POTLATCH RIVER STEELHEAD MONITORING AND EVALUATION

Annual Report
2008

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Idaho Department of Fish and Game

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By

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ABSTRACT

Objectives of the Potlatch River Steelhead Monitoring and Evaluation project are to establish baseline levels of steelhead *Oncorhynchus mykiss* production and productivity and provide an umbrella monitoring component to the numerous habitat restoration projects currently occurring within the drainage. In 2008, the project expanded the monitoring effort into both the upper and lower Potlatch River drainages. A total of 136 adult steelhead were captured during the field season. Of these fish, 61 were captured at lower Big Bear drainage weirs and 75 were captured at upper East Fork drainage weirs. The mark-recapture occurrences resulted in an adult steelhead escapement estimate into the Big Bear drainage (Big Bear and Little Bear Creeks) of 121 (95% CI 69-253) fish and 139 (95% CI 52 – 438) fish into the East Fork Potlatch River. An estimated 4,817 juveniles emigrated from the Bear Creek system, with a 95% confidence interval ranging from 4,055 to 5,722. An estimated 6,979 juvenile steelhead emigrated from the East Fork Potlatch River drainage with a 95% confidence interval ranging from 3,574 to 12,074. The overall smolt arrival estimates to Lower Granite Dam from Big Bear Creek and the East Fork Potlatch River were 76% and 15% respectively (SE 0.07 and 0.03). A total of 68 snorkel sites were sampled throughout the Potlatch River drainage. Of those sites, 56 were randomly selected using the EMAP protocol and 12 sites, all occurring within the East Fork Potlatch River, were historic general parr monitoring (GPM) sites that are long term regional monitoring locations. Mean juvenile steelhead (predominately age-0, age-1 and age-2) and fry densities for the entire drainage were 3.44 and 2.00 fish / 100 m^2 respectively (SE = 1.02 and 0.55). Expanding intensive and broad-scale monitoring techniques during the 2008 field season provided valuable information on steelhead production and productivity on a drainage-wide scale in the Potlatch River.

INTRODUCTION

The Potlatch River Steelhead Monitoring and Evaluation (PRSME) project was initiated in 2005 using Pacific Coastal Salmon Recovery Funds. In 2008 the project was expanded into the upper Potlatch River watershed using National Oceanic and Atmospheric Administration (NOAA) Fisheries Intensively Monitored Watershed Funds. The additional funds allowed work to occur simultaneously throughout the entire drainage. The expanded project in 2008 was initiated to assess steelhead production and productivity throughout the entire Potlatch River drainage.

The Potlatch River likely has the strongest population of wild steelhead present within the lower Clearwater River drainage (Bowersox et al. 2008). The lower Clearwater River steelhead population is important to steelhead recovery; however no information was available regarding population production and productivity. This project was designed to establish baseline indices regarding population dynamics and expand the knowledge of steelhead life history strategies within the Potlatch River and the lower Clearwater River as a whole.

The Potlatch River is a watershed that has undergone significant amounts of change over the past 150 years. Land practices and manipulation associated with agricultural use and timber harvest have significantly altered the aquatic habitats present within the drainage as well as flow dynamics associated with the hydrograph. These changes have resulted in a variety of limiting factors identified by previous work (Johnson 1985; Bowersox and Brindza 2006) within the drainage. These limiting factors include:

1) Extreme flow variation,
2) High summer water temperatures,
3) Lack of riparian habitat,
4) High sediment loads, and
5) Low densities of in-stream structure.

Despite the significantly altered condition of aquatic habitats within the Potlatch River drainage, it does support an important population of wild steelhead trout. Aside from general distribution and abundance data (Schriever and Nelson 1999; Bowersox and Brindza 2006) limited information was available with regards to levels of productivity, production, and life history strategies for this population.

The steelhead population in the Potlatch River has been found to be genetically distinct from other local populations such as Dworshak hatchery strain steelhead (Byrne 2005). The geographic location of the population and lack of hatchery influence within Potlatch River steelhead make understanding population dynamics of this group extremely important regarding recovery actions for Clearwater River steelhead (ICBTRT 2003).

In recent years, the Potlatch River has received additional focus from governmental and non-governmental agencies regarding its' restoration potential. The Latah Country Soil and Water Conservation District, Idaho Department of Fish and Game, Natural Resource Conservation Service, and the U.S. Forest Service have begun significant restoration efforts throughout the drainage. The goal of the ongoing Pacific Coastal Salmon Recovery Funds (PCSRF) project is to determine steelhead population response (production and productivity) to habitat enhancement.

This study is designed to provide baseline information on steelhead within the lower Potlatch River drainage as well as an umbrella monitoring component to habitat restoration projects being implemented within the basin. The framework needs to be adaptive as well as rigid. It needs to be capable of shifting with monitoring needs as well as being able to detect changes within the population.

This report contains results from 2008 which was the fourth field season for the monitoring and evaluation effort in the lower drainage and the first field season in the upper drainage. Field activities included adult escapement estimation, juvenile outmigration estimates, juvenile survival estimates, in-stream density estimates, and habitat surveys.

OBJECTIVES

1) Establish baseline levels of steelhead production and productivity throughout the Potlatch River drainage.
2) Provide a monitoring component to the numerous habitat restoration projects currently ongoing within the Potlatch River drainage.
3) Describe steelhead life history strategies exhibited within the Potlatch River drainage.

STUDY AREA

The Potlatch River drainage is located in Latah, Nez Perce, and Clearwater counties, Idaho. The mainstem Potlatch River is 89.4 km long and has a total drainage area of 152,621 ha (Department of Agriculture 1994). The drainage is approximately 78% private ownership (Schriever and Nelson 1999). The lower watershed, which includes the Big Bear drainage, is dominated almost entirely by private ownership while the upper watershed, which includes the East Fork Potlatch River drainage, is predominately in public ownership with the U.S. Forest Service managing the majority of the upper watershed along with the State of Idaho. Private lands in the upper watershed are owned by Potlatch Timber Corporation (Figure 1). Dominant land use and land type differ between the two drainage areas. The lower watershed is dominated by agricultural use and agricultural uplands and canyon bottomlands while the upper watershed is dominated by timberland and timberland ecotypes (Bowersox and Brindza 2006). Intensively monitored tributaries are Big Bear Creek and the East Fork Potlatch River drainages (Figure 1). The bulk of monitoring infrastructure is located in these drainages (Appendix 1).

Mean daily stream discharge during the 2008 adult trapping season, measured at the USGS flow site (13341570) approximately two miles above the mouth of the Potlatch River, ranged from 18 to 3,130 cfs (Figure 2). Stream flows approached or exceeded 2,000 cfs on four occasions during the adult trapping season (Figure 2). Stream temperature, as measured at the Big Bear Creek weir, ranged from a low of 1.5°C early in the season to a high of 17.0°C near the end of the adult trapping.

METHODS

Adult Sampling

Picket weirs were constructed on February 7th and January 31st at Big Bear and Little Bear Creeks respectively, to capture migrating adult steelhead (Appendix 1). Initially, weirs were outfitted with only an upstream migrant trap box. Both weirs were maintained and checked for fish daily. High flows prevented operation of the weirs for 22 days at Little Bear Creek and 27 days at Big Bear Creek.

Floating weirs were constructed on March 19th and April 5th at the East and West Fork Potlatch River respectively, to captured migrating adult steelhead (Appendix 1). Initially, weirs were outfitted with only an upstream migrant trap box. Both weirs were maintained and checked for fish daily. The West Fork Potlatch River weir was not fully operational for seven days during the spring trapping season. The East Fork Potlatch River weir remained operational for the entire trapping season.

Trapped upstream migrants at all traps were collected from the trap box and anesthetized in tricaine methanesulfonate (MS-222). Upstream fish were marked with a right operculum punch and passive integrated transponder (PIT) tagged in the left cheek. The gender, weight, length, and the presence of any marks were recorded for all fish handled. All wild upstream migrants were released above the weir. Hatchery origin steelhead captured at the weirs were relocated below the weir. Weirs were removed after adult steelhead kelt outmigration was complete.

Downstream trap boxes were installed at lower weir locations by April 15th and by May 15th at upper weir locations. Crowding techniques using nets and temporary barriers were also used at all weir locations to capture additional kelts within 100 m of the upstream side of the weir. Fish captured in the downstream box or by net were given a left operculum punch and released immediately downstream of the weir. Gender, weight, length, the presence of a previous operculum punch and/or PIT tag and PIT tag number if present were recorded for all fish captured.

Total adult escapement above the weirs was calculated using a maximum likelihood estimator (Steinhorst et al., 2004) using the variables of total kelt steelhead captured during the trapping season, marked adults passed upstream and number of marked adults recaptured as kelts. Assumptions we used were: that marked and unmarked adults had the same survival during spawning and individual fish are captured independently with equal probability.

Scale samples were collected from 133 of 136 adult fish captured during the 2008 field season. Scales were not collected if fish were severely deteriorated at the time of capture. Scales were collected posterior to the dorsal fin above the lateral line. Three or four scales were taken from each side of the fish. Scales were stored on Rite-in-Rain paper inside scale envelopes. Scales were read using a microfiche reader. Two independent readers aged the scales and recorded freshwater and saltwater ages. When readers disagreed, a third reader independently aged the scale and a consensus was reached.

Operculum punches were collected from all adult steelhead captured at weir locations. Genetic samples were sent to the IDFG Genetics Laboratory in Eagle, ID. Samples from Big Bear Creek, Little Bear Creek, the East Fork Potlatch River, and the West Fork Potlatch River were examined for levels of heterozygosity and alleles per group. Samples were then compared to other sampled populations throughout Idaho in an un-rooted dendogram to detect relationships.

Twenty-two steelhead tagged as juveniles from the Potlatch River watershed in 2005 and 2006 were detected at Bonneville Dam during the fall of 2007 as upstream adult migrants. Twenty one of these fish were subsequently detected passing Lower Granite Dam later in the migration. One fish detected at Bonneville was not detected at Lower Granite and one fish detected at Lower Granite was not detected at Bonneville. These fish are included in this report since they spawned in the spring of 2008. Run timing, travel time from juvenile to adult detections, travel time from Bonneville to Lower Granite Dam, and travel time from Lower Granite Dam to the Potlatch River drainage are included in this report.

Juvenile Sampling

A rotary screw trap was operated on Big Bear Creek and the East Fork Potlatch River during the 2008 field season (Appendix 1). The Big Bear Creek trap was located approximately 250 m from the confluence with the Potlatch River and below the confluence of Big Bear and Little Bear creeks. Therefore, the screw trap estimated total juvenile steelhead emigration out of both Big Bear and Little Bear Creeks and their tributaries. The East Fork Potlatch River screw trap was located approximately 300 m above the confluence with the mainstem Potlatch River. Screw traps were checked daily throughout the spring and fall trapping seasons. Spring trapping was conducted on Big Bear Creek from February 20th - June 25th and April 1st - June 27th at the East Fork Potlatch River during the spring outmigration. By late June both traps were no longer operational due to insufficient flows at each site. The traps were also operated in the fall from November 8th till December 8th at each trap location. During sampling periods, trapping was only interrupted due to extremely high or low stream discharge. All fish captured at the screw traps were identified and enumerated. In addition, sub-samples of non-target species were weighed and measured. All steelhead were weighed, measured, and scanned for the presence of PIT tags. Juvenile steelhead (>75 mm) not previously tagged were anesthetized using MS-222 solution and tagged in the abdomen with a PIT tag following PIT tagging best practice procedures (Columbia Basin Fish and Wildlife Authority 1999). All PIT tagged individuals were allowed to recover in live wells and were then released approximately 500 m upstream of the screw trap to estimate trapping efficiency. Tag files were created within the P3 PIT tag data management computer program and uploaded to the PTAGIS (www.psmfc.org) database daily.

Total juvenile steelhead outmigration from Big Bear Creek and the East Fork Potlatch River was estimated using Gauss software, specifically the Bailey modified maximum likelihood method developed by Steinhorst et al. (2004). The trapping season was divided into periods based upon trapping efficiency for each trap. A running average of weekly trapping efficiency was plotted in order to determine appropriate outmigration periods. Trapping days were grouped based upon periods of similar recapture probability. Input variables included; number of marked (PIT tagged) fish released upstream for recapture, number of marked fish recaptured, and the number of unmarked fish captured. Assumptions required for the use of this method are that all fish, marked and unmarked, are captured independently with the same probability during each period. Juvenile out-migrant arrivals at Lower Granite Dam were estimated using Survival Under Proportional Hazards (SURPH) 2.2 software (Lady et al. 2001).

A total of 209 and 55 scales were randomly sampled from the out-migrating juveniles collected at the screw trap on Big Bear Creek and the East Fork Potlatch River, respectively. Every fifth fish had scales taken in order to spread samples out over the entire juvenile outmigration. Scales were sampled posterior to the dorsal fin above the lateral line. Scales were stored on Rite-in-Rain paper inside scale envelopes. Scales were read using a microfiche reader. Two independent readers aged the scales and recorded freshwater age. When readers disagreed, a third reader independently aged the scale and a consensus was reached.

To estimate juvenile in-stream survival in the lower Potlatch River tributaries, juvenile steelhead/rainbow trout were PIT tagged throughout the 2005-2007 field seasons. Fly-fishing and backpack electroshocking were conducted at randomly selected locations throughout the tributaries to collect fish for PIT tagging. Electrofishing was conducted following National Marine Fisheries Service guidelines (2000). All juvenile steelhead/rainbow trout, >80 mm, were anesthetized in MS-222, measured, weighed, and PIT tagged. The PIT tag data was uploaded to the PTAGIS database on a daily basis. Detections at the mainstem Potlatch River PIT-tag array and Lower Granite Dam monitoring array will be used to estimate in-stream survival in future years.

Mark-resight snorkel surveys were conducted throughout Potlatch River tributaries during the 2008 field season. Sample sites were selected using a generalized random-tessellation stratification design to provide a spatially balanced panel of survey sites (Stevens and Olsen 2004). Potential sites for the Potlatch River basin were obtained from personnel at the US-EPA, Corvallis, Oregon. Mark-resight snorkeling protocols were consistent with techniques outlined in Copeland et al. 2008.

PIT Tag Arrays

Two in-stream PIT tag arrays were operated during the 2008 field season. Arrays were located on Big Bear creek approximately 250 m above its' confluence with the Potlatch River and on the mainstem Potlatch River approximately 13 km above its' confluence with the Clearwater River (Appendix 1). The Big Bear Creek array consists of six in-stream poly vinyl chloride (PVC) incased antennas anchored to the streambed in an upstream and downstream array configuration. The mainstem Potlatch River array consisted of four flat-plate antennas anchored in pairs in an upstream and downstream array configuration. The Big Bear Creek array was operational throughout the spring and fall migration. The mainstem Potlatch River array was deployed on Oct. 7th 2008 and was operational during the fall outmigration. Both sites have been registered as interrogation locations within the Columbia River basin PTAGIS database. Data from the arrays such as adult migration timing will be included in this report.

Habitat Surveys

A Low Water Habitat Availability Protocol (LWHAP) was conducted to estimate wetted habitat and evaluate wetted habitat quality present within Lower Potlatch River tributaries. Transects were walked August 4th - August 7th 2008. Tributaries were stratified into upland and canyon reaches to disperse transects throughout each tributary. Two 500 m transects were walked within each strata and in each tributary resulting in four transects per tributary. The length of wetted habitat and the number of pools was recorded within each transect. In addition to wetted habitat, pool availability and quality we also measured the maximum depth, modal depth, pool length, pool width, and whether or not salmonids were present (visual observation) for all pools within the transect.

RESULTS

Adult Abundance and Migration Timing

A total of 136 adult steelhead were captured during the 2008 field season. Of these fish, 61 were captured at lower drainage weirs (Big Bear and Little Bear) and 75 were captured at upper drainage weirs (East and West Fork). Results for the upper and lower drainages will be reported separately in this section of the report.

A total of 61 adult steelhead were captured at the lower Potlatch River weirs during the 2008 trapping season. Of these, 41 were captured and marked as upstream pre-spawn migrants. Thirty adult steelhead were captured as downstream post-spawn migrants; 10 of these fish were recaptures. The mark-recapture occurrences resulted in an adult steelhead escapement estimate into the Big Bear drainage (Big Bear and Little Bear Creeks) of 121 (95% CI 69-253) fish.

The first upstream spawner arrived at the lower weirs on February 24th at Big Bear Creek (Figure 3). Fifty percent of the run was passed upstream by March 23rd and the final upstream spawner arrived at the lower weirs on May 7th (Figure 3). The first downstream post-spawn kelt arrived at the lower weirs on April 8th; fifty percent and final kelt arrival occurred on April 28th and May 14th respectively (Figure 3).

Seventy-five adult steelhead were captured at upper Potlatch River weirs during the 2008 field season. Since there was only one recaptured kelt at the West Fork Potlatch River, no escapement estimate was generated for that population. There were 61 adult steelhead captured at the East Fork Potlatch River weir. Of these, 55 were captured and marked as upstream pre-spawn migrants. Twelve adult steelhead were captured as downstream post-spawn migrants; five of these fish were recaptures. This resulted in an adult steelhead escapement estimate of 140 (95% CI 52 – 438) fish. The minimum escapement estimate for the West Fork Potlatch River was 10 fish, based upon individual fish captured.

The first upstream spawner arrived at the upper weirs on March 27th at the East Fork Potlatch River weir (Figure 4). Fifty percent of the run was passed upstream by April 23rd and the final upstream spawner arrived at the lower weirs on May 20th (Figure 4). The first downstream post-spawn kelt arrived at the upper weirs on April 24th; fifty percent and final kelt arrival occurred on June 2nd and June 25th respectively (Figure 4).

Adult Life History

Female steelhead captured at lower drainage weirs ranged from 599 – 845 mm and males ranged from 560 – 905 mm (Table 1). Female steelhead captured in the upper drainage ranged from 550 – 770 mm and males ranged from 545 – 840 mm (Table 1). Both female and male fish captured at lower weirs were distributed in slightly larger size classes and the maximum observed length was larger for both sexes at lower weirs, no significant differences were observed between the upper and lower drainage weirs (Two-tailed t-test, P-value 0.12 and 0.13 females and males, respectively). Furthermore, there was no significant difference observed between size distributions of males compared to females at lower and upper weirs (Two-tailed t-test, P-value 0.55 and 0.38 lower and upper weirs respectively).

Two fish captured at lower drainage weirs were hatchery origin resulting in a hatchery fish occurrence of 3.2% at the lower trap sites. No hatchery fish were captured at upper drainage weirs during the 2008 field season. Origin of hatchery fish captured is unknown.

The observed sex ratio from the 2008 field season was 1.7 males per female at both lower and upper drainage weir locations. The observed ratio does differ significantly (Chi-Square $P = 0.029$ and 0.015 lower and upper weirs respectively) from the expected ratio of 1:1. Total captures of males and females were 39 and 22 at lower weirs and 48 and 27 at upper weirs, respectively. The estimated number of fish by sex comprising the 2008 run was 147 and 103 fish in the lower drainage and 76 and 53 in the upper drainage for males and females respectively.

Scale samples were taken from 134 of the 136 adult steelhead captured during the 2008 field season. Scale samples from 61 fish were able to be aged. Scale analysis displayed a variety of freshwater and ocean life history strategies being utilized within the population (Figure 5). The 2-Fresh 1-Ocean life history was most prevalent with 43% and 69% of the fish sampled displaying this strategy at the lower and upper weirs, respectively (Figure 5).

Twenty-two steelhead PIT-tagged as juveniles in the Potlatch River drainage were detected passing Bonneville Dam and twenty-one of the twenty-two were again detected crossing Lower Granite Dam (Appendix 2). One fish that was detected at Bonneville Dam was not detected at Lower Granite and one fish detected at Lower Granite was not detected at

Bonneville Dam. The first upstream adult was detected at Bonneville Dam on July 12th, 2007 and the last detection was September 12th, 2007 (Appendix 2). The first upstream adult was detected at Lower Granite Dam on September 2nd, 2007 and the last detection was April 11th, 2008 (Appendix 2). Mean travel time from Bonneville Dam to Lower Granite Dam was 53.65 days and mean travel time from Lower Granite Dam to the KHS array on Big Bear Creek was 161.2 days. Ocean life histories included 1-ocean and 2-ocean and these life histories represented 39 and 61 percent of the run-year adult population, respectively.

Juvenile Emigration

Juvenile Outmigration

The rotary screw trap on Big Bear Creek was operated during the spring trapping season from February 20th until June 25th, 2008. During this period, the trap operated a total of 107 nights. Eight hundred and sixty three steelhead were captured, 836 of which were PIT tagged and released above the trap. Of these, 162 were recaptured. The trapping season was subsequently grouped into four periods with different trapping efficiencies (Table 2). An estimated 4,817 juveniles emigrated during the spring of 2008 from the Big Bear Creek system (95% CI, 4055-5722) (Table 2).

In addition, the rotary screw trap was also operated during the fall of 2008 from November 8th through December 9th for a total of 19 nights. No efficiency groups were established for fall trapping since efficiencies remained consistent for the entire trapping season. An estimated 670 juvenile steelhead emigrated during the fall of 2008 from the Big Bear Creek system (95% CI, 549-832)(Table 3).

The rotary screw trap on the East Fork Potlatch River was operated from April 1st until June 27th, 2008. During this period, the trap operated a total of 78 nights. A total of 279 steelhead were captured, 242 of which were PIT tagged and released above the trap. Of these, 8 were recaptured. The trapping season was subsequently grouped into two periods with different trapping efficiencies (Table 4). An estimated 6,979 juveniles emigrated from the East Fork Potlatch River system (95% CI, 3,574-12,074)(Table 4).

In addition, the rotary screw trap was also operated during the fall of 2008 from November 8th through December 9th for a total of 22 nights. A total of 952 steelhead were captured, 160 of which were PIT tagged. The resulting mark-recapture estimate for the fall 2008 outmigration was 3749 (95% CI, 2,797-5,301) (Table 5).

Juvenile steelhead captured at Big Bear Creek and the East Fork Potlatch River ranged from 51 – 234 mm and 71 – 180 mm, respectively. There was considerable differentiation in size class distribution between the two traps. Steelhead sampled from Big Bear Creek screw trap had a larger size distribution than those sampled at East Fork Potlatch River screw trap (Figure 6). Mean length of steelhead sampled at the screw traps was also larger at Big Bear Creek (161.5 mm) compared to the East Fork Potlatch River (112.3 mm). Scales were taken off 209 and 50 juvenile steelhead at Big Bear Creek and East Fork Potlatch screw traps respectively during the 2008 spring outmigration. Age data will be reported in the 2009 annual report after fish are aged at the IDFG Nampa Research Aging Laboratory.

Smolt Outmigration

2008 Smolt Outmigrant Survival

A total of 347 fish tagged at screw traps during the spring 2008 outmigration were detected in the Columbia River hydropower system (311 – Big Bear Creek and 36 – East Fork Potlatch River). The overall smolt arrival estimate to Lower Granite Dam from Big Bear Creek and the East Fork Potlatch River was 76 and 15% respectively (SE 0.07 and 0.03). Capture probability at Lower Granite Dam was 49%. When detection rates were analyzed temporally, it was found that fish tagged in late May, during the peak of the outmigration, were detected at a much lower rate than those that were tagged prior to mid May (Figure 7). Outmigrating smolts from Big Bear Creek were detected at Lower Granite dam April15th - June 17th and April 27th - June 7th for the East Fork Potlatch River.

Length of fish tagged ranged from 78 - 255 mm. The percentage of fish detected at Lower Granite Dam increased in the larger size classes (Figure 8). When looking at temporal and size differences related to detections, larger early migrants had the highest detection rates.

Roving Tagging 2007

Some juvenile steelhead tagged during the summer of 2007 outmigrated from the Potlatch River drainage during the spring of 2008. Low detection rates of 2007 roving tagged juvenile steelhead did not allow for outmigration rate estimates on a tributary level. Therefore, all 2007 roving tagged juvenile steelhead detected during the spring 2008 outmigration were grouped. Roving tagged juvenile steelhead outmigration rate to Lower Granite Dam was estimated at 0.08 (SE=0.01) during the 2008 outmigration season. Capture probability for this group was 36%, which was lower than detection probabilities for fish tagged at screw traps during the 2008 spring outmigration. Out-migrant arrival to Lower Granite Dam was slightly earlier for roving tagged fish than for fish tagged during 2008 at screw traps (Figure 9).

Roving Tagging 2008

Roving tagging was conducted throughout the lower Potlatch River basin from May 28th through August 1st during the 2008 field season. During this timeframe fish were tagged early or late in the day to ensure water temperatures did not exceed the 18°C maximum tagging temperature threshold. A total of 1,108 fish were tagged within the entire drainage (Table 6). Estimates on run timing and over summer survival will become available as these fish outmigrate past Lower Granite dam during the spring of 2009.

Snorkel Surveys

Snorkel surveys were conducted June 15th – July 1st during the 2008 field season. A total of 68 snorkel sites were sampled throughout the Potlatch River drainage. Of those sites, 56 were randomly selected using the Environmental Monitoring and Assessment Program (EMAP) protocol and twelve sites, all occurring within the East Fork Potlatch River, were historic GPM sites that are long term regional monitoring locations. Steelhead densities, predominately juveniles (age-1 and age-2) and fry (age-0) densities for the entire drainage were 3.44 and 2.00 fish / 100 m^2 respectively (SE = 1.02 and 0.55). Juvenile steelhead counts at EMAP sites were highest within the Big Bear Creek drainage (Big Bear, Little Bear, and West Fork Little Bear Creeks) with 6.84 fish/100m^2 (SE = 2.54)(Table 7). Juvenile steelhead densities were higher in the East Fork Potlatch River GPM sites with 11.63 fish / 100m^2 (SE = 2.50) however these counts are very biased due to the non-random selection criteria of the sites. Steelhead age-0 fry densities were extremely variable. Highest mean abundance of fry was within the grouped other tributaries category with 6.31 fish/100m^2 (SE = 2.36) (Table 7). The mean was largely due to high counts in Corral and Cedar Creeks of 16.81 and 11.67 fish / 100m^2. However, the highest single age-0 fry count of 18.25 fish / 100 m^2 still occurred within the Big Bear Creek drainage.

Power Analysis

A power analysis was run on snorkel survey data from the 2008 field season to determine the number of sample sites needed for reliable precision at a tributary and drainage scale. If the test was treated as one-tailed (i.e. greater or lesser than the target) we estimate 15 snorkel sites needed to determine if the new density is within +/- 50% the previous mean at the drainage wide level (Alpha = 0.10, Power = 80%). We also ran sample sites from Big Bear and East Fork Potlatch drainages and estimated 13 and 11 sites were needed to determine +/- 50% of the previous mean within these streams, respectively (Alpha = 0.10, Power = 80%). We also estimated the minimum detectable difference at a drainage wide and tributary level given the current sample design. In 2008 we sampled 56 snorkel sites within the Potlatch River. Repeating this panel of sites in the future will allow us to detect differences of 2.63 fish/100 m^2 (Alpha = 0.10, Power 80%) (Table 8). In 2008, we sampled 10 and 20 sites in the East Fork Potlatch River and Big Bear Creek drainages, respectively. This level of effort will allow us to accurately detect a change from the previous mean of 14.08 and 6.71 fish/100 m^2 at the East Fork Potlatch and Big Bear Creeks, respectively. Given the sizable difference in minimum detectable difference between the two tributaries we will determined a need for a minimum of 20 sites to track tributary level changes.

Low Water Habitat Surveys

Low water habitat availability surveys conducted during the 2008 field season estimated 73% of stream channel within the lower Potlatch River drainage was wetted during the first week in August. Corral Creek had the lowest average percent wetted habitat of the tributaries with only 26% wetted habitat at the survey sites (Appendix 3). The West Fork of Little Bear Creek and Big Bear Creek had the highest percentage of wetted habitat with 98 and 96 % wetted respectively (Appendix 3). Corral Creek also had the lowest pool density with 0.35/100 m^2 and Cedar Creek had the highest pool density with 5.15 pools/100 m^2 (Appendix 3).

DISCUSSION / RECOMMENDATIONS

Combined adult steelhead escapement for Big Bear Creek and the East Fork Potlatch River is providing valuable abundance data regarding steelhead status in the Lower Clearwater Steelhead Major Population Group (MPG). The combined adult escapement estimate for 2008 was 260 fish. While these two areas are believed to be the most significant steelhead producers in the upper and lower drainages given their size, we are collecting adult return data from juvenile PIT tagged fish on other tributaries (Pine Creek, Cedar Creek, and Upper Mainstem Potlatch River). The Big Bear Creek and East Fork Potlatch River drainages contain approximately 152.3 km of significant steelhead producing habitat. This area represents 45% of the significant steelhead producing habitat within the Potlatch River tributaries. If adult abundance is assumed at a similar rate in the rest of the drainage, we roughly estimate an adult steelhead run of 578 fish into the Potlatch River drainage in 2008. Furthermore, this estimate does not include mainstem spawning potential which was recently documented within the Lower mainstem Potlatch River. The minimum abundance threshold for the MPG to be considered viable is 1,500 adult steelhead spawners (NOAA 2006). It is possible that adult escapement into the entire Potlatch River drainage on some years is in the vicinity of 1,000 spawners without taking into account adult escapement into the rest of the Lower Clearwater River. Continued sampling on the Potlatch River and expansion of adult escapement monitoring techniques into other Lower Clearwater tributaries may define recovery within the Lower Clearwater MPG.

Data collected by the PRSME since 2005 has provided significant argument against the A-run designation of the population. Size distribution of adult steelhead captured in the Potlatch River drainage suggest a mix of A-run and B-run characteristics within the population. B-run steelhead is classified by individuals over 775 mm. In 2008, the lower and upper weirs had 24 and 13 % of the upstream spawning run in length classes of 775 mm or greater. The longest individuals captured at the lower and upper weirs were 905 and 840 mm, respectively.

Life history and migration characteristics of adult steelhead captured in the Potlatch River drainage also display a mix of the historic A-run and B-run designations. A-run fish are characterized as 1-ocean and B-run are characterized as 2-ocean life histories (CBFWA 1990). Based upon scale data, 73% and 42% of adult spawners were 2 or 3-ocean life histories in the Potlatch River drainage in 2007 and 2008 respectively. Of the twenty-three know ocean life history fish that returned in 2007, 52% were 2-ocean individuals. In addition, a B-run steelhead is migrationally characterized as an adult that crosses Bonneville Dam after August 25 of the migration year (CBFWA 1990). 26% of the Potlatch River adults that were PIT-tagged as juveniles by PRSME that returned in 2007 crossed Bonneville after August 25th.

We suggest that Potlatch River steelhead display a mix of both A and B-run life history strategies based upon the variety of size, life history, and migration characteristics we have observed. Steelhead life history appears to be very plastic, especially when compared to other anadromous species. The Potlatch River drainage is the largest Lower Clearwater River tributary (Bowersox and Brindza 2006). It is possible that the plastic nature of steelhead life history and migration characteristics is caused by the variety of biological and anthropogenic differences present within this large drainage. A comparison of neighboring Lower Clearwater River tributary and Upper Clearwater River tributary steelhead life history characteristics is warranted to determine if life history differences are a function of drainage size or spatial distribution as one moves further up the Mainstem Clearwater River from historically A-run to B-run populations. If the Potlatch River does contain a wider variety of life history strategies compared to neighboring drainages that demonstrates the high level of importance of the Potlatch River population regarding MPG stability and viability.

LWHAP surveys documented a significant increase in the amount of late summer wetted habitat available for juvenile steelhead in 2008 versus 2007. The overall percentage of late summer wetted habitat in the lower Potlatch River tributaries increased from 54% in 2007 to 73% in 2008. This increase was likely due to higher winter snowfall and cooler than average temperatures during the spring runoff period. Maximum snow water equivalent (SWE) at the Moscow Mountain SNOTEL site was 20 inches during 2007 and 32.7 inches during 2008 (NRCS SNOTEL 2009). Furthermore, SWE was reduced to 0.0 inches by April 26th in 2007 compared to May 25th 2008. (NRCS SNOTEL 2009). LWHAP surveys will be extremely valuable in the future as a means of accounting for the environmental variation in wetted habitat within the Lower Potlatch River tributaries.

LWHAP surveys will provide a valuable tool for assessment and ranking of habitat restoration projects intended to increase water retention in the tributaries. These surveys help quantify flow changes associated with habitat restoration efforts versus yearly environmental changes. These surveys will help quantify steelhead production under varying late summer rearing habitat availability levels. In addition to quantifying aquatic habitat changes, LWHAP surveys have also identified priority tributaries and specific reaches where water retention is limiting and/or where habitat restoration measures may improve late summer steelhead rearing habitat.

There were significant differences between upper and lower drainage adult and juvenile life history strategies observed during the 2008 field season. Adult steelhead were captured approximately a month earlier at lower weirs than upper weirs throughout the spawning migration (Figure 10).

The difference in migration timing and spawning will have significant effects on fry emergence and growth during the first summer of rearing. These differences were apparent in the observed size distributions of juveniles captured during the spring 2008 screw trapping. Upper drainage juvenile steelhead occupied much smaller size classes than did lower drainage juveniles. Aging off scales from both locations will help elucidate if these differences are associated with growth or differences in age structure between the sites. We believe it is a function of both, with low growth rates influencing outmigration and/or movements of juvenile steelhead in the upper drainage. We believe that poor rearing habitat conditions in the upper drainage cause juvenile steelhead to leave their natal tributaries sooner than do juvenile steelhead in the lower drainage. Roper et al. (1994) found that juvenile steelhead utilized pool habitats in the upstream reaches and riffle habitat in downstream reaches of the South Umpqua River, Oregon. Given the low density of pool habitat in the upper Potlatch River drainage we expect a reduced level of juvenile steelhead rearing there until additional pool habitat is made available through habitat restoration efforts. Additional year's data are needed to determine if these discrepancies are observed in future years.

The power analysis conducted on snorkel survey data shows that the current snorkel survey design will be able to detect the level of change that we hope to produce with restoration efforts in the Potlatch River drainage. The Northwest Power and Conservation Council produced a document that characterized steelhead smolt densities in a variety of habitat classes (poor, fair, good, and excellent) within the Columbia River Basin (NPPC, 1986). The smolt density described by NPCC was then converted into a juvenile parr density estimate assuming a 50% parr – smolt survival rate by Petrosky and Holubetz (1988). Expected steelhead parr densities in poor, fair, good, and excellent habitat classes are 6, 10, 14, and 20 fish/100m^2 respectively. Given this designation, the Potlatch River, East Fork Potlatch River and Big Bear Creek drainages currently contain poor steelhead habitat, based upon observed parr densities. It is our belief that through habitat restoration efforts (large woody debris treatment, barrier removal, stream rehabilitation, etc) we can improve stream habitat condition to a good rating. Within the East Fork Potlatch River drainage, a large scale habitat restoration plan is in-place. If we are able to continue to improve habitat at the current pace, we expect a fish density response of approximately 8-10 fish/100m^2 based upon a "good" habitat steelhead density expected level. Power analysis of our current study design shows we will be able to accurately detect these changes at a tributary and drainage scale.

The PRSME continues to direct and influence habitat restoration efforts within the Potlatch River drainage while providing a valuable effectiveness monitoring component to restoration projects occurring within the drainage. Data collected by the PRSME project continues to expand the knowledge of steelhead within the Potlatch River drainage and the Lower Clearwater River MPG.

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LITERATURE CITED

Bowersox, B. S. Wilson, and E. Schriever. 2008. Potlatch River Steelhead Monitoring and Evaluation – Annual Report 2006. Idaho Department of Fish and Game, Report # 08-0138. Boise.

Bowersox, B. and N. Brindza. 2006 Potlatch River Basin – Fisheries inventory Latah, Clearwater, and Nez Perce counties, Idaho 2003-2004. Idaho Department of Fish and Game. Report # 06-16. Boise.

Byrne, A. 2005. Steelhead Supplementation Studies, Annual Progress Report. Idaho Department of Fish and Game. Report # 05-05. Boise.

Copeland, T, J. Johnson, and S. Putnam. 2008. Idaho Natural Production Monitoring and Evaluation, 2007 Annual Report. Idaho Department of Fish and Game Report 08-58. Bonneville Power Administration. Project 1991-073-00. Portland, Oregon.

Columbia Basin Fish and Wildlife Authority (CBFWA). 1990. Integrated system plan for salmon and steelhead production in the Columbia River Basin. Columbia Basin System Planning, 449 p. and 40 subbasin volumes. (Available from Northwest Power Planning Council, 851 S.W. Sixth, Suite 1100, Portland, OR 97204-1348.)

Columbia Basin Fish and Wildlife Authority. 1999. PIT Tag Marking Procedures Manual. pp. 66.

Department of Agriculture, Soil Conservation Service. 1994. Preliminary Investigation Report, Potlatch River; Latah, Clearwater and Nez Perce counties, Idaho.

ICBTRT(Interior Columbia Basin Technical Recovery Team) 2003. Independent populations of Chinook, steelhead, and sockeye for listed evolutionarily significant unites within the interior Columbia River domain, July 2003 working draft. Available http://nwfsc.noaa.gov/trt/ .

Johnson, D.B. 1985. A biological and physical inventory of Clear Creek, Orofino Creek, and the Potlatch River, tributary streams of the Clearwater River, Idaho. Nez Perce Tribe, Fisheries Resource Management. US Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Portland, Oregon.

Lady, J., P. Westhagen, and J.R. Skalski. 2001. SURPH (Survival Under Proprotional Hazards), version 2.2b. Columbia Basin Research. Sseattle, Washington. Available: www.cbr.washington.edu/paramest/surph/ (April 2007).

National Marine Fisheries Service. 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. Available http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf

National Oceanic and Atmospheric Administration (NOAA). 2006. Salmon and Steelhead Recovery Plans for Idaho. Chapter 7 Section 7.2. Available at http://www.idahosalmonrecovery.net/pdfs/PVA7_2_6_1ClearwaterLowerMainstem-stlhd.pdf

Natural Resource Conservation Service – National Water and Climate Center – SNOTEL. 2009. http://www.wcc.nrcs.usda.gov/snotel/snotel.pl?sitenum=989&state=id .

NPPC (Northwest Power Planning Council). 1986. Columbia River basin fishery planning model – technical discussion paper.

Petrosky, C. and T. Holubetz. 1988. Idaho habitat evaluation for off-site mitigation record. Annual report, 1987. Project 83-7. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, Oregon.

Roper, B., D. Scarnecchia, and T. La Marr. 1994. Summer distribution of and habitat use by chinook salmon and steelhead within a major basin of the South Umpqua River, Oregon. Transactions of the American Fisheries Society 123: 298-308.

Schriever E. and D. Nelson. 1999. Potlatch River basin fisheries inventory; Latah, Clearwater, and New Perce Counties, Idaho. Idaho Department of Fish and Game Technical Report 106p. Boise.

Steinhorst, K.Y., Wu, B. Dennis, and P. Kline. 2004. Confidence Intervals for fish out-migration estimates using stratified trap efficiency ,methods. Journal of Agricultural, Biological, and Environmental Statistics 9: 284- 299.

Stevens, D.L., and A.R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association. 99:262-278.

STUDY AREA

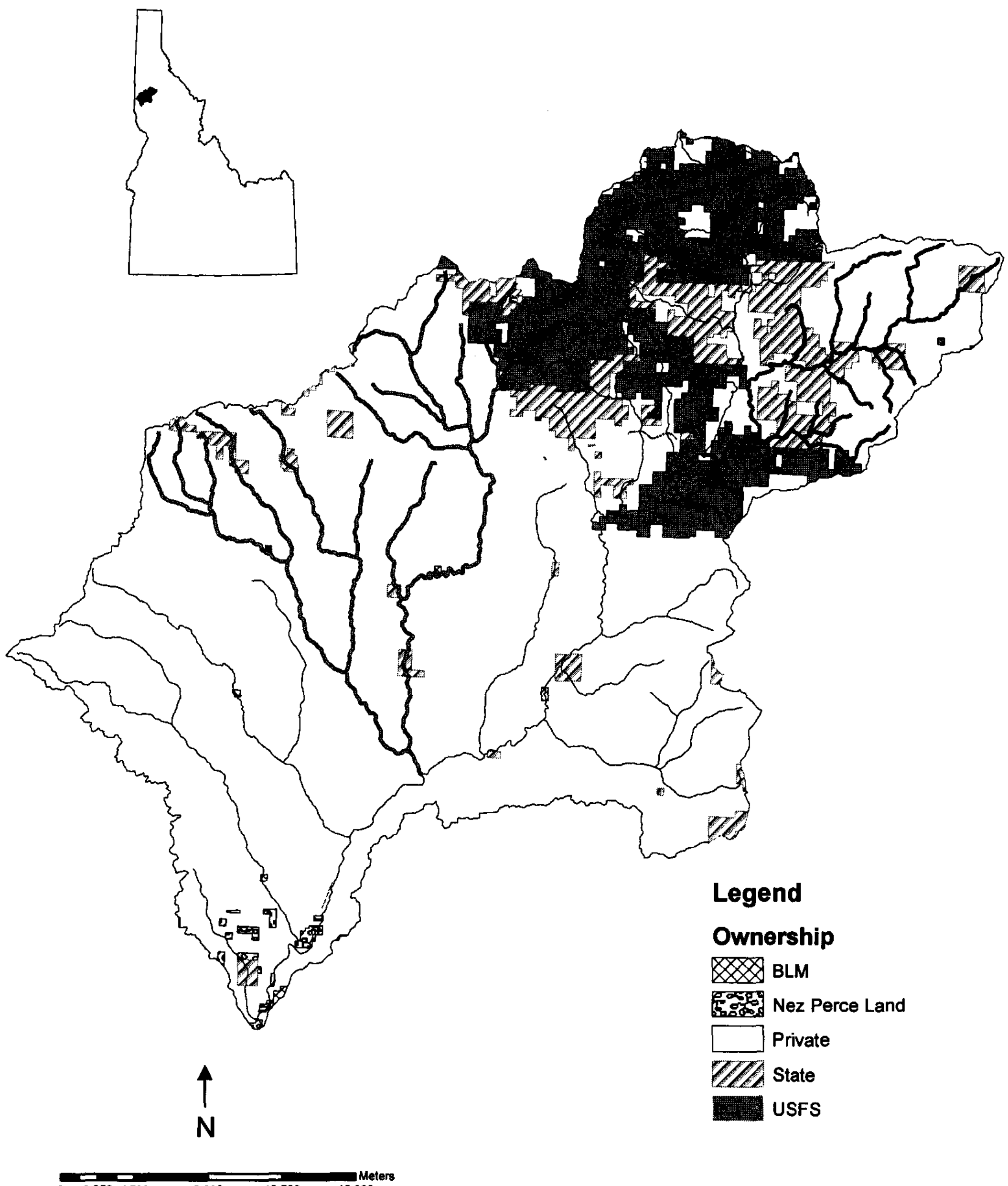


Figure 1. Potlatch River Drainage, Idaho with intensively monitored tributaries, Big Bear and East Fork Potlatch River, highlighted in lower and upper portion of the drainage.

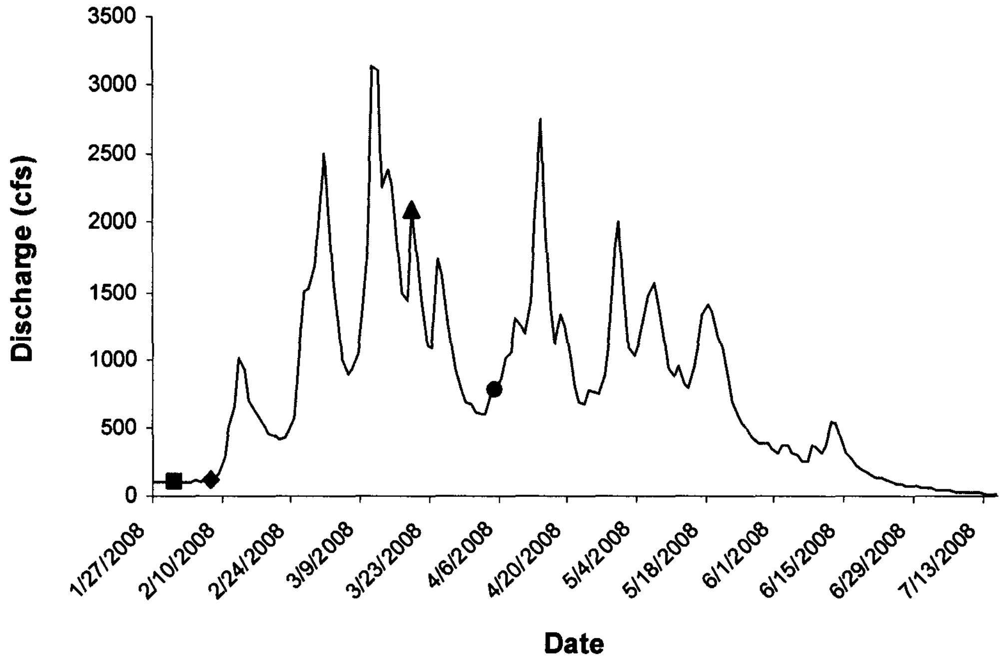


Figure 2. Stream discharge for the mainstem Potlatch River, Idaho 2008. Installation dates for each weir are indicated by the diamond (Big Bear Creek), square (Little Bear Creek), pyramid (East Fork Potlatch River) and oval (West Fork Potlatch River).

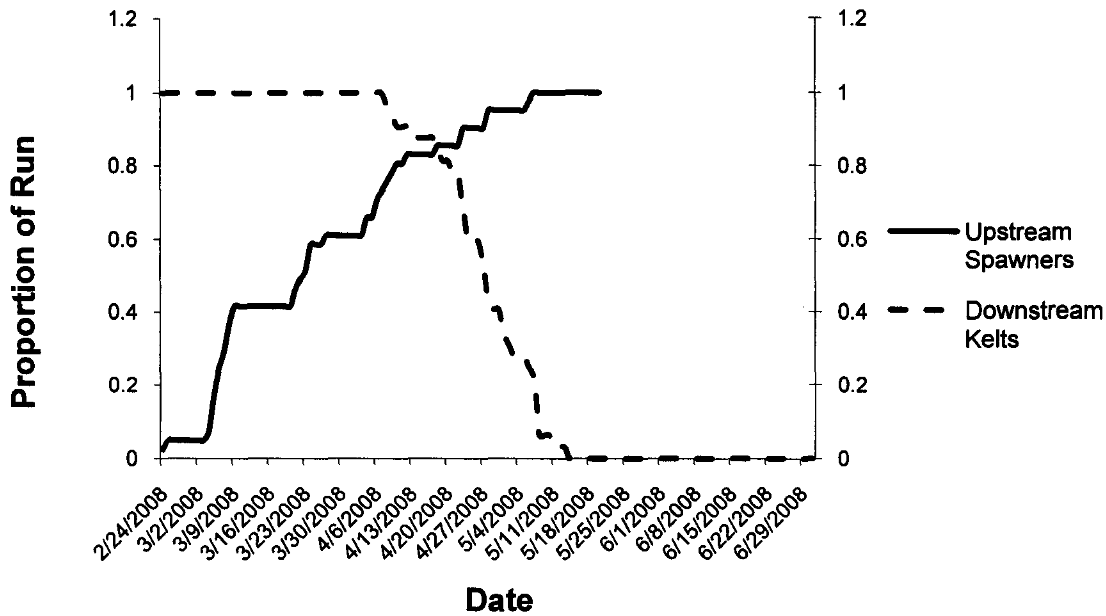


Figure 3. Spawning migration timing of adult steelhead captured at lower Potlatch River, Idaho weirs during the 2008 trapping season

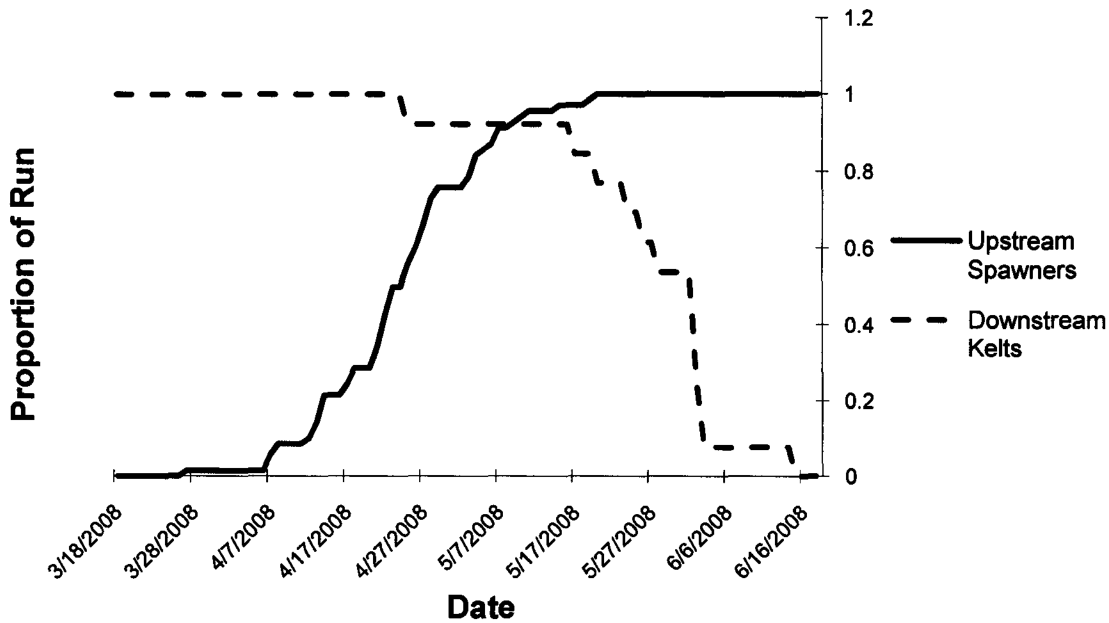


Figure 4. Spawning migration timing of adult steelhead captured at upper Potlatch River, Idaho weirs during the 2008 trapping season.

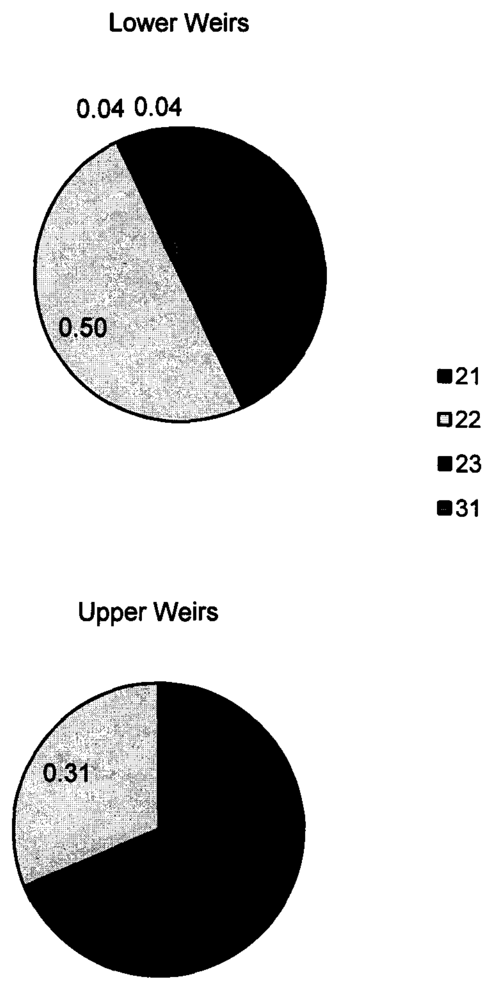


Figure 5. Observed percentages of various freshwater and ocean life history strategies in adult steelhead captured at Lower and Upper weirs during the 2008 field season (n = 60). First number in legend represents freshwater age and second number represents ocean age (i.e. 21 = 2-freshwater, 1-ocean life history).

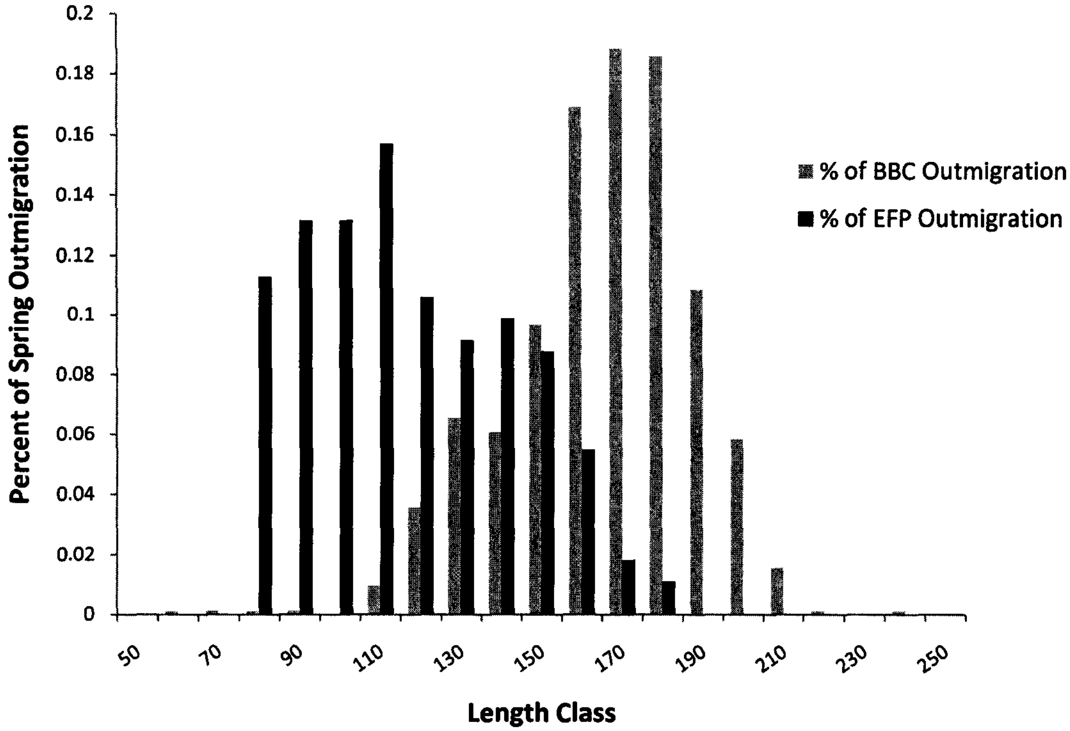
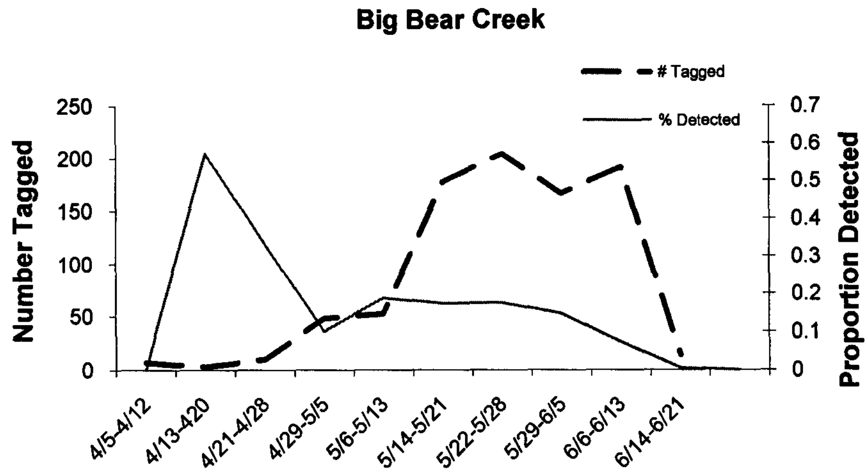


Figure 6. Length frequency histogram of juvenile steelhead captured and measured at the Big Bear Creek (BBC) and East Fork Potlatch River (EFP), Idaho screw traps in the spring of 2008.



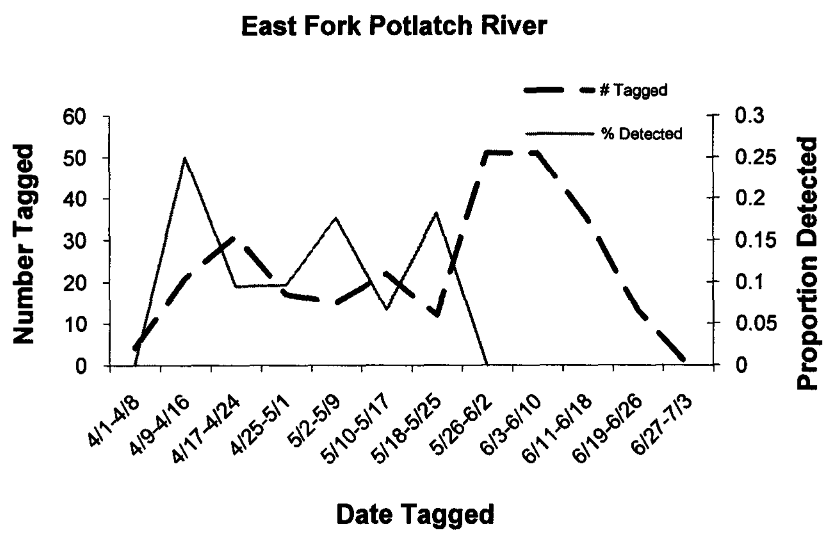


Figure 7. Number of fish tagged at Big Bear Creek and the East Fork Potlatch River, Idaho screw traps by date and the proportion subsequently detected at Lower Granite Dam during the spring 2008 outmigration.

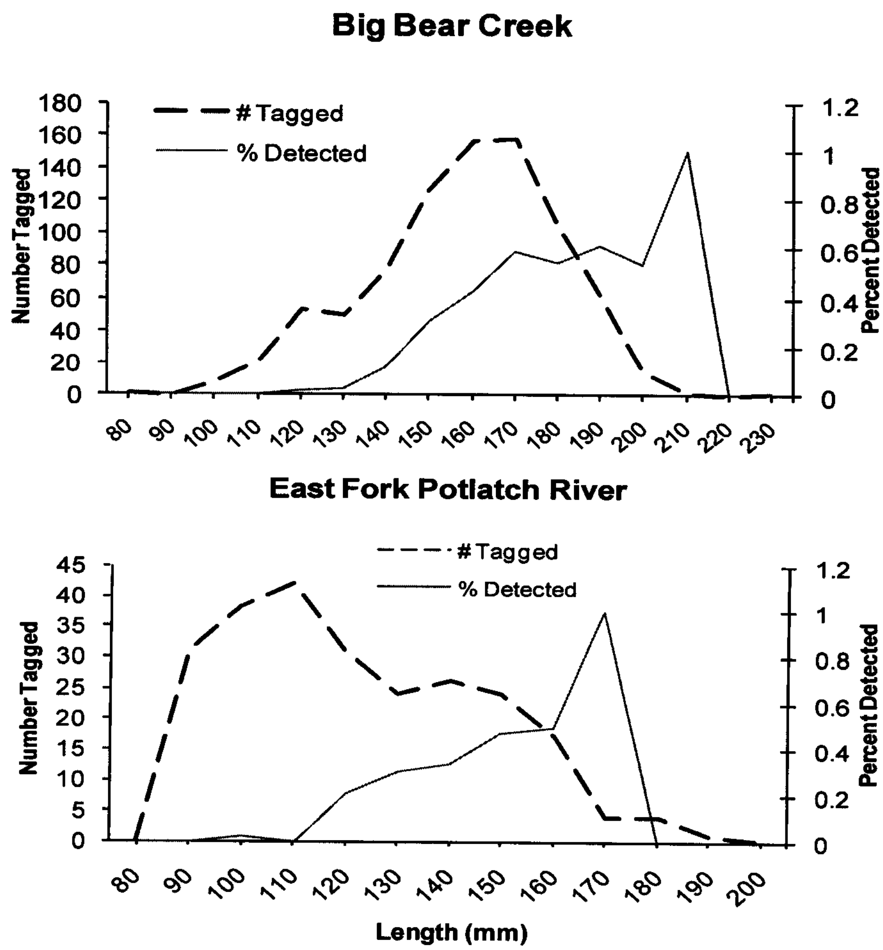


Figure 8. Number of fish tagged at Big Bear Creek and the East Fork Potlatch River, Idaho screw traps by length and the proportion subsequently detected at Lower Granite Dam during the spring 2008 outmigration.

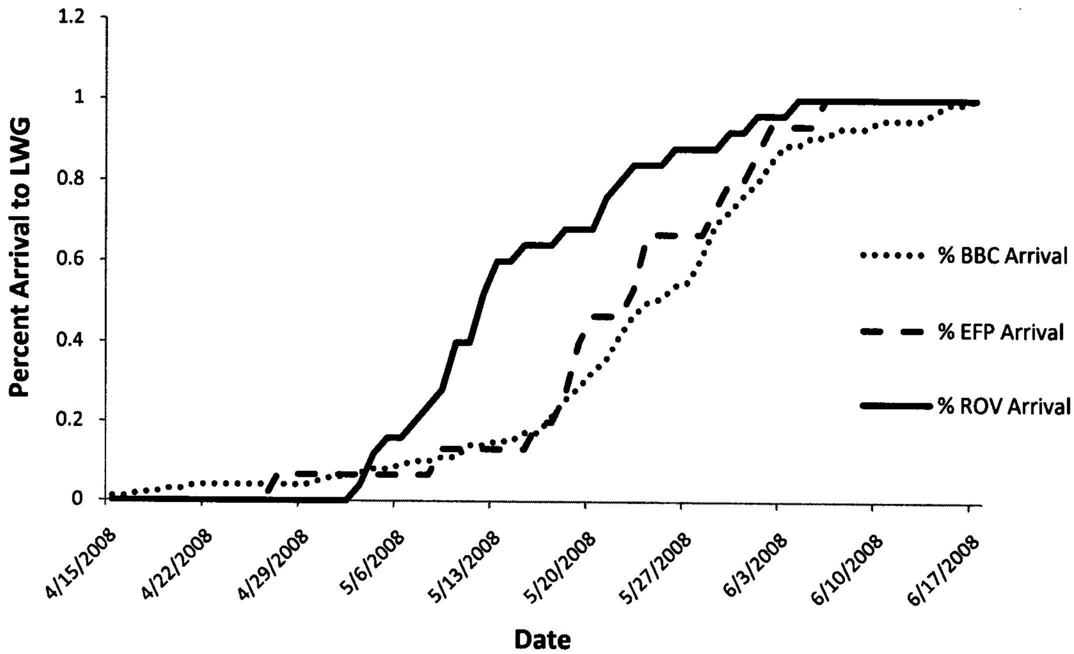


Figure 9. Arrival timing of out-migrating smolts to Lower Granite Dam (LWG), Washington during the spring 2008 outmigration from Big Bear Creek screw trap (BBC), East Fork Potlatch River screw trap (EFP), and 2007 roving tagged fish from all tributaries (ROV).

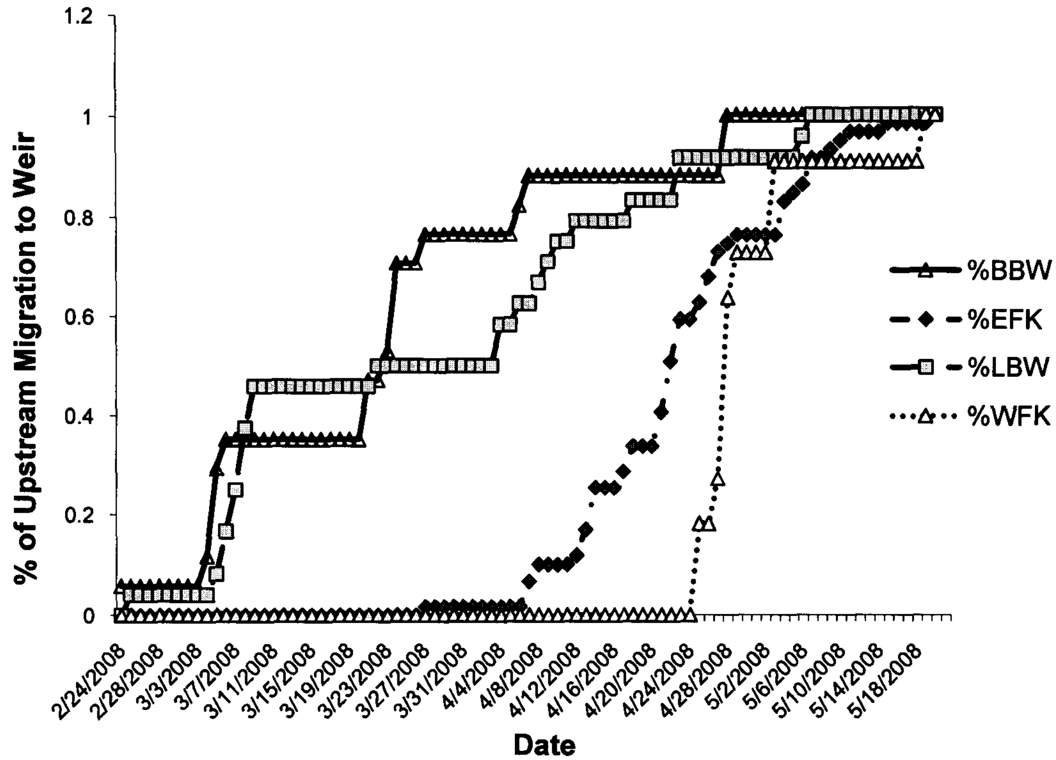


Figure 10. Arrival timing of upstream pre-spawn migrants to the four Potlatch River adult steelhead weirs during the 2008 field season. Big Bear Creek weir (BBW), East Fork Potlatch River weir (EFK), Little Bear Creek weir (LBW) and West Fork Potlatch River weir (WFK) were data monitoring sites.

Table 1. Length distributions for male and female upstream spawners captured and lower and upper Potlatch River weirs during the 2008 field season.

Drainage Location	Sex	Min Length (mm)	Max Length (mm)	n	Avg. Size	SD	SE
Lower Weirs	Female	599	845	15	688.5	75.4	19.5
Lower Weirs	Male	560	905	23	707.3	103.9	21.7
Upper Weirs	Female	550	770	27	652.2	69.4	13.3
Upper Weirs	Male	545	840	41	669.9	88.3	13.8

Table 2. Numbers of juvenile steelhead captured, marked and recaptured at the Big Bear Creek, Idaho screw trap including four single period estimates and over period total calculation for the 2008 spring trapping season. Also included is an average efficiency, migrant estimate, 95% confidence intervals (CI) and Standard Error for each sample period.

Dates	Captured	Marked	Recaptured	Average Efficiency	Migrant Estimate	Lower 95% CI	Upper 95% CI	SE
4/5-4/26	18	17	3	0.18	81	31	153	32.4
4/27-6/6	633	619	95	0.15	4088	3350	5073	430.4
6/7-6/13	193	186	60	0.32	592	460	766	77.1
6/14-6/22	19	14	4	0.29	57	23	113	23.6
Totals	863	836	162	0.23	4817	4055	5722	428.6

Table 3. Numbers of juvenile steelhead captured, marked and recaptured at the Big Bear Creek, Idaho screw trap including single period estimate and total calculation for the 2008 fall trapping season. Also included is the average efficiency, migrant estimate, 95% confidence intervals (CI) and Standard Error for each stratum.

Dates	Captured	Marked	Recaptured	Efficiency	Migrant Estimate	Lower 95% CI	Upper 95% CI	SE
11/8 - 12/12	236	229	80	0.35	670	549	832	69.8

Table 4. Numbers of juvenile steelhead captured, marked and recaptured at the East Fork Potlatch River, Idaho screw trap including two single period estimates and over period total calculation for the 2008 spring trapping season. Also included is an average efficiency, migrant estimate, 95% confidence intervals (CI) and Standard Error for each sample period.

Dates	Captured	Marked	Recaps	Average Efficiency	Migrant Estimate	Lower 95% CI	Upper 95% CI	SE
4/1-5/12	123	95	4	0.04	2362	971	4656	945.6
5/13-6/27	156	147	4	0.03	4618	2099	10138	1993.8
Totals	279	242	8	0.04	6979	3574	12074	211.5

Table 5. Numbers of juvenile steelhead captured, marked and recaptured at the East Fork Potlatch River, Idaho screw trap including three single period estimates and over period total calculation for the 2008 fall trapping season. Also included is an average efficiency, migrant estimate, 95% confidence intervals (CI) and Standard Error for each sample period.

Dates	Captured	Marked	Recaptured	Average Efficiency	Migrant Estimate	Lower 95% CI	Upper 95% CI	SE
11/12 - 11/19	245	47	8	0.17	1307	737	2568	487.1
11/20 - 11/23	435	39	13	0.33	1243	836	2010	317.6
11/24 - 12/10	272	74	16	0.22	1200	771	1868	295.5
Totals	952	160	37	0.24	3749	2797	5301	651

Table 6. The number of juvenile steelhead PIT-tagged during roving tagging efforts in the 2007 field season Potlatch River, Idaho.

Stream	# of Fish Tagged
Big Bear Creek	123
Cedar Creek	122
Corral Creek	59
Little Bear Creek	113
Pine Creek	285
WF Little Bear Creek	113
East Fork Potlatch River	293
Total	1108

Table 7. Observed juvenile steelhead (age-1+) and age-0 fry densities from 2008 snorkel surveys in the Potlatch River watershed, Idaho. Densities represent minimum density estimates and have not been corrected for sightability.

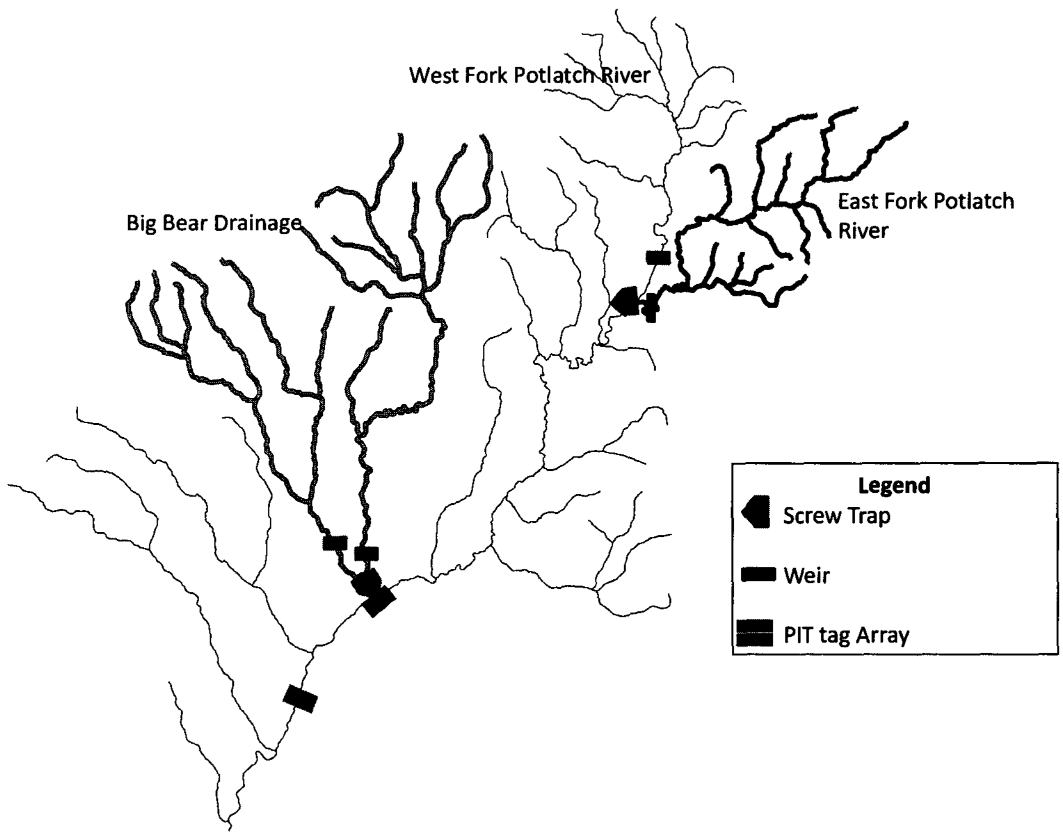
Drainage	Sites (n)	Avg. Visibility (m)	Juvenile Steelhead (Fish / 100 m^2)	SE	Age-0 Fry (Fish / 100 m^2)	SE
EF Potlatch	10	1.49	4.36	1.75	0.00	N/A
Mainstem Potlatch	19	1.78	0.23	0.09	1.82	0.81
Big Bear Drainage	20	1.40	6.84	2.54	1.65	0.92
Other Tribs	7	0.89	1.15	0.50	6.31	2.36
EF Potlatch GPM	12	1.61	11.63	2.50	0.62	0.42
Totals/Averages	56	1.39	3.14	1.22	2.45	1.37

Table 8. Number of sample sites needed for minimal detectable changes at a drainage-wide and tributary level using the 2008 Potlatch River, Idaho snorkel data.

	n	SD	$t_{0.1(2), n-1}$	$t_{0.2(1), n-1}$	Delta	Back trans
Drainage	56	2.832108	1.674	0.885	0.96847	2.633909089
Big Bear Cr	20	3.237782	1.729	0.901	1.904094	6.713314651
East Fork	20	3.02677	1.833	0.93	1.870016	6.488390608
EF GPM	12	1.029861	1.796	0.919	0.807156	2.241523425

APPENDICES

Appendix 1: Map of intensive monitoring drainages and associated sampling infrastructure within the Potlatch River drainage.



Appendix 2: Migration timing of adult steelhead throughout the Columbia River Hydrosystem during the 2007 run year that were PIT-tagged as juveniles in the Potlatch River, Idaho. Juvenile release sites include BBC (Big Bear Creek screw trap), WF LBC (West Fork Little Bear Creek summer tagging) and LWG (Lower Granite Dam).

PIT-tag ID	Juv Release Site	Release Date	BON Obs Date	BON Travel Days	LWG Obs Date	BON - LWG Travel Days	KHS Obs Date	LWG - KHS Travel Days
3D9.1BF1BD157C	BBC	04/15/2005	9/3/07	871.4	10/04/07	31	3/2/2008	149.9
3D9.1BF1CBE919	BBC	04/23/2005	8/26/07	855.1	09/18/07	22.7	*	*
3D9.1BF1C62158	BBC	04/28/2005	9/3/07	857.8	10/12/07	39.4	2/25/2008	135.7
3D9.1BF1C641B8	BBC	04/28/2005	8/23/07	846.9	*	*	*	*
3D9.1BF1C643DA	BBC	04/28/2005	8/29/07	852.8	10/17/07	49.3	2/29/2008	135.1
3D9.1BF168DE6B	BBC	04/30/2005	8/19/07	841.2	10/10/07	51.8	4/29/2008	202.3
3D9.1BF1679570	BBC	05/01/2005	7/12/07	802.1	10/04/07	83.6	2/26/2008	145.3
3D9.1BF1BD2E03	BBC	05/04/2005	7/22/07	809	11/05/07	106.2	*	*
3D9.1BF22ABFAA	BBC	05/04/2005	8/22/07	840.2	10/12/07	50.9	3/10/2008	150.1
3D9.1BF227C1C0	BBC	05/06/2005	8/18/07	834.2	10/13/07	55.6	*	*
3D9.1BF227D430	BBC	05/07/2005	7/23/07	806.7	10/05/07	74.7	3/7/2008	153.8
3D9.1BF1BC6B1F	LWG	05/14/2005	8/26/07	834.1	10/14/07	49.1	*	*
3D9.1BF246A00F	WF LBC	07/28/2005	7/30/07	732	09/21/07	52.9	*	*
3D9.1BF246AD54	WF LBC	08/06/2005	8/5/07	729	09/09/07	35.2	3/8/2008	181.2
3D9.1BF2469E09	BBC	03/28/2006	8/14/07	503.9	09/24/07	41.1	*	*
3D9.1BF246AC5B	BBC	04/21/2006	9/12/07	509	10/14/07	31.8	*	*

Appendix 3. Low Water Habitat Availability Protocol results from the 2008 survey in the Potlatch River watershed, Idaho. Surveys were preformed between 8-4-08 and 8-7-08 except site UCEC3 which was survey on 8-12-08.

Creek	Strata	Site	Total Wetted Length(m)	% Wetted	Total # Pools	Total Length of Pools(m)	Average Pools/100m
Big Bear	U	UBC1	500.00	1.00	9.00	57.30	1.80
Big Bear	U	UBC3	500.00	1.00	10.00	97.60	2.00
Big Bear	L	LBBC1	414.40	0.83	3.00	8.90	0.60
Big Bear	L	LBBC2	500.00	1.00	13.00	96.50	2.60
Big Bear Average			**478.60**	**0.96**	**8.75**	**65.08**	**1.75**
Little Bear	U	ULBC1-A	341.30	0.68	7.00	136.30	1.40
Little Bear	U	ULBC2	325.80	0.65	10.00	150.80	2.00
Little Bear	L	LLBC1	453.00	0.91	5.00	23.40	1.00
Little Bear	L	LLBC2	500.00	1.00	11.00	59.20	2.20
Little Bear Average			**405.03**	**0.81**	**8.25**	**92.43**	**1.65**
WFLBC	U	UWF1	500.00	1.00	4.00	55.70	0.80
WFLBC	U	UWF2	454.80	0.91	2.00	19.10	0.40
WFLBC	L	LWF4	500.00	1.00	3.00	7.60	0.60
WFLBC	L	LWF5	500.00	1.00	4.00	38.20	0.80
WF Little Bear Average			**488.70**	**0.98**	**3.25**	**30.15**	**0.65**
Cedar	U	UCEC3	500.00	1.00	7.00	53.40	1.40
Cedar	U	CECU2	262.00	0.52	2.00	9.30	0.40
Cedar	L	CEC1	500.00	1.00	36.00	74.65	7.20
Cedar	L	CEC2	500.00	1.00	58.00	61.12	11.60
Cedar Average			**440.50**	**0.88**	**25.75**	**49.62**	**5.15**
Pine	U	UPC2-A	0.00	0.00	0.00	0.00	0.00
Pine	U	UPC3-A	0.00	0.00	0.00	0.00	0.00
Pine	L	LPC5-A	500.00	1.00	5.00	40.80	1.00
Pine	L	LPC6-A	500.00	1.00	6.00	34.30	1.20
Pine Average			**250.00**	**0.50**	**2.75**	**18.78**	**0.55**
Corral	U	UCOC7	15.24	0.03	2.00	18.60	0.40
Corral	U	UCOC4	181.50	0.36	4.00	51.50	0.80
Corral	L	LCOC1	0.00	0.00	0.00	0.00	0.00
Corral	L	LCOC2	326.50	0.65	1.00	5.60	0.20
Corral Average			**130.81**	**0.26**	**1.75**	**18.93**	**0.35**
Drainage Average			**365.61**	**0.73**	**8.42**	**45.83**	**1.68**

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