POTLATCH RIVER STEELHEAD MONITORING AND EVALUATION

Annual Report
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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 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 2006 field season. Broad-scale fish and habitat monitoring was also conducted in 2006 on all steelhead bearing tributaries found within the lower Potlatch River. This report includes adult escapement and run timing information for brood year 2006 as well as juvenile outmigration and survival estimates and in-stream density information for brood year 2004 and 2005 fish. We estimated 77 adult spawners above weir locations on Big Bear and Little Bear Creeks with a 95% confidence interval ranging from 33 to 149. An estimated 9,119 juveniles emigrated from the Bear Creek system, with a 95% confidence interval ranging from 5,384 to 16,558. Of the juvenile steelhead/rainbow trout we PIT-tagged in spring 2006; an estimated 38% emigrated past Lower Granite Dam as steelhead smolts. Steelhead/rainbow trout juvenile in-stream densities were highest for both age-0 and age-1 fish within the West Fork of Big Bear Creek.

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INTRODUCTION

The Potlatch River Steelhead Monitoring and Evaluation project started in 2005 to assess steelhead production and productivity within the lower Potlatch River drainage. The Potlatch River has the strongest population of wild A-run steelhead *Oncorhynchus mykiss* present within the lower Clearwater River drainage. The 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:

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 (Johnson 1985, Bowersox and Brindza, 2005)

Despite the significantly altered condition of aquatic habitats within the Potlatch River drainage, it does support an important population of wild A-run steelhead trout. Aside from general distribution and abundance data (Schriever and Nelson 1999, Bowersox and Brindza 2005) 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-B 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.

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 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 (Potlatch River Watershed Restoration, 040 04 CW).

2006 was the second field season for the monitoring and evaluation effort. Results presented in this report predominately cover activities during the 2006 field season. Field activities included adult escapement estimation, juvenile outmigration estimates, in-stream population estimates, and habitat surveys. In addition to the 2006 habitat data, 2005 habitat data has been incorporated into this report for a first round habitat survey summary.

STUDY AREA

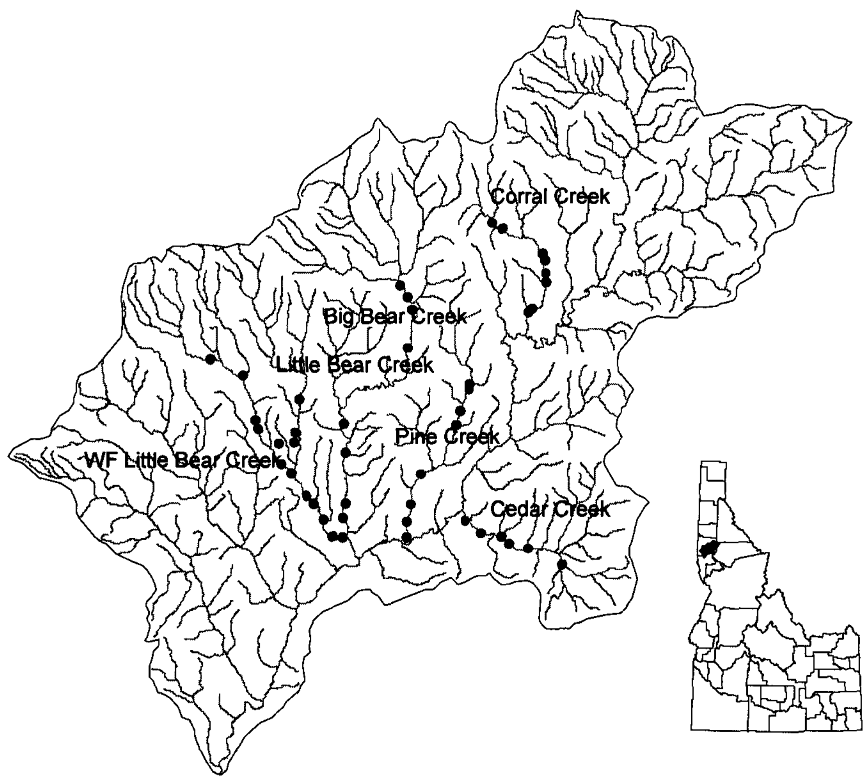

Figure 1. Potlatch River Drainage with lower Potlatch River study tributaries and sampling sites labeled.

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 the 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).

METHODS

Adult Abundance

Pickett weirs were constructed at Big Bear and Little Bear Creeks in the spring of 2006 to capture migrating adult steelhead. Weirs were installed at Big Bear and Little Bear Creeks on March 10th and March 12th respectively. 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 opercula 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.

Downstream trap boxes were installed at each location by the first of April. Fish captured in the downstream box were given a left opercula punch and released downstream. Gender, weight, length, the presence of a previous opercula punch and/or PIT tag number were recorded for all fish captured. All downstream migrants were released below the weir.

Mean daily stream discharge, measured at the USGS flow site (13341570) approximately two miles above the mouth of the Potlatch River, ranged from 77 to 2,770 cfs during the trapping period (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°C early in the season to a high of 14.5°C near the end of the adult trapping season.

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.

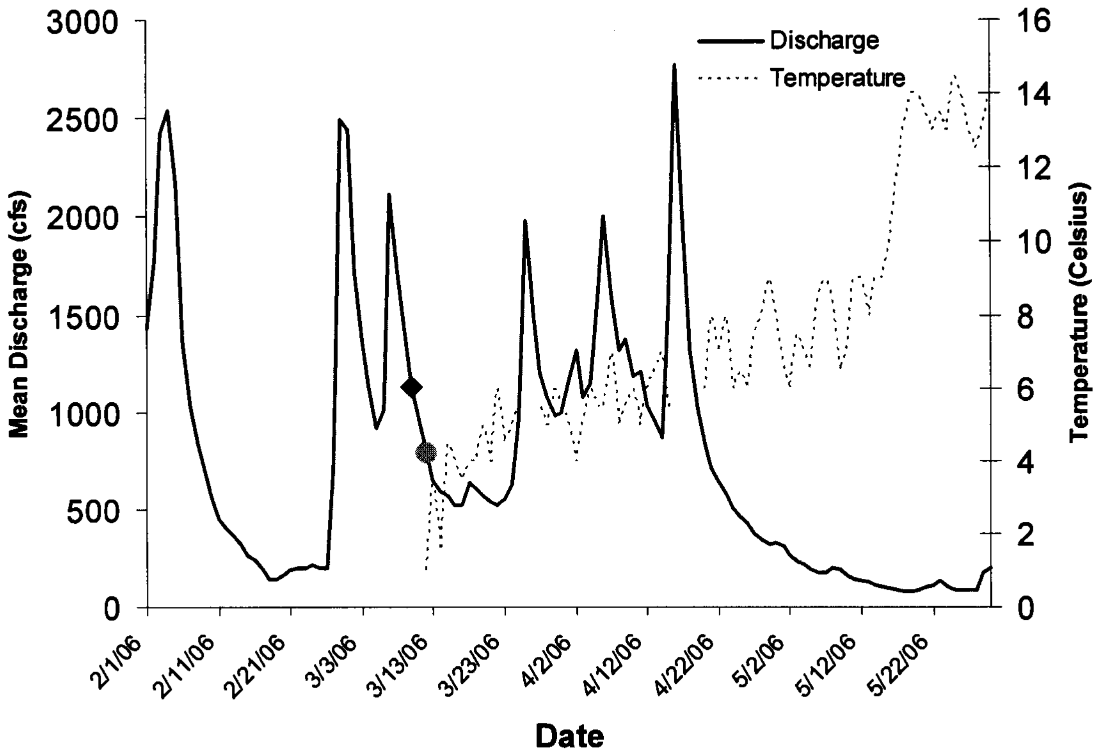

Figure 2. Stream discharge for the Potlatch River and temperature recorded at the weir location on Big Bear Creek in 2006. Installation dates for each weir are indicated by the red diamond (Big Bear Creek) and green circle (Little Bear Creek).

Juvenile Emigration

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 March 12th till June 7th during the spring outmigration. By June 8th 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 20th. 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-sample of non-target species were weighed and measured. All steelhead/rainbow trout were weighed, measured, and scanned for the presence of PIT tags. Juvenile steelhead/rainbow trout previously not 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). 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 P3 and uploaded to the PTAGIS 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 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 outmigrant survival to Lower Granite Dam was estimated using Survival Under Proportional Hazards (SURPH) 2.2 software.

Survey Design

Fish and habitat surveys for this study were designed to track watershed scale changes within the lower Potlatch River drainage. Each of the six study tributaries (Big Bear Creek, Little Bear Creek, the West Fork of Little Bear Creek, Pine Creek, Cedar Creek, and Corral Creek) have eight sampling sites. The eight sampling sites were grouped into two strata, canyon and upland (Brindza and Schriever 2006). Therefore, each tributary has four upland and four canyon sampling sites. Of these four sites, two were selected for the full complement of fish and habitat surveys within each strata and remaining sites only had fish surveys conducted. Data collected from these index sites will be used to assess change within the lower Potlatch River drainage.

Juvenile In-stream Survival

To estimate juvenile in-stream survival in the lower Potlatch River tributaries juvenile steelhead/rainbow trout were PIT tagged throughout the 2005 and 2006 field season. Fly-fishing and backpack electroshocking were conducted at randomly selected locations throughout the length of individual tributaries. All juvenile steelhead/rainbow trout were anesthetized in MS-222, measured, weighed, and PIT tagged. PIT tag data was uploaded to the PTAGIS database on a daily basis. Survival of PIT tagged fish to Lower Granite Dam was estimated using SURPH 2.2 computer software. Overall survival to Lower Granite Dam for 2005 summer tagged fish compared with 2006 out-migrant survival from the Big Bear Creek screw trap was used to provided an estimate of in-stream survival.

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. 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.

RESULTS

Adult Abundance

Given the low capture of adult steelhead at both Big Bear and Little Bear weirs during the 2006 trapping season, an escapement estimate was generated for the entire drainage as well as separately for the two study streams. A total of twenty-five unique steelhead were captured at the two weirs, with ten fish being marked as upstream migrants and three marked fish recaptured as downstream kelts. An estimate of 77 adults spawned above the two weir sites with a 95% confidence interval ranging from 33 to 149.

A total of thirteen unique steelhead were captured at the weir on Big Bear Creek. Of these, four were captured as upstream migrants, tagged and passed above the weir. The first pre-spawn adult was trapped on March 23 and the last was trapped on April 5 (Figure 3). Another ten steelhead kelts were captured while migrating downstream, including one recapture. The first kelt was trapped on April 8 and the last was trapped on May 22. An estimated 35 adults spawned above the weir on Big Bear Creek, with a 95% confidence interval ranging from 7 to 35.

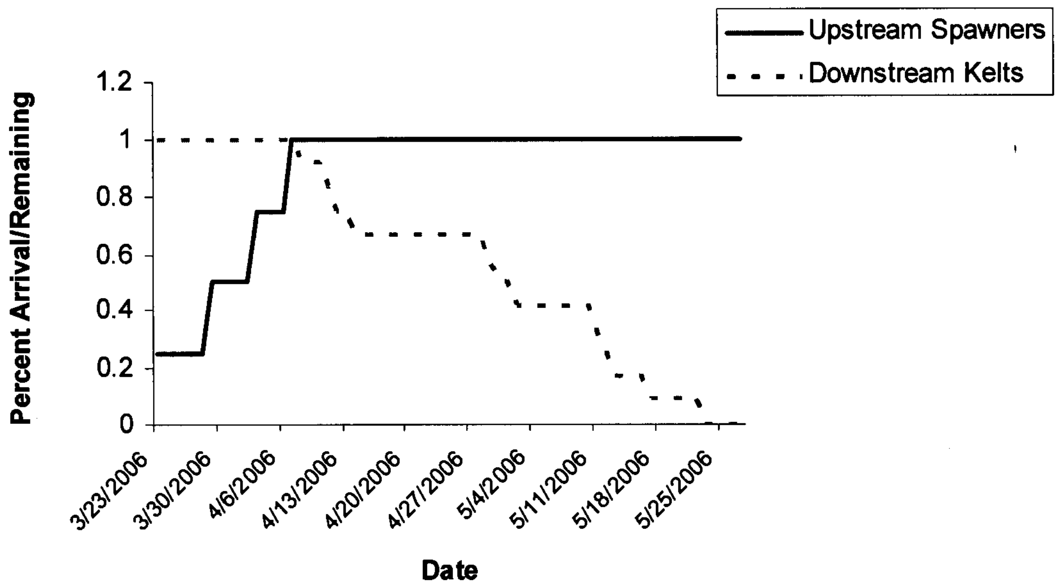

Figure 3. Arrival timing of upstream spawning adult and downstream kelt steelhead at the Big Bear Creek weir in 2006.

A total of twelve unique steelhead were captured at the weir on Little Bear Creek. Of these, six were captured as upstream migrants, tagged and passed above the weir. The first pre-spawn adult was captured on March 16 and the last was captured on April 5 (Figure 4). Another eight steelhead kelts were trapped while migrating downstream, including two recaptures. The first kelt was trapped on April 8 and the last was trapped on April 28. An estimated 33 adults spawned above the weir on Little Bear Creek, with a 95% confidence interval ranging from 10 to 49.

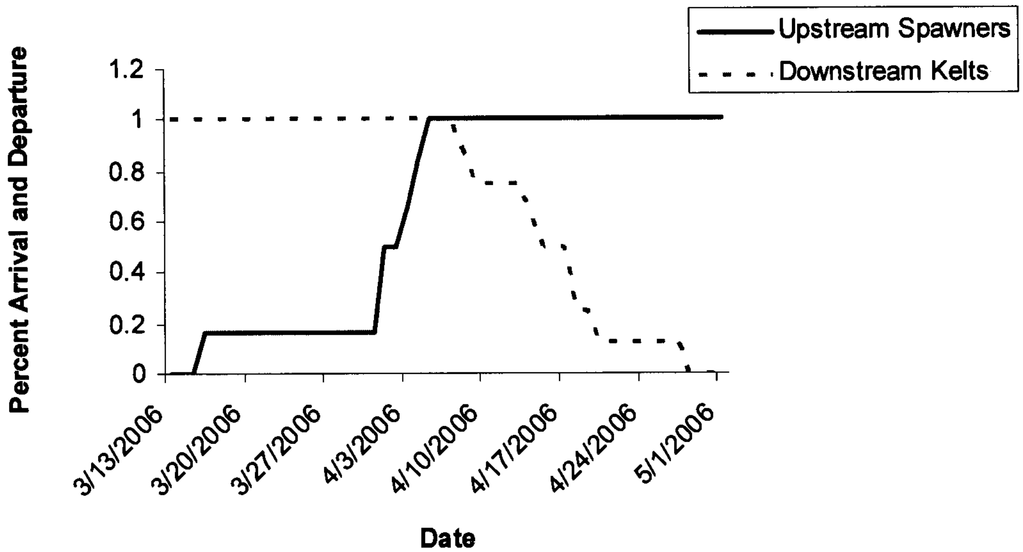

Figure 4. Arrival timing of upstream spawning adult and downstream kelt steelhead at the Little Bear Creek weir in 2006.

Due to the small number of adults captured at each weir, both pre-spawn fish and kelts (first time captures only) from each site were combined for analysis. Of the unique adults captured at both sites, 15 were male and 10 were female, which does not differ significantly (P = 0.748, Fisher's Exact) from the expected ratio of 1:1. Males ranged from 59 to 89 cm fork length, while females ranged from 58 to 75 cm (Figure 5). Length distributions for both sexes were not significantly different (P = 0.267, K-S test).

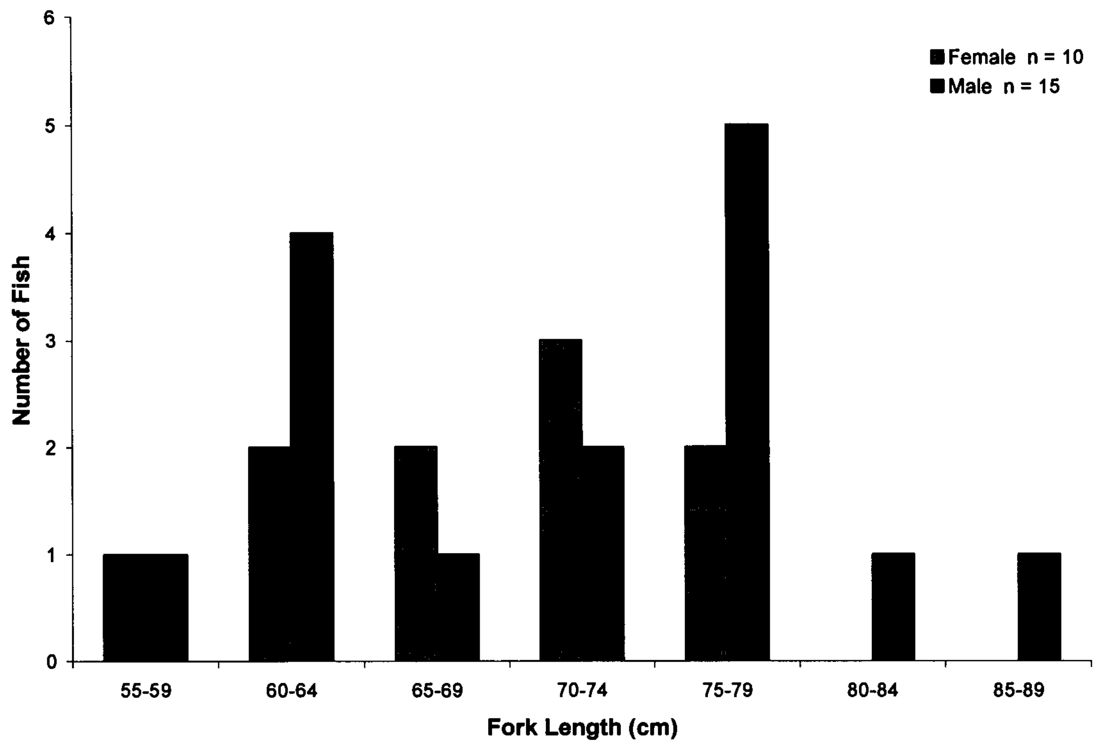

Figure 5. Fork length histogram of adult steelhead captured at the Little Bear and Big Bear Creek Weirs.

Juvenile Outmigration

Spring Migration

The rotary screw trap on Big Bear Creek began fishing on March 12 and fished until June 7, 2006. During this period, the trap operated a total of 78 nights, was pulled four nights due to high flows, and operation was halted eight times by rapidly dropping water levels. A total of 537 unique steelhead/rainbow trout were captured, all of which were PIT tagged and released above the trap. Of these, 61 were recaptured. The trapping season was subsequently grouped into three periods with similar trapping efficiencies (Table 1). An estimated 9,119 juvenile steelhead/rainbow trout emigrated from the Bear Creek system, with a 95% confidence interval ranging from 5,384 to 16,558. Juvenile steelhead/rainbow trout captured in the spring ranged from 100 to 344 mm fork length, with an average of 166 mm (Figure 6). Minimal age data is available from the 2006 trapping season and has not been included in this report.

Table 1. Numbers of fish captured, marked and recaptured at the Big Bear Creek screw trap for three strata of uniform trapping efficiency and the entire season. Also included are an average daily efficiency, migrant estimate and 95% confidence intervals (CI) for each stratum.

Dates					Average		Lower	Upper
					Daily	Migrant	95%	95%
Begin	End	Captured	Marked	Recaps	Efficiency	Estimate	CI	CI
3/28	5/19	246	246	7	0.02	7595	3914	15252
5/20	5/27	247	247	47	0.16	1276	969	1696
5/27	6/7	44	44	7	0.08	248	163	366
Season		537	537	61	N/A	9119	5384	16558

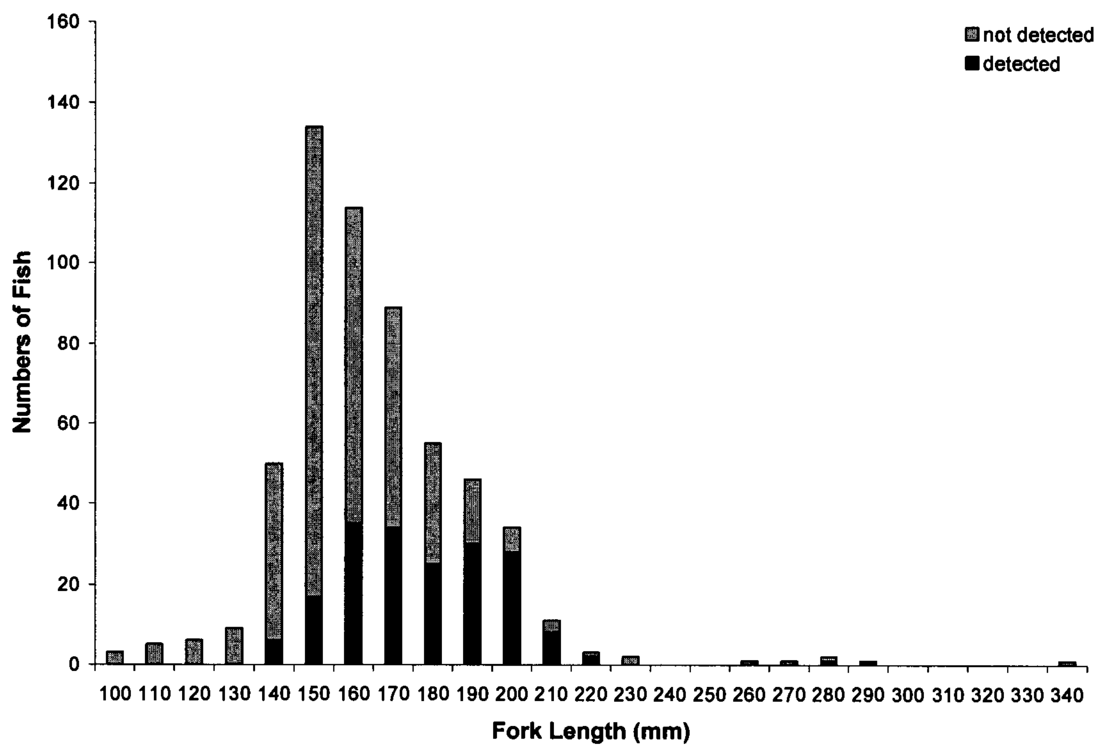

Figure 6. Size frequency histogram of juvenile steelhead/rainbow trout captured and PIT tagged at the Big Bear Creek screw trap in the spring of 2006. Fish that were subsequently detected while migrating through the Snake and Columbia River hydropower system are denoted by the black portion of the bars while fish that were not detected are denoted by the gray portion.

Fall Migration

The screw trap on Big Bear Creek re-deployed on November 7, 2006 once stream discharge had increased sufficiently for operation. The trap was operated for a total of 37 nights, was stopped six times due to dropping water levels, and was pulled on December 20. During this period, a total of 29 juvenile steelhead/rainbow trout were captured, with the majority of the catch (18 fish) occurring on November 9. Of these, seven were tagged and released above the trap. However, no population estimate is possible, as none of the tagged fish released upstream were recaptured. Juvenile steelhead/rainbow trout captured in the fall ranged from 102 to 209 mm fork length, with an average of 148 mm.

Survival

2005 Out-migration

In the spring of 2005, 2,304 juvenile steelhead/rainbow trout were PIT tagged at the screw trap on Big Bear Creek. Of these 1,541 were detected while migrating through the Snake and Columbia River hydropower system later that spring, resulting in an emigration estimate to Lower Granite Dam of 67%. In the spring of 2006, an additional 21 of these fish were detected while out-migrating, resulting in a minimal change to survival estimates.

2006 Smolt Out-migration

Of the juvenile steelhead/rainbow trout PIT-tagged in spring 2006; and estimated 38% emigrated past Lower Granite Dam as steelhead smolts. No fish under 140 mm fork length were detected migrating through the Snake and Columbia River hydro-system (Figure 6). 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).

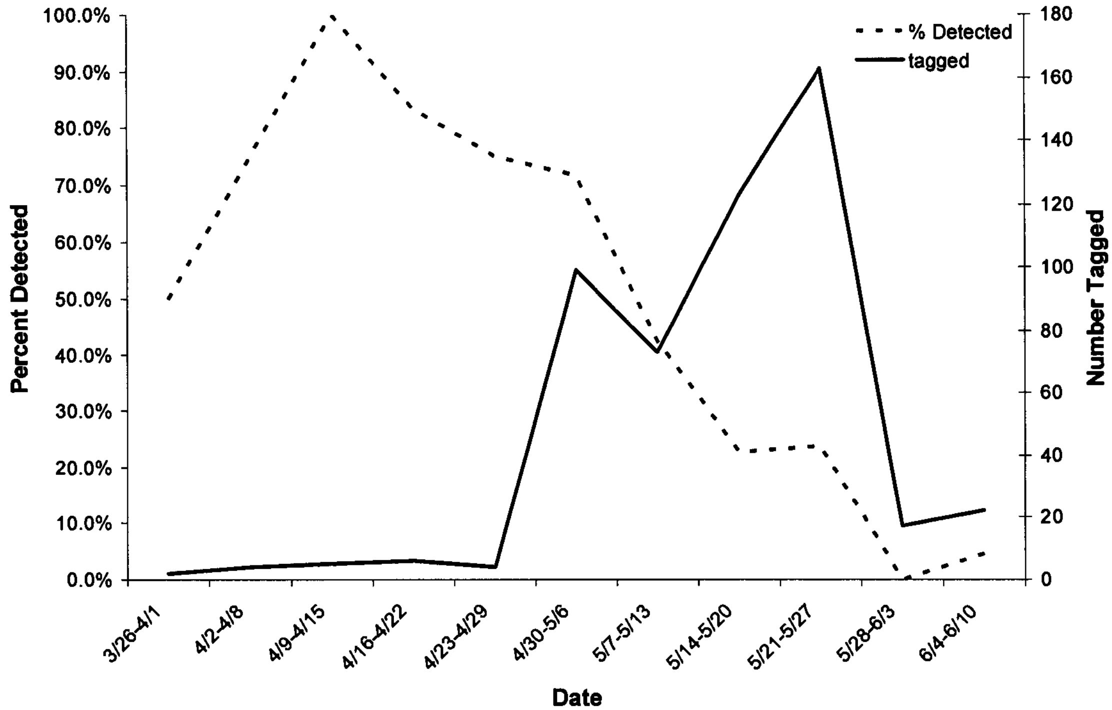

Figure 7. Spring 2006 detections of PIT tagged fish at Lower Granite Dam by date.

In-stream 2005

Roving tagging of juvenile steelhead/rainbow trout was conducted the West Fork of Little Bear Creek, Big Bear Creek, Cedar Creek, Pine Creek, and Corral Creek between July 8 and September 2, 2005. A total of 367 fish were tagged between the five tributaries; of these 51 unique detections were made within the Columbia River hydropower system (Table 2). Overall survival of all summer PIT tagged fish to Lower Granite dam was 13%. Assuming the same outmigration survival as fish tagged at the screw trap, combined in-stream survival (prior to outmigration) was estimated to be 32%. Survival estimates for the West Fork of Little Bear and Cedar Creeks were 37 and 34% respectively. No detections were observed within the hydropower system for Pine, Corral, and Big Bear Creeks; therefore no individual survival estimates were derived for those tributaries.

Table 2 Survival summary data to Lower Granite Dam for roving tagging tributaries and screw trap data from the 2005 and 2006 field seasons.

Tributary	Tag Year	n	First Detect	Last Detect	Mean Time	% Survival Overall	% Survival Instream
WF Little Bear Creek	2005	137	4/19	5/23	267	14	36
Cedar Creek	2005	208	4/17	5/28	279	13	34
Combined Roving	2005	367	4/19	5/28	273	12	32
Screw Trap	2006	537	4/2	6/1	12	38	n/a

In-stream 2006

Roving tagging of juvenile steelhead/rainbow trout was conducted on June 10 and 26, 2006. During this period, a total of 18 juvenile steelhead were tagged in Pine and Corral creeks. Analysis of this data will commence once these fish begin migrating past dams on the Snake and Columbia Rivers in 2007 and beyond.

Electrofishing Surveys

A total of 48 reaches within six tributary streams (8 reaches per stream) were randomly selected for electrofishing surveys. Twenty eight of the sites were not sampled due to environmental limitations such as high water temperatures (≥ 18°C) and negligible stream flow. Salmonids were encountered in 15 of the 20 remaining sites (Appendix 1). A total of 388 age-0 steelhead/rainbow trout and 293 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 both age classes while the remaining streams had extremely low densities (Figure 8).

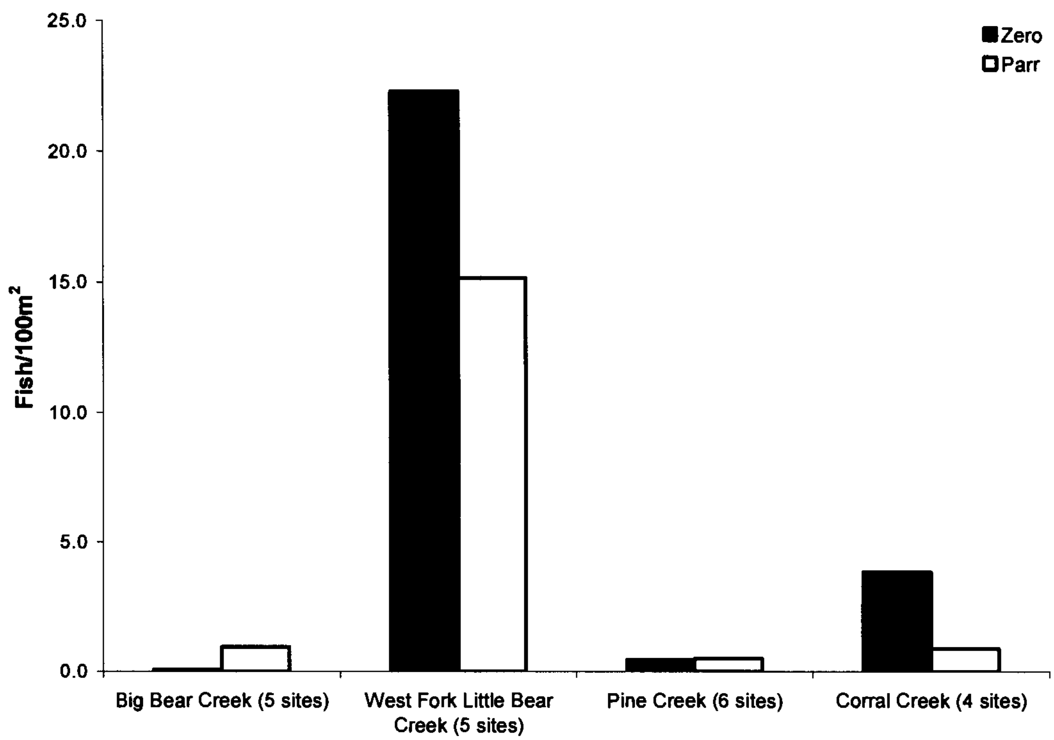

Figure 8. Density estimates for age zero and parr (≥ age 1) rainbow/steelhead in study streams within the Potlatch watershed in which multi-pass electro-fishing was conducted in 2006.

Habitat Surveys

One habitat survey reach was sampled within each of the study streams during the 2005 field season. Habitat surveys were completed for all the remaining sites during the 2006 field season.

Each of the six lower Potlatch River tributaries that are part of the study contain four habitat sites that are surveyed in concurrence with fish population surveys. In 2005, one site was completed for each of the six lower Potlatch River tributaries.

In addition to habitat surveys completed in 2005, another 24 sites were surveyed between May 31 and August 8, 2006. These surveys consisted of four sites each on Big Bear, Little Bear, West Fork Little Bear, Cedar, Corral, and Pine creeks. A summary of the habitat data collected in both years can be found in Appendix A-F.

Tributary streams of the Potlatch River exhibited a range of Rosgen channel types with a predominately cobble substrate (Figure 9). Of the sites surveyed in 2006, the most common channel types were B (13 out of 24), A (6 out of 24) and E (4 out of 24). Only one site exhibited a type F channel, and none exhibited a C or D. While most tributaries had sites with a variety of channel types, Pine creek was entirely a B type channel with substrate progressing from cobble near the mouth to silt at the upper most site. All other tributary streams were dominated by cobble at all sample locations (Figure 9).

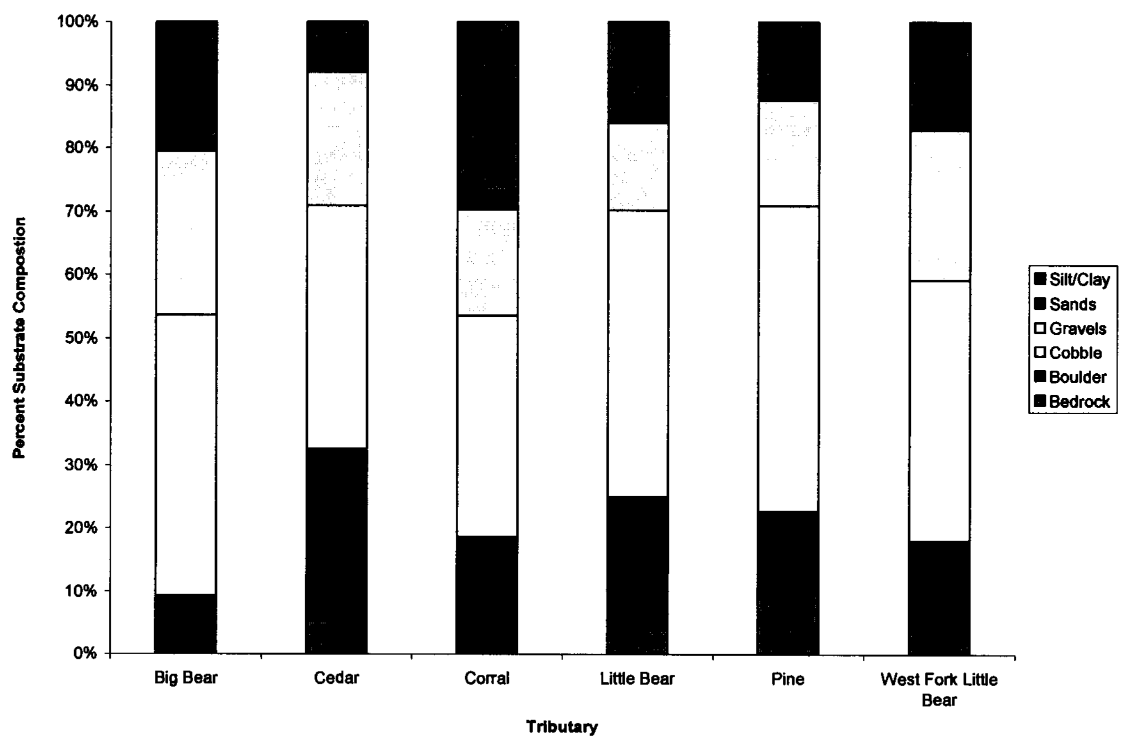

Figure 9. Substrate composition for six tributary streams to the Potlatch River based on Wohlman pebble counts conducted in 2005 and 2006.

Although entrenchment ratios (ER) ranged from 1.1 to 4.5, most sites (18 out of 24) sampled in 2006 were moderately entrenched (ER = 1.4 – 2.2). Pine Creek was the most entrenched tributary, with ER's ranging from 1.2 to 1.6. Big Bear and Corral creeks exhibited the most variation, with sites ranging from deeply entrenched (ER < 1.4) to slightly entrenched (ER > 2.2).

The width/depth ratio (W/D) did not exceed 40 at any of the sites that were surveyed in 2006. Big Bear creek consistently had the highest W/D, ranging from 16.7 to 35.5. The West Fork Little Bear and Cedar creeks tended to have the lowest W/D, with three out of four sites surveyed in 2006 having a W/D <12. Little Bear, Corral and Pine creeks had a mixture of sites with low (< 12) and moderate (12 - 40) W/D.

Channel slopes for the sites surveyed in 2006 ranged from 0.4% to 6.3%. Most sites had a gentle (< 2%) to moderate (2-4%) gradient, with only one site on Cedar Creek classified as steep (> 4%). All sites survey on Big Bear Creek in 2006 had a gentle slope, while all sites surveyed on Little Bear Creek were moderate. Cedar Creek exhibited the greatest variation in channel slope, with sites ranging from gentle to steep.

Canopy cover was measured at 20 out of the 24 sites surveyed in 2006. Percent cover for these sites ranged from 4.0 to 93.8%. Big Bear Creek had the lowest cover, with both sites for which measurements were available being less than ten percent. Little Bear had the highest cover, with all four sites ranging from 65.7 to 92.7%.

A Pfankcuh rating was ascertained for all sites surveyed in 2006. These rating ranged from poor to good, with poor being the most common and good being the least. Cedar Creek had the most sites with a "good" rating, while Big Bear Creek had the fewest "poor" ratings.

Large woody debris was not surveyed in 2006.

DISCUSSION / RECOMMENDATIONS

The estimated number of adults returning to Big Bear and Little Bear Creeks in 2006 (77) was approximately 1/3 that of the previous year (266). The number of wild adult steelhead passing Lower Granite Dam between June 1, 2005 and May 31, 2006 (9,470) was also down from the previous year (18,107) but at a lesser level than what was observed on the Potlatch River (Jon Hansen, IDFG, personal communication). 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.

Weirs on Little Bear and Big Bear Creeks were installed in early March during the 2006 field season. However, two high flow events occurred within the drainage prior to weir installation, at the beginning and end of February, which is typical for this time of year. A study on Asotin Creek, WA has found wild Snake River steelhead in that drainage to migrate upstream to spawn as early as mid-January (Mayer et al. 2006). Therefore, it is possible that portions of the run in monitored streams are migrating upstream prior to weir installation and passing downstream prior to weir installation or during high flow events with the weirs installed. We hope to install both Little Bear and Big Bear Creek weirs by the beginning of February in the 2007 field season.

The estimated number of spring migrants for 2006 (9,119) was also down from 2005 (14,164). However, 95% confidence intervals did overlap between the two years of trapping. As in 2005, no estimate is available for the fall outmigration. During the 2006 fall trapping season, adequate flows (daily mean discharge of 381 cfs) were present within the Potlatch River drainage. This result suggests that limited out-migration occurs during the fall of the year. The installation of a PIT tag array below the screw trap in conjunction with roving tagging in the Bear Creek drainage is expected to be useful in estimating the proportion of juvenile steelhead that emigrate during different time periods throughout the year.

Juvenile survival from the Big Bear Creek screw trap was similar to survival rates within the lower Clearwater River hydro-unit (17060306)(Columbia River DART). Survival rates of juvenile steelhead to Lower Granite Dam of fish PIT tagged at the Big Bear Creek screw trap and in the lower Clearwater hydro-unit were 38% and 37 %, respectively. Survival for those fish tagged at the Clearwater River scoop trap, located 10 kilometers above the mouth was 86% (Columbia River DART). This difference in survival between tributary and main stem tagged fish may be due to a combination of a shorter distance traveled and a higher percentage of smolts tagged at the Clearwater trap. It is very likely that steelhead/rainbow trout tagged in the tributaries may or may not be actively outmigrating. Some individuals will likely residualize while others may rear an additional year prior to outmigration. Fish captured at a mainstem trap likely have a much higher rate of active smolt migration and therefore a higher survival to Lower Granite Dam.

Percent detection of juvenile PIT tagged fish from Big Bear Creek screw trap at Lower Granite Dam decreased towards the end of the trapping season. It is likely that this decrease was due to high discharge and subsequent spill releases at Lower Granite Dam during the month of May. Stream discharge recorded at the U.S. Geological Survey Snake River site near Anatone, WA peaked at 144 kcfs on May 21. A peak spill of 110 kcfs at Lower Granite Dam also occurred on this date. This was more than twice the ten year average. This peak in discharge coincided with peak tagging at Big Bear Creek screw trap.

Multiple year classes of juvenile steelhead were observed at Big Bear Creek screw trap during the 2005 field season (Brindza and Schriever 2005). Evidence from the 2005 and 2006 field season suggests that smaller steelhead may not be completely migrating out of the hydropower system during the spring outmigration season. Juvenile steelhead less than 140 mm fork length tagged at the Big Bear Creek screw trap were not detected at any of the Snake or Columbia River Dams, suggesting that these fish were not ocean migrants. It is likely these smaller fish were parr and were redistributing within the Potlatch Basin or lower Clearwater River before out-migrating in subsequent years. PIT tag detections in 2007 and beyond will confirm this. In addition, a steelhead/rainbow was captured on May 23 that was 344 mm fork length. While this fish has been included in our analyses, it is not known if this was a large steelhead smolt or resident rainbow. A larger tag group and possibly scale analysis of individuals in this size range will be needed to make a better determination as to their life history.

The presence of harsh environmental conditions within the Potlatch River drainage has made coordinating fish and habitat surveys a logistic challenge. Crews have encountered temperatures exceeding NMFS (NMFS 2000) electro shocking guidelines temperature of 18°C as early as May and negligible or sub-surface flow in index reaches as early as June. Habitat surveys and fish surveys need to be completed at a minimum during the same field season to provide better data for fish and habitat analysis. Habitat characteristics and therefore fish densities can easily change within single high flow events within the Potlatch River drainage. We plan on completing all habitat sites with a fish component during the 2007 field season. Sites will be triple pass electro-fished at the start of the field season so they can be completed during ideal water and temperature conditions. Later in the field season habitat data will be collected at the index reaches when environmental conditions are not limiting. Wetted widths recorded during fish surveys will be used to estimate fish density within the reach.

We have attempted to use a variety of techniques to estimate in stream juvenile density within the lower Potlatch River tributaries. In 2005 we used depletion electrofishing to try and provide in-stream population estimates. However, there was concern regarding the assumption of equal probability of capture on subsequent passes after the first pass. In 2006 we attempted to use a mark-recapture estimate. This method proved inadequate since field crews had difficulty obtaining sufficient numbers of fish to mark and the method was too time intensive given the short time frame in which suitable environmental conditions are present. Lockwood and Schnieder (2000) suggest using depletion methods in small streams, when it is expedient to complete sampling in a single day, and when the estimated population is less than 2,000 individuals. Study reaches within the lower Potlatch River meet these criteria. While depletion electrofishing sampling bias has been documented by other researchers (Peterson et al. 2004); in our estimation triple pass electrofishing is the best methodology given the unique conditions within the Potlatch River drainage and this method will be used in the future. Additional work will need to be done to estimate and interpret depletion method bias within the Potlatch River drainage.

Differences in estimated juvenile density may have partially reflected stream conditions. Sites with an acceptable removal pattern generally had a conductivity greater than 50 µsm, while site that had poor removal patterns and very few fish had conductivities of less than 40 µsm. Three sites on the West Fork of Little Bear Creek that had the best removal patterns and highest population densities all had conductivities greater than 100 µsm.

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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 2006. Population estimates and 95% confidence limits (CL) for two age groups of juvenile steelhead were derived using MicroFish 3.0 software.

			Rainbow/Steelhead YOY (0+)				Rainbow/Steelhead Parr (1+)			
Site	Date	Pass	N	Pop. Est.	LCL	UCL	N	Pop. Est.	LCL	UCL
Big Bear Creek										
2.6	6/14	3	2	2	2	15	14	15[1]	14	20
6.8	8/5	0	Excessive Temperature							
8.2	8/5	0	Excessive Temperature							
21.3	6/25	1	0	0	NA	NA	0	0	NA	NA
24.2	5/26	3	0	0	NA	NA	9	9[1]	9	10
25.9	6/1	2	0	0	NA	NA	1	1	NA	NA
27.1	6/1	3	0	0	NA	NA	3	3	NA	NA
Little Bear Creek										
1.4	7/22	0	Excessive Temperature							
2.4	7/22	0	Excessive Temperature							
4.0	7/23	0	Excessive Temperature							
5.6	7/23	0	Excessive Temperature							
6.5	7/23	0	Excessive Temperature							
10.9	8/4	0	Lack of water							
11.7	7/10	0	Excessive Temperature							
14.4	7/21	0	Lack of water							
West Fork Little Bear Creek										
1.2	8/3	0	Excessive Temperature							
2.1	7/9	2	119	156[1]	119	196	56	57[1]	56	60
4.1	8/3	0	Excessive Temperature							
5.4	7/2	3	79	81[1]	79	85	112	116[1]	112	122
6.2	7/11	2	126	137[1]	126	150	69	71[1]	69	75
8.7	6/12	2	0	0	NA	NA	5	5	NA	NA
9.5	5/24	4	0	0	NA	NA	5	5	NA	NA
Cedar Creek										
1.5	7/22	0	Excessive Temperature							
3.2	7/22	0	Excessive Temperature							
4.5	8/7	0	Excessive Temperature							
5.6	8/7	0	Excessive Temperature							
6.8	8/7	0	Excessive Temperature							
7.3	8/7	0	Excessive Temperature							
8.5	8/8	0	Excessive Temperature							
10.2	8/6	0	Lack of water							

[1]An acceptable removal pattern was observed for this age category at this site.

Appendix 1. Continued.

Site	Date	Pass	Rainbow/Steelhead YOY (0+) N	Pop. Est.	LCL	UCL	Rainbow/Steelhead Parr (1+) N	Pop. Est.	LCL	UCL
Corral Creek										
2.7	6/23	1	42	42	NA	NA	0	0	NA	NA
3.1	6/23	1	3	3	NA	NA	0	0	NA	NA
5.8	5/24	2	0	0	NA	NA	0	0	NA	NA
6.5	6/24	3	9	40	9	390	10	20	10	73
7.7	6/24	1	0	0	NA	NA	0	0	NA	NA
8.2	7/25	0	Lack of water							
12.2	7/25	0	Lack of water							
13.3	6/26	1	0	0	NA	NA	0	0	NA	NA
Pine Creek										
1.4	7/20	0	Lack of water							
2.6	6/10	2	0	0	NA	NA	1	1	NA	NA
3.9	6/10	2	8	8[1]	8	10	7	7	NA	NA
6.2	8/6	0	Excessive Temperature							
11.2	7/24	0	Excessive Temperature							
12.2	7/24	0	Excessive Temperature							
13.9	6/11	2	0	0	NA	NA	1	1	NA	NA
14.4	6/11	1	0	0	NA	NA	0	0	NA	NA

[1]An acceptable removal pattern was observed for this age category at this site.

Appendix 2. Results of habitat surveys conducted in the Potlatch Creek watershed in 2005 and 2006. 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. Pfankuch stability ratings are based on both the Pfankuch score and Rosgen stream type.

Site	Date	Channel Type	Entrench Ratio	W/D Ratio	Slope (%)	Canopy Cover (%)[1]	Pfankuch Score	Pfankuch Rating
Big Bear								
2.6	9/27/05	C3	2.8	12.9	1.9	3.98	118	Poor
2.6	6/13/06	B3	2.0	17.1	0.4	4.0	74	Fair
3.4	6/27/06	B3	1.1	16.7	1.0	NA	69	Fair
21.3	6/25/06	B3	2.2	35.5	1.4	NA	92	Poor
25.9	5/31/06	F3	1.4	23.3	0.9	8.2	115	Fair
Little Bear								
1.4	9/28/05	D3	NA	27.4	1.4	28.2	88	Good
2.4	7/7/06	E3	4.5	10.1	2.1	66.7	103	Poor
4.0	7/23/06	A3	1.5	11.7	2.5	65.7	75	Good
11.7	7/10/06	B3	1.5	17.4	2.5	60.2	92	Poor
14.4	7/21/06	B3	2.1	14.1	2.1	92.7	75	Fair
West Fork Little Bear Creek								
2.1	7/8/06	A3	1.6	9.6	3.7	79.2	92	Fair
4.1	8/3/06	A3	1.5	8.1	1.8	62.6	79	Good
6.2	7/9/06	B3	1.4	17.8	1.6	54.0	80	Poor
8.7	6/11/06	E3	2.4	6.6	1.5	36.8	95	Poor
Cedar								
1.5	7/6/06	A3	1.4	9.1	6.3	63.9	66	Good
2.4	10/6/05	A3	1.4	7.4	4.0	45.9	79	Good
3.2	7/6/06	A3	1.6	7.6	1.3	50.9	90	Good
5.6	8/7/06	E3	3.2	6.9	1.8	50.6	99	Poor
8.5	8/8/06	B3	1.7	17.6	2.3	72.2	94	Poor
Corral								
2.7	6/22/06	B3	1.5	27.9	1.8	NA	62	Fair
3.1	10/5/05	E3	2.4	8.8	1.9	37.3	66	Fair
3.1	6/23/06	B3	1.6	15.7	2.3	37.3	88	Poor
8.2	7/25/06	E3	3.6	6.2	0.6	93.8	133	Poor
13.3	6/26/06	A3	1.3	10.7	1.0	NA	128	Fair
Pine								
1.4	7/20/06	B3	1.2	18.6	2.3	67.0	97	Poor
2.6	9/15/05	B3	1.7	9.1	1.8	19.1	89	Poor
3.9	6/9/06	B4	1.2	17.1	2.7	49.8	68	Fair
6.2	2/24/06	B5	1.6	15.0	1.7	60.0	196	Poor
11.2	7/24/06	B6	1.6	11.7	2.3	48.5	51	Good

[1]Canopy Cover percentages were calculated by multiplying the densitometer reading by 1.04 and subtracting the product from 100.

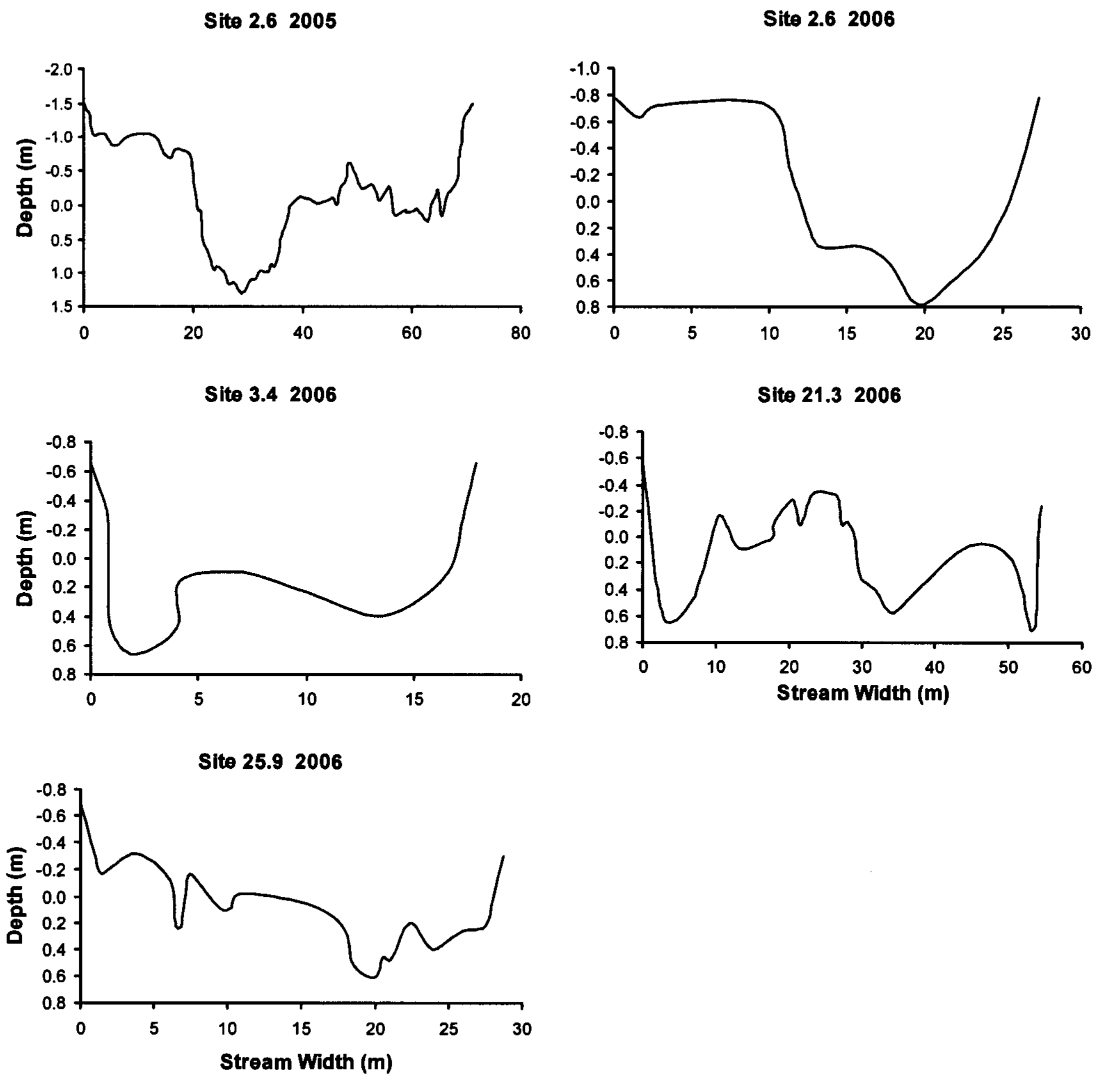
NA – Data not available.

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.

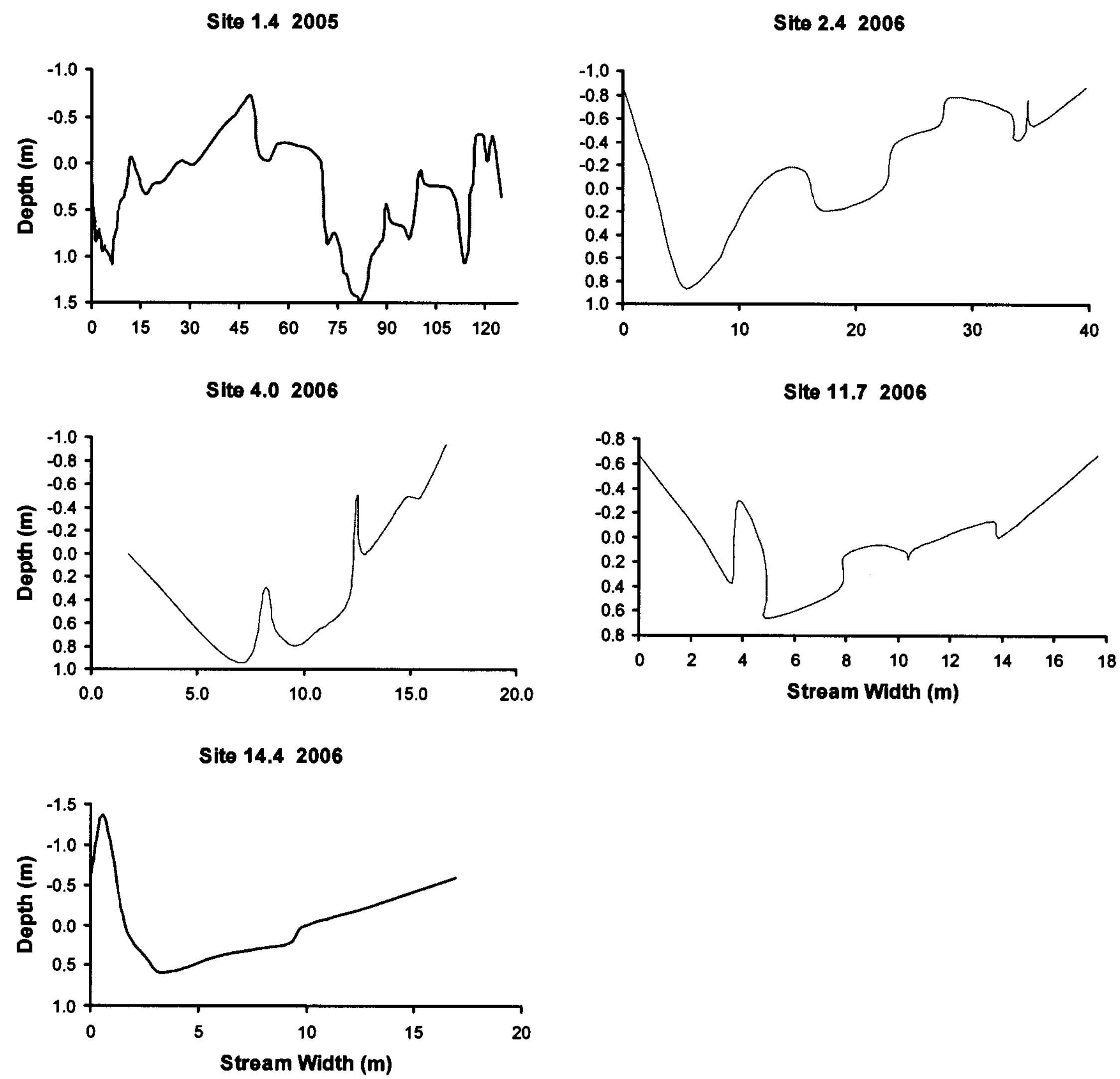
Tributary	Sites	N	S	1/D	E_D	H	E_H	Dominant Taxa
Big Bear Creek	5	252	8	2.8	0.3	1.1	0.6	Mayfly
Little Bear Creek	4	73	6	2.3	0.4	1.1	0.6	Mayfly
West Fork Little Bear Creek	4	137	5	1.5	0.3	0.7	0.4	Caddisfly
Cedar Creek	5	78	5	3.2	0.6	1.3	0.8	Mayfly
Corral Creek	4	176	11	5.1	0.5	1.9	0.8	Mayfly
Pine Creek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

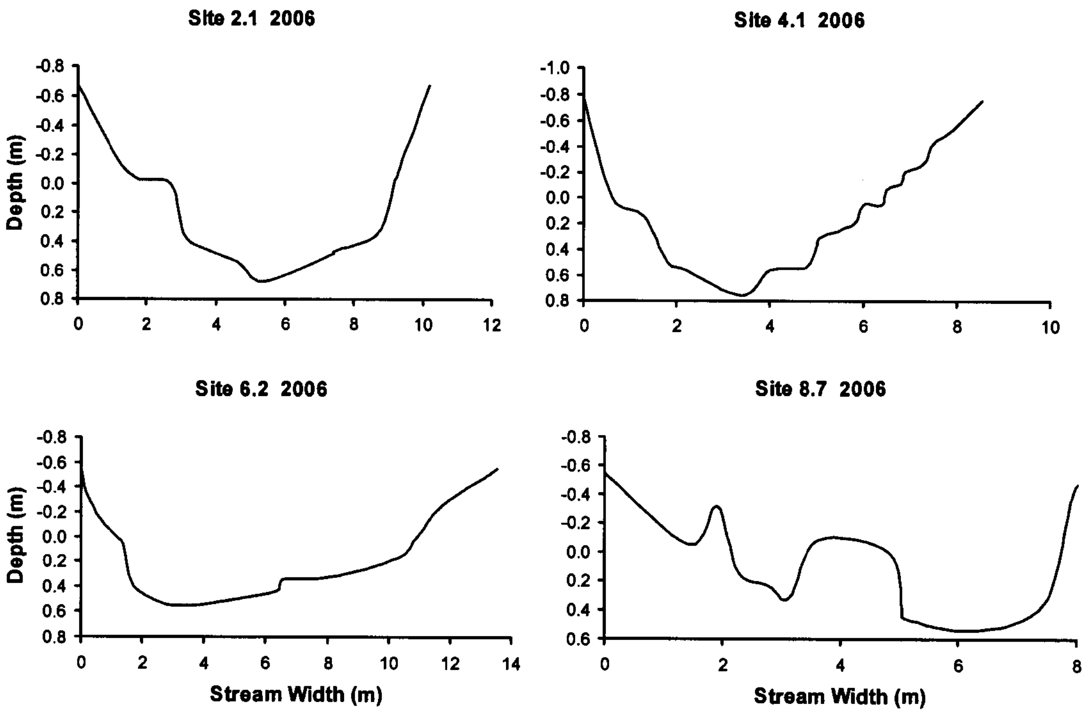
Appendix 4. Cross sectional profiles for four survey sites on Big Bear Creek. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as positive depth and elevations above bankfull indicated as negative depth.



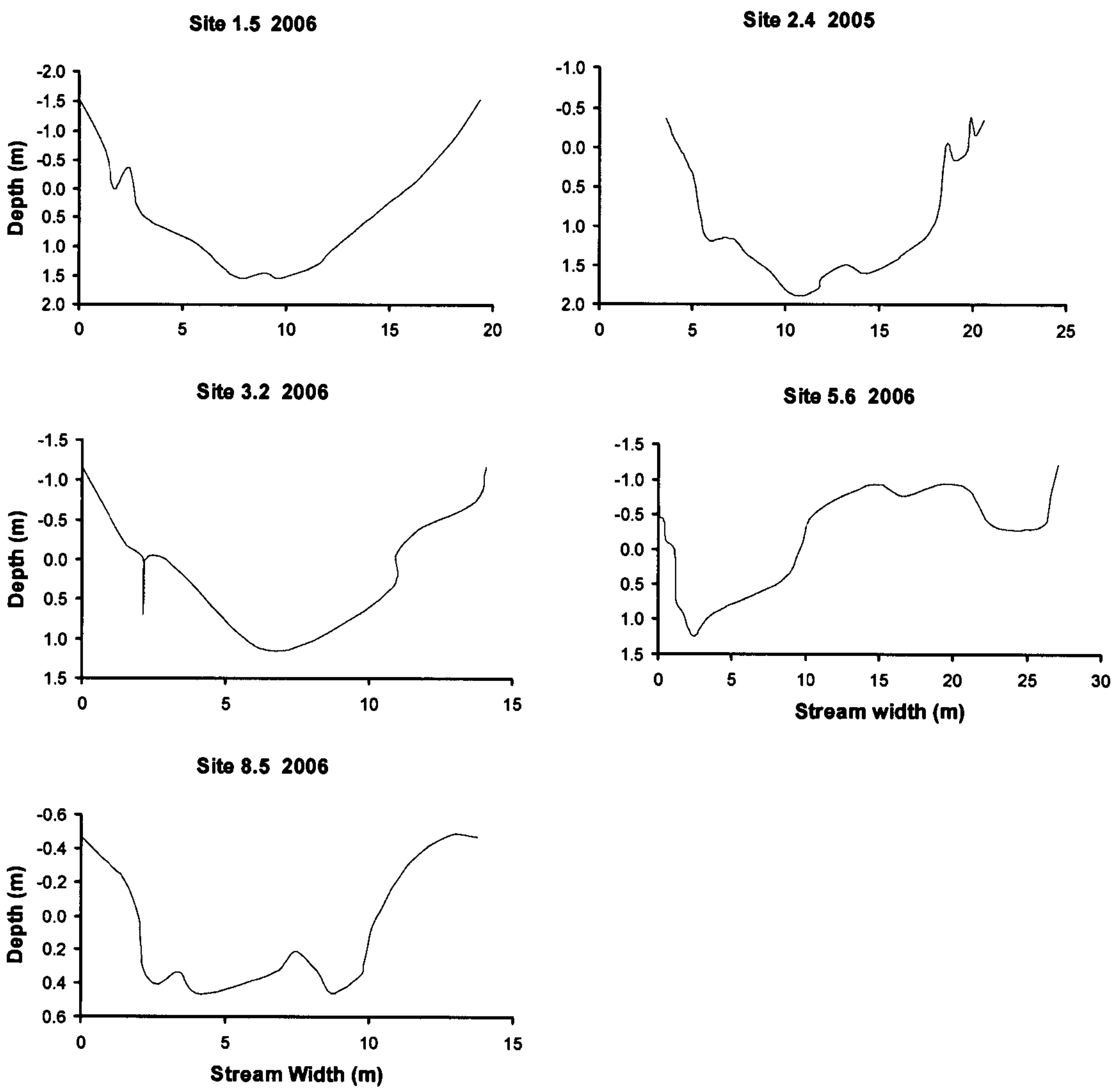
Appendix 5. Cross sectional profiles for four survey sites on Little Bear Creek. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as positive depth and elevations above bankfull indicated as negative depth.



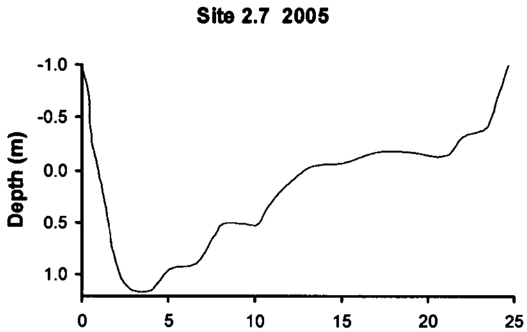
Appendix 6. Cross sectional profiles for four survey sites on the West Fork Little Bear Creek. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as positive depth and elevations above bankfull indicated as negative depth.

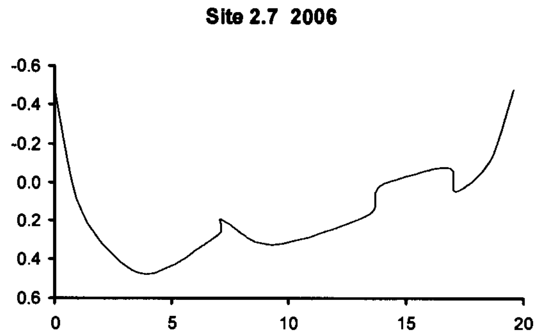


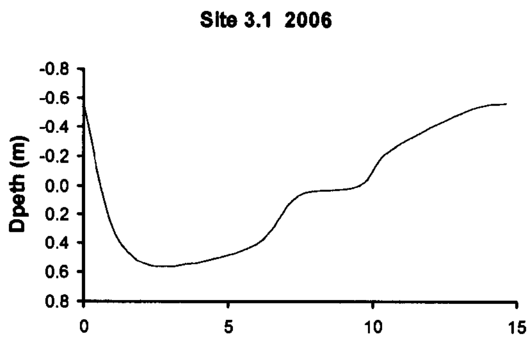
Appendix 7. Cross sectional profiles for four survey sites on Cedar Creek. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as positive depth and elevations above bankfull indicated as negative depth.

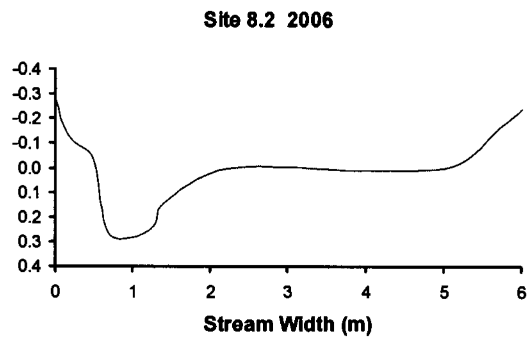


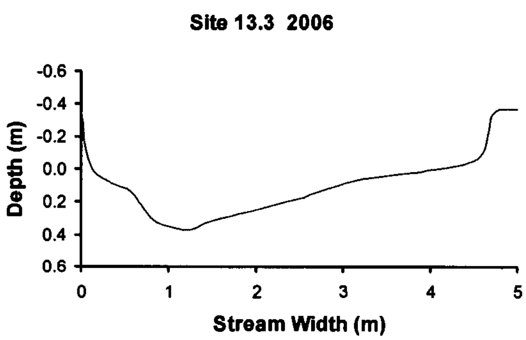
Appendix 8. Cross sectional profiles for four survey sites on Corral Creek. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as positive depth and elevations above bankfull indicated as negative depth.



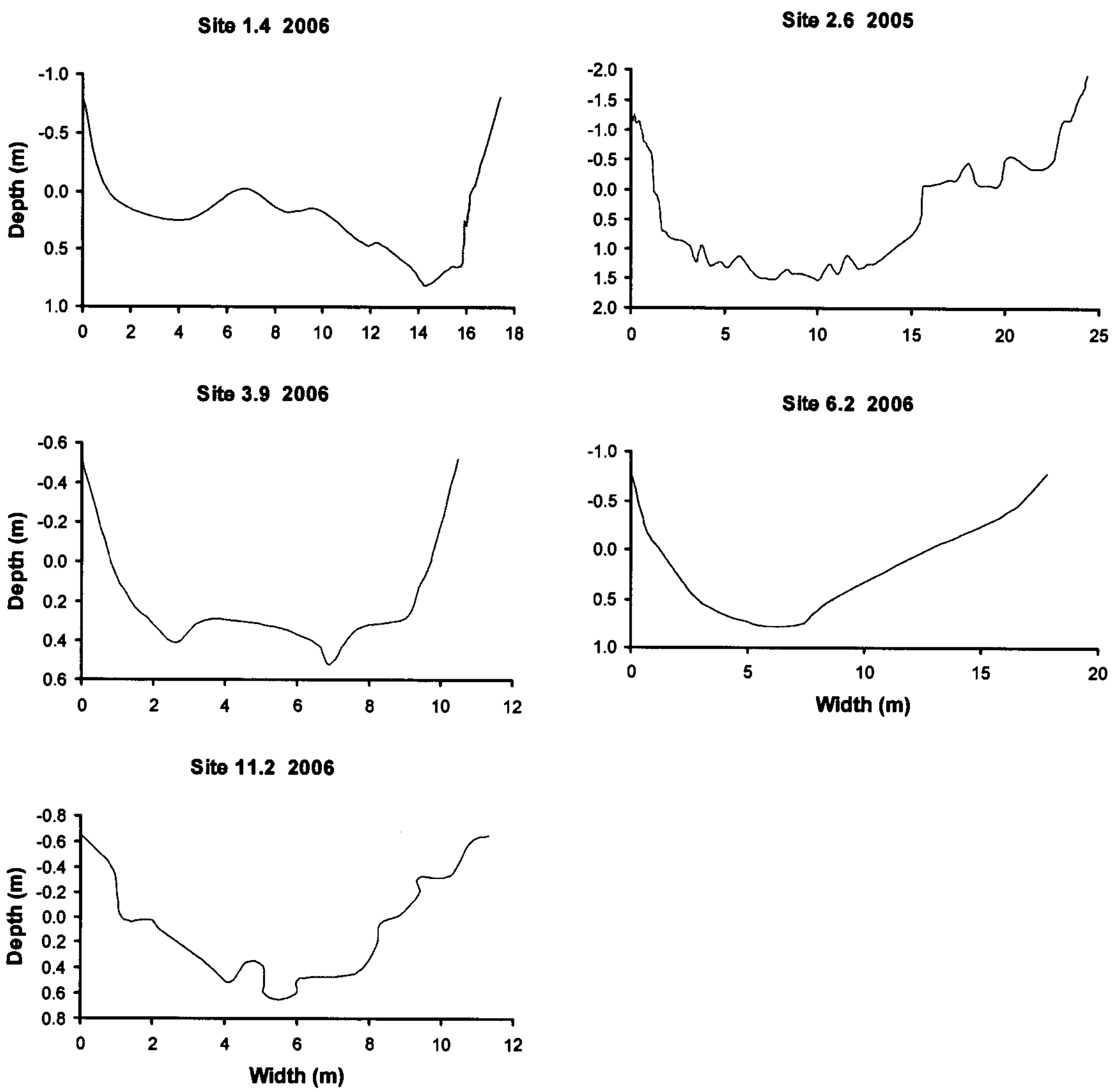








Appendix 9. Cross sectional profiles for four survey sites on Pine Creek. The bank full elevation for each site was defined as zero depth, with elevations below bankfull indicated as positive depth and elevations above bankfull indicated as negative depth.



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