FISHERY MANAGEMENT INVESTIGATIONS

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Paul J. Janssen, Regional Fishery Biologist
Jordan Messner, Regional Fishery Technician
Kim Apperson, Regional Fishery Biologist
Arthur Butts, Regional Fishery Biologist
Melo Maiolie, Regional Fishery Biologist
Brooklyn Hudson, Fishery Technician
Dale B. Allen, Regional Fishery Manager

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MOUNTAIN LAKES SURVEYS

ABSTRACT

We surveyed four high mountain lakes (Kimberly Lakes #1 and #2, Disappointment Lake, and Loon Lake) in 2009 using standard Idaho Department of Fish and Game (IDFG) survey protocol. Kimberly Lake #2 and Disappointment Lake were surveyed as a follow-up on previous brook trout *Salvelinus fontinalis* stock eradication attempts and due to its close proximity Kimberly Lake #1 was also sampled. Loon Lake was sampled to collect tissue samples from the naturally occurring population of kokanee *Oncorhynchus nerka* for genetic analysis of stock origin. Gill net sampling of Kimberly Lakes #1 and #2 yielded no brook trout while Disappointment Lake was found to still contain a large number of brook trout, as well as westslope cutthroat trout *O. clarkii lewisii*. Sampling of Loon Lake failed to produce any kokanee however, we did find a diverse fish assemblage comprised of mountain whitefish *Prosopium williamsoni*, brook trout, and bull trout *S. confluentus*.

Authors:

Jordan Messner
Fishery Technician

Dale Allen
Regional Fishery Manager

Paul Janssen
Regional Fishery Biologist

INTRODUCTION

Kimberly Lakes

The Kimberly lakes are easily accessible by road and are within an area known as Kimberly Mine. Kimberly Lakes #1 (lower lake, catalog #07-243) and #2 (upper lake, catalog #07-244) are relatively small, with a surface area of 1.3 ha and 1.2 ha, and average depth of 3.3 m and 7.3 m, respectively. While Kimberly Lake #2 had virtually no stream spawning habitat brook trout had been successfully reproducing there. The outlet in #1 appeared adequate to maintain viable populations of fish however past surveys indicate none to very limited spawning success.

Historically, Kimberly Lake #2 was stocked and supported populations of rainbow trout *O. mykiss*. Past stream surveys found that the outlet, Bear Creek, contained a small population of wild rainbow trout. After a 1996 gill net survey of the Kimberly Lakes found only brook trout in Kimberly Lake #2, the Department attempted to eradicate this brook trout population in 1998 using gill nets. It was determined that the brook trout present in the lake presented a serious threat to the wild rainbow trout population downstream. Since the eradication attempt the Department has stocked both of these lakes with other salmonid species on numerous occasions. Kimberly Lake #1 had been stocked with arctic grayling *Thymallus arcticus* in 1991, 2001 and 2006, and with westslope cutthroat trout in 1998, 2000, 2004, and 2008. Kimberly Lake #2 was stocked only with westslope cutthroat trout in 1998, 1999, 2002, 2006 and 2008. Standard mountain lake surveys performed in 2001 on Kimberly Lakes #1 and #2 showed that a very small population of brook trout still remained in Kimberly Lake #2, along with abundant westslope cutthroat trout. Gill nets set at Kimberly Lake #1 yielded no fish in the 1996 survey and a small number of westslope cutthroat trout in 2001. The gill net surveys in 2009 were aimed at examining species presence and condition in both lakes.

Disappointment Lake

Disappointment Lake (ITM 326653 E, 455929 N; elev. 2191 m) has a surface area of 6.19 ha. The lake is only accessible by a 2 mi. hike via trail followed by 0.5 mi. of off-trail hiking. Disappointment Lake has a complex history of stocking and attempted brook trout eradication efforts. This lake was determined to be overpopulated with stunted brook trout in the 1980's. The location and relative remoteness of Disappointment Lake made it a perfect candidate for a string of experimental eradication efforts. The first eradication attempts by fisheries managers occurred in 1984 and 1986 when Chinook salmon *O. tshawytscha* were planted in the lake with the intention that they would severely deplete brook trout numbers through predation. A follow-up survey in 1990 found that there were still a large number of stunted brook trout in the lake. In 1991 a rotenone treatment was completed to eradicate all fish inhabiting the lake. Following the rotenone treatment, bull trout were stocked in 1992. Surveys conducted in 1993 and 1995, using gill nets, found only bull trout in the lake, suggesting that the rotenone treatment was a success. We sampled Disappointment Lake in 2009 to determine the current status of its fish population.

Loon Lake

Loon Lake (ITM 355425 E, 453062 N; elev. 1828 m) is a large mountain lake with a surface area of 40.9 ha. Loon Lake is located in a high impact recreational area of the Payette National Forest. It is accessible by a variety of trails, the shortest of which being 5 mi. long. The lake outlet, Loon Creek, holds no major barriers to fish passage and drains into the Secesh River, which is known to host wild anadromous fishes including Chinook salmon and steelhead. The Department has stocked the lake with rainbow and westslope cutthroat trout on many occasions since 1969. Only westslope cutthroat trout have been stocked since 1998 and there are there are no recorded kokanee *O. nerka* stockings.

Kokanee have been reported in Loon Lake since at least the 1960's (1965 IDFG intradepartmental memo by Charlie Neider) and were documented in 2003 by United States Forest Service Fishery Biologist, Caleb Zurstad (USFS file memo). Caleb collected and photographed one kokanee with hook and line gear and observed several adult kokanee spawners near the inlet of Loon Creak while snorkeling on August 6, 2003. Since there are no records of planting kokanee or sockeye *O. nerka* in Loon Lake, these fish could be direct descendants of anadromous sockeye salmon.

OBJECTIVES

1. Determine whether previous brook trout eradication efforts were successful at removing all individuals from Kimberly Lake #2, and Disappointment Lake.

2. Collect tissue samples from Loon Lake kokanee to genetically investigate their origin (sockeye, kokanee, endemic or introduced).

METHODS

Fish populations were sampled using IDFG standard survey, sinking gill nets. We used two nets for each lake (only one for Kimberly Lake #2), setting them multiple times in some cases, in different locations to try to gather a representative sample of all habitat types. If there was a suspicion that bull trout were present in the lake, nets were set for one hour intervals to avoid unwanted harvest. When we determined that bull trout were not present in the lakes (Kimberly Lakes and Disappointment Lake) nets were set overnight. Fish gathered in the nets were weighed and measured. Measurements were recorded as total length (TL) to the nearest mm, and weight to the nearest gram. A random selection of two fish from each lake was sacrificed, dissected, and analyzed for gut contents. Amphibian and reptile populations were noted using a visual encounter survey (VES) method (Crump and Scott, 1994) where the surveyor walked the entire shoreline of each lake and counted the number of each species present by life stages (egg, larvae, juvenile, adult). Temperature, conductivity and pH were also measured at each site. These chemical parameters were measured along the shoreline of the lake, and are representative of surface conditions.

Surveyors at Loon Lake attempted to observe spawning kokanee in the inlet and outlet by walking approximately one mile of each, beginning at the lake and working away from it, being careful to observe the entire reach of the stream.

RESULTS

Kimberly Lakes

Two nets were set, three times each, in Kimberly Lake #1 for a total of 16.5 net hrs. The first four sets were one hour each, and the last two were set overnight. We collected 32 westslope cutthroat trout measuring an average of 263 mm and weighing an average 216 g. Fish were caught at an average of five fish per net and 2 fish per net hour. Water temperature measured 22 C, and conductivity and pH were recorded as 30µs and 8.8, respectively.

Only one net was set in Kimberly Lake #2 due to its relatively shallow depth and small surface area. Surveyors observed very few fish swimming in the lake prior to setting the gill net. The net was set for 2 hours and collected one large westslope cutthroat trout measuring 400 mm and 650 g. Conductivity was recorded as 30µs. Surface temperature and pH were 20 C and 8.6, respectively. VES found one adult Columbia spotted frog *Rana luteiventris* at Kimberly Lake #1 and no amphibians or reptiles at Kimberly Lake #2.

Disappointment Lake

Two gill nets were set overnight in Disappointment Lake. Total net time in the lake was 17 net hours. The two nets yielded 78 brook trout and one westslope cutthroat trout for an average of 39 fish per net and 4.6 fish per net hour. Brook trout collected measured an average 205 mm and 52 g. The westslope cutthroat trout that was caught measured 385 mm and weighed 370 g. Gut content analysis found that the predominant food source being utilized was aquatic invertebrates of the Order Diptera (approximately 95%). VES indicated that western toads *Bufo boreas* inhabit the area. Approximately 100 western toad larvae were observed in the lake.

Loon Lake

Two gill nets were set in Loon Lake, three times each, for no longer than one hour at a time to avoid harvesting bull trout. Total net time in the lake was six hours. Of 36 fish collected in the nets, 29 brook trout measured an average 262 mm and 194 g, five mountain whitefish measured an average 304 mm, and two bull trout measured an average 401 mm. Both bull trout captured were alive and in good condition and were released immediately after being measured. Catches averaged six fish per net and six fish per net hour. Conductivity in the lake was 20 µs. Temperature and pH were recorded as 17.3 C and 8.8, respectively. VES indicated that both Columbia spotted frogs and Western toads were present. Ten Columbia spotted frog adults and 30 juveniles were observed, while one Western toad adult, thousands of juveniles, and one larva were also recorded.

Surveyors attempting to observe kokanee spawning in the inlet and outlet of the lake were unsuccessful. No kokanee were observed in the lake or its tributaries.

MANAGEMENT RECOMMENDATIONS

1. Maintain current stocking of the Kimberly Lakes.
2. Discontinue stocking of Disappointment Lake, due to brook trout presence.
3. Continue to look for kokanee in Loon Lake, time permitting.

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LOWLAND LAKES SURVEYS

ABSTRACT

We completed a Department lowland lake surveys on Corral Creek Reservoir to evaluate the effectiveness of a yellow perch *Perca flavescens* removal project completed in 2007. No yellow perch were collected in the 2009 survey.

We completed an angler use and harvest survey on Fish Lake from June 14 through September 3, 2009. We estimated a total catch of 4,170 rainbow trout from 2,793 hours of effort. Total estimated harvest was 2,085 rainbow trout.

The Payette Lake kokanee population was estimated using hydroacoustic gear and techniques. Estimates revealed a kokanee abundance of 126,472 fish (79 fish/ha). Estimates by age group were 104,504 fry (65/ha), 17,150 age-1 and 2 kokanee (11/ha), and 4,818 age-3 kokanee (3/ha).

Author:

Paul Janssen
Regional Fisheries Biologist

Melo Maiolie
Regional Fisheries Biologist

Dale Allen
Regional Fisheries Manager

OBJECTIVES

To conduct investigations and implement management strategies on lowland lakes and reservoirs to enhance, maintain, and protect McCall area fisheries.

Corral Creek Reservoir

Introduction

Fish populations in Corral Creek Reservoir were sampled to evaluate the effectiveness of the fall 2006 rotenone project to remove the unwanted yellow perch population.

Methods

One sinking and one floating standard lowland lake gillnets were set on the evening of July 21, 2009 in the reservoir. The gill nets were retrieved the next morning and all fish were measured to the nearest mm and weighed to the nearest g.

Results

The combined gill net catch was 29 hatchery rainbow trout. Mean length was 265 mm and mean weight was 137.2 gr. Three of the captured fish likely were planted in 2008 the majority were from the spring 2009 stocking.

Discussion

Net catch results indicate that the rotenone treatment the fall of 2006 was successful in removing yellow perch. The catch also indicated that hatchery rainbow trout were plentiful several months after stocking.

Management Recommendations

1. Maintain current stocking timing and number of rainbow trout.
2. Periodically survey lake for introduced yellow perch.

Fish Lake

Introduction

Fish Lake is a small lowland lake reservoir owned and operated by the Idaho Department of Fish and Game. Prior to 2001, the lake was closed to fishing as it was managed as a westslope cutthroat trout brood stock lake to supply cutthroat trout eggs for the Departments mountain lake stocking program. Fishery management was changed in 2001 to a put and take rainbow trout fishery due to problems producing adequate numbers of adult cutthroat trout spawners and other logistical problems. The brood stock program was then relocated to the Departments' Haypsur hatchery. Since the change in management, there had been no angler use survey completed. We completed an angler use and harvest survey on Fish Lake in 2009. The Department stocked 5,000 rainbow trout catchables and 3,000 fry into Fish Lake in 2009.

Methods

We randomly chose weekday and weekend and holiday days, and one count time per creel day to sample the lake. On each sample day one angler count was made at time of arrival and all anglers were interviewed. We did not spend any additional time at the lake. Anglers were asked how long they had fished that day, how many fish by species they had harvested, and how many fish by species they had released.

Results

We sampled the lake a total of 18 days, ten weekend days and eight weekdays and interviewed a total of 10 groups. These ten groups had spent a total of 60.25 hours fishing and had caught 90 rainbow trout at the time of the interviews for an average catch rate of 1.49 fish/hour. The total estimates for June 14 through October 31, 2009 were 2,948 angler hours to catch 4,170 rainbow trout of which 2,085 were harvested and 2,085 were released (Table 1). Therefore, the harvest rate was 41.7% of the 2009 stocked catchables. Only rainbow trout were reported caught.

Payette Lake Kokanee Investigations

Introduction

The fishery management of Payette Lake was focused on maintaining the kokanee, rainbow trout, and trophy lake trout *S. namaycush* fisheries (IDFG, 2007). Rainbow trout were managed as a put and take fishery. Lake trout and kokanee management has been a dynamic balancing act between special lake trout regulations and kokanee stocking with fairly extensive monitoring to evaluate the effects of each. The fact that kokanee were the primary forage fish

for lake trout in Payette Lake makes the methods to achieving this goal all the more confounding. Lake trout and kokanee have co-existed in Payette Lake since the early 1940's but attempts to manage a trophy lake trout fishery started in 1996. We surveyed Payette Lake kokanee densities in 2009 to help identify needs for future management changes to achieve fishery goals.

Methods

We conducted lake-wide, mobile, hydroacoustic survey on Payette Lake to monitor the kokanee population. This was the tenth (1996, 2000 thru 2007 and 2009) hydroacoustic survey completed on the lake. The survey was conducted at night on August 4 and 5, 2009. We used a Simrad EK60 split-beam, scientific echosounder with a 120 kHz transducer to estimate kokanee abundance. Ping rate was set at 0.3 s/ping. A pole-mounted transducer was located 0.52 m below the lake surface, off the port side of the boat, and pointed downward. The echo sounder was calibrated prior to the survey using a 23 mm copper calibration sphere to set the gain and to adjust for signal attenuation to the sides of the acoustic axis. We used Simrad's ER60 software to determine, and input, the calibration settings.

The lake was divided into three sections for this survey; Southwest – 844 ha, East – 680ha, and Narrows – 82 ha (Figure 1). Sections were divided using lines drawn through the center of Channel Island and across the shallow, narrow portion of the lake (Figure 1). We manually measured the area of each section of the lake inside of the 10 m contour line using a compensating polar planimeter. We followed a uniformly spaced, zigzag pattern of 18 transects traveling from shoreline to shoreline (Figure 1) (MacLennan and Simmonds 1992). Transects were the same as those used in 2007, and 1996. Boat speed was approximately 1.3 m/s (boat speed did not affect our calculations of fish density).

We determined kokanee abundance using echo integration techniques. SonarData's Echoview software, version 4.70.40, was used to view and analyze the collected data. The kokanee layer on each of the echograms was identified (generally 5 m to 30 m deep), integrated to obtain the nautical area scattering coefficient (NASC), and analyzed to obtain the mean target strength of all returned echoes. This integration accounted for fish that were too close together to detect as a single target (MacLennan and Simmonds 1992). Densities were then calculated by the equation:

Density (fish/ha) = $(\text{NASC} / 4\pi 10^{TS/10})\ 0.00292$ where:
NASC is the total backscattering in m^2/nautical $mile^2$, and
TS is the mean target strength in dB for the area sampled.

Separate density estimates were made for kokanee fry on the basis of *in situ* target strengths (TS) (Figure 2). All of the targets of the appropriate target strength were considered to be kokanee. Kokanee fry were defined as all targets under the target strength of -46 dB [approximately 86 mm total length (Love 1971). No trawl data was available for Payette Lake in 2009, but this size break was consistent with other lakes and previous surveys on this lake.

Older age classes of kokanee were defined as targets between -45.9 and -33.0 dB (Figure 2). In our surveys of other lakes, kokanee older than fry were separated on the basis of their percentage within the trawl catch. Since trawl information was not available we did not separate age-1 and age-2 kokanee. We did separate age-3 kokanee targets based on their

target strength- frequency distribution. We caution that this method was of unknown accuracy, but was the only approach available. Age-3 kokanee appeared to be within the group of targets between -39 and -33 dB (200 mm and 410 mm).

To determine a population estimate for kokanee, we averaged (arithmetic mean) the density estimates in each section and multiplied the resulting mean density times the area of each section. Abundance in each of the three sections was summed to estimate the total population.

We estimated the mortality rate for this kokanee population by drawing a catch curve for the kokanee year classes in the lake at the time of the survey. The catch curve was graphed using FAST version 2.0.1 from Auburn University. Abundance estimates of age-1 and age-2 kokanee needed to be estimated individually for this curve. We attempted to keep the points parallel with the best-fit trendline of the catch curve by graphing several iterations. The result was to split the combined population estimate of age-1 and 2 kokanee using a ratio of 10:4.

Results

We recorded 504 returned echoes from fish within the kokanee layer. A target strength-frequency distribution showed echoes ranged between -60 and -26 dB (Figure 2). As expected, most of the objects had a target strength attributable to kokanee fry.

Kokanee densities ranged from 3 to 377 fish/ha on various transects in Payette Lake (Table 2). Generally, the highest densities of each age class were found on the eastern side of the lake.

We estimated Payette Lake contained 104,504 fry (65/ha), 17,150 age-1 and 2 kokanee (11/ha), and 4,818 age-3 kokanee (3/ha) (Table 3). Total kokanee abundance was estimated at 126,472 fish (79 fish/ha).

Densities of kokanee in Payette Lake appeared to have declined from our estimates in 1996 (Table 4). Densities in this survey were also well below the estimates seen in three other lakes in northern Idaho.

We calculated a 64% mortality rate for kokanee from age 0 to 3 based on the catch curve for this population (Figure 3). This estimate should be considered approximate since the proportions used to split the age-1 and 2 group affect the estimated mortality rate, but our split gave a reasonable fit to the trend line in the catch curve.

Discussion

Our hydroacoustic survey in 2009 showed very low densities of fish in the pelagic area of Payette Lake. Even considering all suitable-sized fish were kokanee, a total density of 79 kokanee/ha would be only a fraction of the densities seen in other Idaho lakes (Table 4). Adult kokanee densities of 3 kokanee/ha are likely too low to support a popular sport fishery. However, even at the low densities observed in this study, kokanee would likely contribute a significant amount of forage to the lake trout population.

The hydroacoustic estimate of 4,800 age-3 kokanee appeared to be an overestimate based on the spawning kokanee estimate of 2,200 fish (See Rivers and Streams section this report). In either case the estimate was well below the numbers needed for a productive fishery. The spawner estimate discrepancy was probably due to the inclusion of a couple thousand stocked catchable-sized rainbow trout in the acoustic estimate. During this study we included all fish in the pelagic area, which were the appropriate size, as kokanee.

We also noted a pronounced decline in kokanee abundance since our 1996 survey (Table 3). Total kokanee density dropped from 488 fish/ha to 79 fish/ha. Hydroacoustic equipment had changed from a Simrad EY500 to a Simrad EK60; however, we do not expect this would account for the differences.

Fry densities in Coeur d'Alene, Spirit, and Pend Oreille lakes ranged from about 400 to 1,000 fry/ha. A total of 263,000 (164/ha) kokanee fry were stocked in Payette Lake in 2009 and resulted in densities of 65 wild and hatchery fry/ha by our August survey. Even with the sterile nature of the lake it would appear there is room for higher kokanee densities.

A catch curve of the year classes of kokanee currently in Payette Lake indicated a mortality rate of 64%. This mortality rate is borderline high, but not as high as seen in two of our other predator dominated systems. Both Lake Pend Oreille and Coeur d'Alene Lake have maintained kokanee mortality rates between 60% and 80% for over two generation of kokanee. Both lakes also have abundant predator populations (Maiolie et al, in press). It would seem Payette Lake kokanee could maintain the population with a 64% mortality rate if egg-to-fry survival was reasonably good. We therefore recommend continued monitoring of kokanee mortality including egg-to-fry mortality. Mortality estimates could be further refined by trawling the lake and splitting the hydroacoustic estimate into kokanee age classes based on the percent of each age class in the trawl catch. We also suggest that annual mortality be calculated by following year classes of kokanee from one year to the next instead of the catch curve approach used here.

Management Recommendations

1. Continue annual hydroacoustic surveys and including trawl sampling in 2010 to verify age groups and sizes.
2. Increase the number of stocked kokanee fingerling to boost numbers of catchable kokanee in the future.
3. Continue monitoring kokanee abundance with hydroacoustics to evaluate success of kokanee stockings and identify periods of excessive mortality.

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LAKE CASCADE YELLOW PERCH FISHERY RESTORATION MONITORING AND INVESTIGATIONS

ABSTRACT

We continued monitoring the yellow perch population in Lake Cascade following the yellow perch restoration work from 2004 through 2006 (Janssen et al. 2008). We collected an average of 1,029 yellow perch in each bottom trawl sample in 2009. The majority of yellow perch collected in October were yearlings. This was the first evidence of a strong age class of yearlings since bottom trawl sampling began in 1998. All previous years' sampling were dominated be age 0 fish. We aged yellow perch from 70 mm to 315 mm and found ages ranging from one to five. We observed reduced growth rates of juvenile yellow perch produced from 2006 through 2010 when compared to fish produced from 1998 through 2005. We predicted that the 2008 cohort would recruit to the fishery (200 mm) in five to six years, one year slower than that recorded in 1991 and two years slower than that observed for the 2004 and 2005 cohorts.

Hydroacoustic abundance estimates were made for several fish species in Lake Cascade.

We sonar tagged 20 yellow perch to examine movement patterns and vulnerability to dam entrainment.

We completed the annual holiday angler trend counts and observed a slight drop from 2008.

Authors**:**

Paul Janssen
Regional Fisheries Biologist

Art Butts
Regional Fisheries Biologist

INTRODUCTION

Since the mid 1990's survival of juvenile yellow perch had been poor, resulting in the collapse of this fishery. Northern pikeminnow *Ptychocheilus oregonensis* numbers and subsequent predation on juvenile yellow perch were determined to be preventing yellow perch recovery and were probably the direct cause of the population collapse.

The two treatment restoration plan entailed stocking large numbers of yellow perch adults to overwhelm predators in the lake (primarily adult northern pikeminnow) and secondly to physically reduce the number of predators (northern pikeminnow) in the lake. We transplanted over 860,000 adult yellow perch and removed ¾ of the northern pikeminnow population in the lake from 2004 through 2006 (Janssen et al. 2008). Since 2006 we have annually monitored the response of fish populations to the treatments and we continued this monitoring in 2009.

We began angler counts on holidays in 1998 to track changes in angler use. We started an intensive fish harvest and angler use survey in 2009. This was the first intensive creel survey since 1992.

Yellow Perch Population Trend Monitoring

Introduction

A bottom trawl has been utilized since 1998 as a reliable, repeatable method to monitor changes in yellow perch population structure and abundance. The trawl has been effective in monitoring changes in population size and survival of juvenile yellow perch. The trawl sampling effort was competed again in 2009.

We collected and aged otoliths from yellow perch to determine age and growth rates and to help us interpret trawl sampling results.

Methods

We continued to use the same lake area divisions (east, west, north, and south), effort and transect sites that were developed in 1998 and 1999 and described by Janssen et al. (2003). Trawl transect locations were as close as possible to the established sites. Exact sites change due to water levels and macrophyte bed development. Trawl sites are moved into deeper water to avoid dense macrophyte beds that foul the trawl. We have abandoned trawl sampling in the north area due to the large numbers of stumps that snag the trawl. We counted all yellow perch collected and a representative sample of yellow perch from each sample area was collected. Collected fish were measured for total length to the nearest 1 mm and weighed to the nearest 0.1 g.

We collected otoliths from angler and bottom trawl caught yellow perch throughout the summer and fall months from a range of sizes for age and growth studies. Otoliths were

mounted in epoxy and then sliced at the focus and perpendicular to the axis at a thickness of 60 microns with a jewelers saw. Sliced sections were then coated with a 1:1 solution of glycerin and saline solution to clear any surface scratches and then aged using a dissecting scope. Whole otoliths, which require no preparation, were also utilized and compared with sectioned otoliths. Whole otoliths were also coated with a 1:1 solution of glycerin and saline solution.

Otoliths were placed on a slide and then on a flat black background. An external light source was introduced from the side and adjusted until the opaque rings on the otolith were most visible.

Results

We completed 62 trawl transects in 2009, trawling a total of 309 minutes, collecting 63,580 yellow perch. We averaged 15, 1,736, and 1,359 yellow perch per five minute transect in June, August and October respectively (Table 5). Length frequencies of fish collected in June, August and October are presented in Table 6. The average catch for all transects for all months was 1,029 yellow perch (Table 7).

Length frequency data and otolith ageing indicate the majority of yellow perch collected in the trawl samples for all three periods were age-1 (Table 6). This has not occurred since trawling began in 1998. All previous year's October trawl catches were predominantly age 0. Trawling efficiencies were low in June 2009 as the total catch per trawl of the 2008 cohort was higher in October 2008 and August and October 2009.

Otolith aged fish ranged from one to five years old and ranged in total length from 70 mm to 315 mm (Table 6 and Figure 4).

Discussion

This was the first year since trawling bean in 1998 that age-1 yellow perch dominated the October trawl catch and indicates a large age class of fish produced in 2008. Growth of all cohorts of juvenile yellow perch had declined since 2003 (Table 8). Age-0 fish in October 2008 averaged 44 mm total length while age-0 fish in October 2005 averaged 52 mm. Age-1 yellow perch in October 2009 averaged 63 mm while age-0 fish in October of 1998 and 1999 averaged 72 mm and 71 mm respectively (Table 8).

Growth of yellow perch produced in 2004 and 2005, the first two years of the adult yellow perch introductions, outpaced growth of fish produced from 2006 to 2009. A large gap in fish lengths from 190 mm and 230 mm was observed in fish collected, however no age classes were missing. Yellow perch greater than 230 mm in total length and greater were aged at four and five and fish less than 190 mm were aged from one to three. Lengths at age-1 of the 2004 and 2005 cohorts averaged 115 mm and 114 mm respectively while the 2006 through 2009 cohorts ranged in length from 63 mm to 81 mm (Table 8).

Competition for food appears to be the cause of the growth reductions. Average catch per trawl haul since 2005 had increased significantly. Average catch increased two-fold from 2005 to 2006, three-fold from 2005 to 2006 and nearly six-fold from 2005 to 2008 and 2009

(Table 7). The 2004 and 2005 yellow perch cohorts took only three to four years to reach the harvestable size of 200 mm while yellow perch aged in 1991 took 4 to 5 years to reach 200 mm. We projected it would take five to six years (2013-2014) for the large 2008 cohort to reach 200 mm. The 2006 and 2007 cohorts appeared to be relatively weak probably due to predation by the fast growing 2004 and 2005 cohorts. However, these fish should provide for some harvest in 2011 and 2012 until the 2008 cohort matures and recruits to the fishery in 2013.

The bottom trawl seems to be inefficient at collecting fish over 150 mm even though it catches fish over 300 mm at times. We have age classes that show up in the fishery but are rarely seen in the trawl. It's unknown whether this is due to fish avoiding the trawl or to the minimal probabilities this relatively small trawl will intercept large yellow perch in a randomly chosen sample site in a 25,000 acre reservoir. Various authors have demonstrated that juvenile yellow perch are much more pelagic in nature than mature fish that congregate along vegetated or rocky shorelines and points.

Management Recommendation

1. Continue the annual trawling of Lake Cascade to monitor changes in age class structure and growth of yellow perch.

Lake Cascade Fish Population Monitoring

Introduction

We completed fish population estimates of several fish species using hydroacoustic fish survey techniques. These estimates were utilized to help evaluate fish population changes since completions of the yellow perch restoration treatments. Hydroacoustic fish abundance estimates were previously completed in years 2000 through 2006 on Lake Cascade. (Janssen et.al, 2008).

Methods

General hydroacoustic survey techniques were described by Butts (2007). Specific methods applied to the Lake Cascade survey are described below.

Hydroacoustic estimates of fish densities, lengths, and vertical depth distributions were obtained with a Hydroacoustic Technology, Inc. (HTI) Model 241-2 split-beam digital echo sounder. The 200 kHz sounder was equipped with two transducers: a 15° vertically aimed transducer (down looking) and a 6° horizontally aimed transducer (sidelooking), which was set at a 6° angle below the surface. Transducers were suspended at a 1 m depth using a retractable pole mount mounted on the port side of the boat. Boat speed during data collection

ranged from 1 to 1.5 m/s. Sampling transects were determined prior to surveys and were followed using Global Positioning System (GPS) coordinates (Figure 5).

Data were collected by fast multiplexing equally between both transducers at a sampling rate of 3.0-12.5 pings/s, which allowed for near-simultaneous data collection at 1.5-6.25 ping/s per transducer. A transmit pulse width of 0.2 ms was used for both transducers.

An array of net curtains was set at various depths in pelagic regions for target verification and species partitioning at Lake Cascade during the evening. Nets were set at various sites along hydroacoustic transects using GPS; sites were spaced longitudinally from inlet to outlet. During most net nights, 2 49 m x 6 m net curtains were suspended at various intervals between depths covered by sinking and floating gillnets to ensure that the entire water column was sampled. Each net curtain consisted of 3 m long panels of different mesh arrays that were randomly placed. One net curtain was comprised of 19, 25, 32, 38, 51, 76, and 102 mm stretch mesh, while the other net was comprised of 51, 57, 64, 76, 89, 102, 127, and 152 mm stretch mesh. Each net curtain was considered an individual sampling unit during our analyses. Fish were identified, and total lengths (TL; nearest mm) and weights (nearest g) were measured and recorded. For each fish, capture depth (m) was estimated, and net mesh size (mm) was recorded. Total depth at each netting site was also recorded.

Results

Lake Cascade was surveyed during August 17-20, 2009. Ten standardized transects, beginning at the northern portion of the reservoir, were sampled with hydroacoustics and 9 net curtains were set at random sites throughout the reservoir (Figure 5).

Fish density and population estimates were calculated for fish $\geq$ 250 mm as well as fish of all sizes. Fish densities of all size classes were highest in transects 7-9 and densities of fish >250 mm were low throughout the survey but highest densities were in transects 7 and 8. Fish density estimates for all sizes was highest below 6 m (downlooking), where 52.5 fish/ha were estimated (Table 9). The total density estimate for all size classes of fish was 61.3 fish/ha. For fish >250 mm, 0.6 fish/ha were estimated in depths $\geq$ 6 m, while 0.8 fish/ha were estimated in depths above 6m, resulting in a total density estimate of 1.4 fish/ha. Species proportions observed are presented in Table 10. Expanding density estimates to abundance estimates, we estimated 12,831 (6,833 to 21,016) fish >250 mm and 547,266 (234,525 to 1,261,755) total fish abundance (Table 9).

We collected 222 fish with 9 net curtains during the 2009 survey at Lake Cascade. Gillnet catches of fish consisted primarily of rainbow trout (33% $\pm$ 18%), largescale sucker (31% $\pm$ 22%), kokanee (8% $\pm$ 10%), and northern pikeminnow (8% $\pm$ 6%; Table 10). Rainbow trout ranged from 230-540 mm, largescale suckers *Catostomus macrocheilus* ranged from 350-650 mm, northern pikeminnow ranged from 330-500 mm, and yellow perch ranged from 240-330 mm (Figure 6).

In 2009, we estimated 179,957 ($\pm$ 28,546) rainbow trout, where 4,219 ($\pm$ 719) were >250 mm (Table 11). For northern pikeminnow, 44,373 ($\pm$ 8,645) fish were estimated, of which 1,040 ($\pm$ 213) were above 250 mm. Finally, 170,096 ($\pm$ 34,733) largescale sucker were estimated, with 3,988 ($\pm$ 851) fish >250 mm. The estimate for yellow perch $\leq$250 mm was 39,443 $\pm$ 11,793.

Discussion

Hydroacoustic estimates were divided into two groups: fish ≥ 250 mm and all fish. Both estimates have been used as general trend information for Lake Cascade since 2000 (Figure 7). Estimates of fish ≥250 mm were very low, ranging from a low of 4,258 in 2001 to 88,289 in 2003. Since then it has declined to the second lowest estimate on record, 12,831 in 2009. Between 2004 and 2006, a dramatic increase in the estimate of fish ≤250 mm was observed. Since the last hydroacoustic survey occurred in 2006, that number has declined again to pre-2004 levels.

The 2009 hydroacoustic survey was compromised by a number of technical problems related to the laptop used to collect the hydroacoustic data. A number of transects had to be pieced together because the operating system crashed numerous times during the survey itself. Despite this, the survey may still provide some value to managers in terms of general fish abundance since the last survey in 2006.

Management Recommendations

The manpower required to obtain this estimate was huge and the results were questionable. Because Lake Cascade is relatively shallow it does not lend itself well to hydroacoustic surveys. Unless we can tighten up the estimate with better equipment and can justify the man hours required we should discontinue the use of hydroacoustic population estimates on Lake Cascade. We can detect fish species and population shifts more reliably using gill nets.

Yellow Perch Migration Studies

Introduction

The migration patterns of Lake Cascade yellow perch were unknown. We began to examine yellow perch migration patterns in 2008 and 2009 with the use of sonar tagged fish.

Objectives

1. Determine if yellow perch migrate near the dam and become vulnerable to entrainment.
2. Do yellow perch have seasonal movement patterns which might help explain why fishing success changes throughout the seasons.
3. Do yellow perch have one home area, seasonal home areas, or do they roam aimlessly throughout the year.

Methods

We collected adult yellow perch in May and June with trap nets. Sonotronics model IBT-96-9-I sonar tags weighing 3.8 g each were surgically implanted in the body cavity of each fish. To obtain 15 month battery life each tag was programmed to cycle “ON” for 1.5 minutes and

then “Off” for 30 seconds. Each fish tagged was anesthetized during tag implantation. Only fish greater than 190 g were tagged to keep the tag weight below the manufacturer’s recommendation of no more than 2% of the fish’s total weight. Tag number and fish release site GPS (NAD 83 datum) locations were recorded. Tagged fish were held in live cages for one week to ensure survival at time of release. Tagged yellow perch were released equal distances apart around the perimeter of the lake with no regard to capture location (Figure 4).

The lake was systematically surveyed after release biweekly to monthly via boat and sonotronics acoustic sonar signal receiver in an attempt to locate as many tagged fish as possible in a survey day. When a tag was detected we then continued to triangulate to locate the fishes location as accurately as possible. We then used a GPS (NAD 83 datum) to obtain and record the fish’s location.

Results

Lake Cascade ice cover melted off on May 10th and we set the first trap nets on May 14th. Fish were collected from three locations; Sugarloaf boat ramp bay, the bay just north of Crown Point, and along the east shoreline directly east of the Cascade City boat ramp. We tagged the first yellow perch on May 15th. Tagged fish were held for seven days to monitor post tagging survival. Live, healthy appearing fish were then released.

Prior to release of the first group of fish we found that mature females had spawned in the live cages and had expelled their tags with eggs. Tags in males were found to be intact and these fish were released. The expelled tags were re-implanted into freshly captured males and post spawn females to avoid the expulsion problem. The newly tagged fish were placed in live cages for another seven days. After seven days mortality was nearly 100% and included untagged fish that had been held as well. We assumed that post spawning stress contributed to this mortality. Therefore we then waited until the first of June; when spawning was complete to implant the remaining tags. We observed no mortality of fish tagged after June 1.

We implanted all 20 sonar tags in adult yellow perch in May and June 2008. Tagged yellow perch release locations were evenly distributed along the entire shoreline of the lake with no regard to capture location (Figure 8).

We located 12 of the twenty tagged yellow perch at least once after being released in May and June. However, two fish either expelled their tags or died leaving the tag on the lake bottom as tag signals never moved from the first relocation site. Of the remaining 10 tagged fish, two were relocated only once and two were relocated ten times and both of these were relocated again in 2009 after ice off (Table 12 and Figures 9 thru 21).

Discussion

Most yellow perch appeared to have a specific destination in mind after being released. Average distance traveled for all fish from release site to the first relocation site was 7.8 km while average maximum distance between any subsequent relocation sites was 3.6 km (Table 12). The maximum distance and time a yellow perch traveled from release site to the first relocation site was 15.8 km in 21 days. Three yellow perch traveled over 12 km from release site to first relocation site.

Relocation data suggested that individual yellow perch did have preferred areas. While some tagged fish appeared to wander aimlessly, most remained in a general location for weeks

or even months at a time. When fish did change locations they tended to stay put in the new location for extended periods (Figures 12 and 19). Fish # 54 was located twice in July in the same specific area on the West side of the lake and then was relocated in September on the East side of the lake (Figure 20). It then moved back to the previous location on the West side where it was relocated twice in October.

Travel distance between any relocation sites declined for six of eight fish (two fish were relocated only once) once they arrived at their first relocation site following release (Table 12). The maximum distance traveled by a yellow perch between any two relocation sites was 6.6 km over a period of 13 months.

None of the relocated fish appeared to be in danger of entrainment even though four fish were located on Crown Point at least once and two fish spent a great deal of time in the Crown Point area (Figures 12, 13, 14, and 20). The closest any fish was observed from the outlet was 2,040 m (Figure 13).

Not enough fish were tracked long enough to draw any conclusions regarding seasonal migration patterns. However, two different fish moved to totally different areas during winter ice over (Figures 12 and 18).

Holiday Angler Counts

Introduction

The last comprehensive angler survey was completed on Lake Cascade in 1991 and 1992. Holiday angler counts were begun in 1996 as a relatively inexpensive way to track changes in angling pressure trends until the next comprehensive survey was completed. However, due the collapse of the yellow perch fishery and subsequent drop in angling pressure to near zero in the late 1990's, no comprehensive creel survey was ever scheduled. These angler counts happened to start just prior to the collapse of the yellow perch fishery. They have served as a valuable tool to monitor changes in angling pressure before, during, and after the fishery collapse. They have also been valuable in monitoring the change in angler use during and after the application of the yellow perch fishery restoration treatments from 2004 through 2006. We completed these angler counts again in 2009.

We completed a comprehensive creel survey in 2009 which continued into 2010. Results of that survey will be presented in the 2010 fishery management report.

Methods

We conducted holiday angler counts at 0900 and 1400 hrs in 2009 using a fixed wing airplane on Memorial Day, July 4th and Labor Day. A fixed wing aircraft was used to count all fishing boats and shore anglers. All shore anglers and boat counts were then averaged for a yearly average.

Results

Angler counts were completed on Memorial Day, July 4th and Labor Day in 2009. Both boat and shore angler count averages were lower in 2009 than that counted in 2008 (Table 13). We counted an average of 29 fishing boats and 29 shore anglers in 2009.

Management Recommendation

1. Continue holiday aerial angler counts to monitor angler use and compare results with future creel survey studies.

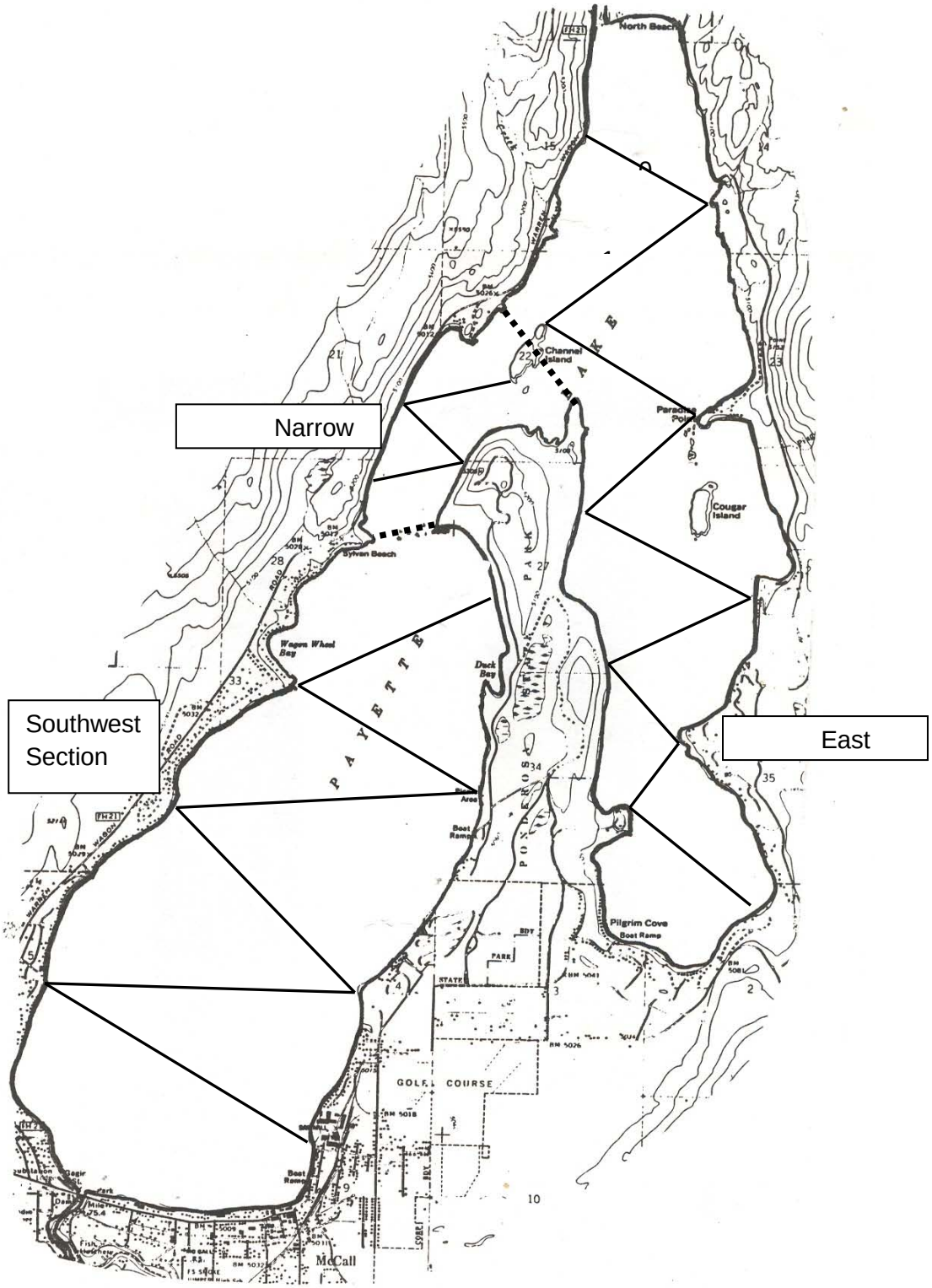


Figure 1. Map of Payette Lake, Idaho, showing the transects used in the hydroacoustic survey on August 4 and 5, 2009.

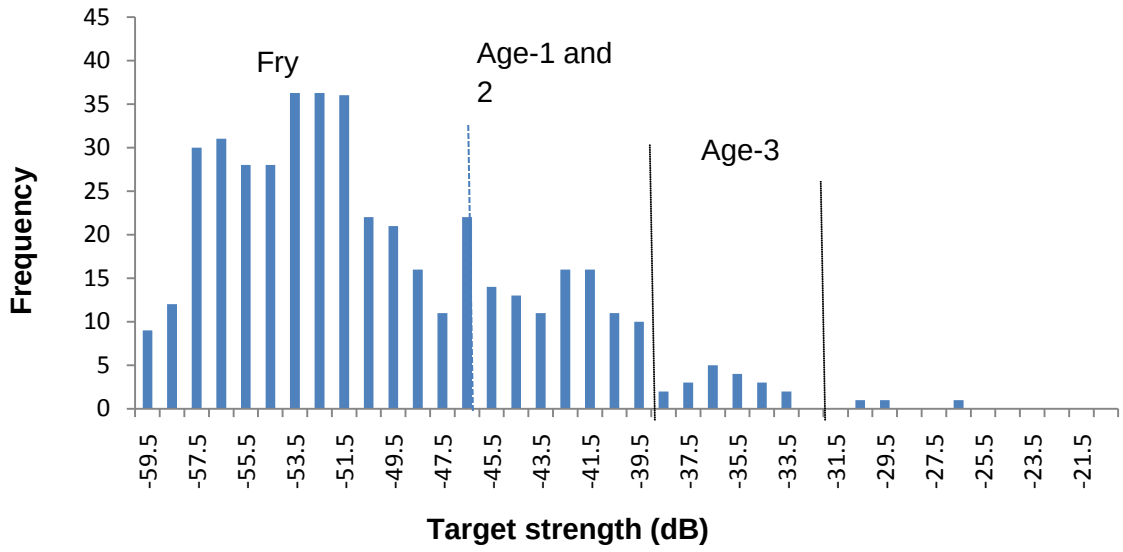


Figure 2. Target strength-frequency distribution of fish within the pelagic area of Payette Lake between the depths of 5 and 30 m, during August 2009.

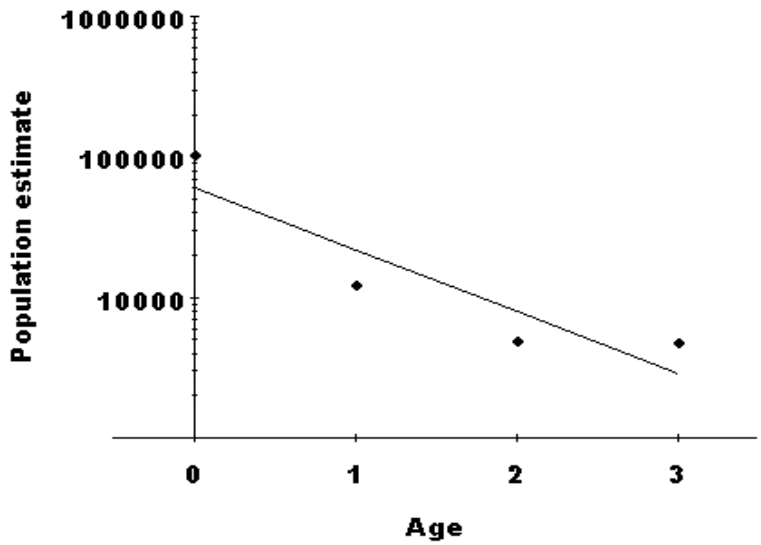


Figure 3. Catch curve of the population estimates of kokanee in Payette Lake, Idaho, 2009. Age-1 and 2 kokanee were split from a combined population estimate. Annual mortality was estimated at 64% from this curve.

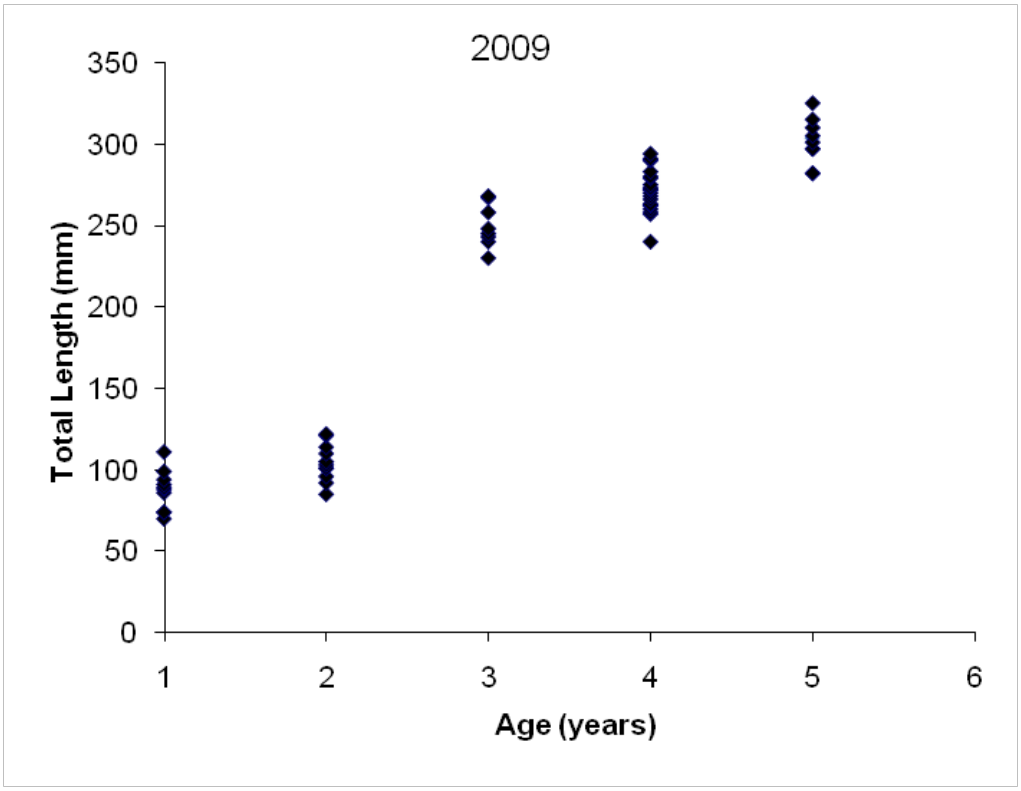


Figure 4. Yellow perch ages at given total lengths read from otoliths from Lake Cascade.

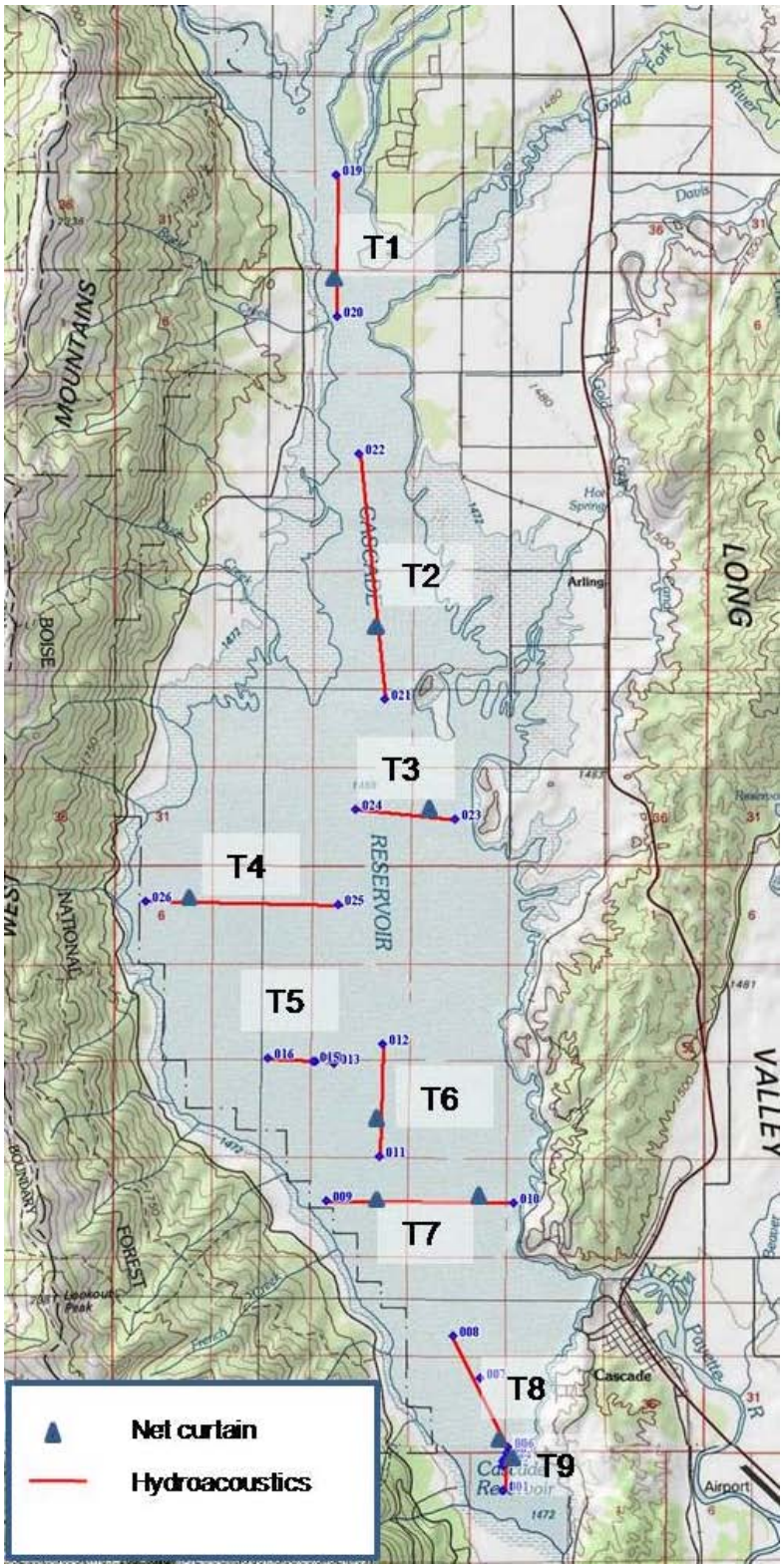


Figure 5. Map of Lake Cascade, Idaho showing hydroacoustic transects and net curtain locations for the 2009 survey.

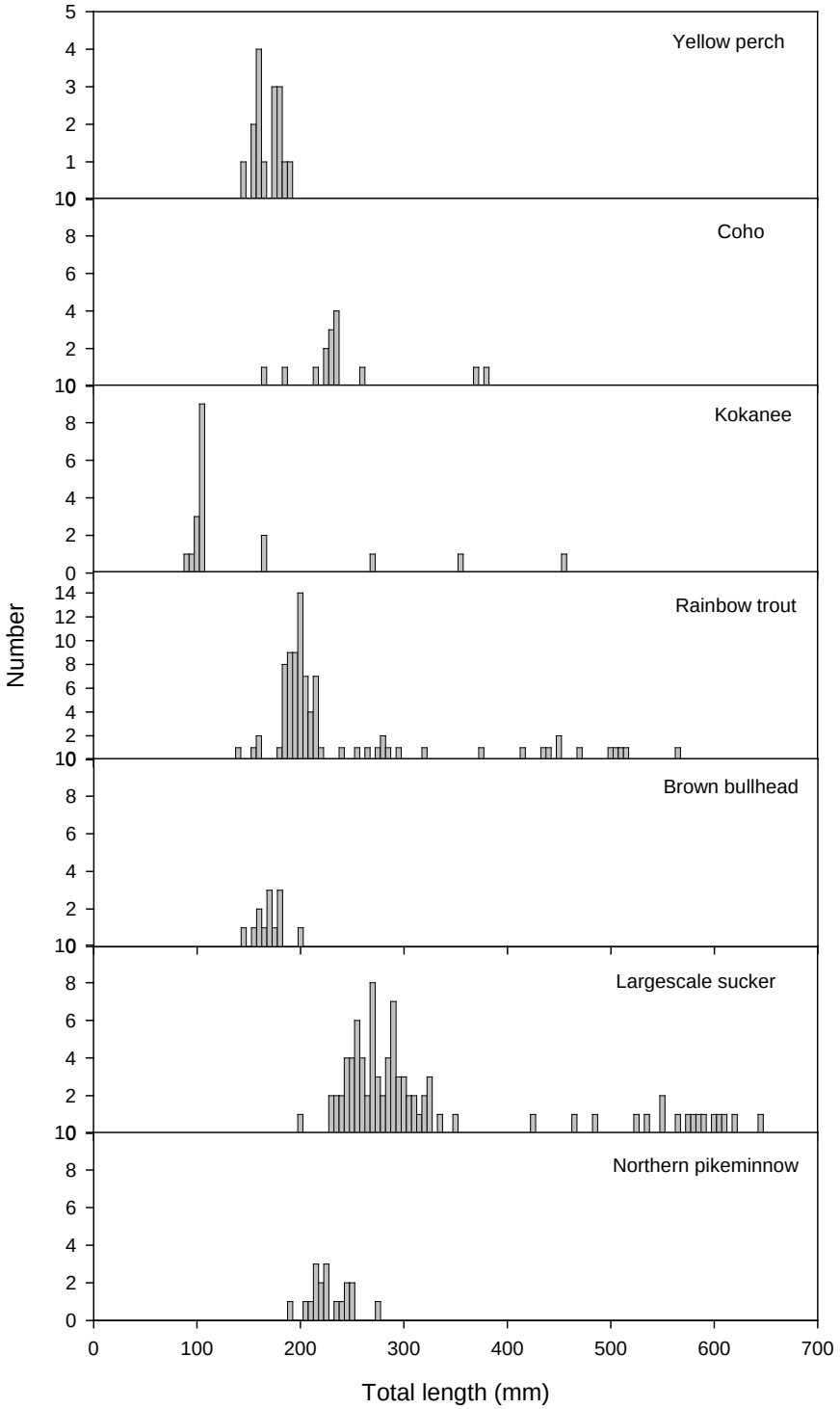


Figure 6. Length distributions of dominant fish species caught in curtain nets at Lake Cascade in 2009.

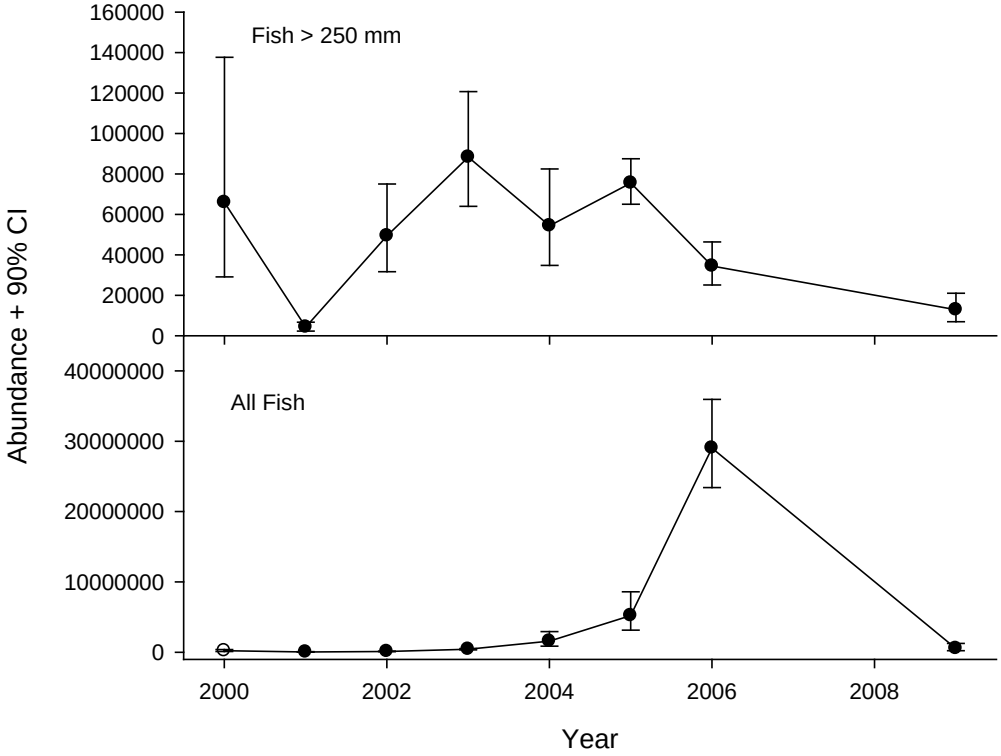


Figure 7. Hydroacoustic abundance estimates ± 90% CI for fish ≥ 250 mm and all size classes at Lake Cascade during surveys conducted between 2000 and 2009.

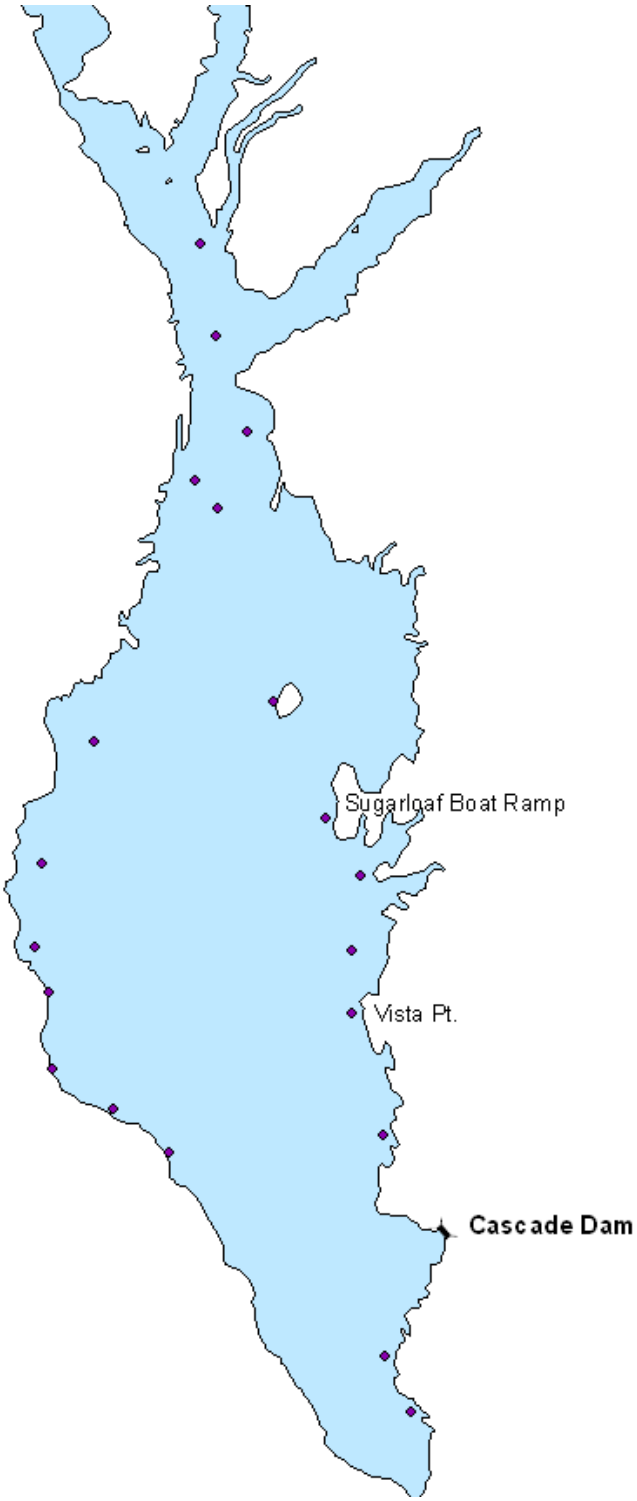


Figure 8. Release sites of all sonar tagged yellow perch in Lake Cascade in 2008.

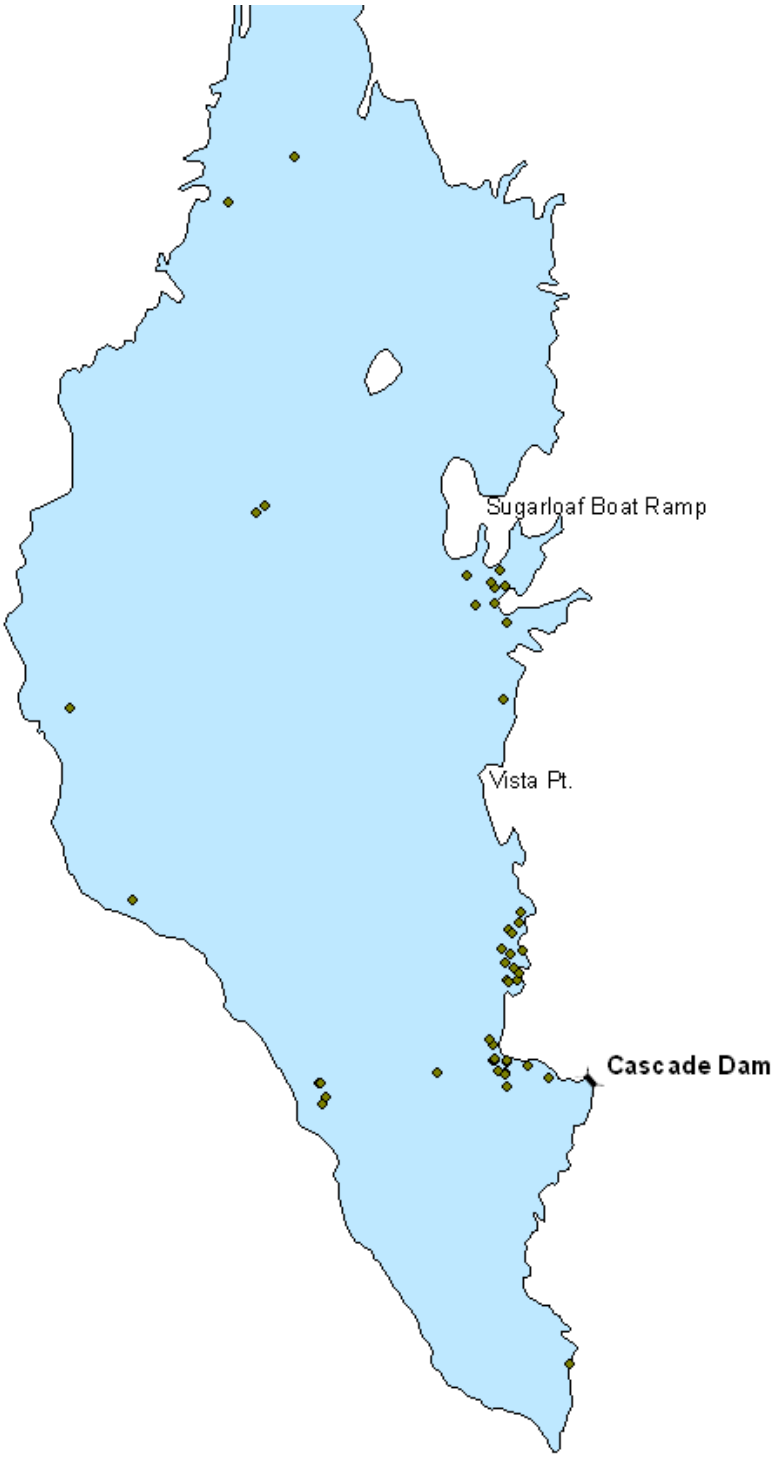


Figure 9. Locations of all sonar tagged fish in Lake Cascade in 2008 and 2009.

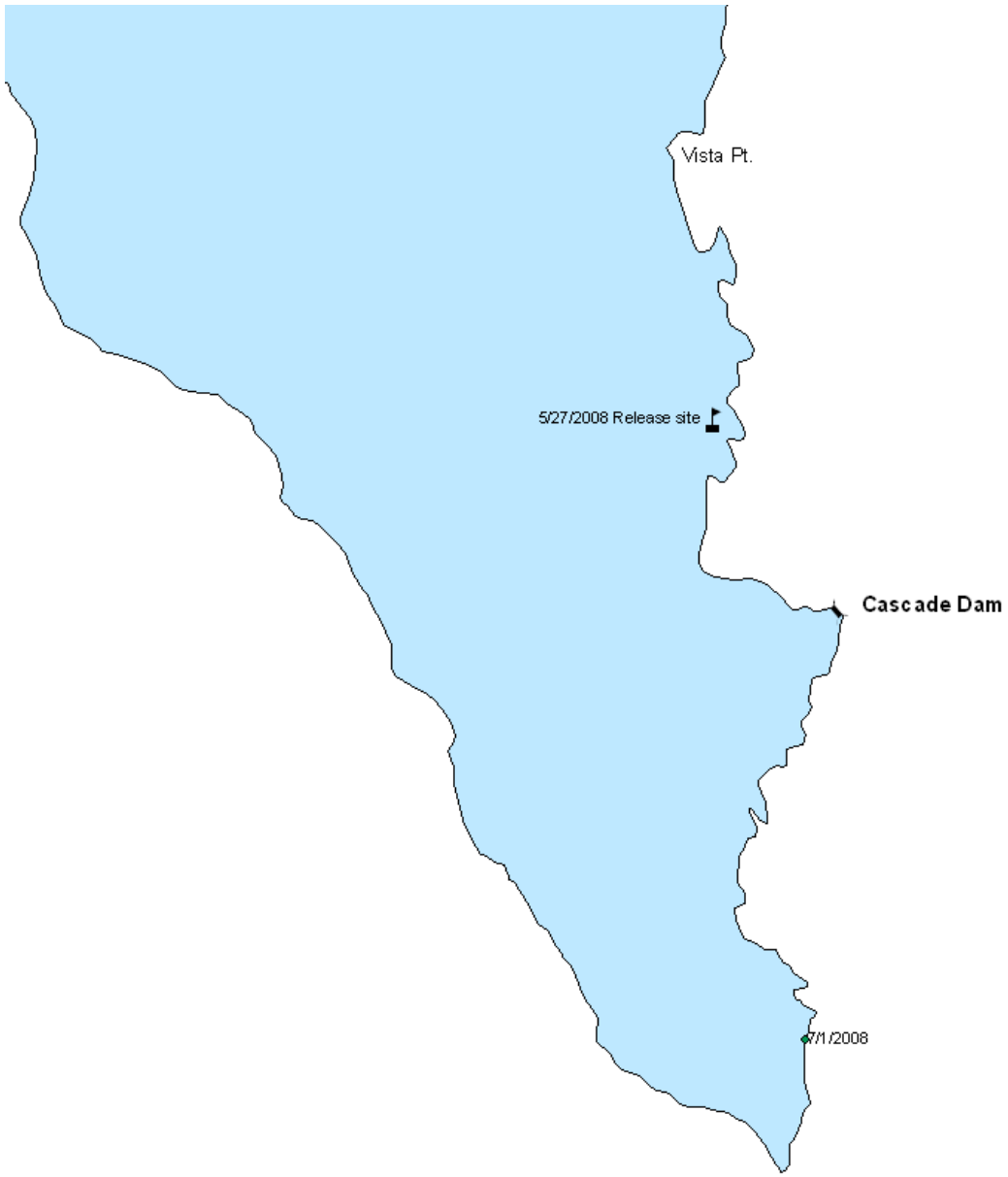


Figure 10. Release site and relocation sites of Tag # 2 in Lake Cascade.

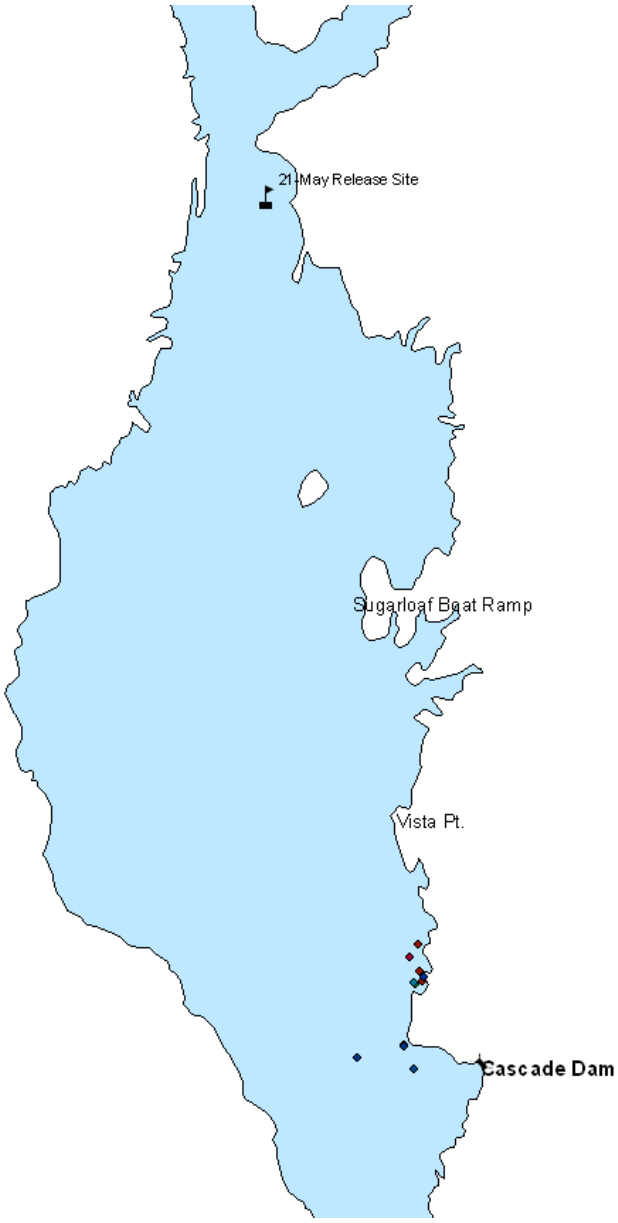


Figure 11. Release site and relocation sites of Tag # 7 in Lake Cascade.

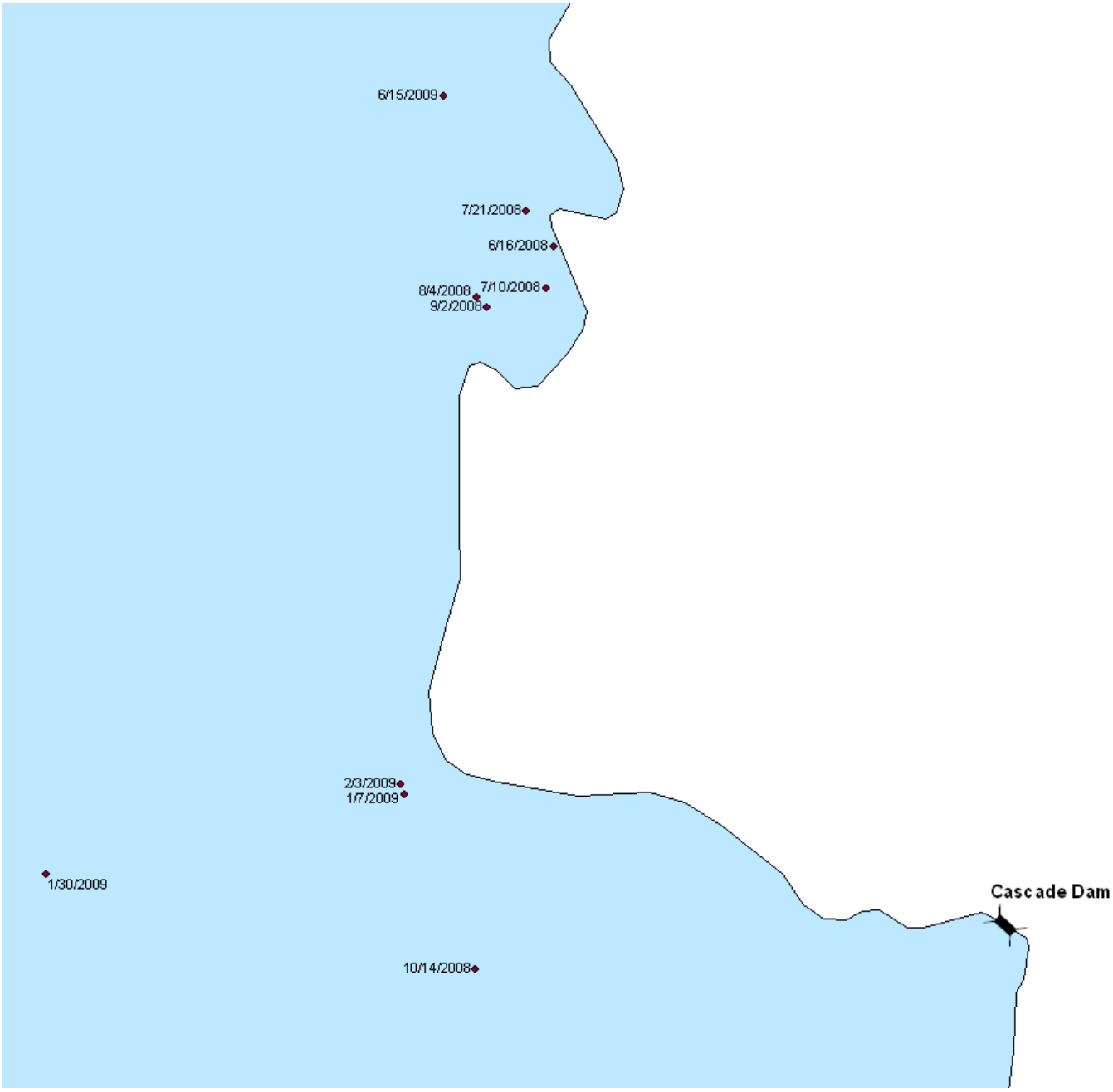


Figure 12. Close up of relocation sites of Tag # 7 in Lake Cascade.

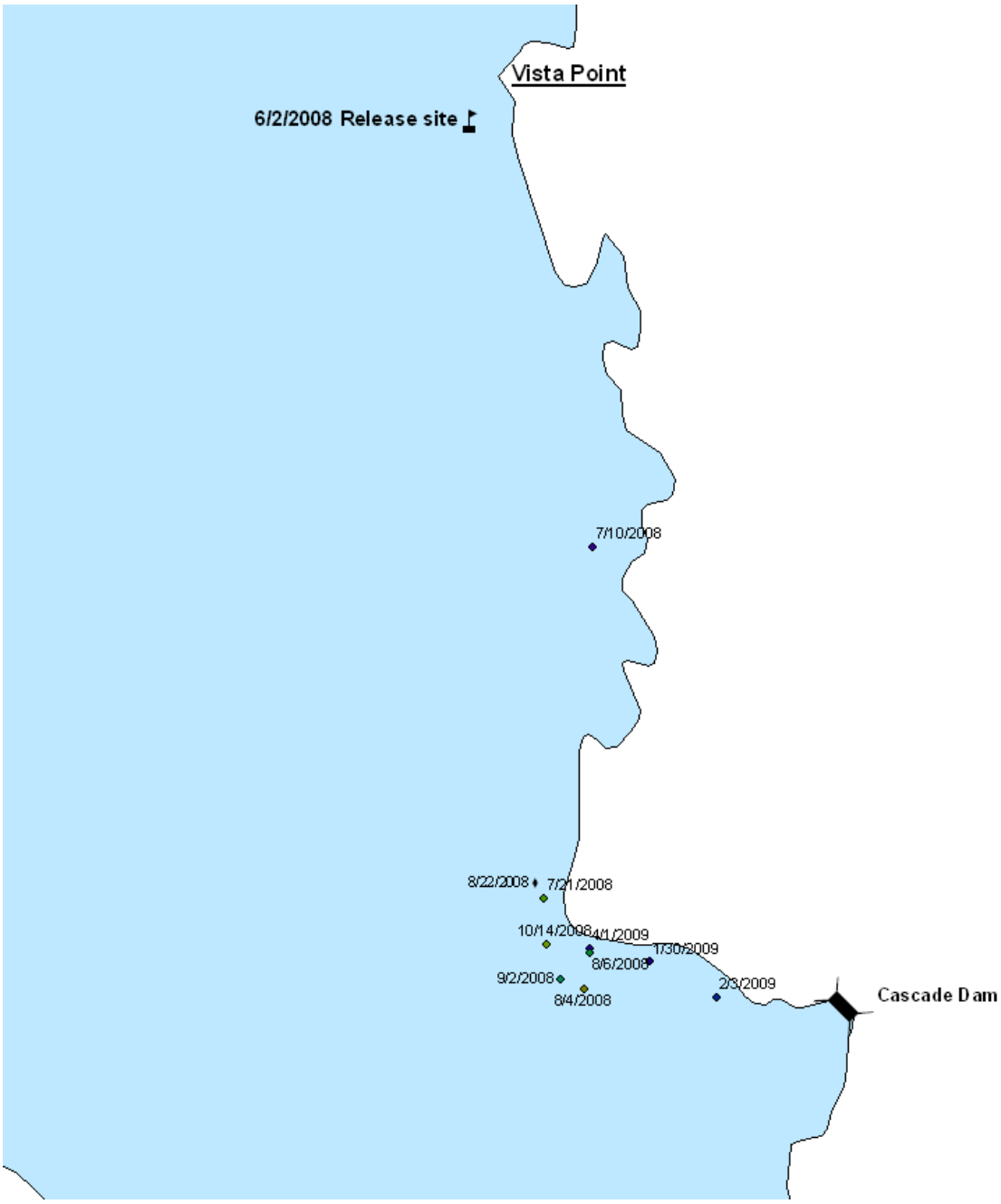


Figure 13. Release site and relocation sites of Tag # 9 in Lake Cascade.

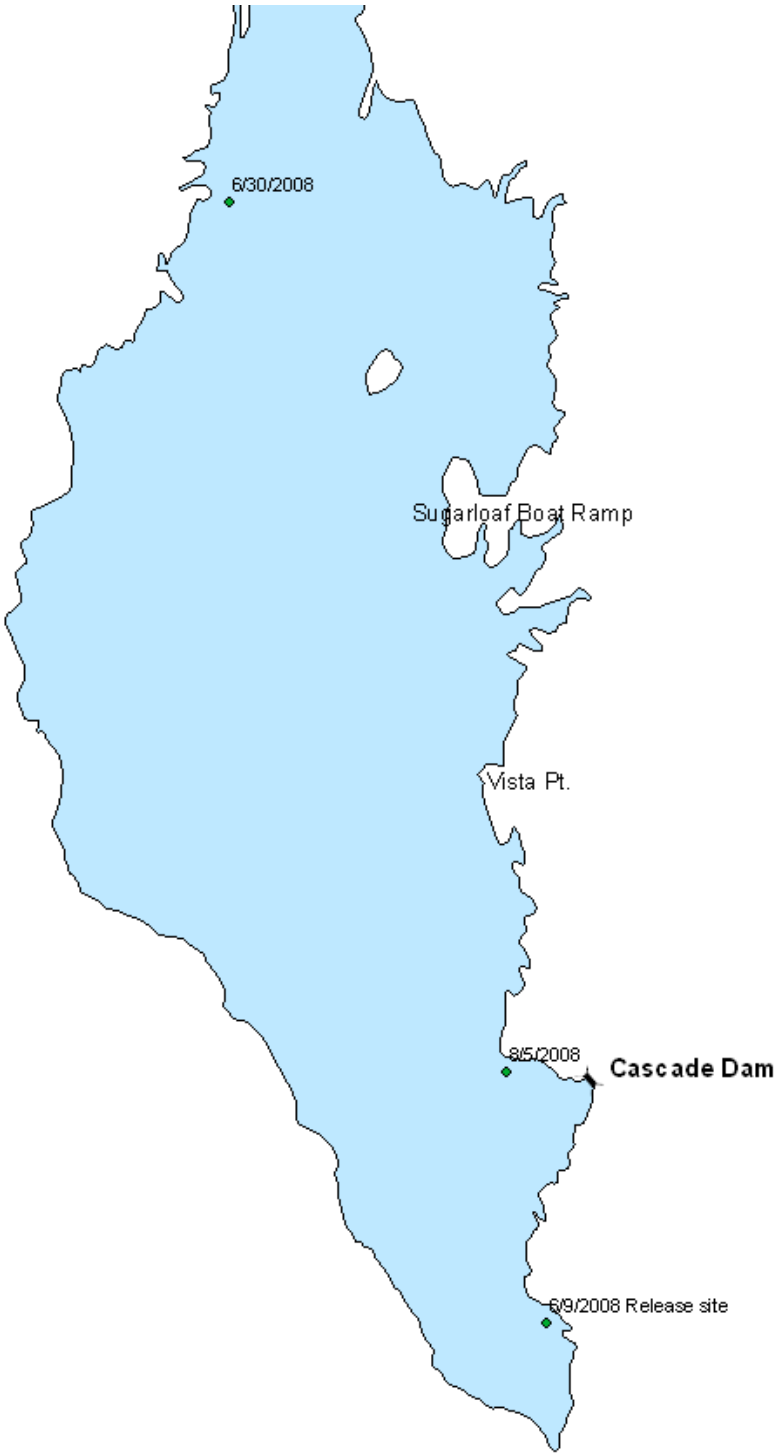


Figure 14. Release site and relocation sites of Tag # 10 in Lake Cascade.

Figure 15. Release site and relocation sites of Tag # 11 in Lake Cascade.

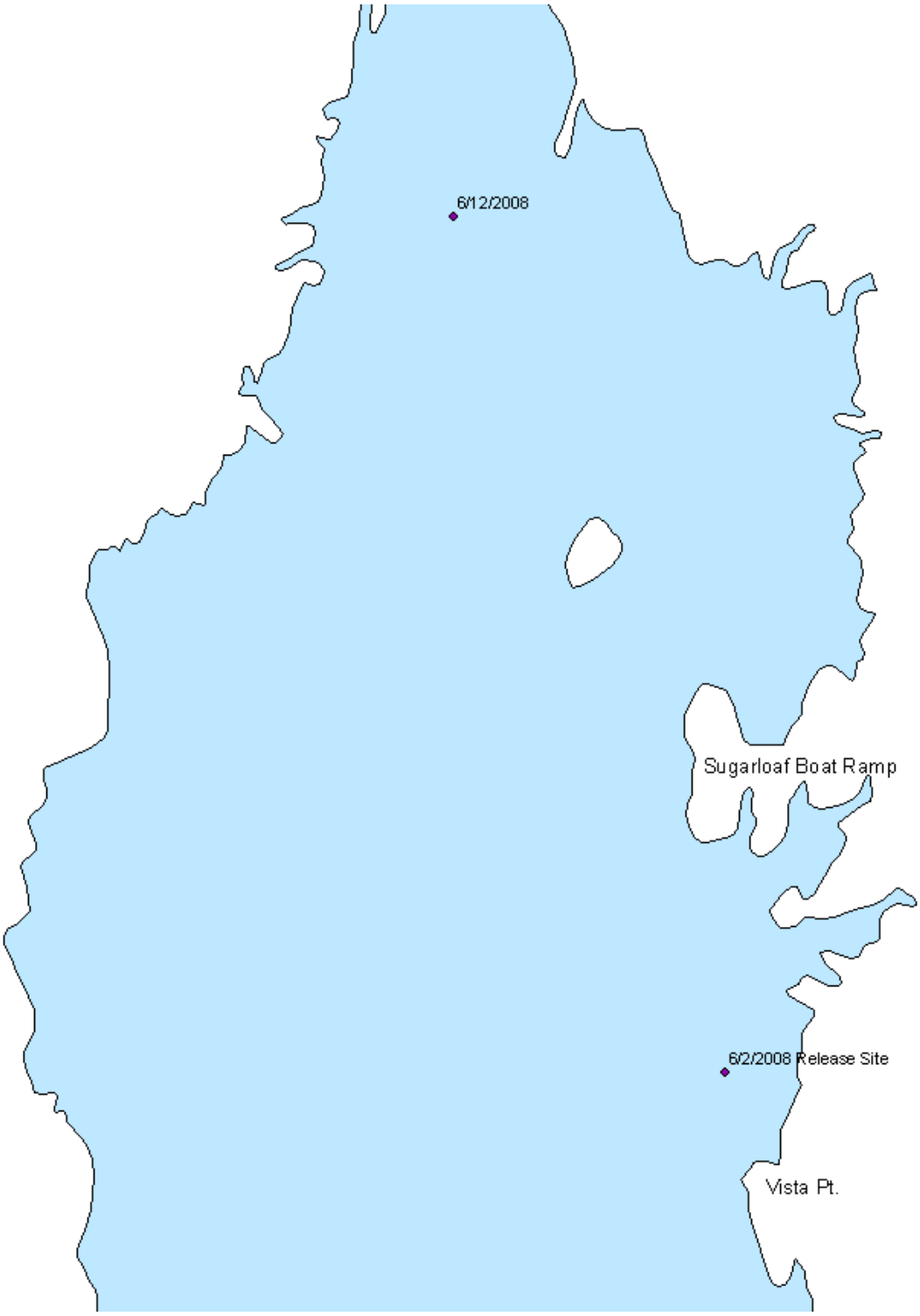


Figure 16. Release site and relocation sites of Tag # 22 in Lake Cascade.

Figure 17. Release site and relocation sites of Tag # 23 in Lake Cascade.

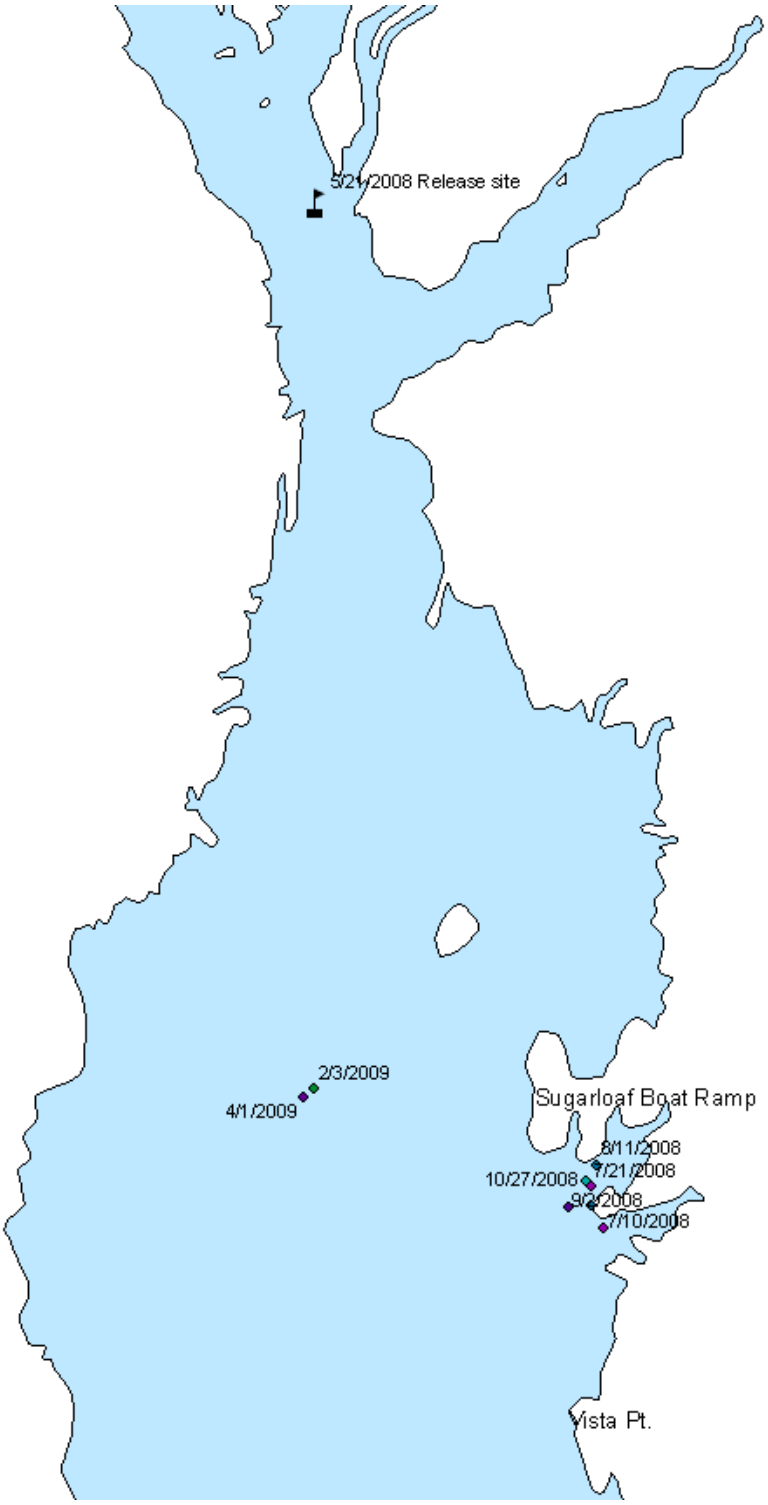


Figure 18. Release site and relocation sites of Tag # 26 in Lake Cascade.

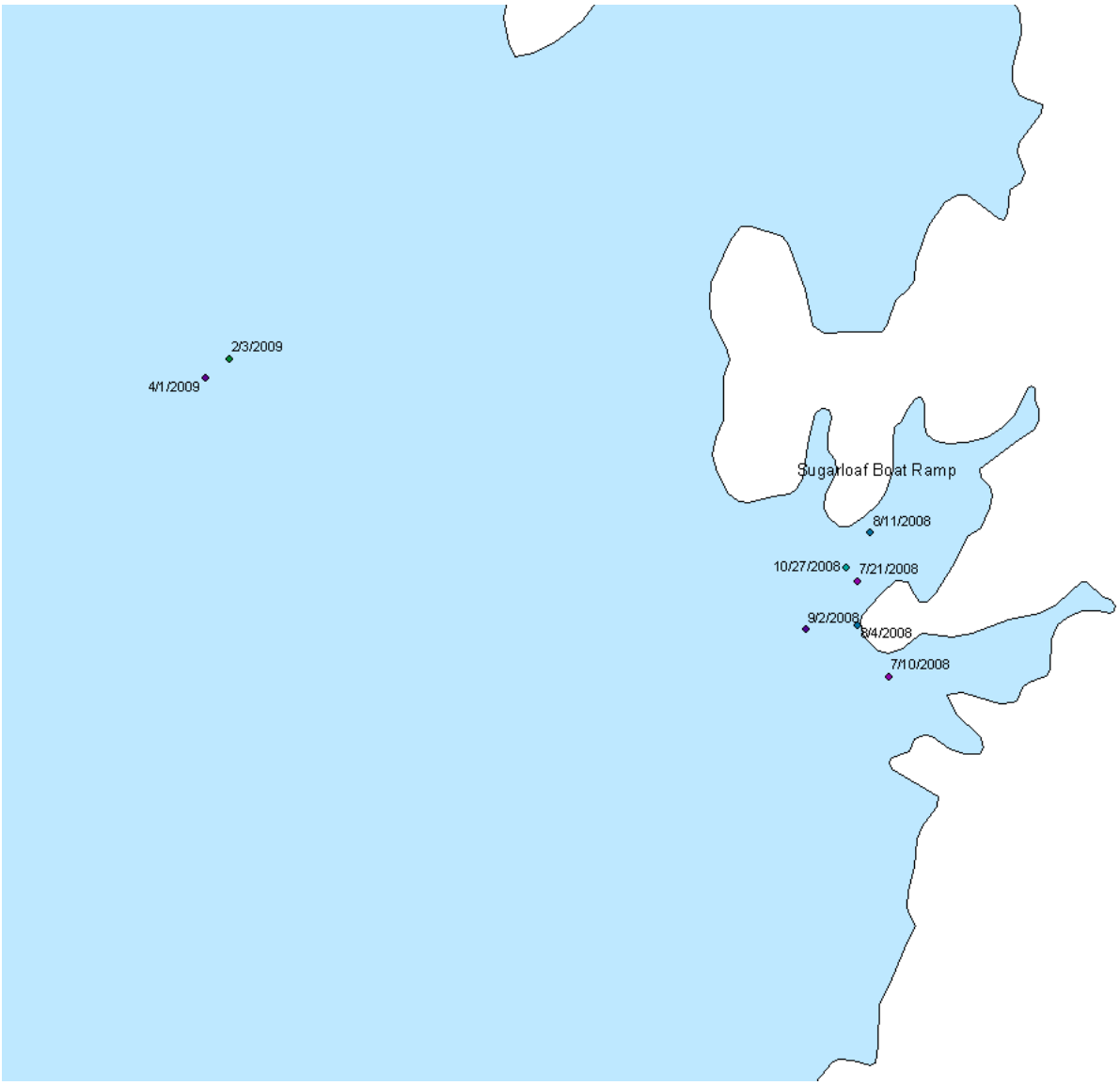


Figure 19. Close up of relocation sites of Tag # 26 in Lake Cascade.

Figure 20. Release site and relocation sites of Tag # 54 in Lake Cascade.

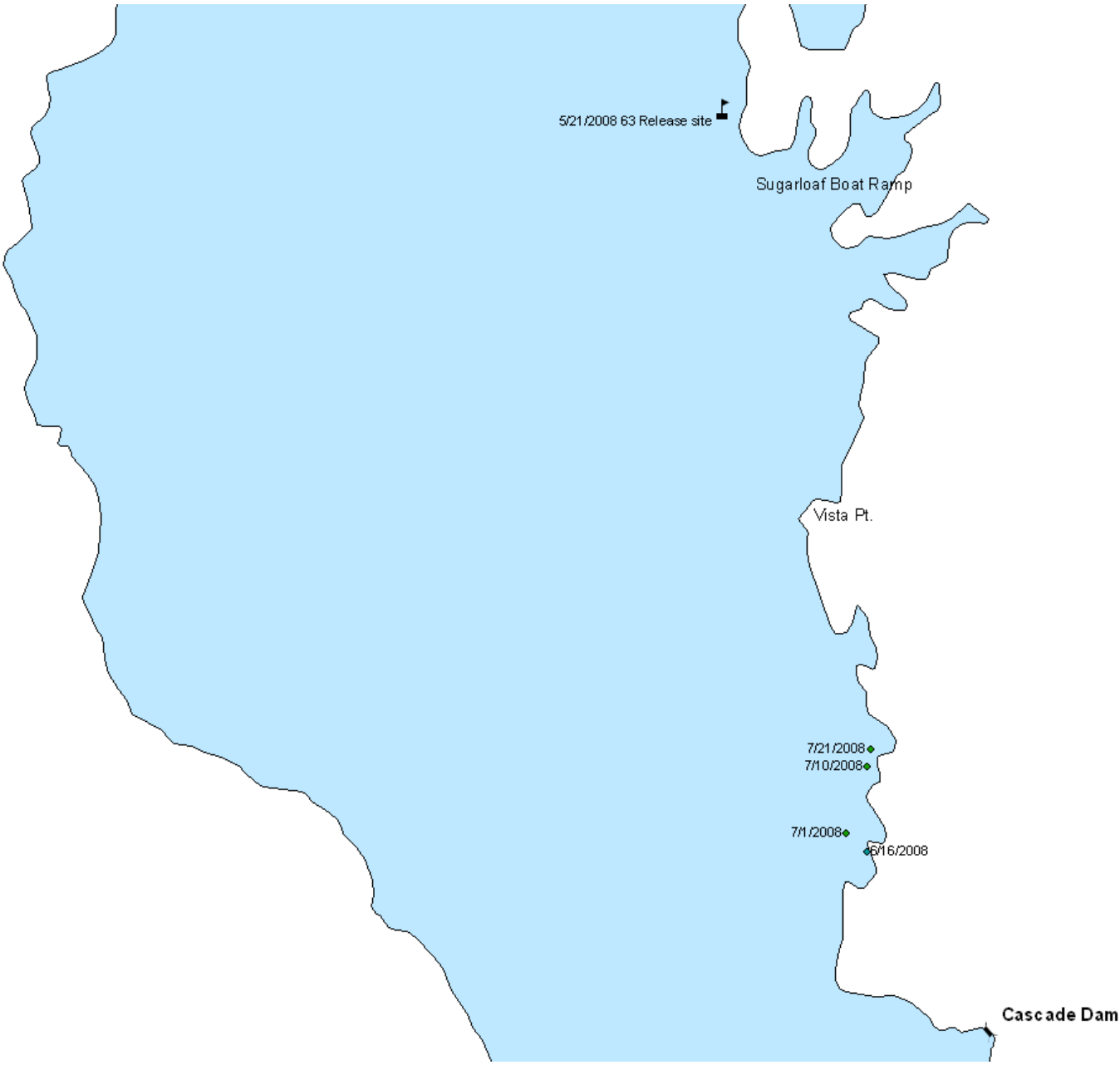


Figure 21. Release site and relocation sites of Tag # 63 in Lake Cascade.

Table 1. Total estimated angler hours, rainbow trout catch, and rainbow trout harvest on Fish Lake from June 14 through October 31, 2009.

Day Type	Estimated Angler Hours	95% CI	Estimated Total Catch	95% CI	Estimated Total Harvest
Weekdays	1470	1925	2297	4431	1148
Weekends	1323	785	1873	4009	937
Combined	2793	2078	4170	5976	2085

Table 2. Density estimates of kokanee on each transect in Payette Lake. NASC = the nautical area scattering coefficient (Transect numbers correspond to those in Figure 1).

Transect number	Number of pings analyzed	NASC	Mean target strength	Total fish density	Fry density (fish/ha)	Kokanee ages 1-2 (fish/ha)	Kokanee age-3 (fish/ha)
1	3065	4.92	-46.34	49	40	6	3
2	2850	6.42	-42.96	29	17	6	6
3	2678	2.94	-49.26	58	40	18	0
4	3213	3.14	-49.54	66	44	11	5
5	1854	2.57	-46.91	29	22	7	0
6	2390	3.09	-35.99	3	0	1	2
7,8,9	3753	8.65	-42.74	38	18	17	3
10	1500	3.17	-50.56	84	77	7	0
11	1882	7.91	-47.16	96	86	6	3
12	1565	7.58	-51.83	268	265	4	0
13	1365	4.41	-46.03	41	32	6	2
14	1833	11.16	-47.42	143	118	25	0
15	1644	16.49	-45.26	129	92	31	6
16	847	17.77	-35.49	15	10	0	0
17	1348	23.68	-48.36	377	344	16	16
18	1619	4.24	-47.14	51	37	12	1
Mean				92	78	11	3

Table 3. Population estimate of kokanee in Payette Lake during the 2009 survey. Areas were measured inside of the 10 m contour.

Section	Section Area (ha)	Density (fish/ha)	Population Estimate
Southwest	844		
Fry		27	22,788
Age-1-2		9	7,596
Age-3		3	2,532
Total		39	32,916
Narrows	82		
Fry		18	1,476
Ages 1-2		17	1,394
Age-3		3	246
Total		38	3,116
East	680		
Fry		118	80,240
Ages 1-2		12	8,160
Age-3		3	2,040
Total		133	90,440
Total Fry		65	104,504
Total Age-1-2		11	17,150
Total Age-3		3	4,818
Total	1,606	79	126,472

Table 4. Comparison of kokanee densities (fish/ha) between various Idaho lakes. All surveys conducted in 2009 used similar gear and were analyzed with the same software. Spirit Lake, Coeur d'Alene Lake, and Lake Pend Oreille had trawling data available to partition the older age classes.

Age class	Payette Lake 2009	Payette Lake 1996	Spirit Lake 2009	Coeur d'Alene Lake 2009	Lake Pend Oreille 2006
Age-0	65	264	970	370[A]	525
Age-1 and 2	11		833	643	143
Age-3	3		103	61	1
Age 4	-		-	-	1
Total Density	79	488	1,906	1,074	670

[A.] Kokanee fry were near record lows during 2009 in Coeur d'Alene Lake.

Table 5. Total and mean catch of yellow perch by area collected in June, August and October 2009 with a bottom trawl from Lake Cascade with 95% confidence intervals (+/-)

	June			August			October		
AREA	**Number of Transects**	**Total Number Perch**	**Average Catch per Transect**	**Number of Transects**	**Total Number Perch**	**Average Catch per Transect**	**Number Transects**	**Total Number Perch**	**Average Catch per Transect**
South	7	162	23 (+/-30)	7	9607	1601 (+/955)	7	4355	622 (+/-937)
West	7	122	17 (+/-23)	7	11336	1619 (+/-797)	7	4978	711 (+/-1665)
East	7	33	5 (+/-3)	6	13775	2026 (+/-1037)	7	19212	2745 (+/-3243)
Totals/Averages	21	317	15	20	34718	1736	21	58545	1359

Table 6. Length frequencies and ages of yellow perch collected with a bottom trawl from Lake Cascade in June, August, and October 2009.

Total length	June	August	October	October otolith ages (trawl and fishery)	Year age class produced
10	0	0	0		
20	2	0	0		2009
30	23	760	167	0	“
40	74	10,064	1,842	0	2008
50	11	17,470	9,882	1,0	“
60	1	5,318	10,216	1	“
70		968	4,690	1	“
80		37	1,509	1,2	2007
90		46	177	2	“
100		31	21	2,3	“
110		14	20	3	2006
120		9	8	3	“
130		1	5	3	“
140		0	4	3	“
150		0	1	3	“
160		0	1	3	2006
170		0	0	-	
180		0	0	-	
190		0	0	-	
200		0	0	-	
210		0	0	-	
220		0	0	-	
230		0	0	-	
240		0	0	4	2005
250		0	0	4	“
260		0	1	4	“
270		0	0	4	“
280		0	1	4	“
290		0	0	4,5	2004
300		0	0	4,5	“
310		0	0	5	“
320		0	0	5	“
330		0	0	-	
340		0	0	-	
TOTALS	111	34,718	28,545		

Table 7. Average yellow perch catch per trawl transect for all transects and areas in Lake Cascade from 1998 through 2009.

YEAR	Average Yellow Perch Catch per 5 Minute Trawl	Dominant October Age Class
1998	2	0
1999	21	0
2000	10	0
2001	18	0
2002	7	0
2003	12	0
2004*	93	0
2005*	220	0
2006*	436	0
2007	651	0
2008	1,140	0
2009	1,029	1

* Years with adult yellow perch introductions and northern pikeminnow removal

Table 8. October total lengths of age-0 and 1 yellow perch collected with the trawl in Lake Cascade from 1998 through 2009.

Year	Age 0 Total length (mm)	Age-1 Total length (mm)
1998	72	120
1999	71	125
2000	71	135
2001	75	135
2002	72	145
2003	71	145
2004*	54	115
2005*	52	114
2006*	42	81
2007	47	73
2008	44	81
2009	40	63

* Years with adult yellow perch introductions and northern pikeminnow removal

Table 9. Hydroacoustic fish densities (fish/ha) per transect and total fish abundance estimates calculated using both the arithmetic and geometric mean densities at Lake Cascade in 2009. Table A is fish >250 mm and Table B is all fish.

A. Fish>250

Transect	Transect length (m)	Fish densities (number / ha)		
		Sidelooking (0-6 m)	Downlooking (>6 m)	Total
1	728	0.7	0.0	0.7
2	818	0.2	0.0	0.2
3	3,062	1.5	0.0	1.5
4	1,831	0.5	2.4	3.0
5	1,088	0.1	0.0	0.1
6	2,330	0.2	0.0	0.2
7	4,054	0.0	6.0	6.0
8	1,652	1.3	5.3	6.6
9	3,162	1.0	0.0	1.0
	Geometric Mean (GM)	**0.6**	**0.8**	**1.4**
	90% CI (GM)	**0.34 to 0.79**	**0.21 to 1.5**	**0.8 to 2.4**
	Abundance (GM)	**4,899**	**6,663**	**12,831**
		3,048 to 7,036	**1,840 to 13,646**	**6,833 to 21,016**

B. **All Fish.**

Transect	Transect length (m)	Fish densities (number / hectare)		
		Sidelooking (0-6m)	Downlooking (>6m)	Total
1	728	2.2	0.0	2.2
2	818	0.5	17.9	18.4
3	3,062	3.6	146.1	149.7
4	1,831	0.9	6.5	7.4
5	1,088	0.1	120.0	120.2
6	2,330	0.5	15.6	16.0
7	4,054	0.2	224.2	224.4
8	1,652	2.4	663.9	666.3
9	3,162	2.7	576.8	579.5
	Geometric Mean (GM)	**1.2**	**52.5**	**61.3**
	Abundance (GM)	**10,478**	**468,903**	**547,266**
		6,513 to 15,461	**177,871 to 1,213,364**	**234,525 to 1,261,755**

Table 10. Species proportions and 90% confidence intervals for fish caught during the 2009 hydroacoustic survey at Lake Cascade.

Species	Proportion	V^	90%CI
Brown Bullhead	0.06	0.002	0.08
Coho Salmon	0.06	0.001	0.06
Kokanee	0.08	0.003	0.10
Largescale sucker	0.31	0.014	0.22
Mountain Whitefish	0.005	0.000	0.01
Northern Pikeminnow	0.08	0.001	0.06
Rainbow trout	0.33	0.010	0.18
Steelhead	0.01	0.000	0.02
Yellow Perch	0.07	0.002	0.08

Table 11. Hydroacoustic abundance estimates for individual species from data collected during the 2005 fish assessment survey at Lake Cascade for A. fish > 250 mm and B. all fish. Abundance was estimated as the product of a species proportion from gill netting data and the total abundance estimate from hydroacoustics.

A. Fish > 250 mm.

Species	Proportion ± 90% CI	Abundance	90% CI
Brown Bullhead	0.06 ± 0.08	751	299
Coho Salmon	0.06 ± 0.06	751	222
Kokanee	0.08 ± 0.10	983	385
Largescale sucker	0.31 ± 0.22	3,988	851
Mountain Whitefish	0.005 ± 0.01	58	26
Northern Pikeminnow	0.08 ± 0.06	1,040	213
Rainbow trout	0.33 ± 0.18	4,219	719
Steelhead	0.01 ± 0.02	116	65
Yellow Perch	0.07 ± 0.08	925	282

B. All fish.

Species	Proportion ± 90% CI	Abundance	90% CI
Brown Bullhead	0.06 ± 0.08	32,047	12,611
Coho Salmon	0.06 ± 0.06	32,047	9,274
Kokanee	0.08 ± 0.10	41,908	16,214
Largescale sucker	0.31 ± 0.22	170,096	34,733
Mountain Whitefish	0.005 ± 0.01	2,465	1,097
Northern Pikeminnow	0.08 ± 0.06	44,373	8,645
Rainbow trout	0.33 ± 0.18	179,957	28,546
Steelhead	0.01 ± 0.02	4,930	2,753
Yellow Perch	0.07 ± 0.08	39,443	11,793

Table 12. Lake Cascade sonar tagged yellow perch statistics (Number of relocations, distances between relocations, dates of; release, first relocation, and last relocation).

Fish tag number	Number of Relocations	Distance Between release site and 1st relocation site (km)	Maximum distance between all relocation sites (km)	Date of release	Date of first relocation	Date of final relocation
2	1		--	5/27/08	6/30/08	same
7	10	13.2	2.1	5/21/08	6/15/08	6/15/09
9	10	1.9	2.1	6/2/08	7/10/08	4/1/09
10	2	15.8	3.4	6/9/08	6/30/08	8/5/08
11	2	3.0	5.7	6/9/08	6/17/08	8/14/08
22	1	7.9	--	6/2/08	6/2/08	same
23	3	6.4	6.6	6/9/08	6/16/08	8/4/08
26	8	12.1	3.75	5/21/08	7/10/08	4/1/09
54	5	4.0	3.4	6/9/08	6/16/08	10/2/08
63	4	6.1	0.8	5/21/08	6/16/08	7/21/08
Average	4.6	7.8	3.6			

Table 13. Average boat and shore angler counts on Lake Cascade on three major holidays; Memorial Day, July 4th, and Labor Day, in 1982, 1991, 1992, and 1996 through 2009 with corresponding intensive creel survey angler hour estimates for 1982, 1991 and 1992.

	Holiday Counts		**Estimated Angler Hours (hours * 1000)**		
Year	**Ave. # Boats**	**Ave. # Shore Anglers**	**Boat Anglers**	**Shore Anglers**	**Total Pressure[1]**
1982	154	85	255.6	129.8	385.4
1991	41.5	32	135.2	102	237.2
1992	52.5	116	144.2	177.3	321.5
1996	35	27	--	--	--
1997	36.5	19	--	--	--
1998	58	39.5	--	--	--
1999	27	31	--	--	--
2000	15	12	--	--	--
2001	11	12	--	--	--
2002	16.5	12	--	--	--
2003	17	6	--	--	--
2004	23	8.5	--	--	--
2005	28	12.5	--	--	--
2006	25	23	–	–	–
2007	24	28	–	–	–
2008	34	37	–	–	–
2009	29	29	**2009/10 Creel survey to be presented in 2010 field season report**		

[1] Does not include ice fishing hours.

2009 Southwest Region (McCall) Annual Fishery Management Report

RIVERS AND STREAMS INVESTIGATIONS

ABSTRACT

We completed a total of seventy three IDFG standard stream surveys in forty nine streams in the South Fork of the Salmon River, East Fork of the South Fork of the Salmon River, Secesh River and North Fork Payette River drainages in 2009. We examined another 38 streams shown on the map which were found to be dry.

The 2009 kokanee spawning run in the North Fork Payette River above Payette Lake was estimated to be 2,232 fish. The lowest estimate since counts began in 1988.

In 2009, temperature recorders were used to monitor the upper Little Salmon River and upper North Fork Payette River drainages throughout summer and early fall. Mean stream temperatures in the main stem Little Salmon River ranged from 17 to 23° C from July through early August. Mud Creek, a tributary to the Little Salmon, remained generally cooler with mean daily temperatures ranging from 15 to 20°C throughout July. Mean daily temperatures in the upper North Fork Payette River ranged from 14 to 19° C from July to early August.

We completed electrofishing surveys in the main stem, road less area of the Salmon River tributaries and pacific lamprey *Petromyzon marinus* ammocetes surveys on six beaches of the main Salmon River. Results showed that all tributaries surveyed had steelhead present along with other species of fishes. Pacific lamprey ammocoetes were present at only two of the six sites. A total of two Pacific lampreys were found.

Authors:

Paul Janssen
Regional Fishery Biologist

Kimberly A. Apperson
Regional Fishery Biologist

Brooklyn Hudson
Fishery Technician

South Fork Salmon River Drainage

Introduction

Over the past year we concentrated our standard survey work in the South Fork Salmon River drainage. The majority of these streams had never been surveyed and baseline data was needed to document fish species presence in the drainage. Some of these streams were intensively surveyed previously by the United Sates Forest Service and were not surveyed this year. We also completed surveys in the North Fork Payette River and Secesh River drainages.

Methods

We used the Department's standard stream survey methodology (B. Horton memo 8/15/1994) to conduct the surveys. We typically made two passes with backpack electrofishing equipment to collect all fish. Fish collected were identified and total length measured to the nearest mm. We used Seber-LeCren, 2 Sample equal effort estimator to calculate densities: $N_{est} = C^2_{1st}/(C_{1st} - C_{2nd})$, $q_{est} = 1- (C2/C1)$, where: C_{1st} = No. captured in first sample, C_{2nd}= No. captured in second sample, and q = Probability of capture. Habitat data were collected in all streams even if no fish were found. However, we did not collect habitat data for streams that were dry.

Results

We completed a total of seventy two IDFG standard stream surveys in forty nine streams in the South Fork of the Salmon River, East Fork of the South Fork of the Salmon River, Secesh River and North Fork Payette River drainages in 2009. We examined another 38 streams shown on the map which were found to be dry.

UTM coordinates of stream survey locations are presented in Table 14. Specific habitat and fishery data for these surveys can be found in the Department's standard stream survey database. Furthermore, many streams in the South Fork of the Salmon River Drainage were completely dry during the months of July and August 2009. We recorded UTM coordinates for these streams and are presented in Table15.

We collected bull trout from nine streams, two of which bull X brook trout hybrids were found (Table16). There were 20 streams with brook trout observed of which one of those also contained bull trout. Westslope cutthroat trout were found in 22 streams and steelhead/redband trout *O. mykiss gairdneri* in 31 streams. Nine streams contained both westslope cutthroat trout and redband trout. We also recorded presence of tailed frogs *Ascaphus truei* and Idaho giant salamanders *Dicamptodon aterrimus*.

MANAGEMENT RECOMMENDATION

1. Continue stream surveys in the South Fork Salmon River Drainage in 2010.

North Fork Payette River above Payette Lake Kokanee Counts

Introduction

The spawning run of kokanee in the North Fork Payette River (NFPR) from Payette Lake has been enumerated since 1988 to assess spawning escapement and to serve as a method of validating kokanee population/density estimates and survival estimates from in-lake population work. This estimate was completed again in 2009.

Methods

We completed kokanee spawner counts by walking the entire stretch of river utilized by spawning kokanee and counting all live spawners. Kokanee were first observed in the river on August 25, 2009. Five counts were completed during spawning. Counts were made weekly until a peak count was established. The total spawning run estimate was made by multiplying the largest daily count by 1.73 (Frost and Bennett 1994).

Results

We counted 1,220, 1,290 and 1,227 live kokanee spawners on September 2, 8, and 11, 2009 respectively. The total spawning run estimate was 2,232 (1,290*1.73) fish (Table17). Average total length of spawners was 405 mm.

Discussion

Kokanee spawner counts continue to decline to the lowest count ever made on Payette Lake. Reasons for the decline are probably due to the recent stockings of small lake trout and the lack of kokanee stocking since 1993. We stocked 87,500, 460,000, and 263,265 kokanee fingerling in 2007, 2008 and 2009 respectively. As noted by Janssen et.al. (*In press)* stocked kokanee do not show up as spawners until the fourth year following the year stocked. Therefore, we do not expect the spawning kokanee run size to increase significantly until at least the year 2011. Also the small number of fish stocked in 2007 may not recruit a large number of spawning fish.

Kokanee population estimates must be completed in each of the next several years to ensure that kokanee numbers increase in the midst of increased lake trout numbers.

Management Recommendation

1. Continue kokanee spawning run counts to monitor kokanee viability in Payette Lake.

Little Salmon River and North Fork Payette River Temperature Monitoring

Introduction

For the past 15 years, the upper Little Salmon River (LSR) drainage has been the focus of ongoing riparian habitat improvement projects and some improvements in agricultural land use practices. Debate has risen among stakeholders regarding what specific factors limit salmonid populations throughout the drainage. Summer stream temperature monitoring began in 1994 to establish baseline data and to track changes that may be influenced by recovery of riparian habitat. Monitoring of stream temperatures was intensified in 2004 to assist with Idaho Department of Environmental Quality's 2006 water quality assessment for development of Total Maximum Daily Load (TMDL) allowances. We consider the sites monitored in 2009 adequate to characterize long-term trends in the upper LSR. The LSR and some tributaries are currently listed as water quality limited for support of cold water biota, with high summer water temperature, fine sediment, and nutrients listed as pollutants of concern.

Summer stream temperature is monitored annually in the North Fork Payette River (NFPR) as part of ongoing evaluation of a minimum in-stream flow that was established in 2000 to provide for salmonid spawning and rearing (Idaho Department of Water Resources permit #65-13894).

Methods

Hobo temperature recorders (Onset model H08, -5 to +35°C) were deployed to monitor water temperature continuously, recording a temperature every 0.5 hours from July 1 through October 4. Each recorder was placed in a waterproof Onset model container and secured by cable to a cinder block. The cinderblock was placed in the stream and cabled to shore. Protocol described by Zaroban (2000) was followed to calibrate recorders prior to use.

Two recorders were placed in the main LSR. Recorders were located at the Circle C Bridge and approximately 0.4 km downstream from Meadow Creek Subdivision Bridge, on Campbell Ranch. Additionally, one recorder was placed in Mud Creek, a headwater tributary to the LSR, immediately below the confluence with Little Mud Creek, under the Highway 95 Bridge. A map of the location of each recorder can be found in Appendix A.

One temperature recorder was secured to near the United States Geological Survey gauging station in the NFPR approximately 0.4 km downstream from Fisher Creek. A map of the location of this recorder can be found in Appendix B.

Results

Figure 22 and Tables 18 and 19 show graphically and in table format the daily mean, minimum, and maximum stream temperatures for the upper LSR in 2009. Average daily temperatures at the upstream LSR site during July were 19.8 ^{o} C and ranged from minimums of 13.3 ^{o} C to maximums of 26.0 ^{o} C. Average daily temperatures at the downstream LSR site during July were 21.7 ^{o} C and ranged from minimums of 16.0 ^{o} C to maximums of 26.3 ^{o} C.

Figure 23 and Table 20 show graphically and in table format the daily mean, minimum and maximum stream temperatures for Mud Creek in 2009. Average daily temperatures exceeded 20° C only once in July and ranged from a minimum of 11.0 ^{o} C to a maximum of 24.0 ^{o} C.

Figure 23 and Table 21 show daily mean, minimum, and maximum stream temperatures for the upper NFPR station in 2009. Summer stream temperatures in the NFPR generally remain adequate for rainbow trout rearing. Mean daily temperature did not exceed 20°C during July.

Salmon River (Roadless Section)Tributary Stream and Pacific Lamprey Surveys

Introduction

Little is known about true status of native fish populations on the Salmon River and its tributaries between Corn Creek and the Wind River. This is due to the remoteness of this wilderness area. During the “Range Wide Assessment of Westslope Cutthroat Trout Project” conducted in 2009, data was lacking for the Salmon River tributaries in this river reach. Our main objective was to inspect the south side tributaries for possible future sampling and to sample fish in some of the tributaries. The second objective of this trip was to collect distribution data for fish species and collect fin tissue samples from steelhead. These samples will be used to examine genetic relationships among steelhead populations. We also wanted to survey four long term snorkel trend sites. On this field stint we performed snorkeling, electro-fishing, and angling surveys on tributaries to the Salmon River. Beaches along the Salmon River were surveyed for pacific lamprey *Petromyzon marinus* ammocoete presence.

Methods

Since this stretch of the Salmon River is a wilderness area, rafts had to be used to access all sites that were surveyed. Snorkeling surveys were conducted by moving slowly upstream while counting all fishes observed and estimating their sizes to the nearest inch. Chinook parr were aged based on length. The presence of non-salmonid species was also noted.

After each site was snorkeled length and width measurements were taken to calculate the surface area. The length of these sites was usually around 50 meters. A total of four trend sites were snorkeled; two sites in Bargamin Creek and two sites in Horse Creek. These sites

have been surveyed semi-annually since 1985. Bargamin Creek 1 starts just above a pack bridge near its confluence with the Salmon River. Bargamin Creek 2 starts about a half mile above the confluence. Horse Creek L1 also starts just above a pack bridge near the confluence. Horse Creek L2 starts about a half mile from the confluence.

Five streams were snorkeled for fish presence: Richardson Creek, Rabbit Creek, California Creek, Warren Creek, and two sites in Little Five Mile Creek. All sites were within one mile of the confluence with the Salmon River.

Disappointment Creek and Cottonwood Creek were surveyed using a backpack electro-shocker, dip nets, and angling gear. Fin tissue samples were taken from steelhead parr at these sites via caudal clip and stored in vials of ethyl alcohol. Lengths of each fish were also recorded.

Beaches at the Swimming Hole, Sheep Creek Lower Camp, Paine Camp, Benjamin Camp, Magpie Camp, Richardson Creek, and below Polly Beamis Ranch were surveyed for pacific lamprey ammocoete presence using a backpack electro-shocker. The total area surveyed usually averaged 70 m^2. Lengths of each ammocoete were recorded. All fish were released after data were recorded.

Results

The results showed that most tributaries surveyed had steelhead present along with other species of fishes. Bargamin Creek sites 1 and 2 had 3.78 and 6.41 steelhead per/100m^2 respectively. Horse Creek sites L1 and L2 had 6.74 and 4.28 steelhead per/100m^2 respectively. Densities in 2009, done by snorkeling, were lower when compared to the mean densities of past surveys (Figure 24). Densities calculated from electrofishing samples are presented in Figure 25. Eight fin tissue samples were collected from steelhead out of Cottonwood Creek. Fifty fin tissue samples were collected from Disappointment Creek steelhead.

Pacific lamprey ammocoetes were present at only two of the six sites that were surveyed. A total of two pacific lamprey were found. One at BLW Polly Beamis Ranch and one at Swimming Hole. This gave BLW Polly Beamis Ranch a density of 0.60 pacific lamprey ammocoete per/100 m^2. Swimming Hole had a density of 2.26 Pacific lampreys per 100 m2 (Figure 26).

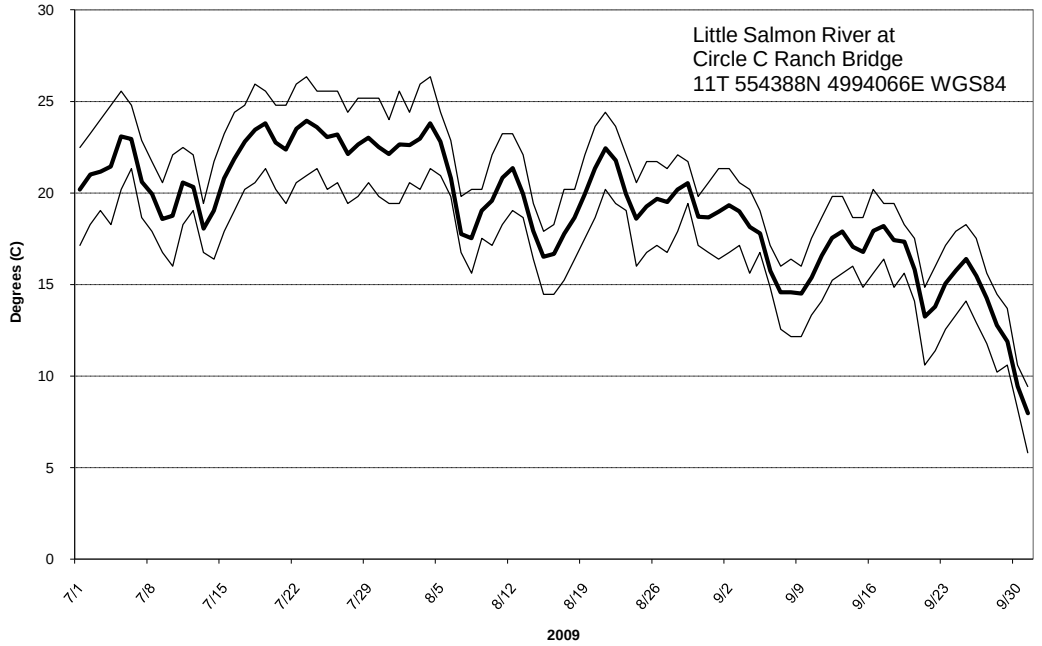
Table 22 shows abundances of all salmonids observed during snorkeling surveys.

Discussion

The purpose of this survey was to begin to document native fish species presence and distribution on the Salmon River and its tributaries between Corn Creek and the Wind River. All the sites surveyed for steelhead were new except for four trend sites. Therefore we had no data on fish densities from the past for most of these sites. Our surveys showed that steelhead snorkel densities at trend sites were slightly lower than the mean of all surveys done since 1985. This survey also showed that steelhead parr inhabit most of the tributaries visited.

Since overall Pacific lamprey numbers have been declining throughout the Columbia drainage (USFWS 2009), we did not expect to find a plethora of lamprey ammocoetes on beaches of the Salmon River. Of the six sites surveyed we were only able to find two Pacific lamprey ammocoete.

Our data from this reconnaissance trip show us that our assumptions of westslope cutthroat trout distribution were not valid; these Salmon River tributaries are dominated by steelhead. Ideally, all tributaries within this river reach need to be surveyed for fish distribution and genetic identification. Utilizing rafts for access was effective and will likely be needed to be used again. Jet boat trips from the lower end could also be effective in getting a sample crew into the area. It will take multiple years to sample this area due to the number of tributaries and availability of funding.



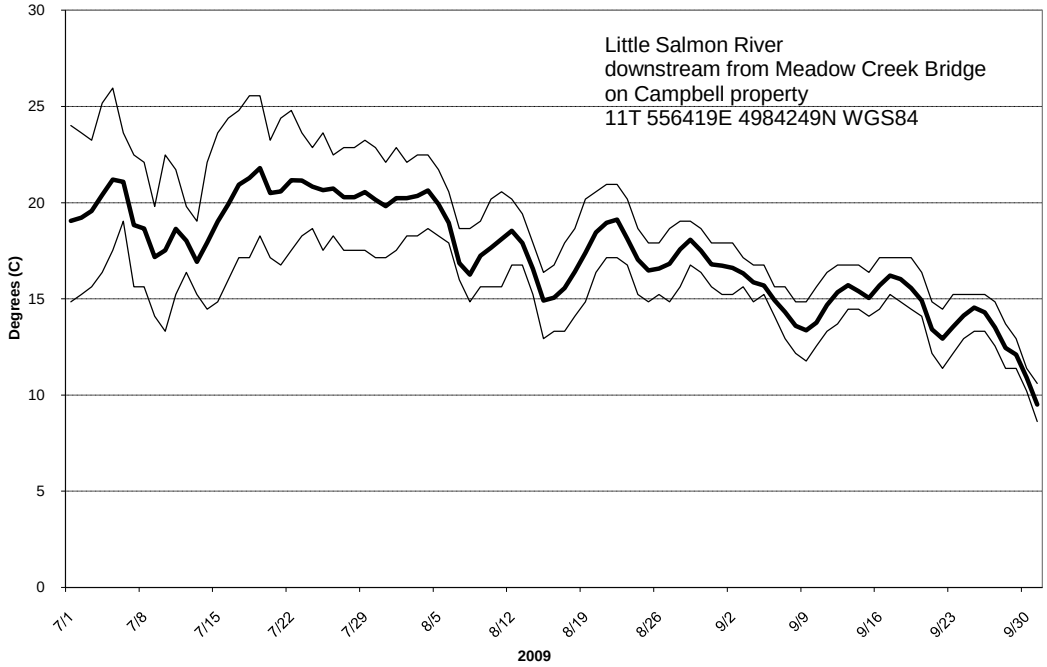


Figure 22. Daily mean, minimum, and maximum stream temperatures in the Little Salmon River, at Circle C Ranch Bridge and downstream from Meadow Creek Bridge, 2009.

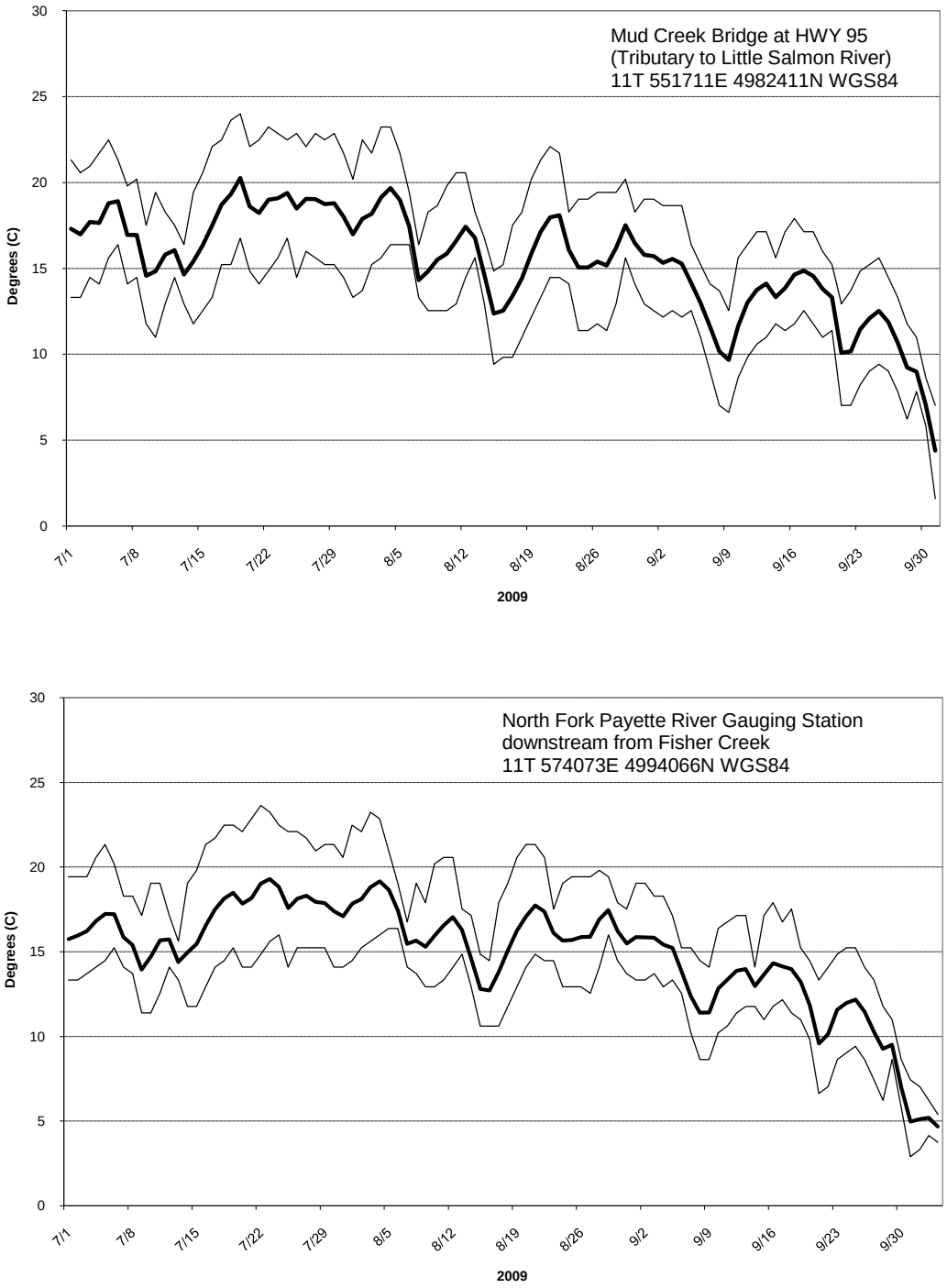


Figure 23. Daily mean, minimum, and maximum stream temperature in Mud Creek and the upper North Fork Payette River at the USGS gauge downstream from Fisher Creek, 2009.

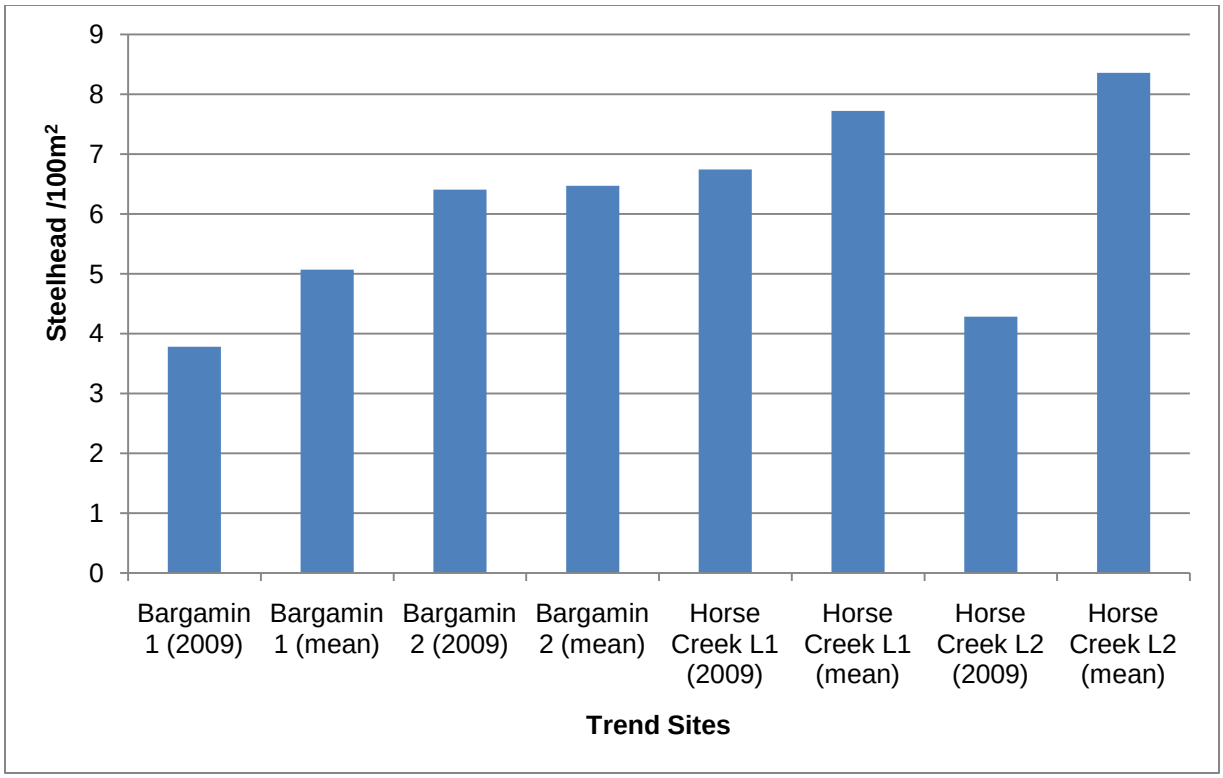


Figure 24. 2009 steelhead densities in trend sites (fish/100m^2) compared to mean densities of past snorkel surveys.

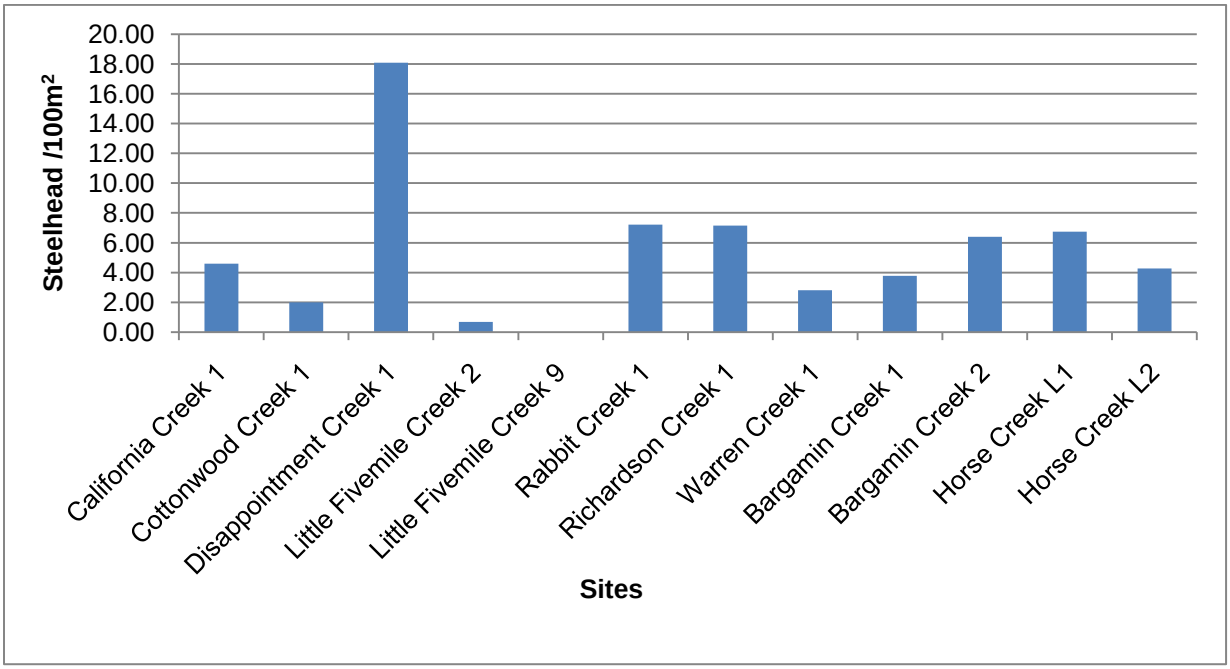


Figure 25. 2009 steelhead densities (fish/100m^2) in each stream.

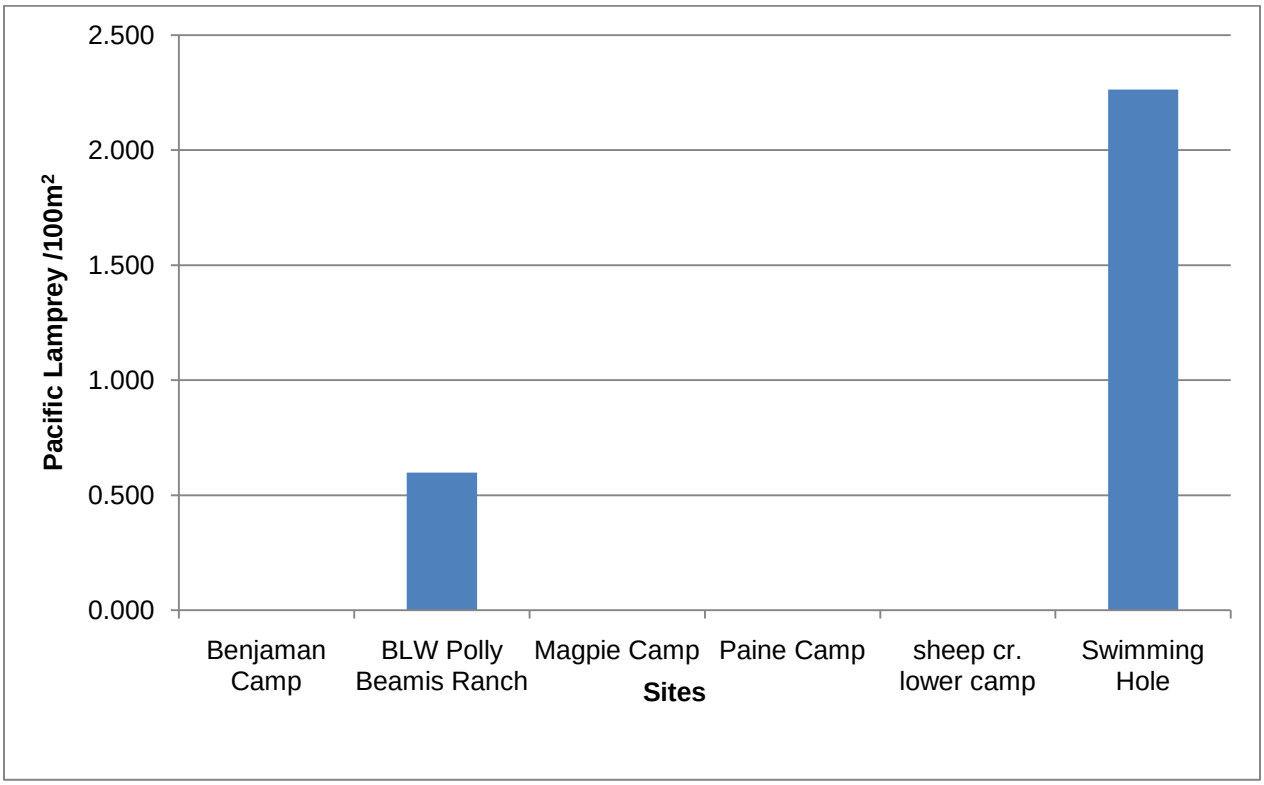


Figure 26. 2009 Pacific lamprey ammocoete densities (fish/100m^2) at each site.

Table 14. UTM coordinates of standard IDFG stream survey sites completed in 2009 (South to North).

Stream	Parent Drainage	Site Number	Easting UTM Coordinate (NAD 27)	Northing UTM Coordinate (NAD 27)
Upper S.F. Salmon R.	Salmon River	1	603462	4929575
Mormon Creek	S.F. Salmon R.	1	603851	4930622
Non-Named Creek 2	S.F. Salmon R.	1	604152	4932395
Yellow Jacket Creek	S.F. Salmon R.	1	603118	4933004
Rice Creek	S.F. Salmon R.	1	607426	4933576
Tyndall Creek	S.F. Salmon R.	1	604292	4936732
Non-Named Creek 1	S.F. Salmon R.	1	604966	4937570
Lodgepole Creek	S.F. Salmon R.	1	605734	4938135
Bear Creek	S.F. Salmon R.	1	604730	4941577
Trail Creek	Curtis Creek	1	600715	4942719
Curtis Creek	S.F. Salmon R.	1	601695	4942855
Warm Lake Creek	S.F. Salmon R.	1.	605047	4945876
Reeves Creek	Cabin Creek	1	606300	4946722
Two-Bit Creek	S.F. Salmon R.	1	602047	4946974
no-name near knox st.	Cabin Creek	1	603965	4947043
Six-Bit Creek	S.F. Salmon R.	1	600332	4947678
Cabin Creek	Warm Lake Creek	3	606927	4950214
Dime Creek	S.F. Salmon R.	1	603459	4950679
Nickel Creek	S.F. Salmon R.	1	603500	4951410
Dollar Creek	S.F. Salmon R.	1	603402	4952502
Mirror Creek	S.F. Salmon R.	1	603642	4953656
Roaring Creek	S.F. Salmon R.	1	604434	4955430
S.F. Goat Creek	S.F. Salmon R.	2	605618	4956100
N.F. Goat Creek	S.F. Salmon R.	3	605510	4956723
Goat Creek Lower	S.F. Salmon R.	1	604209	4956766
Sister Creek	S.F. Salmon R.	1	604636	4958124
Twin Creek S.F.	S.F. Salmon R.	1	604486	4958716
Twin Creek N.F.	S.F. Salmon R.	1	604497	4958860
Cliff Creek Upper	S.F. Salmon R.	2	602652	4959708
Snow slide Creek	S.F. Salmon R.	1	604106	4960454
Cliff Creek Lower	S.F. Salmon R.	1	604998	4961159
Boulder Creek	N.F. Payette	2	581247	4968682
Boulder Creek	N.F. Payette	3	582584	4968828
Boulder Creek	N.F. Payette	1	578468	4969324

Table 14. cont.

Nasty Creek	S.F. Salmon R.	1	602975	4969867
Martin Creek	S.F. Salmon R.	1	601919	4970471
S.F. Camp Creek	S.F. Salmon R.	4	604405	4970861
M.F. Camp Creek	S.F. Salmon R.	3	604459	4970915
N.F. Camp Creek Lower	Camp Creek	2	603451	4971291
Camp Creek	S.F. Salmon R.	1	602178	4971340
Phoebe Creek	S.F. Salmon R.	1	601526	4972217
N.F. Camp Creek Upper	Camp Creek	2	604986	4972768
S.F. Phoebe Creek	S.F. Salmon R.	2	602845	4973277
M.F. Phoebe Creek	S.F. Salmon R.	3	602821	4973667
S.F. Lake Fork Creek	Lake Fork	2	584620	4974117
M.F. Lake Fork Creek	Lake Fork	4	585315	4974610
E.F. Lake Fork Creek	Lake Fork	1	583344	4974715
E.F. Lake Fork Creek	Lake Fork	3	585194	4974801
Salt Creek	E.F. S.F. Salmon R.	1	630046	4978485
Little Indian Creek	S.F. Salmon R.	1	600516	4979924
Indian Creek	S.F. Salmon R.	1	600208	4980341
Profile Creek	E.F. S.F. Salmon R.	1	626673	4985269
N.F. Lake Fork Creek	Lake Fork	1	584491	4985818
Hamilton Creek	S.F. Salmon R.	1	602526	4987405
Zena Creek	Secesh River	1	598705	4988157
Tailholt Creek	S.F. Salmon R.	1	604200	4988347
Cow Creek	Maverick Creek	1	596647	4988676
Circle End Creek	S.F. Salmon R.	1	605009	4988838
Calf Creek	Maverick Creek	1	596005	4989801
Maverick Creek Upper	Secesh River	1	595703	4990068
W.F. Zena Creek	Secesh River	2	600065	4990228
Maverick Creek Lower	Secesh River	1	596676	4990336
Brush Creek	N.F. Payette	1	575364	4990619
E.F. Zena Creek	Secesh River	3	600736	4990650
Lower N.F. Lick Creek	Lick Creek	1	595794	4991930
Pigeon Creek	S.F. Salmon R.	1	606786	4992398
Grave Creek	S.F. Salmon R.	1	607544	4992936
Upper N.F. Lick Creek	Lick Creek	3	593764	4993089
E.F. Split Creek	N.F. Lick Creek	2	595805	4993231
Fritser Creek	S.F. Salmon R.	1	608001	4993772
Devil Creek	S.F. Salmon R.	1	607936	4994389
W.F. Zena Creek Upper	Secesh River	4	601807	4994712

Table 15. UTM coordinates of dry, un-named streams sampled in July and August 2009 in the South Fork Salmon River drainage (From South to North).

Parent Drainage	Easting UTM Coordinate (NAD 27)	Northing UTM Coordinate (NAD 27)
South Fork Salmon River	604045	4956238
“ ”	603826	4956867
“ ”	604079	4957549
“ ”	602944	4960321
“ ”	602754	4961363
“ ”	602883	4961655
“ ”	602443	4961980
“ ”	603120	4962623
“ ”	602984	4963016
“ ”	602849	4963605
“ ”	602314	4964675
“ ”	602863	4965243
“ ”	601962	4965392
“ ”	602951	4965548
“ ”	603032	4965900
“ ”	602727	4966381
“ ”	602951	4966807
“ ”	603425	4967864
“ ”	600969	4974150
“ ”	600516	4974658
“ ”	600116	4974928
“ ”	699507	4976242
“ ”	699039	4976411
“ ”	699737	4976615
“ ”	699127	4976804
“ ”	699710	4976960
“ ”	699879	4977481
“ ”	699473	4977644
“ ”	699601	4977894
“ ”	699940	4978409
“ ”	600400	4979181
“ ”	699974	4980048
“ ”	600461	4981009
“ ”	600604	4981327
“ ”	600400	4981639
“ ”	600814	4982580
“ ”	601101	4985254
“ ”	606790	4989286

Table 16. Fish and amphibian presence/absence by stream and location observed during standard stream surveys completed in 2009 (From South to North).

Stream	Easting UTM Coordinate (NAD 27)	Northing UTM Coordinate (NAD 27)	Rainbow Trout	Westslope Cutthroat	Cut/Rbt Hybrid	Brook Trout	Bull trout	Bull/Brook Hybrid	Long Nosed Dace	Sculpin	Chinook	Mountain Whitefish	Tailed Frog	Idaho Giant Salamander
Upper S.F. Salmon R.	603462	4929575	y	n	n	n	y	n	n	n	n	n	n	n
Mormon Creek	603851	4930622	y	n	n	n	y	n	n	n	n	n	y	n
Non-Named Creek 2	604152	4932395	y	y	n	y	n	y	n	n	n	n	y	n
Yellow Jacket Creek	603118	4933004	y	n	n	n	y	n	n	n	n	n	n	n
Rice Creek	607426	4933576	y	y	n	y	y	n	n	n	n	n	y	n
Tyndall Creek	604292	4936732	n	n	n	n	n	n	n	n	n	n	n	n
Non-Named Creek 1	604966	4937570	n	n	n	n	n	n	n	n	n	n	n	n
Lodge pole Creek	605734	4938135	y	n	y	n	y	y	n	n	n	n	n	n
Bear Creek	604730	4941577	y	n	n	y	n	n	n	y	n	n	n	y
Trail Creek	600715	4942719	y	n	n	y	n	y	n	y	n	n	y	y
Curtis Creek	601695	4942855	y	n	n	n	n	y	n	y	y	n	y	y
Warm Lake Creek	605047	4945876	y	y	n	y	n	n	y	y	y	n	n	n
Reeves Creek	606300	4946722	y	n	n	y	n	n	n	y	n	n	y	n
Two-Bit Creek	602047	4946974	n	y	n	y	n	n	n	n	n	n	y	n
Knox Creek	603965	4947043	n	n	n	n	n	n	n	n	n	n	n	n
Six-Bit Creek	600332	4947678	n	n	n	n	y	y	n	n	n	n	y	n
Cabin Creek	606927	4950214	y	n	n	y	n	n	n	n	n	n	y	n
Dime Creek	603459	4950679	n	n	n	n	n	n	n	n	n	n	n	n
Nickel Creek	603500	4951410	n	n	n	n	n	n	n	n	n	n	n	n
Dollar Creek	603402	4952502	y	n	n	n	n	n	n	y	n	y	y	n
Mirror Creek	603642	4953656	n	n	n	n	n	n	n	n	n	n	y	n
Roaring Creek	604434	4955430	y	n	n	n	n	n	n	n	n	n	y	y

Table 16 cont.

S.F. Goat Creek	605618	4956100	y	n	n	n	n	n	n	n	n	n	n	y
N.F. Goat Creek	605510	4956723	y	n	n	n	n	n	n	n	n	n	y	y
Goat Creek Lower	604209	4956766	y	n	n	y	n	n	n	n	y	n	y	y
Sister Creek	604636	4958124	n	n	n	n	n	n	n	n	n	n	y	y
Twin Creek S.F.	604486	4958716	n	n	n	n	n	n	n	n	n	n	n	y
Twin Creek N.F.	604497	4958860	n	n	n	n	n	n	n	n	n	n	y	y
Cliff Creek Upper	602652	4959708	n	n	n	n	n	n	n	n	n	n	y	y
Snow slide Creek	604106	4960454	n	n	n	n	n	n	n	n	n	n	n	n
Cliff Creek Lower	604998	4961159	n	y	n	n	n	n	n	n	n	n	y	y
Boulder Creek	581247	4968682	y	n	n	y	n	n	n	n	n	n	n	n
Boulder Creek	582584	4968828	y	y	y	n	n	n	n	n	n	n	y	n
Boulder Creek	578468	4969324	y	n	n	y	n	n	n	n	n	n	y	n
Nasty Creek	602975	4969867	y	y	n	n	n	n	n	n	n	n	y	y
Martin Creek	601919	4970471	n	n	n	n	n	n	n	n	n	n	n	y
S.F. Camp Creek	604405	4970861	n	y	n	n	n	n	n	n	n	n	n	y
M.F. Camp Creek	604459	4970915	n	y	n	n	n	n	n	n	n	n	y	y
N.F. Camp Creek Lower	603451	4971291	y	y	n	n	n	n	n	n	n	n	y	y
Camp Creek	602178	4971340	y	n	n	y	n	n	y	y	y	n	y	y
Phoebe Creek	601526	4972217	y	n	n	y	n	n	y	y	y	n	y	y
N.F. Camp Creek	604986	4972768	n	n	n	n	n	n	n	n	n	n	y	n
S.F. Phoebe Creek	602845	4973277	n	n	n	n	n	n	n	n	n	n	n	n
M.F. Phoebe Creek	602821	4973667	n	n	n	n	n	n	n	n	n	n	n	n
S.F. Lake Fork Creek	584620	4974117	n	n	n	y	n	n	n	n	n	n	y	n
M.F. Lake Fork Creek	585315	4974610	n	y	n	y	n	n	n	n	n	n	y	n
E.F. Lake Fork Creek	583344	4974715	n	n	n	y	n	n	n	n	n	n	n	n
E.F. Lake Fork Creek	585194	4974801	y	n	n	y	n	n	n	n	n	n	n	n
Salt Creek	630046	4978485	n	y	n	n	y	n	n	n	n	n	y	n
Little Indian Creek	600516	4979924	n	n	n	n	n	n	n	n	n	n	n	n

Table 16. cont.

Indian Creek	600208	4980341	y	n	n	n	n	n	n	n	y	n	n	y
Profile Creek	626673	4985269	n	y	n	n	y	n	n	n	n	n	y	n
N.F. Lake Fork Creek	584491	4985818	y	n	n	y	n	n	n	n	n	n	y	n
Hamilton Creek	602526	4987405	n	n	n	n	n	n	n	n	n	n	n	n
Zena Creek	598705	4988157	y	n	n	n	y	n	n	y	y	n	y	y
Tailholt Creek	604200	4988347	y	y	n	n	n	n	n	n	n	n	y	n
Cow Creek	596647	4988676	n	y	n	n	n	n	n	n	n	n	y	y
Circle End Creek	605009	4988838	n	n	n	n	n	n	n	n	n	n	n	y
Calf Creek	596005	4989801	n	y	n	n	n	n	n	n	n	n	y	n
Maverick Creek Upper	595703	4990068	n	y	n	n	n	n	n	n	n	n	y	n
W.F. Zena Creek	600065	4990228	y	y	n	n	n	n	n	n	n	n	y	y
Maverick Creek Lower	596676	4990336	n	y	n	n	n	n	n	n	n	n	y	y
Brush Creek	575364	4990619	y	n	n	n	n	n	n	n	n	n	n	y
E.F. Zena Creek	600736	4990650	n	y	n	n	n	n	n	n	n	n	y	n
Split Creek	595794	4991930	y	y	n	y	n	n	n	n	n	n	y	n
Pigeon Creek	606786	4992398	n	n	n	n	n	n	n	n	n	n	n	y
Grave Creek	607544	4992936	n	n	n	n	n	n	n	n	n	n	n	n
W.F. Split Creek	593764	4993089	n	n	n	y	n	n	n	n	n	n	y	n
E.F. Split Creek	595805	4993231	n	y	n	n	n	n	n	n	n	n	y	n
Fritser Creek	608001	4993772	n	n	n	n	n	n	n	n	n	n	y	y
Devil Creek	607936	4994389	n	n	n	n	n	n	n	n	n	n	n	n
W.F. Zena Creek Upper	601807	4994712	n	n	n	n	n	n	n	n	n	n	y	n

Table 17. Payette Lake kokanee spawner counts and estimated spawning run size and biomass in the North Fork Payette River from 1988 through 2009.

Year	Peak Count	Estimated Number of Spawners	KG/Lake HA[1]	Number/Lake HA[1]	Average Spawner Weight(g	Average Spawner Total Length (mm)
1988	13,200	22,800	4.6	13.3	346	--
1989	8,400	14,500	2.9	8.4	349	--
1990	9,642	16,700	3.5	9.7	358	--
1991	10,400	18,000	5.3	10.5	505	365
1992	16,945	29,300	6.4	17.1	377	--
1993	34,994	59,310[a]	8.5	34.6	245	--
1994	25,550	44,200	5.5	25.8	214	--
1995	32,050	55,450	4.8	32.3	147	260
1996	35,090	60,707	5.7	35.4	162 [c]	--
1997	36,300[e]	64,891[d]	5.6	37.8	148	265
1998	14,585	25,232	2.1	14.7	143	254
1999	15,590	26,971	2.9	15.7	184	276
2000	15,520	26,850	2.9	15.6	188	286
2001	15,690[g]	30,144[f]	4.4	17.6	250[b]	--
2002	9,430	16,314	--	9.5	--	--
2003	5,430	9,394	1.5	5.5	279	--
2004	11,290	19,532	--	11.4	--	--
2005	11,780	20,780	--	12.1	--	--
2006	5,580	9,650	--	5.6	--	317
2007	3,925	6,790	1.6	4.0	401	340
2008	2,425	4,195	--	2.4	--	336
2009	1,290	2,232	--	1.3	--	405

[1] 1,717 ha usable kokanee habitat in Payette Lake (Area with depth greater than 40 feet).

[a] Estimate made from stream and weir counts (Frost and Bennett, 1994)
[b] From gill net data of captured spawners in Payette Lake during lake survey.
[c] From trawling collections made in September 1996.
[d] Includes 2,092 fish spawned and removed by Nampa Fish Hatchery.
[e] Does not include 2,092 fish spawned and removed by Nampa Fish Hatchery.
[f] Includes 3,000 fish spawned and removed by Nampa Fish Hatchery.
[g] Does not include 3,000 fish spawned and removed by Nampa Fish Hatchery.

Table 18. Daily mean, minimum, and maximum water temperature (C) in the Little Salmon River, at Circle C Ranch Bridge, 2009.

Date	Mean	Min	Max	Date	Mean	Min	Max	Date	Mean	Min	Max
7/1	20.2	17.1	22.5	8/5	22.8	21.0	24.4	9/9	14.5	12.2	16.0
7/2	21.0	18.3	23.2	8/6	20.8	19.8	22.9	9/10	15.4	13.3	17.5
7/3	21.2	19.0	24.0	8/7	17.7	16.8	19.8	9/11	16.6	14.1	18.7
7/4	21.4	18.3	24.8	8/8	17.5	15.6	20.2	9/12	17.5	15.2	19.8
7/5	23.1	20.2	25.6	8/9	19.0	17.5	20.2	9/13	17.9	15.6	19.8
7/6	22.9	21.3	24.8	8/10	19.6	17.1	22.1	9/14	17.1	16.0	18.7
7/7	20.6	18.7	22.9	8/11	20.8	18.3	23.2	9/15	16.8	14.9	18.7
7/8	19.9	17.9	21.7	8/12	21.4	19.0	23.2	9/16	17.9	15.6	20.2
7/9	18.6	16.8	20.6	8/13	20.0	18.7	22.1	9/17	18.2	16.4	19.4
7/10	18.8	16.0	22.1	8/14	17.9	16.4	19.4	9/18	17.4	14.9	19.4
7/11	20.6	18.3	22.5	8/15	16.5	14.5	17.9	9/19	17.3	15.6	18.3
7/12	20.3	19.0	22.1	8/16	16.7	14.5	18.3	9/20	15.8	14.1	17.5
7/13	18.1	16.8	19.4	8/17	17.8	15.2	20.2	9/21	13.2	10.6	14.9
7/14	19.0	16.4	21.7	8/18	18.7	16.4	20.2	9/22	13.8	11.4	16.0
7/15	20.8	17.9	23.2	8/19	19.9	17.5	22.1	9/23	15.0	12.6	17.1
7/16	21.9	19.0	24.4	8/20	21.3	18.7	23.6	9/24	15.8	13.3	17.9
7/17	22.8	20.2	24.8	8/21	22.4	20.2	24.4	9/25	16.4	14.1	18.3
7/18	23.5	20.6	26.0	8/22	21.8	19.4	23.6	9/26	15.5	12.9	17.5
7/19	23.8	21.3	25.6	8/23	19.9	19.0	22.1	9/27	14.3	11.8	15.6
7/20	22.8	20.2	24.8	8/24	18.6	16.0	20.6	9/28	12.8	10.2	14.5
7/21	22.4	19.4	24.8	8/25	19.3	16.8	21.7	9/29	11.9	10.6	13.7
7/22	23.5	20.6	26.0	8/26	19.7	17.1	21.7	9/30	9.4	8.2	10.6
7/23	23.9	21.0	26.3	8/27	19.5	16.8	21.3	10/1	8.0	5.8	9.4
7/24	23.6	21.3	25.6	8/28	20.2	17.9	22.1				
7/25	23.1	20.2	25.6	8/29	20.5	19.4	21.7				
7/26	23.2	20.6	25.6	8/30	18.7	17.1	19.8				
7/27	22.1	19.4	24.4	8/31	18.7	16.8	20.6				
7/28	22.7	19.8	25.2	9/1	19.0	16.4	21.3				
7/29	23.0	20.6	25.2	9/2	19.3	16.8	21.3				
7/30	22.5	19.8	25.2	9/3	19.0	17.1	20.6				
7/31	22.1	19.4	24.0	9/4	18.1	15.6	20.2				
8/1	22.6	19.4	25.6	9/5	17.8	16.8	19.0				
8/2	22.6	20.6	24.4	9/6	15.8	14.9	17.1				
8/3	23.0	20.2	26.0	9/7	14.6	12.6	16.0				
8/4	23.8	21.3	26.3	9/8	14.6	12.2	16.4				

Table 19. Daily mean, minimum, and maximum water temperature (C) in the Little Salmon River, at Campbell property downstream from Meadow Creek Bridge, 2009.

Date	Mean	Min	Max	Date	Mean	Min	Max	Date	Mean	Min	Max
7/1	19.1	14.9	24.0	8/5	19.9	18.3	21.7	9/9	13.4	11.8	14.9
7/2	19.2	15.2	23.6	8/6	18.9	17.9	20.6	9/10	13.8	12.6	15.6
7/3	19.6	15.6	23.2	8/7	16.9	16.0	18.7	9/11	14.7	13.3	16.4
7/4	20.4	16.4	25.2	8/8	16.3	14.9	18.7	9/12	15.3	13.7	16.8
7/5	21.2	17.5	26.0	8/9	17.2	15.6	19.0	9/13	15.7	14.5	16.8
7/6	21.1	19.0	23.6	8/10	17.7	15.6	20.2	9/14	15.4	14.5	16.8
7/7	18.8	15.6	22.5	8/11	18.1	15.6	20.6	9/15	15.1	14.1	16.4
7/8	18.7	15.6	22.1	8/12	18.5	16.8	20.2	9/16	15.7	14.5	17.1
7/9	17.2	14.1	19.8	8/13	17.9	16.8	19.4	9/17	16.2	15.2	17.1
7/10	17.5	13.3	22.5	8/14	16.6	15.2	17.9	9/18	16.0	14.9	17.1
7/11	18.6	15.2	21.7	8/15	14.9	12.9	16.4	9/19	15.6	14.5	17.1
7/12	18.0	16.4	19.8	8/16	15.1	13.3	16.8	9/20	14.9	14.1	16.4
7/13	16.9	15.2	19.0	8/17	15.6	13.3	17.9	9/21	13.4	12.2	14.9
7/14	17.9	14.5	22.1	8/18	16.4	14.1	18.7	9/22	12.9	11.4	14.5
7/15	19.0	14.9	23.6	8/19	17.4	14.9	20.2	9/23	13.5	12.2	15.2
7/16	19.9	16.0	24.4	8/20	18.4	16.4	20.6	9/24	14.1	12.9	15.2
7/17	20.9	17.1	24.8	8/21	18.9	17.1	21.0	9/25	14.5	13.3	15.2
7/18	21.3	17.1	25.6	8/22	19.1	17.1	21.0	9/26	14.3	13.3	15.2
7/19	21.8	18.3	25.6	8/23	18.1	16.8	20.2	9/27	13.5	12.6	14.9
7/20	20.5	17.1	23.2	8/24	17.0	15.2	18.7	9/28	12.5	11.4	13.7
7/21	20.6	16.8	24.4	8/25	16.5	14.9	17.9	9/29	12.1	11.4	12.9
7/22	21.2	17.5	24.8	8/26	16.6	15.2	17.9	9/30	10.9	10.2	11.4
7/23	21.1	18.3	23.6	8/27	16.8	14.9	18.7	10/1	9.5	8.6	10.6
7/24	20.8	18.7	22.9	8/28	17.6	15.6	19.0				
7/25	20.7	17.5	23.6	8/29	18.1	16.8	19.0				
7/26	20.7	18.3	22.5	8/30	17.5	16.4	18.7				
7/27	20.3	17.5	22.9	8/31	16.8	15.6	17.9				
7/28	20.3	17.5	22.9	9/1	16.7	15.2	17.9				
7/29	20.6	17.5	23.2	9/2	16.6	15.2	17.9				
7/30	20.1	17.1	22.9	9/3	16.3	15.6	17.1				
7/31	19.8	17.1	22.1	9/4	15.9	14.9	16.8				
8/1	20.2	17.5	22.9	9/5	15.7	15.2	16.8				
8/2	20.2	18.3	22.1	9/6	14.9	14.1	15.6				
8/3	20.4	18.3	22.5	9/7	14.3	12.9	15.6				
8/4	20.6	18.7	22.5	9/8	13.6	12.2	14.9				

Table 20. Daily mean, minimum, and maximum water temperature (C) in Mud Creek, tributary to Little Salmon River, at Highway 95 bridge, 2009.

Date	Mean	Min	Max	Date	Mean	Min	Max	Date	Mean	Min	Max
7/1	17.3	13.3	21.3	8/5	19.0	16.4	21.7	9/9	9.7	6.6	12.6
7/2	17.0	13.3	20.6	8/6	17.4	16.4	19.4	9/10	11.6	8.6	15.6
7/3	17.7	14.5	21.0	8/7	14.3	13.3	16.4	9/11	13.0	9.8	16.4
7/4	17.7	14.1	21.7	8/8	14.8	12.6	18.3	9/12	13.8	10.6	17.1
7/5	18.8	15.6	22.5	8/9	15.5	12.6	18.7	9/13	14.1	11.0	17.1
7/6	18.9	16.4	21.3	8/10	15.9	12.6	19.8	9/14	13.3	11.8	15.6
7/7	16.9	14.1	19.8	8/11	16.6	12.9	20.6	9/15	13.9	11.4	17.1
7/8	17.0	14.5	20.2	8/12	17.4	14.5	20.6	9/16	14.6	11.8	17.9
7/9	14.6	11.8	17.5	8/13	16.8	15.6	18.3	9/17	14.9	12.6	17.1
7/10	14.8	11.0	19.4	8/14	14.6	12.9	16.8	9/18	14.6	11.8	17.1
7/11	15.8	12.9	18.3	8/15	12.4	9.4	14.9	9/19	13.8	11.0	16.0
7/12	16.1	14.5	17.5	8/16	12.5	9.8	15.2	9/20	13.3	11.4	15.2
7/13	14.7	12.9	16.4	8/17	13.4	9.8	17.5	9/21	10.1	7.0	12.9
7/14	15.4	11.8	19.4	8/18	14.4	11.0	18.3	9/22	10.2	7.0	13.7
7/15	16.4	12.6	20.6	8/19	15.9	12.2	20.2	9/23	11.5	8.2	14.9
7/16	17.5	13.3	22.1	8/20	17.1	13.3	21.3	9/24	12.1	9.0	15.2
7/17	18.7	15.2	22.5	8/21	18.0	14.5	22.1	9/25	12.5	9.4	15.6
7/18	19.3	15.2	23.6	8/22	18.1	14.5	21.7	9/26	11.9	9.0	14.5
7/19	20.3	16.8	24.0	8/23	16.1	14.1	18.3	9/27	10.7	7.8	13.3
7/20	18.6	14.9	22.1	8/24	15.0	11.4	19.0	9/28	9.2	6.2	11.8
7/21	18.2	14.1	22.5	8/25	15.0	11.4	19.0	9/29	9.0	7.8	11.0
7/22	19.0	14.9	23.2	8/26	15.4	11.8	19.4	9/30	7.0	5.8	8.6
7/23	19.1	15.6	22.9	8/27	15.2	11.4	19.4	10/1	4.4	1.6	7.0
7/24	19.4	16.8	22.5	8/28	16.2	12.9	19.4				
7/25	18.5	14.5	22.9	8/29	17.5	15.6	20.2				
7/26	19.1	16.0	22.1	8/30	16.5	14.1	18.3				
7/27	19.0	15.6	22.9	8/31	15.8	12.9	19.0				
7/28	18.8	15.2	22.5	9/1	15.7	12.6	19.0				
7/29	18.8	15.2	22.9	9/2	15.3	12.2	18.7				
7/30	18.0	14.5	21.7	9/3	15.5	12.6	18.7				
7/31	17.0	13.3	20.2	9/4	15.3	12.2	18.7				
8/1	17.9	13.7	22.5	9/5	14.2	12.6	16.4				
8/2	18.2	15.2	21.7	9/6	13.0	11.0	15.2				
8/3	19.1	15.6	23.2	9/7	11.6	9.0	14.1				
8/4	19.7	16.4	23.2	9/8	10.2	7.0	13.7				

Table 21. Daily mean, minimum, and maximum water temperature (C) in the North Fork Payette River, at USGS gauge upstream from Fisher Creek, 2009.

Date	Mean	Min	Max	Date	Mean	Min	Max	Date	Mean	Min	Max
7/1	15.7	13.3	19.4	8/5	18.7	16.4	21.0	9/9	11.4	8.6	14.1
7/2	15.9	13.3	19.4	8/6	17.4	16.4	19.0	9/10	12.8	10.2	16.4
7/3	16.2	13.7	19.4	8/7	15.5	14.1	16.8	9/11	13.4	10.6	16.8
7/4	16.8	14.1	20.6	8/8	15.7	13.7	19.0	9/12	13.9	11.4	17.1
7/5	17.2	14.5	21.3	8/9	15.3	12.9	17.9	9/13	14.0	11.8	17.1
7/6	17.2	15.2	20.2	8/10	16.0	12.9	20.2	9/14	13.0	11.8	14.1
7/7	15.9	14.1	18.3	8/11	16.6	13.3	20.6	9/15	13.7	11.0	17.1
7/8	15.4	13.7	18.3	8/12	17.1	14.1	20.6	9/16	14.3	11.8	17.9
7/9	13.9	11.4	17.1	8/13	16.3	14.9	17.5	9/17	14.1	12.2	16.8
7/10	14.7	11.4	19.0	8/14	14.6	12.9	17.1	9/18	14.0	11.4	17.5
7/11	15.7	12.6	19.0	8/15	12.8	10.6	14.9	9/19	13.2	11.0	15.2
7/12	15.7	14.1	17.1	8/16	12.7	10.6	14.5	9/20	11.8	9.8	14.5
7/13	14.4	13.3	15.6	8/17	13.8	10.6	17.9	9/21	9.6	6.6	13.3
7/14	14.9	11.8	19.0	8/18	15.1	11.8	19.0	9/22	10.1	7.0	14.1
7/15	15.5	11.8	19.8	8/19	16.2	12.9	20.6	9/23	11.6	8.6	14.9
7/16	16.6	12.9	21.3	8/20	17.1	14.1	21.3	9/24	12.0	9.0	15.2
7/17	17.5	14.1	21.7	8/21	17.7	14.9	21.3	9/25	12.2	9.4	15.2
7/18	18.1	14.5	22.5	8/22	17.4	14.5	20.6	9/26	11.4	8.6	14.1
7/19	18.5	15.2	22.5	8/23	16.1	14.5	17.5	9/27	10.3	7.4	13.3
7/20	17.8	14.1	22.1	8/24	15.7	12.9	19.0	9/28	9.3	6.2	11.8
7/21	18.2	14.1	22.9	8/25	15.7	12.9	19.4	9/29	9.5	8.6	11.0
7/22	19.0	14.9	23.6	8/26	15.9	12.9	19.4	9/30	7.0	5.8	8.6
7/23	19.3	15.6	23.2	8/27	15.9	12.6	19.4	10/1	5.0	2.9	7.4
7/24	18.8	16.0	22.5	8/28	16.9	14.1	19.8	10/2	5.1	3.3	7.0
7/25	17.6	14.1	22.1	8/29	17.5	16.0	19.4	10/3	5.2	4.2	6.2
7/26	18.1	15.2	22.1	8/30	16.2	14.5	17.9	10/4	4.7	3.7	5.4
7/27	18.3	15.2	21.7	8/31	15.5	13.7	17.5				
7/28	17.9	15.2	21.0	9/1	15.9	13.3	19.0				
7/29	17.9	15.2	21.3	9/2	15.8	13.3	19.0				
7/30	17.4	14.1	21.3	9/3	15.8	13.7	18.3				
7/31	17.1	14.1	20.6	9/4	15.4	12.9	18.3				
8/1	17.8	14.5	22.5	9/5	15.2	13.3	17.1				
8/2	18.1	15.2	22.1	9/6	13.8	12.6	15.2				
8/3	18.8	15.6	23.2	9/7	12.4	10.2	15.2				
8/4	19.2	16.0	22.9	9/8	11.4	8.6	14.5				

Table 22. Salmonid fish densities in Salmon River tributaries surveyed by snorkeling in 2009.

		Density (fish/100m2)					
Stream	Site	Bull trout	Chinook salmon parr	Mountain whitefish	Steelhead trout	Trout fry	Westslope cutthroat trout
California Creek 1	1	0.00	0.24	0.12	4.59	1.69	0.12
Cottonwood Creek 1	1	0.00	0.00	0.00	1.99	0.25	0.00
Disappointment Creek 1	1	0.00	0.00	0.00	18.07	0.00	0.00
Little Fivemile Creek 2	2	0.00	0.00	0.00	0.68	0.00	0.00
Little Fivemile Creek 9	9	0.00	0.00	0.00	0.00	0.00	0.00
Rabbit Creek 1	1	0.00	0.00	0.00	7.21	1.60	0.00
Richardson Creek 1	1	0.00	0.00	0.00	7.14	0.00	0.00
Warren Creek 1	1	0.00	0.00	0.00	2.82	0.00	0.00
Bargamin Creek 1	1	0.08	0.00	0.31	3.78	0.39	0.54
Bargamin Creek 2	2	0.14	0.00	0.42	6.41	0.14	0.56
Horse Creek L1	L1	0.35	1.56	0.35	6.74	0.69	0.17
Horse Creek L2	L2	0.00	0.09	0.46	4.28	2.00	0.00
mean		0.05	0.16	0.14	5.31	0.56	0.12
standard deviation		0.10	0.45	0.19	4.71	0.76	0.21

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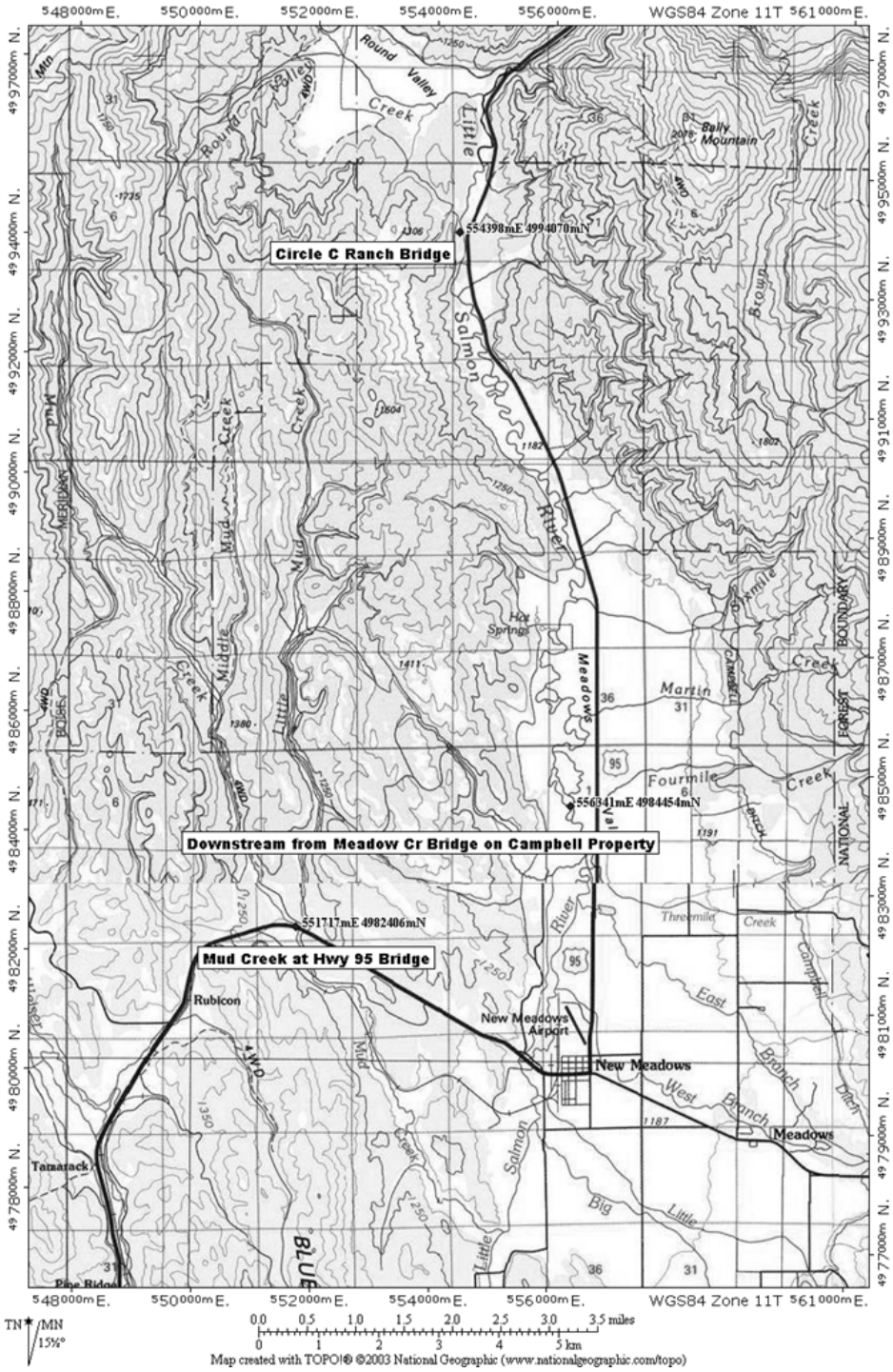
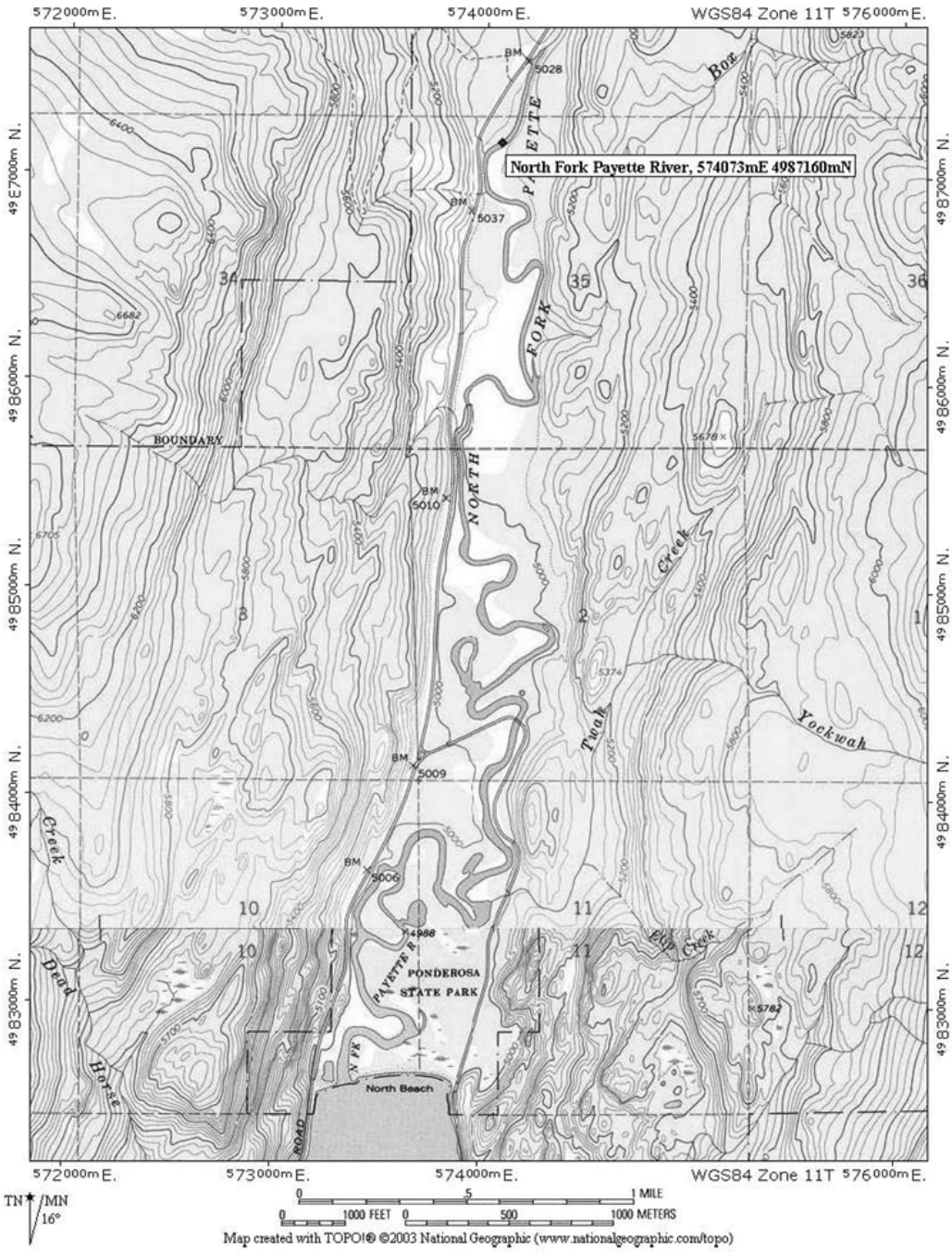
APPENDICIES

Appendix A. Locations of the Hobo temperature recorders in the Little Salmon River drainage in 2009.



Appendix B. Location of the Hobo temperature recorders in the North Fork Payette River drainage in 2009.



Prepared by:

Dale B. Allen
Regional Fishery Manager

Paul J. Janssen
Regional Fishery Biologist

Kim Apperson
Regional Fishery Biologist

Art Butts
Regional Fishery Biologist

Melo Maiolie
Regional Fishery Biologist

Jordan Messner
Fishery Technician

Brooklyn Hudson
Fishery Technician

Approved by:
IDAHO DEPARTMENT OF FISH AND GAME

_____
Edward B. Schriever, Chief
Fisheries Bureau

_____
William D. Horton
State Fishery Manager