged between 105-191 mm.

Population estimates for Redband Trout were only calculated for the upper site at Sheep Creek where total density was 4.4 trout/100 m^2 (Table 23). Relative abundance was calculated as CPUE (trout/100 m^2) from fish collected during the first pass. Pete Creek contained the highest CPUE for Redband Trout $\leq$100 mm while Sheep, Big 5, and Pete creeks had similar capture rates of approximately 3 fish/100 m^2 for fish $\geq$100 mm (Figure 63).

DISCUSSION

The 2013 electrofishing surveys conducted in the Middle Fork Boise River and Bruneau River drainages provided relative abundances of Redband Trout in a number of streams where current status was unknown. Three streams were identified as providing spawning and rearing habitat for Redband Trout in the MFBR system based on presence and size distribution. Furthermore, a resident Bull Trout was collected at the middle site in Sheep Creek, suggesting that additional surveys may be warranted to better describe status and abundance of Bull Trout within that tributary. Redband Trout were also collected in an unnamed tributary to Duncan Creek, in Owyhee County, which also appears to be providing important rearing habitat or perhaps a thermal refuge for Redband Trout within drainage.

Unfortunately, IDFG does not have comparable historic surveys within any of the tributaries sampled in 2013 for long-term trend analysis. Relative abundance over time would have provided useful information for both Redband and Bull trout status within the MFBR system. However, these collections provide starting data points, particularly during an extremely arid and hot summer. The presence of juvenile Redband Trout identifies the inhabited streams as providing potential critical habitat to the persistence of wild trout in the MFBR. IDFG and other agencies may use these surveys when assessing impacts of current or future land management practices. Finally, inhabited drainages may be evaluated for future protection or habitat enhancement projects.

MANAGEMENT RECOMMENDATION

1. Continue to sample three to five tributaries in the MFBR in the next year where current Reband and Bull trout status is outdated or unknown. Sampling should continue upstream from Big Five Creek.

Table 22. Species captured by stream and site during electrofishing surveys in the Middle Fork Boise River and Bruneau River drainages in July 2013.

Stream	Site	Number of species captured: Bull Trout	Redband Trout	Speckled Dace	Sculpin sp.	Northern Pikeminnow	Bridgelip Sucker	Redside Shiner
Sheep Creek (Elmore Co.)	Middle	1	12	3	-	-	-	-
	Upper	-	27	-	-	-	-	-
Big Five Creek	Lower	-	20	-	-	-	-	-
	Middle	-	3	-	-	-	-	-
Pete Creek	2013	-	8	-	4	-	-	-
Repeat Creek	2013	-	-	-	-	-	-	-
Sheep Creek (Owyhee Co.)	2013	-	-	5	-	1	54	54
Unnamed Trib (Duncan Ck)	2013	-	10	-	-	-	-	-
Total	-	1	70	3	4	-	-	-

Table 23. Number of Redband Trout captured, population, and density (fish/100 m^2) estimates by length group and stream in 2013. Multiple passes were limited to the upper site at Sheep Creek in Elmore County, Idaho.

				< 100 mm			≥ 100 mm			Total		
Stream	Site	Temp (°C)	Passes	n	Estimate	95% CI	n	Estimate	95% CI	n	Estimate	fish/100m^2
Sheep Creek (Elmore Co.)	Middle	19.8	1	2	-	-	10	-	-	12	-	-
	Upper	19.2	2	8	8	-	19	19	18-20	27	25	
Big Five Creek	Lower	14	2	11	-	-	9	-	-	20	-	-
	Middle	15.2	1	1	-	-	2	-	-	3	-	-
Pete Creek	2013	14	1	6	-	-	2	-	-	8	-	-
Repeat Creek	2013	Dry	1	-	-	-	-	-	-	-	-	-
Sheep Creek (Owyhee Co.)	2013	23.8	1	-	-	-	-	-	-	-	-	-
Unnamed Trib (Duncan Ck)	2013	13.8	1	-	-	-	10	-	-	10	-	-

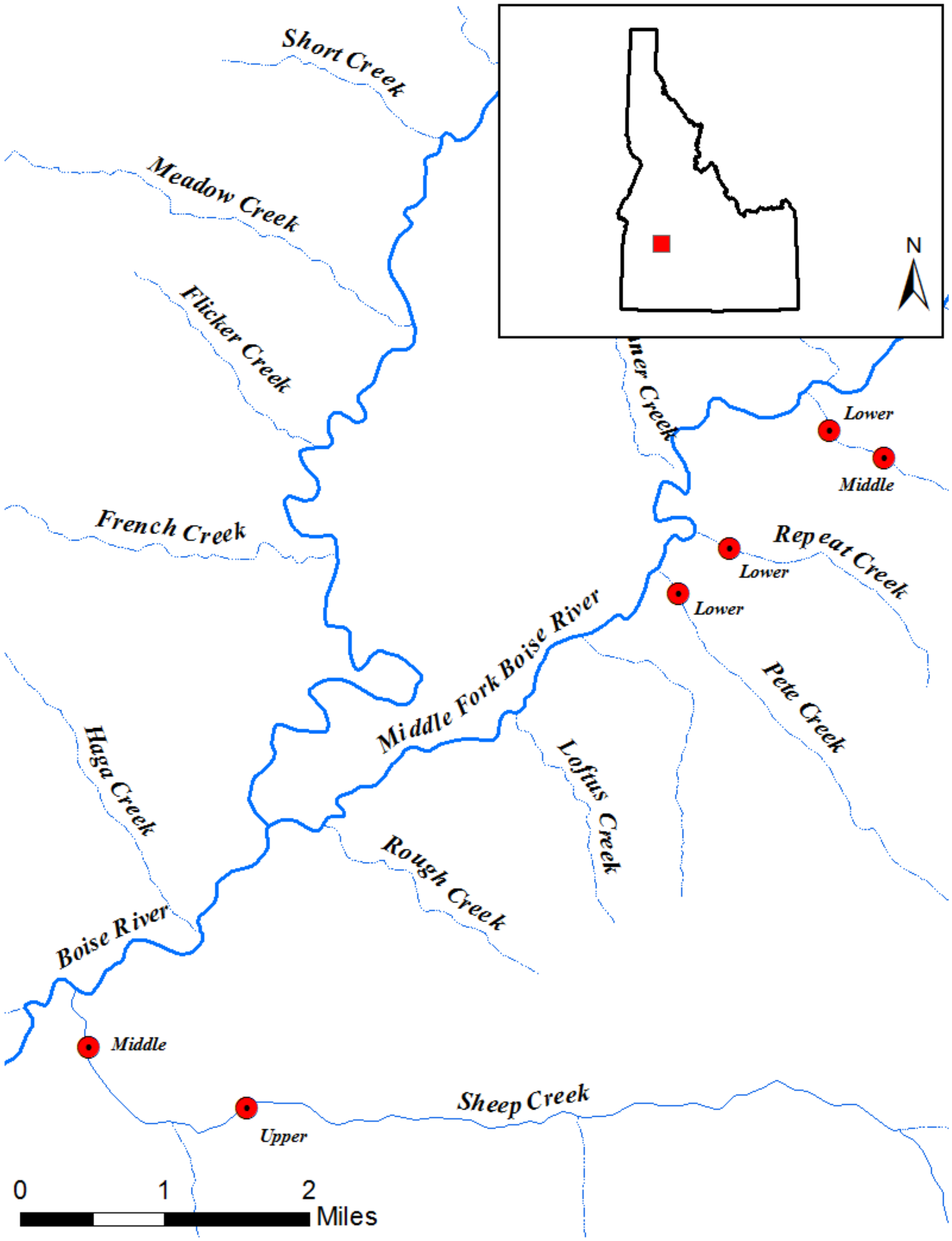

Figure 60. Map of the Middle Fork Boise River drainage, Idaho and the six sites in four streams sampled to assess fish populations within the drainage during July 2013.

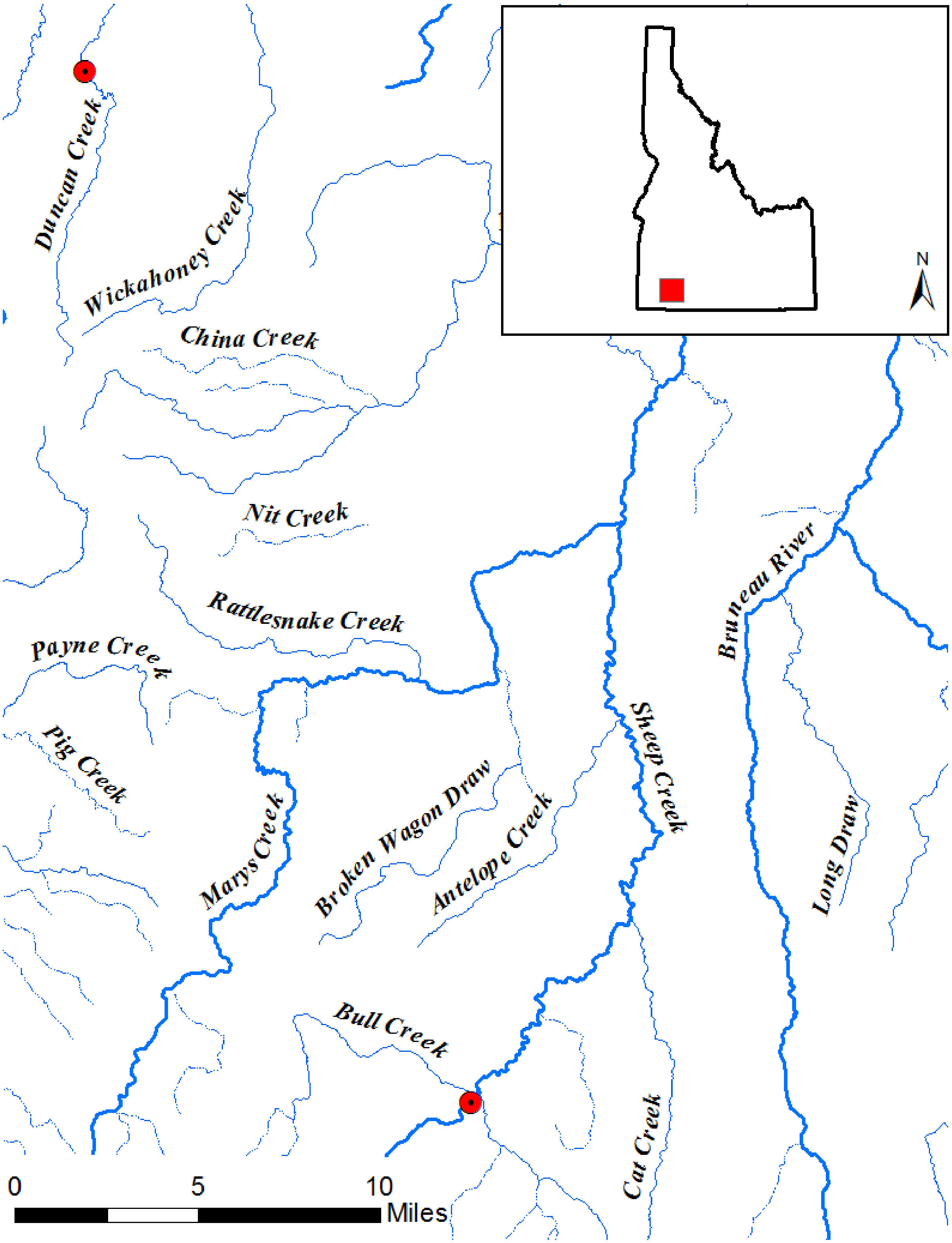

Figure 61. Map of the Bruneau River drainage, Idaho and the two sites sampled to assess fish populations within the drainage during July 2013.

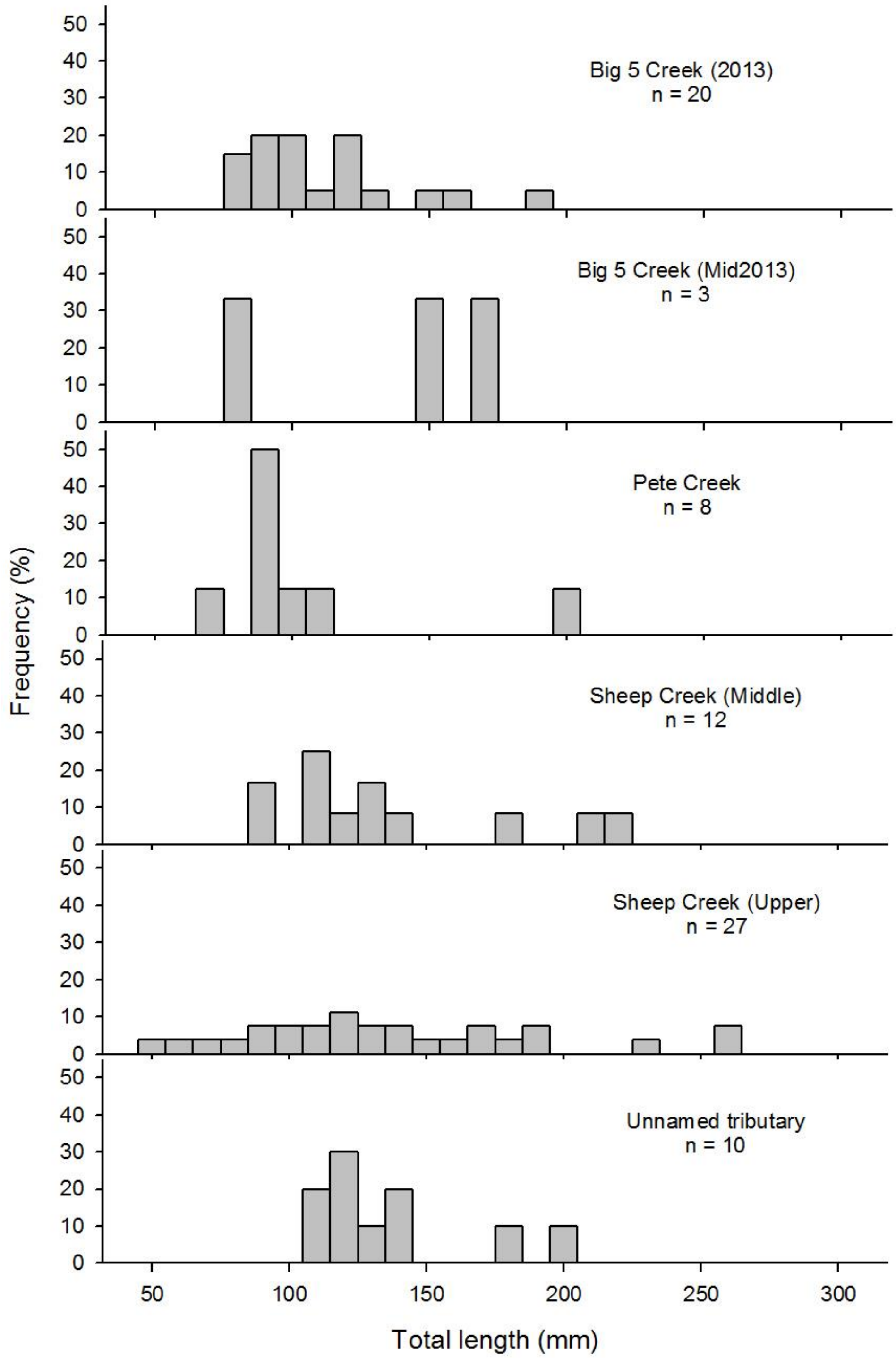

Figure 62. Redband Trout length distribution (%) of fish captured in July 2013 at sites sampled in the Middle Fork Boise and Bruneau river drainages.

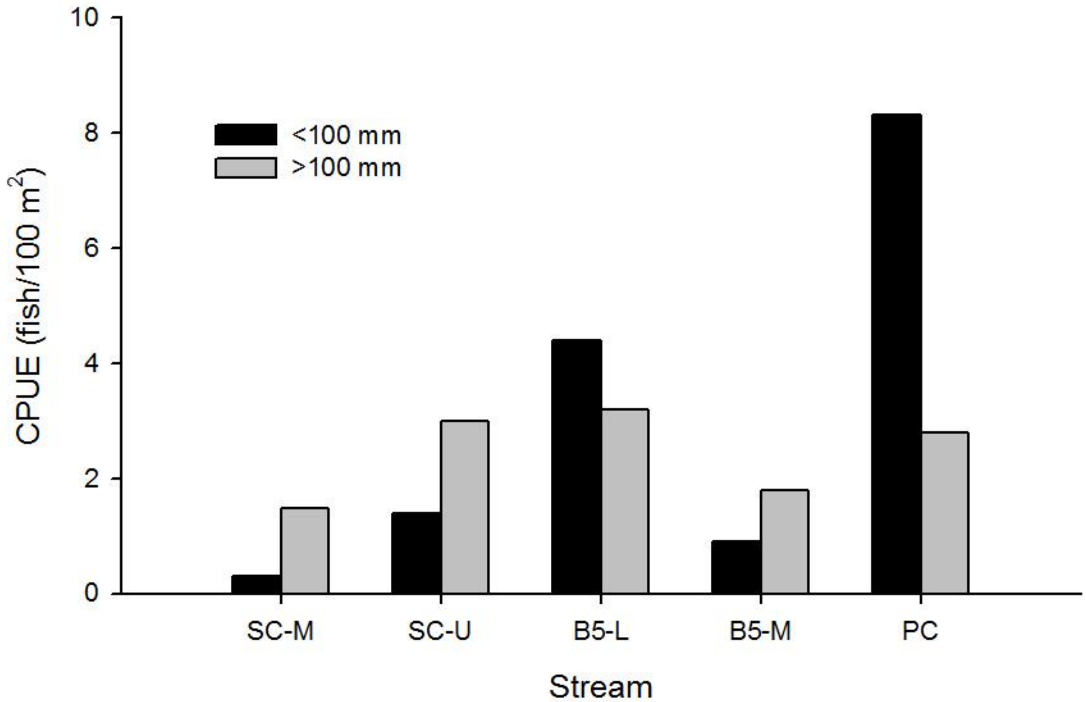

Figure 63. Redband Trout CPUE for two size groups, calculated as fish/100 m^2, for sites in three tributaries to the Middle Fork Boise River, in 2013. Estimates were calculated for Sheep Creek middle site (SC-M), Sheep Creek upper site (SC-U), Big 5 Creek lower site (B5-L), Big 5 Creek middle site (B5-M), and Pete Creek (PC).

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