FISHERY MANAGEMENT INVESTIGATIONS

IDAHO DEPARTMENT OF FISH AND GAME

FISHERIES MANAGEMENT ANNUAL REPORT

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SOUTHWEST REGION

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Lowland Reservoir and Lake Surveys

ARROWROCK RESERVOIR

ABSTRACT

A standard lowland lake survey was conducted at Arrowrock Reservoir to assess the impact of 2011-2012 removal efforts for northern pikeminnow *Ptychocheilus oregonensis* and largescale sucker *Catostomus macrocheilus*. Results were compared to a survey conducted in 2009. A total of 802 fish were captured during the standard lowland lake survey at Arrowrock Reservoir on June 11-14, 2012. Catch was predominately northern pikeminnow (n=348) and largescale suckers (n=259). A total of 16 bridgelip suckers *C. columbianus*, 1 bull trout *Salvelinus confluentus*, 3 chiselmouth *Acrocheilus alutaceus*, 7 kokanee *Oncorhynchus nerka*, 1 mountain whitefish *Prosopium williamsoni*, 37 rainbow trout *O. mykiss*, 128 smallmouth bass *Micropterus dolomieu*, and 2 yellow perch *Perca flavescens* were also captured. Catch-per-unit-effort (CPUE) and weight-per-unit-effort (WPUE) indices for combined species were 162.8 and 83.4. Removal efforts did appear to have an effect on northern pikeminnow as CPUE was reduced 42% from 98 to 57 fish/night. However northern pikeminnow WPUE increased nearly 6-fold from 23 to 100 kg/night between 2009 and 2012. Similarly, while largescale sucker CPUE appears to have been stable between the two periods, WPUE more than doubled between 2009 and 2012. Despite removal efforts there were not pronounced changes in species composition between 2009 and 2012. Northern pikeminnow showed a slight reduction in species composition from 44% to 37%.

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INTRODUCTION

Arrowrock Reservoir is a 3,150 ha, dendritic impoundment located approximately 32 km northeast of Boise, Idaho in the upper Boise River drainage. It is a 29 km-long, narrow canyon reservoir that impounds two major tributaries: the Middle Fork Boise River (MFBR) and South Fork Boise River (SFBR). Arrowrock Dam, which is operated by the U.S. Bureau of Reclamation (BOR), sits directly upstream of Lucky Peak Reservoir. Due to its close proximity to Boise, the reservoir is a popular recreational area for boaters and anglers. The reservoir provides a sport fishery that includes rainbow trout *Oncorhynchus mykiss*, kokanee *O. nerka*, and smallmouth bass *Micropterus dolomieu*. An adfluvial population of bull trout *Salvelinus confluentus* also utilizes Arrowrock Reservoir for overwintering. According to historic Idaho Department of Fish and Game (IDFG) gill netting surveys, the fishery is dominated by two nongame species: northern pikeminnow *Ptychocheilus oregonensis* and largescale sucker *Catostomus macrocheilus*. In addition, yellow perch *Perca flavescens*, bridgelip sucker *Catostomus columbianus*, chiselmouth *Acrocheilus alutaceus*, and redside shiner *Richardsonius balteatus* have also been observed frequently in the reservoir.

Arrowrock Reservoir is managed by BOR for irrigation storage and flood control. Typically the reservoir experiences drawdowns of 60-70% of capacity during the irrigation season while Lucky Peak Reservoir is managed at full capacity through the first week of September for recreation. After Labor Day, Arrowrock Reservoir begins refilling while Lucky Peak Reservoir is dropped to provide storage space for the following spring runoff. During fall 2003, Arrowrock Reservoir was drafted to approximately 1% of capacity for valve replacement and dam repairs. During this period, much of the reservoir was reduced to a river channel which likely caused high levels of mortality to many species. Bull trout experienced mortality rates of 50% during the drawdown period in 2003 (Salow and Hostetler 2004).

Despite stocking over 1.3 million rainbow since the 2003 drawdown, IDFG regional fishery personnel receive complaints every summer regarding poor catch rates. Many anglers also reported catching only northern pikeminnow during fishing trips. Results of a 2009 lowland lake survey further corroborated angler reports. During June 2009, 88% of the total biomass was estimated to be largescale suckers (48% of species composition) and northern pikeminnow (39% of species composition; Butts et al. 2010). Rainbow trout comprised <1% of the total biomass during the survey.

During the fall of 2011 and spring 2012, BOR contracted with a commercial fishing operation, Hickey Brothers Research, LLC, Baileys Harbor, WI, to conduct intensive gillnetting and trap netting in the reservoir to obtain a mark-recapture population estimate for bull trout. The marking efforts were conducted during November 2011 and March 2012. IDFG was a collaborator in these efforts and enumerated and euthanized all northern pikeminnow and sucker spp. encountered during the netting activities. Effectiveness of removal efforts was assessed during a lowland lake survey that was conducted in June 11-14, 2012.

METHODS

Lowland Lake Survey

Fish populations in Arrowrock Reservoir were sampled with standard IDFG lowland lake sampling gears during June 11 – 14, 2012. Arrowrock Reservoir was divided into three sections, (main reservoir, South Fork Boise River (SFBR) arm, and Middle Fork Boise River (MFBR) arm) for sampling to determine if spatial differences in species assemblages existed (Figure 1). Sampling gear included: (1) paired gill nets, (2) trap nets, and (3) night electrofishing. A total of four pairs of gill nets, four trap nets, and one hour of electrofishing were conducted at each section of the reservoir. Paired gill net sets included floating and sinking monofilament nets, 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. Trap nets possessed 15-m leads, 1-m x 2-m frames, crowfoot throats on the first and third of five loops, 19-mm bar mesh, and had been treated with black tar. One trap net fished for one night equaled one unit of trap net effort. For boat electrofishing effort, 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 5 – 6 amps. One hour of active electrofishing equaled one unit of electrofishing effort.

Captured fish were identified to species, measured for total length and weighed in grams using a digital scale. In the event that weight was not collected, length-weight relationships were developed from fish weighed and measured in 2012 which allowed us to estimate weights of un-weighed fish. Furthermore, for those fish not weighed or measured, average weights were used to calculate biomass estimates. Catch data were summarized as the number of fish caught per unit effort (CPUE) and the weight in kg caught per unit effort (WPUE). These indices were calculated by standardizing the catch of each gear type to one unit of effort and then summing across the three gear types.

Nongame Fish Removal

Netting operations in Arrowrock Reservoir were conducted with three types of sampling gear during October 24 – November 11, 2011 throughout the reservoir (Figure 1). Sampling gear included: (1) gill nets, (2) stationary trap nets, and (3) beach seining. Gill nets were sinking monofilament nets, 91- m x 2-m, with mesh sizes of 38, 59, 64, 76, and 89 mm. Gillnets were tied together lengthwise so that total net length was 364 m. Gill nets were retrieved shortly after deployment to avoid bull trout mortality. Trap nets possessed a 122-m lead, 23-m hearts, to a 5-m x 3.7-m x 3.7-m pot with 19-mm bar mesh, and had been treated with black tar. The beach seine was 91-m x 6-m deep and 6-mm bar mesh, with a 6-m bag. Trap nets were checked and processed every two days. In total, 24 trap net sets, 57 gill net sets, and 13 beach seine hauls were conducted during fall 2011. Duration and mesh composition of gill net sets were varied during the netting operation making CPUE and WPUE estimates not comparable.

Spring netting operations occurred during March 26 - April 17, 2012. Gill nets were sinking monofilament nets, 91- m x 2-m, with mesh sizes of 38, 59, 64, 76, 89, and 101 mm. Gill nets were tied together lengthwise so that total net length was between 549 and 1,463 m depending on location and time of day. Gill nets were retrieved immediately after deployment or a maximum of 0.5 hr soak time.

For each seasonal period, captured fish were identified to species, and up to 300 individuals of each species were measured for total length (± 1 mm), and weighed (±1 g for fish under 5,000 g or ± 10 g for fish greater than 5,000 g) with a digital scale. In the event that weight was not collected, length-weight relationships were established from fish weighed and measured which allowed us to estimate weights of un-weighed fish.

RESULTS

Lowland Lake Survey

A total of 802 fish were captured during the standard lowland lake survey (Table 1). Catch was predominately northern pikeminnow (n=348) and largescale suckers (n=259). A total of 16 bridgelip suckers, 1 bull trout, 3 chiselmouth, 7 kokanee, 1 mountain whitefish *Prosopium williamsoni*, 19 rainbow trout, 18 hatchery rainbow trout, 128 smallmouth bass, and 2 yellow perch were also captured. CPUE AND WPUE indices for combined species were 162.8 and 83.4 (Table 1 and 2). Electrofishing was the most effective gear type with a total CPUE of 123, followed by gill nets (CPUE = 36.2). Based on CPUE, northern pikeminnow made up 35% of the total catch, followed by largescale suckers (30%), smallmouth bass (25%), bridgelip suckers (2%), and rainbow trout (wild and hatchery combined) contributed 7% to the total catch. All the other species collected contributed <1% of total catch (Table 1). Based on WPUE, the fish community consisted of largescale suckers (66%), northern pikeminnow (24%), smallmouth bass (4%),bridgelip sucker (2%), and rainbow trout (wild and hatchery combined) contributed 2% to the total catch. Remaining species collected represented less than 1% of the total biomass (Table 2).

Northern pikeminnow were the most abundant fish sampled with 348 fish captured. They were captured with a total CPUE of 56 and a WPUE of 20 kg (Table 1 and 2). Electrofishing yielded the highest CPUE (37 fish/hr) of the individual capture methods followed by gill nets with a CPUE of 17.3 fish/night. Northern pikeminnow ranged between 70 and 570 mm, however 93% of fish were between 300 and 380 mm and likely belong to a single year class (Figure 2).

Largescale sucker were the second most common fish sampled, with 259 fish captured. They were captured with a total CPUE of 49 and a WPUE of 55 kg (Table 1 and 2). Electrofishing yielded the highest CPUE (37 fish/hr) of the individual capture methods followed by gill nets with a CPUE of 11.4 fish/night. Largescale suckers ranged from 340 to 580 mm (Figure 2).

Smallmouth bass were the third most abundant fish species at Arrowrock Reservoir with 128 fish captured. They were captured with a total CPUE of 41 and a WPUE of 4 kg (Table 1 and 2). Electrofishing yielded the highest CPUE (41 fish/hr), followed by gill nets with a CPUE of .25 fish/night. Smallmouth bass ranged from 60 to 470 mm and over 70% of fish were between 100-200 mm (Figure 3).

Of the three most abundant fish species present in Arrowrock Reservoir, in terms of biomass, largescale suckers show the highest WPUE (55.4 kg). Northern pikeminnow followed with a WPUE total of 20.3 kg. Smallmouth bass had a WPUE total of 3.7 kg (Table 1 and 2).

Nongame Fish Removal

A total of 17,673 fish were captured during fall and spring netting efforts (Table 3). Approximately 70% of fish were captured during fall efforts as spring netting efforts were largely compromised by boat problems and vandalism. Catch was mainly largescale and bridgelip suckers (*n* = 8,343) and northern pikeminnow (*n* = 6,918). A total of 991 yellow perch, 546 mountain whitefish, 266 kokanee, 138 smallmouth bass, 198 rainbow trout, and 162 bull trout were also captured. Remaining fish species sampled included chiselmouth, and cutthroat trout (*O. clarki lewisi*). A total of 6,724 kg of sucker *spp*. and 2,560 kg of northern pikeminnow were removed.

Northern pikeminnow ranged in length between 47 and 530 mm; however, 85% were between 300 and 400 mm and likely belong to a single year class (Figure 4). Fish that measured <100 mm were collected in the fall by beach seining only, due to both mesh size and habitat use.

Largescale and bridgelip suckers were not consistently identified correctly by non-IDFG staff involved in netting efforts so these species were combined for analysis purposes. Sucker *spp*. ranged in length from 196 to 553 mm with over 91% of fish between 380 and 530 mm (Figure 4).

Removal efforts appeared to have an effect on northern pikeminnow as CPUE was reduced 42%, from 98 to 57 fish/night (Figure 5). However northern pikeminnow WPUE increased nearly 6-fold from 23 to 100 kg/night between 2009 and 2012. Similarly, while largescale sucker CPUE appears to have been stable between the two periods, WPUE more than doubled between 2009 and 2012. Despite removal efforts there were not pronounced changes in species composition between 2009 and 2012. Northern pikeminnow showed a slight reduction in CPUE composition from 44% to 37% and WPUE was reduced from 39% to 25% (Figure 5). Conversely, largescale sucker composition of CPUE increased from 23% to 31%, while WPUE increased from 45% to 65%. Whether the changes are a result of removal efforts, or simply variance from sampling, is unknown. Other species such as rainbow trout and smallmouth bass did not appear to change significantly between surveys.

DISCUSSION

Although over 6,700 kg of sucker *spp*. and 2,500 kg of northern pikeminnow were removed from the population, 91% of the total biomass collected in June 2012 was from these species. IDFG did not have the resources to estimate population size of these species prior to removal efforts. Therefore there was no way to estimate how many fish would need to be removed to detect a significant effect with the lowland lake survey. By participating in BOR funded netting efforts, IDFG hoped to depress the populations of these rough fish species to a point where survival, growth, and overall species composition of the reservoir was shifted towards sportfish. During the fall efforts, IDFG expenses to remove 6,600 kg of nongame fish were limited to personnel costs of approximately $2,500. Therefore, although removal efforts failed to produce a measurable reduction in abundance and biomass of northern pikeminnow and sucker *sp*. in Arrowrock Reservoir, IDFG's monetary investment was fairly minimal.

The 2009 lowland lake survey also suggested that the historic rainbow trout stocking program has not been successful, particularly in terms of fingerling fish (Butts et al. 2009). However, since 2008 IDFG has tried to shift towards more catchable-sized trout whenever possible to reduce predation. Hatchery rainbow trout more than doubled between the two lowland lake surveys, likely a result of the emphasis on catchable trout stocking. Beginning in 2012, IDFG switched to primarily stocking catchable-sized rainbow trout in the fall. This change is expected to promote the development of a good rainbow trout fishery.

MANAGEMENT RECOMMENDATIONS

1. Monitor rainbow trout and kokanee stocking practices through annual May creel index. Cooperate with BOR during March/April 2013 netting efforts to remove additional northern pikeminnow and sucker *spp*.

2. Continue to explore opportunities to fine funding for future efforts, including conducting a population estimate on northern pikeminnow and largescale sucker to determine the number of fish that would need to be removed.

Table 1. Catch and catch-per-unit-effort (CPUE) statistics by species and gear type for the lowland lake survey conducted in Arrowrock Reservoir on June 11-14, 2012.

	Electrofish Catch	Electrofish CPUE	Gill Net Catch	Gill Net CPUE	Trap Net Catch	Trap Net CPUE	Total Catch	Total CPUE
Bridgelip Sucker	7	2.3	7	0.6	2	0.2	16	3.1
Bull Trout	-	-	1	0.1	-	-	1	0.1
Chiselmouth	-	-	3	0.3	-	-	3	0.3
Kokanee	-	-	7	0.6	-	-	7	0.6
Largescale Sucker	111	37	137	11.4	11	0.9	259	49.3
Mountain Whitefish	-	-	1	0.1	-	-	1	0.1
Northern Pikeminnow	111	37	208	17.3	29	2.4	348	56.8
Rainbow Trout (Wild)	4	1.3	15	5.0	-	-	19	6.3
Rainbow Trout (Hatchery)	12	4	6	0.5	-	-	18	4.5
Smallmouth Bass	123	41	3	0.3	2	0.2	128	41.4
Yellow Perch	1	0.3	1	0.1	-	-	2	0.4
Total	369	123.0	389	36.2	44	3.7	802	162.8

Table 2. Total biomass (kg) and weight-per-unit-effort (WPUE) statistics by species and gear type for the lowland lake survey conducted in Arrowrock Reservoir on June 11-14, 2012.

	Electrofish Weight	Electrofish WPUE	Gill Net Weight	Gill Net WPUE	Trap Net Weight	Trap Net WPUE	Total Weight	Total WPUE
Bridgelip Sucker	3.9	1.3	3.1	0.2	0.3	0.0	7.3	1.5
Bull Trout	-	-	-	-	-	-	-	-
Chiselmouth	-	-	0.9	0.1	-	-	0.9	0.1
Kokanee	-	-	4.7	0.4	-	-	4.7	0.4
Largescale Sucker	124.4	41.5	154.8	12.9	12.3	1.02	291.5	55.4
Mountain Whitefish	-	-	0.2	0.0	-	-	0.2	0.0
Northern Pikeminnow	37.9	12.7	81.9	6.8	9.9	0.83	129.7	20.3
Rainbow Trout (Wild)	1.2	0.4	3.7	0.3	-	-	4.9	0.7
Rainbow Trout (Hatchery)	2.9	1.0	1.9	0.2	-	-	4.8	1.1
Smallmouth Bass	10.4	3.5	1.7	0.2	0.3	0.02	12.4	3.7
Yellow Perch	1.5	0.1	0.3	0.0	-	-	1.8	0.1
Total	182.2	60.4	253.2	21.0	22.8	1.91	458.2	83.4

Table 3. Numbers captured and biomass (kg) removed from population during cooperative efforts to estimate bull trout population size and remove nongame fish from Arrowrock Reservoir during fall 2011 and spring 2012.

	Fall 2011		Spring 2012		Total	
Species	No. captured	Wt. removed (kg)	No. captured	Wt. removed (kg)	No. captured	Wt. removed (kg)
Bull trout	96	-	66	-	162	-
Chiselmouth	70	-	39	-	109	-
Cutthroat *sp.*	2	-	0	-	2	-
Kokanee	5	-	261	-	266	-
Mountain whitefish	234	-	312	-	546	-
Northern pikeminnow	4,079	1,510	2,839	1,050	6918	2,560
Hatcery rainbow trout	96	-	84	-	180	-
Rainbow trout	18	-	0	-	18	-
Smallmouth bass	133	-	5	-	138	-
Sucker *sp.* (largecale	6,297	5,077	1105	891	8343	6,724
and bridgelip combined)		-	-	-		
Yellow perch	971	-	20	-	991	-
Totals	**12,001**	**6,587**	**4,731**	**1,941**	**17,673**	**9,284**

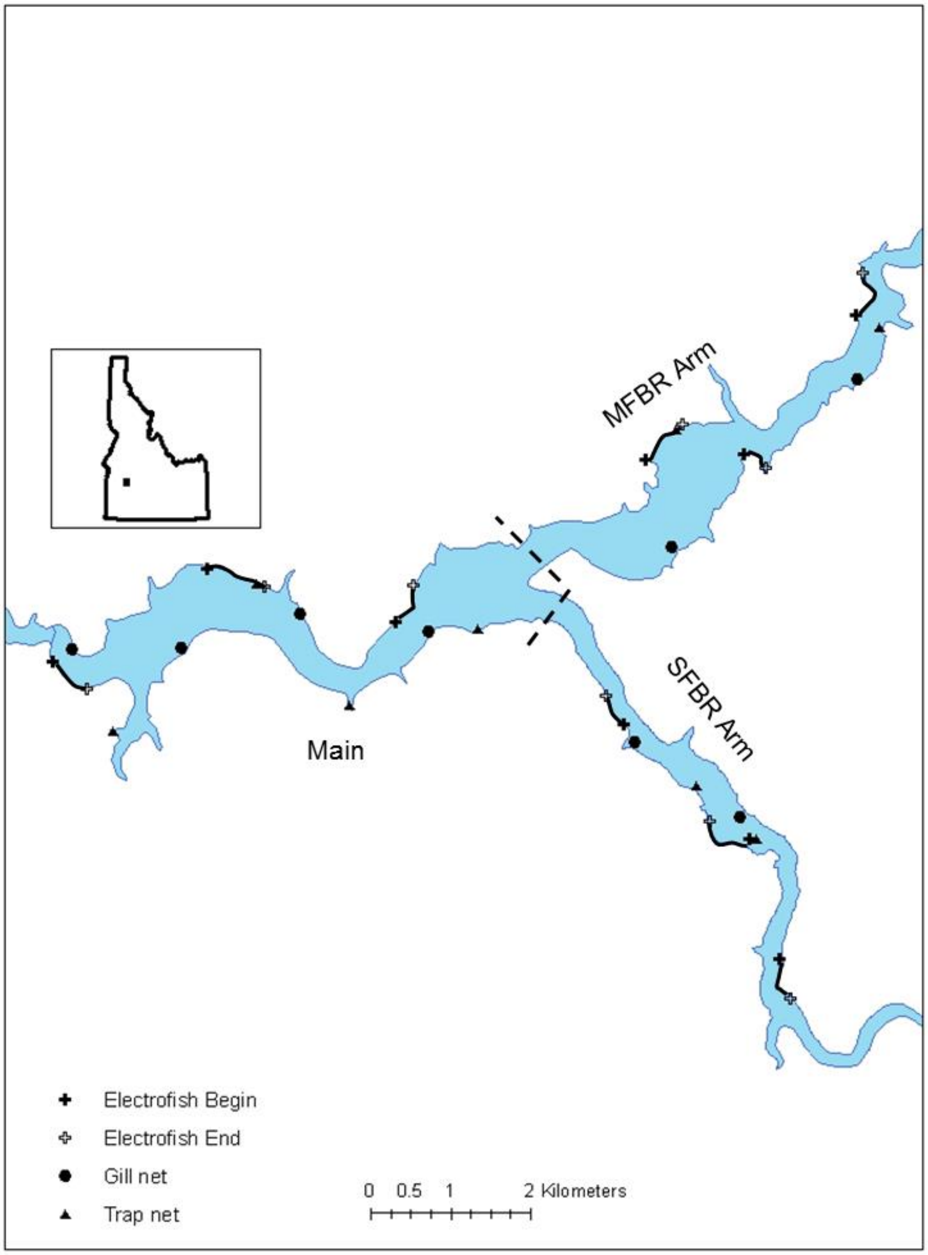

Figure 1. Map of Arrowrock Reservoir and locations of sampling gear used during the 2009 and 2012 lowland lake surveys.

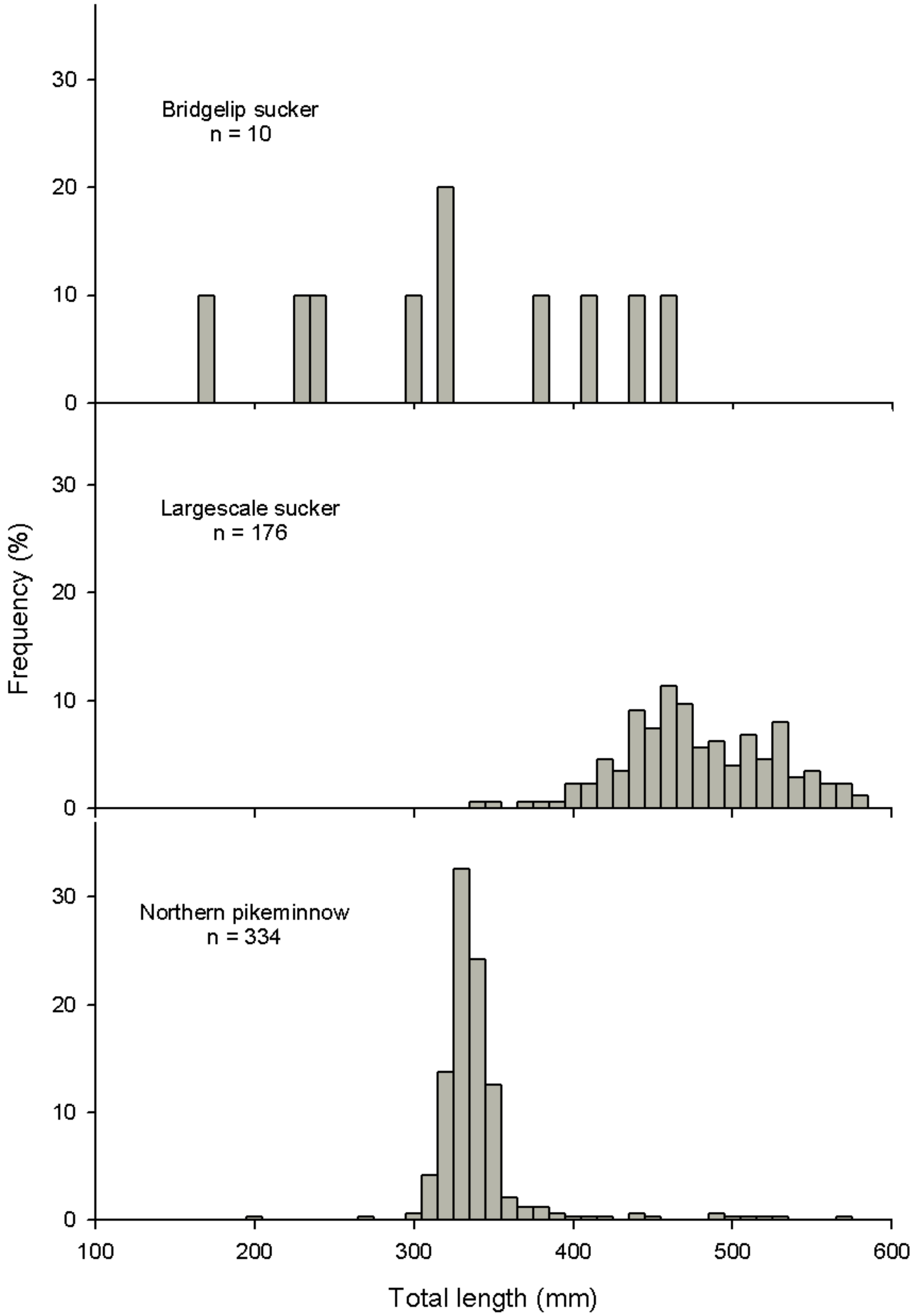

Figure 2. Length frequencies of nongame fish captured during the June 2012 lowland lake survey at Arrowrock Reservoir, Idaho.

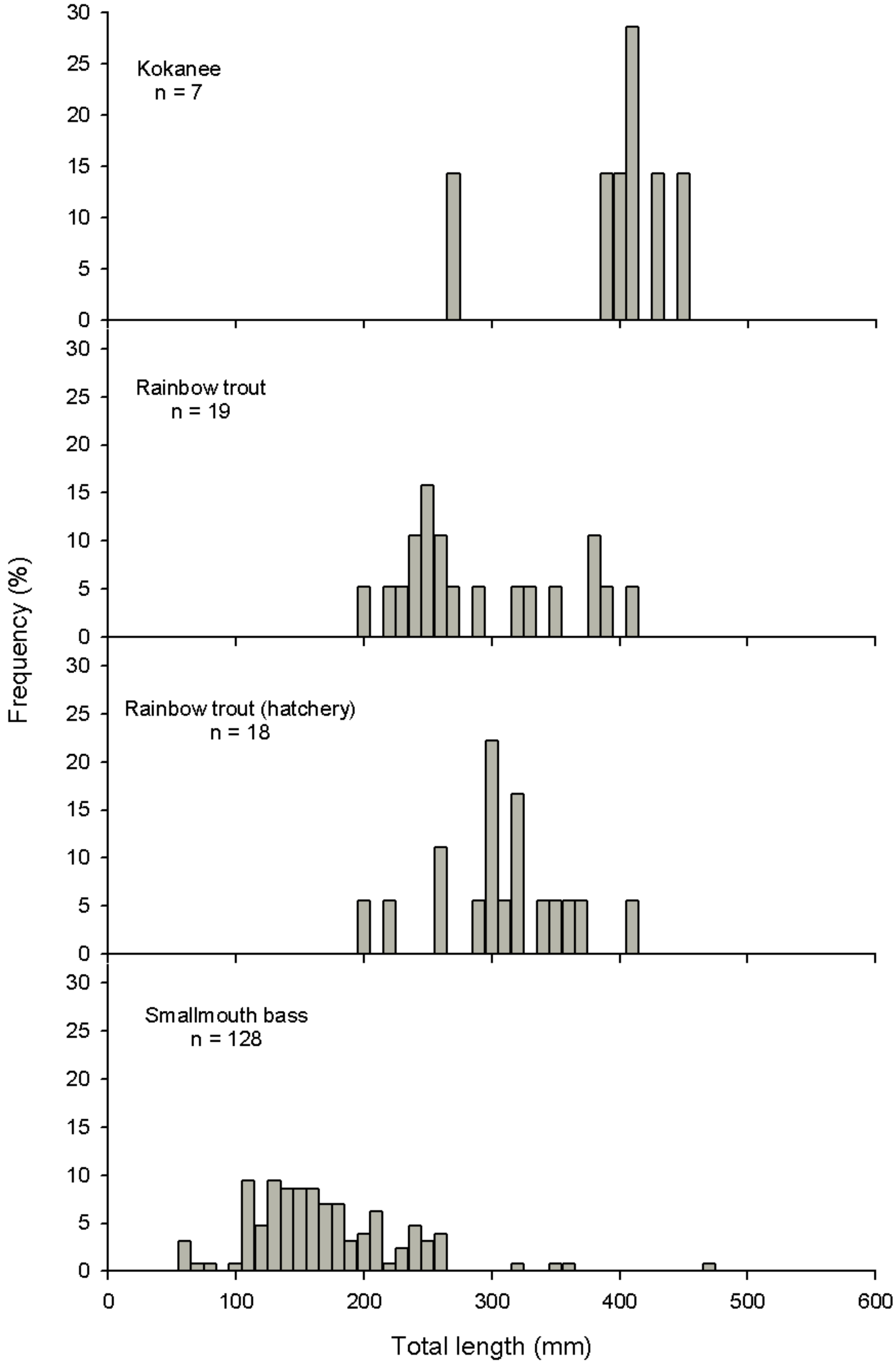

Figure 3. Length frequencies of game fish captured during the June 2012 lowland lake survey at Arrowrock Reservoir, Idaho.

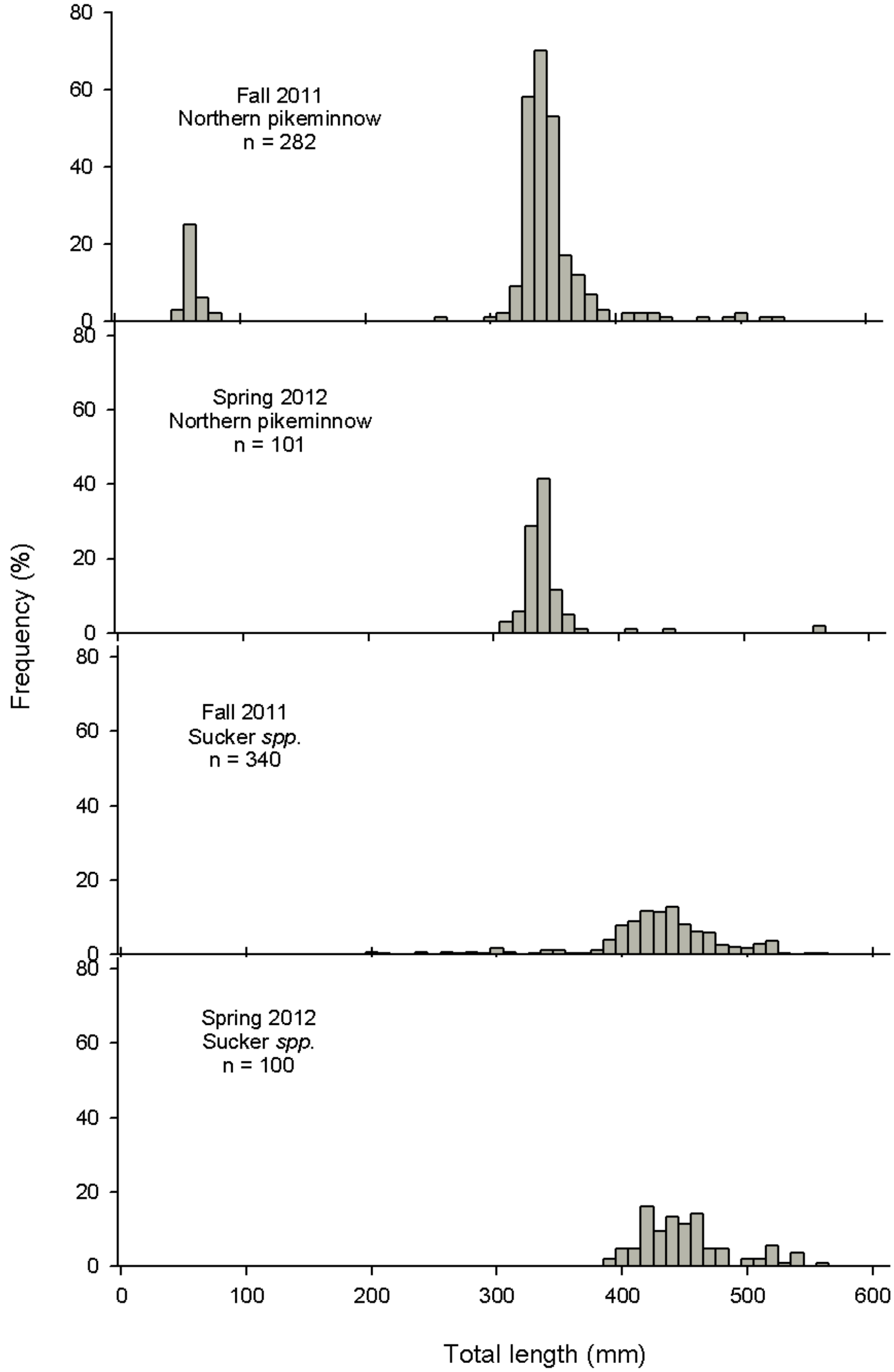

Figure 4. Length frequencies of northern pikeminnow and sucker sp. captured during removal efforts in fall 2011 and spring 2012 at Arrowrock Reservoir, Idaho.

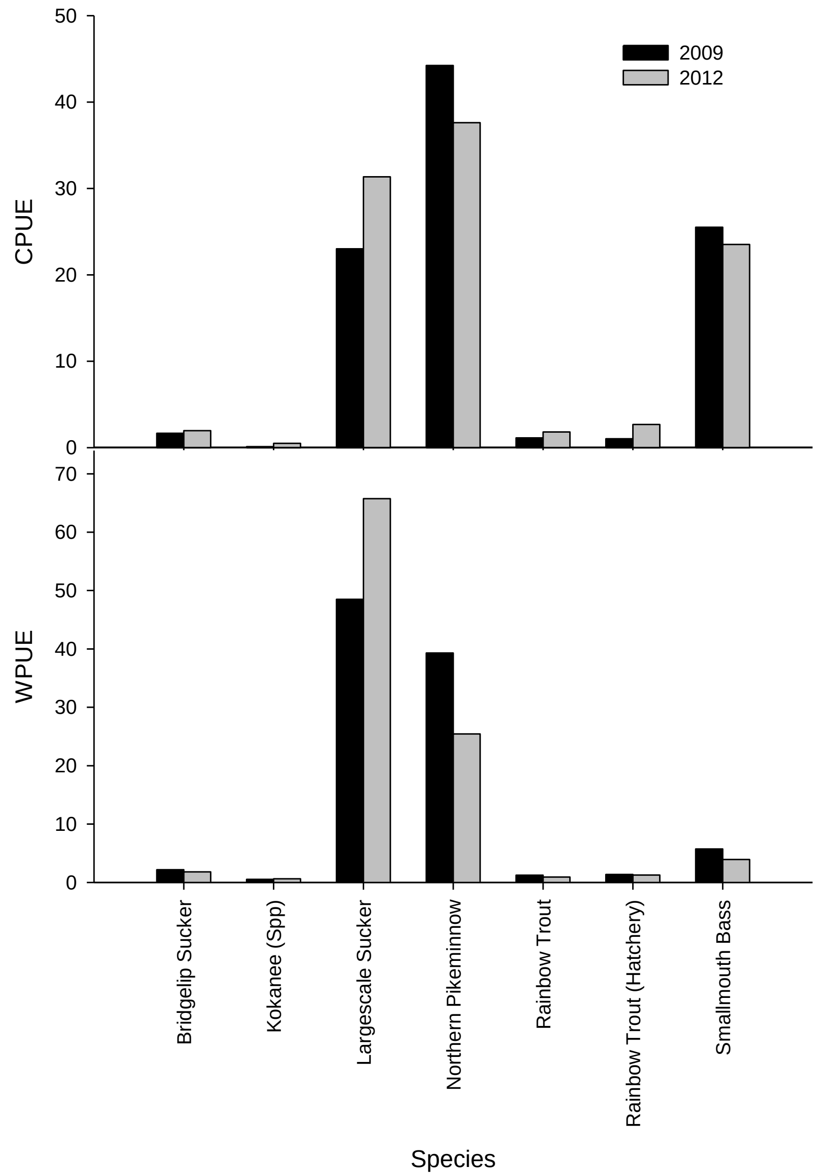

Figure 5. Comparisons by CPUE and WPUE for primary species captured during 2009 and 2012 lowland lake survey at Arrowrock Reservoir, Idaho.

CREEL SURVEY OF BROWNLEE RESERVOIR

ABSTRACT

The Idaho Department of Fish and Game (IDFG) conducted a one-month duration creel survey at Brownlee Reservoir to gauge catch rates and age structure in the recreational harvest. These data will be used as part of a multi-year assessment to determine if larval tows can be utilized to predict fishing quality (for crappie *Pomoxis spp.*) several years later. We also used this opportunity to gather data on other species, and to collect otoliths and estimate fish ages in the recreational creel. We interviewed 313 anglers from 137 distinct parties. Interviewed anglers expended a total of 1,512 h or an average of 4.8 h/trip. Total catch was 3,063 fish with only 20% being harvested. Of the 313 anglers interviewed, 54%, 23%, and 21% of anglers identified their target species as crappie, smallmouth bass *Micropterus dolomieu*, and all species, respectively. Overall catch rates for crappie and smallmouth bass were 0.3 and 1.7 fish/h, respectively. Nearly all crappie were age-6 and produced during the 2006 spawn year. It is likely that crappie fishing will be poor during 2013.

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INTRODUCTION

Brownlee Reservoir is a 6,000-ha impoundment located in southwestern Idaho. The dam, completed during 1959, lies approximately 35 km northwest of Cambridge, Idaho. At full pool, the reservoir is nearly 90 km long and inundates the Snake River channel upstream to Farewell Bend, Oregon. For the 90 km between these two points, Brownlee Reservoir is the boundary between Idaho and Oregon. Because of its location, fisheries management and enforcement responsibilities are shared between the states.

Brownlee Reservoir possesses a diverse fish species assemblage that includes numerous native, non-game and non-native, game fishes. Angler effort focuses primarily on four non-native species: black *Pomoxis nigromaculatus* and white crappie *P. annularis*, smallmouth bass *Micropterus dolomieu*, and channel catfish *Ictalurus punctatus*. Recent studies have sought to gain understanding of these species including recruitment patterns, as well as growth and exploitation rates. From these studies and anecdotal observations, it has become apparent that black and white crappie abundance fluctuates widely and possibly in a cyclical pattern. These fluctuations led to inconsistent catch rates that have stimulated angler interest in establishing more restrictive fishing limits, particularly bag limits, whether warranted or not.

Because of these concerns and our desire to understand and manage these species more effectively, especially crappie, IDFG has and continues to study these populations. We are most interested in establishing whether a link exists between reproductive success (see Larval Tow Chapter) and eventual catch success in subsequent years. Up to this point, only reproductive success has been measured. In order to determine whether this relationships exist, we need to gauge or index fishing success (i.e. catch rate) to compare to reproductive success three or more years previously. Furthermore, it is important to understand the age of fish in the creel, with analysis of otoliths, to link them back to a particular spawn year. During 2012, we used an extensive spot creel survey on Brownlee Reservoir during the month of May to establish an index. A longer time frame and greater spatial scale was desired, but not possible due to time and monetary constraints.

MANAGEMENT GOAL

To determine the relationship between crappie reproductive success and eventual fisheries quality. Ideally, this would allow managers to predict fish abundance and inform anglers of prospective fisheries quality.

OBJECTIVE

To measure catch rates and age structure in the recreational fishery at Brownlee Reservoir during the month of May 2012.

METHODS

During May 2012, we estimated catch rate and creel metrics for Brownlee Reservoir. Sampling periods were selected using a stratified random design. Primary sampling units were days, and were stratified into two categories: 1) weekdays, and 2) weekends and holidays. Four weekdays and four weekend and holiday days were sampled. Days were sub-divided into 2, eight-h periods (secondary sampling units), and one time period was sampled per day. These periods included morning (0600 to 1400 h) and afternoon (1400 to 2200 h). Creel clerks were stationed at the boat ramp/fish cleaning station at Woodhead Park (near the dam on Idaho side) and contacted anglers as they left the fishery. Only completed trip information was used during calculations.

Catch rates were determined from angler interviews. Only complete trip information was used for catch rate estimation to avoid bias associated with incomplete trips (MacKenzie 1991; Hoenig et al. 1997). We determined party size, primary target species, harvest by species, release by species, and angler residency. Interviews were conducted on an individual basis. Interview data were summarized as the ratio of means. Total catch or loss was divided by total effort to determine average catch or loss rate (Pollock et al. 1997). Variance of these rates was calculated as the variance of a ratio (Fleiss 1981). No attempts were made to estimate effort. For harvested fish, length and weight were measured and otoliths were extracted. We estimated fish age by counting annuli utilizing two readers and the consensus method.

RESULTS

We conducted 313 individual angler interviews from 137 distinct parties. Average party size equaled 2.3 anglers/boat. Anglers most often targeted crappie (54%), followed by smallmouth bass (23%), and all species (21%). A very small minority of anglers targeted channel catfish (1%) and rainbow trout *Oncorhynchus mykiss* (1%). Interviewed anglers expended a total of 1,512 h or an average of 4.8 h/trip. Total catch was 3,063 fish with only 20% being harvested. Crappie had a high harvest proportion with 87% of the catch (n = 475) being harvested. Conversely, most smallmouth bass were released, and 176 or 7% of smallmouth bass catch (n = 2,519) was harvested. Total catch for bluegill *Lepomis macrochirus*, channel catfish, and rainbow trout was relatively minor (n = 69).

Overall catch rates for crappie and smallmouth bass were 0.3 and 1.7 fish/h. Catch rates for all remaining species were less than 0.02 fish/h from an overall perspective (Table 4). For anglers targeting specific species catch rates for that particular species were higher than overall. Of the 313 anglers interviewed, 54%, 23%, and 21% of anglers identified their target species as crappie, smallmouth bass, and all species, respectively (Table 5). The catch rate for anglers specifically targeting crappie was 0.46 fish/h. Catch rate for anglers specifically targeting smallmouth bass was 2.3 fish/h. Both of these indices were approximately 30 to 50% higher than for average anglers.

Nearly all crappie from which otoliths were collected were estimated to be age-6. For black crappie, we estimated age for 22 individuals, measuring 225 to 300 mm with an average of 262 mm. All but four individuals were age-6 (Figure 6). For white crappie, we estimated age for 35 individuals, measuring 276 mm to 336 mm with an average of 305 mm. All but one white crappie was estimated as age-6 (Figure 7). The exception was an age-7 individual. Smallmouth bass lengths and ages had a much broader range. We estimated ages for 36 individuals, measuring 297 mm to 393 mm, with an average of 343 mm. Ages ranged from 3 to 11 with an average of 6 (Figure 8). Smallmouth bass growth trajectories were very inconsistent and indicated an inflection point at age-6 with slower growth rates for older fish.

DISCUSSION

Anglers fishing Brownlee Reservoir from Woodhead Park in May preferred targeting crappie over other species. Crappie catch rates were relatively poor, although no specific catch rates objectives exist for Brownlee Reservoir. Crappie catch rates of approximately 4 fish/h would be considered a quality fishery. During 2012, catch rates were approximately 10% or less of this arbitrary objective. Most crappie caught were harvested. Nearly all crappie caught were remnants of the 2006 year class that has supported this fishery for the last four seasons. The lack of released crappie (i.e. small/young individuals) indicates that fishing will be poor during 2013. Catch rates for smallmouth bass were adequate. A large proportion of smallmouth bass were released, though it wasn't determined what portion of released fish was of legal size. Smallmouth bass growth rates showed an odd pattern of no increase in length after age-6, even decreased mean length-at-age after age-6. It is important to remember that this was not a random collection of smallmouth bass. Also, it is quite possible that growth rates for smallmouth bass may have increased over the last 6 years. Alternatively, faster growing older fish may have been harvested already or utilize different habitats.

MANAGEMENT RECOMMENDATIONS

1. Continue to monitor crappie harvest during succeeding years and compare to larval tow data.
2. Determine if a predictive model can be built from collected data.
3. Inform public of predicted fishing quality based on larval tow data.

Table 4. Creel survey metrics for all anglers surveyed at Brownlee Reservoir during May 2012.

Disposition	Bluegill	Channel catfish	Crappie	Rainbow trout	Smallmouth bass	Yellow perch
			Number			
Harvest	4	10	413	2	176	8
Release	20	7	62	1	2343	17
Total catch	24	17	475	3	2519	25
			CPUE			
Harvest	0.003	0.007	0.273	0.001	0.116	0.005
Release	0.013	0.005	0.041	0.001	1.550	0.011
Total catch	0.016	0.011	0.314	0.002	1.666	0.017

Table 5. Creel survey metrics for all anglers surveyed at Brownlee Reservoir during May 2012.

	Crappie			Smallmouth bass			Other species combined		
Primary target species	Harvest	Release	Total	Harvest	Release	Total	Harvest	Release	Total
					Number				
All	41	5	46	24	340	364	2	3	5
Channel catfish	0	0	0	0	3	3	0	0	0
Crappie	361	45	406	109	1244	1353	19	41	60
Rainbow trout	0	4	4	0	1	1	0	0	0
Smallmouth bass	11	8	19	43	755	798	3	1	4
					CPUE				
All	0.158	0.019	0.177	0.092	1.310	1.402	0.008	0.012	0.019
Channel catfish	0.000	0.000	0.000	0.000	0.214	0.214	0.000	0.000	0.000
Crappie	0.407	0.051	0.458	0.123	1.404	1.527	0.021	0.046	0.068
Rainbow trout	0.000	0.400	0.400	0.000	0.100	0.100	0.000	0.000	0.000
Smallmouth bass	0.032	0.023	0.056	0.126	2.207	2.333	0.009	0.003	0.012

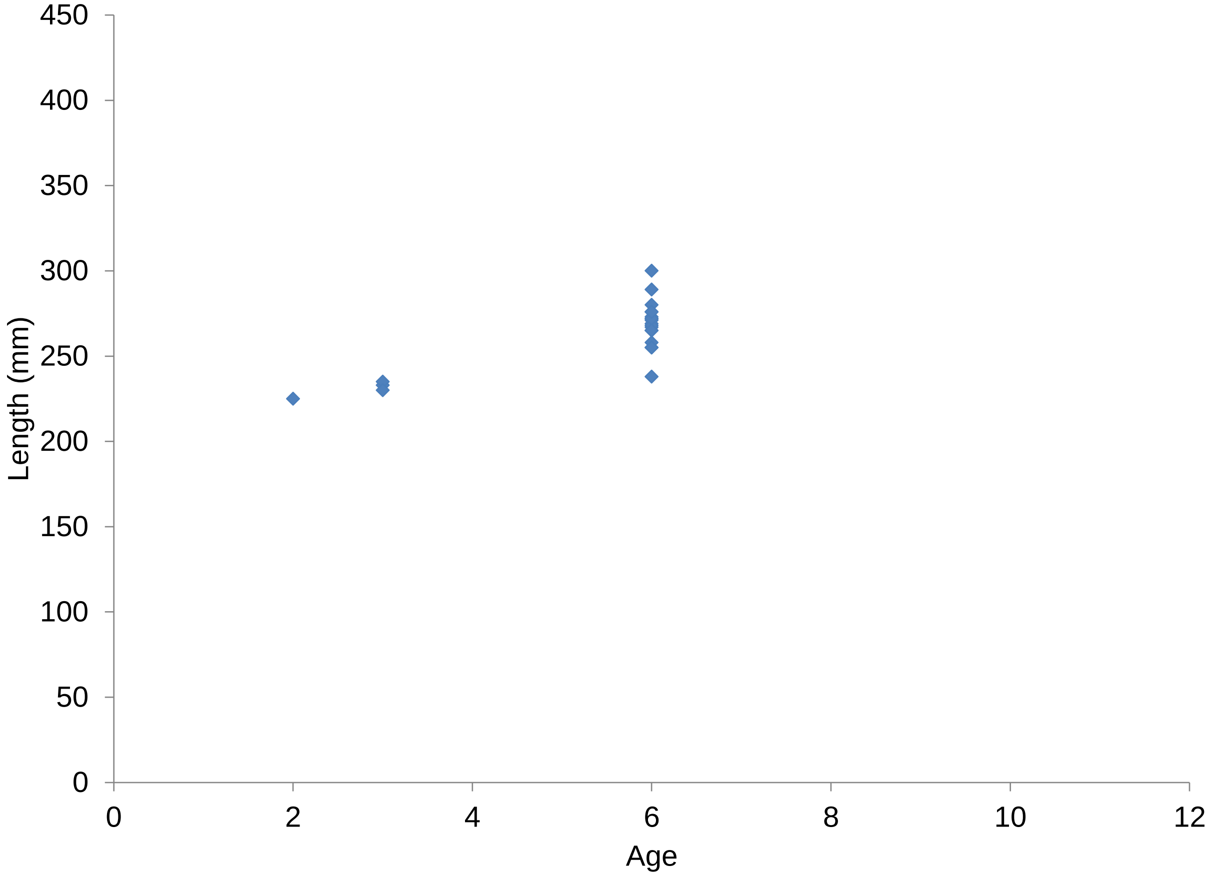

Figure 6. Length-at-age for black crappie (n = 22) collected from Brownlee Reservoir during May 2012.

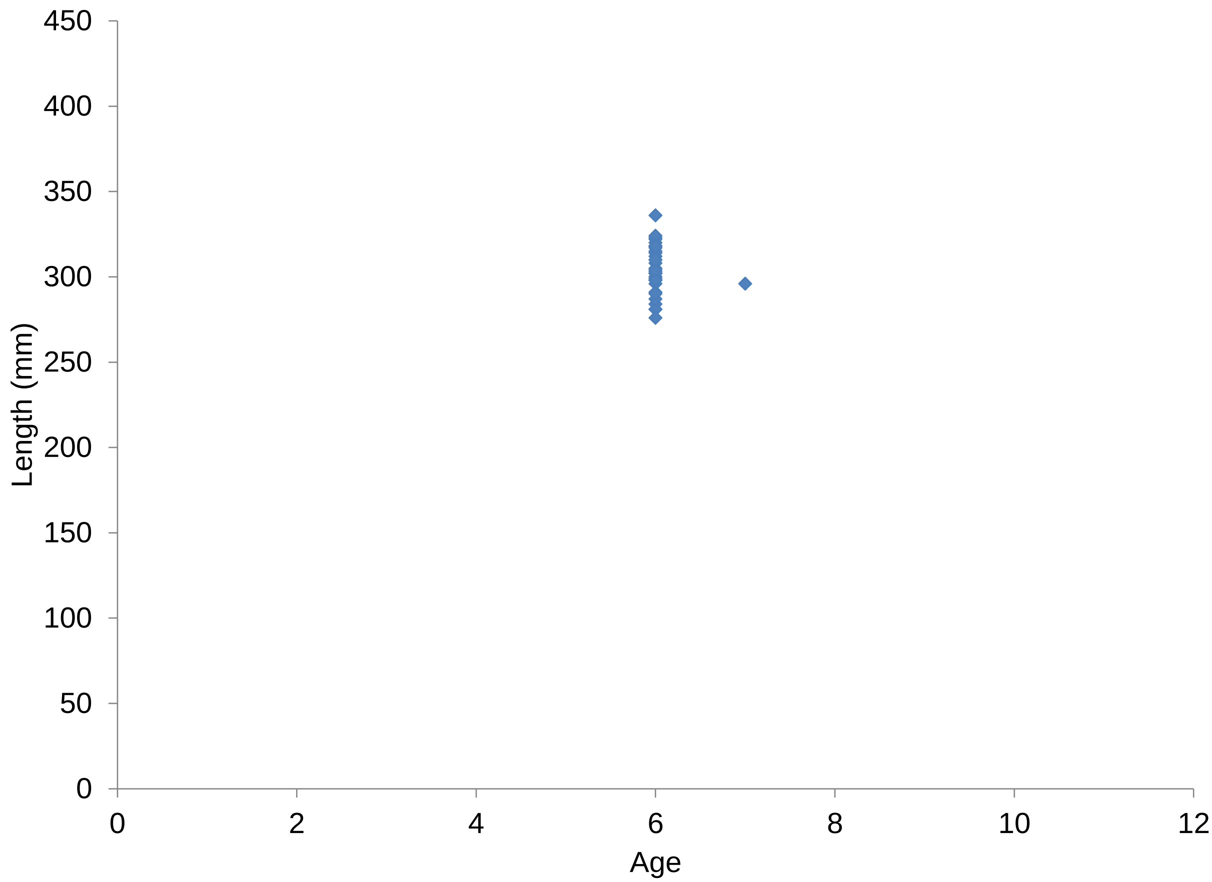

Figure 7. Length-at-age for white crappie (n = 35) collected from Brownlee Reservoir during May 2012.

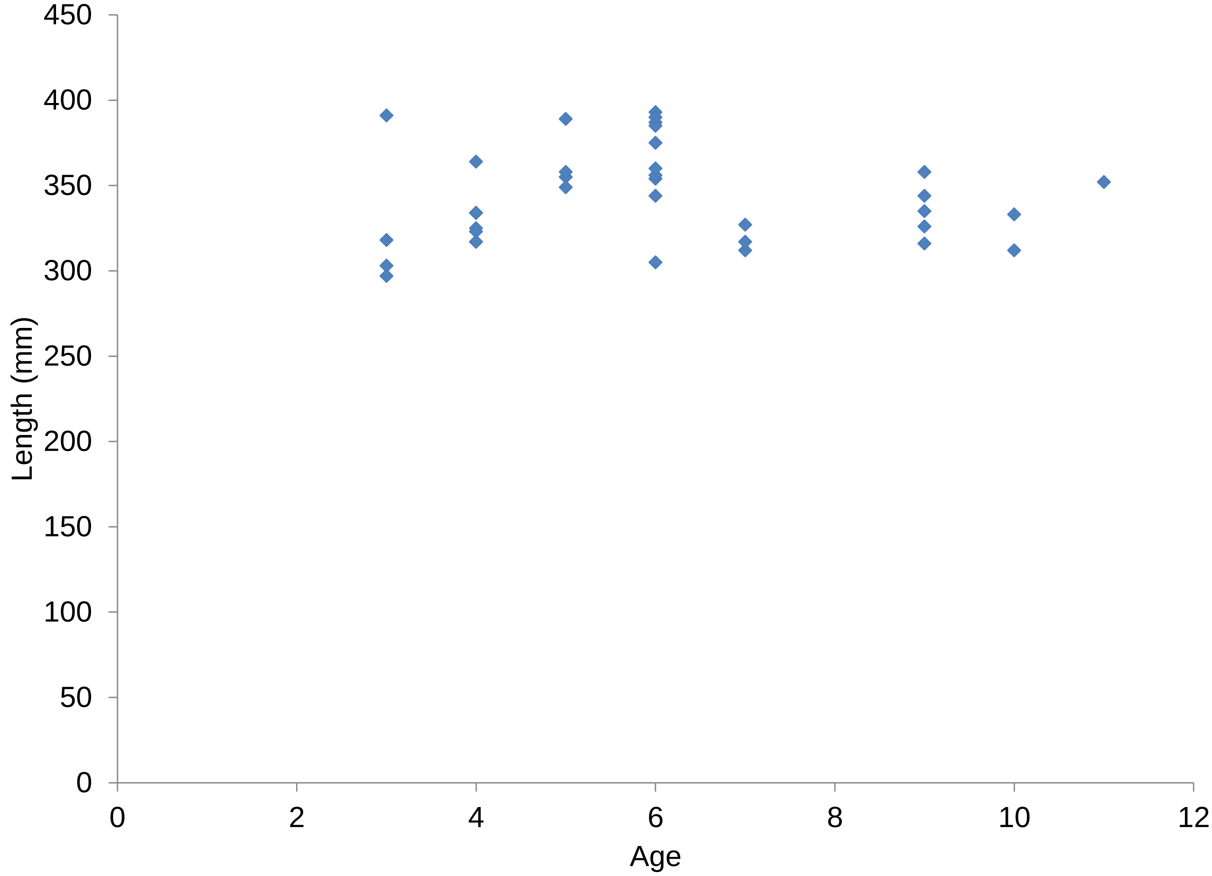

Figure 8. Length-at-age for smallmouth bass (n = 37) collected from Brownlee Reservoir during May 2012.

ANGLER DEMOGRAPHICS AND USE OF COMMUNITY FISHING PONDS

ABSTRACT

In 2010, IDFG stocked approximately 114,000 catchable rainbow trout *Oncorhynchus mykiss* into community ponds, which equates to 41% of the Southwest Region's catchable-sized rainbow trout allocation. A roving-roving creel survey was conducted at Settlers Pond in Meridian, McDevitt and Riverside ponds in Boise, and Merrill Pond in Eagle from May 2011 through April 2012. A total of 248 angler counts were conducted on 62 different dates to estimate fishing effort during the survey. In addition, a total of 665 angler interviews were conducted at the ponds to estimate catch and harvest rates as well as other demographic and social metrics. Annual angler effort varied greatly among ponds, ranging from an estimated 19,546 $\pm$ 10,671 h expended at McDevitt Pond to 3,986 $\pm$ 2,985 h at Merrill Pond. Total angler effort expended at all four ponds was 37,517 $\pm$ 20,411 h. Catch rate estimates were compared with results from a concurrent tag-return study. Because angling trips at community ponds were short with high turnover, it appeared that R_2 (ratio of the mean) was most appropriate; however the majority of interviews were considered incomplete. A total of 20,152 $\pm$ 16,938 rainbow trout were caught at the four ponds, approximately 97% of what was stocked, suggesting a very high use of hatchery fish. The mean age of anglers and their dependents was 30, and 87% were male. Approximately 86% of anglers were Caucasian and the mean travel distance for anglers surveyed was 5.9 mi. Only 33% of anglers were fishing with children. Despite belief by many that community ponds were primarily visited by novice anglers or families looking for close and convenient recreational opportunities, these ponds were frequented largely by very experienced anglers. Average years of fishing experience were 27.3 years, as many anglers reported being introduced to fishing at ages 4-5. Anglers estimated that on average they fished 66.3 days/year. Anglers also estimated that over half of the trips they take each year are to a community pond. Nearly half of anglers classified themselves as currently unemployed or retired (43%). Overall angler satisfaction with ponds appears to be good and the majority of anglers consider catching fish more important than harvesting fish. Over 63% of surveyed anglers supported reducing the daily bag limit of rainbow trout from 6 to 2 fish - if it resulted in improved fishing.

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INTRODUCTION

As the United States becomes increasingly urbanized, hunting and angling participation has declined substantially. According to a 2006 national survey on wildlife-associated recreation, 13% of the U.S. population (16 and older) classified themselves as anglers (U.S. Department of the Interior 2006). This is a marked decline from 19% in 1991 and the peak of 31% that was reported in 1970. Reasons for the decline have been attributed to lack of opportunities, time constraints, and an overall change in lifestyle, where nature-based outdoor activities have been devalued.

The potential threats to natural resources caused by declines in hunting and fishing participation have been well described (Balsman and Shoup 2008; Schramm and Edwards 1994). Most states depend on license sales and federal excise taxes on associated hunting and fishing equipment to fund wildlife management agencies and natural resource conservation programs. Also, decreased citizen involvement in natural resource-related activities may reduce support, involvement, and awareness regarding natural resources.

According to the U.S. Census Bureau (2000), 79% of the U.S. population lives in urban areas. Furthermore, 72% of people that classify themselves as anglers live in these urban areas, where the population has been shown to participate in fishing and hunting opportunities at a lower rate than rural residents (U.S. Department of the Interior 2002). People in urban areas typically have more recreational choices; and therefore, location, convenience, and cost often influence participation. Consequently, many state agencies have increased efforts to provide opportunities that are nearby and convenient for urban residents, such as urban ponds. However, as Pape and Eades (2008) state, a better term for such a program, particularly within southwestern Idaho, is community fisheries. This term describes the location of many of the ponds more accurately and also encompasses smaller communities that still benefit from having a nearby opportunity.

In southwestern Idaho, Boise and the surrounding metropolitan area, known as the Treasure Valley, contained approximately 43% of the state's population in 2010 (U.S. Census Bureau 2011). Ada and Canyon counties alone, contain over 580,000 people, or 37% of the state's population. Although IDFG does not have a formal community fisheries management program, managers have been responsive to the needs for nearby, easily accessible fishing opportunities.

A major component of community fisheries in southwestern Idaho has been the use of small ponds, often located within municipal parks. These ponds are either former gravel pits that are filled with ground water or irrigation ponds where fishing is a secondary use. In most cases, IDFG is responsible solely for fisheries management in the ponds, while city parks departments are responsible for land and facility management activities. Many of the parks that are associated with ponds have a wide variety of amenities, including restrooms, playgrounds, walking paths, and picnic areas. Most ponds contain naturally reproducing bluegill *Lepomis macrochirus* and largemouth bass *Micropterus salmoides*. Hatchery rainbow trout *Oncorhynchus mykiss* are stocked typically on a monthly basis from September through June, when water temperatures are not lethal to trout. Adult channel catfish *Ictalurus punctatus* are captured and moved from the Snake River during June-August to provide a summer fishery in selected ponds.

The community fishing ponds have been popular with city leaders, park departments, and local anglers. This is reflected in the increase in number of community ponds in southwestern Idaho over the past decade, which now totals approximately 35. From 2007 to 2012, the number of community ponds that IDFG stocks with hatchery catchable rainbow trout has increased from 11 to 24. The growth of this fishery program has placed considerable demand upon IDFG hatchery and management budgets as well as personnel. In 2010, IDFG stocked approximately 114,000 catchable rainbow trout into community ponds, which equates to 41% of the region's catchable-sized trout. Based on an estimated cost of $0.84/fish to raise catchable-sized trout, IDFG spends approximately $96,000/year to stock community ponds in the Southwest Region.

Given the substantial resources that are currently directed towards providing and managing fisheries in southwestern Idaho community ponds, there is also a need to evaluate this program. Specifically, managers would like to have more information on anglers that use the community ponds and whether the ponds play a role in angler recruitment. Catch rates, effort, and harvest information will assist future management decisions such as stocking density and frequency, or whether harvest limits need to be changed to ensure more equitable distribution among anglers.

MANAGEMENT GOAL

Provide and manage convenient and cost-effective angling opportunities in southwestern Idaho communities. Promote these easily accessible angling opportunities to enhance the recruitment and retention of new and lapsed anglers.

OBJECTIVES

1. Describe basic demographics of anglers (age, gender, race), as well as monthly and seasonal trends in angler use of community fishing ponds stocked with hatchery rainbow trout.

2. Summarize angler interviews to describe the geographic area each pond serves, the importance of stocking trout, species of interest, experience of anglers, and dependence on community ponds.

3. Compare angler use and demographics with hatchery rainbow trout tag return information collected by IDFG hatchery trout research project. Compare estimates of total catch generated by tag returns, and two common methods for calculating angler catch rates in creel surveys.

4. Develop guidelines for allocating hatchery rainbow trout in community ponds to benefit a geographically wide range of southwestern Idaho communities while also ensuring high utilization of hatchery trout.

METHODS

A roving-roving creel survey that included on-site interviews was conducted at Settlers Pond in Meridian, McDevitt and Riverside ponds in Boise, and Merrill Pond in Eagle beginning in May 2011 through April 2012. The ponds were selected due to popularity with anglers, proximity to each other, and anecdotal evidence indicating that they would reflect a range of use and effort representing the community pond program as a whole. They also provide a range of pond sizes, stocking densities, and amenities (Table 6). Estimates of effort and catch rate were summarized by month and pond. Survey periods were selected using a stratified random sampling methodology, where primary sampling units were days, and were stratified into two categories: 1) weekdays, and 2) weekends and holidays. Categorization of day type was designed to replicate periods of high and moderate use by anglers. Therefore weekdays were defined as Sunday night to Friday afternoon while weekends were defined as Friday night to Sunday afternoon, including holidays. Four primary sampling units were selected from each of these two categories for a total of eight sampled days per month. Days were sub-divided into three, 5-h periods (secondary sampling units), and one time period was sampled per day. These periods included morning (0700 to 1200 h), afternoon (1200 to 1700 h), and night (1700 to 2200 h). Time periods were selected with non-uniform probabilities based on expert opinion (Stanovick and Nielsen 1991). During suspected high use periods (April through October), time periods were selected at probabilities of 0.25 for morning, 0.25 for afternoon, and 0.50 for evenings. During the suspected low use periods (November-February), time periods were selected at probabilities of 0.5 for morning and 0.5 for afternoon, as the night period was dropped due to short day length.

Instantaneous counts were used to estimate angler effort. Angler counts began at randomly selected times within the sampling period and followed a consistent route. Counts began at Settlers Pond, and then continued to McDevitt, Merrill, and Riverside ponds (Figure 9). The entire route was completed generally within 40-60 minutes. Anglers were interviewed for catch and harvest rate information during the period between angler counts. Fishing license numbers were collected from most individual anglers 14 years of age and older. These numbers will be used to increase sample size of angler age and also allow us to ascertain other license buying characteristics from anglers utilizing the community ponds.

Catch rate and estimates of total catch were calculated for rainbow trout, whereas only catch information was collected for bluegill, channel catfish, largemouth bass, and yellow perch. Disposition (i.e. harvested or released) of fish was estimated as the proportion of total catch that were reported as harvested or released in angler interviews. Catch rates were estimated using two methods to assess whether or not disregarding length-of-stay bias affected estimates. Bias has been shown to overestimate catch if trip length is short. Mean catch rate $\widehat{R_1}$ was estimated using the mean of ratios (MOR), when trip interviews were considered incomplete:

$$\widehat{R_1} = \frac{\sum_{i=1}^{n} \frac{c_i}{e_i}}{n}$$

and $\widehat{R_2}$ using the ratio of means (ROM), when 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 (equations $\widehat{R_1}$ and $\widehat{R_2}$ from Pollock et al 1994). Harvest rate was calculated using the equation above and replacing fish caught with fish harvested. All trips less than 0.5 h was excluded from the catch rate calculations. Daily, monthly, and annual catch rates and effort, and numbers of fish caught and harvested by species was calculated. Confidence intervals (90%) were calculated for effort and catch using methods described by Zar et al. (1999).

Tagging for angler exploitation and use estimates was conducted by both IDFG regional and research personnel. On 6 April 2011, 165 catchable rainbow trout tagged with Floy tags (150 non-reward, 15 reward) were stocked in McDevitt Pond to estimate angler exploitation. An additional 138 rainbow trout were tagged and stocked on 19 October 2011. A complete description of tagging methodologies, exploitation calculations, and results are described in Koenig and Cassinelli (2012). Estimates of use (total fish harvested and released) from the April tagging event were used to estimate use for the months of March-July of the creel study, while October results were used for September-February.

Angler Demographics

Demographic and other information that may affect future management of community ponds was also collected. Interview questions were designed to determine the role that the ponds play in angler recruitment, the experience or avidity of anglers using the ponds, and the importance of stocked trout. When staffing allowed, additional secondary sampling units were surveyed to determine whether angler metrics were affected by recent stockings. This information, along with exploitation estimates from a separate tagging study will help determine if a "boom-bust" fisheries existed, defined as when catch rates peak immediately after stocking events and decline sharply afterwards as fish are removed or harvested.

RESULTS

A total of 248 angler counts were conducted on 62 different dates to estimate angler effort during May 2011-April 2012. Due to limited effort, no stocking, and frozen ponds, the survey was temporarily discontinued from December through February. The survey resumed in March when ponds thawed, and angler use and stocking began to increase again. Anglers spent a total of 37,517 ± 20,411 h fishing the four ponds between May 2011 and April 2012. Total annual angler effort varied greatly among ponds, ranging from an estimated 19,546 ± 10,671 h expended at McDevitt Pond to 3,986 ± 2,985 h at Merrill Pond (Figure 10). Riverside and Settlers ponds were similar in total effort with 7,294 ± 3,760 h and 6,629 ± 2,994 h, respectively.

Monthly effort trends were similar among ponds with May-June experiencing the highest effort of the season (Figure 10). However, Settlers Pond was an exception as high effort was also expended in August. Estimated monthly effort was as high as 8,881 h in June at McDevitt Pond and as low as 39 h in November at Merrill Pond. Monthly effort decreased during the warm summer months (July-September) when rainbow trout were not stocked and increased after stocking in October.

A total of 665 angler interviews were conducted at the ponds to estimate catch and harvest rates. Of these, 347 (52%) interviews were from angler that had fished less than 30 minutes, and were not included. Trip length ranged from 0.5 to 9 h, with a mean of 1.8 h (Figure 11). Nearly all interviews were considered incomplete trips as creel clerks rarely encountered anglers as they were leaving. Because of short trip length, anglers were often gone by the time the creel clerks revisited the pond during an interview circuit. Approximately 42% of anglers interviewed had been fishing between 0.5 to 1 h and 74% had been fishing less than 2 h. In the final two months of the survey, we handed out post cards for anglers to complete and deposit in a drop box to attain complete trip information. Unfortunately, angler compliance was poor (<20%).

Anglers reported catching rainbow trout, bluegill, channel catfish, largemouth bass, and yellow perch during interviews. Rainbow trout were the most frequently reported species (n = 574), of which 59% were harvested (Table 7). Bluegill were also frequently caught (n = 320), but harvest was low (8%). Low harvest rates on bluegill were a result of small-sized fish as all fish encountered by creek clerks were less than 250 mm. Twenty channel catfish, six largemouth bass, and three yellow perch were also reported during the course of the creel survey.

Catch rates were calculated using two formulas suggested for both incomplete ($\widehat{R_1}$) and complete trips ($\widehat{R_2}$) to compare results with known numbers of stocked fish and hatchery tag returns (Tables 8-9). It is suggested by Pollock et al. (1994) that $\widehat{R_1}$ is more appropriate for when the trip length does not affect the probability of the angler being selected for an interview, such as in the case of interviewing only anglers who have completed their trip. However, in the case of these community pond fisheries, where trip lengths are characteristically short and angler turnover is high, the use of $\widehat{R_2}$ in the calculation of catch rate may still be appropriate.

Rates varied greatly between the two methods. Catch rates for the $\widehat{R_2}$ method were up to 30-40% higher than the $\widehat{R_1}$ method. Catch rates for rainbow trout varied by month and ponds, ranging from 0 fish/h during periods of minimal effort or months when fish were not stocked to a high of 0.9 ± 0.9 fish/h (Table 9).

The differing methodologies for estimating catch rate also resulted in profoundly different estimates of total annual catch. Expansion of the $\widehat{R_2}$ catch rates into total number of fish caught yielded a catch estimate of 20,152 ± 16,938 rainbow trout at the four ponds from May 2011 through April 2012 (Table 9). In comparison, using the MOR calculation, we estimated that only 5,003 ± 4,903 fish were caught, which is a four-fold difference between the two methodologies.

We used concurrent exploitation studies conducted by IDFG Nampa Research, using angler-reported tags to estimate overall use and exploitation. Fish that were tagged and released into McDevitt Pond were used to estimate use and persistence for all four ponds. Tag return data, adjusted for angler compliance, from fish stocked during April 2011 suggested that 62.9% ± 19.2% of fish were caught while fish stocked during October 2011 resulted in estimates of 34% ± 14.5%. Expanding these estimates by the total number of fish stocked annually over the same period resulted in a catch estimate of 11,007 ± 3,667 rainbow trout (Table 10). Additionally, tag returns provided important information regarding length of time fish persisted in the ponds. Combined data from the two stocking events show that within 1-day of stocking, 25% of fish are caught, whereas over 50% are caught within 4 days (Figure X). Within two weeks post-stocking, over 75% of the fish have returned to creel. Nearly 100% of tags were returned by 40-days post release.

From May 2011 through April 2012, Nampa State Fish Hatchery (NSFH) personnel stocked approximately 20,815 catchable-sized rainbow trout at the four community ponds (Table 10). McDevitt Pond was the highest receiving water with 8,013 trout, followed by Merrill (5,199), Riverside (4,899), and Settlers (2,704) ponds. Comparisons of stocking numbers with the three different estimates of catch over the same period show variable results between methodologies. Total rainbow catch on a monthly and annual basis appears to be lowest when computed with $\widehat{R_1}$ (Table 10). In fact, in most months, estimates obtained with $\widehat{R_1}$ were a fraction of what was stocked and lower than what was estimated with tag returns and ROM. Conversely, $\widehat{R_2}$ -based catch estimates consistently resulted in the largest estimates of the three methods. Confidence intervals around the creel methodologies were larger than tag return estimates of use. This is likely a result of the large variance observed in catch rates between individual anglers that are incorporated into creel-derived estimates. Because $\widehat{R_1}$ resulted in estimates that appear to under-represent actual catch based on tagging and actual numbers of stocked fish, $\widehat{R_2}$ appears to be the most appropriate estimator for catch and catch rates for this study. This is likely because the angling trips at community ponds are short with high turnover, where the length of a trip does not have as pronounced of an influence on sampling probability and creel estimates as for other types of creel studies.

Total catch was highest at McDevitt Pond with 12,946 $\pm$ 12,083 rainbow trout which actually exceeded the 8,013 fish stocked (Table 10). Annual catch (2,983 $\pm$ 489 rainbow trout) was lowest at Merrill Pond, which was 57% of the fish stocked. Similarly, catch was 2,984 $\pm$ 2,990 (61% of total stocked) and 1,239 $\pm$ 1,376 (46% of total stocked) at Riverside and Settlers ponds, respectively. In total, 20,152 $\pm$ 16,938 rainbow trout were caught at the four ponds over a 1-year period, which suggests an overall use rate of 97%.

Despite the wide confidence intervals from creel estimates, it is reasonable to draw the conclusion that a high number of stocked fish return to creel. Koenig and Cassinelli (2012) summarized combined tag returns for fish harvested at 5 community ponds in the Southwest Region, where 50% of the tags were returned in the first 5 days and 75% of tags within two weeks (Figure 13). In addition, there is evidence that a small number of anglers may be harvesting the majority of fish as individual anglers returned 6-7% of all tag returns at 3 of the 5 study waters, which included McDevitt Pond. Tagging information along with monthly harvest estimates from the creel survey suggest that catchable rainbow trout are depleted quickly after stocking which would affect the angler experience at the latter end of stocking intervals.

Angler Demographics

A total of 296 anglers were interviewed to obtain information on angler opinion and demography. Anglers were only interviewed once for the demography and opinion portion of the survey to avoid multiple questionnaires from the same angler.

The mean age of anglers and their dependents taking the survey was 30 and 87% of those surveyed were male (Table 11). Despite an older mean age for ponds, actual age distribution shows that approximately 28% of anglers were under the age of 15 (Figure 12). Creel clerks determined ethnicity from visual observation and discussion with the angler, and approximately 86% were Caucasian, followed by 5% Hispanic. The mean travel distance for anglers surveyed was 5.9 mi, after removing non-residents that were accompanying a local angler. Approximately 13% of anglers live less than a mile from the pond while 35% lived less than 2 miles away (Figure 12). Anglers were generally fishing either alone (33%), with one other person (36%), or in a group of three (17%). Approximately 33% of the anglers surveyed were fishing with a child or grandchild older than 14 years of age.

In general, anglers were experienced and not new to the sport as the mean years of fishing experience as described by the angler themselves was 27 years. Additionally, on average, community pond anglers estimated that they spent 66.3 d/year fishing. Of those days, an estimated 53% of fishing trips were at community ponds. Finally, 59% of anglers interviewed described themselves as currently employed, while 41% were unemployed. It should be noted however, that 120 (41% of those interviewed for demographics) anglers were not asked or refused to answer the employment question, as it was not added to the survey until partway through July 2011.

Anglers were also asked as to whether they would support reducing the daily bag limit of rainbow trout in the ponds from six to two fish (Table 11). Most anglers supported the reduced bag limit, with 63% in favor, 36% opposing, and 2% with no opinion. Coinciding with support for reduction in trout limits, anglers generally did not consider harvesting fish to be as important as catching fish. Over 80% of surveyed anglers considered catching fish to be somewhat important to very important (39%) when surveyed while only a 1/3 of angers considered harvesting fish to be very important (24%) to important (7%; Table 12). Anglers also ranked the importance of fish stocking and satisfaction of the community pond they were fishing. The rankings received were spread somewhat evenly across the spectrum of possible responses, but overall hatchery trout stocking is very important to an angler's decision to fish at a pond. Respondents were mostly positive regarding ranking satisfaction with the pond they were fishing with 40% as very satisfied.

DISCUSSION

Results from the 2011-2012 angler and creel survey show that community ponds in Southwestern Idaho provide important recreational opportunities in urban areas. An estimated 37,517 h were spent angling at these four ponds between May 2011 and April 2012. With an average trip length of 1.8 h, this results in an estimated 20,842 trips, just at these 4 ponds. This value is actually probably underestimates annual trips as average trip length was actually skewed somewhat (mode = 1 h) because of a few anglers that had trips of 4-9 h. Expansion of these numbers to the 21 (60.7 ha) community ponds that IDFG currently stocks with catchable rainbow trout, results in an estimated 934,783 h of annual angling use or 519,324 trips (Table 13). Using the Hebdon et al. (2008) estimate of $21 spent per angling trip, an estimated $431,222 were spent on the four ponds surveyed between May 2011-April 2012, while almost $11 million was spent on angling trips at stocked community ponds region-wide. When viewed as an individual component of statewide fisheries, the Southwest Region's community ponds experience angling effort that rivals or exceeds many of Idaho's prominent fisheries. Additionally, despite the relatively low cost/trip opportunities that community ponds provide local anglers, the economic value of these fisheries are on the same scale as some of the state's most popular fisheries.

Over the last five years, IDFG has struggled with an inability to offset inflation and rising costs of gasoline amongst other expenses. In 2011, rising fish feed costs led to an almost across-the-board 20% reduction in production of catchable rainbow trout. The popularity of community ponds with both anglers and municipalities suggest that demand will only increase as it has over the last decade. City leaders and local businesses should recognize that the ponds play an important local economic role aside from providing recreational opportunities. It is not unreasonable to expect benefiting cities or communities to assist with the financial burden of stocking ponds. In fact, similar models have already been successfully adopted and supported in states such as Utah (Pearce 2011).

Demographic and angler opinion information proved useful for the management of the community pond fisheries in general. As defined by average angler age and angling experience, these ponds are utilized largely by experienced anglers. The role community ponds have in angler recruitment still seems to be important as roughly 1/3 of anglers contacted were fishing with a youth $\leq$14 years old. IDFG programmatic goals for community fisheries are to provide convenient and proximate recreational opportunities for anglers. Providing a fishery for high harvest or subsistence is not desirable or financially feasible. IDFG also recognizes the important role that community ponds may play in recruitment of new and lapsed anglers.

Maintaining reasonable and consistent catch rates of hatchery rainbow trout are an important component of attracting anglers to these ponds. IDFG does not have the ability to stock more fish or provide more frequent stockings because of budget restrictions. Therefore providing more consistent catch rates must be done through the use limit or harvest restrictions. Through this survey, a majority of users have expressed that catching rather than harvesting is more important to angler satisfaction. In addition, most anglers supported a 2-fish limit as a means of making fish last longer or increasing catch rates. Results from this survey, along with other opinion surveys and tagging studies were used to justify implementation of a 2-fish limit at four community ponds, including McDevitt Pond, in 2013.

MANAGEMENT RECOMMENDATIONS

1. Monitor angler compliance and satisfaction with 2-fish limit and potential effects on nearby ponds without restrictions.

2. Evaluate angler demographics and license buying characteristics from community pond license numbers obtained during the creel survey and tag returns.

Table 6. Surface area (ac), stocking numbers, stocking density, and amenities for creel and demography survey waters in 2011-2012.

Water	Surface area (ac)	Stocking # (Monthly)	Stocking Density	Restroom	Playground	Parking	Docks
McDevitt (Norms) Pond	1.19	1000	840			•	
Merril Park Pond	1.76	500	284	•	•	•	
Riverside Pond #1	2.44	800	328	•			
Settlers Park Pond	0.63	300	476	•	•	•	

Table 7. Unexpanded monthly and total catch of fish and disposition as reported by anglers during creel interviews at McDevitt, Merrill, Riverside, and Settlers ponds during May 2011 through April 2012.

	Rainbow trout		Bluegill		Channel catfish		Largemouth bass	
	Harvested	Released	Harvested	Released	Harvested	Released	Harvested	Released
May	56	33	11	106	0	6	0	1
June	68	19	0	66	2	0	0	0
July	3	20	2	55	2	0	0	2
August	0	0	3	19	0	1	0	0
September	3	0	2	11	0	1	0	0
October	29	24	5	24	0	0	0	0
November	50	60	0	0	0	0	0	0
March	51	38	0	4	0	0	0	0
April	77	43	1	11	2	6	0	3
Total	**337**	**237**	**24**	**296**	**6**	**14**	**0**	**6**

Table 8. Angler effort, rainbow trout CPUE and monthly and total catch estimated by $\widehat{R_1}$ for McDevitt, Merrill, Riverside, and Settlers ponds during May 2011 through April 2012.

Water	Month	Daily Effort (h) ± 90% CI	Monthly Effort (h)	RBT CPUE ± 90% CI	(fish/month) ± 90% CI
McDevitt Pond	May	95 ± 64	2,950	0.16 ± 0.12	321 ± 304
	June	396 ± 333	7,520	0.26 ± 0.33	973 ± 913
	July	111 ± 36	3,618	0.01 ± 0.01	42 ± 39
	August	18 ± 14	376	0.00 ± 0.00	0 ± 0
	September	18 ± 15	477	0.00 ± 0.00	0 ± 0
	October	47 ± 23	1,118	0.19 ± 0.20	120 ± 80
	November	35 ± 15	940	0.41 ± 0.19	264 ± 69
	March	67 ± 39	1,713	0.3 ± 0.2	477 ± 534
	April	29 ± 11	834	0.3 ± 0.3	421 ± 443
	Total		**19,546**		**2,618 ± 2,382**
Merrill Pond	May	4 ± 4	110	0.00 ± 0.00	0.0 ± 0.0
	June	111 ± 150	1,593	0.02 ± 0.03	16 ± 27
	July	23 ± 7	625	0.01 ± 0.02	7 ± 11
	August	3.4 ± 2.4	94	0.00 ± 0.00	0 ± 0
	September	5 ± 5	147	0.53± 0.88	100 ± 164
	October	3 ± 3	120	0.00 ± 0.00	0 ± 0
	November	2 ± 2	40	0.00 ± 0.00	0.0 ± 0.0
	March	38 ± 22	1,007	0.3 ± 0.3	16 ± 11
	April	9 ± 3	250	0.7 ± 1.0	137 ± 199
	Total		**3,986**		**276 ± 412**
Riveside Pond	May	21 ± 15	672	0.02 ± 0.02	34 ± 34
	June	94 ± 45	1,888	0.11± 0.12	165 ± 167
	July	39 ± 20	1,300	0.05 ± 0.06	92 ± 124
	August	3 ± 4	81	0.00 ± 0.00	0 ± 0
	September	6 ± 7	140	0.0± 0.00	0 ± 0
	October	16 ± 15	369	0.00 ± 0.00	0 ± 0
	November	7 ± 5	187	0.80 ± 0.90	239 ± 328
	March	51 ± 25	1,666	0.2 ± 0.2	132 ± 157
	April	33 ± 18	858	0.3 ± 0.3	352 ± 350
	Total		**7,161**		**1,014 ± 1,160**
Settlers Pond	May	8 ± 7	269	0.00 ± 0.00	0 ± 0
	June	88 ± 48	1,806	0.01 ± 0.01	14 ± 19
	July	38 ± 15	1,288	0.00 ± 0.00	0 ± 0
	August	22 ± 13	1,005	0.00 ± 0.00	0 ± 0
	September	7 ± 5	214	0.07 ± 0.11	37 ± 61
	October	5 ± 6	104	0.00 ± 0.00	0 ± 0
	November	9 ± 8	250	0.14 ± 0.16	107 ± 159
	March	39 ± 27	922	0.02 ± 0.02	22 ± 21
	April	29 ± 11	834	0.7 ± 0.4	915 ± 689
	Total		**6,692**		**1,095 ± 949**
	All ponds combined		**37,455**		**5,003 ± 4,903**

Table 9. Angler effort, rainbow trout CPUE and monthly and total catch estimated by $\widehat{R_2}$ for McDevitt, Merrill, Riverside, and Settlers ponds during May 2011 through April 2012.

Water	Month	Daily Effort (h) + 90% CI	Monthly Effort (h)	RBT CPUE + 90% CI	Catch (fish/month) + 90% CI
McDevitt Pond	May	95 + 64	2,950	0.9 + 0.5	2,756 + 1,134
	June	396 + 333	7,520	0.6 + 0.4	6,108 + 7,802
	July	111 + 36	3,618	0.04 + 0.04	335 + 307
	August	18 + 14	376	0.00 + 0.00	0 + 0
	September	18 + 15	477	0.00 + 0.00	0 + 0
	October	47 + 23	1,118	0.5 + 0.3	528 + 374
	November	35 + 15	940	1.3 + 0.2	1,150 + 394
	March	67 + 39	1,713	0.5 + 0.3	1,010 + 886
	April	29 + 11	834	0.6 + 0.6	1,058 + 1,186
	Total		**19,546 + 10,671**		**12,946 + 12,083**
Merrill Pond	May	4 + 4	110	0.00 + 0.00	0.0 + 0.0
	June	111 + 150	1,593	0.1 + 0.1	2,615 + NA
	July	23 + 7	625	0.02 + 0.03	15 + 23
	August	3.4 + 2.4	94	0.00 + 0.00	0 + 0
	September	5 + 5	147	0.53 + 0.88	100 + 164
	October	3 + 3	120	0.00 + 0.00	0 + 0
	November	2 + 2	40	0.00 + 0.00	0.0 + 0.0
	March	38 + 22	1,007	0.1 + 0.1	82 + 90
	April	9 + 3	250	0.8 + 1.0	171 + 212
	Total		**3,986 + 2,985**		**2,983 + 489**
Riveside Pond	May	21 + 15	672	0.1 + 0.1	118 + 113
	June	94 + 45	1,888	0.4 + 0.3	701 + 521
	July	39 + 20	1,300	0.2 + 0.1	263 + 156
	August	3 + 4	81	0.00 + 0.00	0 + 0
	September	6 + 7	140	0.0+ 0.00	0 + 0
	October	16 + 15	369	0.00 + 0.00	0 + 0
	November	11 + 7	277	0.9 + 0.9	397 + 362
	March	51 + 25	1,666	0.3 + 0.3	834 + 1,035
	April	35 + 17	901	0.6 + 0.4	671 + 803
	Total		**7,294 + 3,760**		**2,984 + 2,990**
Settlers Pond	May	8 + 7	269	0.00 + 0.00	0 + 0
	June	88 + 48	1,806	0.03 + 0.03	67 + 83
	July	38 + 15	1,288	0.00 + 0.00	0 + 0
	August	22 + 13	1,005	0.00 + 0.00	0 + 0
	September	7 + 5	214	0.13 + 0.22	75 + 123
	October	5 + 6	104	0.00 + 0.00	0 + 0
	November	9 + 8	250	0.5 + 0.5	290 + 476
	March	39 + 27	922	0.2 + 0.2	253 + 240
	April	29 + 11	834	0.6 + 0.4	554 + 454
	Total		**6,629 + 2,994**		**1,239 + 1,376**
	All ponds combined		**37,517 + 20,411**		**20,152 + 16,938**

Table 10. Monthly and annual angler catch of rainbow trout estimated by tag returns, ratio of means ($\widehat{R_2}$), and mean of ratios ($\widehat{R_1}$), and annual stocking numbers for McDevitt, Merrill, Riverside, and Settlers ponds during May 2011 through April 2012.

Water	Month	Tags	R_2 (ROM)	R_1 (MOR)	No. stocked
McDevitt	May	805 ± 246	2,756 ± 1,134	321 ± 304	1,280
	June	1289 ± 394	6,108 ± 7,802	973 ± 913	2,050
	July	-	335 ± 307	42 ± 39	-
	August	-	-	-	-
	September	-	-	-	-
	October	353 ± 150	528 ± 374	120 ± 80	1,035
	November	408 ± 174	1,150 ± 394	264 ± 69	1,197
	December	-	-	-	-
	January	-	-	-	-
	February	163 ± 69	-	-	478
	March	593 ± 181	1,010 ± 886	477 ± 534	943
	April	648 ± 198	1,058 ± 1,186	421 ± 443	1,030
	Totals	**4,260 ± 1,411**	**12,946 ± 12,083**	**2,618 ± 2,382**	**8,013**
Merrill	May	786 ± 240			1,250
	June	1,094 ± 334	2,615 ± NA	16 ± 27	1,740
	July	-	15 ± 23	7 ± 11	-
	August	-	-	-	-
	September	-	100 ± 164	100 ± 164	-
	October	157 ± 67	-	-	460
	November	148 ± 63	-	-	435
	December	-	-	-	-
	January	-	-	-	-
	February	158 ± 67	-	-	464
	March	321 ± 98	82 ± 90	16 ± 11	510
	April	214 ± 65	171 ± 212	137 ± 199	340
	Totals	**2,879 + 934**	**2,983 ± 489**	**276 + 412**	**5,199**
Riverside	May	214 ± 65	118 ± 113	34 ± 34	340
	June	730 ± 223	701 ± 521	165 ± 167	1,160
	July	-	263 ± 156	92 ± 124	-
	August	-	-	-	-
	September	-	-	-	-
	October	148 ± 63	-	-	435
	November	297 ± 126	397 ± 362	239 ± 328	870
	December	-	-	-	-
	January	-	-	-	-
	February	123 ± 52	-	-	362
	March	632 ± 193	834 ± 1,035	132 ± 157	1,005
	April	457 ± 140	671 ± 803	352 ± 350	727
	Totals	**2,601 + 862**	**2,984 ± 2,990**	**1,014 ± 1,160**	**4,899**
Settlers	May	204 ± 62	-	-	325
	June	299 ± 91	67 ± 83	14 ± 19	476
	July	-	-	-	-
	August	-	-	-	-
	September	-	75 ± 123	37 ± 61	-
	October	78 ± 33	-	-	230
	November	229 ± 97	290 ± 476	107 ± 159	672
	December	-	-	-	-
	January	-	-	-	-
	February	123 ± 52	-	-	362
	March	228 ± 70	253 ± 240	22 ± 21	363
	April	174 ± 53	554 ± 454	915 ± 689	276
	Totals	**1,337 + 460**	**1,239 ± 1,376**	**1,095 ± 949**	**2,704**
		11,007 + 3,667	**20,152 ± 16,938**	**5,003 + 4,903**	**20,815**

Table 11. Results of questions posed to 296 anglers during the creel survey for McDevitt, Merrill, Riverside, and Settlers ponds during May 2011 through April 2012.

Question	Results and response summaries
Mean angler age	30 (Range: 1 - 84)
Gender	87% Male, 13% Female
Ethnicity	86% Caucasian, 5% Hispanic, 3% Undetermined, 2% Asian, 1% African American
Mean travel distance	5.9 mi (Range <1 - 36 mi)
Mean Party Size	36% Single, 33% two, 17% three, 13% four or more
No people surveyed w/children fishing	33%
Mean fishing experience (years)	27.3
Mean days/year spent fishing	66.3
% fishing trips at ponds	53%
Employment	59% employed, 41% unemployed, 120 people not surveyed or did not answer
Support two-fish daily limit	63% Support, 36% do not support, 2% no opinion

Table 12. Results of questions posed to 296 anglers during the creel survey for McDevitt, Merrill, Riverside, and Settlers ponds during May 2011 through April 2012.

	Ranking				
	Not Important				Very Important
	1	2	3	4	5
Importance of catching fish	9%	9%	22%	21%	39%
Importance of harvesting fish	34%	19%	16%	7%	24%
Importance of stocked trout	7%	6%	10%	19%	58%
	Very Low				Very High
	1	2	3	4	5
Current angling satisfaction with pond	6%	11%	20%	24%	40%

Table 13. Surface area, estimated angling use, angling pressure in trips/ha, angler cost/trip, and estimated economic value based on cost per trip for community ponds in southwestern Idaho and selected fisheries across the state. Surveyed ponds were McDevitt, Merrill, Riverside, and Settlers ponds surveyed during May 2011 through April 2012. Community ponds are the community ponds in the Treasure Valley area that are currently stocked by IDFG with catchable rainbow trout. Estimates of spending, use, and trips for selected fisheries estimated by Hebdon et al. (2008).

Fishery	Area (ha)	Use (h)	Ann. Trips	Cost/trip	Economic value
Surveyed Ponds	2.4	37,455	20,534	$ 21	$ 431,222
Community Ponds	60.7	934,783	519,324	$ 21	$ 10,905,797
lower Boise River	239	53,447	53,297	$ 46	$ 2,451,662
Brownlee Reservoir	4452	82,684	84,588	$ 139	$ 11,757,732
CJ Strike Reservoir	2735	68,376	68,375	$ 129	$ 8,820,375
Lucky Peak Reservoir	1119	45,026	1,119	$ 72	$ 80,568
Coeur d'Alene Lake	11298	91,591	90,384	$ 73	$ 6,598,032
Henry's Lake	2459	42,410	41,803	$ 292	$ 12,206,476
Lake Pend Orielle	33998	60,297	67,996	$ 295	$ 20,058,820

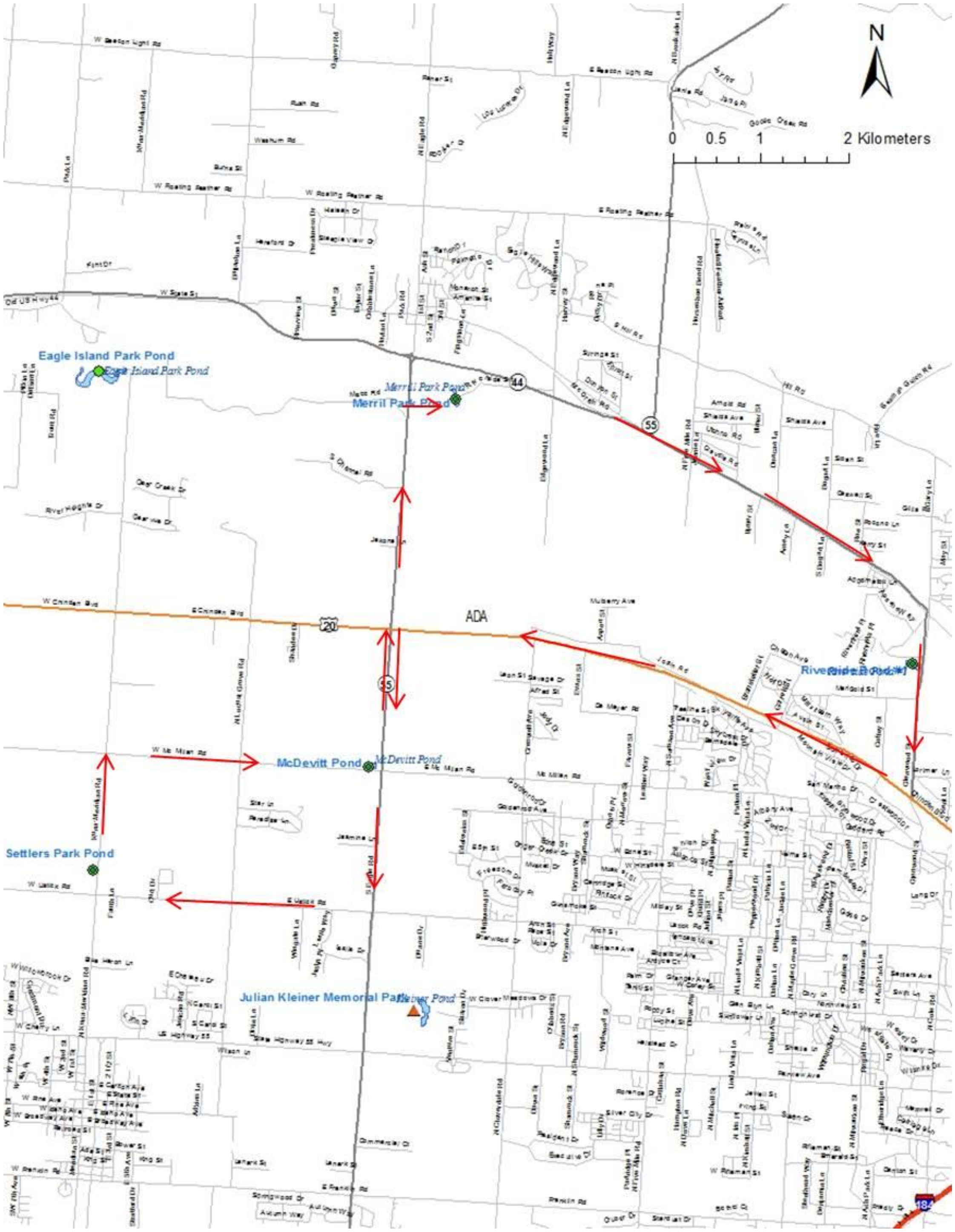

Figure 9. Map of creel route and locations of Settlers, McDevitt, Merrill, and Riverside ponds, where creel surveys were conducted in May 2011 through April 2012.

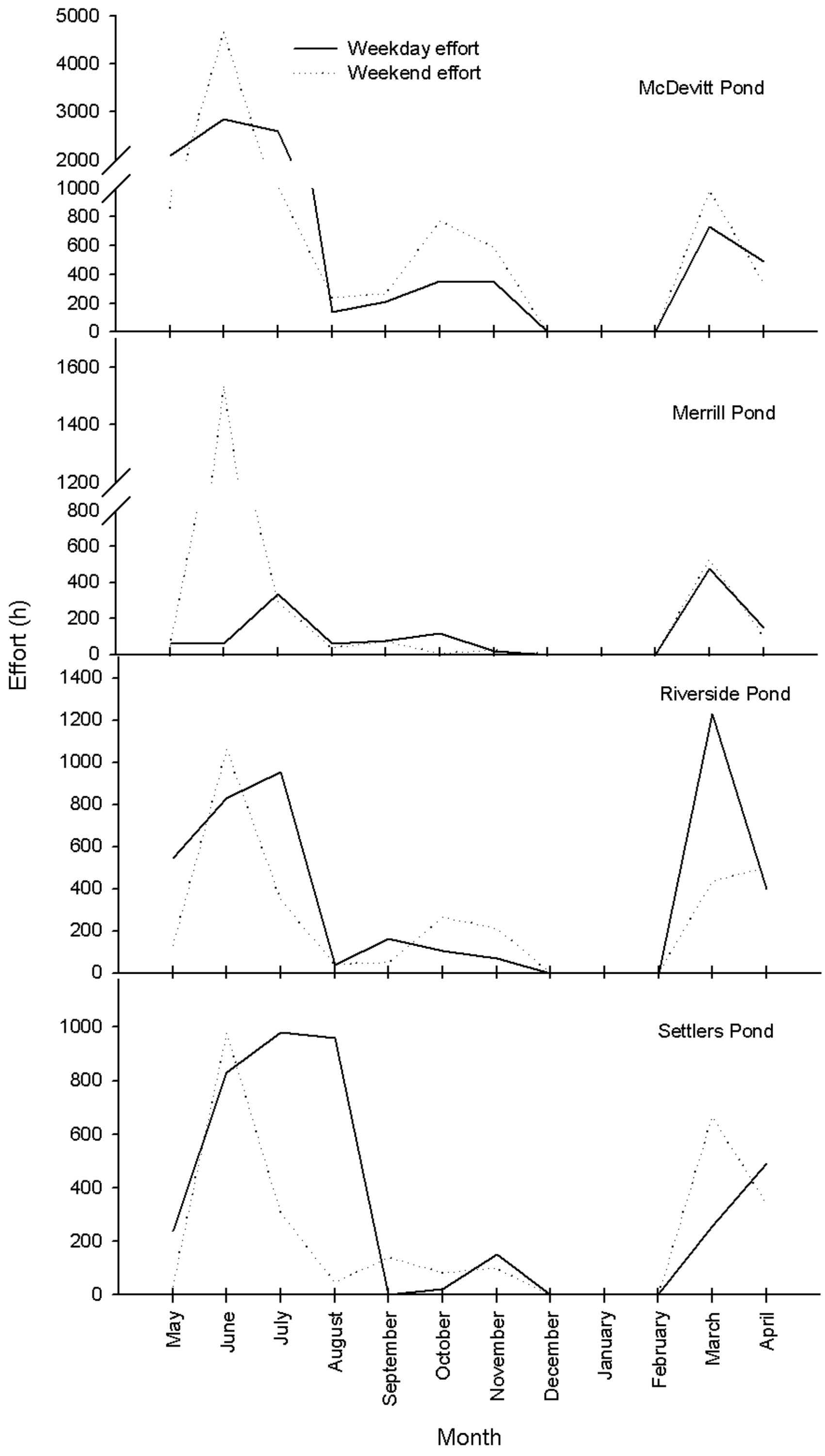

Figure 10. Annual angler effort by day type and month at Settlers, McDevitt, Merrill, and Riverside ponds, from May 2011 to April 2012.

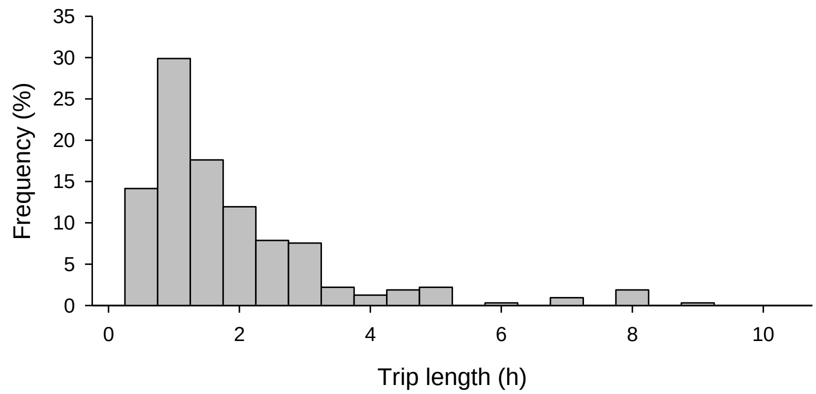

Figure 11. Frequency distribution of angler trip length as reported by anglers at time of creel interview at Settlers, McDevitt, Merrill, and Riverside ponds, from May 2011 to April 2012.

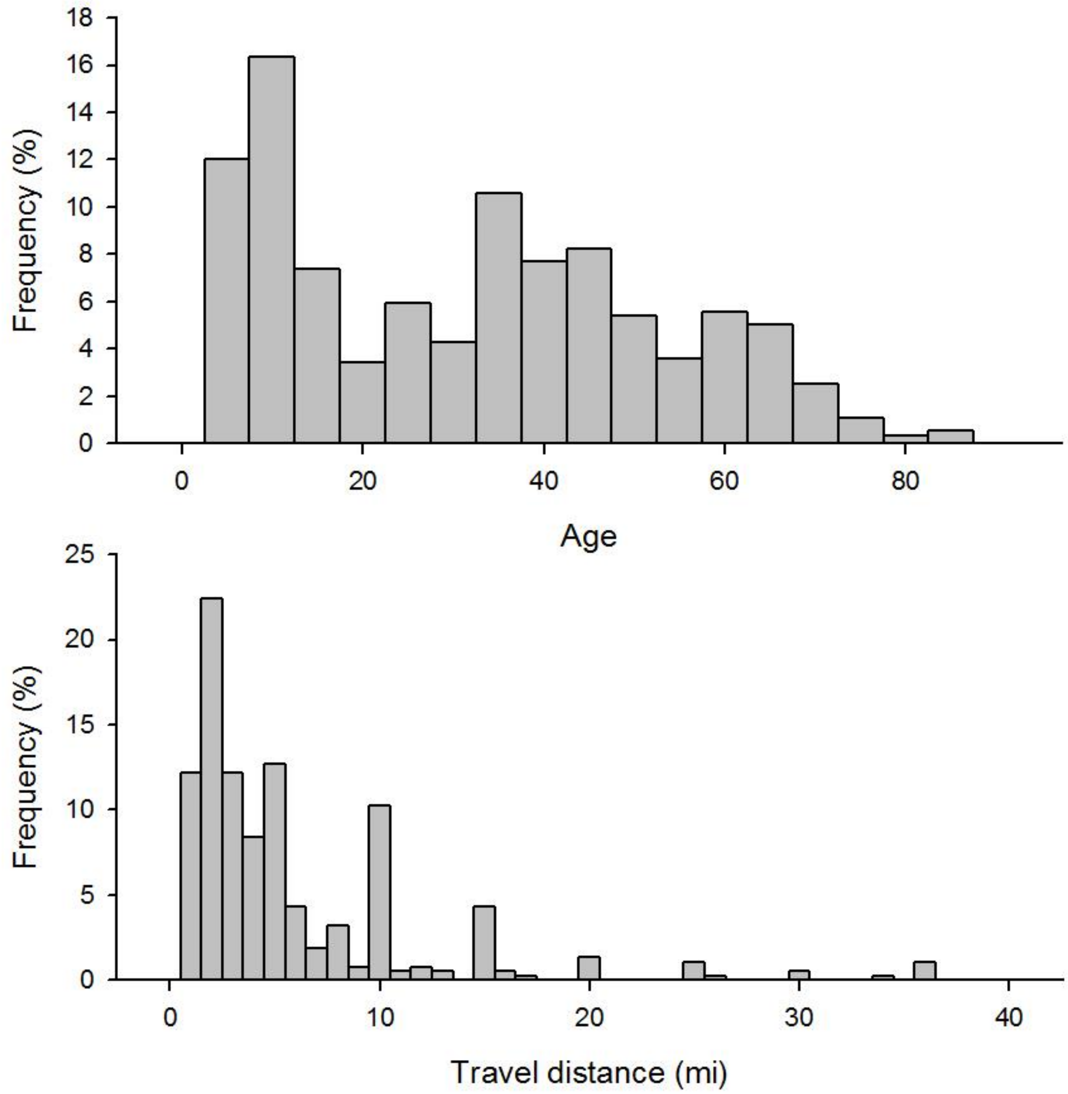

Figure 12. Frequency distribution of age and travel distance as reported by anglers at time of creel interview at Settlers, McDevitt, Merrill, and Riverside ponds, from May 2011 to April 2012.

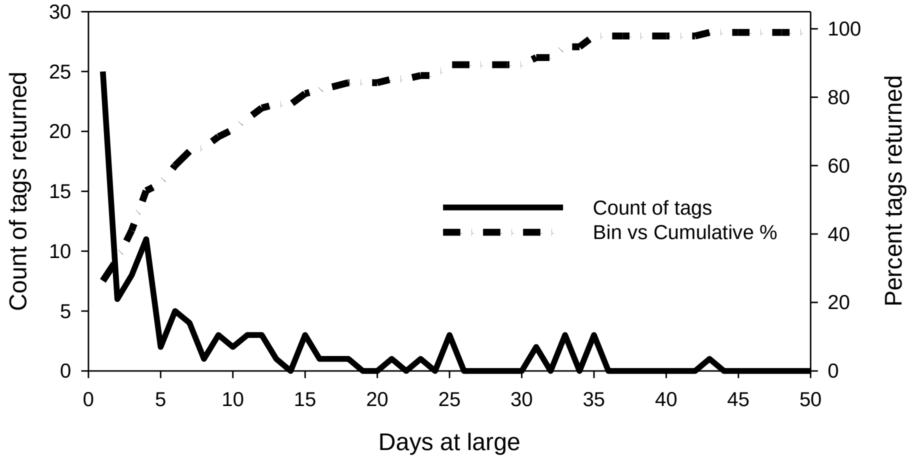

Figure 13. Cumulative return of tags implanted in 398 rainbow trout stocked into McDevitt Pond in April and October 2011, as reported by Koenig and Cassinelli (2012).

DEADWOOD RESERVOIR

ABSTRACT

To assess kokanee salmon *Oncorhynchus nerka* population dynamics, fourteen hydroacoustic transects were conducted at Deadwood Reservoir on July 17, 2012. Total mean kokanee density was 1,894 (1,709 to 2,100) fish/ha. When expanded to a population estimate using the reservoir surface area (1,223 ha) on the survey date, a total of 2,316,774 (2,090,366 to 2,567,691) kokanee were estimated. Age-0 kokanee made up 56% of this total or 1,299,957 (1,208,094 to 1,398,797) fish. Overall density 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 egg quotas for the hatchery system. Escapement objectives were developed allowing weir operators to pass fish throughout the escapement period. We estimated that to produce an August 2013 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. A total of 393 fish were captured during the lowland lake survey on July 16-19, 2012. Nearly 60% of the catch was mountain whitefish (n = 230), followed by kokanee (15%; n = 57). Westslope cutthroat trout *Oncorhynchus clarkii lewisi*, rainbow trout *O. mykiss*, fall Chinook salmon *O. tshawytscha*, and bull trout *Salvelinus confluentus* were also captured. Fall Chinook salmon appear to be growing quite well with the 2009 year class exceeding 500 mm within three 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. clarkii 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, increases in population result in decreases in adult fish length. 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 one of Idaho's primary egg sources, 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 size 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 washing 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 2012 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 stocking in 2009 to function as both kokanee population control and also diversify the reservoir sport fishery. Fall Chinook salmon were historically stocked in 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 and potential impacts on bull trout, which were federally listed under the Endangered Species Act (ESA) as "threatened" in 1998. 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. A lowland lake survey was planned for Deadwood Reservoir in 2012 to assess the survival, growth, and diet of fall Chinook salmon. Despite low stocking densities, biologists need to ensure the fall Chinook 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, 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 17, 2012. Hydroacoustic methodology and analysis is described in detail in Butts et al. (2011).

Lowland Lake Survey

Fish populations in Deadwood Reservoir were assessed with standard IDFG lowland lake sampling gears during July 16-19, 2012. Sampling gear included: (1) paired gill nets, and (2) trap nets. Boat electrofishing was not attempted because low water conductivity limits success. Paired gill net sets included floating and sinking monofilament nets, 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. Trap nets possessed 15-m leads, 1-m x 2-m frames, crowfoot throats on the first and third of five loops, 19-mm bar mesh, and had been treated with black tar. One trap net fished for one night equaled one unit of trap net effort. In total, eight trap nets and eight gill net pairs were deployed.

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. 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). These indices were calculated by standardizing the catch of each gear type to one unit of effort and then summing across the gear types.

Chinook Redd Count

The Deadwood River, from the confluence of Ross Creek downstream to the reservoir mouth, was surveyed on October 25, 2012 to index fall Chinook salmon abundance. Approximately 12.7 km of the mainstem Deadwood River were surveyed, adding approximately 6 km to historic surveys conducted by Flatter et al. (2004). One 2-person crew began at the confluence of Ross Creek and walked downstream to Deer Creek, while another crew walked from Deer Creek downstream to 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

Fourteen hydroacoustic transects were surveyed at Deadwood Reservoir on July 17, 2012 (Figure 14). Converted target strengths suggested that kokanee ranged between 30 and 400 mm, and the length frequency from converted target strength corresponded well with fish collected during mid-water trawling in previous years (Figure 15).

Fish densities among transects ranged from 1,167 fish/ha to 2,990 fish/ha with the highest densities (1,435 fish/ha) of fish corresponding to age-0 fish (Table 14). Age-2 kokanee displayed the lowest densities (116 fish/ha) among age classes. Overall, total mean kokanee density was 1,894 (1,709 to 2,100) fish/ha. When expanded to a population estimate using the reservoir surface area (1,223 ha) on the survey date, a total of 2,316,774 (2,090,366 to 2,567,691) kokanee were estimated. Age-0 kokanee made up 56% of this total or 1,299,957 (1,208,094 to 1,398,797) fish. Population estimates for remaining age classes are reported in Table 14.

Between 2009 and 2011, estimated kokanee abundance increased seven-fold, mostly due to the abundant age-0 year classes in 2010 and 2011 (Figure 16). However, in 2012, hydroacoustic estimates suggested a 41% decrease in total kokanee abundance. Comparisons with historic numbers collected between 2009-2012 shows all size classes are still well above estimates for 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.

The 2012 escapement objective was modeled using 2012 hydroacoustic density estimates, mean female length, and previous estimates of fecundity, egg retention and deposition rates, and egg-to-fry survival estimates. Overall density 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 egg quotas for the hatchery system. Hydroacoustic surveys between 2000 and 2012 show that on average, the age-0 year class is approximately 63% of the total population. Biologists used these numbers to project the number of age-0 fish in July/August that would be produced by a single female, spawning the previous year (91 fish/female). Expanding this estimate to population objectives, we estimated that to produce an August 2013 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. Therefore, over a typical 3-4 week period, approximately 350-400 individual females could be passed per week, assuming that unknown hundreds of females escape capture around and during weir operations. For example, after weir removal in 2011, we estimated 4,000-6,000 individuals were still in the stream below the weir. Weather events may also cause weir failure as in 2006-07, when rain storms forced the temporary removal of weirs due to rising stream levels. Therefore we assumed that the total number of spawning females has the potential to more than double due to uncontrollable circumstances and thus the objective for spawning females was kept conservative to account for these potential issues. Biologists were not concerned with limiting male fish as additional fish transported nutrients upstream in an otherwise sterile system. Remaining fish were euthanized and subsequently transported upstream and dumped in the river for fertilization purposes. The weirs were operated until capture rates in the upstream box of the Deadwood River weir were negligible.

Lowland Lake Survey

A total of 393 fish were captured during the lowland lake survey on July 16-19, 2012 (Table 15). Nearly 60% of the catch was mountain whitefish (n = 230), followed by kokanee (15%; n = 57). Westslope cutthroat trout, rainbow trout, Chinook salmon, and bull trout were also captured. CPUE and WPUE indices for combined species were 26.2 and 0.006, respectively (Tables 15-16). Gill netting was the most effective gear type as trap net catch contributed only 6% of total catch and 3% of total weight for all species combined. Only redside shiners were more effectively captured with trap nets. Mountain whitefish ranged from 160 to 440 mm and CPUE for gill nets was 31.4 fish per gill net pair.

Only nine fall Chinook salmon were captured ranging from 310 to 591 mm, probably representing 3 different stocking groups as all fish were marked with an adipose clip (Table 17). Four of the nine fish were male, and both males that were ≥500 mm were mature, and were expected to spawn that year. All females, including 3 fish ≥500 mm were still immature and would not have spawned in 2012. All but 3 fish stomachs were empty, but those 3 contained fish parts. Two of the stomach samples clearly contained age-1 kokanee (~130 mm) and the remaining was unidentifiable because of advanced digestion. The condition factors for these fish ranged from 0.91 to 1.33, and all fish appeared quite healthy and to be growing well. Fall Chinook CPUE was 1.3 fish with paired gillnets.

The 58 kokanee captured in gill nets ranged from 190 to 400 mm and appeared to be comprised of three age classes (ages 2-4; Figure 17). Younger fish (age-0 and age-1) were not captured because of gear selectivity towards larger fish. 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 estimated average length of a mature female to be 280 mm.

Rainbow trout and westslope cutthroat trout were also prominent in total catch and appear to be providing a valuable sport fishery at Deadwood Reservoir. Rainbow trout ranged from 90 to 500 mm, with multiple year classes, and a mixture of hatchery and wild origin fish (Figure 17). Over 50% of the fish captured were greater than 300 mm and almost 20% were greater than 400 mm. Westslope cutthroat trout ranged from 170 to 390 mm and all fish appeared to be wild origin as these fish were last stocked as fry in 1998.

Chinook redd counts

A total of 13 fall Chinook salmon redds were counted along 12.7 km of the mainstem Deadwood River (Figure 18). Nine of these redd sites occurred between the confluences of Ross and Deer creeks while the remaining 4 redd sites were observed between Deer Creek and the reservoir. No live fish or carcasses were observed during the survey.

DISCUSSION

Hydroacoustic evaluations of the Deadwood Reservoir kokanee population suggest that that the population is responding to control efforts implemented in 2010 and 2011. However, annual monitoring shows how quickly the Deadwood Reservoir population can increase when control measures are not utilized, as in 2009. Currently, mean female spawner length has been declining from approximately 340 mm in 2009 and 2010 to 267 mm in 2012, well under the management goal minimum length of 325 mm (Figure X). 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 2013. 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 in 2011 and 2012. However, 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. During 2011, fish were not allowed past the Trail Creek weir, and only fish at the very end of the spawning run were allowed past the Deadwood River weir after it was removed. By allowing a consistent 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 density estimates and spawning female lengths suggested that keeping the population roughly between 800,000 to 1 million fish (250 to 320 fish/ac) 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).

Standardized gill net sets were useful for determining mature female kokanee lengths and thus escapement objectives for the upcoming spawning run. Fall Chinook salmon were also captured and evaluated, although catch was lower than expected. Trap nets were not effective in capturing sport fish and thus should not be continued in the future.

Fall Chinook salmon are growing quite well with the 2009 year class exceeding 500 mm within three years. Surprisingly, females of this size were still immature suggesting that fish will be growing an additional year or more before spawning. Chinook salmon that were examined were feeding primarily on age-1 kokanee and so most benefits of predation pressure on the kokanee year classes probably are not occurring on the age-0 year classes. 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 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.

MANAGEMENT RECOMMENDATIONS

1. Continue monitoring the kokanee population in Deadwood Reservoir with hydroacoustics and sample pre-spawning fish to estimate mean length in 2013. 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. 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 14. Kokanee densities (number/ha) per transect and total abundance estimates calculated by arithmetic and geometric mean densities at Deadwood Reservoir, Idaho on July 14, 2010.

		Fish densities (number / ha)				
Transect	**Transect length (m)**	**Age-0**	**Age-1**	**Age-2**	**Age-3**	**Total**
1	555	865	184	52	66	1,167
2	446	1,045	300	84	116	1,545
3	437	737	272	188	182	1,379
4	456	816	324	106	163	1,410
5	280	1,135	693	251	333	2,412
6	505	930	766	416	567	2,679
7	363	1,435	1,024	236	295	2,990
8	362	936	539	148	252	1,875
9	1399	1,369	627	205	239	2,441
10	113	1,219	139	0	38	1,396
11	556	944	365	219	163	1,691
12	773	1,258	586	162	185	2,191
13	542	1,185	518	174	211	2,088
14	822	1,297	623	204	162	2,286
	Arithmetic Mean (AM)	**1,084**	**497**	**175**	**212**	**1,968**
	90% CI (AM)	**70**	**80**	**32**	**42**	**180**
	Abundance (AM)	**1,325,366**	**608,137**	**213,571**	**259,726**	**2,406,800**
		± 86,082	**± 97,536**	**± 39,621**	**± 51,285**	**± 219,653**
	Geometric Mean (GM)	**1,063**	**435**	**116**	**177**	**1,894**
	90% CI (GM)	**988 to 1,144**	**355 to 532**	**69 to 196**	**140 to 225**	**1,709 to 2,100**
	Abundance (GM)	**1,299,957**	**531,928**	**141,843**	**217,076**	**2,316,774**
		1,208,094 to 1,398,797	**434,497 to 651,147**	**83,902 to 239,222**	**171,301 to 274,995**	**2,090,366 to 2,567,691**

Table 15. Catch and cath per unit effort (CPUE) by species and gear type for the lowland lake survey conducted in Deadwood Reservoir, Idaho on July 16-19, 2012.

	Gill Net Catch	Gill Net CPUE	Trap Net Catch	Trap Net CPUE	Total Catch	Total CPUE
Bull Trout	5	0.7	0	0	5	0.3
Chinook Salmon	9	1.3	0	0	9	0.6
Kokanee	57	8.1	1	0.1	58	3.9
Mountain Whitefish	220	31.4	10	1.3	230	15.3
Rainbow Trout	36	5.1	6	0.8	42	2.8
Rainbow X Cutthroat Trout	2	0.3	1	0.1	3	0.2
Redside Shiner	0	0.0	6	0.8	6	0.4
Westslope Cutthroat Trout	39	5.6	1	0.1	40	2.7
Totals	368	52.6	25	3.1	393	26.2

Table 16. 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 16-19, 2012.

	Gill Net Weight	Gill Net WPUE	Trap Net Weight	Trap Net WPUE	Total Weight	Total WPUE
Bull Trout	0.8	1.1×10^{-4}	-	-	0.8	0.5×10^{-4}
Chinook Salmon	11.1	1.6×10^{-3}	-	-	11.1	7.4×10^{-4}
Kokanee	7.0	1.0×10^{-3}	0.1	0.1×10^{-4}	7.1	4.7×10^{-4}
Mountain Whitefish	40.7	5.8×10^{-3}	1.8	2.2×10^{-4}	42.5	2.8×10^{-3}
Rainbow Trout	11.8	1.7×10^{-3}	0.2	0.3×10^{-4}	12.0	0.8×10^{-3}
Rainbow X Cutthroat Trout	0.8	1.1×10^{-4}	0.5	0.7×10^{-4}	1.3	0.9×10^{-4}
Westslope Cutthroat Trout	9.7	1.4×10^{-3}	0.2	0.3×10^{-4}	9.9	6.6×10^{-4}
Totals	82	1.2×10^{-2}	3	0.4×10^{-3}	85	0.6×10^{-2}

Table 17. Individual fall Chinook salmon data collected during the lowland lake survey conducted in Deadwood Reservoir, Idaho on July 16-19, 2012.

Length	Weight	Condition	Sex	Maturity	Stomach
310	351	1.18	M	I	E
377	486	0.91	F	I	E
382	648	1.16	M	I	2 kok, ~130 MM
397	700	1.12	f	I	1 fish no ID
513	1567	1.16	F	I	1 kok 130 mm
520	1332	0.95	F	I	E
534	1496	0.98	M	M	E
534	1755	1.15	F	I	E
591	2744	1.33	M	M	E

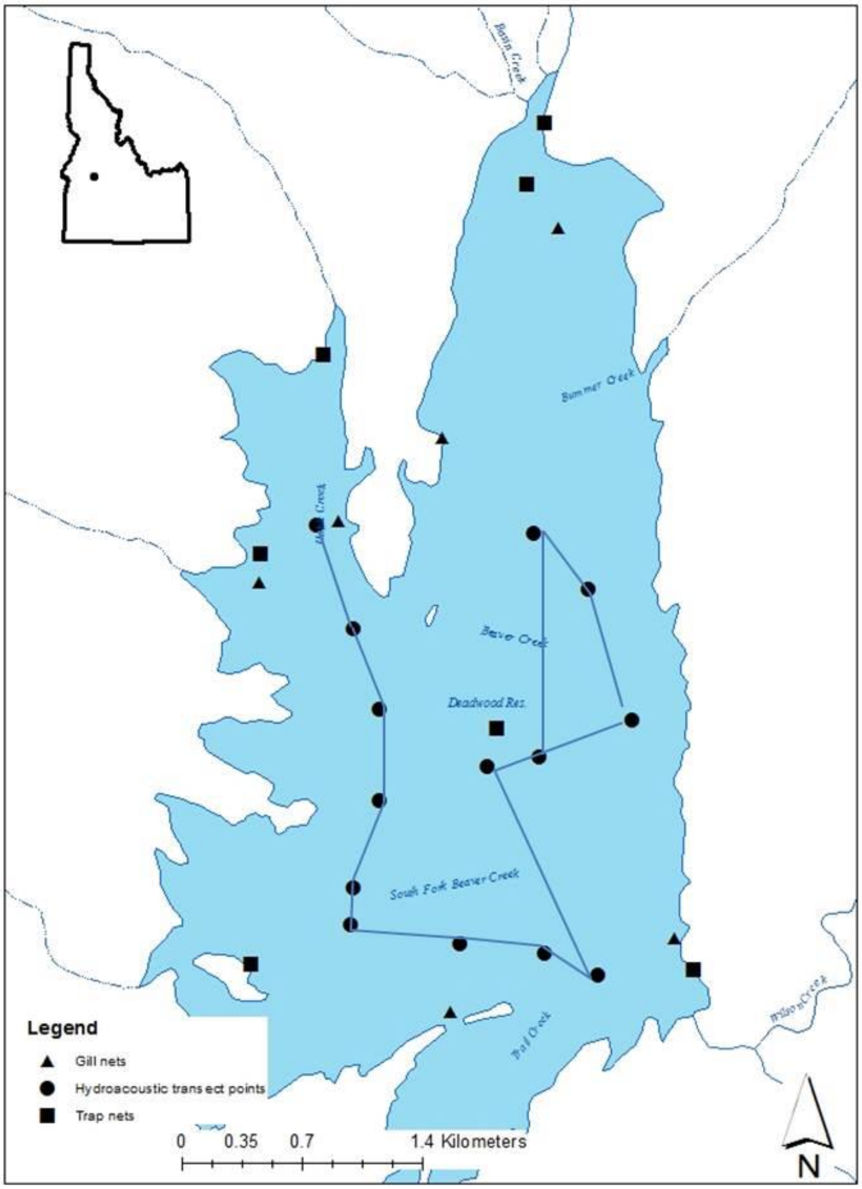

Figure 14. Map of Deadwood Reservoir, Idaho showing hydroacoustic transect and sampling gear locations during the 2012 survey.

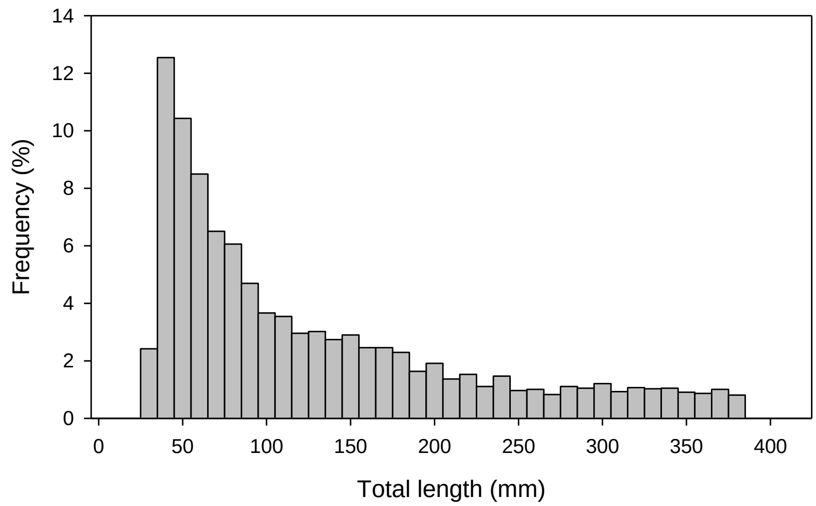

Figure 15. Length frequency of kokanee as estimated by converted hydroacoustic target strengths at Deadwood Reservoir, Idaho on July 17, 2012.

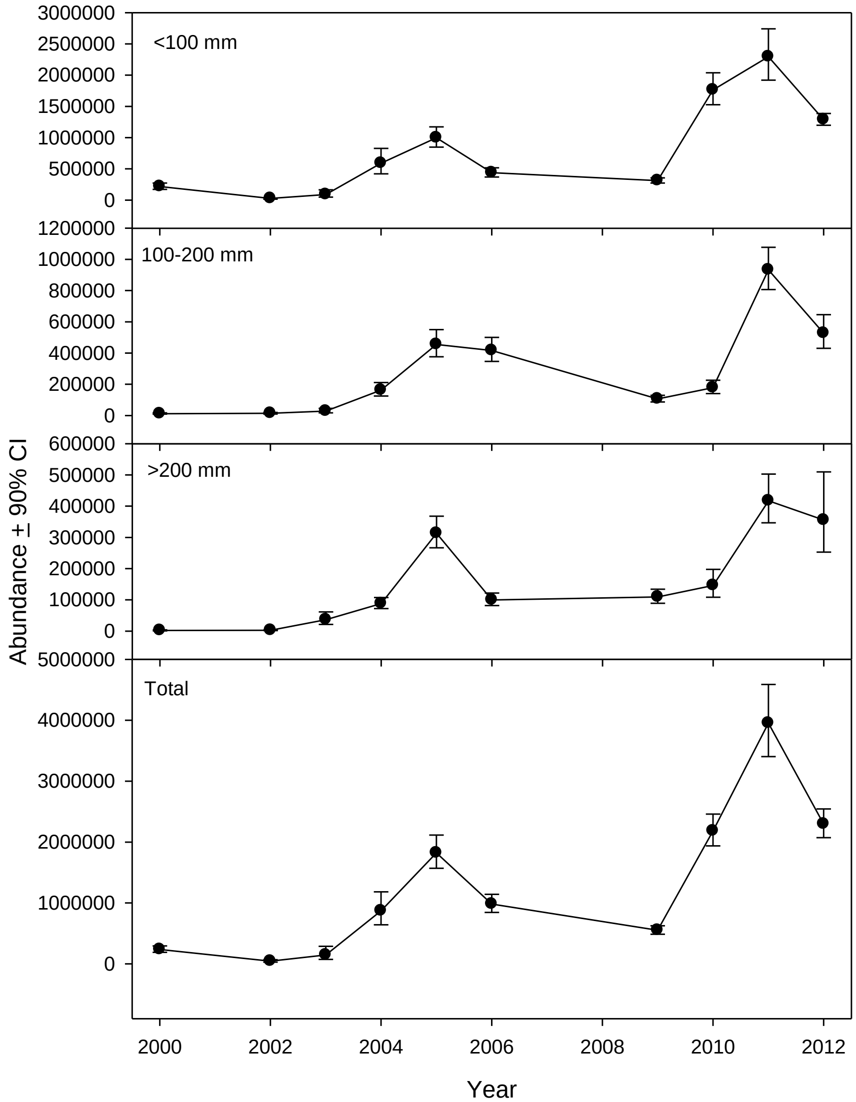

Figure 16. Comparison of kokanee abundance estimates ± 90% CI for fish <100 mm (age-0), 100-200 mm (age-1), >200 mm (age-2+), and total fish as estimated from annual hydroacoustic surveys in 2000-2012 at Deadwood Reservoir, Idaho.

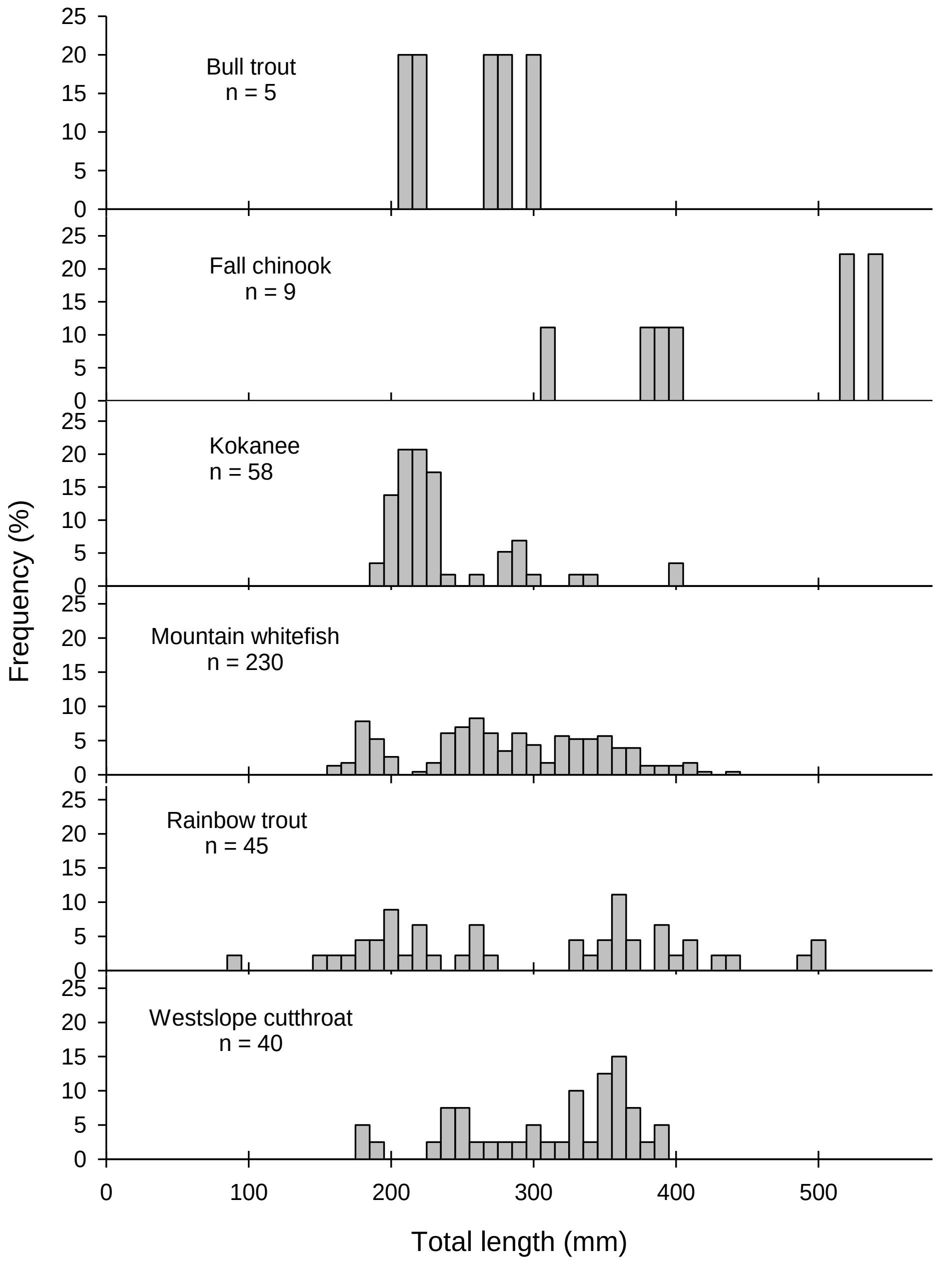

Figure 17. Length frequency and sample size of species captured in standardized sampling gear during the lowland lake survey at Deadwood Reservoir, Idaho on July 16-19, 2012.

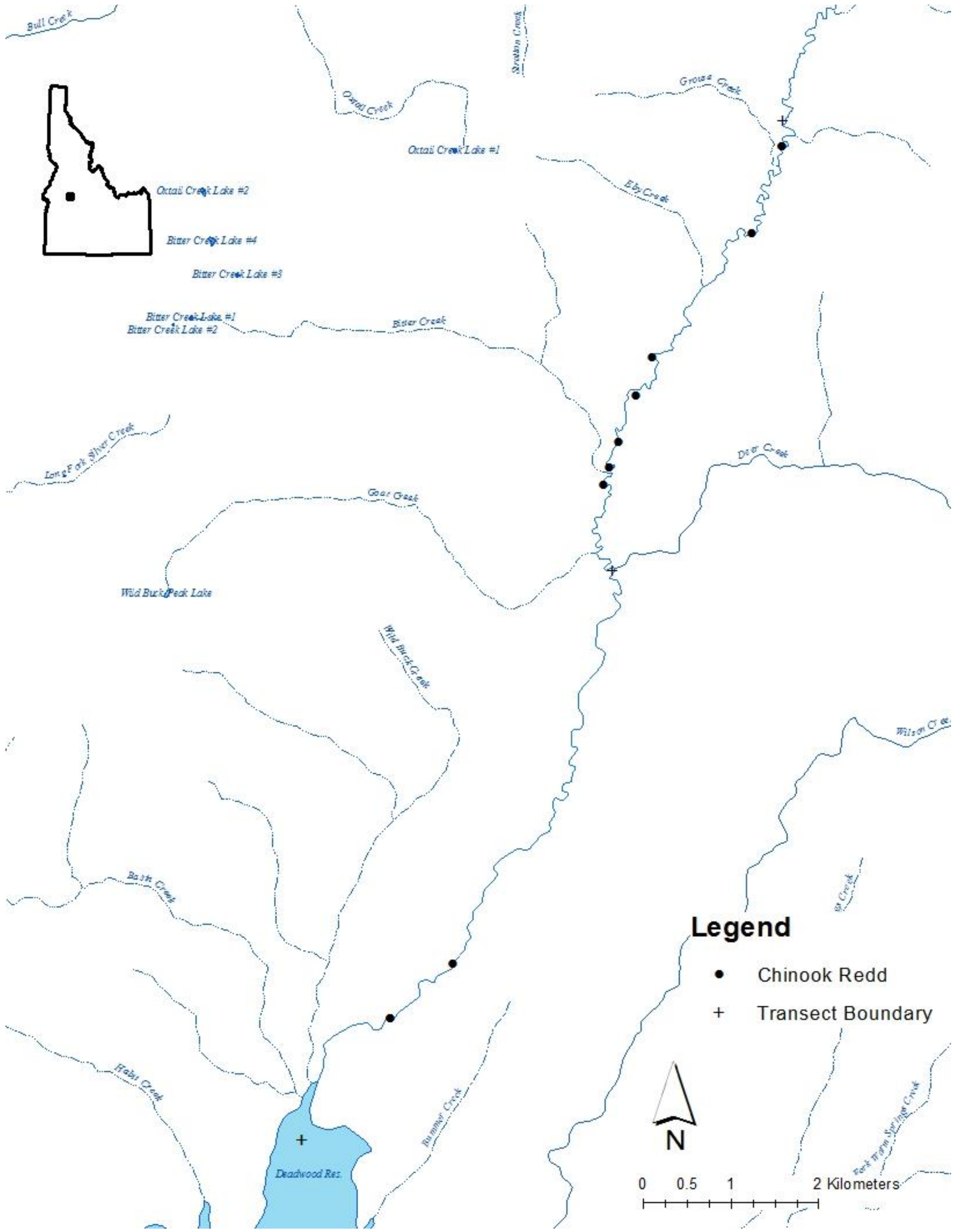

Figure 18. Map of Deadwood Reservoir, Idaho showing fall Chinook redd survey boundaries and observed redd locations for October 25, 2012 survey.

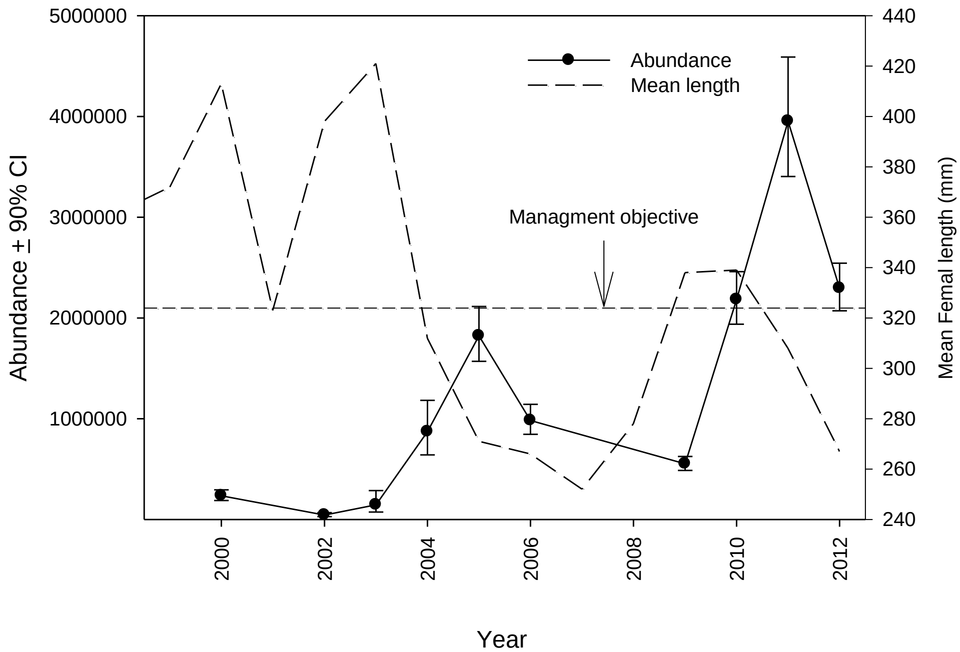

Figure 19. Trend data for 2000-2012 hydroacoustic abundance estimates and mean female total length (mm) collected at the Deadwood River trap from 1998-2012. The management goal for mean adult length is also shown.

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

ABSTRACT

Creel interviews were conducted with anglers leaving Arrowrock and Lucky Peak reservoirs in May 2012 in order to estimate angler catch rates and fish size of kokanee salmon *Oncorhynchus nerka* and rainbow trout *O. mykiss*. The goal of this survey was to develop an index for the fishery that can inform management practices or improve understanding. A total of 518 anglers were interviewed for catch information. At Arrowrock Reservoir, overall catch-per-unit-effort (CPUE) of kokanee was 0.12 fish/h while CPUE at Lucky Peak Reservoir was 0.44 fish/h. The majority of kokanee were caught during the weekend/holiday and early time periods at both reservoirs. At Arrowrock Reservoir, kokanee length ranged from 295 to 440 mm, with an overall mean of 391 mm. At Lucky Peak Reservoir, fish ranged from 217 to 490 mm, with a mean length of 376 mm. Rainbow trout were caught at rates of 0.13 and 0.06 fish/h at Arrowrock and Lucky Peak reservoirs, respectively. Rainbow trout length at Arrowrock Reservoir ranged from 256-412 mm with a mean of 324 mm while fish from Lucky Peak Reservoir ranged from 235-447 mm with a mean of 323 mm.

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INTRODUCTION

The Lucky Peak Reservoir kokanee salmon *Oncorhynchus nerka* fishery is one of the most successful and popular programs in the state and we are experiencing a sizeable increase in angler interest in this fishery. Arrowrock and Lucky Peak reservoirs are two impoundments on the Boise River approximately 10 km east of Boise (Figure 20). Recently, Arrowrock Reservoir has gained popularity as IDFG has begun annually stocking kokanee in 2009. The Lucky Peak kokanee fishery relies solely on stocking of fingerling or fry kokanee salmon in the spring. The Arrowrock 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).

Through the internet, 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 18). The default stocking request for Arrowrock Reservoir is 50,000 fish or 16.1 fish/acre in May. Recent annual variations in reported catch rates have led anglers to question current stocking densities. Additionally, as Arrowrock Reservoir has gained popularity in recent years, many anglers are demanding that more fish be stocked. In fact, some variability may indeed be attributed to size at stocking, timing of stocking, or numbers stocked. 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 define kokanee management goals for catch rates and size of fish at maturity. Additionally, obtaining a better understanding of how reservoir management practices 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 an index to relate back to stocking practices or reservoir environment.

MANAGEMENT GOAL

Provide and manage for attractive kokanee fisheries in Arrowrock and Lucky Peak reservoirs where fish exceed 355 mm.

OBJECTIVE

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 utilizing two check stations and surveying anglers similar to the access-access survey design described by Pollock et al. (1994). However, as we were not attempting to estimate total effort, we did not conduct angler counts. 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. Our focus was on kokanee and rainbow trout *Oncorhynchus mykiss* but we collected data on all fish species reported.

Creel clerks were stationed at two access sites to intercept anglers as they left the fisheries. The surrounding road system of the reservoirs offered an ideal situation where most, if not all, anglers leaving either reservoir can be intercepted at one of the check stations. During May 2012, 8 dates, with 4 days of both weekday and weekend/holiday sampling units were randomly selected. Two sampling periods were also used: an early period (09:00-15:00 h) and a late period (15:00-21:00 h).

Our focus was on completed fishing trips. Creel station #1 was just east state Highway 21 at Spring Shores Road turnoff (Figure 21). This creel station intercepted anglers from Spring Shores Marina, and Mack's Creek ramp, and Arrowrock Reservoir (Figure 21). Creel Station #2 was west of Barclay boat ramp at the overflow parking area. This station intercepted anglers leaving Barclay and Turner Gulch boat ramps (Figure 22). 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 be 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 until slower periods.

Size At Maturity

Collecting and measuring spawning fish or carcasses collected 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 or not this information can be obtained from May creel as well. If, after 2-3 years, minimal differences exist between size at maturity information collected from spawning fish and creel, efforts may be discontinued.

At Lucky Peak Reservoir, spawning kokanee utilize Mores and Grimes creeks. In these streams, fish congregate in the few deep holding pools, particularly at the confluence of these streams. On September 10, 2012, kokanee were collected with a backpack electrofishing unit in Mores Creek at the confluence with Grimes Creek. We collected up to 30 fish of each sex to calculate size at maturity for kokanee in Lucky Peak Reservoir.

RESULTS

Angler Catch Rate And Fish Size

A total of 518 anglers were interviewed for catch information during May 2012. Of the anglers interviewed, 200 anglers had fished at Arrowrock Reservoir and the remaining 318 at Lucky Peak Reservoir. A total of 85 anglers were interviewed during a weekday, while 433 anglers were interviewed during the weekend/holiday period. Average trip length of anglers fishing at Arrowrock and Lucky Peak reservoirs were 4.1 and 4.4 h, respectively. At Arrowrock Reservoir, 58% of anglers indicated that they were targeting rainbow trout while 39% were targeting kokanee (Figure 23). However, most Lucky Peak anglers were targeting kokanee (85%) while only 13% stated they were targeting rainbow trout. Anglers indicating they had no preference or that were targeting smallmouth bass made up 2% or less at both reservoirs.

At Arrowrock Reservoir, overall CPUE of kokanee was 0.12 fish/h while CPUE at Lucky Peak Reservoir was 0.44 fish/h (Table 19). For anglers targeting kokanee, catch rates were the same at Arrowrock Reservoir but slightly higher at Lucky Peak Reservoir (0.49 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 as well (Figure 24). Kokanee measured in the creel at Arrowrock Reservoir ranged from 295 to 440 mm, with an overall mean of 391 mm (Figure 25). Two age classes were likely represented in the creel based on length distributions. At Lucky Peak Reservoir, fish ranged from 217 to 490 mm, with a mean size of 376 mm. Age-2 and 3 fish also appear to be represented in the creel at Lucky Peak Reservoir.

Rainbow trout were caught at rates of 0.13 and 0.06 fish/h at Arrowrock and Lucky Peak reservoirs, respectively (Table 19). Anglers targeting rainbow trout caught fish at a rate of 0.19 and 0.06 fish/h at Arrowrock and Lucky Peak reservoirs, respectively. Fish were primarily caught during the weekend/holiday and early periods as well at both reservoirs. The majority of rainbow trout were caught by shore anglers at Arrowrock Reservoir (74%) while trolling captured 94% of fish at Lucky Peak Reservoir (Figure 26). Similarly, most rainbow trout were caught by bait at Arrowrock Reservoir (69%) while approximately 92% were caught by lures at Lucky Peak Reservoir. Rainbow trout at Arrowrock Reservoir ranged from 256-412 mm with a mean of 324 mm while fish from Lucky Peak Reservoir ranged from 235-447 mm with a mean of 323 mm (Figure 27).

Size At Maturity

A total of 61 spawning fish were collected from a large pool at the confluence of Mores and Grimes creeks on September 10, 2012 to assess size at maturity of fish from Lucky Peak Reservoir. Mean length of spawning males and females was 386 and 393, respectively. Overall, fish ranged from 330 to 480 mm, with a mean length of 390 mm (Figure 25). As in the creel, two age groups appear to be represented during the spawning run, likely age-2 and 3 fish.

Spawning fish from Arrowrock were not sampled in 2012. However, in SFBR, large numbers of spawning individuals were observed along the roaded section of the river. These numbers appear to exceed number from previous years and therefore the situation should be monitored.

DISCUSSION

The May 2012 creel survey provided useful estimates of catch rates and fish size for both kokanee and rainbow trout at Arrowrock and Lucky Peak reservoirs. Although this survey did not include instantaneous angler counts, catch rates and fish size should prove to be useful indices for monitoring the fisheries of both reservoirs. However, as with most indices, data from multiple years will need to be collected to truly gauge the usefulness of this survey for management.

The 2012 survey also provided insights as to whether the same quality of data could be collected with less effort. In 2012, anglers were interviewed on 4 weekday and 4 weekend/holiday days, for a total of 8 days. However, over five times as many anglers were interviewed on the weekend/holiday (n = 433) period as were interviewed during weekdays (n = 85). In addition, approximately 97% of anglers were interviewed during the early period, from 0900-1500 hrs. Estimates of weekend/holiday and early time period catch rates for kokanee and rainbow trout at both reservoirs were nearly identical to total overall estimates. Additionally, overall mean fish size in creel was estimated at 376 mm for all dates and just 3 weekend/holiday dates. This suggests that we would be able to obtain the same quality data in with fewer dates, including two or three early weekend/holiday sampling periods rather than eight randomized sampling periods. However, as this was the first year of creel information, the current design should be repeated at least one additional year before sample size is reduced.

Mean length at maturity estimates were slightly longer than that of fish in the May creel at Lucky Peak Reservoir. Two age groups appeared to be present in the length distribution of spawning individuals and fish in creel. Based on past ageing estimates of kokanee in Lucky Peak Reservoir, it was thought that fish matured at age-2. However, 2012 length distributions suggested that a significant portion of the population may mature at age-3. Uncertainty in size at age should be solved by taking otoliths from 2013 creel and spawner samples. Due to morphological changes in males from kype development, an index on size at maturity should only include females. Determining the management goal for size at maturity based on an index created by spawning individuals will likely require additional years before we can adequately characterize or target length or catch rated based management objectives. However, based on 2012 creel and spawner length estimates, an average length of 350 mm seems to be an appropriate and achievable goal for kokanee size at both reservoirs.

In addition to repeating the May creel index and length at maturity estimates in 2013, regional fishery staffs plan to investigate whether mid-water trawling and hydroacoustics can be used to monitor younger year classes in these populations. 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 predicted. 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.

Table 18. Stocking information for kokanee in Arrowrock and Lucky Peak reservoirs, Idaho.

Water	Year	Date	Fry No.	Fry Density (fish/ha)	Fingerling No.	Fingerling Density (fish/ha)	Rearing hatchery
Arrowrock Reservoir	2004	3-Jun	-	-	69,255	55.2	Mackay
1,255 ha	2004	14-Jun	-	-	7,800	6.2	Mackay
	2006	9-May	-	-	70,000	55.8	Mackay
	2010	3-Jun	29,000	23.1	-	-	Mackay
	2011	8-Jun	30,000	23.9	-	-	Mackay
	2012	2-May	50,130	39.9	-	-	Mackay
Lucky Peak Reservoir							
1,153 ha							
	2004	3-Jun	145,750	126.4	-	-	Mackay
	2004	14-Jun	-	-	10,200	8.8	Mackay
	2005	3-Jun	26,000	22.5	174,150	151.0	Mackay
	2006	24-May	-	-	308,050	267.2	Mackay
	2007	31-May	-	-	245,000	212.5	Mackay
	2008	3-Jun	195,570	169.6	-	-	Cabinet Gorge
	2009	3-Jun	-	-	199,800	173.3	Mackay
	2010	3-Jun	-	-	151,050	131.0	Mackay
	2011	8-Jun	174,640	151.5	-	-	Mackay
	2012	2-May	200,910	174.2	-	-	Mackay

Table 19. Catch rates by various time periods, angling methods, and gear types for kokanee and rainbow trout at Arrowrock and Lucky Peak reservoirs, Idaho.

	Kokanee		Rainbow trout	
	Arrowrock	Lucky Peak	Arrowrock	Lucky Peak
Weekday	0.06	0.61	0.22	0.08
Weekend/Hol	0.13	0.40	0.12	0.06
Early Period	0.11	0.43	0.12	0.07
Late Period	0.38	0.94	0.41	0.00
Shore	0.03	0.02	0.17	0.03
Still boat	0.00	0.09	0.00	0.06
Trolling boat	0.28	0.49	0.09	0.07
Lures	0.25	0.47	0.1	0.07
Bait	0.03	0.16	0.16	0.05
Kokanee targeted	0.24	0.49	-	-
Rainbow trout targeted	-	-	0.19	0.06
Overall	0.12	0.44	0.13	0.06

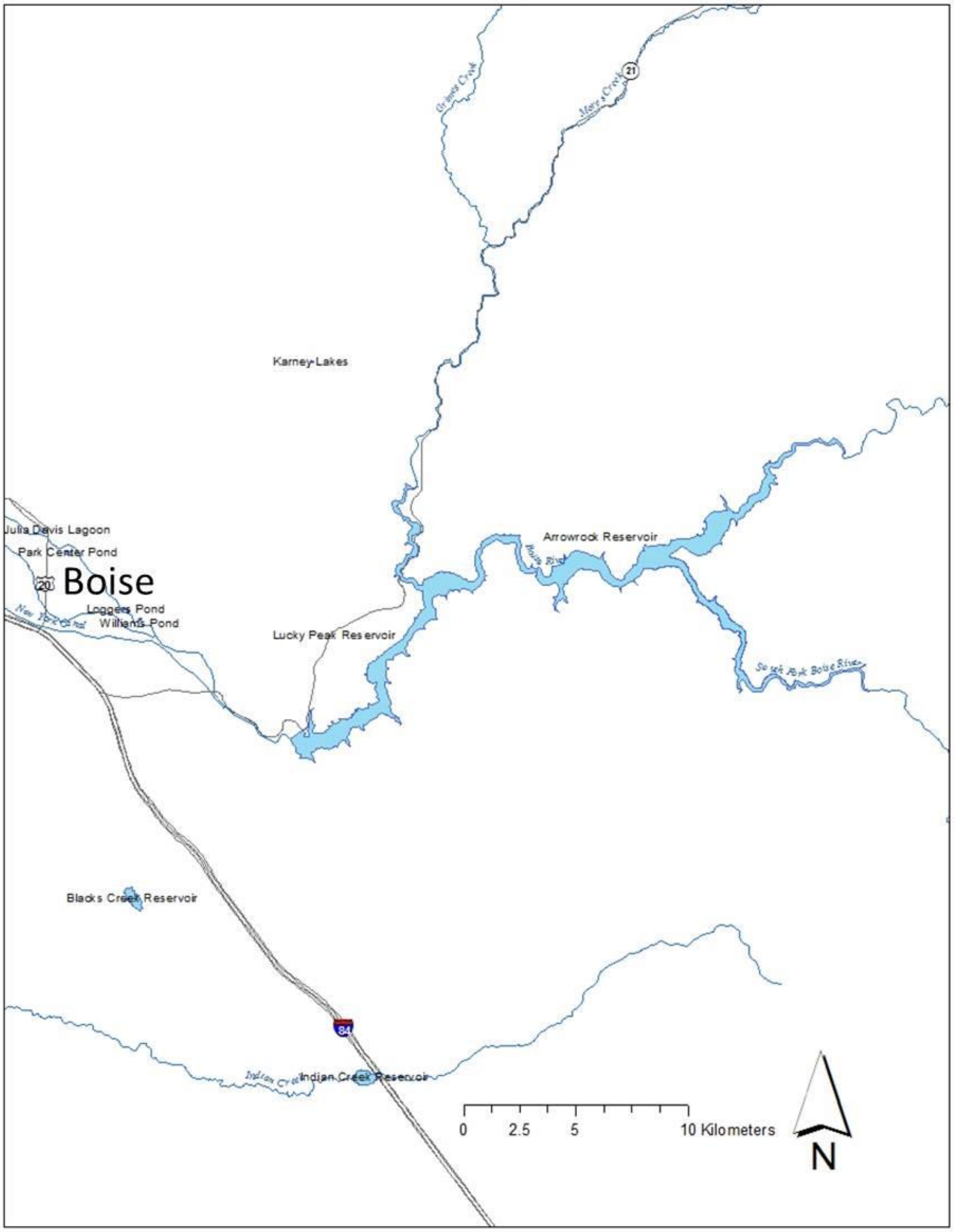

Figure 20. Map of Arrowrock and Lucky Peak reservoirs in relation to Boise, Idaho.

Figure 21. Location of Creel Station #1, where clerks can intercept both Lucky Peak and Arrowrock reservoir anglers.

Figure 22. Location of Creel Station #2, where creel clerks can intercept anglers departing Barclay and Turner Gulch boat ramps.

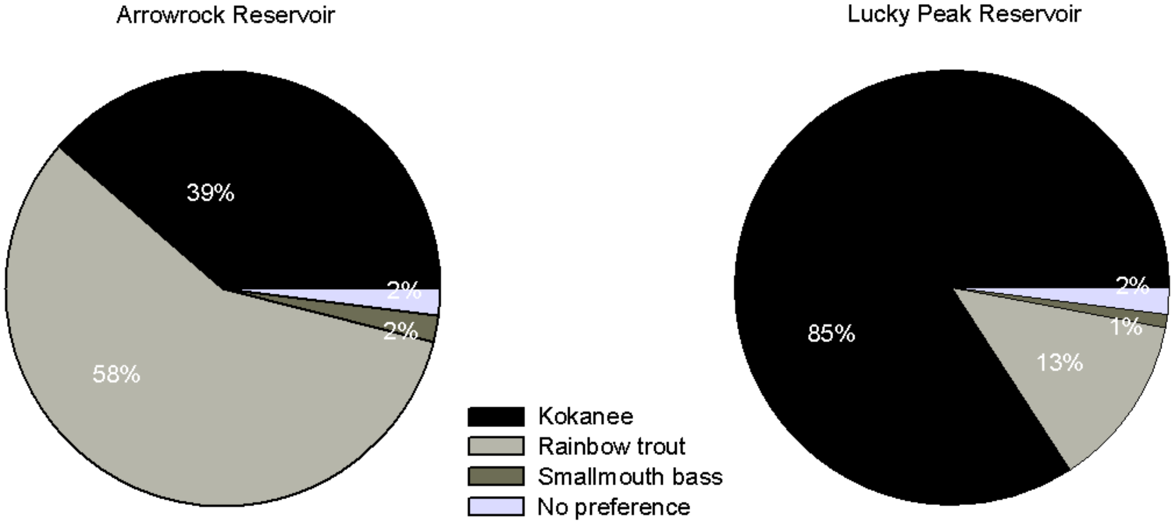

Figure 23. Proportion of targeted species by anglers fishing Arrowrock and Lucky Peak reservoirs in May 2012.

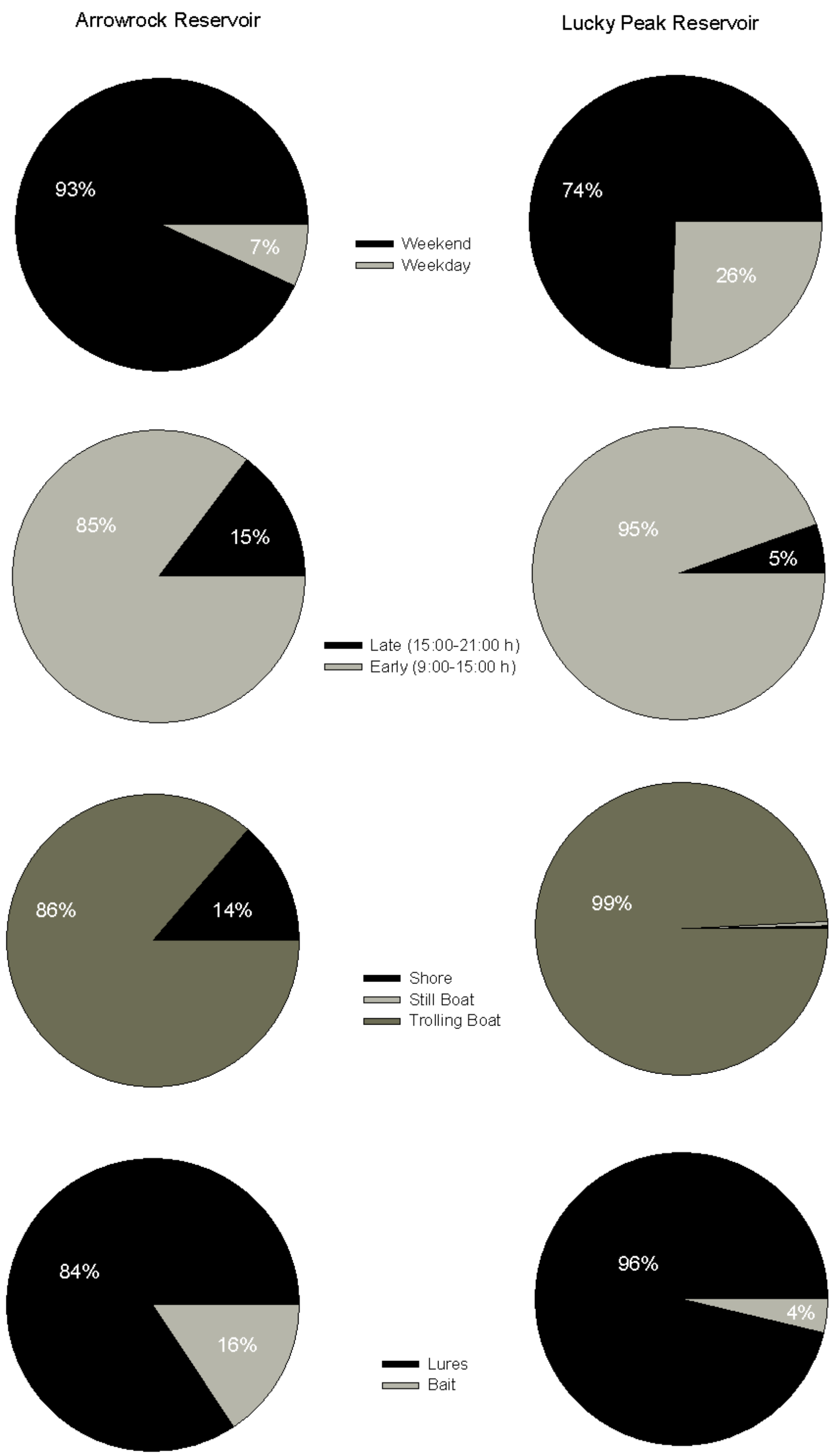

Figure 24. Proportion of kokanee caught by various time periods, fishing methods and gear as reported by anglers at Arrowrock and Lucky Peak reservoirs in May 2012.

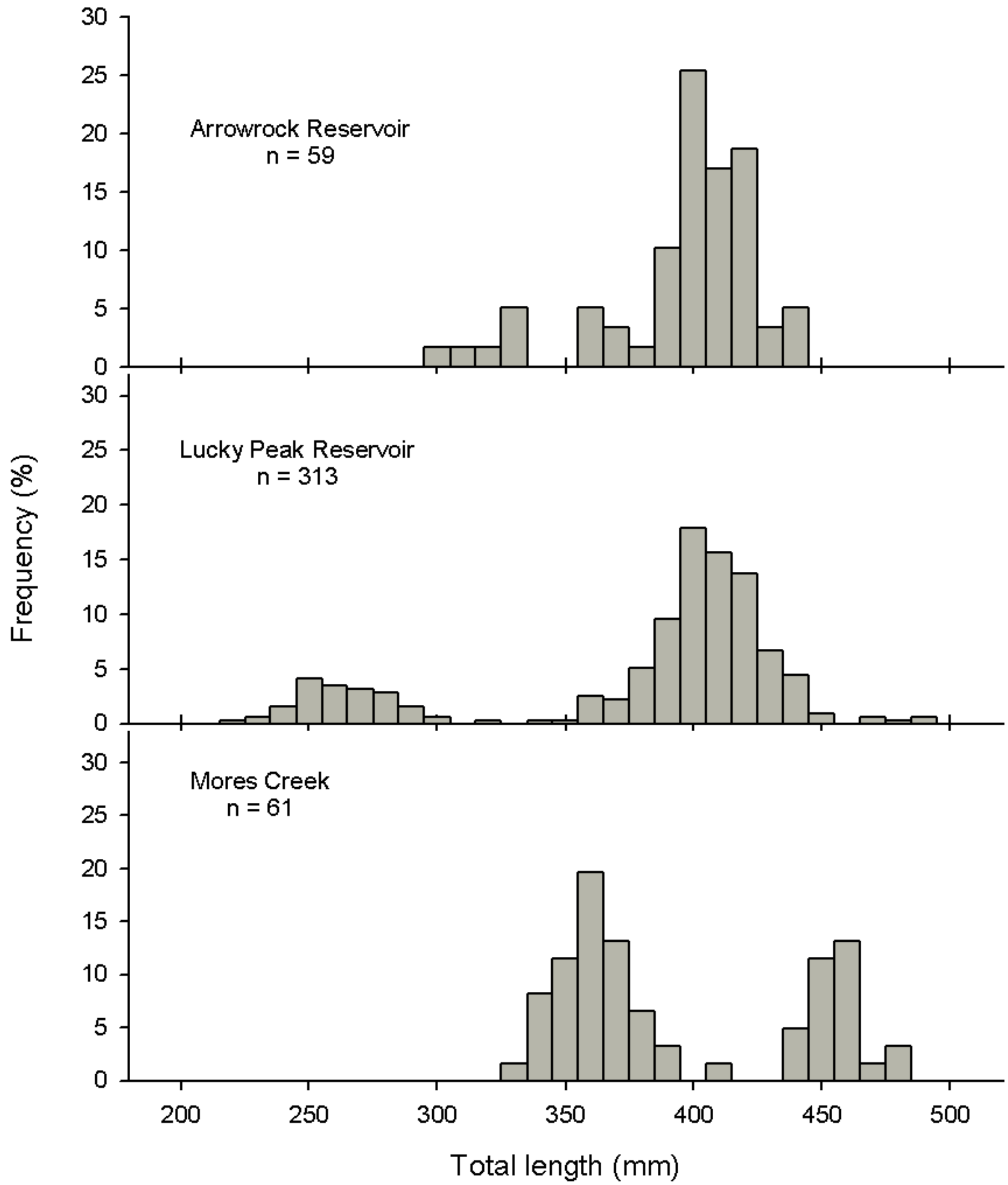

Figure 25. Length frequency distributions of kokanee observed in the creel in May 2012 at Arrowrock and Lucky Peak reservoirs. Spawning kokanee were captured In Mores Creek at the confluence of Grimes Creek on September 10, 2012.

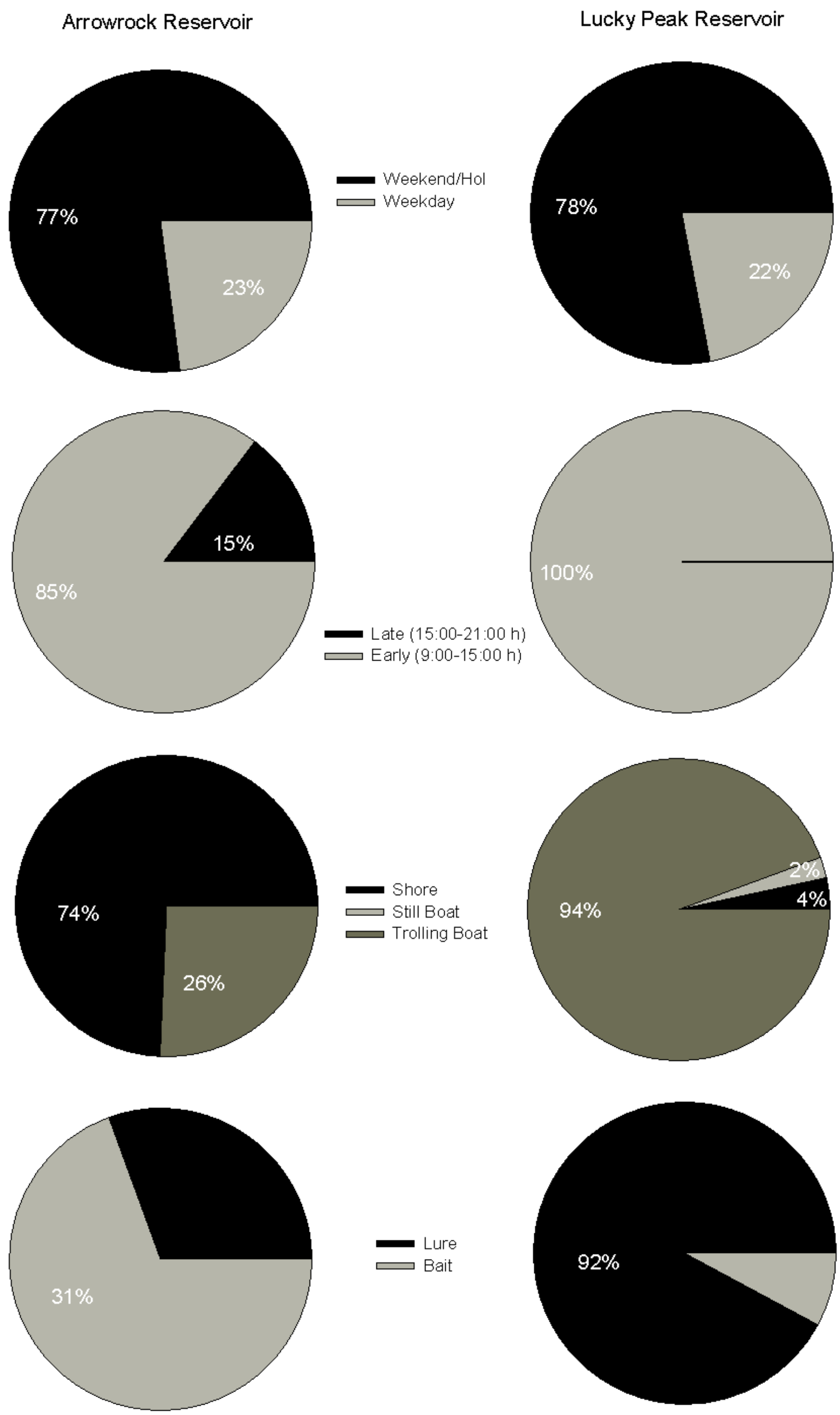

Figure 26. Proportion of rainbow trout caught by various time periods, fishing methods and gear as reported by anglers at Arrowrock and Lucky Peak reservoirs in May 2012.

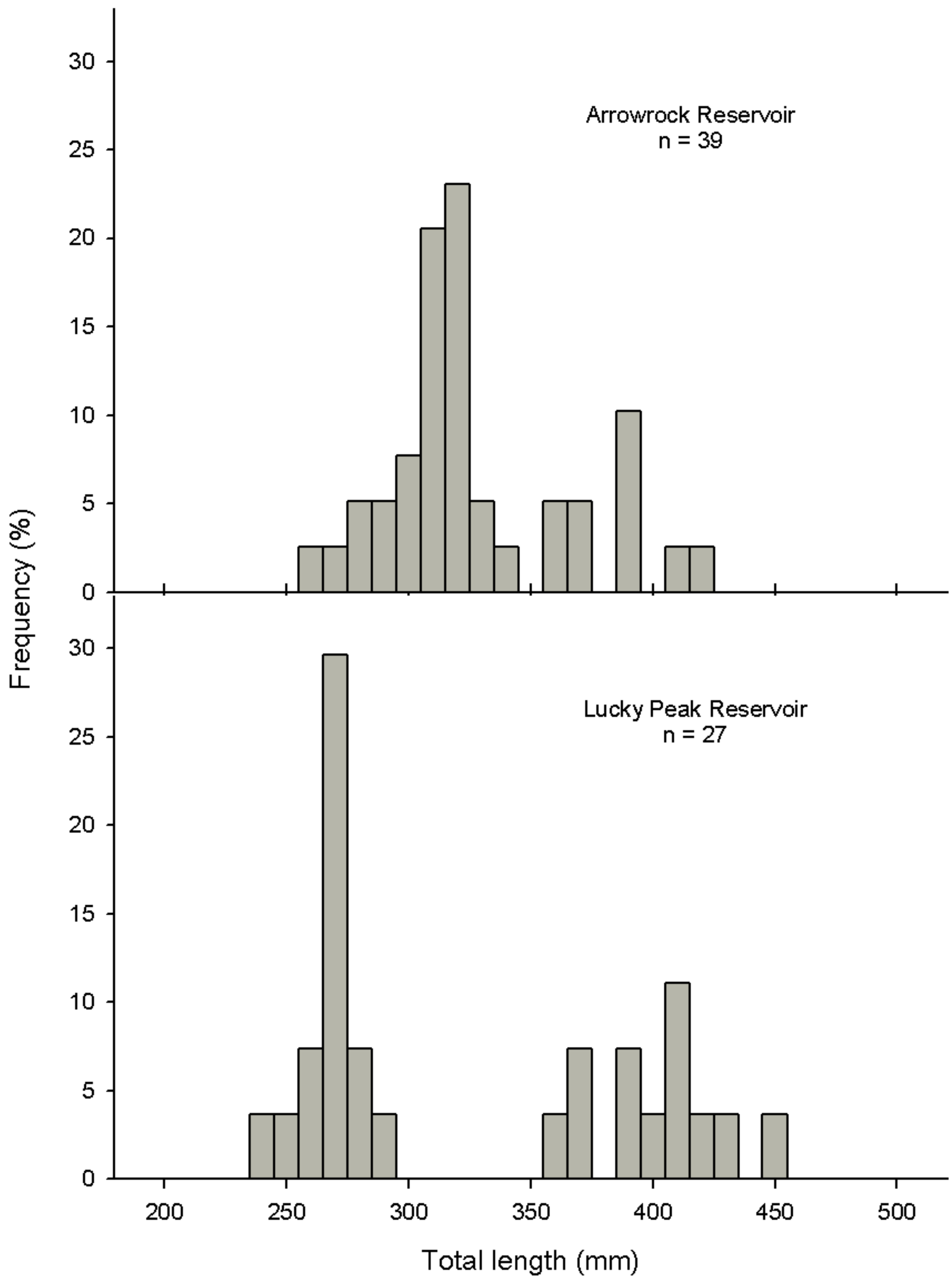

Figure 27. Length frequency distributions of rainbow trout observed in the creel in May 2012 at Arrowrock and Lucky Peak reservoirs.

ASSESSMENT OF LARVAL FISH PRODUCTION IN BROWNLEE AND CJ STRIKE RESERVOIRS

ABSTRACT

Idaho Department of Fish and Game (IDFG) staff conducted larval trawl surveys in Brownlee and CJ Strike reservoirs during 2012 to gain a better understanding of recreationally-important warm water fish recruitment patterns, factors that may affect reproductive success, and to monitor trends. Larval fish density was monitored by horizontally trawling a Neuston net near the waters' surface at ten to eleven 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 83 crappie/100 m^3 (n = 8). Densities during 2012 (94 crappie/100 m^3) were near the average (2005-2012), and were nearly double the densities documented during 2011. From 2005 to 2012, 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 = 7). Densities during 2012 (3.6 crappie/100 m^3) were the second lowest recorded during this time period (lowest = 1 crappie/100 m^3 during 2011).

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INTRODUCTION

Fisheries for black *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, these species have been characterized by widely variable year-class strengths, which often lead to inconsistent fisheries. Year-class strength seems to be determined early in life, 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 eventual year-class strength as long as strength is not affected substantially by population bottlenecks later in life (e.g. survival during winter). Regardless, documentation of years with low larval production will identify potentially poor fishing years two to three years later. Monitoring of year-class strength in Brownlee and CJ Strike reservoirs has been conducted by IDFG's fisheries research personnel since 2005 as part of a statewide project. That project was discontinued by 2010, though we plan to continue 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 index the density of larval fish at Brownlee and CJ Strike reservoirs. Trawls were made with a 1 m x 2 m x 4 m long Neuston net at ten to 11 sites spread throughout each of the reservoirs (Figures 28-29). Trawls were begun at dusk and all sites were completed within three or four hours. Mesh size was 1.3 mm. The net was fit with a flow meter to estimate the volume of water sampled. Trawl duration was 5 minutes and an average volume sampled was 432 and 391 m^3/tow at Brownlee and CJ Strike reservoirs, respectively. Trawls were made on an approximately bi-weekly basis beginning June 18 and ending August 1, 2012, which overlapped peaks of crappie production in previous years. Specimens were stored in 10% formalin and viewed under a dissecting microscope. Sampled fish tow were identified to species and measured for length, unless the total number of larval fish exceeded 50 individuals. For large samples, we randomly selected 50 individuals, identified and measured those, and counted the remainder.

RESULTS

Brownlee Reservoir

A total of 44 trawls were conducted on four sampling dates. Bluegill, channel catfish, crappie, and smallmouth bass were sampled. Crappie were by far the most abundant species sampled comprising 96% of the identified fish on June 18th, 94% on July 2th, 99% on July 18th, and 99% on August 1, 2012 (Figure 30). Average density of crappie was highest for June 18, our initial sampling date, and equaled 94 crappie/100 m^3. The highest density at an individual site (911 crappie/100 m^3) occurred at site 1 (upstream of Hibbard Creek) on June 18th. During 2012, high larval abundances occurred in the uppermost site (sites 1), as well as in the lower reservoir (site 11), but higher densities in the lower reservoir only occurred later in the season (July 18th). By the next sampling period, moderate densities were only found in the upper 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 83 crappie/100 m^3 (n = 8). Densities during 2012 (94 crappie/100 m^3) were near the average (2005-2012), and were nearly double the densities documented during 2011.

CJ Strike Reservoir

A total of 29 trawls were conducted on 3 sampling dates. No samples were collected from trend monitoring site 4 during mid-July due to excessive floating debris. Four species or groups of species were sampled including bluegill, channel catfish, crappie *Pomoxis* spp., and yellow perch. Crappie were the most abundant group sampled composing 89%, 80%, and 79% of the identified fish on June 19th, July 3, and July 16th, respectively (Figure 31). Mean density of crappie averaged among all sites was highest at our initial sampling date (3.6 crappie/100 m^3 on June 19th) and decreased subsequently to 1.8 and 0.5 crappie/100 m^3 on July 3 and 16th, respectively. The highest density at an individual site, 6.7 crappie/100 m^3, occurred at site 4 (west side of Bruneau Pool) on June 19th. From 2005 to 2012, 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 = 7). Densities during 2012 (3.6 crappie/100 m^3) were the second lowest recorded during this time period (lowest = 1 crappie/100 m^3 during 2011).

DISCUSSION

Production of larval crappie in large reservoirs in the Southwest Region shows high spatial and temporal variation and was asynchronous among reservoirs during 2012, similar to 2011. For instance, larval production in Brownlee Reservoir was near average since monitoring began eight years ago. During 2012, spawning events in the upper reservoir produced a vast majority of the larvae. This tendency was very similar to 2006 (a highly abundant year class that recruited very well) spatially, but with slightly lower densities. If spatial influences affect these year classes similarly, the 2012 year class has the potential to be relatively good year class. It is possible that larval crappie produced in the lower reservoir suffer high entrainment rates, though it is difficult to substantiate this claim. If this is true, recruitment may only be affected by upper reservoir reproduction. In stark contrast, larval production in CJ Strike Reservoir was at the lower end of the range for this system and the second lowest recorded since annual monitoring began during 2005. These observations are despite what were thought to be relatively good spawning conditions caused by high inflows from the Bruneau River.

MANAGEMENT RECOMMENDATIONS

1. Monitor age structure in the harvest for fisheries on Brownlee and CJ Strike reservoirs.

2. Attempt to capture younger age classes with otter trawls to document relative abundance of advanced age-0 and age-1 crappie.

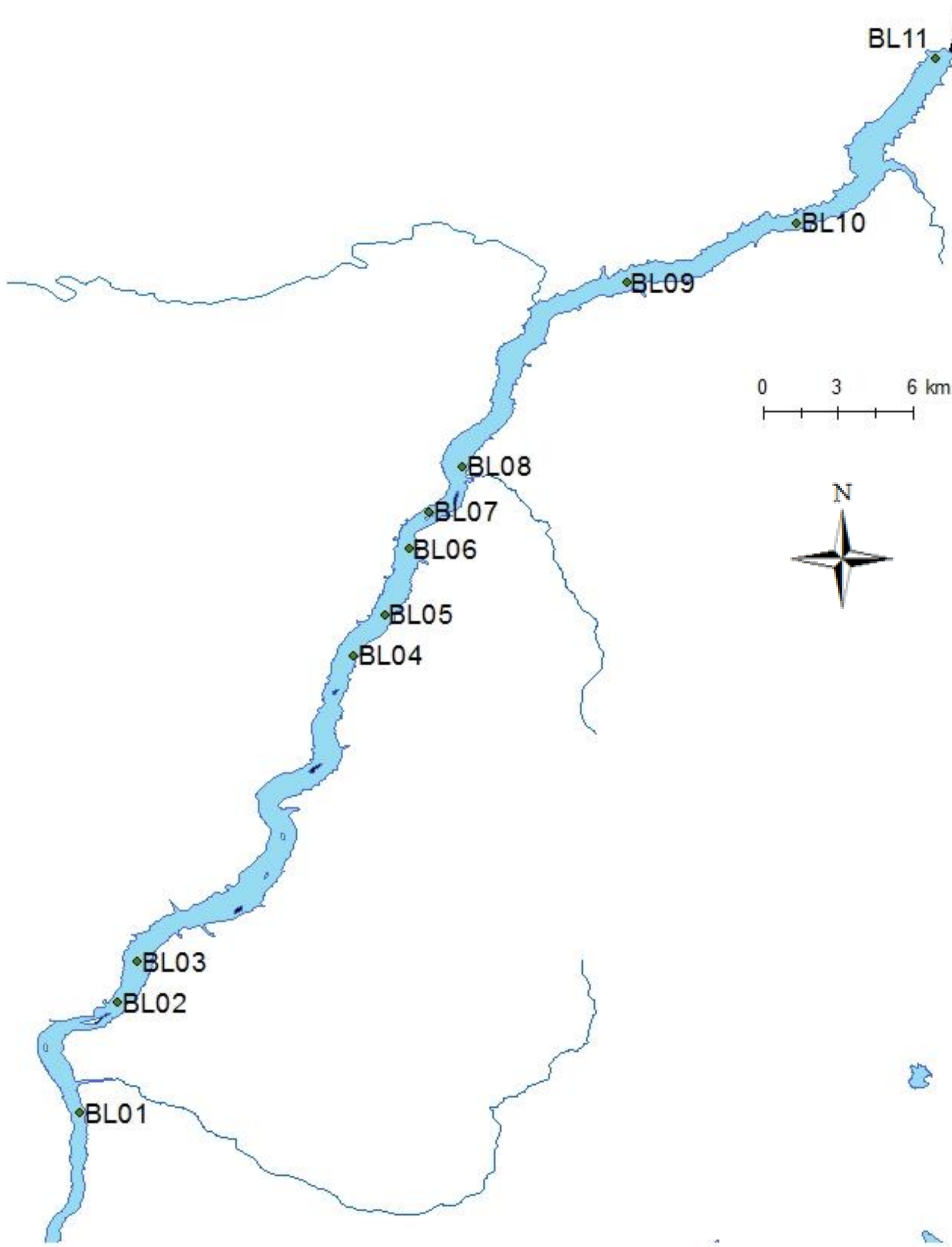

Figure 28. Location of eleven trawl sites used to index the abundance of larval fish in Brownlee Reservoir from 2005-2012.

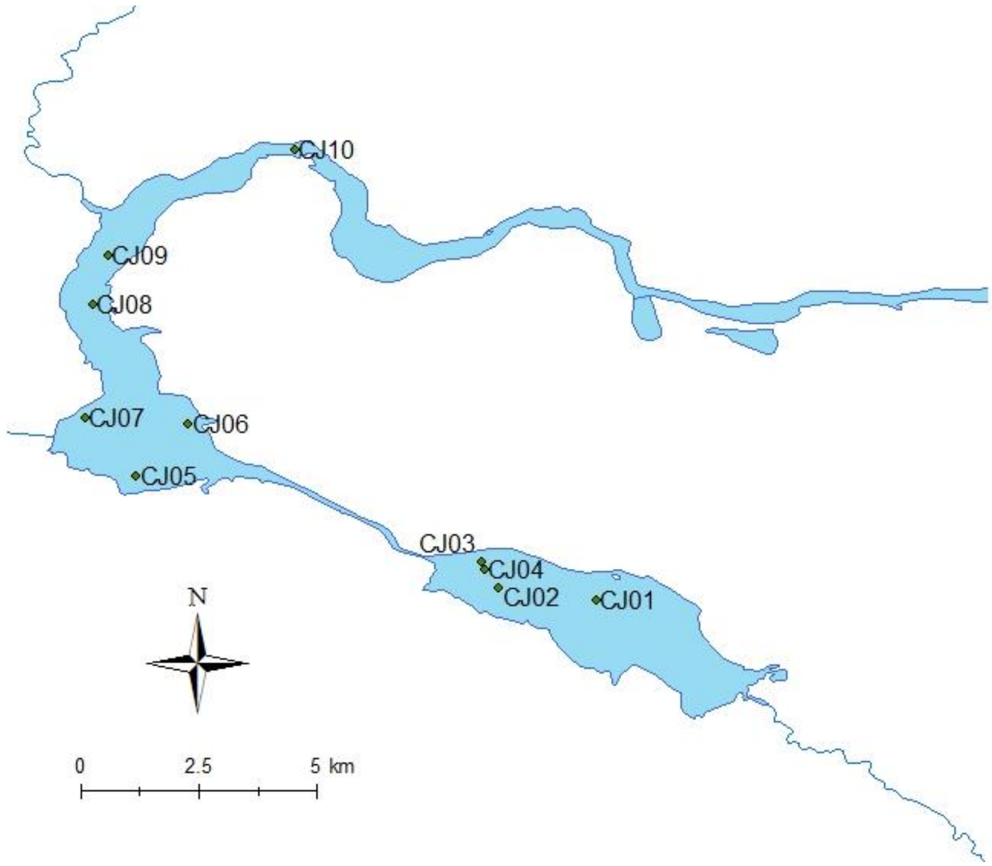

Figure 29. Location of ten trawl sites used to index the abundance of larval fish in CJ Strike Reservoir from 2005-2012.

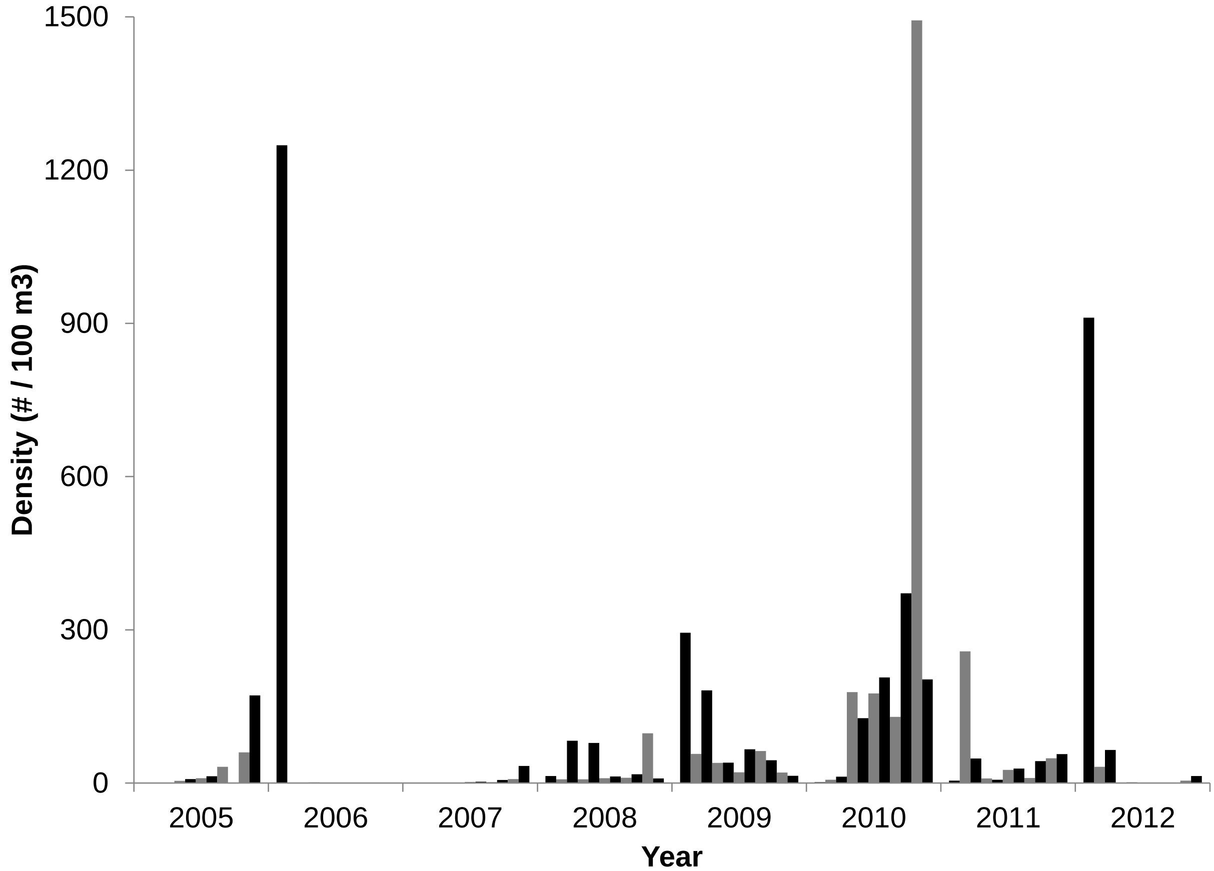

Figure 30. Densities of larval crappie (#/100 m^3) in Brownlee Reservoir during 2005 through 2012. Bars within each year represent eleven individual sites. Site 1 (upstream) through site 11 (near Brownlee Dam) are displayed from left to right within X-axis categories.

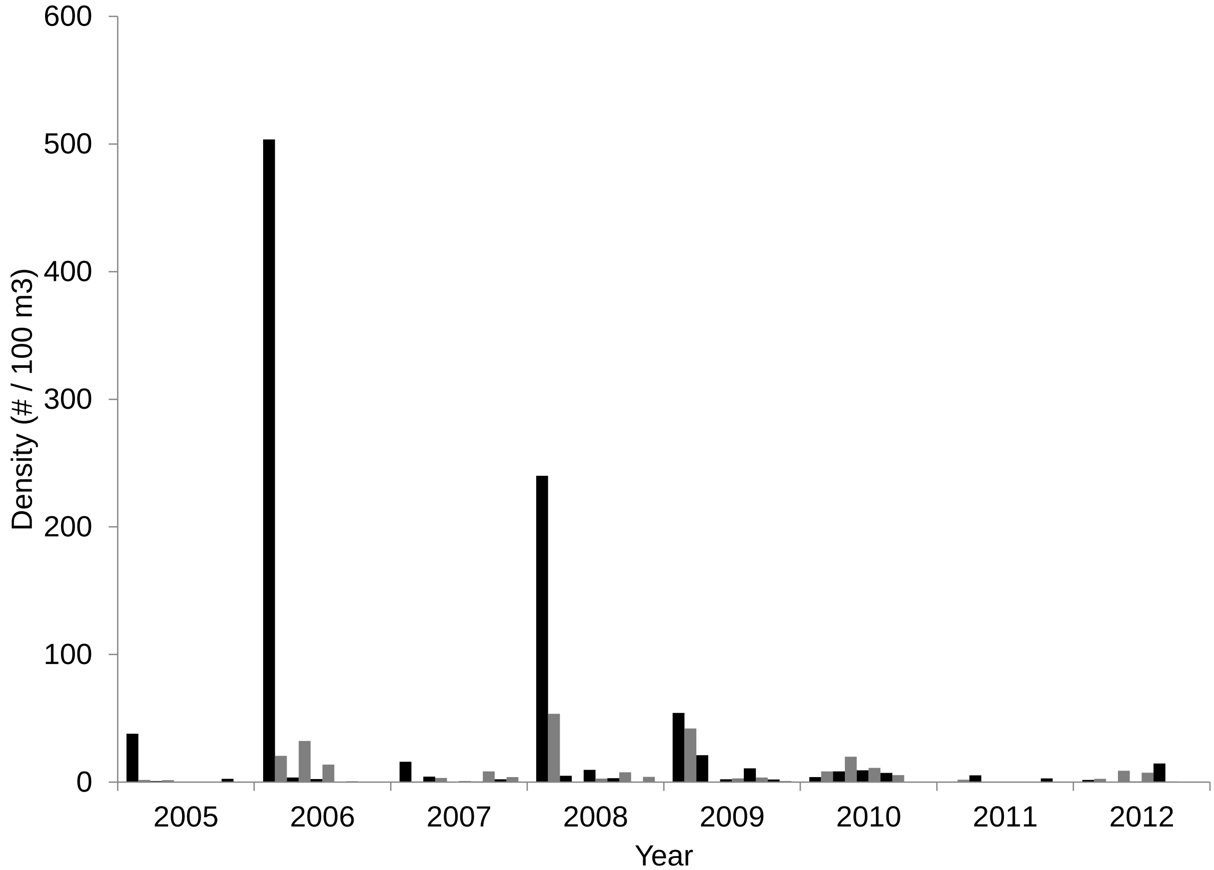

Figure 31. Densities of larval crappie (#/100 m^3) measured in CJ Strike Reservoir during 2005 through 2012. Bars within each year represent ten individual sites. Sites #1 through 10 are displayed from left to right within X-axis categories.

SAWYERS POND INVASIVE SPECIES INVESTIGATION AND LOWLAND LAKE SURVEY

ABSTRACT

During 2011, Idaho Department of Fish and Game (IDFG) employees received several reports of red-bellied pacu *Piaractus brachypomus*, an invasive species, being caught or observed in Sawyers Pond. To determine the validity of these reports, IDFG employees conducted a lowland lake survey during 2012. During the May 2012 survey, a total of 333 fish were sampled. Fortunately, no pacu were sampled. Nearly 75% of the catch by number was bluegill *Lepomis macrochirus* (*n* = 196) and pumpkinseed *L. gibbosus* (*n* = 44). Lesser numbers of crappie, both black and white, *Pomoxis spp.*, (*n* = 43), largemouth bass *Micropterus salmoides* (*n* = 20), and yellow perch *Perca flavescens* (*n* = 19), were also sampled. Few channel catfish *Ictalurus punctatus* (*n* = 7) or rainbow trout *Oncorhynchus mykiss* (*n* = 4) were sampled despite past stocking and translocation efforts. Total catch-per-unit-effort (CPUE) equaled 181 fish and total weight-per-unit-effort (WPUE) equaled 10 kg. All largemouth bass and bluegill sampled were retained and translocated to a newly developed pond in Boise (Kleiner) to establish new populations. Artificial structures were added to Sawyers Pond to increase cover for juvenile fish. Furthermore, cottonwood trees and willow stakes were planted along the north shoreline.

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INTRODUCTION

Sawyers Pond is located approximately 3.5 km southwest of Emmett, Idaho. Prior to 1999, this property was part of a privately-owned gravel extraction business. After gravel extraction was completed, the owners donated the land and ponds to Idaho Department Fish and Game (IDFG). The pond is a combination of two semi-rectangular basins partially separated by a long isthmus that is breeched on the south end. Combined surface area of these two basins is 14 ha. Because of its past use as a gravel pit, Sawyers Pond is a steep-sided, lacks substantial shoreline vegetation, and possesses minimal cover. Currently, IDFG manages this pond as a community fishing water with general bag and length limits.

During 2011, several anglers reported catching or observing red-bellied pacu *Piaractus brachypomus* in Sawyers Pond. Idaho Department of Agriculture categorizes this species as invasive. Early detection is an important first step in preventing establishment of an invasive species. Idaho winter temperatures are thought to be too cold for this species' survival; however, if warmer micro-habitats are available within Sawyers Pond, population establishment might be possible. Fisheries personnel conducted a lowland lake survey to determine the status of pacu in Sawyers Pond and also to develop a better understanding of other portions of the fish community.

Sawyers Pond is a popular two-story fishery. Efforts to improve fishing include regularly stocking hatchery rainbow trout *Oncorhynchus mykiss* from September to May, and channel catfish *Ictalurus punctatus* in the warmer months. In the early 1990's, IDFG stocked several popular warm water species that have established self-sustaining populations. Additionally, hatchery rainbow trout are stocked monthly for approximately 7 months per year. For example, a total of 7,236 and 7,802 catchable sized rainbow trout (≥ 152 mm) were stocked during 2011 and 2012, respectively. Also, channel catfish are translocated from the Snake River to improve summer fishing opportunities. During 2011 and 2012, 195 and 100 channel catfish were transferred to Sawyers Pond, respectively (Table 4).

Because of its previous use as a gravel pit Sawyers Pond has steep banks, lacks shoreline vegetation, and possesses minimal in-pond cover. Habitat improvement project were initiated during 2012. Despite relatively simple cover, Sawyers Pond possesses robust largemouth bass and bluegill populations allowing us to use it as a founding source for warm water fishes. In conjunction with sampling efforts, bass and bluegill were translocated to a newly created community fishing water (Kleiner) in Boise.

METHODS

Fish populations in Sawyers Pond were assessed with standard IDFG lowland lake sampling gear during May 15-16, 2012. Sampling gear included: (1) paired gill nets, (2) trap nets, and (3) night electrofishing. Paired gill net sets included floating and sinking monofilament nets, 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. Trap nets possessed 15-m leads, 1-m x 2-m frames, crowfoot throats on the first and third of five loops, 19-mm bar mesh, and had been treated with black tar. One trap net fished for one night equaled one unit of trap net effort. For boat electrofishing effort, 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 5 - 6 amps. One hour of active on-time electrofishing equaled one unit of effort. In total, six trap net units, two gill net pair units, and one electrofishing unit were utilized during 2012.

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. In the event that weight was not collected, length-weight relationships were built from fish weighed and measured in 2012 which allowed us to estimate weights. 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 that 80 indicate suboptimal body condition and suggest less than ideal foraging conditions. Standard weight values for estimation of W_r were obtained for lentic rainbow trout (Simpkins and Hubert 1996). 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). These indices were calculated by standardizing the catch of each gear type to one unit of effort and then summing across the three gear types. Only recreationally important fishes were surveyed, non-game fish such as the common carp *Cyprinus carpio* were not collected or counted. All largemouth bass *Micropterus salmoides* and bluegill *Lepomis macrochirus* sampled were trans located. Two separate Boy Scouts of America projects were initiated during 2012 each was designed to improve aquatic or riparian habitats at Sawyers Pond.

RESULTS

A total of 333 fish were caught utilizing three gear types (Table 20). Of the 333 fish caught bluegill and pumpkinseed *L. gibbosus* were the most abundant species comprising 59% (*n* = 196) and 13% (*n* = 44) of the catch, respectively. Crappie, both black and white, *Pomoxis spp.*, largemouth bass, and yellow perch represented the next most common species in Sawyers Pond at 13% (*n* = 43), 6% (*n* = 20), and 6% (*n* = 19), respectively. The least common fish species present were channel catfish 2% (*n* = 7) and hatchery rainbow trout 1% (*n* = 4). Electrofishing was the most effective gear type with a total CPUE of 155 fish/hr caught. Trap nets were the second most effective gear type yielding a CPUE of 26 fish per net night followed by paired gill net sets at 13 fish per net night (Table 20). The WPUE was highest for gill netting, followed by electrofishing (Table 21).

Bluegill and pumpkinseed were the most abundant fish present in Sawyers Pond equaling 72% of the population surveyed by number (Table 22). Catch rate was the highest with electrofishing gear for both species at 98 and 35 CPUE, respectively (Table 20). Bluegill ranged from 40-190 mm (Figure 32) while pumpkinseed ranged from 60-190 mm (Figure 33). Relative weights (W_r) of both species indicate that these populations are in above average body condition. The W_r for bluegill and pumpkinseed was 114 and 132, respectively (Table 24).

Largemouth bass represented 6% of the total catch (Table 20). Electrofishing was the most effective gear type for bass with a CPUE of 16 fish/hr (Table 20). Largemouth bass display an above average relative weight (Wr) of 110 (Table 24). Largemouth bass were a large portion of the fish community based on WPUE. They represented the second most biomass by species (22% of the fish community; Table 22). The average length of a largemouth bass sampled was 199 mm (Figure 35).

Rainbow trout were the least commonly sampled species with only four encounters despite stocking 15,038 in 2011-2012. This suggests a high rate of angler use, low susceptibility to our gear types, or high mortality. Electrofishing was the most successful gear type for rainbow trout accounting for 75% of the catch by number (Table 20).

Channel catfish also represented a low total catch percentage, despite translocations. Again, this indicates a large amount of fishing pressure, low susceptibility to our gear types, or high mortality. Gill nets yielded a CPUE of 4 fish per net night (Table 20). Although the catch by number was low for catfish, the WPUE was high at 3 kg (Table 21). Catfish had a high relative weight (W_r) of 141 (Table 5), indicating good condition and adequate food resources. Catfish had the highest percent biomass of gamefish at 36% due to their high average weight (Table 22).

Translocations and habitat improvements were part of fisheries management activities for Sawyers Pond during 2012. In total, 20 largemouth bass and 196 bluegill were translocated from Sawyers Pond to Kleiner Pond in Meridian, Id. Subsequent visual observations at Kleiner Pond indicated that both species spawned successfully. Furthermore, a Boy Scout created 36 artificial structures (i.e. spider blocks). We sunk these structures at six locations in clusters to provide additional cover and rearing habitat for juvenile fish. Lastly, another Boy Scout organized a work party that planted 15 1-gallon cottonwood trees and 50 willow stakes along a 100 m segment of the north shore of the east basin.

DISCUSSION

Sawyers Pond possesses a diverse, healthy fish community. Fortunately, no pacu were sampled. Largemouth bass and *Lepomis spp.,* the primary sportfish sampled, are abundant, include some large individuals, and are in above average condition. For example, several largemouth bass over 400 mm were sampled with the largest reaching 491 mm and 1,816 g. Additionally, all other species sampled possessed a high average relative weight indicating ample forage.

Despite healthy sportfish populations, Sawyers Pond has opportunities for improvement that will require additional efforts. For one, common carp were plentiful. Secondly, Eurasian watermilfoil *Myriophyllum spicatum* is present especially in the eastern basin near boat docks and the ramp. This invasive plant will require herbicide application on a 2- or 3- year rotation or addition of grass carp. Lastly and probably most importantly, Sawyers Pond has relatively poor fish habitat that will require additional riparian planting efforts and further deployment of artificial structures.

Table 20. Total catch and catch per unit effort (CPUE) of fishes caught by gear type and species in Sawyers Pond during the 2012 lowland lake survey.

Species	Electrofish catch	Electrofish CPUE (fish/hr)	Gill net catch	Gill net CPUE (fish/net-night)	Trap net catch	Trap net CPUE (fish/net-night)	Total catch	Total CPUE
Black Crappie	1	1	0	0	40	7	41	7
Bluegill	98	98	4	2	94	16	196	116
Channel Catfish	0	0	7	4	0	0	7	4
Largemouth Bass	16	16	3	2	1	0	20	18
Pumpkinseed	35	35	0	0	9	2	44	37
Rainbow Trout (Hatchery)	3	3	1	1	0	0	4	4
White Crappie	0	0	2	1	0	0	2	1
Yellow Perch	2	2	8	4	9	2	19	8

Table 21. Weight Per Unit Effort (WPUE) of Sawyers Pond during the 2012 lowland lake survey. Gear type catch weight per species followed by gear type WPUE per species.

Species	Electrofish weight	Electrofish WPUE	Gill net weight	Gill net WPUE	Trap net weight	Trap net WPUE	Total weight	Total WPUE
Black Crappie	0	0	0	0	3	1	3	1
Bluegill	2	2	0	0	3	0	4	2
Channel Catfish	0	0	11	3	0	0	11	3
Largemouth Bass	2	2	2	1	2	0	6	3
Pumpkinseed	1	1	0	0	0	0	1	1
Rainbow Trout (Hatchery)	1	1	0	0	0	0	1	1
White Crappie	0	0	0	0	0	0	0	0
Yellow Perch	0	0	0	0	0	0	1	0

Table 22. Species breakdown of catch, number of each species caught, species percent of catch and game fish biomass*.

Species	Number of fish	Total fish counted	Percent of catch	Biomass per species in kg	Total biomass in kg	Percent of biomass
Black Crappie	41	333	12	3	27	13
Bluegill	196	333	59	4	27	16
Channel Catfish	7	333	2	11	27	39
Largemouth Bass	20	333	6	6	27	22
Pumpkinseed	44	333	13	1	27	4
Rainbow Trout (Hatchery)	4	333	1	1	27	4
White Crappie	2	333	1	0	27	0
Yellow Perch	19	333	6	1	27	2

*- Carp were not counted or collected thus skewing the biomass per species in Sawyers Pond. Percent of biomass would decrease if carp were included.

Table 23. Recent Stocking history from 2005 to 2012 in Sawyers Pond with total fish stocked per year and total fishes stocked by species.

Species	2012	2011	2010	2009	2008	2007	2006	2005	Grand Total
Black crappie									90
Bluegill									930
Brown trout									3,440
Channel catfish	100	195	54	214	967	792	788		4,319
Domestic kamloops									51,360
Eagle lake rainbow									3,500
Erwin rainbow									3,120
Fall chinook	1,908								1,908
Hayspur kamloops triploid									4,350
Hayspur rainbow									13,772
Hayspur rainbow triploid	4,292		1,418	641					6,351
Lahontan Cutthroat									12
Largemouth bass									7
Mt Lassen rainbow									5,647
Rainbow x Cutthroat									1,035
Triploid troutlodge kamloop	3,416	7,236	7,836	7,762	7,984	7,467	10,433	9,423	96,369
Troutlodge									11,114
Unspecified Rainbow	94							1,318	9,233
White crappie									500
Grand Total	9,710	7,431	9,308	8,617	8,951	8,259	11,221	10,741	217,057

Table 24. Relative weight (W_r) of species in Sawyers Pond where 100 represents optimal body condition, greater than 100 indicates robust body condition and less than 80 indicates suboptimal.

Species	Count of fish	Average of (Wr)
Black Crappie	41	99
Bluegill	196	114
Channel Catfish	7	141
Largemouth Bass	20	110
Pumpkinseed	44	132
Rainbow Trout (Hatchery)	4	NA
White Crappie	2	115
Yellow Perch	19	86
Grand Total	333	113

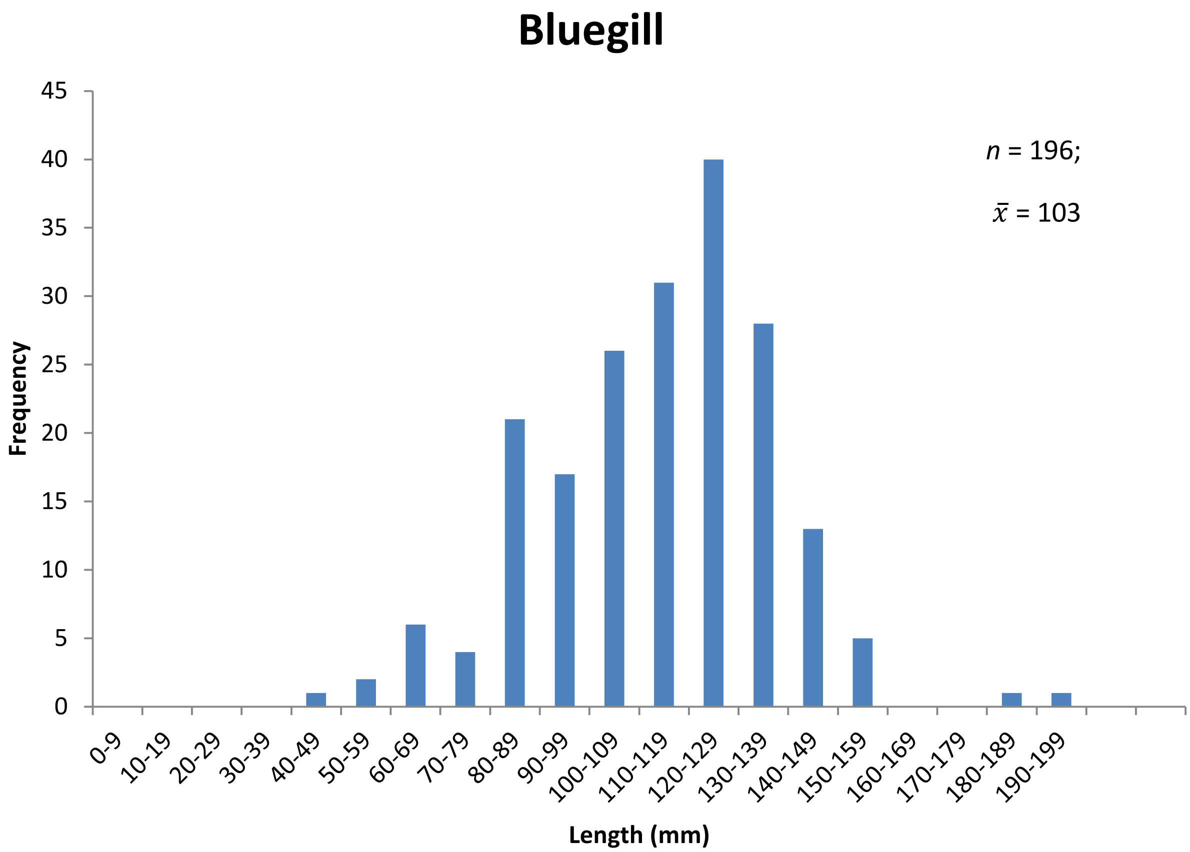

Figure 32. Bluegill length frequency histogram for Sawyers Pond. Bluegill were the most abundant species encountered during the 2012 survey.

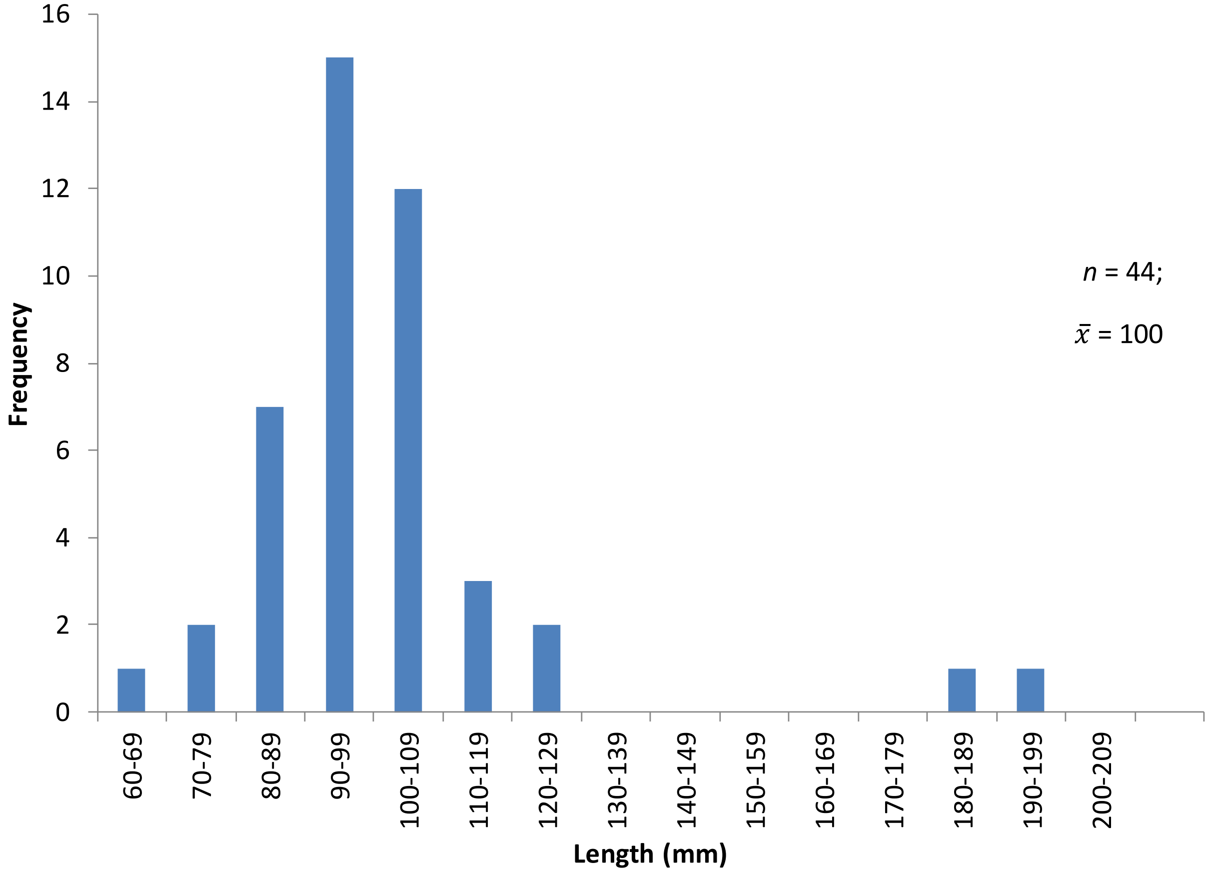

Figure 33. Pumpkinseed length frequency histogram for Sawyers Pond. Pumpkinseed were the second most abundant fish surveyed.

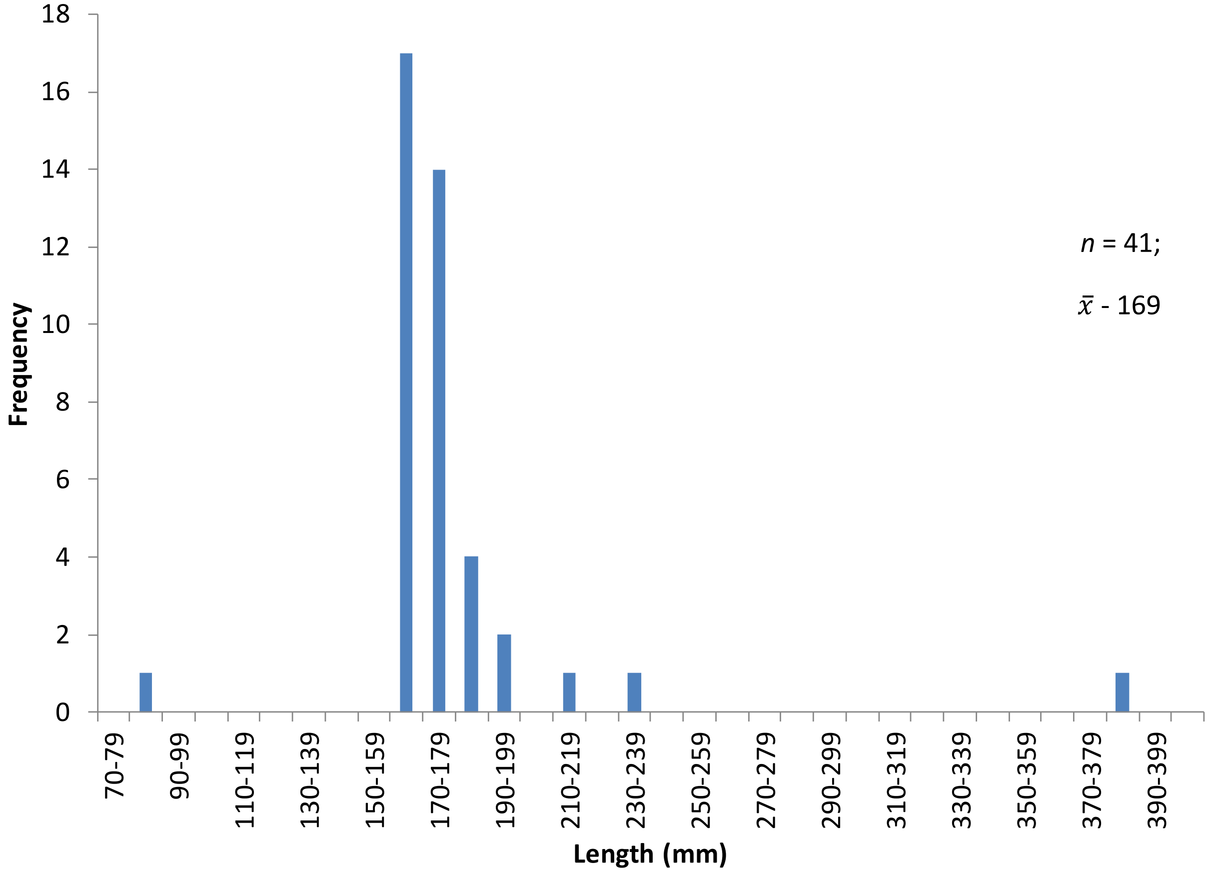

Figure 34. Black crappie length frequency for Sawyers Pond. Black crappie were the third most abundant fish surveyed.

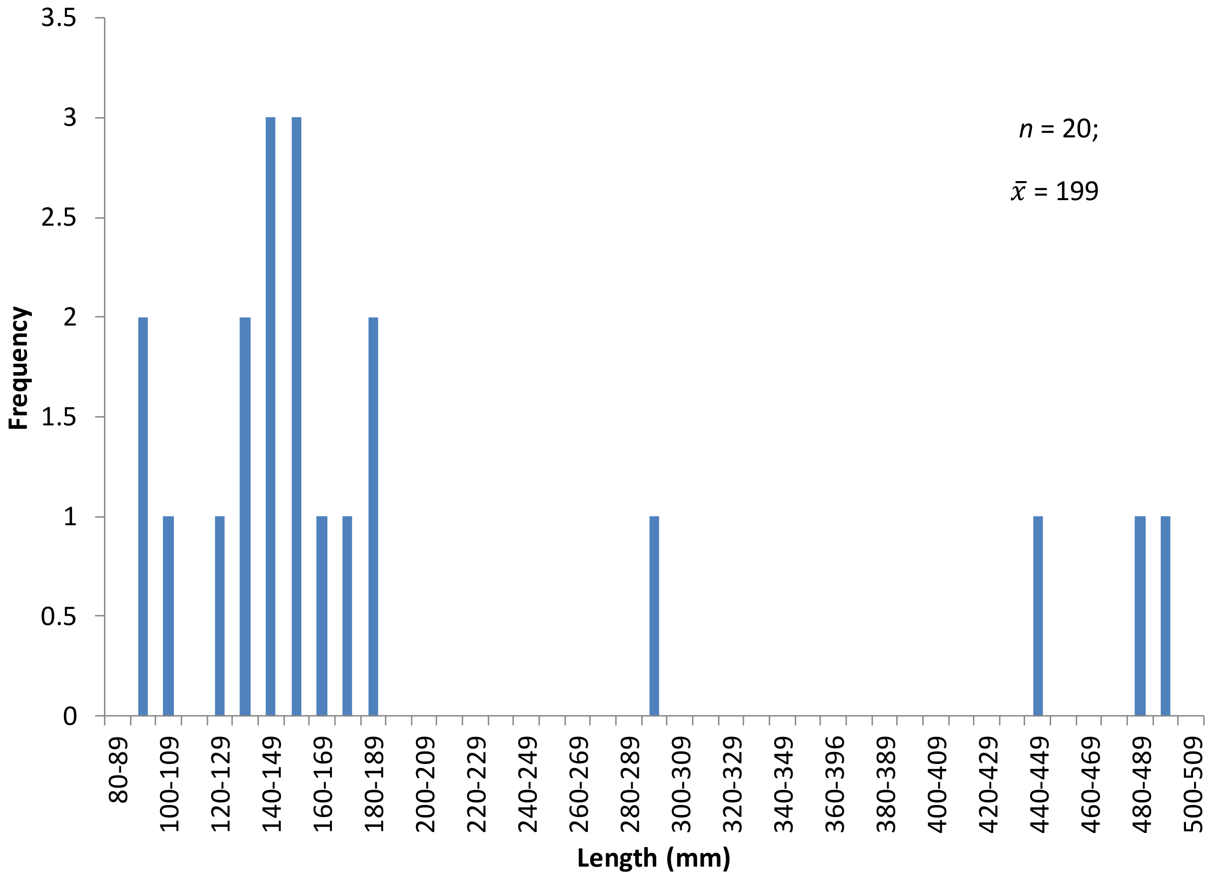

Figure 35. Largemouth bass length frequency histogram for Sawyers Pond. Largemouth bass were the fourth most abundant fish sampled during the 2012 survey.

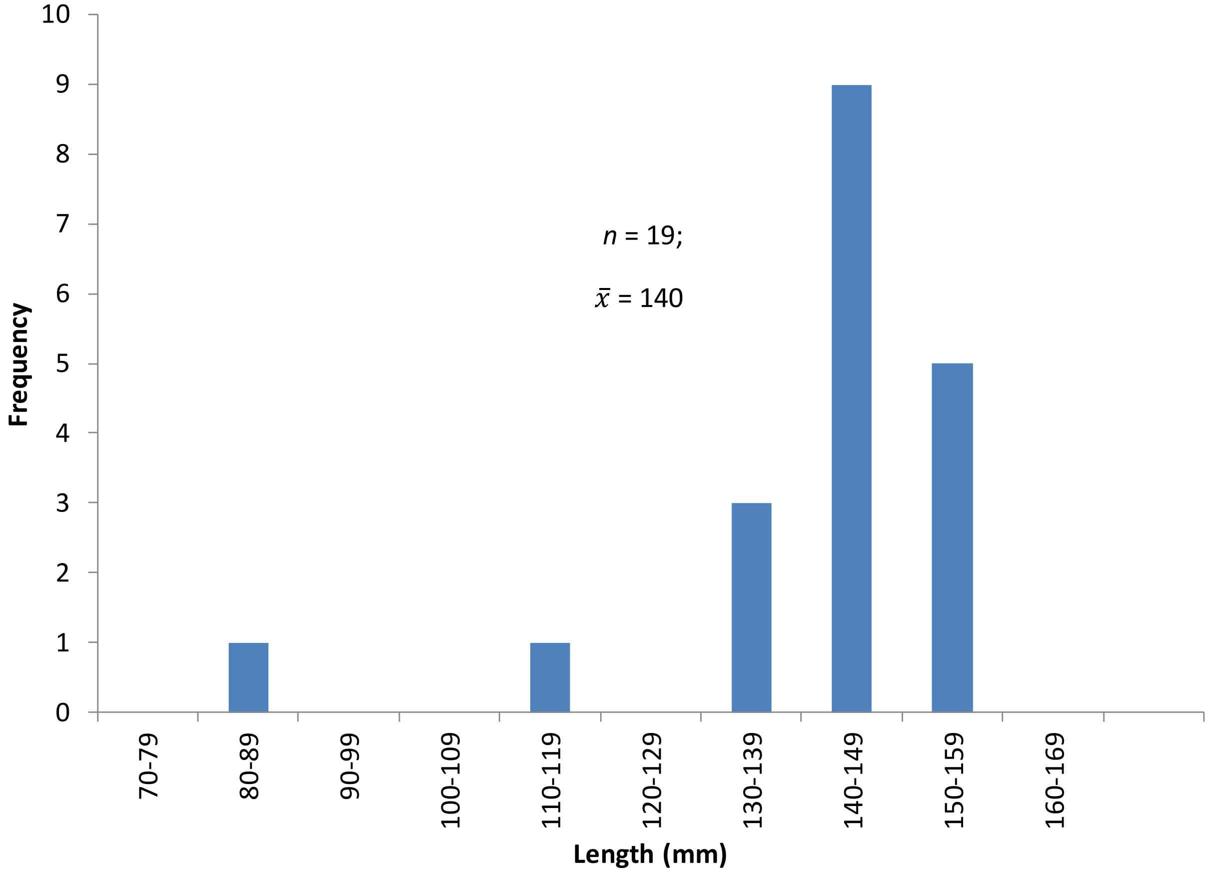

Figure 36. Yellow perch length frequency histogram for Sawyers Pond. Yellow perch were the fifth most abundant fish surveyed.

WARMWATER FISH TRANSFERS

ABSTRACT

Southwest Region personnel transferred several species of fish to 17 waters during 2012 to create new populations, reestablish populations in drought stricken waters, bolster catch rates in existing fisheries, and to control nuisance aquatic plants. These efforts led to the transfer of 2,809 fish including: 892 bluegill *Lepomis macrochirus*, 1,375 channel catfish *Ictalurus punctatus,* 4 crappie *Pomoxis spp*., 175 grass carp *Ptenopharyngodon idella*, 301 largemouth bass *Micropterus salmoides*, 15 smallmouth bass *Micropterus dolomieu*, and 47 yellow perch *Perca flavescens*. Success or failure of these efforts will be determined by future monitoring efforts.

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INTRODUCTION

Regional fisheries personnel transferred bluegill *Lepomis macrochirus*, channel catfish *Ictalurus punctatus*, largemouth bass *Micropterus salmoides*, smallmouth bass *Micropterus dolomieu,* and yellow perch *Perca flavescens* to ponds and reservoirs in southwest Idaho to establish self-sustaining populations or provide fishing opportunity. Due to a series of low water years, Indian Creek Reservoir was nearly dewatered by late summer 2010. Previously, a popular recreational fishery for bluegill and largemouth bass existed. During winter 2010-2011, higher snowpack and a wetter than normal spring acted to fill this reservoirs to the highest level since spring 2006. Water levels were sufficient during 2012 to warrant additional efforts. We sought to restock this water with bluegill and largemouth bass to rebuild fishable populations, as these populations had declined. Also, one new community park pond in Meridian, Idaho (Kleiner) was stocked with bluegill and largemouth bass to establish self-sustaining populations. Additionally, we sought to establish a self-sustaining population of channel catfish in Black Canyon Reservoir by transferring pre-spawn adults from the Snake River. Currently, Black Canyon Reservoir provides only marginal fisheries due to relatively poor water quality, sediment load, and an abundance of small panfish and non-game fish. We hope that transferred pre-spawn adults will recruit successfully, create a self-sustaining population, and provide additional fishing opportunity. We continued transferring adult-sized channel catfish to community fishing ponds to provide put and take fishing opportunities. Lastly, we purchased grass carp for aquatic vegetation control.

OBJECTIVES

1. To re-establish or bolster warmwater fisheries in Indian Creek and Blacks Creek reservoirs as well as Kleiner Pond by capturing and transferring ictalurids and centrarchids.

2. To continue to provide channel catfish fishing opportunities in community fishing ponds.

3. To control aquatic plants by purchasing and transferring grass carp

METHODS

We utilized boat electrofishing equipment to capture warm water fish for transfer to local waters. Source waters included private ponds, commercial gravel ponds, as well as public waters (Crane Falls Reservoir, Bruneau Dunes Pond, Snake River, and Soulen Reservoir). At these locations, we collected fish with day and night electrofishing efforts from May 19 to August 17, 2012 using a Smith Root electrofishing boat or a jet-powered electrofishing boat equipped with a Coffelt 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, fish were supplied with supplemental oxygen at the rate of 2 l/minute. Most transfers occurred on the same day as capture; however, some occurred the following morning.

RESULTS AND DISCUSSION

During 2012, we captured and transferred a total of 2,809 fish including: 892 bluegill, 1,375 channel catfish, 4 crappie, 175 grass carp, 301 largemouth bass, 15 smallmouth bass, and 47 yellow perch (Table 25). Anecdotal information and structured lowland lake surveys will be used to determine whether these efforts were successful or whether additional efforts are needed. Also, we will continue transferring channel catfish to community fishing waters as these fisheries have become popular and are cost effective. Distribution and allocation of fish will be modified based on tag returns, pond size, and fishing pressure.

MANAGEMENT RECOMMENDATIONS

1. Continue transfers of channel catfish to community fishing waters. Assess and modify stocking levels based on pond size and fishing pressure.

2. Determine whether bluegill and largemouth bass transfers were successful. If not, transfer additional fish.

3. Monitor drought-stricken waters to determine if these waters and populations may be used as sources for pond stockings.

Table 25. Number of bluegill, channel catfish, and largemouth bass captured and transferred to local waters during 2012 to create self-sustaining populations or provide fishing opportunity.

Date	Collecting water	Receiving water	Species	Number	Average weight (lbs)
06/06/12	Snake River near Parma	Black Canyon Reservoir	Channel Catfish	180	4
06/28/12	Snake River near Parma	Black Canyon Reservoir	Channel Catfish	125	4
08/16/12	Snake River near Parma	Black Canyon Reservoir	Channel Catfish	240	4
08/17/12	Snake River near Parma	Black Canyon Reservoir	Channel Catfish	200	4
06/26/12	Crane Falls Reservoir	Blacks Creek Reservoir	Bluegill	352	0.25
06/26/12	Crane Falls Reservoir	Blacks Creek Reservoir	Largemouth bass	138	0.75
06/26/12	Crane Falls Reservoir	Blacks Creek Reservoir	Yellow Perch	47	0.25
06/05/12	Snake River near Parma	Caldwell Pond #1	Channel Catfish	50	4
06/28/12	Snake River near Parma	Caldwell Pond #1	Channel Catfish	50	4
06/05/12	Snake River near Parma	Caldwell Pond #2	Channel Catfish	60	4
06/28/12	Snake River near Parma	Caldwell Pond #2	Channel Catfish	50	4
06/14/12	Opaline	Duff Lane Pond	Grass Carp	125	1
06/05/12	Snake River near Parma	Eds Pond	Channel Catfish	20	4
06/28/12	Snake River near Parma	Eds Pond	Channel Catfish	20	4
06/05/12	Snake River near Parma	Horseshoe Bend Pond	Channel Catfish	40	4
06/28/12	Snake River near Parma	Horseshoe Bend Pond	Channel Catfish	40	4
05/19/12	Bruneau Dunes	Indian Creek Reservoir	Bluegill	250	0.25
05/22/12	Crane Falls Reservoir	Kleiner Pond	Bluegill	290	0.25
05/22/12	Crane Falls Reservoir	Kleiner Pond	Largemouth bass	148	0.75
06/14/12	Opaline	Lowman Ponds	Grass Carp	50	1
06/05/12	Snake River near Parma	McDevitt Pond	Channel Catfish	50	4
06/06/12	Snake River near Parma	Parkcenter Pond	Channel Catfish	60	4
06/06/12	Snake River near Parma	Quinns Pond	Channel Catfish	35	4
06/06/12	Snake River near Parma	Riverside Pond	Channel Catfish	30	4
06/05/12	Snake River near Parma	Sawyers Pond	Channel Catfish	50	4
06/28/12	Snake River near Parma	Sawyers Pond	Channel Catfish	50	4
06/05/12	Snake River near Parma	Settlers Pond	Channel Catfish	25	4
06/12/12	Soulen Reservoir	Weiser Community Pond	Largemouth bass	15	2
06/13/12	Soulen Reservoir	Weiser Community Pond	Smallmouth bass	15	2
06/14/12	Soulen Reservoir	Weiser Community Pond	Crappie	4	0.8

HIGH MOUNTAIN LAKES SURVEYS

ABSTRACT

Idaho Department of Fish and Game (IDFG) personnel surveyed 78 alpine lakes during July and August 2012 in the Southwest Region. Surveys were located across five watersheds (HUC 6) and included Baron Creek, Benedict Creek, Goat Creek in the S. F. Payette River, Johnson Creek (N. F. Boise River) and the Queens River (M. F. Boise River). Most of the lakes in this area had either not been surveyed by IDFG, or had not surveyed since 1996. Of the sites surveyed, only 68 sites contained water while 10 were found to be dry. Fish were found in only 20 lakes (29%), with 17 of these having been stocked within the last 20 years. Westslope cutthroat trout *Oncorhynchus clarkii lewisi* were the most common and widespread fish species found, but rainbow trout *O. mykiss*, golden trout *O. mykiss aguabonita*, brook trout *Salvelinus fontinalis* and grayling *Thymallus arcticus* were also present in some lakes. The Baron Creek drainage contained the highest diversity of fish, with four different species of salmonids present.

Amphibians were found in 25 lakes (37%), but were only found in 4 lakes in sympatry with fish. No fish were found in 48 lakes (71%), of which 24 had a maximum depth of at least 2 m. Of these fishless lakes with a maximum depth of at least 2 m, amphibians were documented in only 14 (71%). Amphibian species observed included Columbia spotted frog *Rana pretiosa*, long-toed salamander *Ambystoma macrodactylum*, Western toad *Bufo boreas* and tailed frog *Ascaphus montane.* No fish or amphibians were encountered in 27 sites, most of which were unnamed lakes less than 0.5 ha in area.

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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. Assess factors affecting the distribution, relative abundance, and species composition of fish and amphibian populations in high mountain lakes including stocking strategies, habitat characteristics, and human use.

3. Adjust stocking where appropriate to more efficiently use hatchery resources and to conserve native fish and amphibian fauna.

METHODS

We conducted surveys on 78 mountain lakes in the Southwest Region between July 24 and August 8, 2012. The lakes were located across five headwaters (HUC 6) including, Baron Creek, Benedict Creek, Goat Creek, Johnson Creek and the Queens River (Figures 37 and 38). Some lake in these drainages had never been surveyed by IDFG, while some had not been surveyed since 1993. At each lake, we assessed fish and amphibian presence/absence, human use, and habitat characteristics. Some lakes that were capable of supporting fish or had previous stocking history were sampled with Swedish type floating experimental gill nets. Nets measured 46 m long by 1.5 m deep, with 19, 25, 30, 33, 38, and 48 mm bar mesh panels. One unit of sampling effort was defined as one gill net fished overnight (one net-night). When gill nets were not used, fish were collected with hook and line gear to obtain species, length, and weight information. All fish captured were identified to species, measured for total length (mm), and weighed (g). Fulton's condition factor was calculated for each captured fish according to the formula (Anderson and Neumann 1996):

$$K = (100{,}000 \times W)/L^3$$

where *W* is weight (g) and *L* is length (mm). For instances when time constraints prevented fish sampling, lakes were visually surveyed during amphibian surveys for the presence of fish.

Habitat surveys consisted of collecting limnological and morphological data in individual lake basins. 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 spawning habitat availability in each lake and the inlets and outlets was determined based on substrate quality, flow, and gradient.

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, sub-adult, or larvae. Shoreline habitat 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

Of the 78 lakes surveyed, 68 contained water, while 10 were dry. Overall, fish were documented in only 20 lakes, indicating that 71% of those containing water are fishless, but that this varied by drainage (Table 26).

Of the 20 lakes where fish were documented, 17 had been stocked within the last 20 years, while only 12 had been stocked in the last 10 years. This indicates stocking has already been discontinued in 5 lakes (Table 27). Westslope cutthroat trout *Oncorhynchus clarkii lewisi* were the most common and widespread fish species found, but rainbow trout *Oncorhynchus mykiss*, golden trout *Oncorhynchus mykiss aguabonita*, brook trout *Salvelinus fontinalis* and grayling *Thymallus arcticus* were also present in some lakes. The Baron Creek drainage contained the highest diversity of fish, with four different species of salmonids present (Table 28).

Amphibians were observed in 25 (37%) of the lakes that contained water, and most often occurred in fishless habitats. Of the 25 lakes with amphibians, 21 (84%) were fishless and four (16%) contained fish, all in the Baron Creek drainage (Table 26). Amphibian species observed included Columbia spotted frog *Rana pretiosa*, long-toed salamander *Ambystoma* macrodactylum, Western toad *Bufo boreas* and tailed frog *Ascaphus montane* (Table 29)*.* We observed neither fish nor amphibians in 24 lakes (35%), mostly in the Queens River drainage (Table 26).

Survey results from individual and groups of lakes, organized by drainage (HUC 6), are summarized below.

<u>Baron Creek – S. F. Payette River</u>

We surveyed 19 lakes in the Baron Creek, SF Payette (HUC 6) watershed during July 24 – July 26, 2012. Only one of these lakes was found to be dry. Of the 18 remaining lakes surveyed with water, fish were present in only five (Table 26). Four species of salmonids were found in this basin, including brook trout, westslope cutthroat trout, golden trout, and arctic grayling (Table 27). Baron Lake (aka Baron Lake #4 in stocking records) has a robust, naturally reproducing brook trout population. Despite a consistent history of stocking westslope cutthroat trout, and more recently triploid rainbow trout (Table 27), surveys did not find any evidence of these species. Further stocking should be discontinued until the existing brook trout population is removed or extirpated naturally (by winter kill).

Baron Lake #6 contains a remnant population of arctic grayling despite not having been stocked since 1973. Golden trout were also found here, and the current stocking strategy appears to be working. No trout reproduction is apparent, and spawning habitat is unavailable. This lake could benefit from occasional arctic grayling stocking and this species should be added to the stocking request list.

Braxon Lake contains a low density of large westslope cutthroat trout (Table 27) as well as Columbia spotted frogs (Table 29). Little trout reproduction (if any) is likely, but fingerling trout were present – possibly from 2010 rainbow trout stocking, or some natural recruitment. Stocking was changed from westslope cutthroat trout to triploid rainbow trout in 2010. As of these surveys, no rainbow trout were documented. However, rainbow trout may have been too small to be sampled with hook/line gear. No change in stocking strategy is warranted at this time. Lower Braxon Lake also contained westslope cutthroat trout (Table 27, Table 28), as well as Columbia spotted frogs (Table 29). Some natural reproduction of westslope cutthroat is likely, but at very low levels, given the low fish density. This lake was also switched to a triploid rainbow trout stocking rotation in 2010, but no rainbow trout were documented. Rainbow trout may have been too small to be sampled with hook/line gear. No change in stocking strategy is warranted at this time, but future surveys should be conducted to evaluate whether the change to triploid stocking was successful.

Little Baron Lake (aka Baron Lake #3) contains as naturally reproducing brook trout population, as well as Columbia spotted frogs. Little change in the fish population is evident from previous surveys conducted in 1993. This lake appears to support a good brook trout fishery, with an average size of 220 mm, with several sampled over 280 mm long.

Of the 18 lakes with water, amphibians were found in 15 of the lakes, with 4 lakes having Columbia spotted frog occurring in sympatry with fish (Baron Lake, Little Baron Lake, Upper Braxon Lake and Braxon Lake). Three fishless unnamed lakes with maximum depth greater than 3m also contained Columbia spotted frogs (Table 26, 29). Long-toed salamanders were only found in Baron Lake #1 and Upper Baron Lake, both relatively deep lakes where fish were not documented. Baron Lake #1 and Baron Lake #2 (above) had been stocked with westslope cutthroat trout, but not since 1969 and 1973, respectively. Both lakes were previously surveyed in 1993 and determined to be fishless based on hook/line and gill net sampling. Based on 2012 surveys documenting them in Baron Lake #1, long-toed salamanders likely occur in Baron Lake #2, a similar fishless deep lake (8 m) nearby. These two lakes offer an important opportunity to maintain fishless habitat for long-toed salamanders. Currently, this basin offers a diverse mixture of fishing opportunities as well as at least two large deep fishless lakes (and likely a third) for amphibians, with additional smaller, deep, fishless lakes as well.

Benedict Creek – S. F. Payette River

We surveyed four lakes located in the Benedict Creek drainage on August 7, 2012. Three small unnamed lakes were found dry, while westslope cutthroat trout were found in Everly Lake (Table 26). Everly Lake was historically stocked with westslope cutthroat trout on a 2-year rotation, but was switched to triploid rainbow trout in 2011. Westslope cutthroat trout were on averaged 322 mm in length (Table 28), which is similar to results from surveys in 1993. No rainbow trout were sampled, probably because they were too small to recruit to the hook and line sampling gear. Natural recruitment in this lake appears to be limited based on the size distribution and lack of fry or fingerlings. No changes to the stocking rotation are warranted at this time. No amphibians were found to be present, and recreational use appears very low.

Goat Creek – S. F. Payette River

We surveyed eight lakes located in the Goat Creek drainage on July 26, 2012 (Table 26). Westslope cutthroat trout were present in each lake and no amphibians were documented. Bead Lake #1 and Bead Lake #2 appear to support westslope cutthroat trout fisheries with excellent catch rates and average length of 254 – 333 mm (Table 28). The stocking rotation in both lakes was switched to triploid rainbow trout in 2010, but none were sampled during these surveys. It will likely take several years of stocking before the established westslope cutthroat trout populations in these lakes transitions over to rainbow trout.

The Feather Lakes (#1-4), Little Warbonnet, and Warbonnet lakes are a connected chain of lakes containing naturally reproducing westslope cutthroat trout. Stocking was discontinued in these lakes in 1995, and trout populations are apparently maintaining themselves at this time. Surveys indicated high catch rates of westslope cutthroat trout, with average sizes between 165 mm and 247 mm (Table 28). No camp sites or fire rings were found on any of the lakes in the chain, suggesting only minimal human use, probably because of the strenuous off-trail hikes required to reach the area. No amphibians were found during 2012 surveys in this portion of the Goat Creek drainage (Table 29).

Johnson Creek – N. F. Boise River

We surveyed six lakes in the Johnson Creek basin during August 7-8, 2012. Three of the lakes were large, deep lakes (Arrowhead, Azure, Pats lakes) and contained a mixture of rainbow trout, golden trout, and westslope cutthroat trout (Table 26).

Arrowhead Lake is stocked every two years and was converted to triploid rainbow trout beginning in 2010 (Table 27). Two rainbow trout were sampled (mean length 115 mm), indicating that the stocking was successful. Catch rates for westslope cutthroat were over 3 fish/h with an average size of 271 mm (Table 28), which is similar to data collected by IDFG in 1996.

Azure Lake contained both westslope cutthroat trout, and what appeared to be westslope cutthroat trout x golden trout hybrids. The westslope cutthroat trout (mean length 418 mm) appear to be remnants from stocking in 1996, before it was discontinued. Golden trout were more regularly stocked, but were discontinued after 2006. The current low density population of cutthroat trout x golden trout hybrids (mean length 267 mm) might suggest some limited reproduction, as was hypothesized similarly in 1996. Given the low fish densities and relative rarity of golden trout available for stocking, we recommend golden trout stocking be reinstated on a 3 year rotation.

Pats Lake contained westslope cutthroat trout with an average length of 237 mm. Catch rates were 10 fish/hr, suggesting a high density population. Although this lake is schedule to be stocked every 2 years, the stocking records show it was stocked in 2008 and 2009 with westslope cutthroat trout and with triploid rainbow trout in 2011, which might explain the higher densities. No rainbow trout were found, likely because they were too small to recruit to the angling gear at this time. Stocking could be changed from a two-year rotation to a three-year rotation to help increase average size. No campsites or fire rings were noted in any of the lakes, suggesting recreational use is rare in this area.

Amphibians were found in only 1 of the 6 lakes. Long-toed salamanders were present in a small, deep unnamed fishless lake (Table 29). This small lake was only a few hundred meters away from Azure Lake, where westslope cutthroat trout and golden trout are present. Similarly, long-toed salamanders were found in 1996 in a small pond immediately adjacent to Johnson Lake, in the southern portion of the Johnson Creek drainage (Allen et al., 1999). Many of the lakes were surveyed by IDFG in 1995 and 1996. Data from these past surveys and those in 2012 suggest these two small ponds are the only known locations where long-toed salamanders occur in this area. No amphibians have been found in any of the large, deep lakes of the Johnson Creek drainage, all of which contain westslope cutthroat trout (Allen et al., 1999). Columbia spotted frogs are the most common amphibian found, which mainly occur in the shallow (1-2 m) ponds surrounding Johnson Lake (Allen et al., 1999).

<u>Queens River – M. F. Boise River</u>

We surveyed 41 lakes in the Queens River (M. F. Boise River) drainage on August 7-8, 2012, six of which were dry (Table 26). Only 3 of the 35 lakes with water contained fish (8.5%), although they included two of the largest lakes surveyed (Table 26). These included Cliff Lake, Plummer Lake and Queens River Lake #33. Species include rainbow trout and westslope cutthroat trout. Human use was rare at all of these lakes, with only one camp site or fire ring reported for any lake surveyed.

Cliff Lake supports an excellent population of westslope cutthroat trout (mean length 290 mm) with high catch rates (3.7 fish/hr). Stocking was changed to triploid rainbow trout in 2010, but was discontinued completely in 2011 before any were stocked (Table 27). Surveys indicated spawning habitat is limited and no fry or fingerlings were present. Previous stocking appears to be working well, and natural reproduction is not evident in the size frequency distribution of fish present. We recommend that stocking be reinstated on a 3-year rotation at the original density of 500 triploid rainbow trout.

Plummer Lake contains a low density population of rainbow trout, stocked on a 3-year rotation (Table 27). Rainbow trout ranged from 200 – 270mm with an average length and condition of 233 mm and 1.6, respectively. Catch rates were near 1 fish/h, while fish condition was 1.6, reflecting a relatively low density (Table 28). No changes in stocking are needed at this time.

Queens River Lake #33 contains a naturally reproducing population of westslope cutthroat trout, with no stocking on record as of the last 30 years (Table 27). Fish ranged in total length from 190 – 260 mm, with an average of 229 mm. This is similar to data previously collected in 1998, but with slightly lower catch rates of 1.6 fish/h (Table 28).

No fish were present in Slide Lake, which was previously surveyed in 1996 and contained a low density population of rainbow trout. Stocking was discontinued in 1997, and fish have apparently been extirpated since. We recommend maintaining Slide Lake in its current fishless condition for amphibian habitat.

Of the lakes with water, amphibians were found in 10 lakes (28.5%), all of which were fishless (Table 26). However, no amphibians were found in several fishless unnamed lakes with water 3 – 10 m deep (Table 26). Columbia spotted frog was the most commonly observed species (9 lakes), but western toad and tailed frogs were also found (Table 29). Long-toed salamanders were present in 4 lakes. Two connected lakes, Queens River #34 and #35 are deep, fishless habitat, likely important for maintaining salamander populations. These lakes have not been historically stocked and should remain fishless.

MANAGEMENT RECOMMENDATIONS

1. Discontinue fish stocking in Baron Lake (aka Baron Lake #4). The existing reproducing brook trout population appears to be limiting the current stocking efforts.

2. Reinstate grayling stocking in Baron Lake #6. The lake currently supports grayling, but no spawning habitat exists, and grayling have not been stocked since 1973.

3. Maintain Baron Lake #1 and Baron Lake #2 as fishless lakes to provide large deep lake habitat for long-toed salamanders.

4. Reinstate stocking golden trout in Azure Lake on a three-year rotation with 750 fish.

5. Change stocking in Pats Lake from 2-year rotation to 3-year rotation to reduce densities and increase average size.

6. Reinstate stocking in Cliff Lake of 500 Troutlodge Inc. triploid rainbow trout on a 3-year rotation.

7. Maintain fishless, deep lake habitat for amphibians in the Queens River Lakes #34, #35, and #36 lakes chain.

Table 26. Lake name, LLID number, map number, selected physical habitat attributes and amphibian presence/absence for lakes surveyed in the Baron, Benedict, Goat, and Johnson creek drainages and the Queens River drainage during July 24 through August 8, 2012.

Lake name	LLID	Map #	Elevation (m)	Area (ha)	Max depth (m)	Fish observed	Amphibians observed
Baron Creek - SF Payette R							
Baron L.	1150330440816.00	1	2535	19.81	41	Yes	Yes
Baron L. #1	1150471440931.00	2	7625	2.82	7	No	Yes
Baron L. #6	1150435440757.00	3	2748	1.8	15	Yes	No
Braxon L.	1150128440878.00	4	2518	1.75	10	Yes	Yes
Little Baron L.	1150335440880.00	5	2481	2.92	10	Yes	Yes
Lower Braxon L.	1150161440889.00	6	2505	0.59	3	Yes	Yes
Unnamed L.	1150137440818.00	7	2630	0.31	4	No	Yes
Unnamed L.	1150143440827.00	8	2639	0.08	1	No	No
Unnamed L.	1150198440855.00	9	2603	0.37	3.5	No	No
Unnamed L.	1150199440867.00	10	2616	0.26	11	No	Yes
Unnamed L.	1150202440872.00	11	2619	0.14	2.75	No	Yes
Unnamed L.	1150204440878.00	12	2616	0.1	2.5	No	Yes
Unnamed L.	1150217440881.00	13	2631	0.02	7	No	Yes
Unnamed L.	1150222440878.00	14	2631	0.17	Dry	No	No
Unnamed L.	1150229440884.00	15	2634	0.35		No	Yes
Unnamed L.	1150266440817.00	16	2615	0.37	6	No	Yes
Unnamed L.	1150275440809.00	17			1	No	Yes
Unnamed L.	1150280440804.00	18			0.5	No	Yes
Upper Baron L.	1150298440777.00	19	2593	7.08	18	No	Yes
Benedict Creek- SF Payette R							
Everly L.	1150839439550.00	20	2631	4.87	18	Yes	No
Unnamed L. .	1150749439565.00	21	2751	0.66	Dry	No	No
Unnamed L. .	1150796439571.00	22	2643	0.71	Dry	No	No
Unnamed L. .	1150805439551.00	23	2634	0.13	Dry	No	No
Goat Creek - SF Payette R							
Bead L. .	1150529440718.00	24	2638	1.05	10	Yes	No
Feather L. . #1	1150510440675.00	25	2678	0.14	1.5	Yes	No
Feather L. . #2	1150499440671.00	26	2679	0.26	4	Yes	No
Feather L. #3	1150485440666.00	27	2685	0.59	6	Yes	No
Feather L. #4	1150477440658.00	28	2687	0.5		Yes	No
Little Warbonnet L.	1150434440637.00	29	2713	1.76	10	Yes	No
Upper Bead L.	1150505440705.00	30	2652	0.82	8	Yes	No
Warbonnet L.	1150402440634.00	31	2719	4.67	14	Yes	No

Table 26. (Continued).

Lake name	LLID	Map #	Elevation (m)	Area (ha)	Max depth (m)	Fish observed	Amphibians observed
Johnson Creek - NF Boise R							
Arrowhead L.	1151176439696.00	32	2677	2.5	13	Yes	No
Azure L.	1151324439649.00	33	2518	5.66	15	Yes	No
Pats L.	1151245439717.00	34	2542	3.8	13	Yes	No
Unnamed L.	1151140439691.00	35	2754	0.3	0.1	No	No
Unnamed L.	1151175439717.00	36	2752	0.07	0.5	No	No
Unnamed L.	1151326439670.00	37	2522	0.09	7	No	Yes
Queens R - MF Boise R							
Cliff L.	1151247439410.00	38	2592	0.44	10	Yes	No
Plummer L.	1150813439516.00	39	2621	3.76	18	Yes	No
Queens River Frog Pond	1151196439593.00	40	2643	0.57	3	No	Yes
Queens River L. #33	1150922439405.00	41	2506	2.67	9	Yes	No
Queens River L. #34	1151055439631.00	42	2813	0.79	3	No	Yes
Queens River L. #35	1151091439639.00	43	2694	1.86	4	No	Yes
Queens River L. #36	1151074439651.00	44	2652	0.57	7	No	Yes
Slide L.	1151265439398.00	45	2607	0.53	4	No	No
Unnamed L.	1150762439497.00	46	2799	0.07	Dry	No	No
Unnamed L.	1150840439503.00	47	2617	0.3	1.5	No	Yes
Unnamed L.	1150845439480.00	48	2645	0.44	2	No	No
Unnamed L.	1150908439447.00	49	2739	0.44	1	No	No
Unnamed L.	1150928439707.00	50	2718	0.1	1.5	No	No
Unnamed L.	1150930439418.00	51	2503	0.1	1.25	No	No
Unnamed L.	1150939439692.00	52	2566	0.24	5	No	Yes
Unnamed L.	1150940439732.00	53	2737	0.14	1.75	No	No
Unnamed L.	1150942439724.00	54	2737	0.15	0.3	No	No
Unnamed L.	1150946439711.00	55	2737	0.17	0.2	No	No
Unnamed L.	1150956439628.00	56	2558	0.12	Dry	No	No
Unnamed L.	1150956439688.00	57	2785	0.1	2	No	No
Unnamed L.	1150957439711.00	58	2737	0.49	0.3	No	No
Unnamed L.	1150965439618.00	59	2766	0.3	1.5	No	No
Unnamed L.	1150983439725.00	60	2680	0.12	1.75	No	No
Unnamed L.	1150993439676.00	61	2800	0.2	1	No	No
Unnamed L.	1150999439733.00	62	2755	0.05	0.5	No	No
Unnamed L.	1151011439696.00	63	2815	0.17	5	No	No
Unnamed L.	1151027439729.00	64	2791	0.27	8	No	No
Unnamed L.	1151032439673.00	65	2753	0.78	10	No	No
Unnamed L.	1151060439671.00	66	2732	0.29	3	No	No
Unnamed L.	1151109439516.00	67	2520	0.06	Dry	No	No
Unnamed L.	1151109439520.00	68	2399	0.05	1	No	Yes
Unnamed L.	1151121439539.00	69	2551	0.49	0.5	No	No

Table 26. (Continued).

Lake name	LLID	Map #	Elevation (m)	Area (ha)	Max depth (m)	Fish observed	Amphibians observed
Queens R - MF Boise R							
Unnamed L.	1151154439559.00	70	2595	0.14	Dry	No	No
Unnamed L.	1151167439592.00	71	2666	0.15	Dry	No	No
Unnamed L.	1151175439600.00	72	2667	0.16	Dry	No	No
Unnamed L.	1151186439540.00	73	2733	0.24	1.5	No	Yes
Unnamed L.	1151186439583.00	74	2396	0.11	0.75	No	Yes
Unnamed L.	1151187439573.00	75	2611	0.06	1.25	No	No
Unnamed L.	1151193439541.00	76	2733	0.11	1.5	No	No
Unnamed L.	1151198439554.00	77	2644	0.57	2.5	No	Yes
Unnamed L.	1151199439564.00	78	2644	0.53	2.5	No	No

Table 27. Fish species present and fish stocking history (to 1967) by species from lakes where fish were observed during 2012 alpine lake surveys. Years shown indicate the most recent year fish were stocked, with the typical stocking frequency shown in parentheses.

Lake name	Sample date	Fish present	Species observed	Stocking History				
				BKT	GDN	GRY	RBT	WCT
Baron Creek - S.F. Payette River								
Baron L.	7/24/2012	YES	BKT				2011	2009 (3 yr)
Baron L. #6	7/25/2012	YES	GRY, GDN		2011 (4 yr)			
Braxon L.	7/25/2012	YES	WCT				2010*	2008 (3 yr)
Little Baron L.	7/26/2012	YES	BKT			1996		
Lower Braxon L.	7/25/2012	YES	WCT				2010*	2008 (3 yr)
Benedict Creek - S. F. Payette River								
Everly L.	8/7/2012	YES	WCT				2011*	2009 (2 yr)
Goat Creek - S.F. Payette River								
Bead L.	7/26/2012	YES	WCT				2010*	2008 (3 yr)
Feather L. #1	7/26/2012	YES	WCT					1995 (3 yr)
Feather L. #2	7/26/2012	YES	WCT					1995 (3 yr)
Feather L. #3	7/26/2012	YES	WCT					1995 (3 yr)
Feather L. #4	7/26/2012	YES	WCT					1995 (3 yr)
Little Warbonnet L.	7/26/2012	YES	WCT					
Upper Bead L.	7/26/2012	YES	WCT				2010*	2008 (3 yr)
Warbonnet L.	7/26/2012	YES	WCT					
Johnson Creek - N.F. Boise R.								
Arrowhead L.	8/7/2012	YES	RBT, WCT				2012 (2 yr)*	2008 (2 yr)
Azure L.	8/7/2012	YES	WCT, GDNxWCT		2006 (3 yr)			1989 (2 yr)
Pats L.	8/7/2012	YES	WCT				2011 (2 yr)*	2009 (2 yr)
Queens River - M.F. Boise R.								
Cliff L.	8/8/2012	YES	WCT					2009 (3 yr)
Plummer L.	8/7/2012	YES	RBT				2012 (3 yr)	
Queens River L. #33	8/7/2012	YES	WCT					

* Programatic change to triploid rainbow trout

Table 28. Mean total length (mm), mean weight (g), mean relative weight (W_r), mean condition factor (K) for fish species by lake and drainage collected from alpine lakes between July 24 and August 8, 2012. Catch-per-unit-effot (CPUE) is shown for gill nets (fish/net-night) and angling (fish/hr) and includes lake area (ha) and current stocking density (fish/ha).

Lake name	Species	Length (mm)	N	Weight (g)	N	Relative wt. (Wr)	Condition (K)	Gill net CPUE	Angling CPUE	Area (ha)	Num stocked	Stock dens.
Baron Creek - S.F. Payette River												
Baron L.	BKT	247	81	151	81	92.9	1.0	40.5	-	19.8	1000	50
Baron L. #6	GRL	325	8	-	-	-	-	-	1.3	1.8	500	278
	GDN	257	5	-	-	-	-	-	0.8		-	-
Braxon L.	WCT	341	3	-	-	-	-	-	1.0	1.8	1000	571
Little Baron L.	BKT	220	10	-	-	-	-	-	1.0	2.9	-	-
Lower Braxon L.	WCT	204	4	-	-	-	-	-	1.3	0.6	500	847
Benedict Creek - S. F. Payette River												
Everly L.	WCT	322	8	299	8	78.5	0.9	-	1.8	4.9	1000	205
Goat Creek - S. F. Payette River												
Bead L.	WCT	254	20	-	-	-	-	-	5.0	1.1	500	476
Feather L. #1	WCT	208	3	-	-	-	-	-	-	0.1	-	-
Feather L. #2	WCT	165	2	-	-	-	-	-	-	0.3	-	-
Feather L. #3	WCT	219	7	-	-	-	-	-	7.0	0.6	-	-
Feather L. #4	WCT	246	7	-	-	-	-	-	7.0	0.5	-	-
Little Warbonnet L.	WCT	224	15	-	-	-	-	-	10.0	1.8	-	-
Upper Bead L.	WCT	333	4	-	-	-	-	-	1.1	0.8	500	610
Warbonnet L.	WCT	247	2	-	-	-	-	-	0.8	4.7	-	-
Johnson Creek - N. F. Boise R.												
Arrowhead L.	RBT	115	2	33	2	208.9	2.2	-	0.4	2.5	1000	400
	WCT	271	17	201	17	246.3	2.5	-	3.2		-	-
Azure L.	WCT	418	2	545	2	64.6	0.8	-	0.3	5.7	1000	177
	WCTxGDN	267	5	211	5		1.1	-	0.8		-	-
Pats L.	WCT	237	20	150	10	79.9	0.9	-	10.0	1.0	750	789
Queens River - M. F. Boise River												
Cliff L.	WCT	290	10	192	10	69.1	0.8	-	3.7	0.4	-	-
Plummer L.	RBT	233	4	194	4	148.9	1.6	-	0.9	3.8	1000	266
Queens River L. #33	WCT	229	8	128	2	112.1	1.2	-	1.8	2.7	-	-

Table 29. Amphibian counts by species and life stage and fish presence for alpine lakes surveyed from July 24 through August 8, 2012. Juveniles include all sub-adult and larval stages. Unnamed lakes are listed by LLID number for identification.

	Columbia spotted frog			Long-toed salamander			Tailed frog			Western toad			Fish present	Comments
	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae		
Baron Creek - SF Payette R														
Baron L	4	-	-	-	-	-	-	-	-	-	-	-	YES	
Baron L #1	-	-	-	-	-	8	-	-	-	-	-	-	NO	
Baron L #6	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Braxon L	2	-	-	-	-	-	-	-	-	-	-	-	YES	
Little Baron L	27	-	130	-	-	-	-	-	-	-	-	-	YES	
Lower Braxon L	4	-	-	-	-	-	-	-	-	-	-	-	YES	
Unnamed Lakes														
1150137440818.00	-	1	-	1	-	-	-	-	-	-	-	-	NO	
1150143440827.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150198440855.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150199440867.00	43	3	-	-	-	-	-	-	-	-	-	-	NO	
1150202440872.00	12	8	-	-	-	-	-	-	-	-	-	-	NO	
1150204440878.00	14	6	54	-	-	-	-	-	-	-	-	-	NO	
1150217440881.00	38	-	102	-	-	-	-	-	-	-	-	-	NO	
1150222440878.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1150229440884.00	44	8	-	-	-	-	-	-	-	-	-	-	NO	
1150266440817.00	56	-	60	-	-	-	-	-	-	-	-	-	NO	
1150275440809.00	43	-	10	-	-	-	-	-	-	-	-	-	NO	
1150280440804.00	8	-	-	-	-	-	-	-	-	-	-	-	NO	
Upper Baron L	-	1	1	-	3	-	-	-	-	-	-	-	NO	
Benedict Creek SF Payette R														
Everly L	-	-	-	-	-	-	-	-	-	-	-	-	NO	
Benedict Creek-SF Payette R														
Unnamed Lakes														
1150749439565.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1150796439571.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1150805439551.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake

Table 29. (Continued).

	Columbia spotted frog			Long-toed salamander			Tailed frog			Western toad			Fish	Comments
	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	present	
Goat Creek-SF Payette R														
Bead L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Feather L #1	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Feather L #2	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Feather L #3	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Feather L #4	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Little Warbonnet L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Upper Bead L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Warbonnet L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Johnson Creek - NF Boise R														
Arrowhead L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Azure L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Pats L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Unnamed Lakes														
1151140439691.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151175439717.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151326439670.00	-	-	-	-	11	1	-	-	-	-	-	-	NO	
Queens R - MF Boise R														
Cliff L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Plummer L	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Queens River Frog Pond	6	1	-	6	-	-	-	-	-	-	-	-	NO	
Queens River #33	-	-	-	-	-	-	-	-	-	-	-	-	YES	
Queens River L #34	24	-	400	0	4	0	2	-	-	-	-	-	NO	
Queens River L #35	9	-	-	1	15		-	-	-	-	-	-	NO	
Queens River L #36	6	-	-	-	-	-	-	-	-	-	-	-	NO	
Slide L	-	-	-	-	-	-	-	-	-	-	-	-	NO	
Unnamed Lakes														
1150762439497.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1150840439503.00	-	100	-	-	-	-	-	-	-	-	-	-	NO	
1150845439480.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150908439447.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	

Table 29. (Continued).

	Columbia spotted frog			Long-toed salamander			Tailed frog			Western toad			Fish present	Comments
	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae	Adult	Juvenile	Larvae		
Queens R - MF Boise R														
1150928439707.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150930439418.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150939439692.00	-	-	-	-	1	-	-	-	-	-	-	-	NO	
1150940439732.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150942439724.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150946439711.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150956439628.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1150956439688.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150957439711.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150965439618.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150983439725.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150993439676.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1150999439733.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151011439696.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151027439729.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151032439673.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151060439671.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151109439516.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1151109439520.00	-	250	-	-	-	-	-	-	-	-	-	-	NO	
1151121439539.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151154439559.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1151167439592.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1151175439600.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	Dry lake
1151186439540.00	1	-	-	2	-	-	-	-	-	-	-	-	NO	
1151186439583.00	3	-	-	-	-	-	-	-	-	3	-	-	NO	
1151187439573.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151193439541.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	
1151198439554.00	16	450	-	-	-	-	-	-	-	-	-	-	NO	
1151199439564.00	-	-	-	-	-	-	-	-	-	-	-	-	NO	

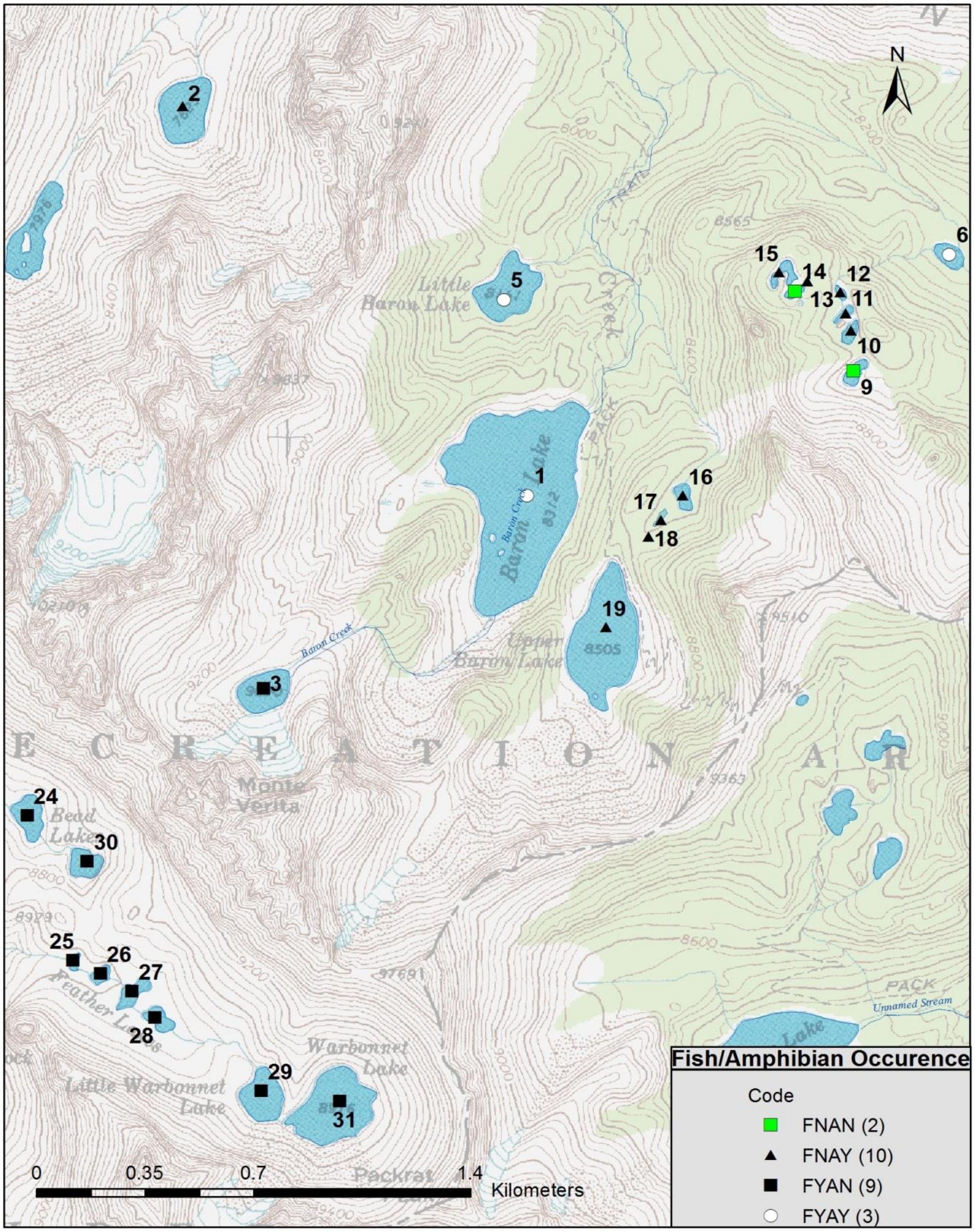

Figure 37. Lakes surveyed by IDFG personnel during July and August 2012 in Baron Creek, Benedict Creek, and Goat Creek (HUC 6) in the S. F. Payette River drainage. Lake names and map reference numbers appear in Table 26. Legend denotes survey results for presence/absence of fish and amphibians: FNAN is no fish, no amphibians, FNAY is no fish, yes amphibians, FYAN is fish yes, amphibians no, and FYAY is fish yes, amphibians yes.

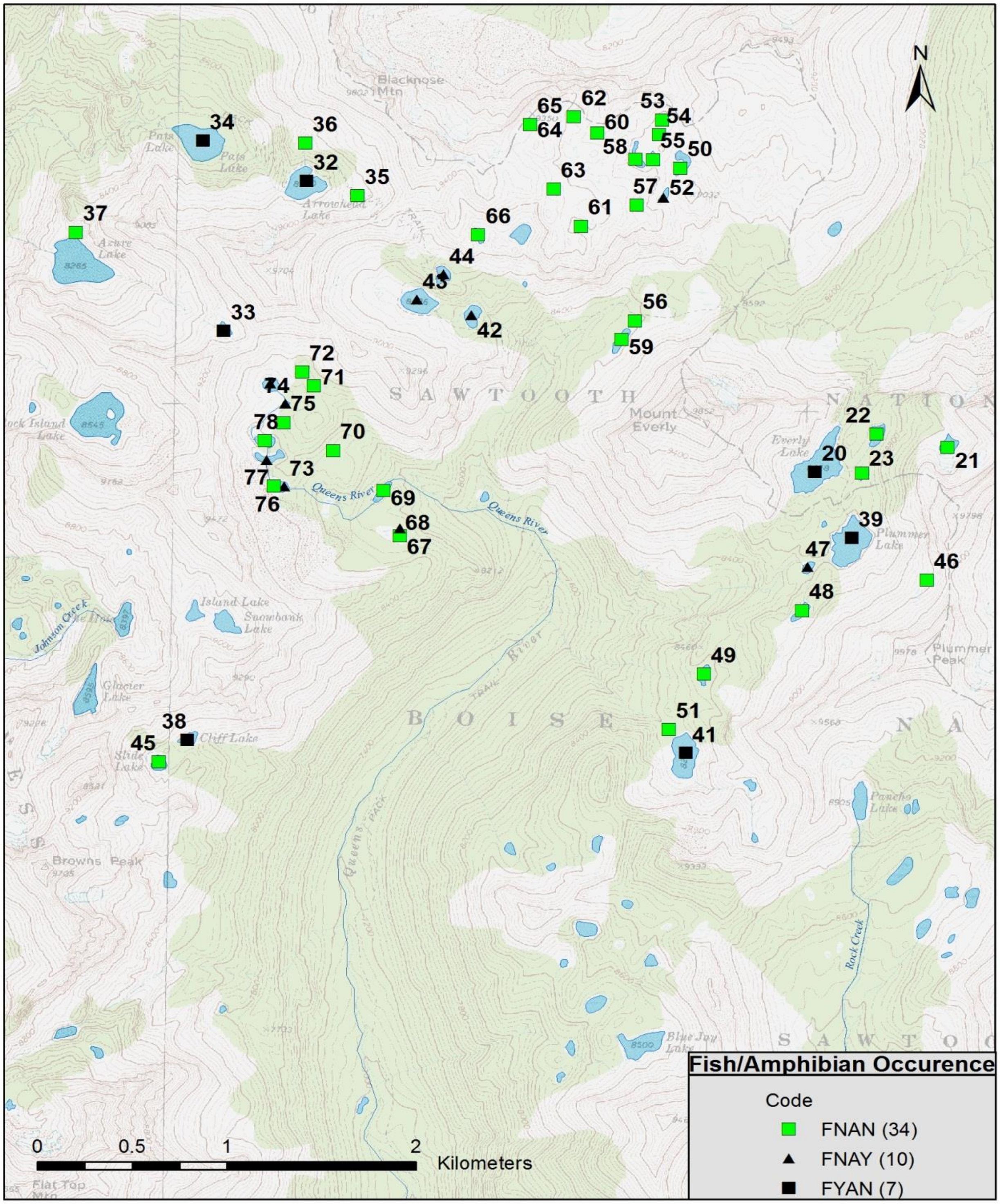

Figure 38. Lakes surveyed by IDFG personnel during July and August 2012 in Johnson Creek (N. F. Boise River) and Queens River (M. F. Boise River) (HUC 6). Lake names and map reference numbers appear in Table 26. Legend denotes survey results for presence/absence of fish and amphibians: FNAN is no fish, no amphibians, FNAY is no fish, yes amphibians, FYAN is fish yes, amphibians no, and FYAY is fish yes, amphibians yes.

RIVERS AND STREAMS INVESTIGATIONS

DISTRIBUTION OF REDBAND AND BULL TROUT IN THE SOUTH FORK BOISE AND PAYETTE RIVER DRAINAGES

ABSTRACT

Tributaries in the South Fork Boise River (below Anderson Ranch Reservoir) and Squaw Creek (Payette River) were surveyed to collect information on the distribution of redband trout *Oncorhynchus mykiss gairdneri* and bull trout *Salvelinus confluentus*. In the South Fork Boise River drainage, 10 sites were surveyed across 4 tributaries. Redband trout were present at all sites, except Little Rattlesnake Creek, where no salmonids were sampled. Multiple-pass depletion estimates were made at three sites, and redband density ranged from 5.7 – 12.6 fish/100 m^2. Size distribution of redband trout in Cottonwood Creek and Rattlesnake Creek suggests these are resident redband trout populations. Redband trout collected in Trail Creek was mainly age-0 fry, suggesting use by a fluvial spawning population. Bull trout were captured in Rattlesnake Creek and Cottonwood Creek, but were in very low densities.

As part of a cooperative effort with the US Forest Service to collect information on redband trout and bull trout distribution, 24 stream sites across 8 streams were sampled in the in the upper Squaw Creek drainage of the Payette River. Redband trout were found in each stream except for Gabe's Creek, where only bull trout were found (at the lower site). No salmonids were found at seven sites. Depletion estimates were made at 16 sites, and redband trout density was highly variable (3.2 – 50.4 fish/100m^2). Of the 1,083 redband trout captured, 77% were over 100 mm in length. Based on size distributions, most of these streams appear to have resident populations of small redband trout, with bull trout in some locations. A total of 79 bull trout were caught across three streams: Gabe's, Renwick, and Third Fork Squaw creeks. Third Fork Squaw Creek had the highest bull trout densities of the streams surveyed (15.1 fish/100m^2), while only one bull trout was collected in Renwick Creek. Densities of redband trout appear to be similar or higher than previous samples at the most comparable locations.

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INTRODUCTION

The South Fork Boise River (SFBR) below Anderson Ranch Dam is a nationally renowned tailwater trout fishery and was the first river section in Southwest Idaho to be managed under “Quality Trout” regulations. This fishery is supported by a population of wild rainbow trout *Oncorhynchus mykiss* and mountain whitefish *Prosopium williamsoni*. Migratory bull trout *Salvelinus confluentus* are present at very low densities, and native nongame fish inclu512 de largescale suckers *Catostomus macrocheilus*, northern pikeminnow *Ptychocheilus oregonensis* and sculpin *Cottus sp*. Rainbow 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 mainly be 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).

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. Currently, little information on fish populations within these tributaries is available. 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, road construction and maintenance, 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). We conducted additional sampling in 2012 on Trail, Rattlesnake, Little Rattlesnake and Cottonwood creeks to evaluate their potential as a source of juvenile fish to the SFBR. Data describing the trout communities in tributaries to the SFBR will help guide management, conservation, and restoration efforts in the future.

In addition to sampling in the SFBR drainage, surveys were also conducted in Upper Squaw Creek (Payette River). These surveys were part of a cooperative effort with the USFS to collect information on the distribution of redband and bull trout in portions of the Payette River. Surveys were intended to sample a larger extent of stream habitat in portions of Squaw Creek thought to contain redband and bull trout populations. This area contains grazing allotments on federally-administered lands, and additional distribution data for USFS sensitive fish species will help inform land management decisions in the drainage.

METHODS

Four tributaries to the South Fork Boise River were sampled in 2012 to evaluate presence, distribution and abundance of redband trout and bull trout. Ten sites were sampled across Rattlesnake, Little Rattlesnake, Cottonwood, and Trail creeks (Table 30). Sites on Trail Creek were selected from a 1:100,000 hydrography layer through the Environmental Protection Agency's Environmental Monitoring and Assessment Program (see Stevens and Olsen 2004). All other sites were selected from previously sampled IDFG and USFS survey sites. Sampling occurred from September 11 to September 18, 2012, except for Trail Creek, which was surveyed on November 7, 2012. Sampling occurred from September 11 to September 18, 2012

Seven streams in the Upper Squaw Creek drainage were selected based on the distribution of federal grazing allotments, as well as locations historically sampled by IDFG or USFS. Sites were mainly short (100 m) multiple-pass depletion reaches, but additional longer single-pass (1000 m) reaches were added to collect presence/absence information over larger spatial scales (Table 31). All sampling in the Squaw Creek drainage occurred between August 15 and September 5, 2012.

Fish sampling

We used a combination of single-pass and multi-pass electrofishing sites to determine the abundance of salmonids using a backpack electrofishing unit (Smith-Root Model 15-D) with pulsed DC. 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. For multiple pass reaches, 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. Study sites were generally 100 m in length. Sections of stream where vegetation was too thick to sample effectively were not included in the sample site. In some locations, longer single pass reaches (1000 m) were used to assess long sections of stream to sample greater area (Table R1, Table R2). Fish abundance and associated confidence intervals at depletion sites were estimated with the Maximum-likelihood function in 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. Depletion estimates were only attempted for salmonids and were not applied to nongame fish or amphibian species.

Habitat Sampling

Various habitat measurements were recorded at ten 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; Arendt 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

South Fork Boise River

In the South Fork Boise River drainage, we surveyed 10 sites across 4 tributaries (Table 30). Redband trout were present in at all sites, except Little Rattlesnake Creek, where no salmonids were sampled. A total of 340 redband trout were collected, with 198 of them being less than 100 mm in total length. Multiple-pass depletion estimates were made at three sites, and redband trout density ranged from 5.7 – 12.6 fish/100 m^2. At these sites, capture probability for redband trout was high (0.84 or greater) at all sites (Table 30). Most locations were sampled with single pass electrofishing, so no density estimates were calculated for these samples. Cottonwood Creek and Rattlesnake Creek appear to contain resident populations of redband trout over 100 mm in length, while Trail Creek mainly contained redband trout less than 100 mm (Figure 41). Bull trout were captured in Rattlesnake Creek and Cottonwood Creek, but only in very low numbers (Table R1). Only three bull trout were captured during these surveys. One large adult bull trout (TL = 492 mm) was collected in Rattlesnake Creek, likely a fluvial fish from the South Fork Boise River or Arrowrock Reservoir. Tailed frogs were found present at one site in Rattlesnake Creek (Table 30).

Upper Squaw Creek

In the upper Squaw Creek drainage of the Payette River, 24 sites were sampled across eight streams. Redband trout were found in each stream except for Gabe's Creek, where only bull trout were found (at the lower site). No salmonids were found at seven sites (Table 31). Depletion estimates were made at 16 sites, and redband trout density varied considerably across sites (3.2 – 50.4 fish/100m^2). Of the 1,083 redband trout captured, 77% were over 100 mm in length. No salmonids were captured at 7 of the sampling sites (Table 31). Often, these sites were the furthest upstream in the drainages sampled (Figure 40). No redband trout were found in Gabe's Creek, but bull trout were found present at the lower site near confluence with Third Fork Squaw Creek (Figure 40). A total of 79 bull trout were caught across three streams: Gabe's, Renwick, and Third Fork Squaw creeks. Third Fork Squaw Creek had the highest densities of bull trout of the streams surveyed (15.1 fish/100m^2), while only one bull trout was collected in Renwick Creek (Table 31). Tailed frogs were documented in Antelope, Rammage, Second Fork Squaw, Third Fork Squaw, and Gabe's creeks (Table 31).

A coordinated long-term monitoring effort has not been organized for the upper Squaw Creek drainage. However, fish surveys have been conducted in this drainage since at least 1993 for a variety of different projects (Figure 41). While direct comparisons across years are not available for specific sites, some sites were close enough in location and format to compare redband densities to 2012 data. We examined previously collected data and tabulated closely located sites. Only sites with multiple-pass electrofishing data were included, as single-pass data were not comparable. Only four locations were close enough with similar surveys to be compared (Table 32). For these four locations, densities of redband rainbow increased in most areas compared to 2004 surveys, except for one area (sites 06Wilson1 and #5) in Third Fork Squaw Creek, where densities remained similar (Table 32). Densities increased consistently in both size groups for streams where previous surveys had been conducted. Compared to previous surveys, bull trout remained rare at these sites, and no density estimates were possible because of limited sample sizes.

DISCUSSION

Size distribution of redband trout in Cottonwood Creek and Rattlesnake Creek suggests these are resident populations (Figure 41). Redband trout collected in Trail Creek were mainly age-0 fry, suggesting use by a fluvial spawning population (Figure 41). These data are very similar to other nearby tributaries. Previous sampling in 2011 of showed very similar size distributions in Bock, Mennecke, Cayuse and Cow creeks, all dominated by age-0 redband trout (Butts et al. 2013). Size distributions in these creeks show very few age-1 or older fish. This suggests either very poor overwinter survival of age-0 fish, or emigration to the main stem South Fork Boise River. If these creeks sustain enough water through the winter, they may be important spawning tributaries and could contribute to redband trout recruitment in the South Fork Boise River. Before any of the streams are further considered for habitat improvements, seasonal flow in these streams should be investigated to determine if these tributaries can provide annual spawning habitat.

Our sampling in the upper Squaw Creek drainage documented a mix of redband trout and bull trout. The Rammage Creek drainage appears to mainly be occupied by redband trout, as no bull trout were documented during our surveys. Third Fork Squaw Creek appears to contain a mixture of resident redband trout and a well-established bull trout population. Gabes Creek also contained bull trout, but were only present at the site near its confluence with Third Fork Squaw Creek. Bull trout were also present in Renwick Creek, but in very low density, as only one fish was captured (Table 31). Based on size distributions, most of these streams appear to have resident populations of small redband trout, with bull trout in some locations (Figure 42).

Some comparisons to previous samples in 1994 and 2004 were available. While these sites were not exact replicate locations, they were in close enough proximity to give general information on redband trout abundance and distribution over time. Densities of redband trout appear to be similar or higher than previous samples at the most comparable locations (Table 32).

Table 30. Estimated abundance and density (fish/100 m^2) of redband trout and bull trout by length group at 2012 monitoring sites in the South Fork Boise drainage sampled in 2012. Depletion estimates and density were not generated for single-pass electrofishing sites.

						Site	< 100 mm				> 100 mm				Total			
Stream	**Section**	**Species**	**Lat**	**Lon**	**Passes**	**length**	**n**	**Estimate**	**95% CI**	**C. P.**	**n**	**Estimate**	**95% CI**	**C. P.**	**Estimate**	**fish/100 m^2**	**Comment**	**Amphibians**
Cottonwood Cr.	95CWint1	RBT	43.63339446	-115.8243885	2	105	0	0	-	-	23	23	± 1	0.89	23	7.0		
Cottonwood Cr.	CTW_054	RBT	43.67088271	-115.8258454	1	106	0	-	-	-	12	-	-	-	-	-		
		BLT					0	-	-	-	1	-	-	-	-	-		
Cottonwood Cr.	IDFG1	RBT	43.63954024	-115.8306429	2	100	0	0	-	-	23	23	± 1	0.92	23	5.7		
L. Rattlesnake Cr.	LRC01	N/A	43.58983541	-115.6982287	1	-	0	-	-	-	0	-	-	-	-	-	No fish	
Rattlesnake Cr.	92RSINT5	RBT	43.57322091	-115.68269	1	105	1	-	-		10	-	-	-	-	-		
Rattlesnake Cr.	RMR13	RBT	43.59193662	-115.5952229	2	100	2	2	± 0	1	54	55	± 3	0.84	57	12.6		Tailed frog
		BLT					0	-	-	-	1	-	-	-	-	-		
Rattlesnake Cr.	RS1658	RBT	43.59920107	-115.5746115	1	100	1	-	-	-	10	-	-	-	1	-		
Rattlesnake Cr.	XRS1753	RBT	43.60766214	-115.5706271	1	90	0	-	-	-	4	-	-	-	-	-		
		BLT					0	-	-	-	1	-	-	-	-	-		
Trail Cr.	TC01	RBT	43.44010209	-115.62504	1	102	166	-	-	-	4	-	-	-	-	-		
Trail Cr.	TC02	RBT	43.43686721	-115.6358713	1	110	28	-	-	-	2	-	-	-	-	-		

Table 31. Estimated abundance and density (fish/100 m^2) of redband trout and bull trout by length group at 2012 monitoring sites in the Upper Squaw Creek (Payette River) drainage sampled in 2012. Depletion estimates and density were not generated for single-pass electrofishing sites.

						Site	< 100 mm				> 100 mm				Total			
Stream	Section	Species	Lat	Lon	Passes	length	n	Estimate	95% CI	C. P.	n	Estimate	95% CI	C. P.	Estimate	fish/100 m^2	Comment	Amphibians
Antelope Cr.	02Ant12	N/A	44.38551332	-116.1861769	1	105	0	-	-	-	0	-	-	-	-	-	No fish	
Antelope Cr.	94Anto	RBT	44.37509601	-116.1973407	3	107	14	14	± 2	0.67	44	45	± 3	0.67	59	26.9		Tailed frog
Gabes Cr.	UNKNGB1	RBT	44.43359128	-116.2038625	2	110	1	1	± 0	1	21	21	± 1	0.91	22	6.2		Tailed frog
		BLT					2	2	± 0	1	7	7	± 0	1	22	6.2		
Gabes Cr.	UNKNGB2	N/A	44.43562321	-116.1769104	1	-	0	-	-	-	0	-	-		-	-	No fish	
Rammage Cr.	06Ramm4	RBT	44.41158393	-116.1848113	3	104	1	1	± 0	1	13	13	± 2	0.65	14	3.2		Tailed frog
Rammage Cr.	2dFQ=srt-E	N/A	44.42093544	-116.2075196	1	1000	0	-	-	-	0	-	-		-	-	No fish	
Rammage Cr.	RMGMEAD1	RBT	44.41467672	-116.2034633	2	113	34	35	± 4	0.79	132	140	± 10	0.75	175	32.9		Tailed frog
Rammage Cr.	RMG-srt-B	N/A	44.41631608	-116.1945858	1	1000	0	-	-	-	0	-	-	-	-	-	No fish	
Rammage Cr., 1st Trib	95SFRM5	RBT	44.40601934	-116.2075371	3	102	11	11	± 1	0.73	26	27	± 4	0.62	38	31.3		Tailed frog
Rammage Cr., 2nd Trib	11RAM22	RBT	44.4192926	-116.1989304	2	102	30	39	± 21	0.51	54	58	± 8	0.72	97	28.5		Tailed frog
Renwyck Cr.	06Renwyck	RBT	44.37885192	-116.1634396	2	103	2	2	-	1	40	42	± 5	0.76	44	12.7		
Renwyck Cr.	10REN42	N/A	44.38365463	-116.1578538	1	105	0	-	-	-	0	-	-	-	-	-	No fish	Tailed frog
Renwyck Cr.	94RENO	RBT	44.36831474	-116.1946079	2	105	9	9	± 2	0.82	41	42	± 4	0.81	51	10.9		Tailed frog
Renwyck Cr.	Rnwk2	RBT	44.37646932	-116.1795871	2	103	14	16	± 8	0.61	34	36	± 6	0.74	52	13.0		
Renwyck Cr.	RNWKSrt1	BLT	44.37358993	-116.1884756	1	1000	0	-	-	-	1	-	-	-	-	-	No RBT	
Second Fork Squaw Cr.	02SFSQ50	RBT	44.36335795	-116.1991567	2	102	22	22	± 2	0.85	90	91	± 3	0.87	113	23.7		Tailed frog
Second Fork Squaw Cr.	02SFSQ60	RBT	44.37528865	-116.1979754	3	101	26	56	± 98	0.19	31	32	± 4	0.63	88	50.4		
Second Fork Squaw Cr.	94SFS9	RBT	44.37007533	-116.1977758	2	103	22	22	± 1	0.92	74	74	± 2	0.91	96	37.0		Tailed frog
Third Fork Squaw Cr.	00TFS76	N/A	44.44306232	-116.1973558	1	108	0	-	-	-	0	-	-	-	-	-	No fish	Tailed frog
Third Fork Squaw Cr.	06Wilson1	RBT	44.43723935	-116.2034242	2	100	11	11	± 3	0.79	49	49	± 1	0.93	60	16.9		Tailed frog
		BLT					6	6	± 1	0.86	7	7	-	1	13	3.7		
Third Fork Squaw Cr.	06Wilson3	RBT	44.43957358	-116.2026413	2	104	8	8	± 2	0.80	23	23	± 2	0.85	31	8.6		Tailed frog
		BLT					14	14	± 1	0.93	40	40	± 1	0.98	54	15.1		
Third Fork Squaw Cr.	2dFKsrtB	N/A	44.42249545	-116.2125221	1	1000	0	-	-	-	0	-	-	-	-	-	No fish	
Third Fork Squaw Cr.	IDFGSQ1	RBT	44.42410675	-116.2112969	2	106	21	23	± 7	0.68	104	109	± 6	0.80	132	31.4		
		BLT					0	-	-	-	1	-	-	-	-	-		
Third Fork Squaw Cr.	TFS70	RBT	44.43228064	-116.2046429	2	102	5	5	± 3	0.71	76	77	± 3	0.85	82	21.0		
		BLT					1	-	-	-	-	1	-	-	2	-		

Table 32. Estimated abundance and density (fish/100 m^2) of redband trout and bull trout by length group at four similar locations in the upper Squaw Creek (Payette River) drainage compared to previous surveys.

								Site	< 100 mm				> 100 mm				Total	
Year	Drainage	Stream	Section	Species	Lat	Lon	Passes	length	n	Estimate	95% CI	C. P.	n	Estimate	95% CI	C. P.	Estimate	fish/100 m^2
2012	Payette R.	Third Fork Squaw Cr.	06Wilson1	RBT	44.43723935	-116.2034242	3	100	11	11	± 3	0.79	49	49	± 1	0.93	60	16.9
				BLT					6	6	± 1	0.86	7	7	-	1.00	13	3.7
1994	Payette R.	Third Fork Squaw Cr.	#5	RBT	44.43589064	-116.2036073	3	61.2	24	28	±10	0.46	47	48	±3	0.74	76	19.1
				BLT					0	-	-	-	1	-	-	-	-	-
2012	Payette R.	Third Fork Squaw Cr.	IDFGSQ1	RBT	44.42410675	-116.2112969	2	106	21	23	± 7	0.68	104	109	± 6	0.80	132	31.4
				BLT					0	-	-	-	1	-	-	-	-	-
2004	Payette R.	Third Fork Squaw Cr.	Lowest (overdraw)	RBT	44.4233546	-116.2119628	3	75	30	32	± 5	0.58	61	67	± 9	0.55	99	15.5
2012	Payette R.	Second Fork Squaw Cr.	02SFSQ50	RBT	44.36335795	-116.1991567	2	102	22	22	± 2	0.85	90	91	± 3	0.87	113	23.7
2004	Payette R.	Second Fork Squaw Cr.	Overdraw	RBT	44.3639142	-116.1987955	3	80	19	20	± 4	0.88	35	37	± 5	0.80	57	12.2
2012	Payette R.	Renwyck Cr.	Rnwk2	RBT	44.37646932	-116.1795871	2	103	14	16	± 8	0.61	34	36	± 6	0.74	52	13.0
2004	Payette R.	Renwyck Cr.	Renwick #1	RBT	44.37626323	-116.1798842	2	110	1	1	-	-	9	9	± 1	0.90	10	2.9
				BLT					0	-	-	-	1	-	-	-	-	-

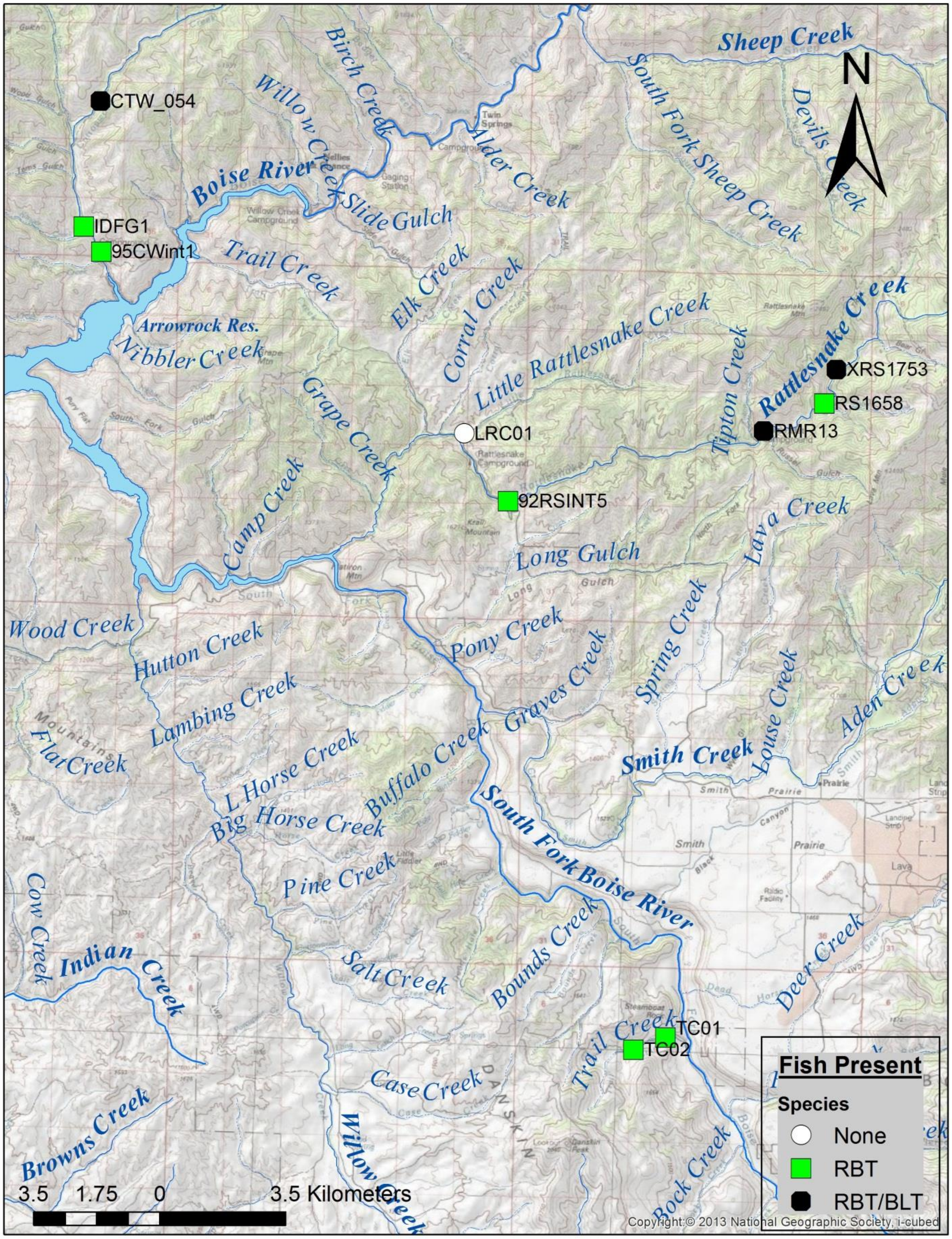

Figure 39. Stream survey sites in the South Fork Boise River sampled during 2012 to collect distribution and abundance data for redband trout and bull trout.

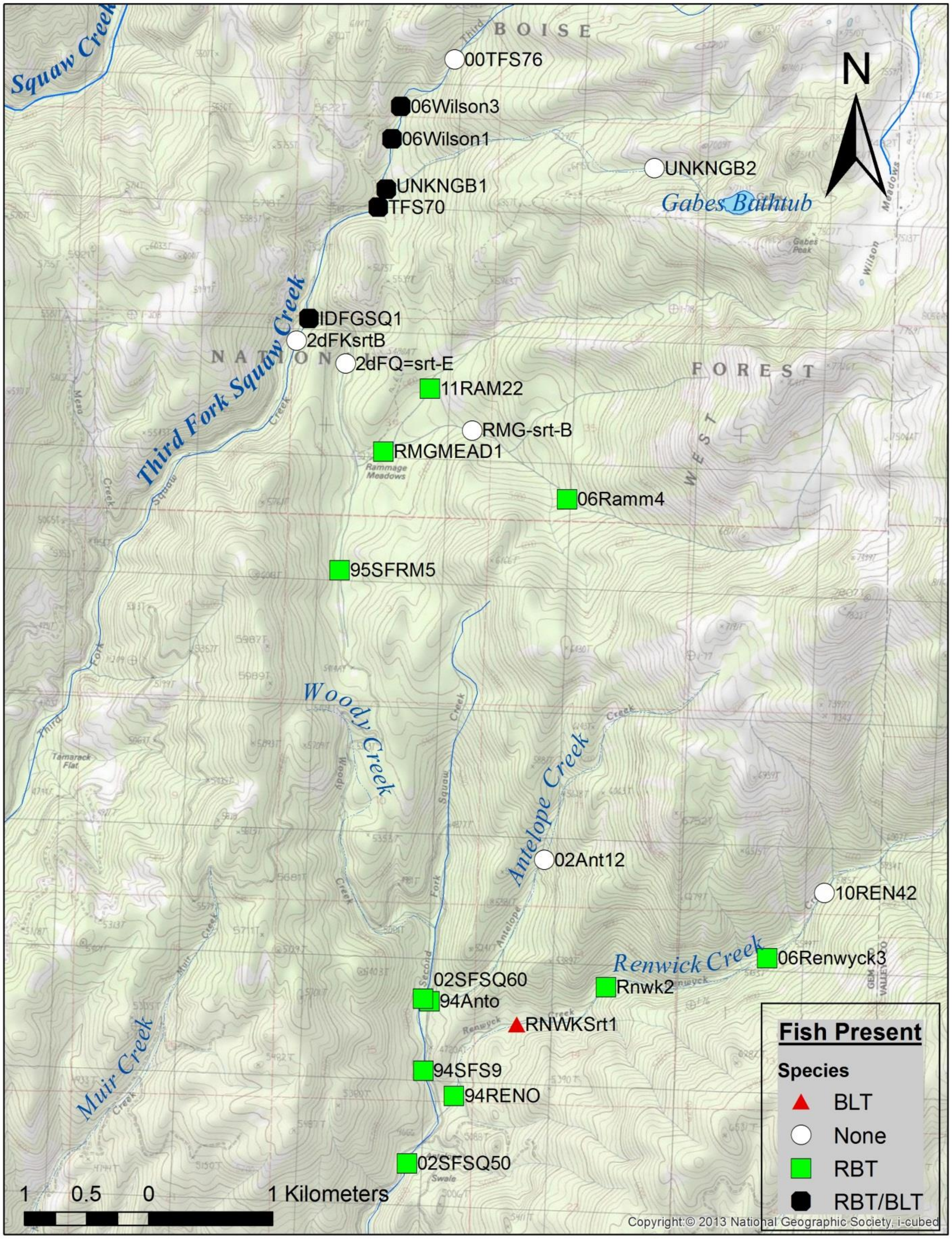
Squaw Creek
BOISE
NATIONAL
FOREST
WEST
N
00TFS76
06Wilson3
06Wilson1
UNKNGB2
UNKNGB1
TFS70
Gabes Bathtub
IDFGSQ1
2dFKsrtB
2dFQ=srt-E
11RAM22
RMG-srt-B
RMGMEAD1
Third Fork Squaw Creek
06Ramm4
95SFRM5
Woody Creek
Antelope Creek
02Ant12
10REN42
Renwick Creek
06Renwyck3
02SFSQ60
94Anto
Rnwk2
RNWKSrt1
Muir Creek
94SFS9
94RENO
02SFSQ50
1 0.5 0 1 Kilometers
Fish Present
Species
BLT
None
RBT
RBT/BLT
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Figure 40. Stream survey locations in upper Squaw Creek (Payette River drainage) sampled during 2012 to collect distribution and abundance data for redband trout and bull trout.

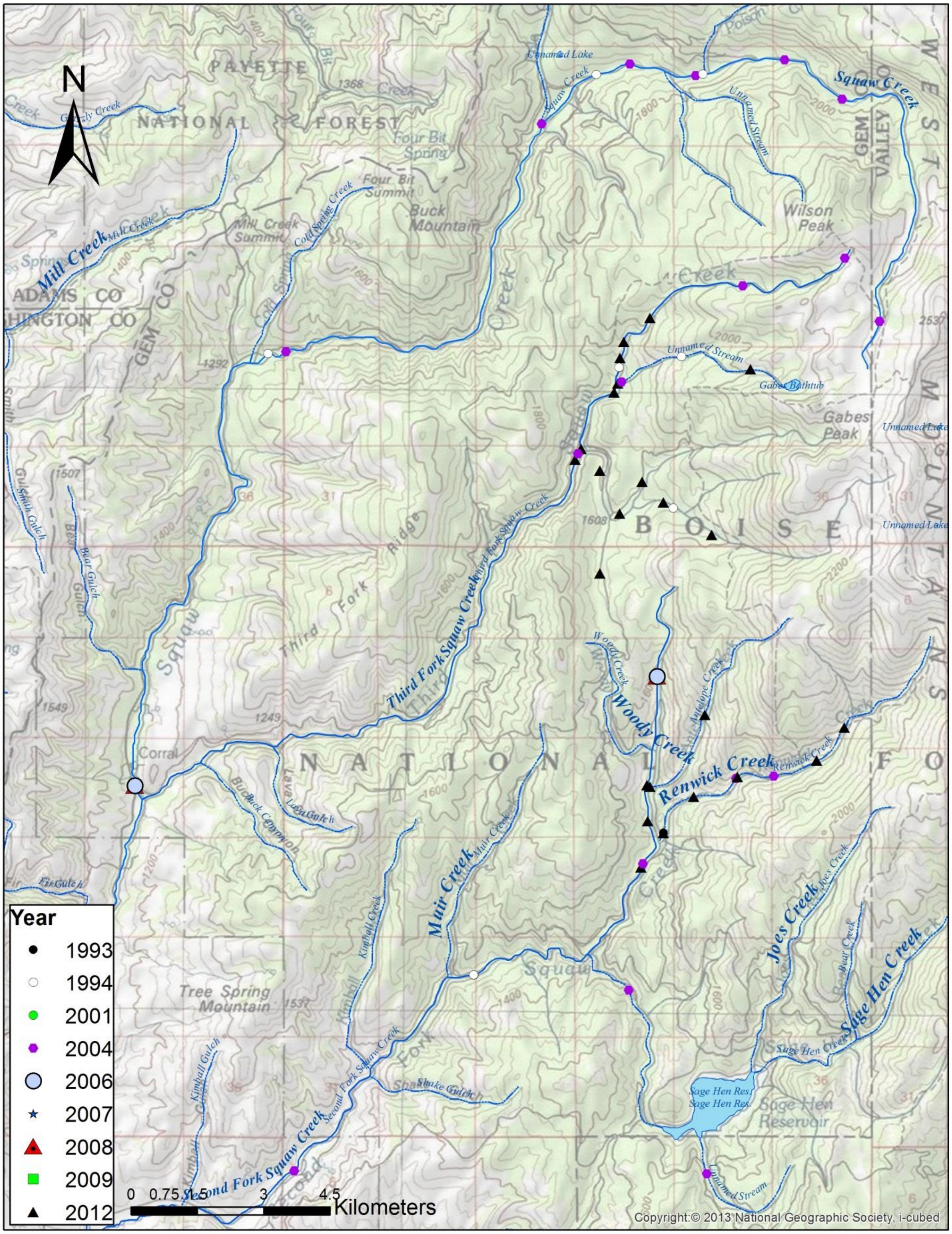

Figure 41. Distribution of survey locations in upper Squaw Creek (Payette River drainage) sampled since 1993 to collect distribution and abundance data for redband trout and bull trout.

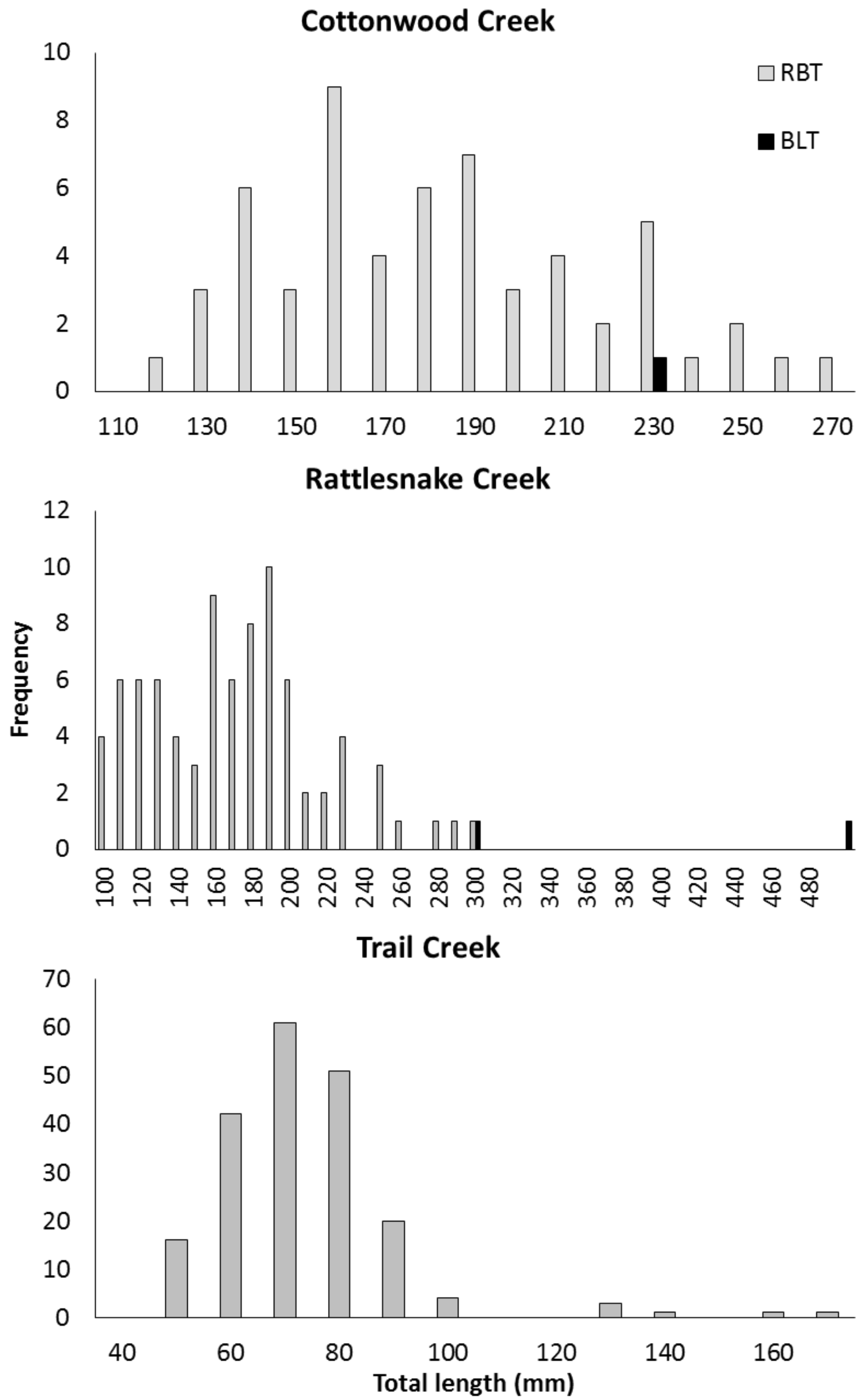

Figure 42. Length frequency distribution of redband trout (gray bars) and bull trout (black bars) sampled from three tributaries in the South Fork Boise River drainage in 2012.

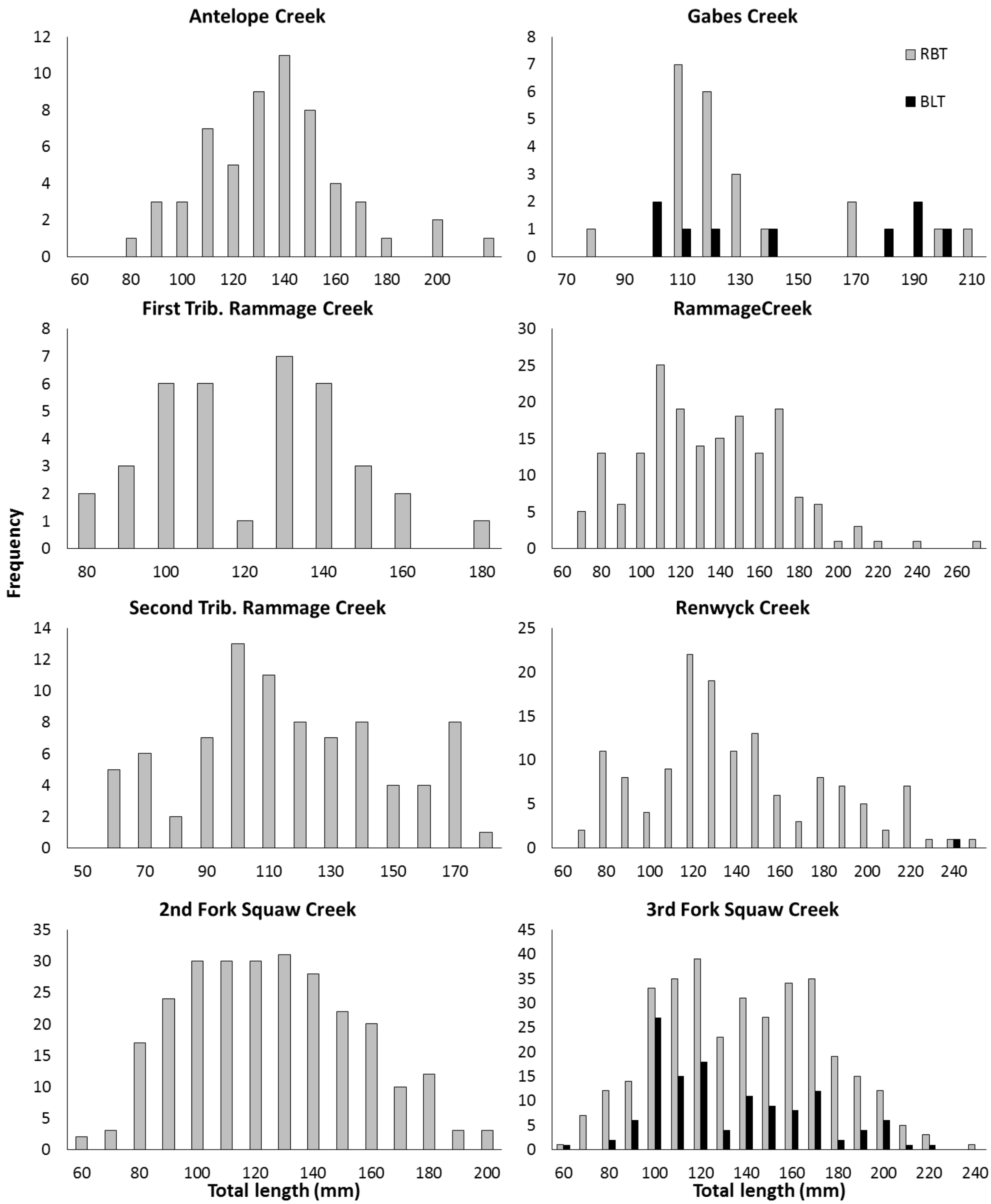

Figure 43. Length frequency distribution of redband trout (gray bars) and bull trout (black bars) sampled from tributaries in the upper Squaw Creek drainage (Payette River) in 2012.

LONG-TERM MONITORING OF REDBAND TROUT POPULATIONS IN DESERT BASINS OF THE BRUNEAU, OWYHEE, AND SNAKE RIVER DRAINAGES

ABSTRACT

As part of a long-term redband trout *Oncorhynchus mykiss gairdneri* monitoring effort, Idaho Department and Fish and Game (IDFG) and Bureau of Land Management personnel sampled 63 stream sites within the Bruneau, Owyhee, and Snake River drainages. During 2012, the fifth year of sampling for this effort, we surveyed four sites in the Bruneau River, above the confluence with the Jarbidge River. These sites were originally sampled by IDFG in 1995. Redband trout were captured at three of four sites. Redband trout density ranged from 0 trout/100 m^2 to 1.40 trout/100 m^2, with a mean of 0.92 ± 0.75 trout/100 m^2 of stream (mean ± 90% CI). For all four 2012 sites combined, a total of 33 redband trout were observed, ranging in total length from 120 – 290 mm, similar to data from 1995. Where redband trout were found, densities appear to be slightly higher than those from 1995 surveys, which is most likely related to differences in survey methods (snorkeling vs. electrofishing) than actual changes in redband trout populations.

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INTRODUCTION

Redband trout *Oncorhynchus mykiss gairdneri* are native to all major river drainages in Southwestern Idaho. Within this large and diverse geographical area, redband trout have adapted to a variety of stream habitats including those of montane and desert areas. 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 unsuccessfully petitioned for listing under the Endangered Species Act (ESA), under the assumption that they could be considered a separate sub species. Since that time, additional research has indicated that only one species of resident stream dwelling redband trout may exist in Southwest Idaho (Cassinelli 2008). Regardless of species designations, it is important to monitor redband trout population status across Idaho. Population status of the redband trout from montane habitats has been studied extensively in Southwestern Idaho. However, due to remoteness and little angling interest, the redband trout from desert habitats has received less attention (Schill et al. 2007). These habitats include tributaries of the Bruneau, Owyhee, and Snake River drainages most often in headwater areas. As these populations are near the southern extent of their range and water temperatures are projected to increase, it has become more important to monitor these populations closely.

Zoellick et al. (2005) completed a long-term assessment of redband trout distribution, density, and size structure. This assessment compared redband population characteristics at 43 sites within the Bruneau, Owyhee, and Snake river drainages from 1993-2003 to data collected at the same sites during 1977-1982. Site numbers referred to in this report correspond to the site numbers in Zoellick et al. (2005). As a continuation of this effort, Idaho Department of Fish and Game (IDFG) and Bureau of Land Management personnel resampled 43 sites over a three- to five-year period beginning in 2008. Also, an additional 20 sites were added to increase the distribution of sampling across the species distribution in the high desert environs of Southwest Idaho. During 2012, four sites on the Bruneau River were sampled.

METHODS

Originally, depletion electrofishing was used to estimate fish population characteristics at all sites. However, we encountered technical difficulties at the first site. Only one backpack unit could be used, limiting our effectiveness at collecting fish (Site #60). Other sites were subsequently surveyed using snorkeling gear. Sites #61-63 were sampled using two snorkelers. Snorkelers worked in tandem, moving upstream along each bank. Each snorkeler counted fish individually, and coordinated with each other on fish in the middle of the stream to avoid duplicate counts. Data were recorded by a third crew member following on shore. Fish were identified to species and total length was estimated visually.

We sampled four sites during 2012 in the Bruneau River, above the confluence with the Jarbidge River (Figure 44). All four of the sites had been sampled previously by IDFG staff in 1995 (Allen et al. 1998) using backpack electrofishing gear. Previously-sampled sites were located using descriptions, photographs, or coordinates (Table 33). Sampling efforts focused on redband trout, but non-game species were also captured, identified, and visually categorized as sparse (1-10), many (10-50), or abundant (>50).

RESULTS

Redband trout were captured at three of the four sites sampled. No redband trout were collected from Site #60, but this was likely a result of equipment malfunction, which prevented effective sampling. Only one of the two electrofishing units was working, and the stream was large enough that using one unit was very ineffective. As a result, we used snorkeling equipment for the other 3 surveys, which seemed to be much more effective, given the size of the Bruneau River in these reaches.

For all the 2012 sites combined, a total of 33 redband trout were sampled Total count of redband trout at each site ranged from zero to 13, with densities (trout/100m2) between from 0 – 1.40 (Table 34). Redband trout density for the three sites from which redband trout were sampled averaged 1.2 trout/100 m^2 of stream and was similar across sites where redband trout were found (Table 34). Similar to the 1995 surveys, Site #61 again had the lowest density of redband trout across the four sites surveyed. Overall, redband trout density was slightly higher compared to the 1995 estimates. However, direct comparisons are inappropriate given the differences in sampling methods used between the two time periods.

As Allen et al. (1998) previously reported for these sites, very few juvenile redband trout were observed. The mean total length ranged from 187 – 212 mm, which is very similar to those reported from the 1995 electrofishing surveys (Table 34). Of the 33 redband trout observed, 55% (18) were over 200 mm in total length, while none were less than 120 mm. The largest redband trout (290 mm) was seen at Site #61,

No non-native trout or smallmouth bass were observed in this subset of sites. In addition, six native species were sampled during these stream surveys including chiselmouth *Acrocheilus alutaceus*, northern pikeminnow *Ptychocheilus oregonensis,* redside shiner *Richardsonius balteatus,* mountain whitefish *Prosopium williamsoni,* largescale sucker *Catostomus macrocheilus,* and sculpin *Cottus spp.*

DISCUSSION

For the small number of sites sampled during 2012, presence of redband trout was similar to past surveys. Redband trout were seen at 3 of 4 sites, and likely existed at all sites but were not collected likely due to equipment problems. More redband trout were noted during 2012 surveys than those previously done in 1995. Previous sampling used depletion electrofishing to estimate total abundance by site, whereas the 2012 surveys relied on a total count by snorkeling. Both methods are estimates, but we were not able to estimate our bias in snorkeling without comparison to another (presumably) more reliable method.

Currently, there are only four established monitoring sites on the Bruneau River. While this is only a small sub-set of the sites that will be sampled across the range of redband trout, more sites should be added to the Bruneau River. Future sampling should include sites further upstream in the Bruneau River to document abundance trends higher in the drainage. Documenting the upstream range (within Idaho) will also help future management and conservation efforts if more information about redband trout distribution is available.

Table 33. Site name, location and description of four redband trout monitoring sites sampled in 2012.

Site	Location (NAD83)	Site length (m)	Description
Bruneau R. #60	42.32731 N 115.65335 W	100	Above Jarbidge R.
Bruneau R. #61	42.14467 N 115.67110 W	120	Triguero Rd. access
Bruneau R. #62	42.07344 N 115.65085 W	120	Below Black Rock Crossing
Bruneau R. #63	42.05302 N 115.65064 W	120	Above Black Rock Crossing

Table 34. Total count, density, and mean total length of redband trout (#/100 m^2) sampled at four Bruneau River sites in 2012 and 1995.

Year	Site	Site length (m)	Method	RBT count	RBT dens. (fish/100 m^2)	RBT length (mm)
2012	Bruneau R. #60	100	Electrofishing	0*	0*	-
	Bruneau R. #61	120	Snorkel	13	1.40	212
	Bruneau R. #62	120	Snorkel	9	0.97	209
	Bruneau R. #63	120	Snorkel	11	1.30	187
1995	Bruneau R. #60	100	Electrofishing	9 ± 3	0.89	185
	Bruneau R. #61	105	Electrofishing	4 ± 2	0.48	163
	Bruneau R. #62	86	Electrofishing	6	0.81	231
	Bruneau R. #63	100	Electrofishing	8 ± 2	0.83	194

* Because of equipment problems, only 1 backpack unit was used. This was very inefficient given the size of the stream, limiting our ability to detect RBT present.

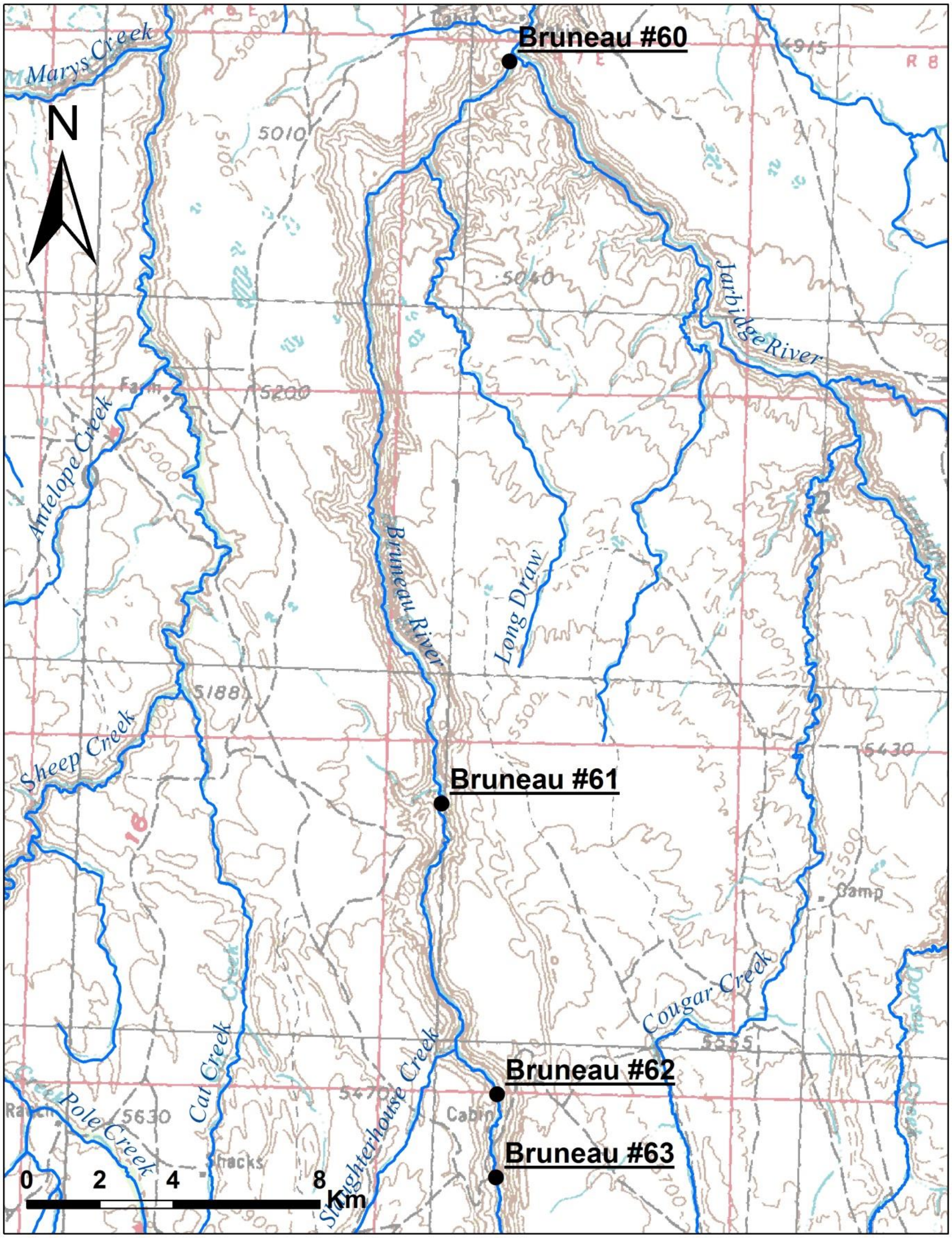

Figure 44. Map of monitoring sites sampled in the Bruneau drainage to assess redband trout populations in 2012.

SOUTH FORK BOISE RIVER ELECTROFISHING SURVEY

ABSTRACT

We used mark-recapture techniques in the South Fork Boise River (SFBR) to estimate abundance of trout in each section and mountain whitefish in the upper section in October 2012. A total of 798 rainbow trout *Oncorhynchus mykiss* were collected during both mark and recapture runs. Fish lengths ranged from 82-550 mm and multiple modes were observed within the length distributions. During marking efforts, we captured 495 wild rainbow trout greater than 100 mm in the three sections combined. We marked 494 rainbow trout during the marking run and sampled 303 fish during the recapture run, of which, 58 were marked. Rainbow trout density was estimated at 1,099 rainbow trout/km for the overall 9.6 km reaches. Rainbow trout densities and size structures in the SFBR have been relatively stable from 2006-2012. The numbers of trout greater than 400 mm are currently providing an excellent fishery despite the relative lack of smaller trout in the survey section. The canyon section below Danskin Bridge was sampled on July 30, 2012. A total of 11 transects were sampled between Danskin and Neal bridges during the 1-day survey. We captured 123 wild rainbow trout with a size range of 150 to 470 mm and a mean length of 343 mm. Comparison of length frequencies between the 2012 tailwater and canyon sections show a greater proportion of mid-sized rainbow trout between 200 and 450 mm in the canyon section as was observed in 2008.

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INTRODUCTION

The South Fork Boise River below Anderson Ranch Dam (SFBR) is a highly valued trout fishery and was the first river section in Southwest Idaho to be managed under "Quality Trout" regulations. Regulations restrict terminal tackle to no bait and barbless hooks from Neal Bridge (Forest Road 189) upstream to Anderson Ranch Dam. Rainbow trout harvest is restricted to 2 fish, none under 20 inches. The fishery is supported by a population of wild rainbow trout *Oncorhynchus mykiss* and mountain whitefish *Prosopium williamsoni*. Migratory bull trout *Salvelinus confluentus* are present at very low densities, and native non-game fish include largescale suckers *Catostomus macrocheilus*, northern pikeminnow *Ptychocheilus oregonensis* and sculpin *Cottus sp*.

The SFBR between Anderson Ranch Dam to the confluence of Arrowrock Reservoir is divided into two recreational sections: 1) the tailwater section, approximately 16 km long, runs from Anderson Ranch Dam downstream to Danskin bridge, and 2) the canyon section, approximately 27 km long, runs from Danskin Bridge downstream to Neal Bridge (Figure 49). The tailwater section has a public road and access along the entire reach and receives more angling pressure. It is also a popular destination for drift-boat fishing. The canyon section has extremely limited access by foot or road because of the high canyon walls and is accessible mostly by raft due to the Class II and III rapids in the section.

In 2006, sampling methodologies for the tailwater section were changed from raft electrofishing to canoe electrofishing in order to increase sampling efficiency and obtain better population estimates. In addition, 3 sections that were approximately 1-km long were identified within the historic surveys' boundaries for sampling. Kozfkay et al. (2010) demonstrated a pronounced increase in electrofishing efficiency for all size groups of rainbow trout resulting from the shift in sampling methodologies.

From 1994 to 2006, rainbow trout population trends in the tailwater section suggested decreasing abundance, an increase in size, and a relative lack of intermediate-size (200-400 mm) fish. Size distribution 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 recruitment is not a limiting factor in the population.

In 2008, IDFG surveyed the canyon section to compare wild rainbow trout size distribution to the tailrace section, and to establish trend reaches in the canyon for semi-annual monitoring. Because of the difficult access and whitewater conditions, there had not been a documented attempt to assess fish populations within the canyon section prior to this event. Results suggested that size classes of rainbow trout between 200-400 mm were more abundant downstream in the canyon section versus the upstream tailwater section (Kozfkay 2009). It was recommended after that sampling period to repeat the survey during the same year as the tailwater sections when possible.

METHODS

From 1994 to 2004, SFBR rainbow trout populations were monitored using a mark-recapture survey in a 9.6 km section every three years with raft mounted electrofishing gear.

However it was determined that better population estimates could be attained sampling smaller sections more intensively with a canoe and mobile anode setup (Kozfkay et al 2009). Therefore since 2006, rainbow trout populations in the SFBR have been monitored in three approximately 1-km sections every three years (Figure 45). The current three stream reaches are located within the boundaries of the original reach. Kozfkay et al. (2009) describes the location of the stream reaches within the old survey boundaries. Riffles formed the upper and lower reach boundaries. Section length was determined from 1:24,000 topographic maps. Wetted widths were measured with a hand-held laser range finder (Leupold RX series). Section area was estimated by multiplying mean widths and section 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 in each section and mountain whitefish in the upper section. 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. The canoe served as the cathode and carried the generator, Midwest Lake Electrofishing Systems (MLES) Infinity electrofisher, and a live well for holding fish. Oxygen was introduced to the live well (2 L/minute) 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 an power output of 3,200-3,400 watts. Crews consisted of seven to nine 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 live well.

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 live well. When the live well was judged to be at capacity the crew stopped at the nearest riffle to process fish.

Rainbow trout and bull trout were marked in all three sections on October 13-14, 2012. Whitefish were only marked in the upper section. 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. Only fish larger than 100 mm were marked. Fish were measured for total length (mm) and a subset was weighed (g). Fish were released 50 to 100 m upstream from the processing site to prevent them from drifting downstream into the next section of water to be sampled. Recapture sampling was completed on October 19-20, 2012. During the recapture effort, all whitefish and trout greater than 100 mm were captured and placed in the live well. Fish were examined for marks on the caudal fin. All fish were measured for length (mm).

Fisheries Analysis + (FA+), software developed by Montana Fish, Wildlife, & Parks, was used to generate mark-recapture and electrofishing efficiency estimates (MFWP 2004). To account for selectivity of electrofishing gear population estimates (N) were calculated using a maximum likelihood estimation to fit the recapture data. A capture probability function of the form

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

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/km for comparison to previous surveys. Observed mortalities during the marking run were recorded excluded from the population estimates.

Proportional stock density (PSD) indices were calculated using the equation from Anderson (1976) with rainbow trout values from Anderson and Neumann (1996).

*PSD = [Rainbow trout ≥ 400 mm / Rainbow trout ≥ 250 mm] * 100*

Canyon Reach Survey

A raft mounted with electrofishing gear was used to collect fish and estimate size structure in the canyon section during July 30, 2012. Sample sites corresponded to previously sampling efforts in 2008 (Butts et al. 2009) but instead of taking two days to complete, the 2012 survey was completed in a single day (Figure 46). Beginning and ending transect coordinates were recorded for each sampling reach using a Garmin Global Positioning System (GPS). In one case, the canyon walls prohibited the GPS unit from communicating with satellites and the coordinates were estimated afterwards with topographic software. Electrofishing equipment included a raft, generator, MLES Infinity electrofisher, and two booms each supporting a 76-cm ring from which eight dropper anodes were suspended, and 11 m of 0.95-cm, diameter stainless steel cable served as a cathode. Frequency was set at 25-30 pulses per second with a power output of 3200-3400 watts. Electrofishing was conducted with a single pass from upstream to downstream. One person rowed the raft and one person attempted to capture all trout. Only trout and whitefish were placed in the livewell. In addition, one raft carried a crew to process and record information collected from captured fish. Upon completion of a section, or when the livewell was judged to be at capacity, the crew stopped at the nearest riffle to process fish. Fish were identified and measured for total length (mm). River flow during electrofishing was approximately 51 m^3/s which was identical to the July 19-20, 2008 survey.

Fry Monitoring

Rainbow trout fry were monitored using a Smith Root Type VII backpack shocker in six sections of the SFBR on October 30, 2012 (Figure 45). Four of the 33-m sections 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 artificial red monitoring sites that were being monitored by BOR. 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 density estimates and lengths were compared to those collected in previous years.

RESULTS AND DISCUSSION

A total of 798 rainbow trout were collected during both mark and recapture runs. Fish lengths ranged from 82-550 mm and multiple modes were observed within the length distributions (Figure 47). During marking efforts, we captured 495 wild rainbow trout greater than 100 mm in the three sections combined. We marked 494 rainbow trout and recaptured 58 of the marked fish. Rainbow trout density was estimated at 1,099 trout/km for the overall 9.6 km reach (Figure 48). During the two previous surveys, estimated rainbow trout densities were 870 trout/km in 2009 and 705 trout/km in 2006 in the combined reaches.

Rainbow trout density estimates were similar between reaches, except for the middle reach, which has been historically problematic (Figure 48). As in previous years, low numbers of recaptured rainbow trout (n=9) influenced the population estimate for the middle reach. This reach also includes a number of deep runs where wading is not possible. Sampling in these stretches consists of attempting to herd fish to the bottom of the runs; however, many fish are likely escaping capture in these areas.

Over the last 12 years, large rainbow trout in the SFBR has increased as indexed by PSD, from 58 in 2000 to a high of 72 in 2009. In 2012, the PSD decreased somewhat to 64 due to the increased numbers of medium-sized fish between 300-400 mm. Since 2000, the proportion of rainbow trout between 102-230 mm (4-9 in.) has increased with every sampling event, from 17% in 2000 to 49% in 2009. However, in 2012, this length group declined to 42% (Figure 49). In contrast, the proportion of fish >406 mm (16 in) increased with each event, from 33% in 2009 to 36% in 2012. The number of fish exceeding 508 mm (20 in.) has remained stable at 3% between 2009-2012 but is still 10% lower than what was observed in 2006.

Mountain whitefish were only collected in the upper section in 2012 to provide trend information. A total of 539 whitefish were collected ranging between 100-570 mm and length distributions were similar between 2006-2012, though the mode of 390 mm was much more pronounced (Figure 50). We marked 355 mountain whitefish and recaptured 67 of the marked fish. Mountain whitefish has also shown to be quite stable between the sampling periods where 1,092 fish/km were estimated for the upper section in 2012 (Figure 48).

We captured 15 bull trout within the combined reaches. Bull trout ranged from 340-510 mm, and the mean size was 448 mm (Figure 51). Ten fish were marked and two was recaptured but sample size was too small to provide valuable estimates of population size or density.

In 2006, the electrofishing gear changed from raft electrofishing with mounted anodes to canoe electrofishing with mobile anodes vastly increased sampling efficiency for smaller fish compared to previous efforts with raft electrofishing (Kozfkay 2009). In 2012, IDFG Southwest Region personnel obtained a new electrofisher, 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. Efficiency curves calculated for the 2006-2012 surveys show that capture efficiency has varied between the three surveys and that the addition of a third probe and new electrofisher has increased capture efficiency of rainbow trout ≥325 mm (Figure 52). Interestingly, the ability to capture fish between 100-300 mm has varied substantially between surveys. Despite an additional anode, efficiency was lower in 2012 than in 2009 for fish between 100-300 mm. Furthermore, efficiency was dramatically different between 2006 and 2012 for this same size group, despite the same electrofisher and anode setup. The variation in efficiency for smaller fish could be due in part to differences in how intensely individual anode operators were sampling shoreline areas. It may also be related to the number of netters per anode. Both possible issues suggest areas to revisit to further standardize surveys in order to reduce variability in estimates.

Rainbow trout densities and size structure in the SFBR have been relatively stable from 2006-2012. The numbers of trout greater than 400 mm are currently providing an excellent fishery despite the relative lack of smaller trout in the survey section. Despite angler concerns over the atypical size distribution observed in the tailwater section, 2008 and 2012 electrofishing in the canyon section has suggested that rainbow trout between 250-400 mm were present in higher proportions downstream (Kozfkay et al. 2010).

Canyon Reach Survey

A total of 11 transects were sampled between Danskin and Neal bridges during the 1-day survey. We captured 123 wild rainbow trout (Table 35) with a size range of 150 to 470 mm and a mean length of 343 mm (Figure 53). Comparison of length frequencies between the 2012 tailwater and canyon sections show a greater proportion of mid-sized rainbow trout between 200 and 450 mm in the canyon section as was observed in 2008 (Figure 53; Kozfkay 2009). However, proportion of rainbow trout <180 mm and >480 mm were also much higher in the tailwater section. Length frequencies and current knowledge of available spawning habitats suggest that spawning and early rearing occurs in the tailwater section and tributaries above Danksin Bridge. It also appears that once fish reach 180 mm, many may be dropping downstream into the canyon section. This suggests possible segregation based on size or habitat. However, comparing relative abundance between the two sections for rainbow trout <180 mm is problematic because of the differences in sampling efficiencies for smaller fish between the two sampling methods. Rainbow trout <180 mm are generally found in shallow near-shore habitats with less flow which are less likely to be sampled efficiently by the raft gear. Additionally, electrofishing is size-selective for larger individuals and without correction, often results in biased estimators of population size and size structure for smaller and slower growing individuals (Anderson 1995). Overall, raft electrofishing is less efficient for all size classes as the ability to capture fish is decreased by the limited mobility of the anodes and netter and by the inability to shock both banks. A total of 153 mountain whitefish were also captured (range = 180-520 mm; Figure 53). Mountain whitefish length distributions were similar between the two sections although a greater proportion of fish >400 mm were captured in the canyon section.

Fry monitoring

We collected 340 rainbow trout fry among the four sections ranging between 25-77 mm. As in previous years, most of the fish were in section 4 (43%), directly above Cow Creek bridge, and section 2 (36%). IDFG estimated overall mean fry density to be 2.3 ± 2 fish / m in October 2012 (Figure 54). Fry density appears to be rather stable since 1996, ranging from 2.2 ± 0.7 fish/m in 1996 to 3.1 ± 3.4 fish/m in 2009. Though conclusions may be limited from 4 years of data spaced 16 years apart, fry monitoring may provide valuable information on recruitment and survival if implemented on an annual basis. These baselines may be particularly important as IDFG, in cooperation with BOR and Trout Unlimited (TU) study stranding issues during declining flows in the fall.

MANAGEMENT RECOMMENDATIONS

1. Continue to monitor rainbow trout population trends in the tailwater (roaded) section on 3 year intervals or less. However consider replacing the middle section with a more suitable site for sampling methodology.

2. Continue to monitor the downstream canyon section and examine the possibility of pit-tagging smaller fish to see if they migrate upstream to the tailwater section as they grow.

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

Table 35. Transect lengths and number captured by fish species during the July 30, 2012 electrofishing survey of the canyon section of the South Fork Boise River between Danskin and Neal bridges. Transects were established in 2008 and lengths were estimated from start and end GPS coordinates and transect site descriptions.

Transect	Transect length (km)	Mountain whitefish	Rainbow trout	Bull trout	Kokanee	Total
Transect 1	0.7	13	6	-	-	19
Transect 2	0.7	9	5	-	-	14
Transect 3	1.3	22	12	-	1	35
Transect 4	0.5	11	13	1	-	25
Transect 5	1.6	29	23	-	-	52
Transect 6	0.9	19	9	-	-	28
Transect 7	0.8	18	18	-	-	36
Transect 8	0.5	2	4	-	-	6
Transect 9	0.7	10	3	-	-	13
Transect 10	1	3	5	-	-	8
Transect 11	1.3	17	25	-	-	43
Total	10	153	123	1	1	279

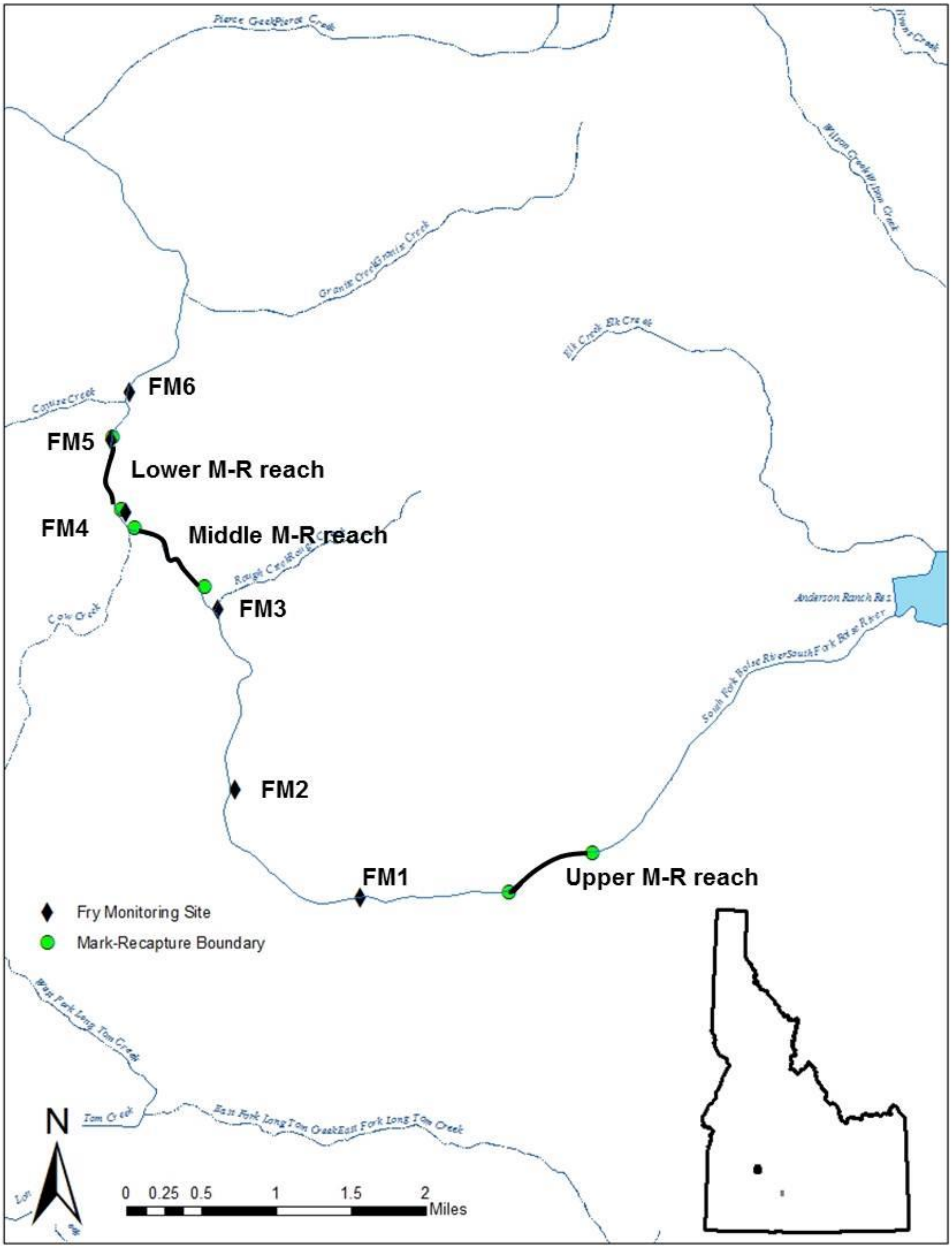

Figure 45. Map of South Fork Boise River, Idaho tailwater section showing location of 2012 mark-recapture section boundaries and fry monitoring sites.

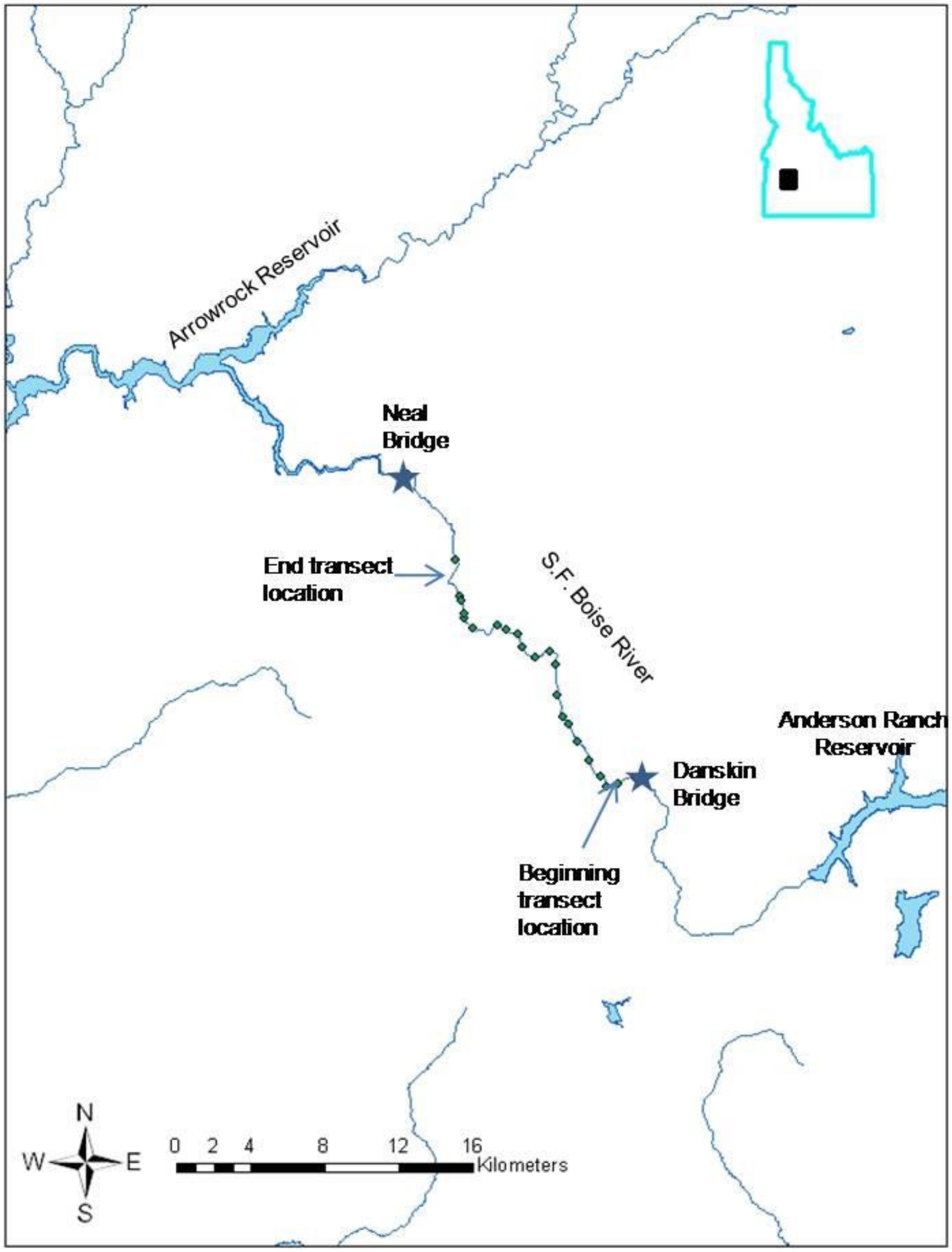

Figure 46. Map of South Fork Boise River, Idaho canyon section showing location of 2012 canyon electrofishing reach boundaries.

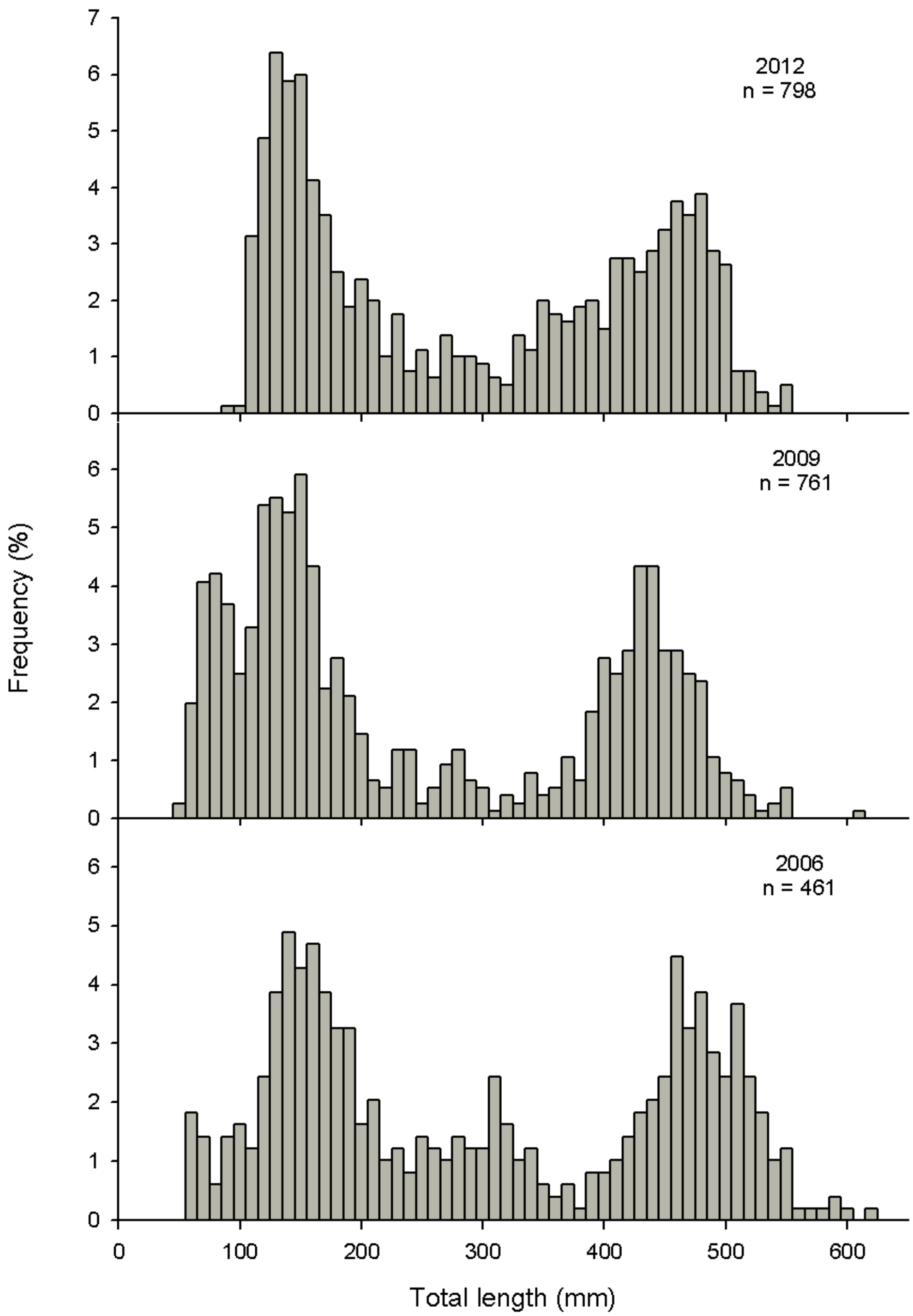

Figure 47. Length distributions of rainbow trout, calculated as proportion of total catch, during population surveys at the South Fork Boise River below Anderson Ranch Dam between 2006-2009. Only trout larger than 100 mm are included in population estimates.

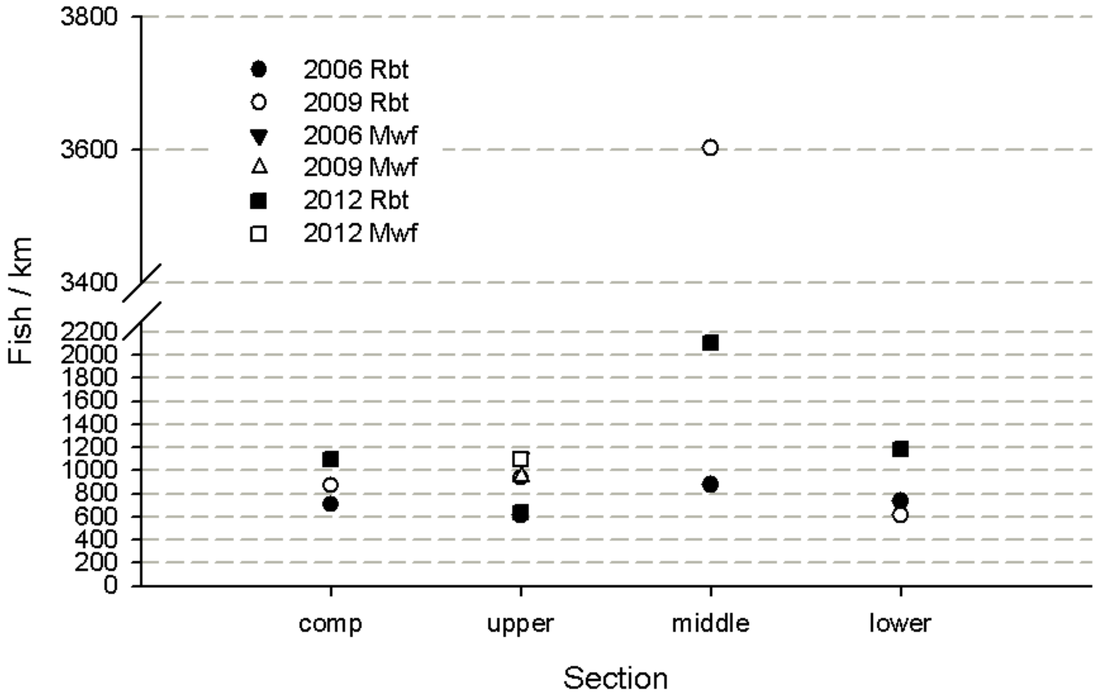

Figure 48. Linear density estimates for rainbow trout (>100mm) by reach for the South Fork Boise River in 2009 from maximum likelihood estimation. Comp is the estimate from pooling the data from all three reaches.

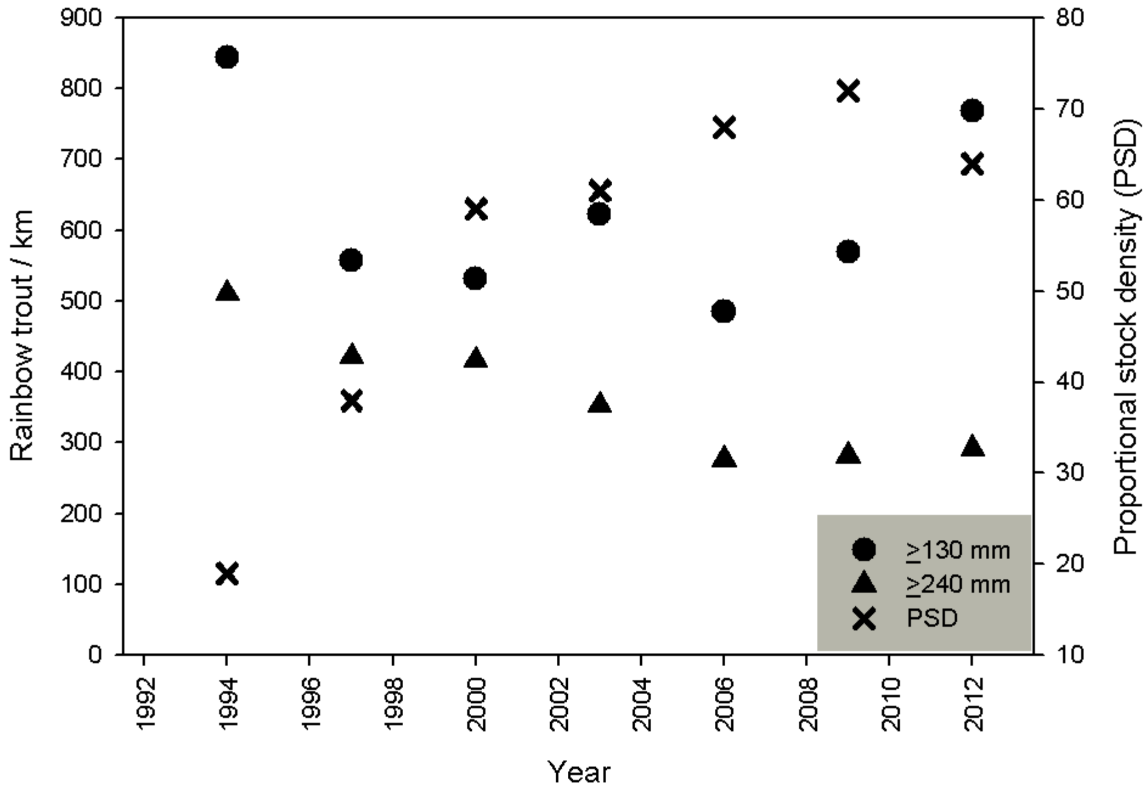

Figure 49. Linear density and Proportional Stock Density (PSD) for rainbow trout on the South Fork Boise River downstream from Andersen Ranch Dam between 1994 and 2012. Estimates were for rainbow trout ≥130 mm and ≥240 mm.

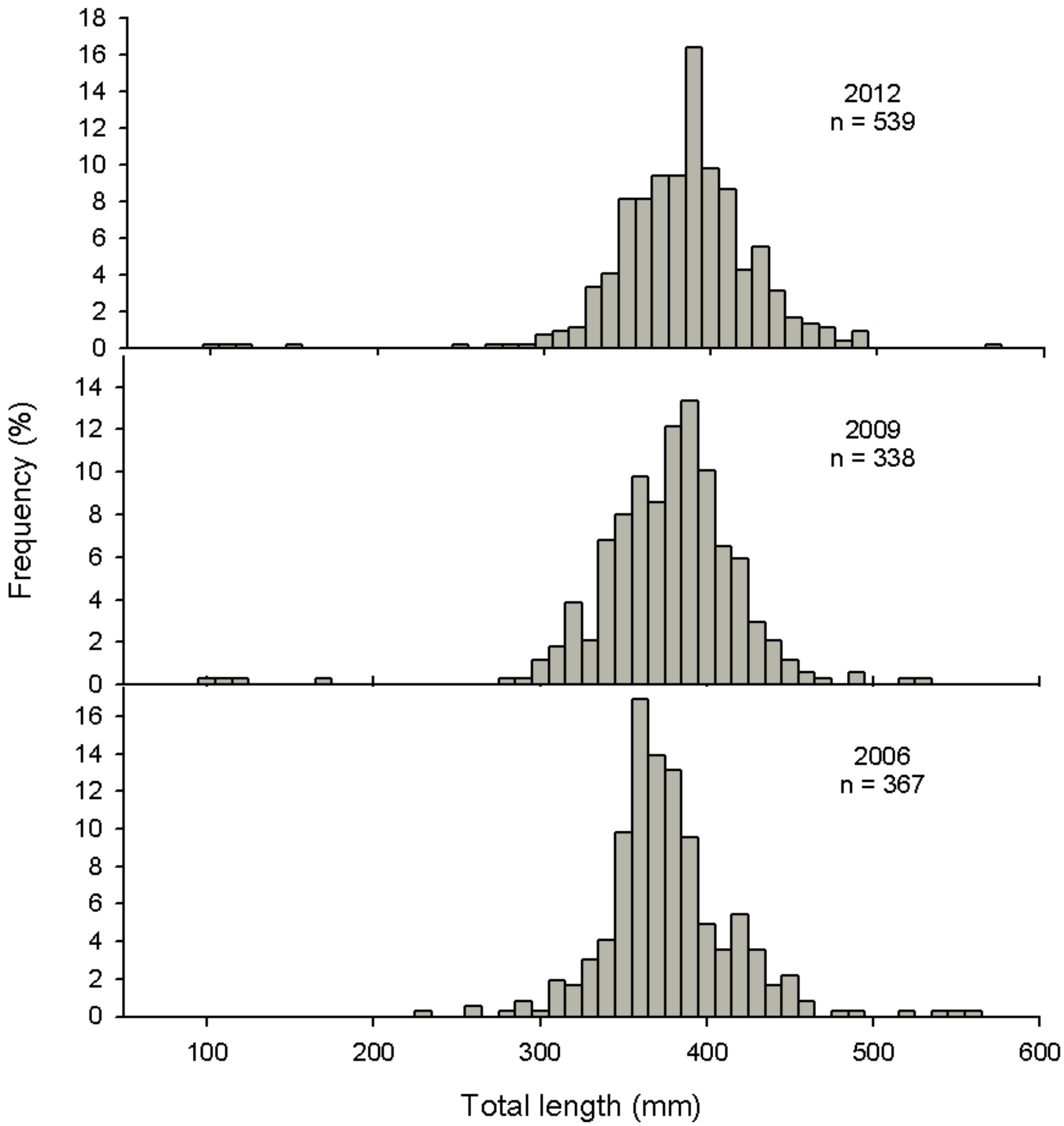

Figure 50. Length distributions of mountain whitefish, calculated as proportion of total catch, during population surveys at the South Fork Boise River below Anderson Ranch Dam in 2006-2012. Only whitefish larger than 100 mm are included.

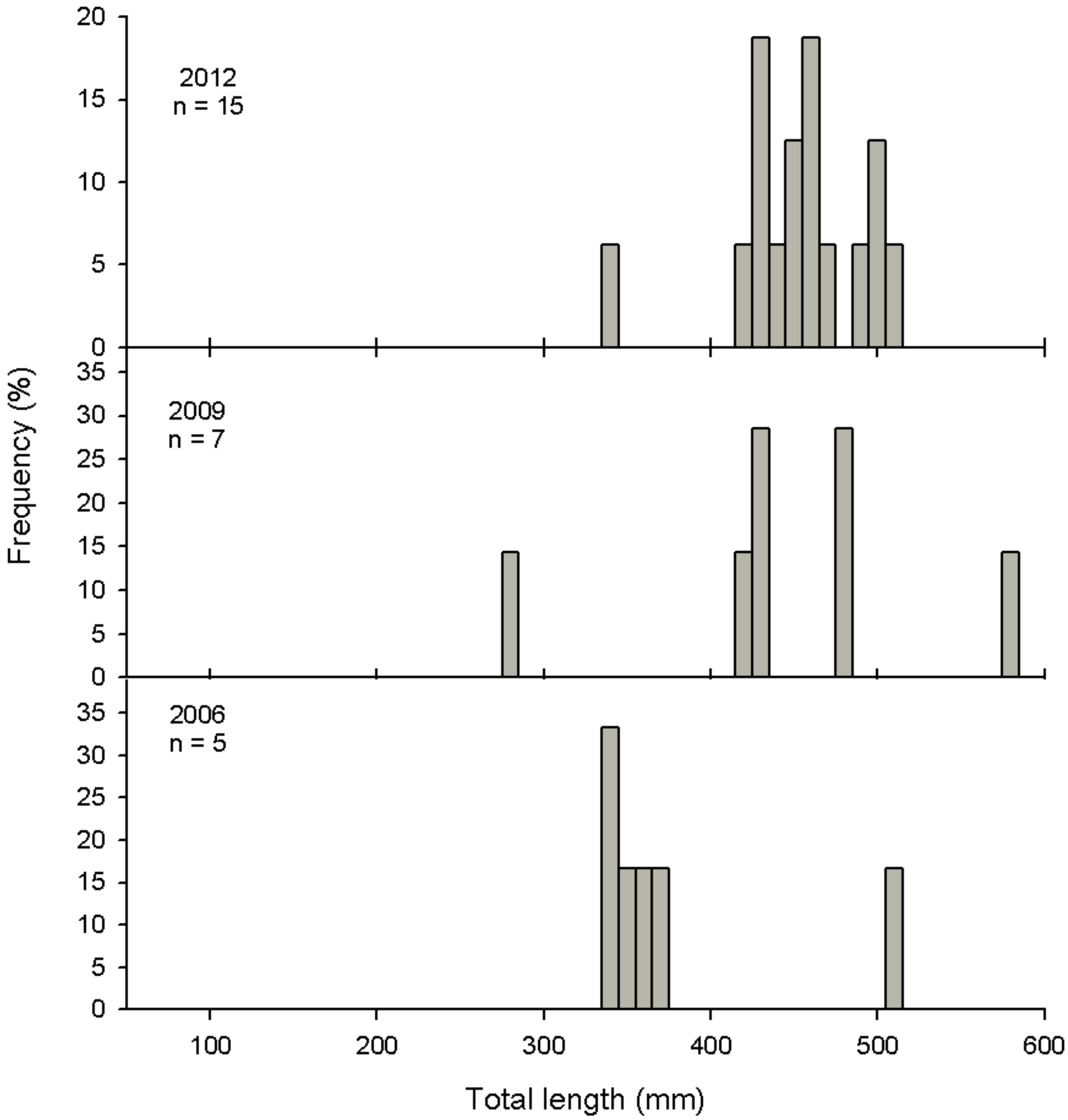

Figure 51. Length distributions of bull trout, calculated as proportion of total catch, during population surveys at the South Fork Boise River below Anderson Ranch Dam in 2006 and 2009.

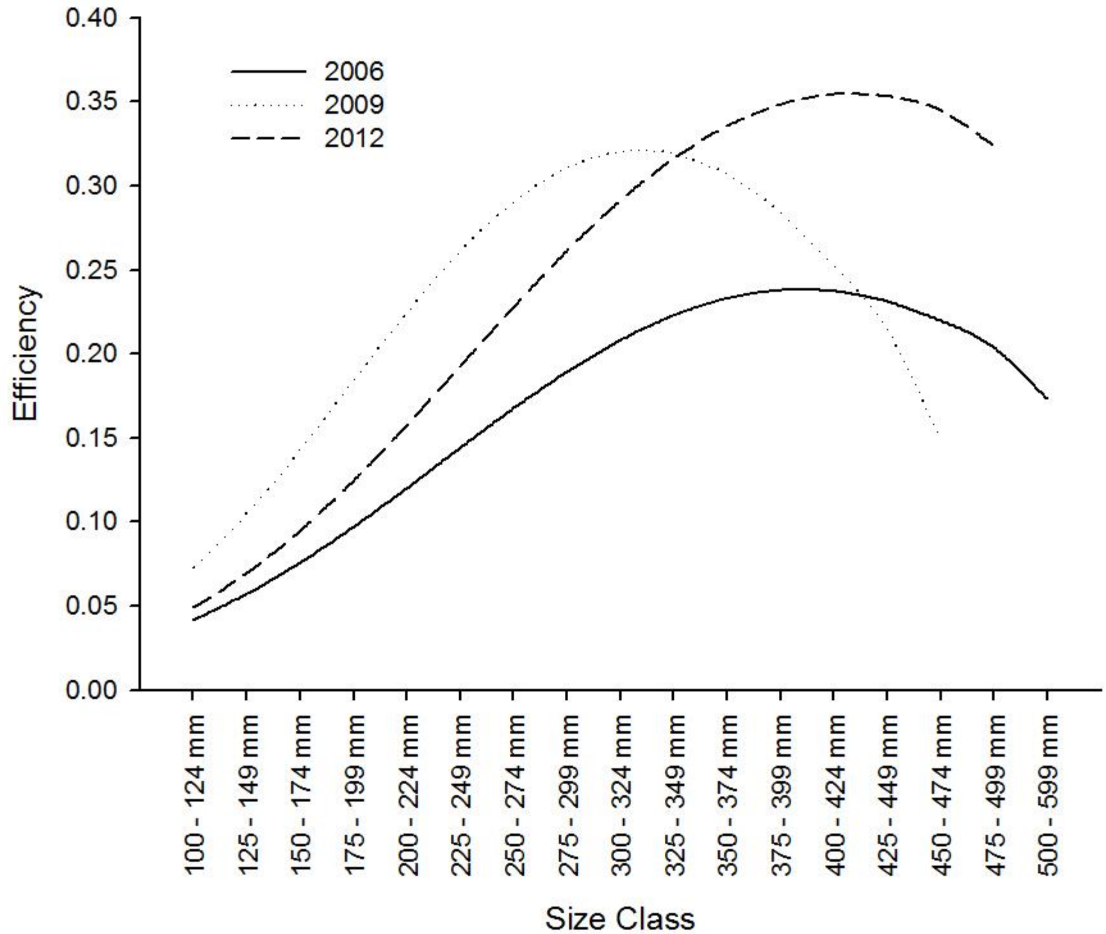

Figure 52. Capture efficiency curves for rainbow trout mark-recapture surveys on the South Fork Boise River downstream from Andersen Ranch Dam between 2006-2009 when two throw probes were used and 2012 when three throw probes were used.

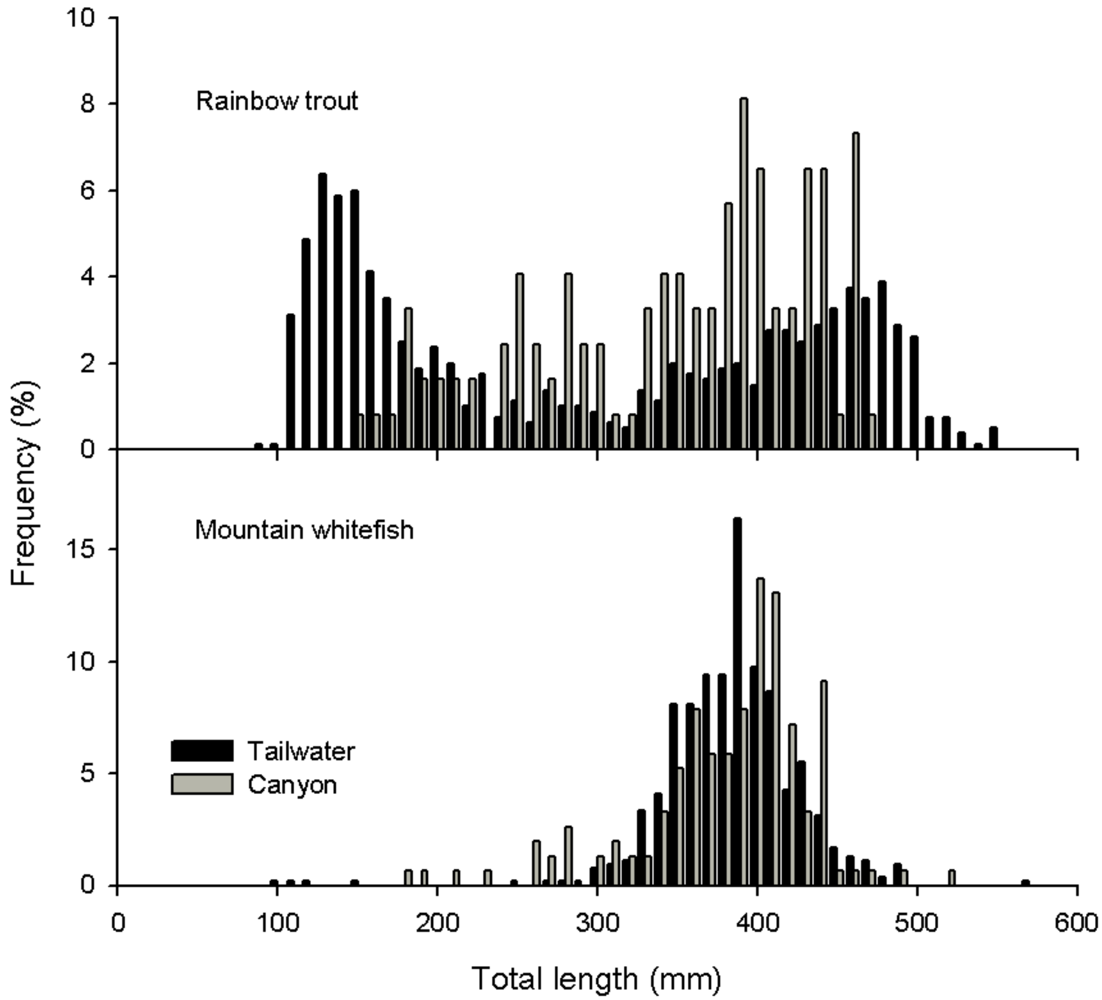

Figure 53. Length distributions of rainbow trout and mountain whitefish, calculated as proportion of total catch, during July 30, 2012 electrofishing survey in the canyon section of the South Fork Boise River between Danskin and Neal bridges and the tailwater section during October 13-20, 2012.

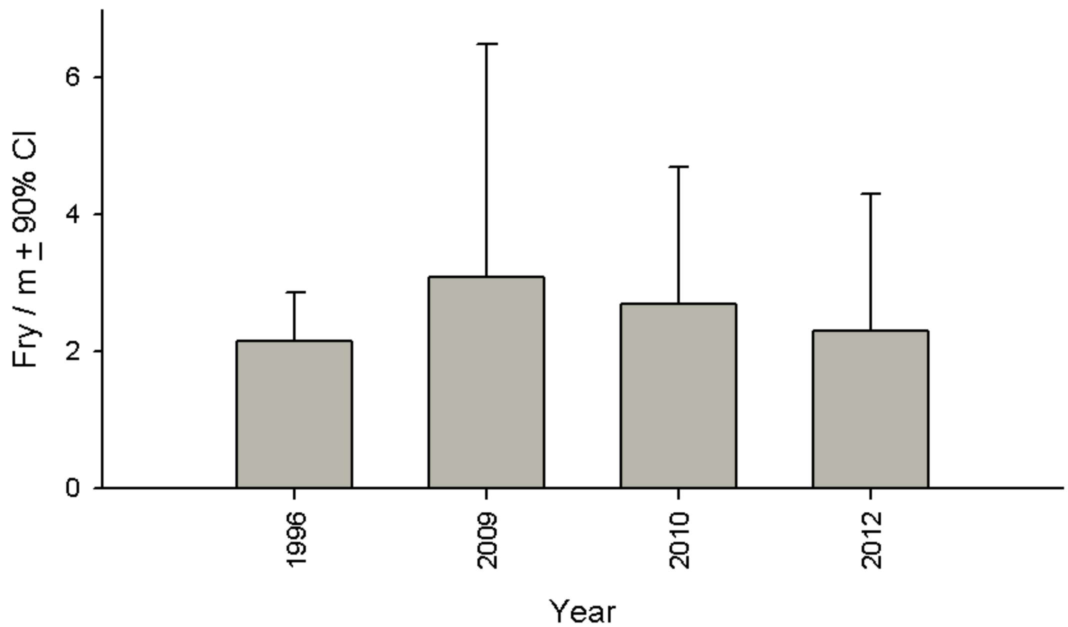

Figure 54. Comparison of mean rainbow trout fry linear density of fish collected at four 33-m long shoreline trend sections between 1996-2012 at the South Fork Boise River, Idaho.

UPPER MIDDLE FORK SALMON RIVER CHINOOK SALMON REDD COUNTS

ABSTRACT

Spawning ground surveys were conducted along 11 historical trend monitoring transects in Bear Valley, Elk, and Sulphur creeks from August 29 through 31, 2012 to index the abundance of wild Chinook salmon *Oncorhynchus tshawytscha.* In Bear Valley Creek, 259 redds were counted along six transects (Figure 31). While this count exceeded the 10-year average (155 redds) by 67%, it represent a 29% decline compared to the recent high of 2003 (364 redds) and a 62% decline from the highest counts ever noted during 1961 (675 redds). In Elk Creek, 238 redds were counted along three transects (Figure 31). These counts exceeded the 10-year average (168 redds) by 42%, but represented a 37% decline from the recent high of 2002 (377 redds), and a 64% decline from the historical high of 1961 (654 redds; Figure 35). In Sulphur Creek, 19 redds were counted along two transects during 2012. These counts were 57% lower than the 10-year average, and a 79% decline from the recent high of 2002 (93 redds; Figure 35), and a 95% decline from the historical high of 1957 (381 redds). Despite the brief recent increasing trend since 2004, total redd counts in this area are still much lower than the historical high of 1,440 redds counted within these streams during 1957 or the consistently high counts documented during the 1960s (only 10 transects were surveyed until 1988).

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INTRODUCTION

Tributaries of the upper Middle Fork Salmon River, including Bear Valley, Elk, and Sulphur creeks possess some of the best remaining spring/summer Chinook salmon *Oncorhynchus tshawytscha* spawning habitat in the Snake River basin. Idaho Department of Fish and Game (IDFG) has conducted annual spawning ground surveys on these streams since 1957 to enumerate the number of Chinook salmon redds, primarily, as an index of adult population abundance. Initially, surveys were conducted along fairly long transects (6-8 km) using aerial counts or, less often, on foot; however, beginning in about 1989, transects were split into shorter segments (3-4 km) and have been surveyed on foot annually during the last week of August (Hassemer 1993).

Despite the abundance of high quality spawning and juvenile rearing habitat, overall numbers of wild Chinook salmon have declined precipitously from highs observed during the late 1950 and 1960s. This led to federal listing of Snake River Chinook salmon as threatened under the Endangered Species Act in 1992. Since then, returning adult abundances have remained critically low, except for a three-year period from 2001-2003, when adult numbers rebounded temporarily. During 2004-2005, this trend reversed, and adult abundances returned to near historical low levels of the late 1990s.

OBJECTIVES

1. Index the abundance of returning wild adult Chinook salmon by counting redds within historical trend monitoring transects in Bear Valley, Elk, and Sulphur creeks.

2. Compare current redd count information to historical trend data.

METHODS

Spawning ground surveys were conducted along 11 historical trend monitoring transects in Bear Valley, Elk, and Sulphur creeks (Figure 30) from August 29 through 31, 2012. The timing of initial surveys conducted along Bear Valley, Elk, and Sulphur creeks was similar to past sampling dates, at a time when nearly all adult Chinook salmon had recently spawned.

All surveying techniques followed the protocol outlined by Hassemer (1992). Prior to conducting surveys, surveyors were required to attend an IDFG sponsored training session taught by experienced biologists. Afterwards, pairs of surveyors walked upstream through each transect. After locating a prospective redd site, surveyors determined and recorded whether a redd, multiple redds, or a test dig had been excavated. Redd locations were recorded with hand-held global positioning system units. For each site, surveyors also recorded the number of live and dead adult Chinook salmon observed, as well as their estimated age and sex. Biological samples were collected from salmon carcasses and provided to the Idaho Natural Production Monitoring and Evaluation Project. All survey data was entered and archived in the Spawning Ground Survey database.

RESULTS AND DISCUSSION

In Bear Valley Creek, a total of 259 redds were counted along six transects during 2012 surveys (Figure 55). While this count exceeded the 10-year average (155 redds) by 67%, it represent a 29% decline compared to the recent high of 2003 (364 redds) and a 62% decline from the highest counts ever noted during 1961 (675 redds). Despite remaining low compared to historical counts, redd counts along these six Bear Valley Creek transects show a consistent increasing trend across the last six years (Figure 56-58). As in previous years, redds in Bear Valley Creek were most concentrated (229 of the 259 total) in the three transects in the center portion of the survey area, bracketing the mouth of Elk Creek (WS-10a, WS-9d, WS-9c, Table 36; Figure 57). A total of 50 live adult Chinook salmon and 126 carcasses were observed.

In Elk Creek, a total of 238 redds were counted along three transects (Figure 59). These counts exceeded the 10-year average (168 redds) by 42%, but represented a 37% decline from the recent high of 2002 (377 redds), and a 64% decline from the historical high of 1961 (654 redds; Figure 59). The majority of redds in Elk Creek (n = 138) were concentrated in the most upstream monitoring sites, WS-11a. Similar to counts in 2011, redd numbers decreased in lower transects along Elk Creek (Table 36). A total of 36 live adult Chinook salmon and 138 carcasses were observed.

Unlike the increasing trends in Elk and Bear Valley creeks, redd counts in in Sulphur Creek declined in 2012. A total of 19 redds were counted along two transects during 2012, showing a 75% decline compared to 2011 (79 redds). For Sulphur Creek transects, these counts were 57% lower than the 10-year average, and a 79% decline from the recent high of 2002 (93 redds; Figure 60), and a 95% decline from the historical high of 1957 (381 redds). No live adult Chinook salmon were observed, and only three carcasses were observed (Table 36).

Over the three monitoring streams and 11 trend monitoring transects combined, a total of 516 redds were counted in 2012 (Figure 61). This total exceeds the 10-year average by 41% and is the highest total count since 2003 (n = 783; Figure 61). Despite the brief recent increasing trend since 2004, total redd counts in this area are still much lower than the historical high of 1,440 redds counted within these streams during 1957 or the consistently high counts documented during the 1960s (only 10 transects were surveyed until 1988). During this decade, cumulative counts in this area exceeded 770 redds in all years except 1965 when 536 redds were counted. Furthermore, total redd counts during 2012 were still 20% less than recent highs documented during 2001-2003, when cumulative counts averaged 643 redds for this period.

MANAGEMENT RECOMMENDATIONS

1. Continue monitoring the abundance of wild adult Chinook salmon by counting redds in Bear Valley, Elk, and Sulphur creeks.

2. Continue pursuing strategies to improve down river and ocean survival of these stocks.

Table 36. Total new redds counted by transect during 2012 Chinook salmon redd count trend surveys (8/29/12 – 8/31/12) in the upper Middle Fork Salmon River basin.

Waterbody	SGS Transect	2012 redds	Live fish	Carcasses	Previous 10 Yr Avg.
Bear Valley Creek	WS-10a	88	29	65	51
	WS-10b	6	2	10	8
	WS-9a	3	0	1	3
	WS-9b	21	1	5	10
	WS-9c	70	8	28	27
	WS-9d	71	10	17	56
Total		*259*	*50*	*126*	*155*
Elk Creek	WS-11a	138	10	100	83
	WS-11b	89	26	20	56
	WS-11c	11		18	29
Total		*238*	*36*	*138*	*168*
Sulphur Creek	OS-4	4	0	0	18
	WS-12	15	0	3	26
Total		*19*	*0*	*3*	*44*

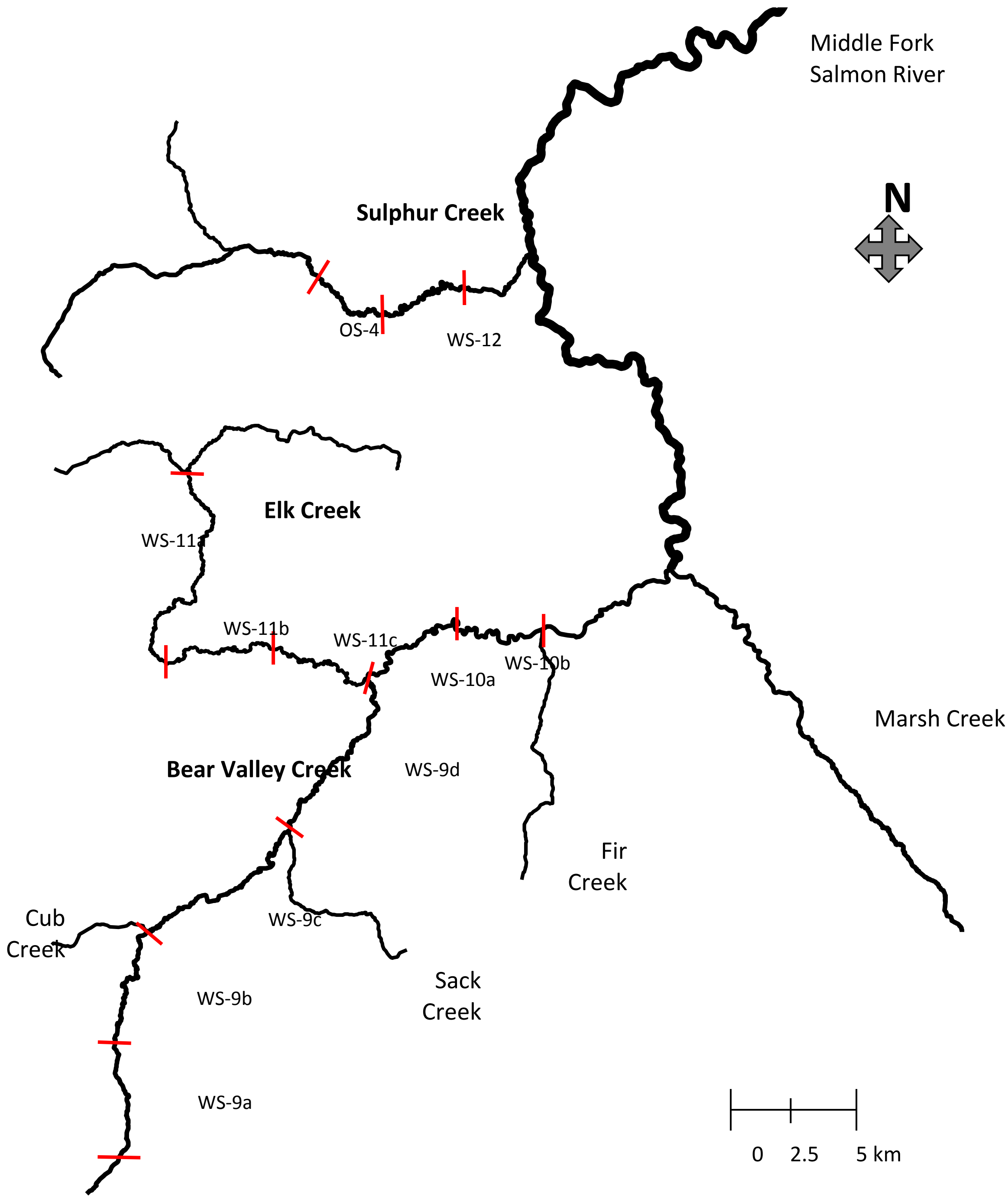

Figure 55. Location of 11 trend monitoring transects on Bear Valley, Elk, and, Sulphur creeks used to index the abundance of wild spring/summer-run Chinook salmon in the upper Middle Fork Salmon River Drainage, ID. Red lines denote transect boundaries.

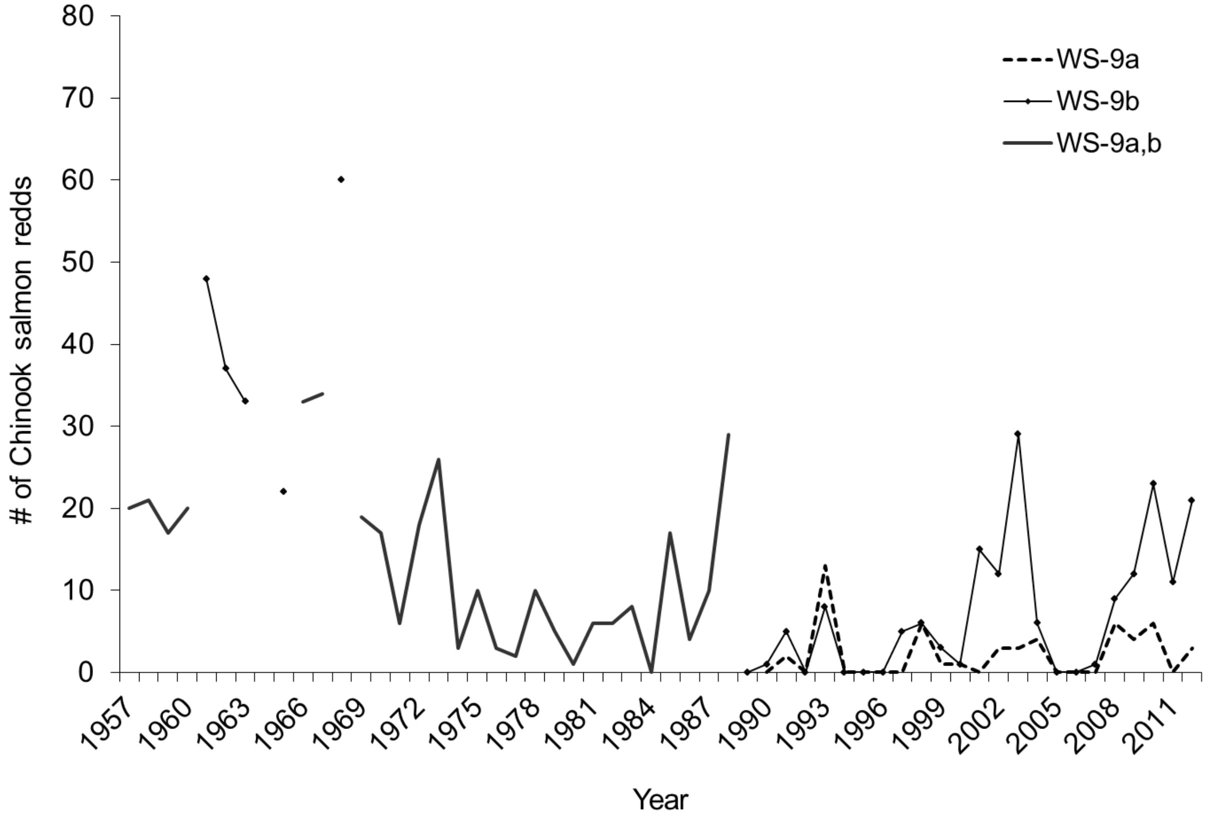

Figure 56. Number of Chinook salmon redds counted along upper Bear Valley Creek index transects from 1957-2012. The solid line represents a cumulative count for WS-9a & b that was monitored in most years from 1957 to 1989.

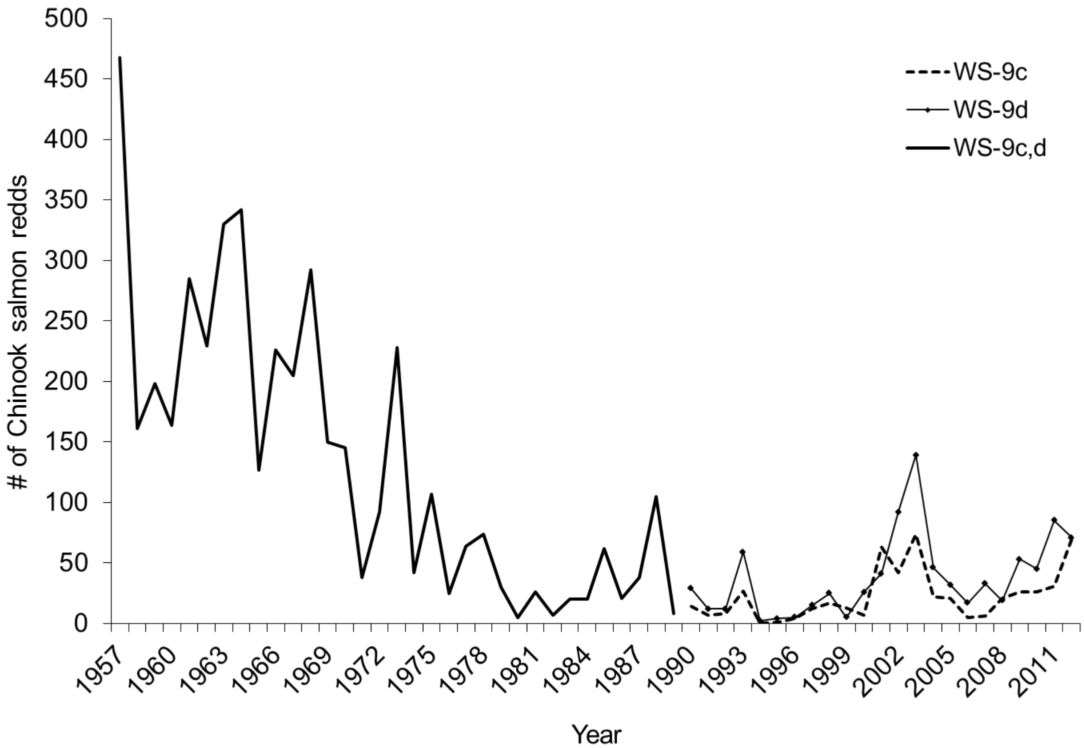

Figure 57. Number of Chinook salmon redds counted along middle Bear Valley Cr. Index transects from 1957-2012. The solid line represents cumulative counts for WS-9c and d.

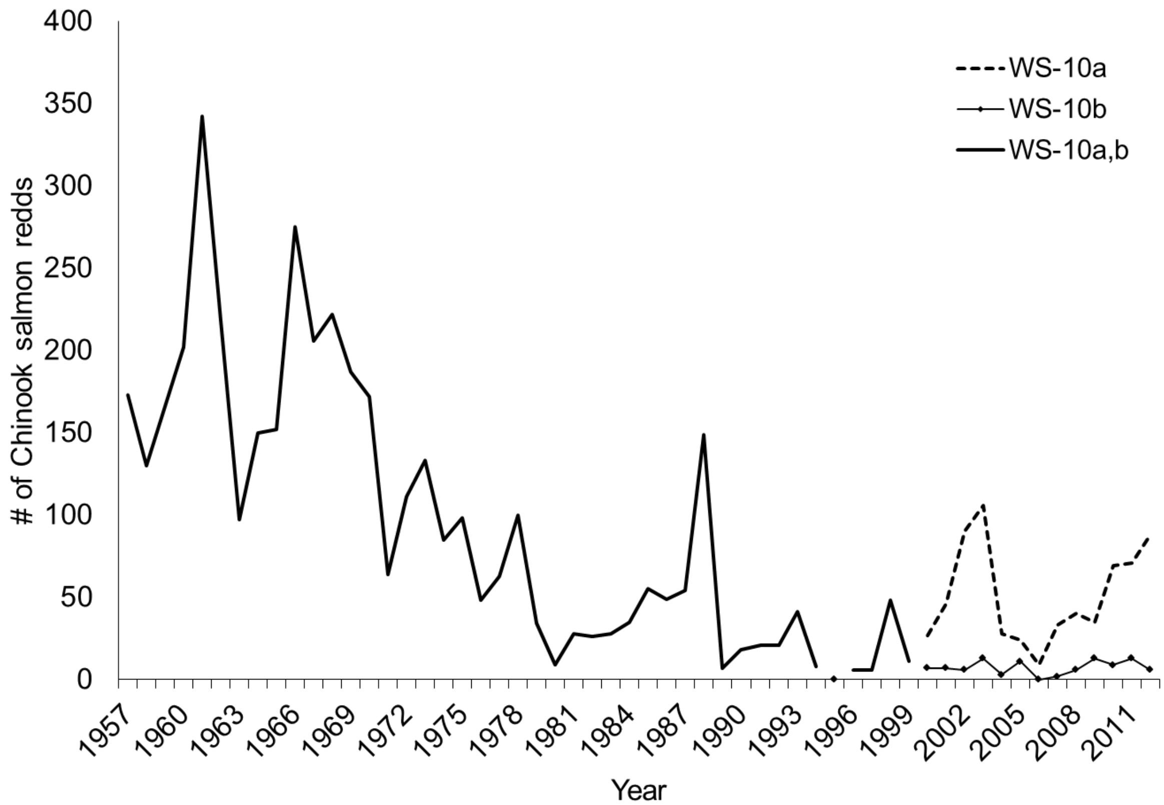

Figure 58. Number of Chinook salmon redds counted along lower Bear Valley Cr. index transects from 1957-2012. The solid line represents cumulative counts for WS-10a & b.

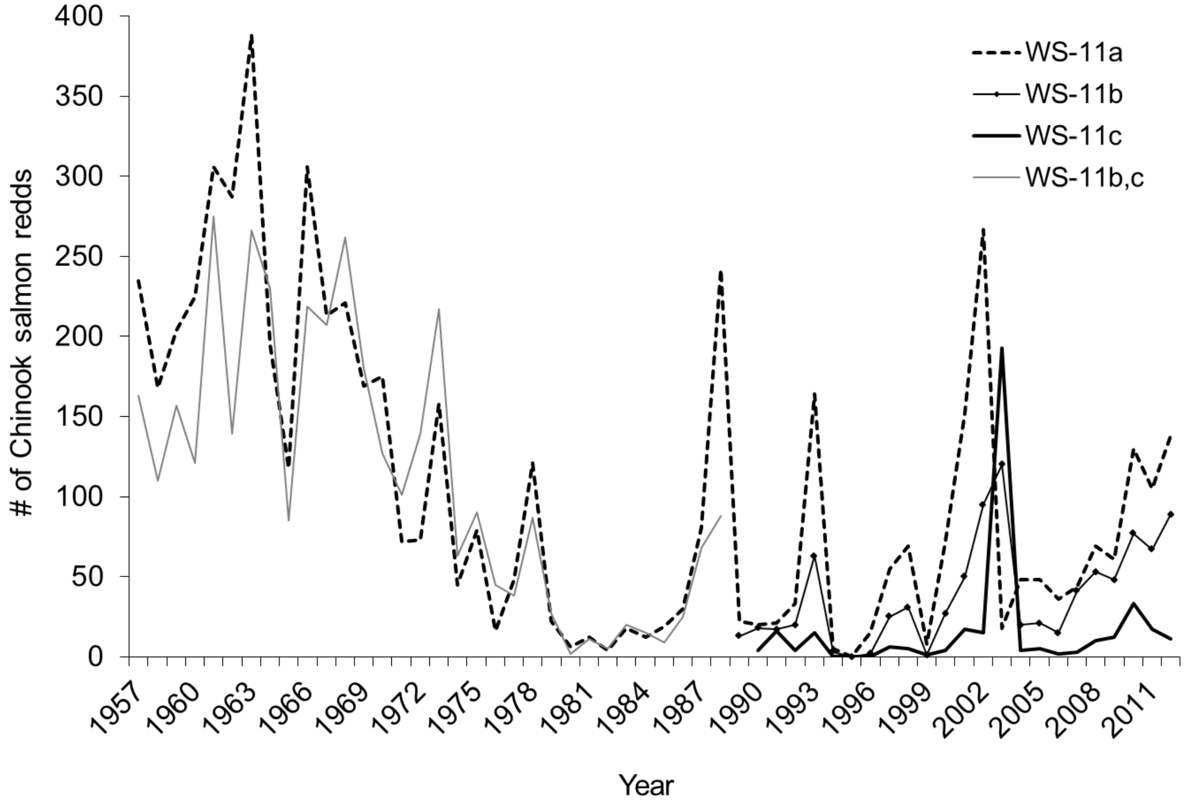

Figure 59. Number of Chinook salmon redds counted along Elk Creek index transects from 1957-2012. The solid line represents a cumulative count for WS-11b and WS-11c, whereas all other lines represent individual transects.

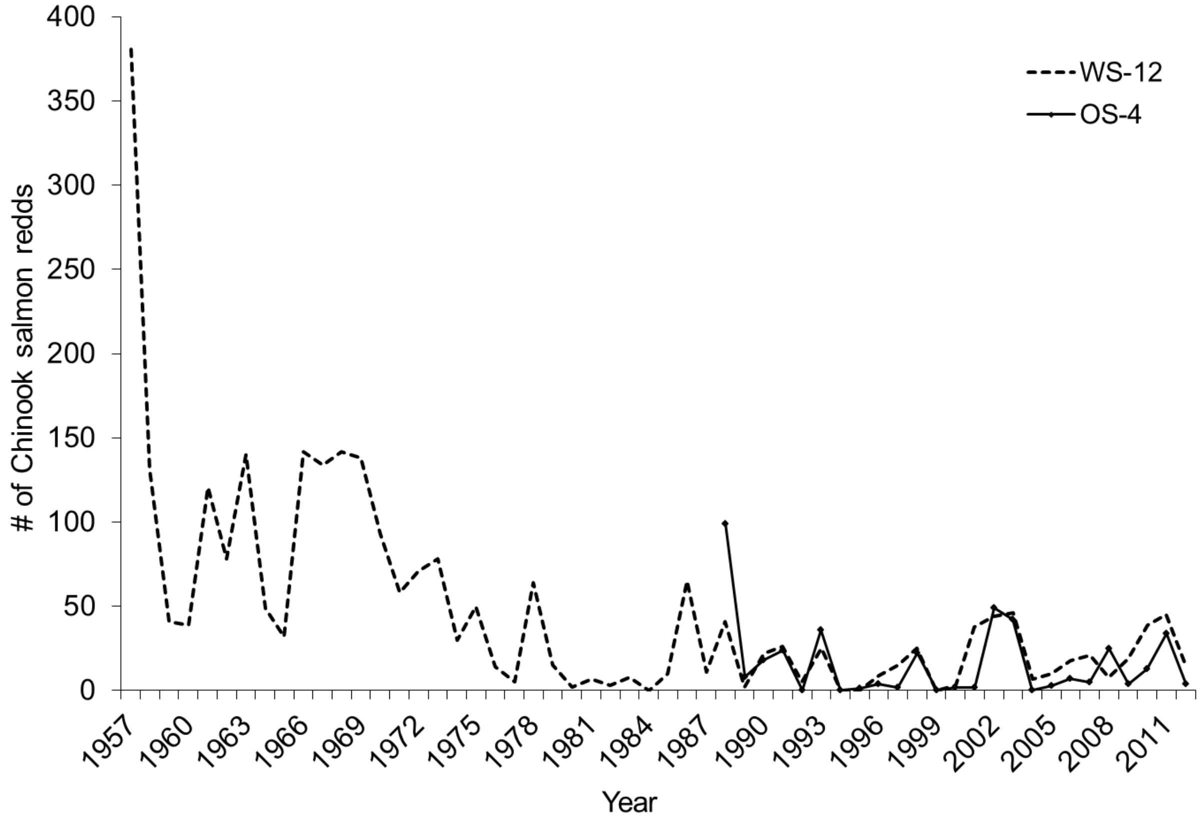

Figure 60. Number of Chinook salmon redds counted along Sulphur Creek index transects from 1957-2012.

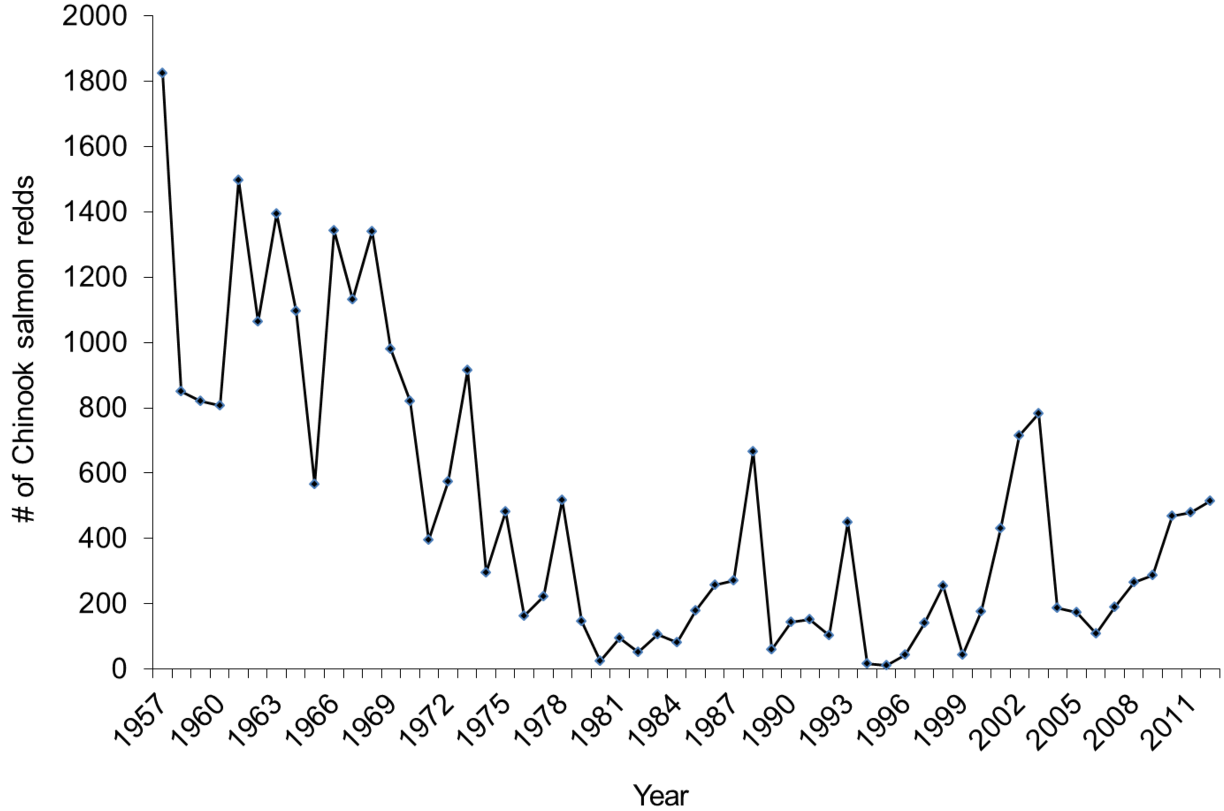

Figure 61. Cumulative number of Chinook salmon redds counted along 11 trend monitoring sites in Bear Valley, Elk, and Sulphur creeks from 1957 through 2011. Counts for the upper Sulphur Creek transect (OS-4) from 1957-1987 were estimated with linear regression techniques and data collected from 1988-2011.

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