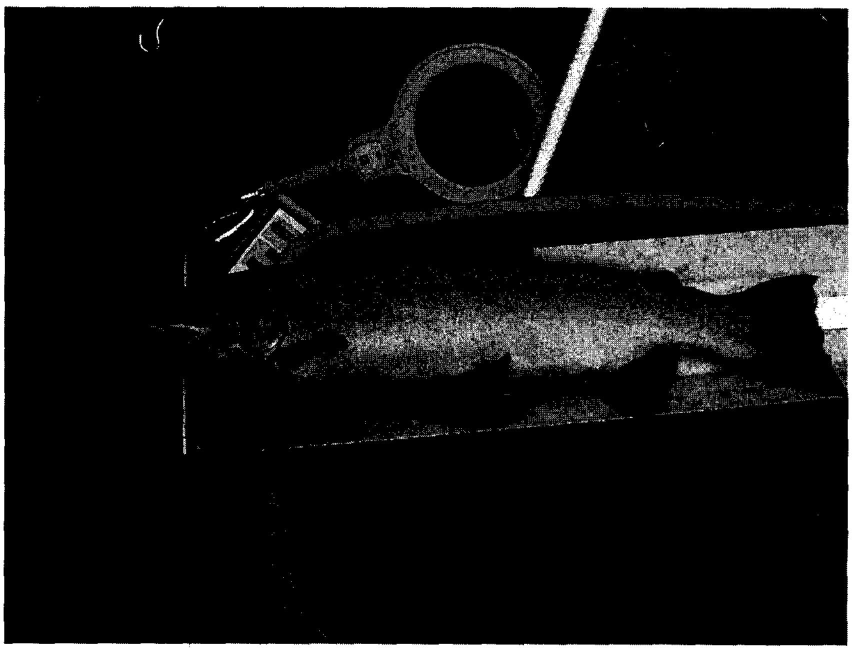
POTLATCH RIVER STEELHEAD MONITORING AND EVALUATION

Annual Report
2007



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Pacific Coast Salmon Recovery Funds
Contract # 05 052 CW
IDFG # 08-139

December 2008

2007 Potlatch River Steelhead Monitoring and Evaluation

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ABSTRACT

The Potlatch River Steelhead Monitoring and Evaluation project was started in 2005 to assess steelhead production and productivity in relation to large scale habitat restoration occurring within the drainage. The monitoring effort provides a measure of success to agencies initiating habitat restoration projects within the drainage. Intensive steelhead *Oncorhynchus mykiss* population monitoring was conducted on Big Bear Creek, a tributary to the main stem Potlatch River. Two adult steelhead weirs and one juvenile fish screw trap were operated on this drainage during the 2007 field season. Broad-scale fish and habitat monitoring was also conducted in 2007 on all steelhead bearing tributaries found within the lower Potlatch River. This report includes adult escapement and run timing information for brood year 2007 as well as juvenile outmigration and survival estimates and in-stream density information for brood year 2004, 2005 and 2006 fish. We estimated 177 adult spawners above weir locations on Big Bear and Little Bear Creeks with a 95% confidence interval ranging from 94 to 289. An estimated 9,187 juvenile steelhead/rainbow trout emigrated from the Bear Creek system, with a 95% confidence interval ranging from 8,019 to 10,542. Estimated emigration rate of PIT-tagged juvenile smolts from Big Bear Creek to Lower Granite Dam was 38% (SE 0.03%). Steelhead/rainbow trout juvenile in-stream densities were highest for age-0 in Cedar Creek and age-1 fish within the West Fork of Big Bear Creek. Genetic analysis was run on adult steelhead captured during the spring outmigration. Big Bear Creek and Little Bear Creek exhibited little (although significant) differentiation (χ^2 49.61, d.f. 34, p-value = 0.040), (F_{ST} = 0.005). Significant genetic differentiation was observed between Big and Little Bear Creeks and samples from the Dworshak hatchery (p-value < 0.00001), (F_{ST} = 0.020-0.024)

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INTRODUCTION

The Potlatch River Steelhead Monitoring and Evaluation (PRSME) project was initiated in 2005 to assess steelhead production and productivity within the lower Potlatch River drainage. The Potlatch River has the strongest population of wild steelhead present within the lower Clearwater River drainage. The lower Clearwater River steelhead distinct population segment 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 lower 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 has 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 within the drainage. These limiting factors include (Johnson 1985; Bowersox and Brindza 2006):

1) Extreme flow variation
2) High summer water temperatures
3) Lack of riparian habitat
4) High sediment loads
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 is 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 County Soil and Water Conservation District has begun significant restoration efforts on the agricultural lands associated with the lower Potlatch River 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. The project is focused on lower Potlatch River tributaries where PCSRF and other funds are being used to implement habitat restoration.

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 enough to shift with monitoring needs as well as rigid to detect changes within the population.

This report contains results from 2007 which was the third field season for the monitoring and evaluation effort. Field activities included adult escapement estimation, juvenile out-migration estimates, in-stream density estimates, and habitat surveys.

OBJECTIVES

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

STUDY AREA

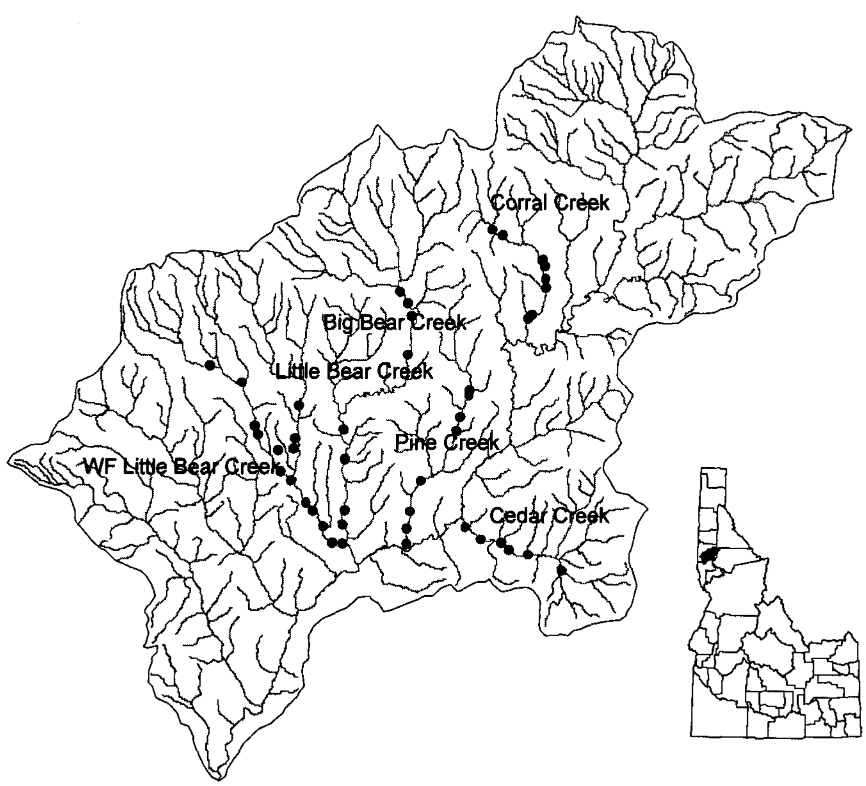

Figure 1. Potlatch River Drainage with lower Potlatch River study tributaries and sampling sites.

The Potlatch River drainage is located in Latah, Nez Perce, and Clearwater counties. The main stem 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). Work conducted by this ongoing PCSRF funding is focused on major lower Potlatch River tributaries; Big Bear Creek, Little Bear Creek, the West Fork of Little Bear Creek, Pine Creek, Cedar Creek, and Corral Creek (Figure 1).

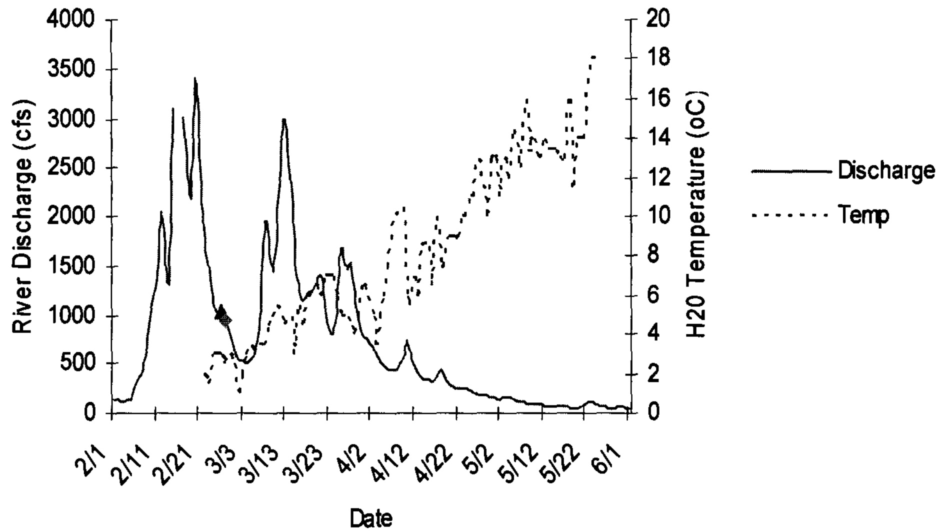

Figure 2. Stream discharge for the Potlatch River, Idaho and temperature recorded at the weir location on Big Bear Creek in 2007. Installation dates for each weir are indicated by the triangle (Big Bear Creek) and diamond (Little Bear Creek).

Mean daily stream discharge during the 2007 adult trapping season, measured at the USGS flow site (13341570) approximately two miles above the mouth of the Potlatch River, ranged from 64 to 3,000 cfs (Figure 2). Stream flows approached or exceeded 2,000 cfs on three occasions during the adult trapping season. 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 season.

METHODS

Adult Sampling

Picket weirs were constructed at Big Bear and Little Bear Creeks in the spring of 2007 to capture migrating adult steelhead. Weirs were installed at Big Bear and Little Bear Creeks on February 26th and February 27th respectively. Both traps were pulled after adult steelhead migration was complete on May 16th. Initially, weirs were outfitted with only an upstream migrant trap box. Both weirs were maintained and checked for fish daily. Trapped upstream migrants were collected from the trap box and anesthetized in MS-222. Upstream fish were marked with a right operculum punch and 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 fish captured at the weirs were relocated below the weir.

Downstream trap boxes were installed at each weir location by the first of April. Fish captured in the downstream box 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 number 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 variable of marked adults passed upstream, number of unmarked adults captured as kelts and number of marked adults captured as kelts. Assumptions required are 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 49 of 62 unique adult fish captured during the 2007 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 upstream spawning and downstream kelt steelhead captured at Big Bear and Little Bear Creek weirs. Genetic samples were sent to the Idaho Department of Fish and Game Genetics Laboratory in Eagle, ID. Samples from Big Bear and Little Bear Creeks were examined for levels of heterozygosity and alleles per group. Samples were then compared to other sampled populations throughout Idaho in an un-rooted dendrogram to detect relationships.

A total of five steelhead that we tagged as juveniles in 2005 were detected within the Columbia River hydropower system during the fall of 2006 as upstream adult migrants. Two of these fish were subsequently detected passing Lower Granite Dam later in the migration. These fish are included in this report since they spawned in the spring of 2007. Run timing, travel time from juvenile to adult detections and travel time from Bonneville to Lower Granite Dam are included in this report.

Juvenile Sampling

A rotary screw trap was operated on Big Bear Creek 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/rainbow trout emigration out of both Big Bear and Little Bear creeks and their tributaries. The screw trap was checked daily from February 22nd thru May 31st during the spring out-migration. By May 31st the trap was no longer operational because of insufficient flow at the site. The trap was also operated in the fall from November 8th till December 12th. During these periods, trapping was only interrupted due to extremely high or low stream discharge. All fish captured at the screw trap were identified and enumerated. In addition, sub-samples of non-target species were weighed and measured. All steelhead/rainbow trout were weighed, measured, and scanned for the presence of Passive Induced Transponder (PIT) tags. Juvenile steelhead/rainbow trout (>80 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 out-migration from Big Bear Creek trap 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. A running average of weekly trapping efficiency was plotted in order to determine appropriate out-migration 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 survival to Lower Granite Dam was estimated using Survival Under Proportional Hazards (SURPH) 2.2 software (Lady et al. 2001).

A total of 285 scales were randomly sampled from the out-migrating juveniles collected at the screw trap on Big Bear Creek. Every fifth fish had scales taken in order to spread samples out over the entire juvenile out-migration. 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 and saltwater ages. 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. 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 main stem Potlatch River PIT-tag array and Lower Granite Dam will be used to estimate in-stream survival in future years.

Electrofishing and habitat surveys were conducted in six Lower Potlatch River tributaries during 2007. A total of 22 sites were sampled using triple pass depletion methods. Two selected sites were not surveyed due to logistical issues. Three passes were conducted as long as an adequate removal pattern (decrease by 50%) was observed on each pass. At transects where depletion objectives were not obtained an additional pass was done until removal criteria was met. Juvenile steelhead/rainbow trout sampled during the electrofishing surveys were also tagged with PIT tags and uploaded to the PTAGIS database.

PIT-tag Array

An in-stream PIT-tag array was built and deployed on Big Bear Creek during the 2007 field season. The array consists of six in-stream antennas anchored to the streambed in an upstream and downstream array pattern. Three antennas were arranged longitudinally across the streambed upstream and downstream of the reader ~ 10 m apart. The array has been operational since October 25th, 2007. The array site was registered as an interrogation location within the Columbia River basin PTAGIS database. Data from the array such as adult migration timing, juvenile/smolt migration timing, and survival will be reported in the 2008 Annual Report when we get detections from the 2008 migration.

Habitat Surveys

Habitat sampling design was modified from Harrelson et al. (1994) and Rosgen (1996). Surveys included longitudinal and cross-section profiles, Wohlman pebble counts (Rosgen 1996), canopy cover estimation using a densiometer, stream channel typing (Rosgen 1996), macroinvertebrate counts (USDA 1998), Pfankuch channel stability rating (Rosgen 1996), large organic debris enumeration, and a vegetation summary (Rosgen 1996).

Benchmarks were established for each site above the flood prone area. Longitudinal and cross-section profiles were measured using a surveyor's level and stadia rod from each benchmark. Measurements were taken at regular intervals including all significant elevation changes along each section. Flood-prone, bankfull, and wetted width were established along each cross section.

A Low Water Habitat Availability Protocol (LWHAP) was created to estimate wetted habitat present within Lower Potlatch River tributaries during the late summer. In addition to wetted habitat, the protocol was designed to measure pool availability and quality within Lower Potlatch River tributaries during the same time period. Tributaries were stratified into upland and canyon reaches to disperse transects throughout each tributary. Transects were walked July 30 - August 2 2007. 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. The maximum depth, modal depth, pool length, pool width, and whether or not salmonids were present (visual observation) was then recorded for all pools within transects.

RESULTS

Adult Abundance

A total of 62 individual adult steelhead were captured during the 2007 field season. Of these fish, 19 were captured at Big Bear Creek and 43 were captured at Little Bear Creek. The combined 2007 adult steelhead escapement for both Big Bear and Little Bear Creeks was estimated to be 177 adult steelhead with a 95% CI ranging from 94-289 fish.

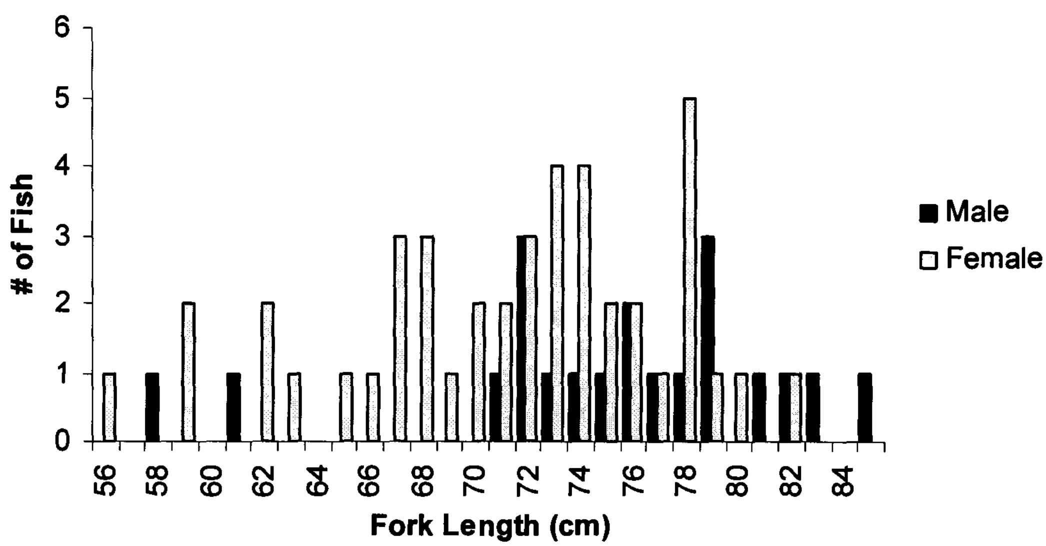

Figure 3. Fork length histogram of adult steelhead captured at the Little Bear and Big Bear Creek weirs during the 2007 trapping season.

Males ranged from 58 to 85 cm fork length, while females ranged from 56 to 82 cm (Figure 3). While length distributions for sexes were not significantly different (P = 0.078, K-S test) male distribution tended towards larger length classes.

Two fish captured at the weirs were of hatchery origin resulting in a hatchery fish occurrence of 3.2 % at the trap sites. Hatchery fish frequency during the previous two years of the study was 3.7 and 0.0% respectively in 2005 and 2006. One hatchery origin fish captured during the 2007 field season was marked with an orange elastomer and coded-wire tag. The fish was originally released by Washington Department of Fish and Wildlife on the Tucannon River.

A total of 19 adult steelhead were captured at Big Bear Creek weir during the 2007 field season. Twelve were captured as upstream migrants, tagged and passed above the weir. The first pre-spawn adult was trapped on March 5th and the last was trapped on March 25th (Figure 4). Fifteen steelhead kelts were captured while migrating downstream, including eight recaptures. The first kelt was trapped on April 7th and the last was trapped on May 10th (Figure 4). The captures resulted in an adult escapement estimate of 27 adult steelhead within Big Bear Creek with a 95% CI ranging from 16-42 fish.

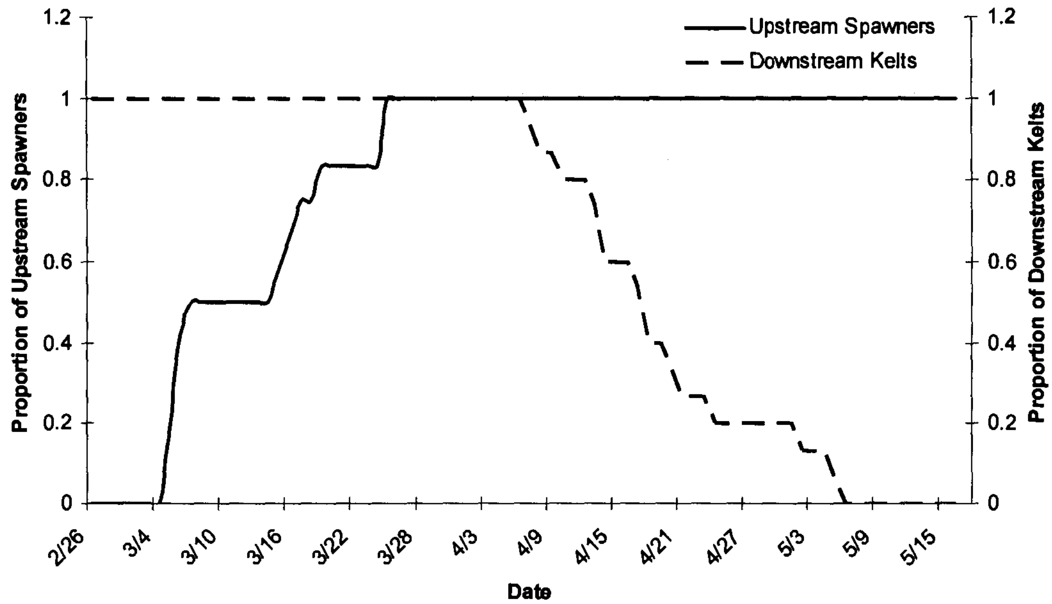

Figure 4. Arrival timing of upstream spawning adult and downstream kelt steelhead at the Big Bear Creek weir in 2007.

A total of 43 adult steelhead were captured at the weir on Little Bear Creek. Of these, 11 were captured as up-stream migrants, tagged and passed above the weir. The first pre-spawn adult was captured on March 6th and the last was captured on April 1st (Figure 5). Another 38 adult steelhead kelts were trapped while migrating downstream that included three recaptures of adults tagged as upstream migrants. The first kelt was trapped on March 27th and the last was trapped on May 5th (Figure 5). The captures resulted in an adult escapement estimate of 147 adult steelhead within Little Bear Creek with a 95% CI ranging from 64-493 fish.

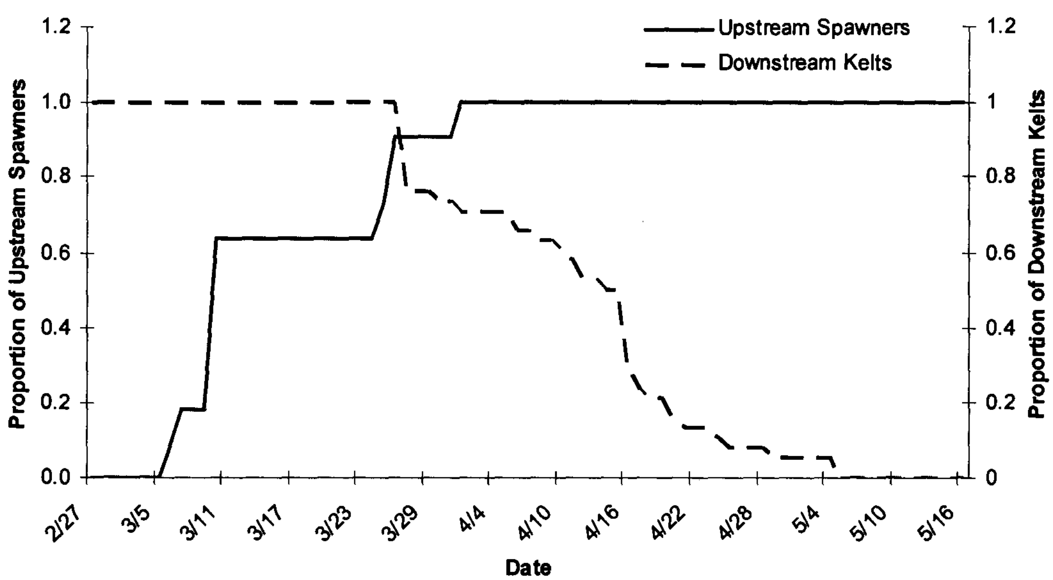

Figure 5. Arrival timing of upstream spawning adult and downstream kelt steelhead at the Little Bear Creek weir in 2007.

Total unique captures of males and females were 19 and 43 respectively. The estimated number of males and females comprising the 2007 run was 54 and 123 fish respectively. The observed sex ratio from the 2007 field season was 2.2 females per male. The observed ratio does differ significantly (*P* = 0.037, Chi-Square) from the expected ratio of 1:1.

Scale samples were taken from 49 of the 62 adult steelhead captured during the 2007 field season. Scale samples from 39 fish were able to be aged. Scale analysis displayed a variety of freshwater and ocean life history strategies being utilized within the population (Figure 6). The 2-Fresh 2-Ocean life history was most prevalent with 56% of the fish sampled displaying this strategy (Figure 6).

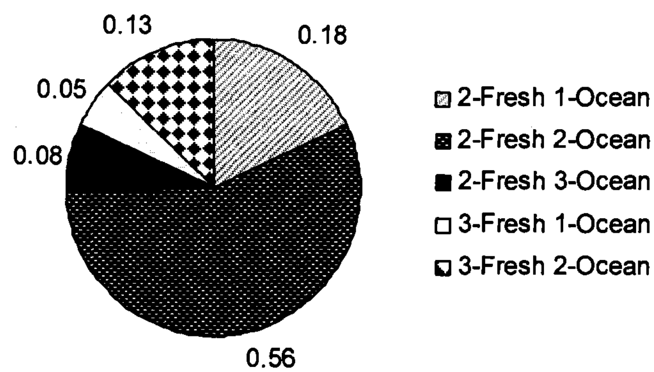

Figure 6. Observed proportions of various freshwater and ocean life history strategies in adult steelhead captured at Big Bear and Little Bear Creeks during the 2007 field season (n = 39).

The number of alleles observed per locus ranged from 6.59 (Big Bear Creek, low sample size) to 10.24 (Little Bear Creek). Samples from Big Bear Creek and Little Bear Creek exhibited little (although significant) differentiation (χ^2 49.61, d.f. 34, p-value = 0.040), F_{ST} = 0.005) (Table 1)(Matt Campbell, personal communication). Significant genetic differentiation was observed between Big and Little Bear Creeks and samples from the Dworshak hatchery (p-value < 0.00001), F_{ST} = 0.020-0.024) (Figure 7) (Matt Campbell, personal communication). While Potlatch River steelhead did group with other Clearwater River stocks, significant differentiation was observed.

Table 1. Genetic diversity statistics for the two sample groups from the Potlatch River, ID. Sample size (N), H_E = unbiased heterozygosity, H_O = observed heterozygosity, NA_{AVG} = average number of alleles observed in each population, # of loci out of HWE (after Bonferroni correction), and # of tests significant for linkage disequilibrium for each population (Campbell, 2008).

Population	N	H_E	H_O	NA_{AVG}	# of loci out of HWE	# of tests significant for linkage disequilibrium
Big Bear Creek (Potlatch R.)	12	0.7321	0.6903	6.59	0	0
Little Bear Creek (Potlatch R.)	42	0.7569	0.7421	10.24	0	4

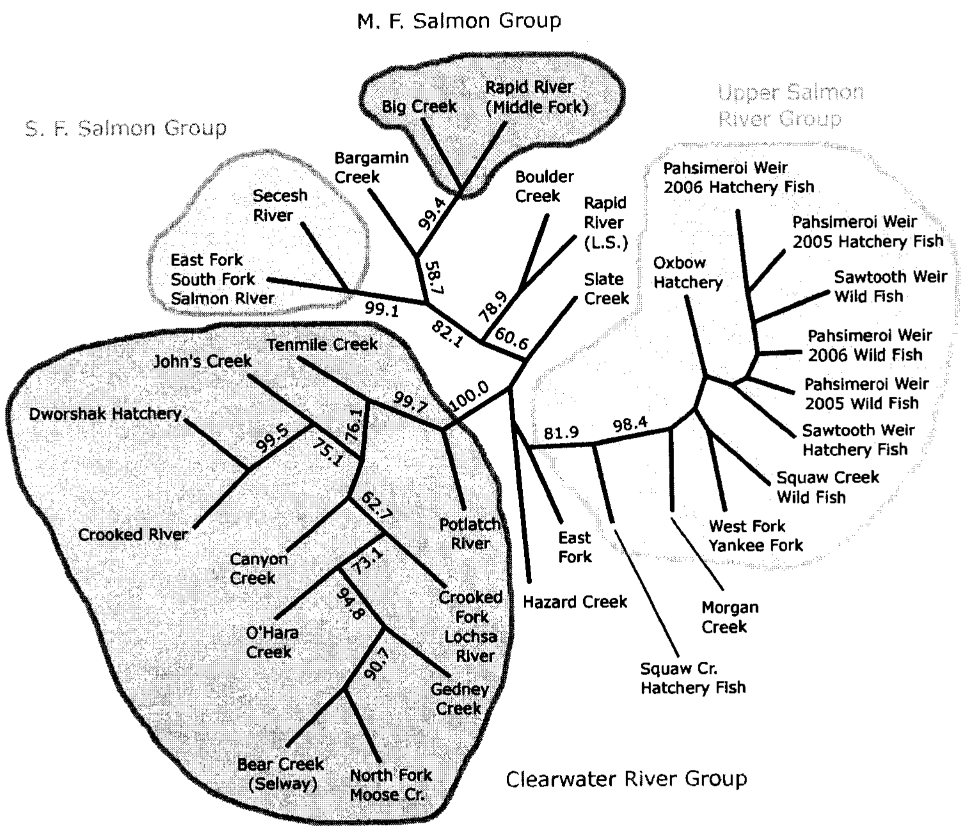

Figure 7. Un-rooted dendrogram showing population relationships (Fitch-Margoliash tree based on Cavalli-Sforza and Edwards (1967) genetic chord distances using a combined data set containing the 2007 and 2006 sample/analysis groups). Colored shapes enclose tree branches that correspond with geographical areas. Bootstrap values are reported as percentages of the total and were listed only if they exceeded 50%. (Campbell, 2008)

Six fish were detected at Bonneville Dam and two of the six were again detected crossing Lower Granite Dam (Table 2). The first upstream adult was detected at Bonneville Dam on July 7th, 2006 and the last was detected August 9th, 2006. Mean travel time from release to observation at Bonneville Dam was 466.54 days. The two fish were detected at Lower Granite Dam on September 26th and October 21st, 2006 and had a mean travel time from release to detection of 538.45 days.

Table 2. Adult steelhead detections during the fall of 2006

Return Year	Detection Site	PIT Tag ID	Release Site	Obs	Obs Date/Time	Travel Days
2006	Bonneville	3D9.1BF1CAE091	BIGBEC	BO1	07/15/06 06:09	450.9
2006	Bonneville	3D9.1BF2276B65	BIGBEC	BO4	08/03/06 15:35	455.1
2006	Bonneville	3D9.1BF169A64C	BIGBEC	BO1	08/05/06 09:57	460.8
2006	Bonneville	3D9.1BF1BD15B3	BIGBEC	BO4	08/06/06 06:30	475.2
2006	Bonneville	3D9.1BF1C4E81C	BIGBEC	BO1	08/09/06 07:53	490.7
2006	Lower Granite	3D9.1BF169A64C	BIGBEC	GRA	09/26/06 05:22	512.6
2006	Lower Granite	3D9.1BF1C4E81C	BIGBEC	GRA	10/21/06 23:38	564.3

Juvenile Emigration

Spring Migration

The rotary screw trap on Big Bear Creek began fishing on February 2 and fished until May 31, 2007. During this period, the trap operated a total of 87 nights, was pulled four nights due to high flows, and operation was halted eight times by rapidly dropping water levels. A total of 1,293 steelhead/rainbow trout were captured, 1,264 of which were PIT tagged and released above the trap. Of these, 219 were recaptured. The trapping season was subsequently grouped into four periods with different trapping efficiencies (Table 3). An estimated 9,187 juveniles emigrated from the Bear Creek system, with a 95% confidence interval ranging from 8,019 to 10,542.

Table 3. Numbers of fish captured, marked and recaptured at the Big Bear Creek screw trap including four single period estimates and over period total calculation. Also included is an average daily efficiency, migrant estimate, 95% confidence intervals (CI) and Standard Error for each stratum.

	Dates	Captured	Marked	Recaptured	Average Efficiency	Migrant Estimate	Lower 95% CI	Upper 95% CI	SE
3-Mar	17-Apr	82	65	13	0.2	387	236	653	114
18-Apr	1-May	397	338	47	0.14	2804	2147	3729	411.8
2-May	15-May	969	822	136	0.17	5821	4928	6951	510.9
23-May	31-May	57	39	12	0.31	175	108	290	47.2

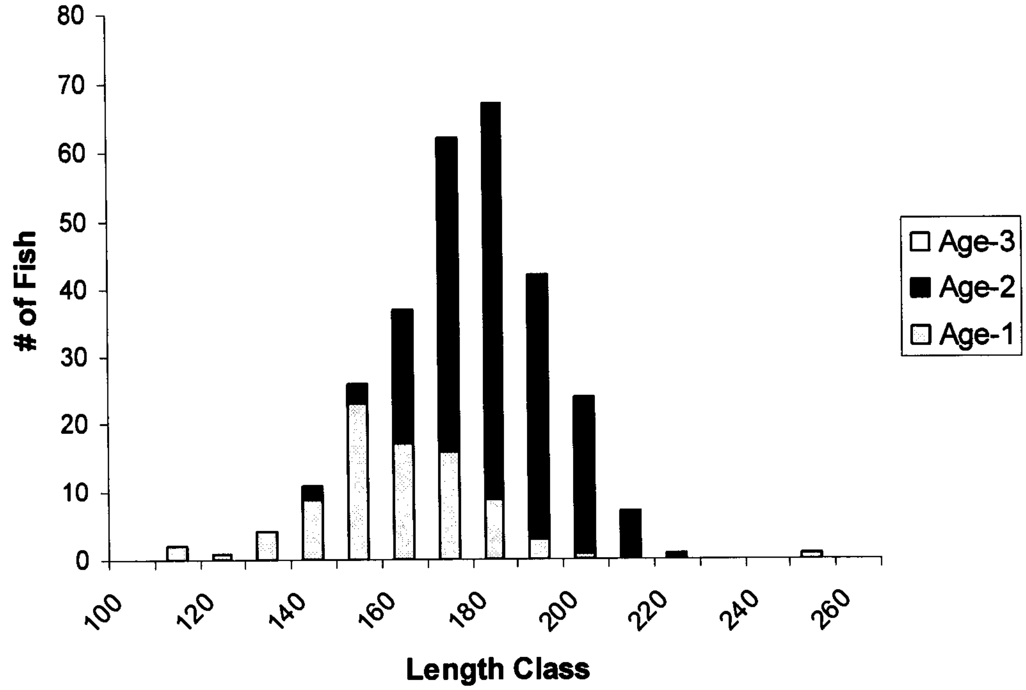

Figure 8. Size and age frequency histogram of juvenile steelhead/rainbow trout captured and PIT tagged at the Big Bear Creek screw trap in the spring of 2007.

Scale samples were taken and aged from 285 of the 1,293 juvenile steelhead/rainbow trout captured during the 2007 spring out-migration. Juvenile steelhead/rainbow trout captured in the spring ranged from 78 to 255 mm fork length, with an average of 167 mm (Figure 8). Aged fish were used to estimate the proportion of different age-classes represented within the out-migration and provide an estimated number of out-migration by age-class (Table 4). We estimated 2,740 age-1 (BY 06), 6,414 age-2 (BY05), and 32 age-3 (BY04) out-migrants comprised the run in 2007 (Table 4).

Table 4. Estimated age of the 2007 juvenile steelhead/rainbow trout out-migration from Big Bear Creek drainage by age-class.

	Age-1	Age-2	Age-3	Total
Age from Scales	85	199	1	285
Proportion of Run	0.298	0.698	0.004	1.00
Est # of Fish / age	2740	6414	32	9186

Fall Migration

A total of 25 juvenile steelhead/rainbow trout were captured during the fall migration. There were insufficient numbers of recaptures to generate an out-migration estimate.

Survival

2007 Smolt Outmigrant Survival

Of the juvenile steelhead/rainbow trout PIT-tagged in spring 2007; an estimated 38% emigrated past Lower Granite Dam as steelhead smolts (SE 0.03). Capture probability at Lower Granite Dam was 23%. When detection rates were analyzed temporally, it was found that fish tagged in late May, during the peak of the out-migration, were detected at a much lower rate than those that were tagged prior to mid May (Figure 9). The temporal range of detections at Lower Granite dam was April 14th thru October 4th.

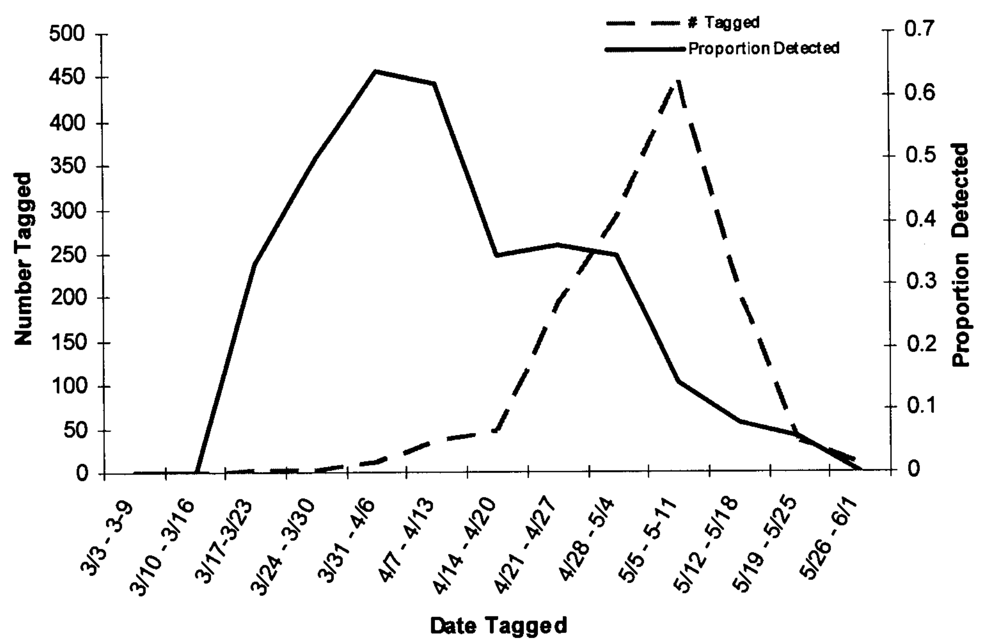

Figure 9. Number of fish tagged by date and percent detected at Lower Granite Dam during the spring 2007 out-migration.

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 10). When looking at temporal and size differences related to detections, larger early migrants had the highest detection rates.

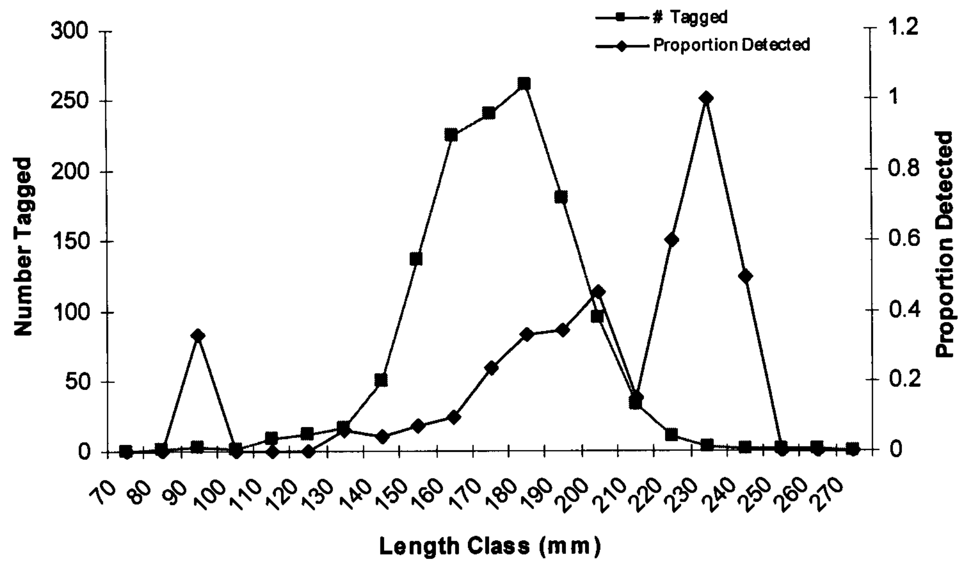

Figure 10. Number of fish tagged by length class and subsequently detected at Lower Granite Dam during the spring 2007 out-migration.

Roving Tagging

Roving tagging was conducted throughout the lower Potlatch River basin during the 2007 field season. Fish were tagged between May 17th and June 21st till water temperatures exceeded recommended tagging levels. A total of 596 fish were tagged within the lower tributaries (Table 5). Estimates on run timing and over summer survival will become available as these fish out-migrate past Lower Granite dam during the spring of 2008. Due to low tagging numbers during the 2006 field season, no over summer survival and/or out-migration timing information is available for 2007.

Table 5. The number of juvenile steelhead/rainbow trout PIT-tagged during roving tagging efforts in the 2007 field season.

Stream	# of fish tagged
Big Bear Creek	9
Cedar Creek	145
Corral Creek	100
Little Bear Creek	103
Pine Creek	201
WF Little Bear Creek	38
Grand Total	596

Electrofishing Surveys

Twenty-two of 24 randomly selected electrofishing sites were sampled during the 2007 field season. Sites with associated habitat surveys were sampled in 2007 since surveys had not been completed during the same calendar year in previous field seasons. Salmonids were encountered in 18 of the 22 sites (Appendix 1). A total of 422 age-0 steelhead/rainbow trout and 317 parr were captured. Although six sites exhibited an acceptable removal pattern for at least one age group of salmonids, only three sites (all within the West Fork of Little Bear Creek) had such a pattern for both age categories. Densities were calculated for tributaries in which electro-fishing was conducted at one or more sites. The West Fork Little Bear Creek had the highest densities of parr while Cedar Creek had the highest densities of age-0 fish (Figure 11).

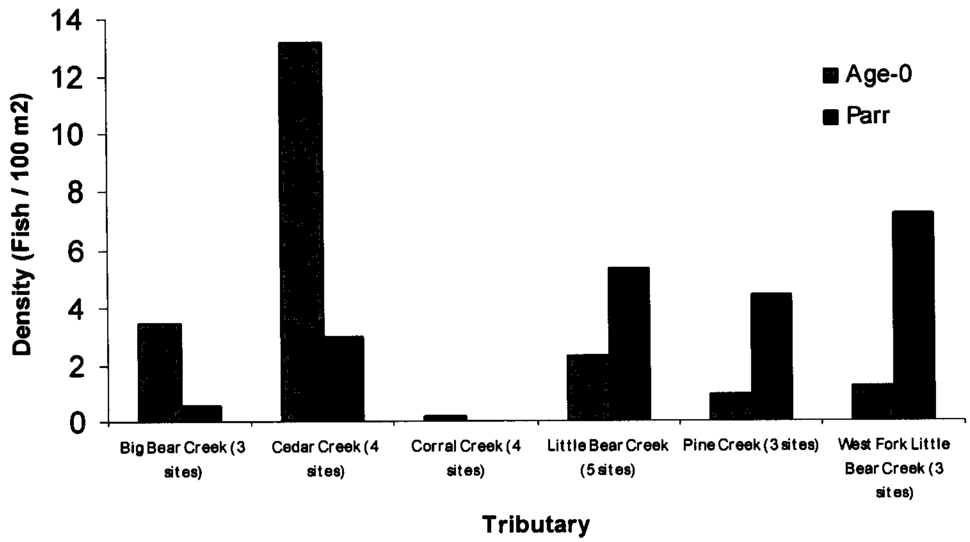

Figure 11. Density estimates for age zero and parr (≥ age 1) steelhead/rainbow trout in study streams within the Potlatch watershed in which multi-pass electro-fishing was conducted in 2007.

Habitat Surveys

Each of the six lower Potlatch River tributaries that are part of the study contain four habitat sites that were surveyed in concurrence with fish population sampling. These surveys consisted of sites on Big Bear, Little Bear, West Fork Little Bear, Cedar, Corral, and Pine creeks. In 2007, 22 of the 24 sites were surveyed. The remaining sites were not surveyed due to logistical issues at the sites. A summary of the habitat data collected can be found in Appendix 2-9.

Tributary streams of the Potlatch River exhibited primarily B1 and B2 Rosgen channel types which exhibited 2-4% gradient and boulder/bedrock substrate types. Of the sites surveyed, the most common substrate compositions were bedrock (9 out of 22), boulder (7 out of 22), and gravel (5 out of 22).

Entrenchment ratios (ER) were calculated for 16 of the 22 sites ranging from 0.8 to 3.9. Of the 16 sites, 8 sites were deeply entrenched (ER < 1.4), 4 sites were moderately entrenched (ER = 1.4 – 2.2), and 4 sites were slightly entrenched (ER > 2.2). Cedar Creek was the most entrenched tributary with Corral and Pine Creeks showing the most variation, with sites ranging from deeply entrenched to slightly entrenched.

The width/depth ratio (W/D) did not exceed 25 at any of the sites that were surveyed in 2007. Big Bear Creek consistently had the highest W/D ratio, ranging from 8.2 to 25. Little Bear, Cedar, Corral, and Pine creeks tended to have the lowest W/D ratios, with 15 of the 22 sites surveyed having a W/D ratio < 12. Big Bear and West Fork Little Bear creeks had a mixture of sites with low (<12) and moderate (12 – 40) W/D ratios.

Channel slopes for the sites surveyed in 2007 ranged from 0.2% to 5.6%. Most sites (20 out of 22) had a gentle (<2%) to moderate (2-4%) gradient, with one site on Cedar Creek and one site on West Fork Little Bear Creek being classified as steep (>4%). Cedar and West Fork Little Bear creeks had the greatest variation in channel slope with sites ranging from gentle to steep.

Canopy cover was measured at all 24 survey sites in 2007. Percent cover for these sites ranged from 0.0 to 62.95%. Big Bear Creek had the lowest cover, with one site measuring 0% cover and the other two sites measuring 6.7% and 8.25%. Cedar Creek had the highest cover percentages with three out of four sites having >55% cover.

Large woody debris (LWD) was found in varying densities throughout the lower six Potlatch River tributaries. Cedar Creek had the highest densities with LWD being found at all four sites. Big Bear Creek had LWD present in only one of the three sites surveyed.

Low Water Habitat Surveys

Low water habitat availability surveys conducted during the 2007 field season estimated 54% of stream channel within the lower Potlatch was wetted during the first week in August. Corral Creek had the lowest average percent wetted habitat of the tributaries with only 15% wetted habitat at the survey sites (Appendix 10). Big Bear Creek and Cedar Creek had the highest percentage of wetted habitat with 80 and 78% respectively (Appendix 10). Corral Creek also had the lowest pool density with 0.2 per 100 m^2 and Cedar Creek had the highest pool density with 2.85 pools per 100 m^2 (Appendix 10).

DISCUSSION / RECOMMENDATIONS

Adult steelhead returns have varied during the three field seasons that weirs have been operated in the Big Bear Creek drainage. The estimated number of adults returning to Big Bear and Little Bear Creeks in 2007 (177) was between the previous estimates in 2005 and 2006 of 266 and 77 adults, respectively. The number of wild adult steelhead passing Lower Granite Dam during those three years has fluctuated but at a reduced rate; between 9,470 and 18,107 fish (Jon Hansen, IDFG, personal communication). Furthermore, adult escapement to Fish Creek, a pristine tributary in the upper Clearwater Basin, was similar for 2005 (121) and 2006 (119). This suggests that steelhead returns to the Potlatch do not fluctuate in proportion to other populations above Lower Granite and may be heavily influenced by conditions within the watershed. Monitoring of these populations over multiple life cycles will likely be required in order to elucidate the cause of these variations.

Hatchery stray rates into the Potlatch River continue to be low, 0.0 – 3.7%, from 2005-2007. This is considerably lower stray rates than those observed at Asotin Creek, WA and Fish Creek, ID. Stray rates within these populations have ranged from 7.6-18.2% during the same time period (Byrne and Copeland 2007, Mayer, personal communication). The Potlatch River has never had juvenile steelhead smolt releases. The only hatchery steelhead releases were pre-spawn adults released from Dworshak National Fish Hatchery in the mid-1980's. Given its geographic location, the lack of a hatchery influence within the population is impressive. Genetic data from fish sampled in 2007 provides further evidence to this being a unique population. Potlatch River fish do group with Clearwater River populations but are distinct within that group.

Due to a series of high water events during February 2007, picket weirs were not installed on Big Bear and Little Bear Creeks until February 26th and February 27th respectively. The first upstream adult was captured at Big Bear Creek on March 5th. It still remains to be seen if a portion of the run is migrating into Big Bear Creek prior to weir installation. A study on Asotin Creek, WA, another lower Snake River tributary has documented steelhead migration as early as mid-January (Mayer et al. 2006). We will attempt to install weirs in the beginning of February during the 2008 field season to determine if Big Bear Creek has an early migration component as well.

Juvenile life history strategies between the screw trap at Big Bear Creek and Lower Granite Dam remain unclear. Juvenile smolt detections at Lower Granite Reservoir are higher for large/early migrating smolts. Smolt survival to Lower Granite Dam is comparable to those observed in Asotin Creek and Fish Creek, two other wild steelhead populations within the Snake River Basin above Lower Granite Dam (Tim Copeland, personal communication and Kent Mayer, personal communication). It is possible that these fish truly survive at a higher rate than smaller/later migrating individuals. However, it is also possible that the undetected component of the out-migration is not crossing Lower Granite Dam during the spring out-migration period. We have observed limited smolt detections from previous years tagging actively out-migrating the following spring. However, these limited detections have done little to change the overall survival to Lower Granite Dam. It is also possible that some individuals are residualizing within the Potlatch River and/or Lower Clearwater River and never undertaking an out-migration. Deploying a PIT-tag array on the main stem Potlatch River will enhance our ability to estimate survival out of the Potlatch River as well as look at movements from the Lower Clearwater River.

The lack of late summer habitat has been cited as a limiting factor within the Lower Potlatch (Bowersox and Brindza 2006). LWHAP surveys conducted during the 2007 field season provided a feasible method for quantifying summer steelhead/rainbow trout habitat present within Lower Potlatch River tributaries. A number of habitat restoration projects in the Lower Potlatch River are intended to increase late summer streamflow by increasing upland water retention. This protocol will increase the ability to gage success of habitat restoration efforts within the basin. We will soon be able to see if there is a correlation between late summer habitat availability and a variety of steelhead population metrics such as juvenile out-migration population estimates the following year, juvenile summer survival, and adult returns in subsequent years based upon wetted habitat availability, summer water temperatures, and pool characteristics.

Establishing an unbiased consistent method for juvenile steelhead population estimation has continued to be a challenge for the project. As noted in the 2006 Annual Report, we have been attempting to identify the best method for juvenile abundance estimation in the Potlatch River (Bowersox et al 2007). To date we have used triple pass electrofishing and electrofishing mark-recapture techniques (National Marine Fisheries Service 2000). After the 2006 field season we felt that triple pass electrofishing would be the best method to use given the low population size present within sample transects (Lockwood and Schnieder 2000). However, we still had difficulty getting reasonable triple pass estimates in 2007. During the 2008 field season we will use techniques developed from the statewide General Parr Monitoring (GPM) protocol for mark-resight snorkeling. This method was evaluated by GPM crews during the 2007 field season and was found to be a productive and logistically feasible method for juvenile salmonid population estimation (Copeland et al. 2008).

Mark-resight snorkeling will also alleviate some of the constraints we have experienced using electrofishing. High water temperatures have decreased the number of sites we have been able to complete in past field seasons. There are no water temperature constraints with snorkeling. In addition, tributaries within the lower Potlatch River exhibit a wide range of conductivities (<10 µs - > 50 µs). This results in the inability to effectively shock fish in low conductivity water. Snorkel estimates will not be biased based upon water conductivity. One constraint that is shared between electrofishing and snorkeling is a lack of water within the survey site. We are hoping to coordinate with GPM crews in June each year to produce a multiple crew survey effort to complete snorkel surveys prior to dewatering. The effectiveness of this approach will be reported on in the 2008 annual report.

The project continues to integrate and cooperate with other statewide programs. By incorporating mark-resight snorkel techniques used by IDFG, GPM crews data from the Potlatch River is compatible with statewide monitoring programs. We have also been working with IDFG Nampa Research to coordinate data collection efforts between PRSME and the Idaho Steelhead Monitoring and Evaluation studies.

Minor changes to the study design of the PRSME are allowing the framework to become more adaptive to habitat project monitoring needs. By incorporating GPM protocols and data, the crew will better be able to respond to monitoring needs throughout the basin. For example, a large fish passage barrier was removed from the Corral Creek drainage during the fall and early winter of 2007. There are already plans to increase PIT-tagging and surveying within Corral Creek to determine if the newly opened habitat is being utilized and how those fish are contributing to the population. Similarly, an out-migration barrier on Pine Creek is planned for removal in 2008-2009. We are also planning to increase PIT-tagging in Pine Creek during 2008 to look at differences in out-migration timing and in-stream summer survival.

The PRSME project will be expanding in 2008. We have secured NOAA Intensively Monitored Watershed (IMW) funds to begin monitoring steelhead population dynamics and life history traits in the upper Potlatch River basin. This phase of the project will be interwoven with the current efforts in the lower basin to give a basin wide perspective for Potlatch River steelhead. We will use a similar study design in the upper basin to produce comparable data throughout the basin. Similar to the current project on the lower Potlatch; the work in the upper basin will also provide an umbrella monitoring component to the variety of habitat restoration projects planned for the upper Potlatch River.

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APPENDIX

Appendix 1. Results of multi-pass electro-fishing surveys conducted on 100 m transects within the Potlatch River Basin in 2007. Population estimates and 95% confidence limits (CL) for two age groups of juvenile steelhead were derived using MicroFish 3.0 software.

Site	Date	Pass	Rainbow/Steelhead YOY (0+) N	Pop. Est.	LCL	UCL	Rainbow/Steelhead Parr (1+) N	Pop. Est.	LCL	UCL
Big Bear Creek										
3.4	8-Jun	3	93	146	78	214	5	5	2	8
21.3	12-Jun	3	0	N/A	N/A	N/A	0	N/A	N/A	N/A
25.9	11-Jun	3	0	N/A	N/A	N/A	6	9	N/A	N/A
Little Bear Creek										
1.4	13-Jun	3	10	10	8	12	15	15	13	17
2.4	8-Jun	3	0	N/A	N/A	N/A	37	37	36	38
4	9-Jun	3	23	24	20	28	57	67	52	82
11.7	7-Jun	3	8	8	7	9	24	24	23	25
14.4	7-Jun	3	17	17	16	18	3	3	3	3
West Fork Little Bear Creek										
2.1	10-Jun	4	9	9	7	11	35	38	31	45
4.1	10-Jun	3	1	N/A	N/A	N/A	34	38	30	46
6.2	18-Jun	3	3	3	2	4	10	10	8	12
Cedar Creek										
1.5	19-Jun	3	18	23	8	38	17	17	16	18
2.4	20-Jun	3	47	49	44	54	24	24	22	26
3.2	20-Jun	3	182	232	192	272	18	18	17	19
5.6	21-Jun	3	1	1	N/A	N/A	2	2	N/A	N/A
Pine Creek										
1.4	19-Jun	3	0	N/A	N/A	N/A	27	27	25	29
3.9	21-Jun	3	8	8	6	10	12	12	11	13
11.2	18-Jun	3	0	N/A	N/A	N/A	0	N/A	N/A	N/A
Corral Creek										
2.7	12-Jun	3	1	1	N/A	N/A	0	N/A	N/A	N/A
3.1	12-Jun	3	1	1	N/A	N/A	0	N/A	N/A	N/A
8.2	11-Jun	3	0	N/A	N/A	N/A	0	N/A	N/A	N/A
13.3	11-Jun	3	0	N/A	N/A	N/A	0	N/A	N/A	N/A

Appendix 2. Results of habitat surveys conducted in the Potlatch River watershed in 2007. Channel types are classified according to Rosgen (1996), based on entrenchment ratio, width to depth ratio, slope, and valley type. Canopy cover percentages were calculated from densiometer readings.

Site	Date	Channel Type	Entrench Ratio	W/D Ratio	Slope (%)	Canopy Cover (%)
Big Bear Creek						
3.4	7/11/2007	B1	1.3	15.8	0.7	6.76
21.3	7/11/2007	B1	NA	25	0.9	0
25.9	7/12/2007	B2	2.2	8.2	0.6	8.25
Big Bear Avg.			1.75	16.33	0.73	5.00
Little Bear Creek						
1.4	6/28/2007	B2	NA	13	1.9	40.3
2.4	6/26/2007	B1	0.8	11.1	0.7	37.96
4	6/26/2007	B3	1.2	9.3	0.6	59.28
11.7	7/10/2007	B4	1.5	11.9	2.07	42.64
14.4	7/10/2007	B4	2.1	8.5	1	20.3
Little Bear Avg.			1.40	10.20	1.09	40.05
W.F. Little Bear Creek						
2.1	7/4/2007	B1	NA	3.7	5.4	27.82
4.1	7/5/2007	B1	1.3	15.4	0.4	20.28
6.2	7/4/2007	B4	NA	4.9	3.5	48.1
W.F. Little Bear Avg.			NA	8.00	3.10	32.07
Cedar Creek						
1.5	6/27/2007	B2	1.3	9.7	5.6	62.95
2.4	6/27/2007	B2	0.9	10.1	0.6	55.38
3.2	7/11/2007	B1	0.8	5.1	1.4	32.76
5.6	6/27/2007	B1	3	6.5	0.03	72
Cedar Avg.			1.50	7.85	1.91	55.77
Corral Creek						
2.7	7/10/2007	B4	1.6	11.9	0.2	36.92
3.1	7/10/2007	B1	3.1	10.5	2.1	54
8.2	7/2/2007	B2	NA	5.9	1.1	2.08
13.3	7/2/2007	B1	NA	5.2	0.4	4.94
Corral Avg.			2.35	8.38	0.95	24.49
Pine Creek						
1.4	6/25/2007	B2	3.9	7.2	1.8	35.88
3.9	7/9/2007	B4	1.3	9	0.3	52.8
11.2	7/11/2007	B2	2.7	9.7	2.1	37.18
Pine Avg.			2.63	8.63	1.40	41.95

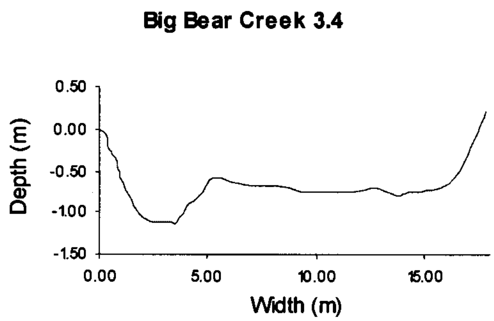
[1]Canopy Cover percentages were calculated by multiplying the densitometer reading by 1.04 and subtracting the product from 100.
NA – Data not available.

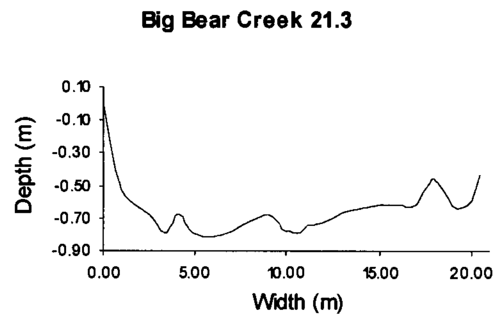
Appendix 3. Measures of aquatic macroinvertebrate diversity found in six tributaries of Potlatch Creek. For each stream that was sampled, the number of sample sites, overall sample size (N), taxa richness (S), Simpson's Index (D)[1] and Equitability (E_D)[2], Shannon-Weiner Index (H)[3] and Equitability (E_H)[4], and dominant taxa observed at the site are given. A sample was collected at each site by towing a sieve across a standardized stream transect.

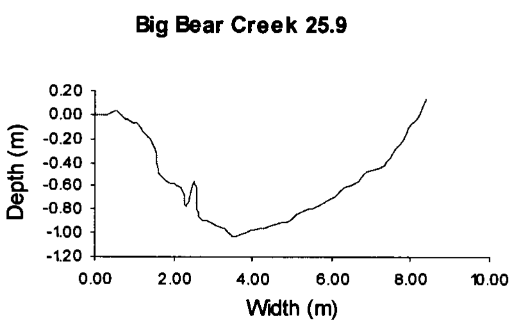
Tributary	Sites	N	S	1/D	E_D	H	E_H	Dominant Taxa
Big Bear Creek	5	252	8	2.8	0.3	1.1	0.6	Mayfly
Little Bear Creek	4	73	6	2.3	0.4	1.1	0.6	Mayfly
West Fork Little Bear Creek	4	137	5	1.5	0.3	0.7	0.4	Caddisfly
Cedar Creek	5	78	5	3.2	0.6	1.3	0.8	Mayfly
Corral Creek	4	176	11	5.1	0.5	1.9	0.8	Mayfly
Pine Creek	4	246	6	1.1	0.2	0.6	0.3	Caddisfly

[1]Simpson's Index was calculated using the bias corrected form, where $D = \sum(n_i(n_i-1)/(N(N-1)$.
[2]Simpson's Equitability was calculated as $E_D = D/D_{max} = (1/D)(1/S)$, where S = taxa richness.
[3]Shannon-Weiner Index was calculated as $H = -\sum(p_i \ln(p_i))$
[4]Shannon-Weiner Equitability was calculated as $E_H = H/H_{max} = H/\ln(S)$, where S = taxa richness.

Appendix 4. Cross sectional profiles for three survey sites on Big Bear Creek in 2007. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as negative depth and elevations above bankfull indicated as positive depth.

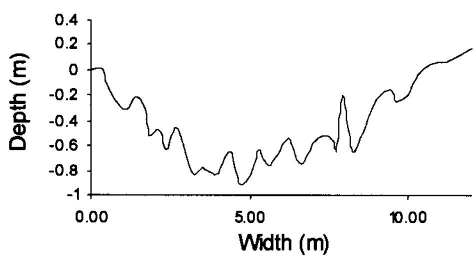




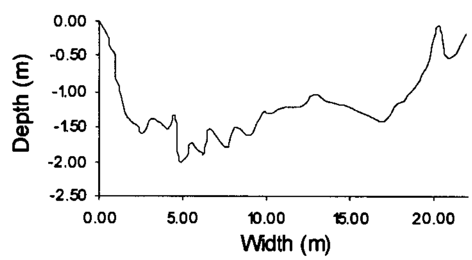


Appendix 5. Cross sectional profiles for five survey sites on Little Bear Creek in 2007 The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as negative depth and elevations above bankfull indicated as positive depth.

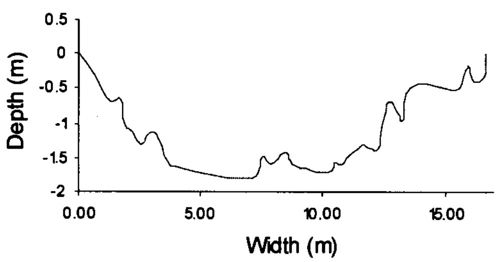
Little Bear Creek 1.4



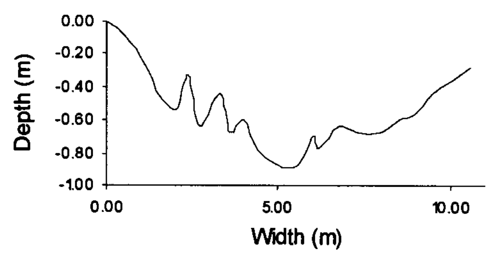
Little Bear Creek 2.4



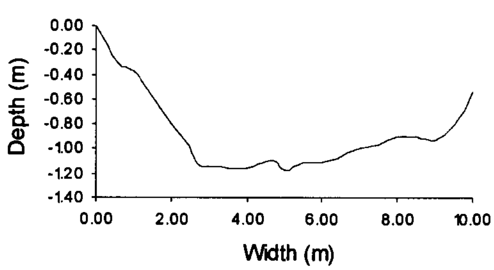
Little Bear Creek 4.0



Little Bear Creek 11.7

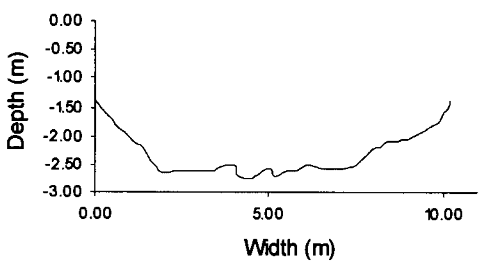


Little Bear Creek 14.4

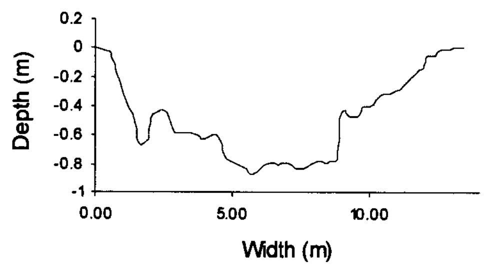


Appendix 6. Cross sectional profiles for three survey sites on the West Fork Little Bear Creek in 2007. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as negative depth and elevations above bankfull indicated as positive depth.

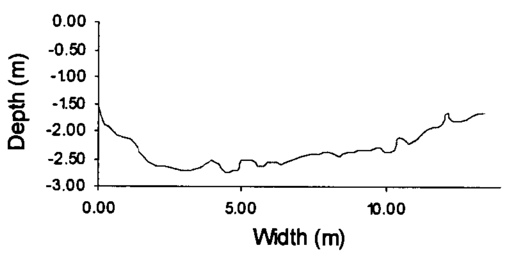
W.F. Little Bear Creek 2.1



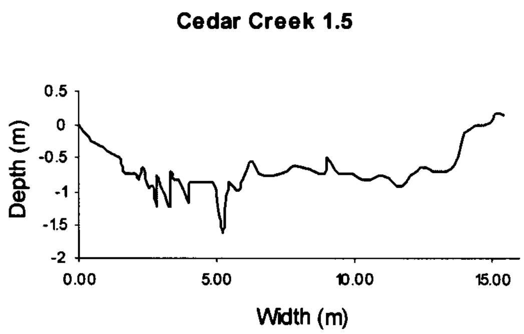
W.F. Little Bear Creek 4.1

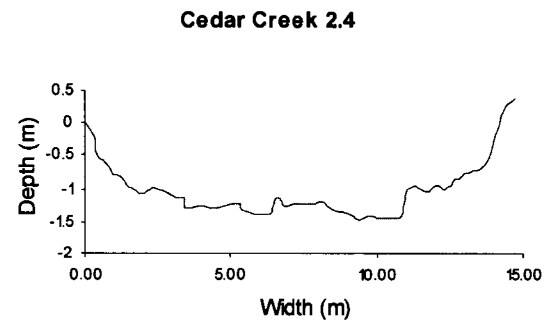


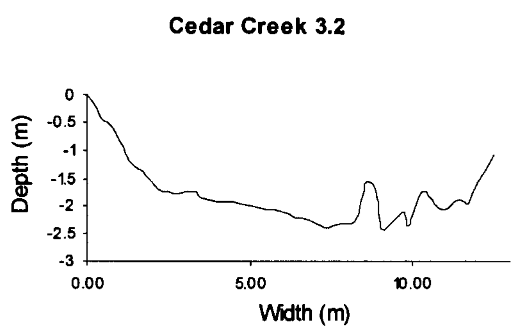
W.F. Little Bear Creek 6.2

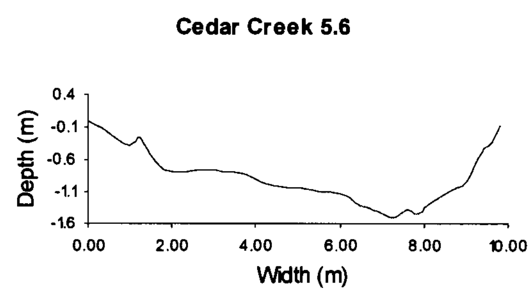


Appendix 7. Cross sectional profiles for four survey sites on Cedar Creek 2007. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as negative depth and elevations above bankfull indicated as positive depth.



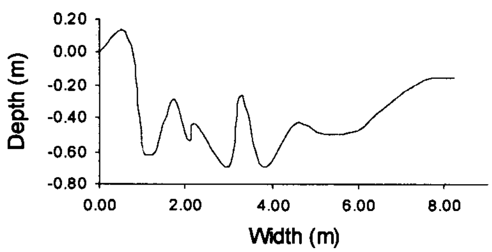




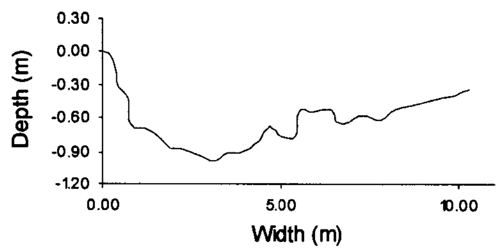


Appendix 8 Cross sectional profiles for four survey sites on Corral Creek in 2007.The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as negative depth and elevations above bankfull indicated as positive depth.

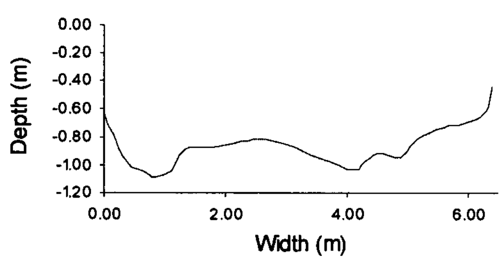
Corral Creek 2.7



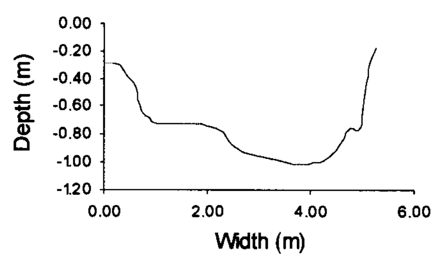
Corral Creek 3.1



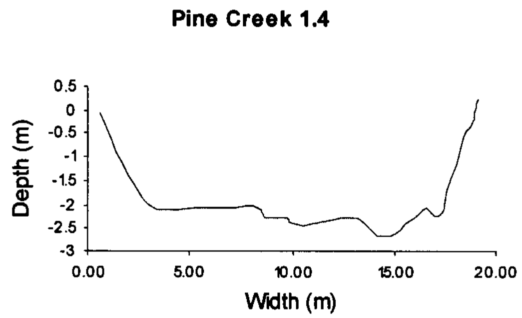
Corral Creek 8.2

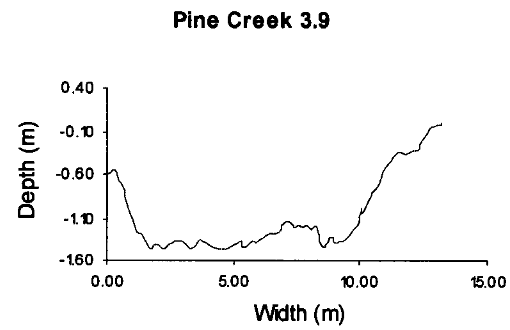


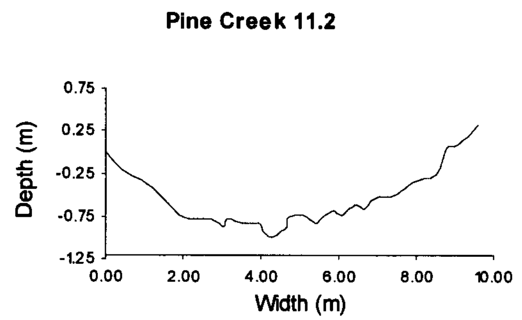
Corral Creek 13.3



Appendix 9. Cross sectional profiles for four survey sites on Pine Creek in 2007.The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as negative depth and elevations above bankfull indicated as positive depth.







Appendix 10. Results of the Low Water Habitat Availability Survey conducted lower Potlatch River tributaries during the 2007 field season.

Tributary	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	1.00	30.00	0.20
Big Bear	U	UBC3	268.55	0.54	5.00	186.15	1.00
Big Bear	L	LBBC1	340.50	0.68	6.00	39.40	1.20
Big Bear	L	LBBC2	498.00	1.00	5.00	120.50	1.00
Big Bear Average			**401.76**	**0.80**	**4.25**	**94.01**	**0.85**
Little Bear	U	ULBC1-A	161.70	0.32	6.00	160.20	1.20
Little Bear	U	ULBC2	195.00	0.39	3.00	72.70	0.60
Little Bear	L	LLBC1	117.10	0.23	3.00	29.60	0.60
Little Bear	L	LLBC2	493.00	0.99	8.00	86.70	1.60
Little Bear Average			**241.70**	**0.48**	**5.00**	**87.30**	**1.00**
WFLBC	U	UWF1	95.40	0.19	0.00	0.00	0.00
WFLBC	U	UWF2	0.00	0.00	0.00	0.00	0.00
WFLBC	L	LWF4	500.00	1.00	9.00	50.30	1.80
WFLBC	L	LWF5	476.50	0.95	4.00	48.70	0.80
WF Little Bear Average			**267.98**	**0.54**	**3.25**	**24.75**	**0.65**
Cedar	U	UCEC3	454.90	0.91	14.00	74.40	2.80
Cedar	U	CECU2	201.00	0.40	2.00	16.50	0.40
Cedar	L	CEC1	500.00	1.00	18.00	158.70	3.60
Cedar	L	CEC2	400.00	0.80	23.00	79.00	4.60
Cedar Average			**388.98**	**0.78**	**14.25**	**82.15**	**2.85**
Pine	U	UPC2-A	7.50	0.02	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	4.00	46.60	0.80
Pine	L	LPC6-A	494.70	0.99	7.00	71.50	1.40
Pine Average			**250.55**	**0.50**	**2.75**	**29.53**	**0.55**
Corral	U	UCOC7	16.00	0.03	2.00	14.50	0.40
Corral	U	UCOC4	67.60	0.14	0.00	0.00	0.00
Corral	L	LCOC1	57.90	0.12	2.00	17.00	0.40
Corral	L	LCOC2	159.90	0.32	0.00	46.50	0.00
Corral Average			**75.35**	**0.15**	**1.00**	**19.50**	**0.20**
Drainage Average			**271.05**	**0.54**	**5.08**	**56.21**	**1.02**

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