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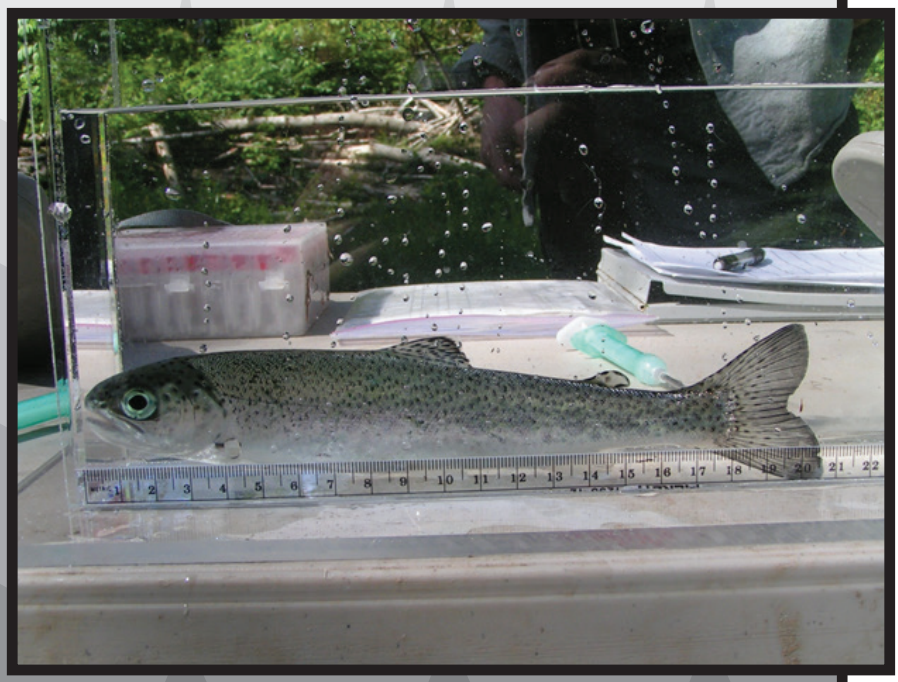
Abundance and Age Structure of Skagit River Steelhead Smolts: 2012 Annual Report



by Clayton W. Kinsel, Shannon E. Vincent, Mara S. Zimmerman, and Joseph H. Anderson

Washington Department of
FISH AND WILDLIFE
Fish Program
Science Division

FPT 13-05

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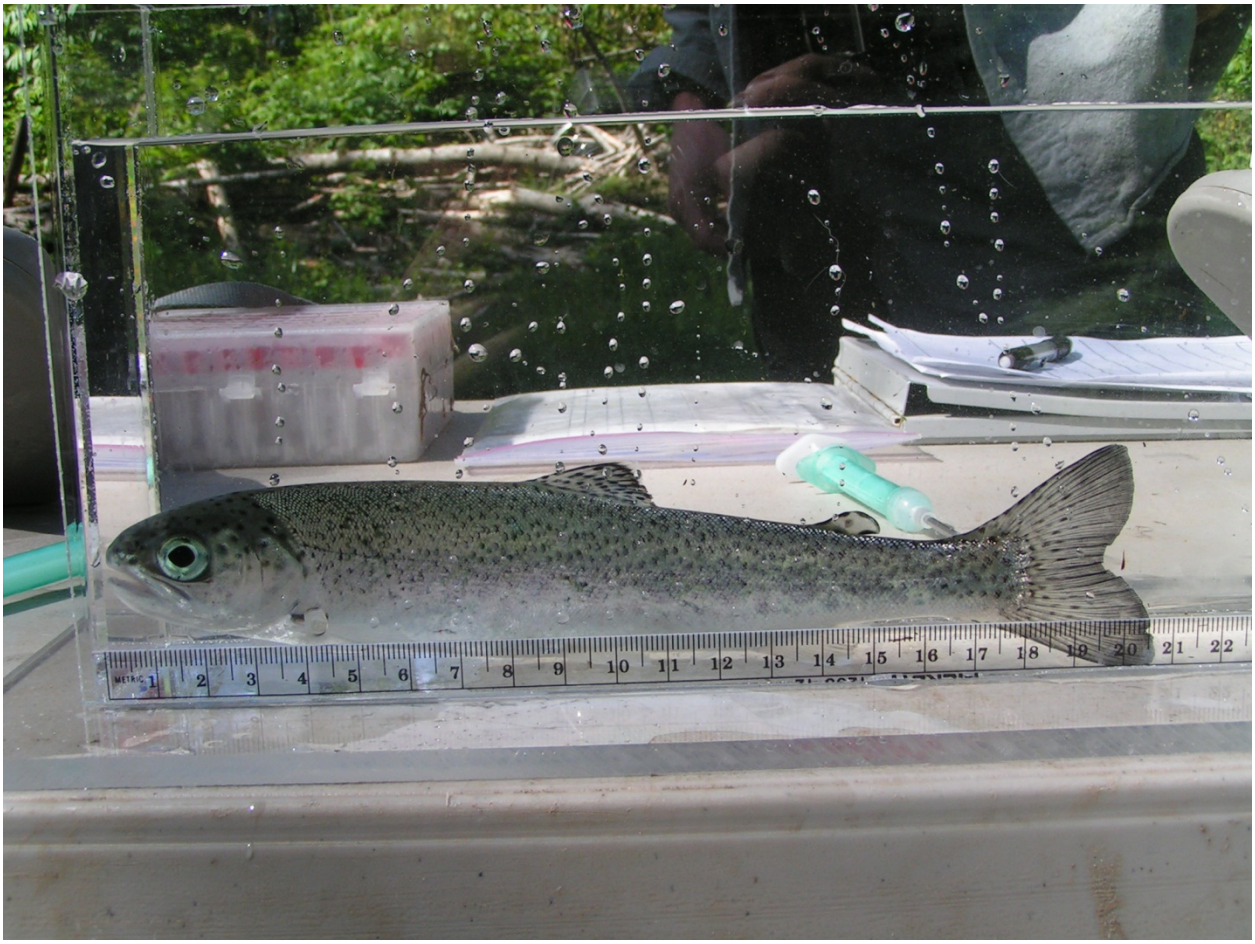

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Upper Skagit Indian Tribe (EPA Puget Sound Partnership Implementation Agreement #11EPAPSP442)

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Acknowledgements

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In 2012, the mainstem Skagit River trap was supported by Dingell-Johnson Act funds administered by the U.S. Fish and Wildlife Service and State of Washington General Funds. Daryle Hamburg with Skagit County Dike District 17 was very helpful in providing utility easements and access for our trapping operation on the Skagit River. Land owner Modesta Armendarez provided us a storage area for our traps and equipment on site.

WDFW staff were instrumental to both the mainstem and tributary trapping operations. Scientific technicians John Koenig and Jim Crook did an excellent job responding to storms, high-water events and debris to insure fish health, safety and collection of data in the tributaries. Biologist Pete Topping provided his technical expertise in installing, operating and removing traps. Technicians Mat Gillum, Jim Repoz, Dean Toba, Eric Kummerow, Rachel Nelson and Jeff Parr provided assistance with trap installation and operation. In particular, the mainstem trap requires working every night through, rain, snow, wind, high water and debris to assure the successful completion of the trapping season. We are grateful for our experienced and knowledgeable field crew. Matt Klungle provided statistical assistance in estimating abundance and investigating size selectivity issues.

The Skagit trapping operation would not have been possible without the dedication and assistance of everyone listed above. Thank you.

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Executive Summary

During the first year of the study we were able to successfully capture, tag and release sufficient numbers of steelhead (*Oncorhynchus mykiss*) smolt to estimate abundance from each of three tributary trapping locations (Table 1). An interesting finding was that trapping locations further upstream or at higher elevation (Bacon and Illabot creeks) had earlier median catch dates than the lower tributary (Finney Creek). Matching this trend was the mainstem trap where steelhead catch had the latest median catch date (Table 1). Also the higher elevation and colder water tributaries of Illabot and Bacon creeks had more age-4- and age-3 smolts than Finney Creek and the mainstem trap. Steelhead smolt population age structure was different in each sampled tributary (Table 6). A total of 1,096 steelhead smolts were PIT-tagged in the three upstream tributaries.

Table 1.—Steelhead smolt abundance from Skagit River tributaries and mainstem trap.

Tributary Name	Abundance (%CV)	Avg. Fork Length (mm)(+/-1 S.D.)	Median Catch Date
Bacon Creek	8,253 (75.6%)	168.0 (22.64)	April 21, 2012
Illabot Creek	2,705 (9.3%)	173.9 (17.45)	April 25, 2012
Finney Creek	2,464 (32.9%)	155.7 (24.42)	May 13, 2012
Mainstem Traps	N/A	174.0(21.3)	May 15, 2012

We captured 431 steelhead at the mainstem trap, but only one was a recapture of a smolt tagged in the three upstream tributaries. Due to an insufficient number of recaptures, we were unable to estimate total Skagit basin steelhead smolt abundance.

Introduction

This report provides the results for 2012 juvenile salmonid monitoring efforts conducted by Washington Department of Fish and Wildlife's (WDFW) Wild Salmon Production Evaluation (WSPE) unit in the Skagit Basin in North Puget Sound. The Skagit River juvenile salmon trapping project, initiated by WDFW in 1990, began with the goal of estimating natural coho salmon smolt (*Oncorhynchus kistuch*) abundance and was later expanded to estimate abundance of wild juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and to enumerate other salmonid migrants. The 2012 trapping season marks the twenty-second year of monitoring.

Beginning with the 2012 trapping season, the Upper Skagit Indian Tribe (USIT) and WDFW again expanded the scope of Skagit River trapping by adding three upstream trapping locations targeting juvenile steelhead trout (*Oncorhynchus mykiss*). Gayeski et al. (2011) estimated current Puget Sound steelhead abundance at 1-4% of historic levels prior to the 20th century. In 2007, Puget Sound Steelhead populations were listed as threatened under the Endangered Species Act (ESA). The Skagit River steelhead population is included in this listing and is believed to have historically sustained the largest steelhead population in Puget Sound. Recent 2007-2010 escapement estimates for Skagit River steelhead have been below the minimum 6,000 escapement floor, leading to fishery closures. Many factors may be responsible for population declines of Puget Sound steelhead, but insufficient data exist to identify and address limiting factors. Screw traps targeting steelhead smolts were operated on three Skagit River tributaries in concert with the mainstem trap to estimate population abundance via mark-recapture, both at a tributary level and a Skagit Basin wide level. These additional trap sites will provide important information on population age structure, life history, body size, migration timing and population distribution of Skagit River steelhead.

Objectives

The goal of this study was to supply critical information on the abundance, spatial structure, and diversity of juvenile steelhead in the Skagit River basin. These data are critical for effective recovery planning of ESA-listed steelhead in Puget Sound. More specifically, our objectives were to:

(1) Estimate the abundance of steelhead smolts from three Skagit River tributaries
(2) Estimate the abundance of steelhead smolts in the entire Skagit River basin
(3) Provide life history information (age, size and migration timing) for Skagit River steelhead

The secondary objectives of this study were to:

(4) Enumerate catch by species and age-class for each trap site.
(5) Sub-sample other species for fork-length (mm).

Methods

Trap Operation and Locations

Tributary Screw Traps

Floating screw traps (5-ft or 1.5-m diameter) were used to capture juvenile salmonids on three tributaries of the Skagit River. These traps are supported by floating pontoons constructed of either aluminum or steel. Traps were held in place in the stream's thalweg using Amsteel 3/8-inch winch line or 3/8-inch stainless aircraft cable attached to bow-mounted winches or d-rings. In all cases, cables and lines were anchored to large trees using heavy duty nylon straps to prevent tree damage. All traps were rigged so that crew would be able to move them towards shore into protected waters during periods of flooding and heavy debris.

Trapping locations were selected based on biological and physical criteria. We selected tributaries with known, relatively high abundances of spawning adults and rearing juvenile steelhead. Secondly, streams were selected based on the logistics of successfully operating screw traps. Streams with secure, easy access (for trap assembly and installation) near their mouths were prioritized. Sites also required adequate velocity and funneling of stream flows in order maximize catch of large smolts. Based on these criteria, we selected trapping locations on Bacon, Illabot, and Finney creeks.

Tributary screw traps were operated continually, flows and debris loads permitting, throughout the steelhead smolt emigration period from late March through mid-June. Each trap was checked at least once per day and occasionally more frequently during high flow periods.

Bacon Creek is a north bank tributary that enters the Skagit River at kilometer 133.4. Bacon Creek originates from high elevation snowfields and glaciers in North Cascades National Park and has a drainage area of 132.09 km^2 (Williams et al. 1975). The trap was located just upstream of the Highway 20 bridge, 0.32 km upstream of confluence with Skagit River, accessed through Seattle City Light property (Figure 1).

Illabot Creek trap site was located on private property accessed off of Martin Ranch Road along the south bank of the Skagit River. Illabot Creek has a drainage area of 119.66 km^2 and enters the Skagit River at km 115.2. The creek begins in snow fields above 5,000 feet in elevation in the Glacier Peak Wilderness. The trap site was located approximately 1.1 km up Illabot Creek from its confluence with the Skagit River (Figure 1).

Finney Creek has the largest drainage area (139.78 km^2) of the three study tributaries, and also differs from the others because it originates from lower elevation peaks. Finney Creek enters the Skagit River on the south bank at river km 76.4, and the trapping location is 3.7 km miles up Finney Creek from its confluence with the Skagit River (Figure 1). Finney Creek originates in the Mount Baker Snoqualmie National Forest but a majority of the stream flows through privately owned timberland on the lower reaches. Forestry practices in Finney drainage are known to have caused silting and erosion problems (Williams et al. 1975).

Skagit River Mainstem Traps

Juvenile salmonids were caught with two types of traps: a floating inclined-plane screen trap (scoop trap) and a screw trap (Volkhardt et al. 2007). Both traps are contained between steel pontoon barges, outfitted with two five-ton, bow-mounted anchor winches loaded with up to 600 ft of 3/8-inch aircraft cable. Overall, the scoop trap barge measures 13-ft x 44-ft, while the screw trap barge is 15-ft x 30-ft. The scoop trap has a 6-foot wide inclined screen and is fished 3.5-feet deep to maintain an oblique angle to the flow. We have found that the angle formed by the 16 ft-long screen, set 3.5-ft deep at the entrance, precludes impingement of salmon as small as pink and chum fry, as there is sufficient sweep velocity across the surface relative to the direction of river flow. At this depth, the scoop trap screens a rectangular cross-sectional area of 21 ft^2. The 8 ft diameter screw trap screens a cross-sectional area of 25 ft^2, in the shape of a semi-circle.

The traps were placed in the lower Skagit River at river km 27.4 km (Figure 1). Four anchor lines were attached to railway bridge support structures after obtaining permission from Burlington Northern-Santa Fe (BNSF) Railroad. Traps were positioned side by side in the zone of highest water velocity, which occurs just south of the southernmost pier and approximately 70-ft from the south bank. Velocity at this site varies as a function of discharge. At low flows it averages around 5 feet per second (fps), and increases to around 9 fps at high flows.

Traps were fished every night and every third day, flows and debris loads permitting. Operation of mainstem traps began in late January and continued through late July, encompassing emigration periods of juvenile Chinook, coho, pink and chum salmon as well as juvenile steelhead and bull trout.

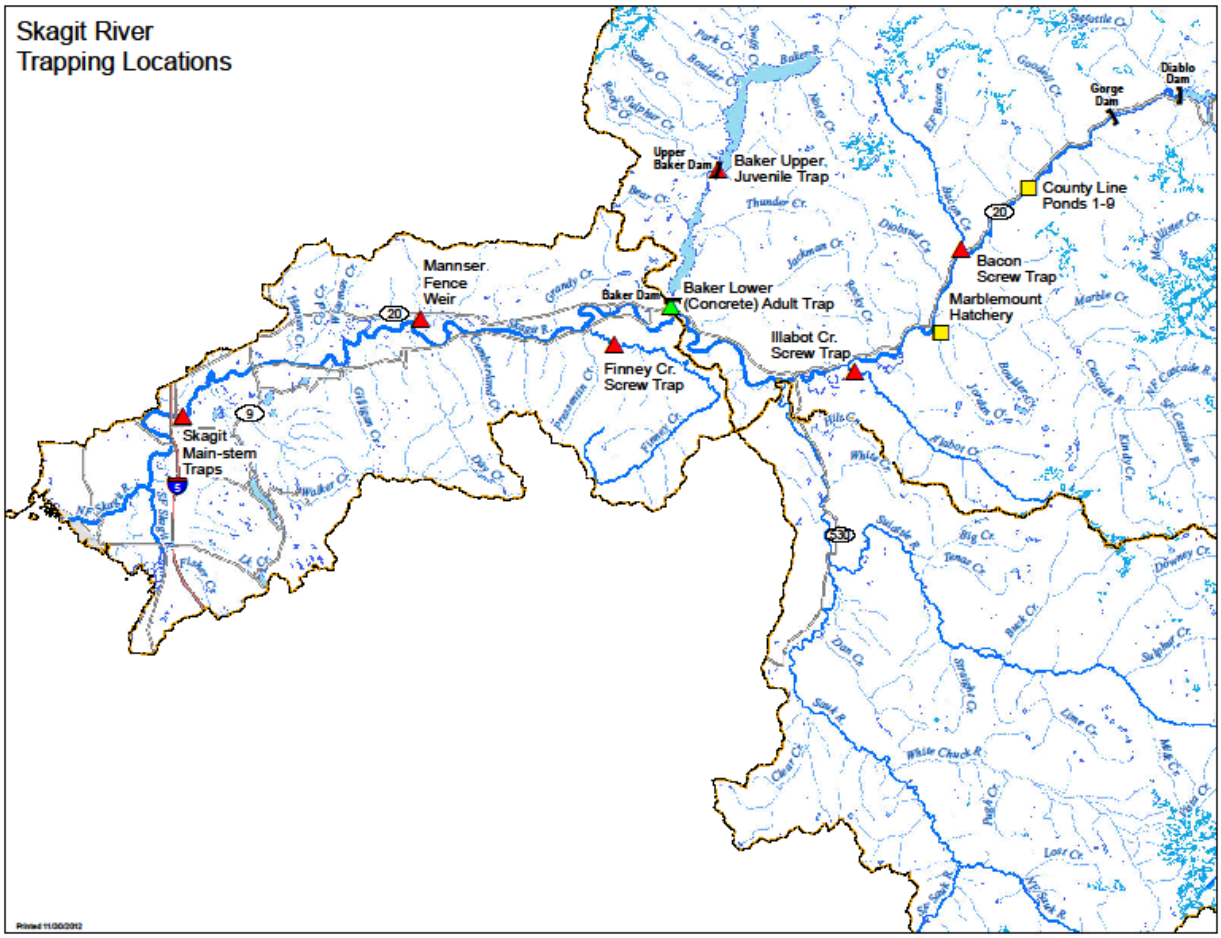

Figure 1.─Location of Skagit Basin trapping sites operated during 2012.

Fish Collection

Tributary Screw Traps

Tributary screw traps were checked at a minimum of once per day and additionally when heavy debris loads or high flows warranted. At the end of each trapping period, all captured fish were sorted by species and life history type and then enumerated. Fork length (FL) was measured (mm) from a sub-sample of Chinook, bull trout and coho. Sampled fish were anesthetized using a solution of 50 mg Tricaine Methanesulfonate (MS-222) per liter of water.

Steelhead smolts were the primary focus of our tributary trapping study. Juvenile steelhead were classified as parr or smolts by appearance. All smolts in healthy condition were PIT-tagged (passive integrated transponder) with Biomark HPT 12 tags and sampled for fork length (mm). Scale and genetic samples (caudal fin clip) were collected from 20% of steelhead smolts. All measured, tagged or sampled (e.g., scales, genetics) fish were anesthetized and held in aerated recovery buckets. Anesthetized fish were not released until they regained equilibrium and an upright swimming position. PIT-tagged steelhead smolts were released upstream of traps at least one mile to allow potential recapture and measurement of trapping efficiency. Any PIT-tagged

steelhead smolts recaptured at the mainstem Skagit River trapping location would permit a basin-wide steelhead smolt abundance estimate (USIT and WDFW 2012a, b).

The PIT-tagging of steelhead smolts was conducted by an experienced and trained crew of field technicians and biologists. PIT-tagging procedures were conducted in accordance to protocols outlined by the Columbia Basin Fish and Wildlife Authority (1999).

Skagit Mainstem Traps

Traps were fished every night (sunset to sunrise) and every third day (sunrise to sunset), flow and debris levels permitting. Traps were pulled and catch enumerated at the end of each fishing period. All captured fish were sorted by species and mark status (adipose fin clips, coded wire tags, PIT tags) and then enumerated. Fork length (FL) was measured from a sub-sample of coho and Chinook catches and all bull trout and steelhead catch.

All unmarked steelhead smolts captured at the mainstem trap were sampled for presence of PIT tags. We used a nonparametric Kolmogorov-Smirnov (K-S) two-sample test (Sokal and Rohlf 1981) to compare fork length differences across trap sites and assess potential size selectivity.

Trout were enumerated by three different age classes: fry, parr and smolt. Because of their small size, fry cannot be identified to species (either steelhead or cutthroat) and are lumped together. Parr were typically between 50 and 150 mm, dark in color (brown with spots on the tale), caught throughout the trapping season, and did not display the morphological characteristics of smolts (i.e., silver coloration, black fin tips, faint parr marks),. Smolts were chrome in appearance, larger in size (90 to 350 mm), with many spots along the dorsal surface and tail. Parr and smolts were assigned as either steelhead or cutthroat based on mouth size and presence or absence of red coloration on the ventral surface of the gill covers.

Origin was assigned has hatchery or wild based on the mark or tag status of each fish. Hatchery releases above the screw trap in 2012 included 226,050 ad-marked winter steelhead (Table 2).

Table 2-WDFW hatchery steelhead smolt releases into the Skagit Basin, 2012 (Source: WDFW Hatcheries Headquarters Database, Feb 2013).

Species	Release Location	Ad-CWT	Ad-Clip Only	Unmarked	Unmarked/ CWT	Total
Steelhead	Cascade River	0	195,050	0	0	195,050
Steelhead	Baker River	0	31,000	0	0	31,000
Total			226,050	0	0	226,050

Trap Efficiency Trials

Tributary Traps (Steelhead)

Steelhead trapping efficiencies from Bacon, Illabot and Finney Creek trapping locations were obtained by PIT-tagging all maiden captured steelhead smolts in healthy condition and releasing them above the trap. Fish were PIT-tagged the same day they were captured and taken to designated release location for each stream, roughly a mile upstream of the trap site. This

distance allows for mixing and spacing of fish within the stream, promoting representative recapture rates.

Mainstem Trap

The steelhead PIT-tagged at Bacon, Illabot and Finney Creeks also form the mark group that might be recaptured at the mainstem trapping location. Every steelhead smolt that is captured at the mainstem trap was scanned for presence of a PIT-tag. If steelhead tagged in the tributaries are recaptured at the mainstem trap in sufficient numbers, we can estimate total system steelhead smolt abundance.

Abundance Estimates

Steelhead

To estimate steelhead smolt abundance from each tributary trapping location we used DARR 2.0 (Darroch Analysis with Rank Reduction) to estimate abundance and the associated variance (Bjorkstedt 2005). We did not expand missed steelhead catch of maiden or recaptured fish during trap outage period. We have no reason to believe that marked and unmarked fish differed in movement patterns during trap outages, so these missed catches did not introduce bias into our abundance estimates.

Size and Age Structure and Migration Timing

Median migration date was the date that 50% of juvenile migrants were estimated to have passed the trap and was derived from daily migration data. If daily migration estimates were not available for a species (e.g., no abundance estimate due to low trap efficiency), median catch date was reported as a proxy for median migration date. The use of catch data to estimate migration timing should be viewed with caution as catch numbers have limited meaning without trap efficiency information.

Results

Steelhead

Trap Operation and flows

Tributary Traps fished consistently around the clock unless prevented by debris, damage to the traps, or high flow conditions. Debris causing the screw traps to stop fishing could have occurred at any time during the period between trap checks. Upon arrival to a stopped trap, crews had no method to determine the duration of the successful fishing period prior to the stoppage. Therefore trap outages are reported as the number of days the crew arrived at the trap to find it non-functional (Table 3). Traps would fish during a portion of these outages, as evidenced by fish in the live box despite the stopped screw.

Table 3.-Trapping start and end dates by location and associated number of days trap was stopped.

Trapping Location	Start Date	End Date	Days in Season	Days Fishing	Days stopped
Bacon	3/29/2012	6/26/2012	90	79	11
Illabot	3/27/2012	6/26/2012	92	91	1
Finney	4/1/2012	6/26/2012	87	81	6

Flows during the 2012 steelhead emigration and trapping project were high, resulting in a number of screw stoppages at the tributary locations. Snow pack levels in the North Cascades were well above average through the trapping period, resulting in high flows associated with snow melt in both Bacon and Illabot creeks (USDA NRCS 2012). Of the three study tributaries, Bacon Creek is the only one that has a flow monitoring station (USGS 12179900). The 2012 average daily mean stream discharge in Bacon Creek was the highest on recorded for the period of current record spanning from 1999-2012. Flows at the beginning of the trapping season until mid-April were close to the 13-year average on Bacon Creek. After mid-April flows were consistently above average with several large flow spikes during this period, making for very challenging trapping conditions in our first season of monitoring tributaries (Figure 2).

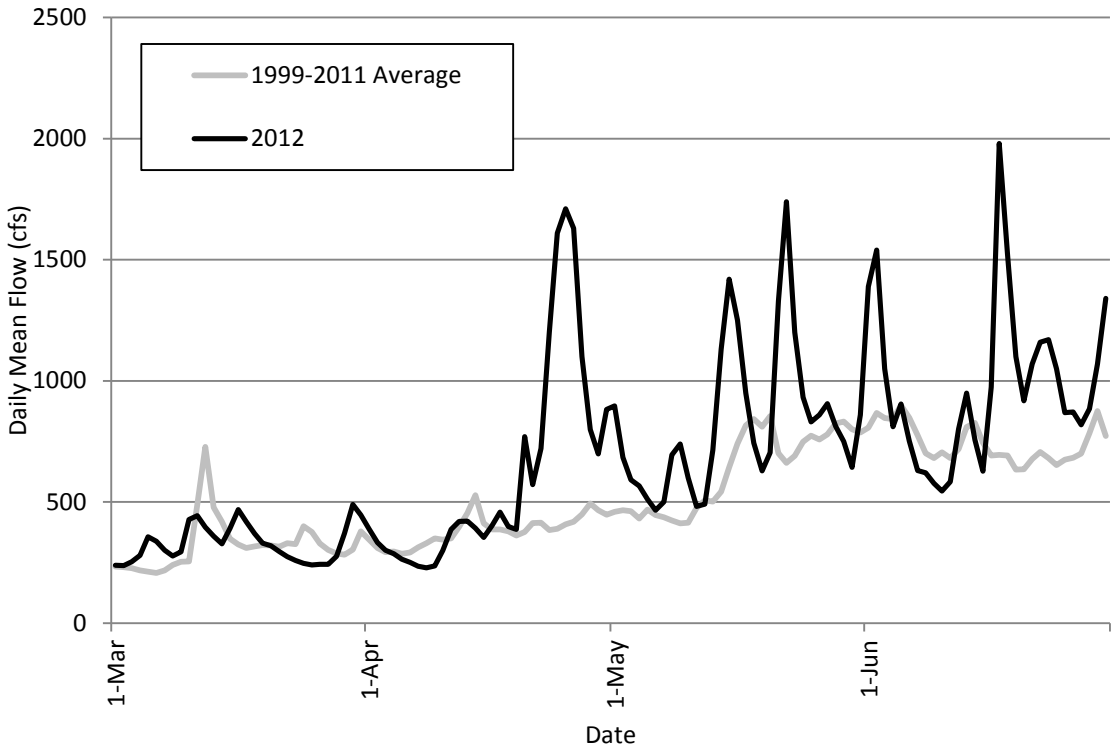

Figure 2.─Bacon Creek average daily mean flows (USGS gauge 12179900) 1999-2011 compared to 2012 daily mean flow.

At the Skagit River mainstem trap, flows were also very high during steelhead emigration, remaining well above the long-term average for most of the period (Figure 3). The trapping crew was able to fish the gear according to schedule throughout the period of the steelhead emigration. The only major trap outages occurred on June 17th-19th when flows reached nearly 60,000 cfs near Mount Vernon. During this time the mainstem trap was out for a few days due to heavy debris and damage to the screw trap. This outage occurred after the majority of the observed steelhead catch, so missed catch was likely minimal.

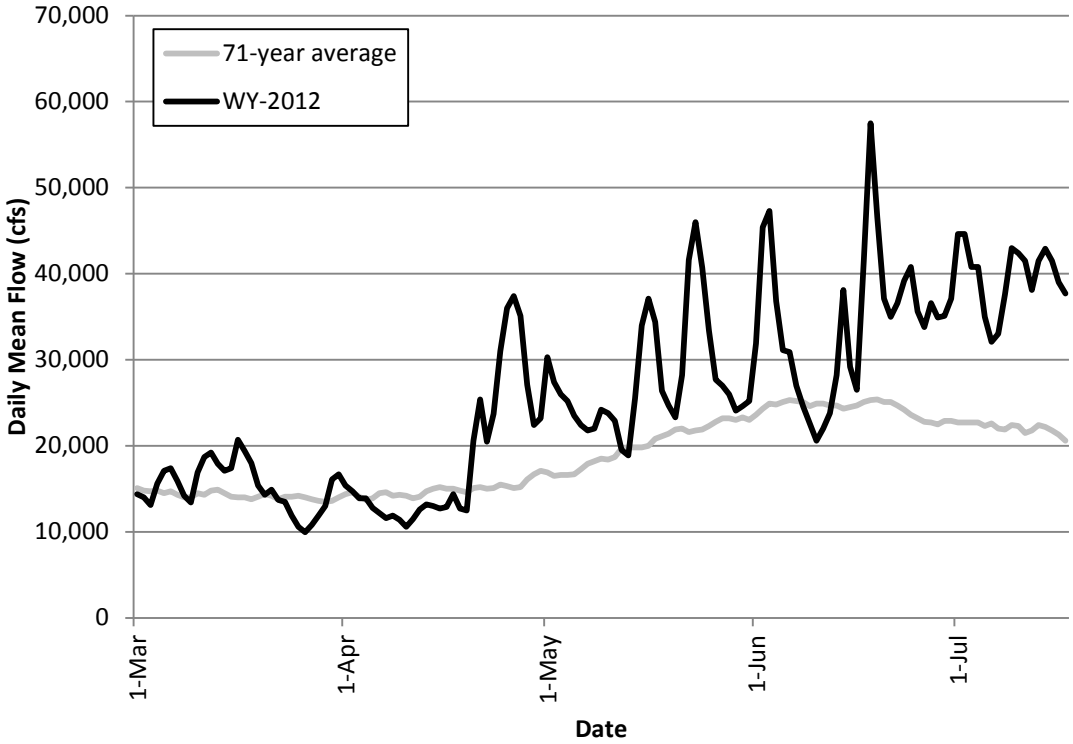

Figure 3-Skagit River average Skagit River daily mean flow during March – July averaged over 71 years (1940-2011) compared to 2012 daily mean flows at USGS gauge 12200500 near Mount Vernon.

Our methods for calculating steelhead smolt production from each tributary rely on the assumption that when trap outages occur we are missing maiden catch but also missing PIT-tagged recaptures. Therefore we do not need to calculate estimated missed catch for trap outage periods as maiden captures and recaptures missed will offset each other in the estimate.

Catch and Timing

Steelhead were captured at all four traps sites (Table 4). At the mainstem Skagit trap, most steelhead smolts were captured in the screw trap (N = 379) rather than the scoop trap (N = 52). These numbers are actual catch as we did not expand for trap outage periods. The mainstem trap site has been fishing with both a screw and scoop traps on roughly the same fishing schedule through the steelhead smolt emigration period since 1993. Steelhead smolt catches during this time period have averaged 840 smolts a season, indicating that catch during the 2012 season was low relative to most years (Figure 4).

Table 4.-2012 steelhead smolt catch and catch timing by trap site.

Trap Site	Steelhead Smolt Catch	First Catch Date	Median Catch Date	Last Catch Date
Bacon Creek	203	3/30/2012	4/21/2012	6/25/2012
Illabot Creek	745	3/28/2012	4/25/2012	6/12/2012
Finney Creek	166	4/2/2012	5/13/2012	6/24/2012
Mainstem	431	2/3/2012	5/15/2012	7/10/2012

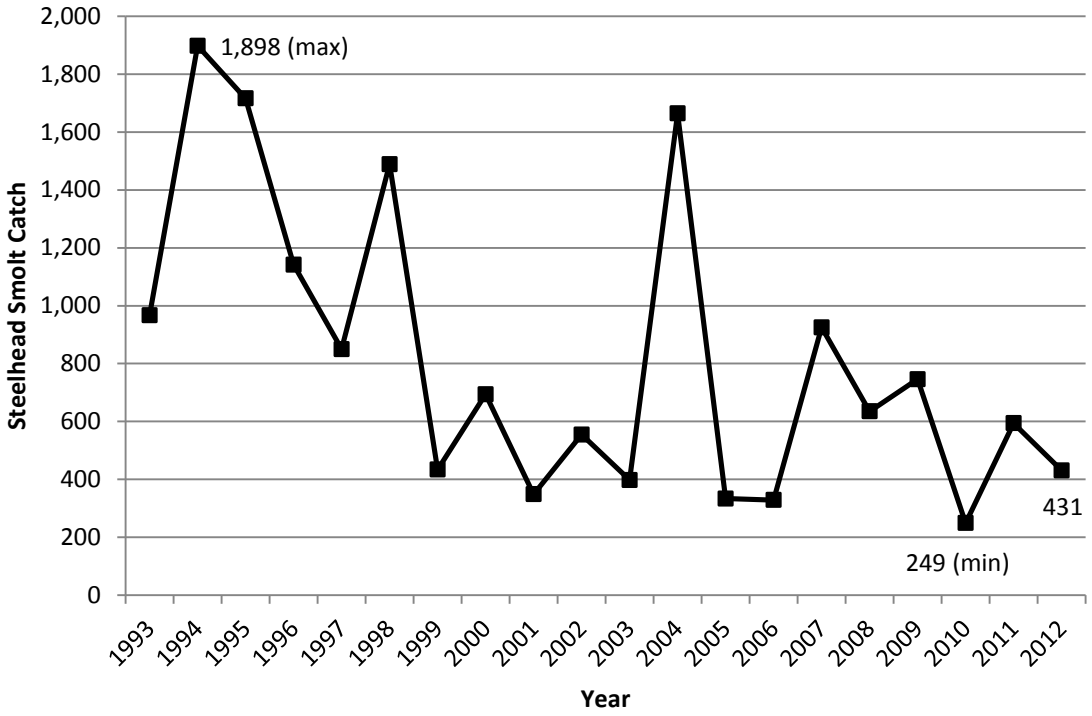

Figure 4.-Skagit River mainstem trap site steelhead smolt catches 1993-2012..

At each tributary trap site we captured small numbers of steelhead smolts (1-2) on the morning of our first trap checks, indicating the migration was just getting started when we installed the traps (Appendix B). The mainstem traps are installed in late January to capture juvenile Chinook which emigrate earlier than steelhead. During the month of February and March, a total of eight steelhead smolts were captured which is not unusual as we see minimal numbers of early emigrants annually in the Skagit traps.

Median migration (catch) dates were much earlier for Bacon and Illabot creeks compared to Finney Creek and the mainstem trap (Figure 5, Table 4). Timing of steelhead smolt catch at the mainstem in 2012 was nearly identical to the observed (1990-2011) average median migration date of May 16. The order of which median migration dates occurred for this first year of monitoring was related with distance upstream from the Skagit River mouth, with tributaries furthest upriver peaking first. Steelhead smolt emigration was essentially complete by late June at all four trap sites.

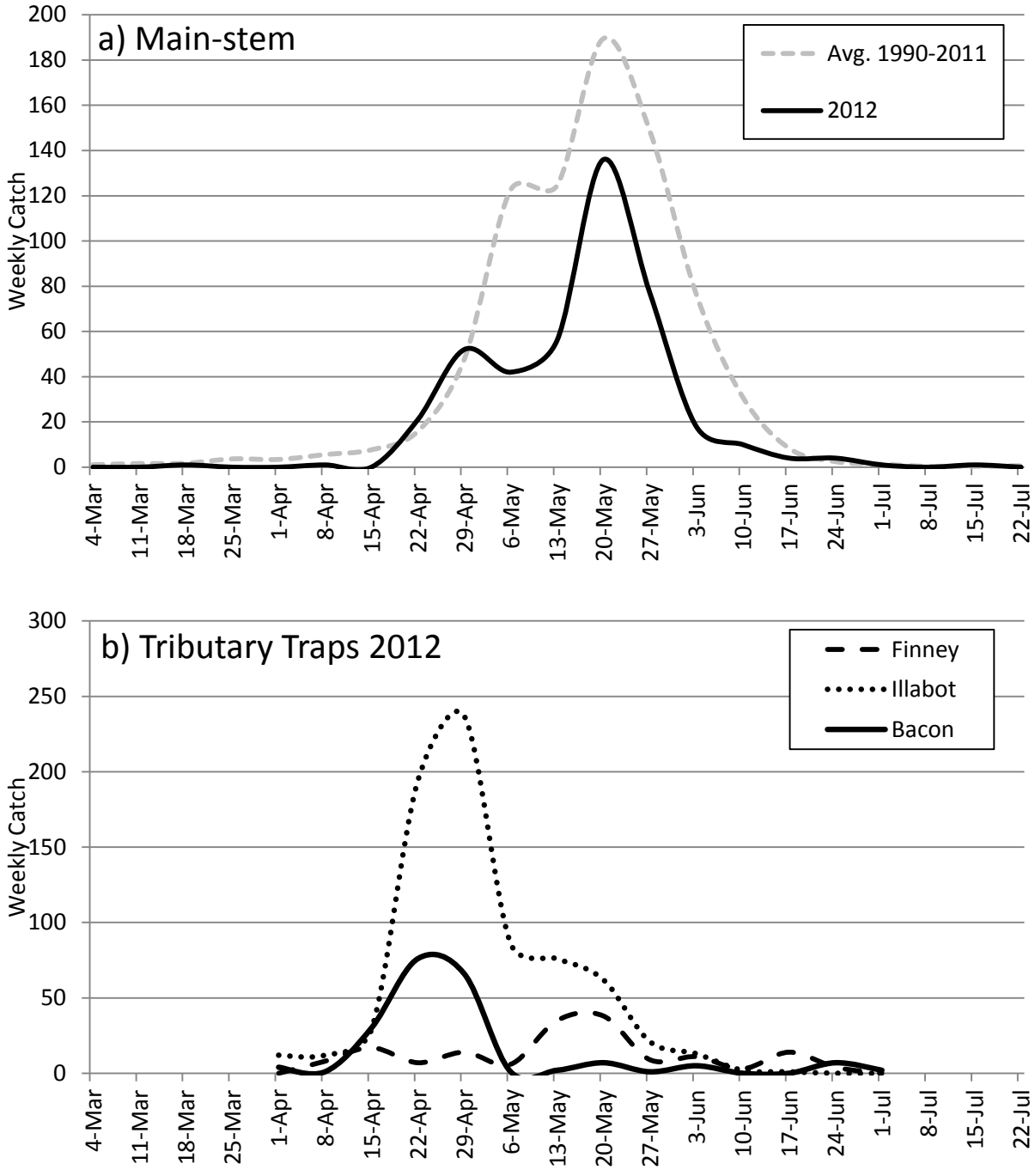

Figure 5-Migration timing of wild steelhead smolts at mainstem Skagit River traps (a) and at tributary trapping locations (b) during 2012.

We identified steelhead smolts by silver coloration, fading or barely visible parr-marks, and darkening of dorsal and caudal fin tips. If a steelhead had dark coloration and very visible parr-marks they were identified as trout parr. We use the general term "trout parr" to describe the majority of these darker fish with very visible parr markings. Parr are typically much smaller (< 65mm) than smolts. Parr can be difficult to positively identify as steelhead or cutthroat trout. Given the lack of cutthroat smolts captured in our tributary traps, it is likely that a majority of the

fish identified as trout parr are juvenile steelhead parr. At the Bacon, Illabot, Finney and mainstem trap sites we captured 287, 516, 522 and 272 trout-parr respectively (Appendix B). Trout parr catch at the mainstem did not show a distinct timing curve typical of a migration (Figure 6). Trout parr catches did indicate a distinct migration past tributary traps. Catches of trout parr were still high at the end of our trapping season and on our last day of trapping (June 26), we captured 4, 11 and 29 trout parr in Bacon, Illabot, and Finney creeks, respectively. The high parr catches in Finney in late June may suggest that as temperatures warm and summer approaches, fish are seeking rearing habitat downstream in the lower creek or Skagit River (Figure 6).

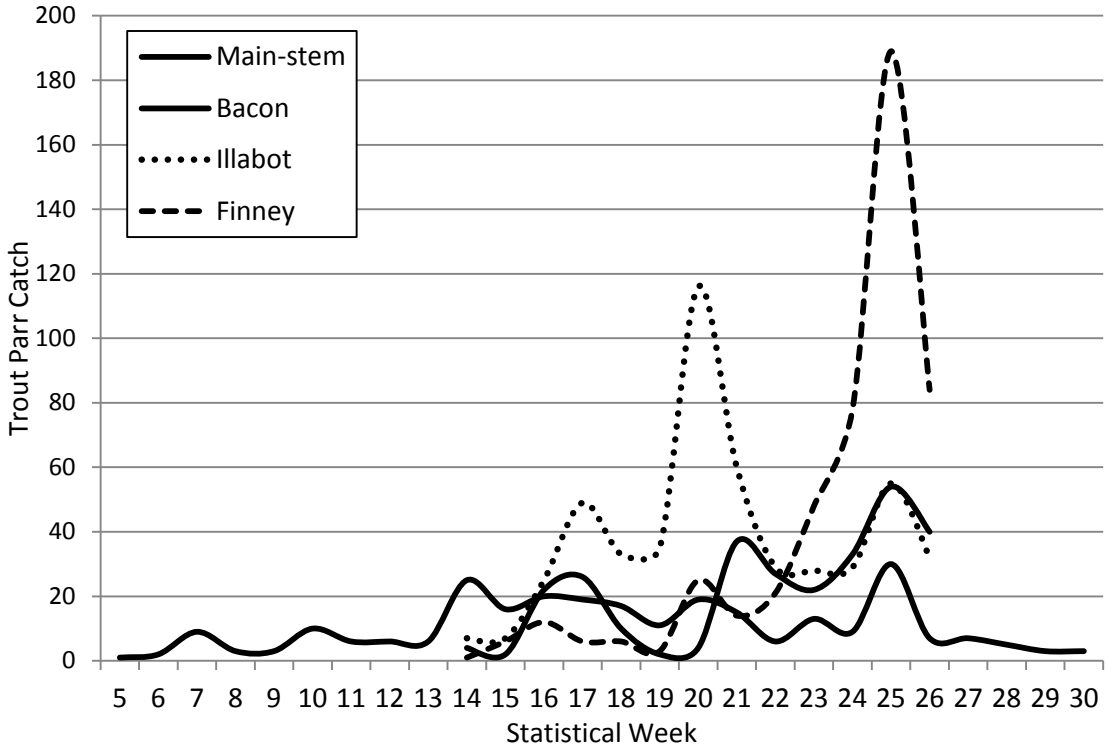

Figure 6.- Trout parr catch at Skagit River trapping locations by statistical week.

In Illabot Creek two ad-marked steelhead smolts were captured one on April 11th and one on April 17th. These dates are before the first reported release date of May 1 from Marblemount hatchery of steelhead smolts. These fish were either escapees from the hatchery that strayed up Illabot or they may have been fish from previous year's release that strayed up the creek and reared for a period before being caught in the smolt trap.

A total of 195,050 hatchery steelhead smolts were reported released (volitionally) beginning on May 1 (statiscal week 19) and continuing through May 15 from the Marblemount hatchery. On May 15 (statistical week 21) another group of 31,000 hatchery ad-marked smolts were released from the Baker River. At the mainstem trap site we captured a total of 701 ad-marked hatchery steelhead smolts. Peak catch timing for wild and hatchery steelhead smolts at the mainstem trap site occurred during statistical week 21 with peak catch day being May 16 when 43 steelhead smolts were caught (Figure 7).

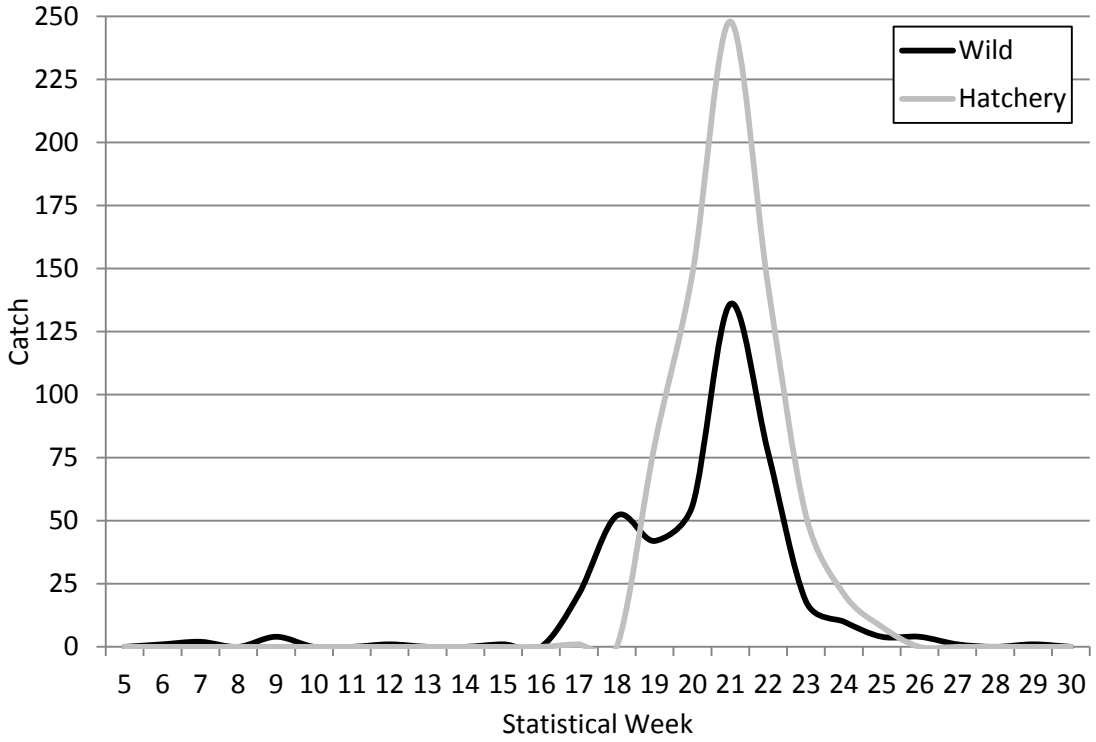

Figure 7.-Migration timing of wild and hatchery steelhead smolts at mainstem Skagit trap site.

Length and Age

Bacon Creek

Fork-lengths were measured from 189 steelhead smolts captured in the Bacon Creek trap. These smolts averaged 168 mm with the largest smolt measuring 222 mm and the smallest being 115 mm (Table 6).

Of the 37 scale samples taken from steelhead smolts in Bacon Creek, 31 were readable. Age composition of the smolt population leaving Bacon Creek were 54.8% age-3, 32.3 % age-2 and 12.9% age-4 smolts. Of all the trap sites, Bacon Creek had the highest percentage of age-4 steelhead smolts (Table 7). Size range overlap occurred between age-2 and age-3 and between age-3 and age-4 smolts (Table 8, Figure 8).

Illabot Creek

At the Illabot Creek trap site, we measured 743 steelhead smolts. Average size was 173.9 mm, ranging to a low of 119 mm and to a high of 244 mm (Table 5). Of the tributary trapping locations, Illabot Creek had the largest smolts.

Age composition of steelhead smolts leaving Illabot Creek were dominated by age-3fish which made up 89.9% of our sample. Age-4 smolts made up 5.9% and age-2 smolts made up the remaining 4.2% of our age sample (Table 6). Overlap between fork-length ranges of subsequent

year classes also occurred on Illabot Creek with age-2 overlapping age-3 and age-3 overlapping with age-4 (Table 7, Figure 8).

Finney Creek

Finney Creek steelhead smolts were by far the smallest among all of our trapping locations. We sampled 164 fish for fork lengths and the average size was 155.7mm (Table 5). The next smallest average size for a group of smolt was from Bacon Creek and Finney smolts were on average over 12 mm smaller.

Thirty two steelhead smolts were scale sampled from the Finney Creek trap resulting in readable samples from 27 fish. Age structure of Finney steelhead were dominated by age-2 smolts (74.1%) followed by age-3 (18.5%) and age-1 (7.4%) (Table 6). Despite the small size of the whole group of smolts emigrating from Finney Creek, the age-2 smolts were the largest among the tributary locations (Table 7). Finney Creek is a lower elevation, lower gradient drainage than Illabot or Bacon Creeks, which are fairly steep and originate from snowfields and glaciers. The physical differences in these watersheds likely accounts for the difference in age structure among their smolt populations.

Mainstem

Steelhead smolts captured in the mainstem traps averaged 174 mm fork length, the largest among the trapping locations (Table 5). Plausible explanations include growth during downstream migration from upstream tributaries, or possibly that captures from the mainstem trap include smolts that reared in the main Skagit River, which might be generally larger than fish rearing in tributaries (with the exception Illabot).

Scale age composition of smolts captured in the mainstem were; 77.1% age-2 and 22.9% age-3 migrants. No age-1 or age-4 smolts were seen at all in our sample (Table 6). Size of the age- 2 smolts captured in the mainstem were significantly larger (KS-test α=0.05) than those captured at tributary locations (Table 7). This suggests that age-2 smolts that reared in the mainstem Skagit River or other unsampled tributaries are growing faster than those that were captured in the higher elevation tributary traps.

Table 5. - Steelhead smolt length data (mm) by trap site.

Trap Site	# Sampled	Average	Standard Deviation	Min	Max
Bacon	189	168.0	22.64	115	222
Illabot	743	173.9	17.45	119	244
Finney	164	155.7	24.42	103	220
Mainstem	327	174.0	21.26	111	268

Table 6.-2012 steelhead smolt scale age results by traps site.

Trap Site	# Sampled	# Readable	% Age 1	% Age 2	% Age 3	% Age 4
Bacon	37	31	0.0%	32.3%	54.8%	12.9%
Illabot	146	119	0.0%	4.2%	89.9%	5.9%
Finney	32	27	7.4%	74.1%	18.5%	0.0%
Mainstem	93	70	0.0%	77.1%	22.9%	0.0%

Table 7.-Fork length (mm) size range by age of steelhead smolt captured in Skagit trapping locations.

	Age 1			Age 2			Age 3			Age 4		
Trap Site	Avg.	Min	Max	Avg.	Min	Max	Avg.	Min	Max	Avg.	Min	Max
Bacon	-	-	-	152.2	131	165	182.4	150	215	195.8	192	199
Illabot	-	-	-	152.4	140	164	180.9	135	212	198.6	183	210
Finney	121.5	121	122	165.7	139	213	175.2	143	199	-	-	-
Mainstem	-	-	-	173.3	145	260	184.4	142	240	-	-	-

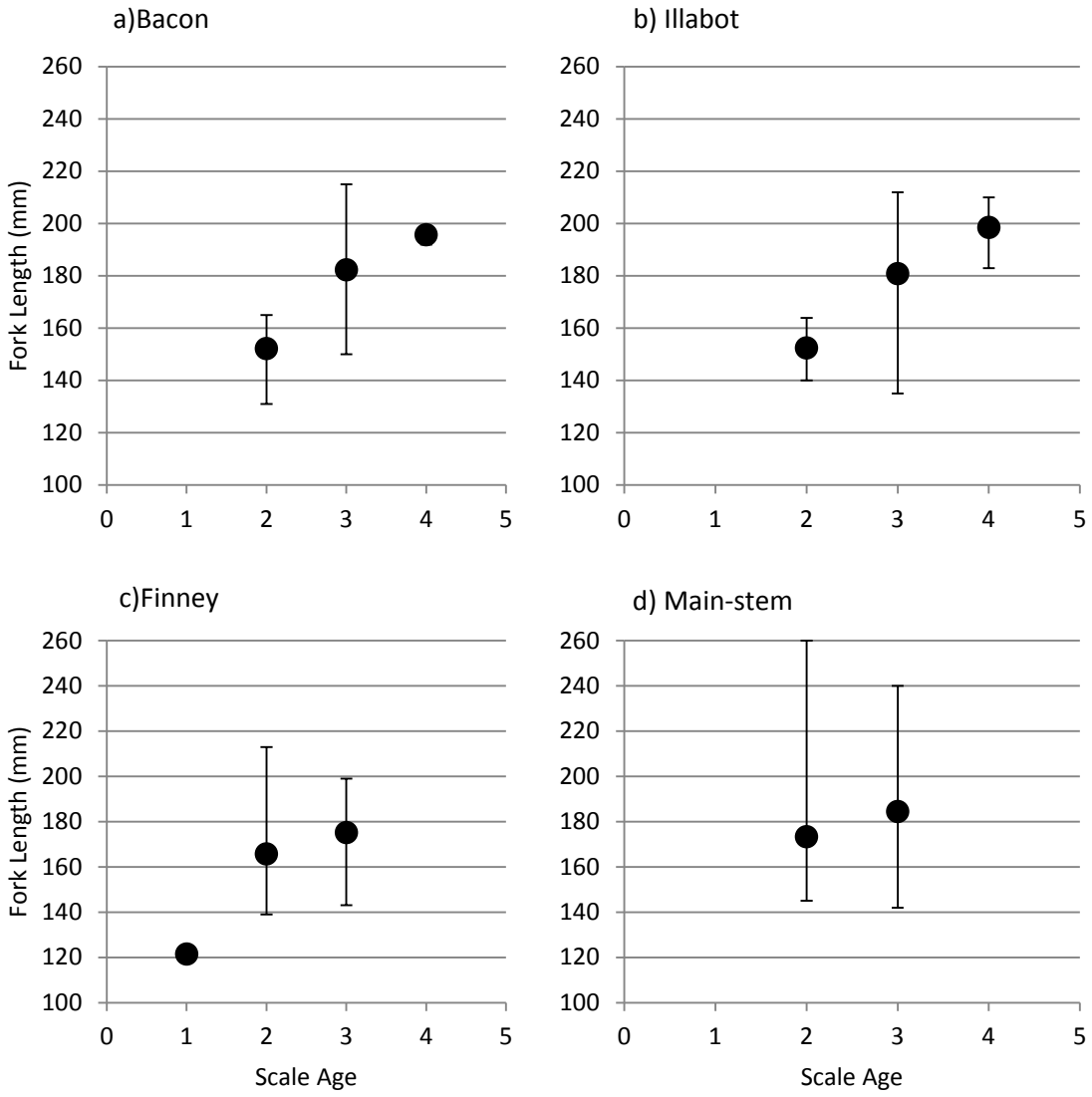

Figure 8.-Steelhead smolt scale age and associated average, minimum and maximum fork length (mm) for Bacon (a), Illabot (b), Finney (c) and mainstem Skagit (d) trap sites.

Tagging and Trap Efficiency

Two trapping designs were followed in attempt to make steelhead smolt production estimates. For Bacon, Illabot and Finney Creeks we used a single partial capture trap, mark-recapture study design to estimate steelhead smolt production. We PIT-tagged all captured smolts that were in good condition and released them at our designated release locations, all over a mile upstream of each trapping site. We chose these release locations to allow for fish to redistribute within the river before arriving back at the trapping location. We tagged and released 189, 743, 164 steelhead smolts in Bacon, Illabot, and Finney Creeks respectively. Trapping efficiency was the highest at the Illabot Creek trap site where we recaptured over 30% of released smolts. The Illabot trap site was perfectly located in the middle of the stream in an area were flow was fast and the stream narrowed considerably. Trapping efficiency was comparatively low in Bacon where we recaptured 3.7% and at our Finney Creek trap, capturing 7.9% (Table 8).

Table 8.-Number of steelhead smolts PIT-tagged and released, and associated number recaptured from tributary trapping locations.

Trap Site	# Marked	Recaptures	Recapture Rate	Release Site Distance Upstream (mi)
Bacon	189	7	3.70%	1.0
Illabot	743	228	30.69%	1.4
Finney	164	13	7.93%	1.0
Total	1,096	n/a	n/a	n/a

The 1,096 steelhead smolts that were PIT-tagged and released from the tributary trapping location made up the mark group available for recapture at the mainstem trapping location. We captured only one of these PIT-tagged steelhead as a recapture at the mainstem (0.09%). The one recaptured steelhead smolt was a fish that was tagged in Bacon Creek on April 17 and had a fork length of 186 mm. It was recaptured 19 days later on May 6th at the mainstem trap and had a fork length of 190 mm.

Production estimates

Size selectivity at the tributary trapping locations appears to have not been a factor in estimating production. We used a Kolmogorov-Smirnnov (K-S) test *(α=0.05)* to test length frequency distributions between maiden and recaptured smolts at each location. We observed no significant difference between the two groups, indicating that size selectivity did not bias our estimates.

Steelhead smolt production estimates were completed from each tributary trapping location. Bacon Creek had a much higher smolt estimate than Finney or Illabot creeks, which were similar to each other (Table 9). We were unable to estimate steelhead smolt production for the entire Skagit basin because only one PIT-tagged steelhead smolt was recaptured at the mainstem site.

Table 9.-Steelhead smolt catch and production estimations, 2012.

Stream	Start Date	End Date	Actual Catch	Production Estimate	Variance	C.V.
Bacon	3/29/2012	6/26/2012	203	8,253	3.90E+07	75.6%
Illabot	3/27/2012	6/26/2012	745	2,705	63,903.39	9.3%
Finney	4/1/2012	6/26/2012	166	2,464	658,303.14	32.9%

Other Species

We captured a large number of juvenile bull trout in Illabot Creek, with fewer captured in Bacon and Finney creeks. (Table 11). Bull trout averaged 143.8 mm at Illabot Creek, noticeably larger than those sampled at the mainstem trap site (Table 10).

Table 10.-Fork length statistics from bull trout sampled at mainstem and Illabot Creek trap sites.

Trap Site	Average	S.D.	Min.	Max.	Count
Mainstem	138.2	23.5	94	318	198
Illabot	143.8	25.4	110	225	84

The pink fry catch in Illabot Creek (140,435) was the highest catch total for any species across the tributary trapping locations (Table 11). Illabot Creek had the highest catch totals among the tributary sites for Chinook 1+, cutthroat 1+, steelhead smolts, bull trout 1+, coho 1+, chum and pink fry. The Bacon Creek trap caught the most Chinook sub-yearlings and coho fry, while the Finney Creek trap captured the highest number of trout parr.

Table 11.-Catch total of wild salmonids by trap site, 2012.

Trap Site	Chin 0+	Chin 1+	Stlhd 1+	Cutt 1+	Trout Parr	Bull Trout 1+	Coho 1+	Coho Fry	Chum	Pink	Sock 1+	Sock Fry
Main-stem	50,417	154	431	237	272	204	14,021	362	16,536	753,284	106	7
Bacon	2,235	55	203	0	287	34	769	3,876	64	20,244	0	0
Illabot	366	110	745	2	516	965	7,810	127	1,801	140,435	0	0
Finney	195	17	166	0	522	3	119	716	35	1,976	0	0
Mannser	0	0	20	2,327	-	0	24,613	0	0	0	0	0

Discussion and Synthesis

Assumptions for Mark-Recapture Estimates

The mark-recapture approaches used to derive juvenile abundance estimates was based on five assumptions (Seber 1973, Hayes et al. 2007). These assumptions must be met, or accommodated,

in order to ensure an unbiased abundance estimate. The study design for the Skagit River production evaluation was developed to minimize violating the estimator assumptions.

Assumption 1. Population is closed with no immigration or emigration and no births or deaths.

The emigration assumption is technically violated because the trap catches fish that are emigrating from the river. However, we assume that the entire cohort is leaving the system within a defined period and that the abundance of juveniles can be estimated at a fixed station during this migration. This assumption is supported by the modality of downstream movement and the condition of the yearling fish (visibly undergoing a process of smoltification) and well documented behavior (emigration timing).

Two potential sources of deaths due to the trapping operations are marking related mortality and in-river predation. The stress associated with handling or marking is minimized by gentle handling and all marking/tagging and is conducted by experienced, well trained staff. To reduce marking impacts, fish were held in cool oxygenated water and given sufficient time for recovery. Any fish behaving differently or displaying ill-effects were not released upstream of the trap as part of a release group.

When PIT-tagging steelhead smolts at the tributary trapping locations, we often held fish for extended periods after tagging in a large recovery fish tote. Over the season we observed no tagging related mortality. Also pointing to minimal PIT-tagging related mortality was the fact that of all the fish we recaptured at Illabot (N = 228), none were dead in the live box and all appeared to be in excellent condition.

It is unlikely that all the fish that were part of our mark and tag groups survived to pass or be recaptured in the traps. Therefore it is likely that all our reported trapping efficiencies are biased low.

With larger migrants such as the PIT-tagged steelhead, it is likely that in-river mortality due to predation is fairly low because of their larger size and better swimming abilities. We do not expect a large bias in our steelhead estimate due to in river mortality.

Assumption 2. All animals have the same probability of being caught.

This assumption would be violated if trap efficiency changes over time, if small fish are caught at a different rate than large fish, or if fish are moving downstream at different rates.

Using the (K-S) test *(α=0.05)* to test length frequency distributions between maiden and recaptured steelhead smolts at each tributary trapping location showed no significant difference between the two groups, indicating size selectivity did not bias our estimates.

Assumption 3. Marking does not affect catchability.

This assumption would be violated if catch rates differed between tagged and untagged fish. Behavioral differences between maiden captures and recaptured fish are currently unknown. Handling and tagging the fish may also make them more prone to capture if the stress of handling compromises fish health.

We only tagged healthy steelhead smolts at the tributary trapping locations. We also make sure they have ample time for recovery and have regained equilibrium and all normal swimming ability before release. Often times these smolts are jumping at the bucket lids prior to release indicating they are lively and have recovered from sedation and handling.

Assumption 4. Marked fish mix at random with unmarked fish.

This assumption would be violated if marked and unmarked fish were spatially or temporally distinct in their downstream movements.

At Bacon, Illabot and Finney creeks, the release sites are all about 1-mile upstream of the traps with many pools, riffles and other obstacles allowing them to sufficiently mix spatially and temporally before potential recapture.

Assumption 5. No marks are lost and all marks are detected.

This assumption would be violated if fin clips or tags were not retained or detected on recaptured fish.

Beginning on May 16, at the Illabot Creek trap site we began applying a caudal clip as well as a PIT-tag to all steelhead smolts released upstream of the trap for recapture (67 total). All the recaptures of these caudal marked fish (15) still had PIT-tags, indicating tag retention was not an issue. The 2012 trapping crew was comprised of well trained, technicians that worked in pairs to ensure data quality and accuracy.

Steelhead

Despite the very high spring flows at the tributary traps, we were able to successfully operate traps and estimate the abundance of steelhead smolts from Bacon, Illabot and Finney creeks (Table 9). We were not able to estimate total basin abundance as only one of the 1,096 PIT-tagged steelhead was recaptured at the mainstem trap. However, the low catch total of steelhead smolts at the mainstem may suggest that the spring of 2012 may have been a low steelhead smolt abundance year for the Skagit River basin as a whole. Adult escapements for smolts emigrating in 2012 were also estimated to be among the lowest escapements observed, with 2010 escapement estimated at 3,981 and the 2009 escapement estimated at 2,502. Steelhead smolt catch totals from the mainstem trap (Figure 4) and adult escapement numbers are generally on a downward trend through time (Figure 9).

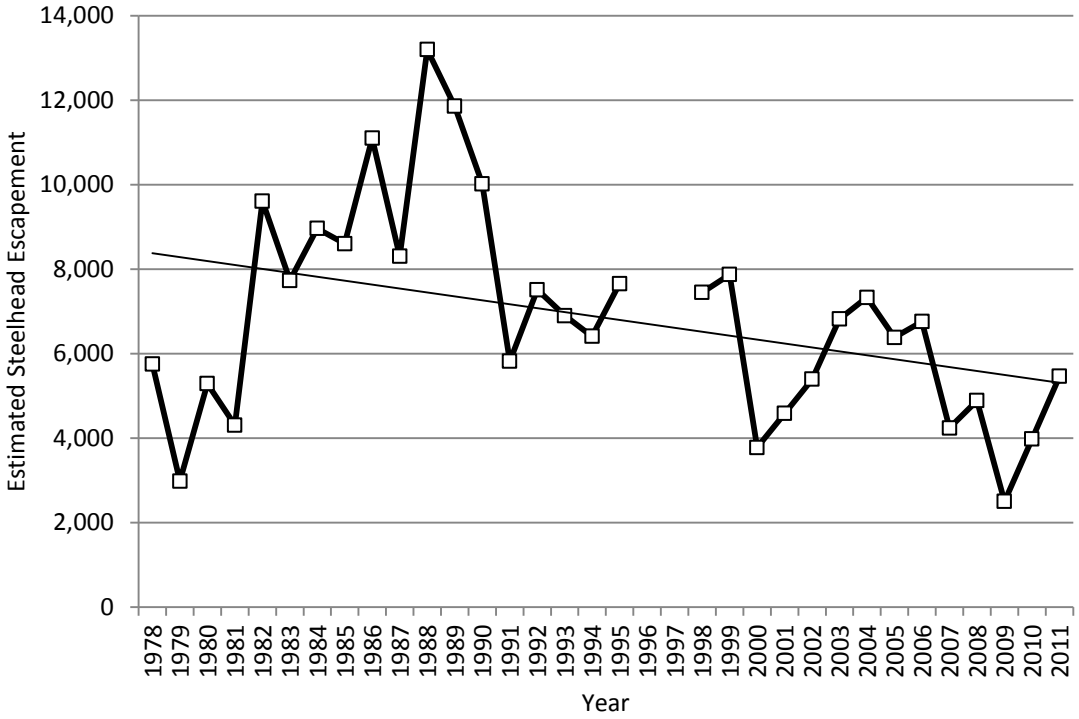

Figure 9-Skagit River steelhead escapement estimates 1978-2011.

The age of steelhead smolts captured in the traps differed depending on the location. Illabot Creek was dominated by age 3-smolts (89.9 %) and age 3-smolts were very prevalent in Bacon Creek (54.8%). Finney Creek was dominated by age 2-smolts (74.1%), as was the catch at the mainstem (77.1%) (Table 6). It is apparent that the higher elevation streams (Bacon, Illabot) that originate from glaciers and snow fields are producing older smolts as it likely takes longer for fish to reach size in the cooler water. On the other hand, the younger age-2 smolts in in Finney Creek may result because this basin is a lower elevation, rain dominated system. It remains unclear if age composition of catch at the mainstem trap is representative of the entire emigrating smolt population, or if size selectivity of the mainstem trap biases catch towards younger smolts. Further sampling in future years at the mainstem and tributary trapping locations will provide insight into variation in smolt population age structure.

Conclusion and Recommendations: Tributary Trapping and Steelhead

Overall, the first season of Skagit River tributary trapping was successful. We installed and operated traps in Bacon, Illabot, and Finney creek for the first time, providing a new opportunity to learn about steelhead smolts in the basin. We successfully estimated steelhead smolt abundance from all three tributaries and gathered important and interesting information on population age structure, migration timing, body size and expanded genetic baseline data on basin population. We were not able to estimate total Skagit basin steelhead abundance in 2012 due to the smaller than expected number of PIT-tagged steelhead smolts in our mark group and the low steelhead capture efficiency of the mainstem trap.

During the next season we will attempt to increase our PIT-tagged release group of steelhead smolts by adding another screw trap or weir trapping location. We also will try to increase the efficiency our tributary traps in order to capture a larger portion of the emigrants. Furthermore, we will consider releasing a group of individually enumerated and marked hatchery steelhead smolts to learn more about trapping efficiency of the mainstem trap. This group will allow us to compare efficiency of wild and hatchery smolts. We may also use hatchery recapture numbers as a surrogate for wild recapture numbers (with assumptions) if necessary.

WDFW and USIT will also collaborate with Seattle City Light (SCL) during the 2013 season to implement an acoustic tagging study on Skagit steelhead smolts. Fish from each trapping location will be acoustic tagged to evaluate downstream migration behavior and freshwater survival.

Appendix A

2012 Statistical Weeks

Statistical Week #	Start Date	End Date
1		01/01/12
2	01/02/12	01/08/12
3	01/09/12	01/15/12
4	01/16/12	01/22/12
5	01/23/12	01/29/12
6	01/30/12	02/05/12
7	02/06/12	02/12/12
8	02/13/12	02/19/12
9	02/20/12	02/26/12
10	02/27/12	03/04/12
11	03/05/12	03/11/12
12	03/12/12	03/18/12
13	03/19/12	03/25/12
14	03/26/12	04/01/12
15	04/02/12	04/08/12
16	04/09/12	04/15/12
17	04/16/12	04/22/12
18	04/23/12	04/29/12
19	04/30/12	05/06/12
20	05/07/12	05/13/12
21	05/14/12	05/20/12
22	05/21/12	05/27/12
23	05/28/12	06/03/12
24	06/04/12	06/10/12
25	06/11/12	06/17/12
26	06/18/12	06/24/12
27	06/25/12	07/01/12
28	07/02/12	07/08/12
29	07/09/12	07/15/12
30	07/16/12	07/22/12
31	07/23/12	07/29/12
32	07/30/12	08/05/12
33	08/06/12	08/12/12
34	08/13/12	08/19/12
35	08/20/12	08/26/12
36	08/27/12	09/02/12
37	09/03/12	09/09/12
38	09/10/12	09/16/12
39	09/17/12	09/23/12
40	09/24/12	09/30/12
41	10/01/12	10/07/12
42	10/08/12	10/14/12
43	10/15/12	10/21/12
44	10/22/12	10/28/12
45	10/29/12	11/04/12
46	11/05/12	11/11/12
47	11/12/12	11/18/12
48	11/19/12	11/25/12
49	11/26/12	12/02/12
50	12/03/12	12/09/12
51	12/10/12	12/16/12
52	12/17/12	12/23/12
53	12/24/12	12/30/12

Appendix B.

Daily Catches in Skagit River Tributary Screw traps, 2012

Appendix B1. ─Daily catches in the Bacon Creek screw trap 2012.

Date	Check Time	Stlhd Smolt	Chinook 1+	Chinook 0+	Coho 1+	Pink Fry	Chum Fry	Coho Fry	Trout Parr	Cutthroat 1+	Bull Trout 1+
3/30	915	2	0	96	16	1,525	2	146	1	0	1
3/31	930	1	0	59	49	900	6	47	3	0	0
4/1	1150	1	2	45	22	700	13	58	0	0	1
4/2	900	1	0	39	10	700	3	23	0	0	0
4/3	900	0	1	44	38	925	1	29	0	0	1
4/4	857	0	2	25	11	875	5	27	0	0	0
4/5	936	0	1	13	11	1,500	0	23	0	0	0
4/6	907	0	1	7	1	1,100	2	8	0	0	0
4/7	1010	0	0	18	5	1,600	4	13	0	0	0
4/8	905	0	0	46	8	2,000	5	49	1	0	0
4/9	855	0	1	91	9	1,325	8	72	1	0	0
4/10	915	3	9	261	31		6		3	0	0
4/11	1050	5	5	297	38	1,650	2	110	1	0	0
4/12	908	6	9	157	15	1,075	0	122	1	0	0
4/13	844	8	5	75	21	680	2	66	6	0	0
4/14	930	4	3	93	26	480	0	42	3	0	0
4/15	840	4	0	80	15	490	0	47	4	0	1
4/16	830	0	0	137	13	680	0	23	4	0	0
4/17	1110	24	1	163	17	710	0	26	9	0	1
4/18	850	6	1	33	24	320	0	15	1	0	0
4/19	844	1	2	33	20	420	0	47	2	0	2
4/20	1130	9	10	85	28	500	1	42	4	0	0
4/21	1003	29	1	0	9	6	0	0	1	0	0
4/22	1015	8	0	3	15	17	0	0	3	0	0
4/23	1030	52	0	3	8	25	0	1	5	0	2
4/23	2130	0	0	2	0	0	0	0	1	0	0
4/26	730	8	0	1	18	2	0	1	3	0	0
4/27	855	3	0	0	13	4	0	0	1	0	2
4/28	905	2	0	1	6	4	0	0	2	0	0
4/29	910	1	0	1	13	4	0	0	3	0	0
4/30	945	0	0	2	8	0	0	1	1	0	0
5/1	850	1	0	0	3	2	0	0	1	0	1
5/2	900	0	0	0	3	0	0	0	0	0	0
5/3	1045	0	0	1	3	0	0	2	0	0	0
5/4	1020	0	0	2	1	0	0	0	0	0	0
5/5	830	0	0	1	1	3	0	4	0	0	0
5/6	830	0	0	0	0	3	0	3	0	0	0
5/7	850	0	0	2	0	0	0	0	1	0	0
5/8	940	0	0	1	2	0	0	1	0	0	0
5/9	908	0	0	2	2	2	0	1	1	0	0
5/10	718	0	0	0	1	0	0	1	1	0	0
5/11	835	0	0	0	1	0	0	0	0	0	0
5/12	814	0	0	0	0	0	0	0	0	0	0
5/13	833	2	0	0	1	0	0	0	2	0	0
5/14	925	0	0	0	5	0	0	0	0	0	0
5/15	920	3	0	3	19	1	0	4	1	0	2

Date	Check Time	Stlhd Smolt	Chinook 1+	Chinook 0+	Coho 1+	Pink Fry	Chum Fry	Coho Fry	Trout Parr	Cutthroat 1+	Bull Trout 1+
5/16	845	1	0	0	29	0	0	0	12	0	2
5/17	850	1	0	3	23	0	0	0	8	0	3
5/18	926	1	0	12	20	1	0	4	2	0	1
5/19	810	0	0	9	6	1	1	4	6	0	0
5/20	828	1	0	10	20	0	0	9	2	0	0
5/21	832	0	0	7	14	0	0	1	6	0	0
5/22	900	-	-	-	-	-	-	-	-	-	-
5/25	1130	0	0	10	15	3	0	10	9	0	0
5/26	822	1	1	4	12	0	0	14	9	0	1
5/27	754	0	0	3	2	10	1	39	5	0	0
5/28	722	0	0	18	2	0	1	66	4	0	1
5/29	900	0	0	4	6	0	0	17	4	0	1
5/30	815	1	0	14	3	0	0	53	1	0	0
5/31	935	0	0	6	4	1	0	97	2	0	0
6/1	1345	0	0	12	11	0	0	57	5	0	0
6/2	846	3	0	1	2	0	0	4	3	0	1
6/3	736	1	0	13	4	0	0	24	4	0	3
6/4	739	0	0	5	2	0	0	18	3	0	0
6/5	745	0	0	9	2	0	1	112	0	0	1
6/6	840	0	0	9	0	0	0	76	4	0	0
6/7	805	0	0	5	2	0	0	23	3	0	1
6/8	805	0	0	18	0	0	0	231	4	0	0
6/9	820	0	0	14	0	0	0	142	3	0	2
6/10	810	0	0	25	0	0	0	427	5	0	0
6/11	735	0	0	8	3	0	0	45	14	0	0
6/12	806	0	0	5	16	0	0	198	20	0	0
6/13	840	0	0	8	0	0	0	271	14	0	0
6/14	705	0	0	20	1	0	0	219	11	0	0
6/15	800	0	0	0	0	0	0	19	1	0	0
6/16	811	0	0	0	6	0	0	167	8	0	0
6/17	815	-	-	-	-	-	-	-	-	-	-
6/19	745	0	0	23	4	0	0	92	6	0	0
6/20	745	1	0	17	0	0	0	54	13	0	0
6/21	750	3	0	2	0	0	0	17	10	0	0
6/22	755	1	0	4	0	0	0	84	5	0	0
6/23	845	1	0	2	0	0	0	25	3	0	3
6/24	910	1	0	2	0	0	0	7	0	0	0
6/25	900	2	0	6	0	0	0	48	3	0	0
6/26	1040	0	0	5	0	0	0	139	4	0	0
Total		203	55	2,235	769	20,244	64	3,867	287	0	34

Appendix B2.-Daily catches in Illabot Creek screw trap, 2012.

Date	Check Time	Stlhd Smolt	Ad-Mark Stlhd	Chinook 1+	Chinook 0+	Coho 1+	Pink Fry	Chum Fry	Coho Fry	Trout Parr	Cutt 1+	Bull Trout 1+
3/28	730	2	0	0	17	8	18,000	86	27	1	0	1
3/29	730	0	0	1	1	6	13,300	107	7	1	0	0
3/30	715	2	0	2	5	24	2,500	21	0	1	0	0
3/31	715	6	0	8	0	50	2,325	34	0	2	0	2
4/1	1000	2	0	4	6	29	2,550	25	4	1	0	4
4/2	715	4	0	0	12	29	4,375	76	0	1	0	0
4/3	720	1	0	2	8	17	7,050	38	1	0	0	0
4/4	717	1	0	1	10	15	3,700	116	3	0	0	1
4/5	716	4	0	2	15	21	6,325	245	24	0	0	4
4/6	713	0	0	1	8	8	6,150	77	8	2	0	0
4/7	745	1	0	0	3	5	9,450	47	7	3	0	1
4/8	720	1	0	0	7	10	13,050	72	7	2	0	6
4/9	715	1	0	2	10	14	13,950	102	4	0	0	0
4/10	710	3	0	0	3	10	9,600	213	13	1	0	2
4/11	815	10	1	6	16	28	7,225	71	5	4	0	2
4/12	715	6	0	7	0	22	4,400	48	2	6	0	7
4/13	708	7	0	5	0	36	1,550	6	0	4	0	4
4/14	920	1	0	2	6	31	2,000	89	7	3	0	4
4/15	715	1	0	0	9	33	3,420	63	1	4	0	5
4/16	720	0	0	1	4	6	4,990	158	2	3	0	0
4/17	720	50	1	3	13	51	1,600	21	0	4	0	3
4/18	1050	8	0	5	6	44	1,160	55	0	2	0	10
4/19	701	12	0	7	5	28	1,750	27	3	11	0	5
4/20	715	-	-	-	-	-	-	-	-	-	-	-
4/21	712	73	0	19	0	120	0	0	0	6	0	6
4/22	730	51	0	9	17	161	0	0	0	15	0	25
4/23	725	65	0	2	10	144	1	0	0	11	0	25
4/24	1030	38	0	1	1	168	3	0	0	6	1	23
4/25	930	34	0	1	0	71	3	0	0	3	0	19
4/26	920	16	0	0	2	38	3	0	0	0	0	24
4/27	711	28	0	1	0	36	1	0	0	5	0	25
4/28	715	29	0	5	0	79	0	0	0	2	0	30
4/29	720	27	0	3	0	115	0	0	0	7	0	35
4/30	820	16	0	1	6	66	0	0	0	10	0	33
5/1	720	19	0	2	0	64	0	0	0	1	0	27
5/2	730	17	0	0	1	57	0	0	0	1	0	15
5/3	838	10	0	0	6	113	0	0	0	5	0	14
5/4	909	5	0	1	0	69	2	1	0	5	0	27
5/5	705	11	0	1	0	73	0	0	0	6	0	26
5/6	709	8	0	3	0	88	0	0	0	9	0	28
5/7	730	7	0	1	4	150	0	0	0	8	0	21
5/8	725	5	0	0	7	216	0	0	0	22	0	31
5/9	710	27	0	0	6	255	0	0	0	14	0	36
5/10	1115	15	0	0	0	177	0	0	0	15	0	39
5/11	714	5	0	0	3	90	1	1	0	9	0	19
5/12	700	10	0	0	3	153	1	0	0	8	0	17
5/13	719	7	0	0	10	256	0	0	0	37	0	28
5/14	720	14	0	0	6	497	0	0	0	11	0	30
5/15	715	16	0	0	11	571	0	0	0	6	1	12

Date	Check Time	Stlhd Smolt	Ad-Mark Stlhd	Chinook 1+	Chinook 0+	Coho 1+	Pink Fry	Chum Fry	Coho Fry	Trout Parr	Cutt 1+	Bull Trout 1+
5/16	715	10	0	0	5	262	0	0	0	6	0	19
5/17	724	6	0	0	2	224	0	0	0	17	0	15
5/18	720	7	0	0	2	195	0	0	0	9	0	18
5/19	715	5	0	0	1	151	0	0	0	6	0	11
5/20	715	4	0	0	6	181	0	0	0	10	0	18
5/21	720	2	0	0	0	128	0	0	0	6	0	13
5/22	720	6	0	0	6	200	0	0	0	2	0	10
5/23	930	4	0	0	3	228	0	0	0	1	0	11
5/24	845	2	0	0	3	200	0	0	0	6	0	9
5/25	950	3	0	0	1	163	0	0	0	3	0	6
5/26	723	3	0	0	6	150	0	0	0	3	0	2
5/27	700	1	0	0	6	96	0	0	0	5	0	6
5/28	626	5	0	0	6	121	0	0	0	9	0	11
5/29	750	1	0	0	2	64	0	0	0	3	0	3
5/30	715	1	0	0	6	132	0	0	0	3	0	1
5/31	720	2	0	0	1	86	0	0	0	4	0	13
6/1	1215	0	0	0	3	155	0	0	0	6	0	10
6/2	1210	4	0	0	3	161	0	0	0	4	0	5
6/3	653	0	0	1	4	95	0	0	0	2	0	10
6/4	655	0	0	0	7	99	0	1	1	6	0	7
6/5	658	1	0	0	2	60	0	0	0	1	0	6
6/6	740	1	0	0	2	31	0	0	0	3	0	2
6/7	720	0	0	0	3	29	0	0	0	0	0	1
6/8	725	0	0	0	3	31	0	0	0	3	0	1
6/9	734	0	0	0	3	26	0	0	0	2	0	1
6/10	720	0	0	0	3	22	0	0	0	8	0	2
6/11	702	0	0	0	4	16	0	0	0	12	0	12
6/12	715	1	0	0	2	28	0	0	0	24	0	2
6/13	800	0	0	0	0	25	0	0	0	11	0	6
6/14	610	0	0	0	3	34	0	0	0	7	0	4
6/15	710	0	0	0	1	20	0	0	0	4	0	5
6/16	730	0	0	0	2	15	0	0	0	5	0	5
6/17	730	0	0	0	3	6	0	0	0	0	0	1
6/18	712	0	0	0	0	2	0	0	0	4	0	1
6/19	708	0	0	0	0	1	0	0	0	2	0	0
6/20	703	0	0	0	0	1	0	1	0	0	0	0
6/21	715	0	0	0	0	6	0	0	0	7	0	6
6/22	710	0	0	0	0	3	0	0	1	11	0	8
6/23	830	0	0	0	5	0	0	0	0	4	0	12
6/24	825	0	0	0	0	2	0	0	0	3	0	4
6/25	820	0	0	0	0	5	0	0	0	5	0	6
Totals		745	2	110	366	7,810	140,435	1,801	127	516	2	965

Appendix B3.-Daily catches in Finney Creek screw trap, 2012.

Date	Check Time	Stlhd Smolt	Chinook 1+	Chinook 0+	Coho 1+	Pink Fry	Chum Fry	Coho Fry	Trout Parr	Cutt 1+	Bull Trout 1+
4/2	1040	1	2	0	1	3	0	0	1	0	0
4/3	1050	1	0	0	0	4	0	0	1	0	0
4/4	1021	0	0	3	0	8	0	2	2	0	0
4/5	1039	2	2	0	1	0	0	0	0	0	0
4/6	0:00	0	0	0	0	18	0	0	1	0	0
4/7	1130	2	0	0	0	0	0	0	0	0	0
4/8	1040	2	0	0	0	1	0	0	0	0	0
4/9	1015	2	0	0	0	6	0	0	2	0	1
4/10	1120	5	1	0	0	4	0	0	4	0	0
4/11	1400	6	0	0	0	10	0	0	2	0	0
4/12	1120	1	1	0	0	8	0	0	1	0	0
4/13	1040	0	1	0	0	4	0	0	0	0	0
4/14	1130	2	0	0	0	8	0	0	0	0	0
4/15	1015	1	0	0	0	13	0	0	0	0	0
4/16	950	2	0	0	0	15	0	0	5	0	0
4/17	1350	0	0	0	1	500	0	8	0	0	0
4/18	733	1	1	0	0	21	0	0	0	0	0
4/19	1018	2	0	0	1	66	0	0	2	0	0
4/20	900	-	-	-	-	-	-	-	-	-	-
4/22	1205	2			2	29	0	0	3	0	0
4/23	1350	0	1	0	2	92	1	0	1	0	0
4/24	830	3	0	0	0	16	0	0	0	0	0
4/25	745	0	1	0	3	22	0	0	0	0	0
4/26	1130	5	0	2	3	130	0	0	0	0	0
4/27	1018	5	1	0	3	57	0	0	0	0	0
4/28	1034	1	0	0	5	17	0	0	3	0	0
4/29	1040	0	1	0	3	18	0	0	0	0	0
4/30	1100	0	0	0	4	22	0	0	3	0	0
5/1	1110	0	0	0	1	22	0	1	0	0	0
5/2	1005	3	0	0	4	51	0	0	0	0	0
5/3	730	0	0	1	1	16	0	1	0	0	0
5/4	755	2	0	0	3	18	0	1	1	0	0
5/5	936	1	0	0	4	10	0	0	1	0	0
5/6	915	0	0	2	6	3	0	0	0	0	1
5/7	950	7	0	0	6	18	0	0	1	0	1
5/8	1005	5	0	0	1	89	0	3	3	0	0
5/9	1020	4	1	2	6	103	0	2	4	0	0
5/10	830	6	1	0	2	21	0	0	4	0	0
5/11	945	2	1	1	2	27	0	0	2	0	0
5/12	916	2	0	0	3	163	2	0	8	0	0
5/13	1004	9	2	0	2	38	0	0	2	0	0
5/14	1050	8	0	0	5	31	1	3	2	0	0
5/15	1040	11	0	0	3	31	0	4	2	0	0
5/16	1020	2	0	0	2	41	0	5	0	0	0
5/17	1040	2	0	0	1	31	0	0	0	0	0
5/18	1115	2	0	0	2	30	1	5	1	0	0

Date	Check Time	Stlhd Smolt	Chinook 1+	Chinook 0+	Coho 1+	Pink Fry	Chum Fry	Coho Fry	Trout Parr	Cutt 1+	Bull Trout 1+
5/19	917	0	0	0	5	3	0	33	2	0	0
5/20	932	13	0	0	2	16	0	0	7	0	0
5/21	943	3	0	2	3	13	0	3	2	0	0
5/22	1030	3	0	3	3	28	1	26	0	0	0
5/23	740	1	0	3	4	27	1	46	0	0	0
5/24	730	0	0	0	0	10	0	21	4	0	0
5/25	807	0	0	3	1	12	0	17	3	0	0
5/26	958	0	0	0	2	3	1	3	3	0	0
5/27	903	2	0	0	1	3	0	8	5	0	0
5/28	818	3	0	0	2	8	0	2	6	0	0
5/29	1005	0	0	0	1	2	0	4	7	0	0
5/30	950	5	0	0	0	1	0	2	11	0	0
5/31	1120	2	0	0	2	1	0	0	12	0	0
6/1	1005	1	0	1	1	0	0	0	10	0	0
6/2	1050	0	0	24	1	0	0	69	1	0	0
6/3	905	0	0	1	1	3	0	2	4	0	0
6/4	843	0	0	4	0	1	1	0	3	0	0
6/5	850	1	0	1	0	0	0	2	9	0	0
6/6	1000	0	0	5	0	0	1	10	1	0	0
6/7	915	0	0	5	0	0	0	1	9	0	0
6/8	940	0	0	9	0	0	0	53	6	0	0
6/9	1001	0	0	4	0	1	1	6	6	0	0
6/10	930	2	0	1	0	0	0	0	8	0	0
6/11	842	3	0	2	4	0	2	0	39	0	0
6/12	930	3	0	2	2	0	1	0	34	0	0
6/13	950	3	0	2	0	0	0	0	26	0	0
6/14	820	3	0	4	0	0	0	1	21	0	0
6/15	915	1	0	0	0	0	0	1	22	0	0
6/16	920	1	0	5	0	0	0	2	72	0	0
6/17	920	0	0	30	0	0	0	192	12	0	0
6/18	808	1	0	28	1	0	0	116	2	0	0
6/19	952	0	0	11	0	0	21	0	9	0	0
6/20	901	1	0	6	0	0	0	9	8	0	0
6/21	915	0	0	3	0	0	0	5	15	0	0
6/22	915	0	0	4	0	0	0	5	24	0	0
6/23	1028	1	0	9	0	0	0	13	6	0	0
6/24	1100	1	0	7	0	0	0	26	9	0	0
6/25	1022	0	0	1	0	0	0	0	13	0	0
6/26	825	0	0	4	0	0	0	3	29	0	0
Totals		166	17	195	119	1,967	35	716	522	0	3

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