Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska

Progress Report for 2015

For Alaska Department of Fish and Game
Contract IHP-13-013

Volume 1

Authors:
Eric Knudsen, Peter Rand, Kristen Gorman, and Julia McMahon
Prince William Sound Science Center
P.O. Box 705
Cordova, AK 99574

Ben Adams and Victoria O'Connell
Sitka Sound Science Center
834 Lincoln St., Suite 200
Sitka, AK 99835

David R. Bernard
D.R. Bernard Consulting, LLC
2481 NW 87th Avenue
Ankeny, IA 50023-8829

November 18, 2016

Table of Contents

ABSTRACT

This is the fourth in a series of annual reports on data collection and analysis for studies of hatchery-wild interactions of Pink Salmon in Prince William Sound (PWS) and Chum Salmon in PWS and Southeast Alaska (SEAK). This work was performed by the Prince William Sound Science Center under contract to Alaska Department of Fish & Game. The SEAK portion was further subcontracted to Sitka Sound Science Center. Hatchery Pink Salmon and Chum Salmon in Alaska have thermal-marked otoliths that were used to determine hatchery or wild origin through samples collected at sea and in streams. As in 2013 and 2014, ocean sampling was conducted at nine stations near the entrances to PWS in 2015. Otoliths from 2,278 Pink Salmon and 1,296 Chum Salmon were analyzed for thermal marks indicating hatchery or wild origin. The overall 2015 proportion of hatchery fish across all ocean stations was 55% for Pink Salmon and 69% for Chum Salmon. The proportions of hatchery fish in the ocean sampling varied by station and time. Stream studies were conducted in 2015 for two major purposes: an analysis of straying of hatchery-origin spawners into natural populations in all study streams; and an investigation of the relative survival of hatchery-origin and wild-origin offspring following natural spawning (results of the latter will be forthcoming after DNA tissue analyses are completed). In 2015 field sampling on the spawning grounds, 88,749 individual fish of both species were sampled during repeated visits to 64 streams for both studies combined. Otoliths were collected from all specimens for identification of possible hatchery origin. Fractions of hatchery Pink Salmon were estimated for 28 PWS spawning populations and hatchery fractions of Chum Salmon were estimated for 17 PWS and 32 SEAK streams. Fractions in each case were estimated by stream, then by district (PWS) or Sub-region (SEAK), and then by region. PWS Pink Salmon hatchery fractions in 2015 ranged from 0.00 to 0.81 in individual streams. PWS Pink Salmon hatchery fractions tended to be high only in certain districts, such as the Eshamy District (0.81) and the Southwestern District (0.34). The estimated PWS-wide Pink Salmon hatchery fraction in spawning streams was 0.10. PWS Chum Salmon stream hatchery fractions were all equal to or less than 0.08, except in Siwash, Swamp, and Cabin Creeks where the hatchery fractions were 0.33, 0.79, and 0.90, respectively. The PWS-wide Chum Salmon stream hatchery fraction was estimated to be 0.03. Hatchery fractions in 32 SEAK Chum Salmon streams were similarly mostly low (≤0.20) except Sawmill, Glen, Prospect, and Fish Creeks where the hatchery fractions were 0.38, 0.40, 0.50, and 0.87, respectively. The SEAK-wide estimated Chum Salmon stream hatchery fraction was 0.09. Using information from both ocean sampling and field sampling programs, as well as data from the commercial fisheries, an estimated 140.9 million Pink Salmon entered PWS in 2015 of which an estimated 63.5 million were wild fish and 77.3 million were hatchery fish. An estimated 3.6 million Chum Salmon entered PWS in 2015 of which 1.1 million were wild fish and 2.5 million were hatchery fish.

INTRODUCTION

Prince William Sound Science Center (PWSSC) and its sub-contracting partner Sitka Sound Science Center (SSSC) are engaged in scientific data collection and analysis services requested under the State of Alaska contract IHP-13-013 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska". This is the fourth annual report, focusing on the results of 2015 data collection and analysis, as well as summarizing some results from 2013 through 2015.

The plans and intentions of this contracted research are guided by two documents: 1) the ADF&G RFP 2013-1100-1020, dated May 7, 2012 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska and 2) the PWSSC proposal for the project, dated June 29, 2012. The overarching purposes of this research are to:

- Estimate the proportion of the annual runs of Pink Salmon and Chum Salmon in Prince William Sound (PWS) comprised of first-generation offspring of hatchery salmon.
- Determine the extent and annual variability in straying into natural streams of hatchery Pink Salmon in PWS and Chum Salmon in PWS and Southeast Alaska (SEAK), and
- Assess the impact on fitness (productivity) of wild Pink Salmon and Chum Salmon stocks due to straying of hatchery fish into natural streams.

The 2015 field research was organized into three major activities:

- Ocean sampling near PWS entrances to estimate hatchery fractions of Pink Salmon and Chum Salmon runs;
- Adult sampling in streams to estimate the hatchery fractions of spawning salmon and to collect DNA samples for fitness studies; and
- Sampling of alevins from the gravel in two experimental streams for collecting DNA tissues for the fitness studies.

Adult salmon sampling in streams was further subdivided into PWS and SEAK activities implemented by PWSSC and SSSC, respectively. The 2015 adult sampling results are presented in this report.

The second spring sampling of alevins (2014 and 2015) in fitness study streams followed the second summer sampling of their parents (2013 and 2014) and the 2015 alevin sampling results are reported here.

The methods in this report reflect guidance in the RFP, some refinements made following the 2012 preliminary field season (Buckhorn et al. 2013), the 2013 full season (Knudsen et al. 2015a), and the 2014 field season (Knudsen et al. 2015b), as well as changes made as a result of consultation with the Science Panel in November 2012, December 2013, December 2014, and April 2015. A complete, revised 2015 field sampling protocol is presented in Appendices A-E.

This report includes summaries of sample collection during 2015 for estimating hatchery fractions and for the DNA-based fitness studies. DNA samples were delivered to the ADF&G Gene Conservation Lab and the subsequent fitness analysis will be reported later. This report includes analysis of hatchery proportions of Pink Salmon and Chum Salmon from the ocean sampling and analysis of hatchery fractions by stream, district or sub region, and region. It also includes estimates of the total run sizes of wild and hatchery-origin Pink Salmon and Chum Salmon in PWS. Last, sampling activities for alevins from Fish and Stockdale Creeks in spring of 2015, for part of the fitness study, are reported here.

REFERENCES

Buckhorn, M., T. Kline, and V. O’Connell. 2013. Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska. Annual Report 2012 for Contract IHP-13-013. Prince William Sound Science Center, Cordova.

Knudsen, E., M. Buckhorn, K. Gorman, D. Crowther, K. Froning, M. Roberts, L. Marcello, B. Adams, V. O’Connell, D. Bernard. 2015a. Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska. Final Progress Report for 2013, For Alaska Department of Fish and Game Contract IHP-13-013, Cordova, Prince William Sound Science Center, Alaska.

Knudsen, E., M. Buckhorn, K. Gorman, P. Rand, M. Roberts, B. Adams, V. O’Connell, D. Bernard. 2015b. Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska. Final Progress Report for 2014, For Alaska Department of Fish and Game Contract IHP-13-013, Cordova, Prince William Sound Science Center, Alaska.

PWS OCEAN SAMPLING 2015 SEASON

Authors - Pete Rand, Eric Knudsen, David Bernard

Introduction

The purpose of the ocean test fishery was to intercept salmon at the entrances of Prince William Sound to better estimate the proportion of hatchery to wild salmon throughout the Sound. Commercial fishery samples target hatchery fish and do not represent the true ratio of wild to hatchery fish in Prince William Sound. So sampling over 2013, 2014, and 2015 was intended to provide information on interannual variation on hatchery fractions while within-season sampling provided hatchery fractions plus near real-time run size indices on a bi-weekly basis. The results of the PWS ocean sampling also contributed in part to the estimation of the following (see PWS run-size section below):

- number of wild salmon spawning in the wild;
- number of hatchery salmon spawning in the wild (hatchery strays);
- total production of hatchery salmon (including hatchery strays); and
- total production of wild salmon (excluding hatchery strays).

Methods

Fish Collection Methods

The ocean sampling fishing portion of the work during the 2015 field season was conducted aboard a contracted 32' commercial fishing vessel named the F/V Rebound operated by Brad Reynolds, M.S., the same vessel and operator as in the previous two years. The sampling season for ocean-run Pink Salmon and Chum Salmon occurred from May 15 to August 30, 2015 with only slight modifications in the methods from 2013 (to improve catchability), and no changes from 2014. Fishing occurred at nine systematically selected stations, three of which were spaced approximately equidistant across Hinchinbrook Entrance (named Hinchinbrook stations H01, H02, and H03) and the remaining six (named Montague stations M01, M02, M03, M04, M05, and M06) across the entrances[1] to PWS just west of Montague Island (Figure 1).

The vessel made sets beginning in the area of each fixed station (Figure 1) using a 200-fathom drift gillnet consisting of four panels with different ($4^{3/8}$, $4^{3/4}$, $5^{1/8}$, and $5^{1/2}$ inch) stretch mesh. All nine stations were fished over a 2-day period (labeled by TRIP ID) and the catch was delivered to personnel at PWSSC. There were normally two sampling trips per week. This was repeated for the entire fishing season with the exception of a few days not fished due to rough weather. Sets were planned to be a maximum of one hour using the entire 200 fathoms of net with adjustments to decrease these maximums in the case of large catches, vessel traffic, weather, or the presence of marine mammals. If the full 200 fathoms were not used after fishing all stations, then the net was reversed on the reel for the next round of fishing. Date, time, latitude and longitude were recorded in the database at: 1) the start and end of any periods of net

---

[1] M01 and M02 in Montague Strait, M03 and MO4 in Latouche Passage, M05 off Point Erlington, and MO6 in Prince of Wales Passage.

setting; 2) the beginning and end of any drift; and 3) the start and end of any net retrieval. Other data recorded included weather and tide state.

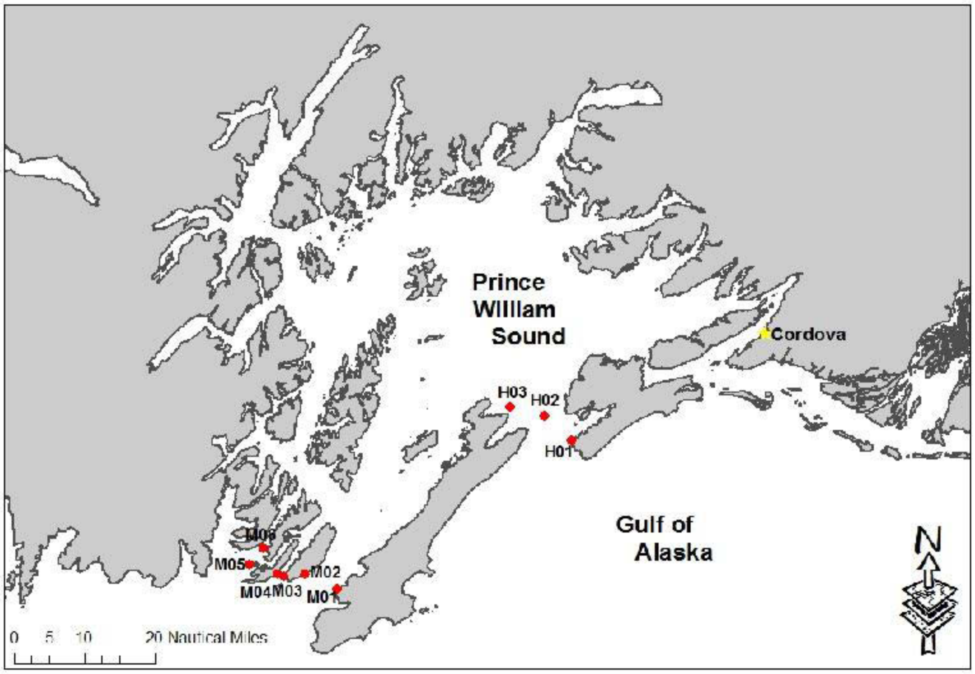


Figure 1. Ocean sampling stations in Montague Strait and Hinchinbrook Entrance.

Once the net was retrieved, fish were removed from the net and total number of each species in the catch was recorded. The target sample retained from each station (up to 20 per species from Hinchinbrook stations; 10 per species from Montague stations) was tagged with a color-coded Floy tag, bled in the field, and put on ice. Catches that exceeded the maximum target sample number per station were systematically subsampled to acquire the appropriate sample size. Chum Salmon and Pink Salmon samples beyond the maximum sample number were retained if it was determined they would not survive release. The same occurred for species of salmon that were not part of this study. All specimens retained were processed and the otoliths and data turned over to ADF&G (see Appendix A for complete fishing protocols).

Sample Processing Methods

Fish were delivered to PWSSC personnel and separated by station and species. The following fish morphometric data were collected to accompany the otolith extraction: total length (TL), standard length (SL), mid-eye socket to hypural bone length (MEH), total weight (TW), gonad weight (GW), and sex (S). Otoliths were extracted by making a horizontal cut from just above the eye straight back towards the posterior of the cranium. Otoliths were placed in individual cells in labeled trays and the tray and cell numbers were recorded for each fish in an electronic database following prescribed ADF&G methods (see Appendix A for complete sampling protocols).

Fish in good condition were gutted and returned to ice to be sold under the ADF&G commercial fishing permit. Fish that were not in sellable condition were disposed of at sea.

Otoliths were read by the ADF&G lab personnel in Cordova following their standard procedures. ADF&G personnel supplied the otolith reading results back to PWSSC and they were incorporated into the project database.

Data Analysis Methods

The objectives of the ocean sampling in 2013 - 2015 included estimating the fractions of hatchery fish in each run of Pink Salmon and Chum Salmon to PWS. The hatchery fractions and their variances were estimated at the trip within station, station, and entire Sound levels for each species. Because hatchery fraction estimates calculated from trip to trip were based on different total catches at each station, there was a need to first weight the fractions by the relative catch per unit of effort at each station on each trip.

Catch per Unit of Effort

All total catches were adjusted for comparability based on a standard unit of fishing effort: net fathoms times time fished. Fishing at each station on each day was characterized by setting the net, drifting it, sometimes adjusting the length of net, then retrieving it, and sometimes re-deploying and retrieving again. The expression below accounted for the simplest situation (one deployment, one drift, and one retrieval) or the more complex situation of multiple adjustments and drifts within one fishing event at a station (referred to later as one complete haul per station). A simplifying assumption is that, during deployment or retrieval, the net is fishing 50% of the deployment or retrieval time duration, even though the deployment or retrieval may not be exactly linear. Catch per unit of effort (CPUE) was calculated as:

$$CPUE = C_s /(((DS_1 - SB)/2) * L_1) + \sum_{d=1}^{n} (((DE_d - DS_d) * L_d)) +$$

$$\sum_{d=1}^{n} (((L_d * (DS_d - DE_{d-1})) + (((L_{d-1} - L_d) * ((DS_d - DE_{d-1})/2))) + (((RE - DE_{d=n})/2) * L_{d=n})$$

Where C_s = number caught per date and station, L = fathoms of net, SB = set begin time, DS = drift start time, DE = drift end time, RE = retrieve end time, and *d* = drift number. The first term in the equation is the catch by species. The second term calculates the effort for the first deployment interval only (net length*time/2). The first summation calculates effort for one or more drifts in a given haul (i.e., station and date). The second summation calculates effort for any other intermediate deployments or retrievals. It accounts for the amount of net already out plus or minus 50% of the change in net length. The last term calculates effort during the final retrieval.

Estimates of Hatchery Fraction

There were 31 two-day fishing trips in 2015. Not all scheduled trips resulted in samples. There were four types of outcomes for the 31 scheduled trips for 9 stations (279 possible combinations) in 2015:

Outcome:	Comment:	Outcome frequency: Pink salmon	Outcome frequency: Chum salmon	Adjustment:
1. Target species caught, origin determined for all or some of the catch	Determination for only "some" due to subsampling large catches	227	207	None
2. Target species caught, origin determined for none of the catch	One target species caught, unable to determine origin from otolith	0	0	Exclude Trip – Most Calculations
3. No target species caught	CPUE = 0	51	71	Exclude Trip – Most Calculations
4. No fishing	Weather	2	2	Exclude Trip – All Calculations

Because there were catches of each species on almost every trip, the data were not truncated for extended gaps in catch as they were in 2013 (Knudsen et al. 2015a).

Trip Within Station

The fraction of hatchery fish in a catch from a specific trip at a specific station was estimated as

$$\hat{p}_{st} = \frac{z_{st}}{m_{st}} \qquad (1)$$

where *s* is a specific station, t is a specific trip (date), m_{st} is the number sampled in the catch at station *s* during trip *t* of the target species for which origin was determined, and z_{st} is the number within m_{st} determined to be of hatchery origin.

By Station

Sample estimates of hatchery fractions for specific stations were weighted when combined to produce unbiased estimates of hatchery fractions for specific stations. Ideally weights would be based on numbers of Pink (or Chum) Salmon (*N*) passing near each station during a trip in relation to all the Pink (or Chum) Salmon passing during the season:

$$W_{st} = \frac{a_{st} N_{st}}{\sum_{t'=1}^{T_s} a_{st'} N_{st'}} \qquad (2)$$

where *t′* represents trips to station *s* during the season including trip *t*, and $a_{st} = 1$ if the trip *t* to station *s* resulted in outcome 1 or $a_{st} = 0$ otherwise. Remember that, in 2015, $T_s = 31$ for both

Chum Salmon and Pink Salmon. Because values of the *N*s are unknown, catch per unit of effort (*CPUE*) was used as a surrogate. Note that catch C is a function of fishing effort (E), catchability (q), and abundance such that $C = qEN$, which makes $N = CPUE\ (1/q)$. Substitution into the equation above provides estimated weights in terms of catch per unit of effort:

$$\hat{W}_{st} = \frac{a_{st} CPUE_{st}(1/q_s)}{\sum_{t'=1}^{T_s} a_{st'} CPUE_{st'}(1/q_s)} = \frac{a_{st} CPUE_{st}}{\sum_{t'=1}^{T_s} a_{st'} CPUE_{st'}} \tag{3}$$

so long as the catchability is the same during all trips at station s. Fishing protocols at each station were standardized over the duration of ocean fishing to reduce variability in catchability, however, catch is a stochastic process even if catchability is a constant (see Appendix A). For these reasons surrogate weights add some uncertainty to estimated fractions, so weights were labeled $\hat{W}_{st}$ instead of W_{st}. The estimate for the fraction of hatchery fish at a specific station for the season was calculated as

$$\hat{p}_s = \sum_{t=1}^{T_s} \hat{W}_{st} \hat{p}_{st}\ . \tag{4}$$

Equation 4 is an unbiased estimator for a proportion estimated with random sampling without replacement through a two-stage design for each station. In our project, fish comprised the subsampling (second) stage and trips the first sampling stage.

For the Sound

The estimated mean fraction of hatchery-produced salmon of the target species in the overall PWS run for 2015 was calculated as the weighted average of the estimated fractions for stations:

$$\hat{\bar{p}} = \sum_{s=H01}^{H01 \cdots M06} \hat{W}_s \hat{p}_s\ . \tag{5}$$

Here the weights were based on the estimated mean CPUE for each station:

$$\hat{W}_s = \frac{\overline{CPUE}_s}{\sum_{s'=H01}^{H01 \ldots M06} \overline{CPUE}_{s'}} \tag{6}$$

$$\overline{CPUE}_s = \frac{\sum_{t=1}^{T_s} \mu_{st} CPUE_{st}}{\sum_{t=1}^{T_s} \mu_{st}} \tag{7}$$

where $\mu_{st} = 1$ if results during trip t to station s had outcomes 1, 2, or 3, and $\mu_{st} = 0$ if outcome 4.[2] Note that Equations 6 and 7 can be modified to estimate the hatchery fraction for any possible combination of stations (say Hinchinbrook stations vs. Montague Stations).

[2] Two different multipliers, λ and ω, are required because CPUE = 0 (outcome 3) provides no information on the fraction of hatchery fish in the catch, but does provide information on the appropriate weight to be used to estimate the fraction for the entire PWS.

Estimated Variance of Hatchery Fraction

By Station

The variance of a parameter estimated through a two-stage sampling design is the variance of the expected value of the parameter across first-stage units plus the expected value of variances of the parameter within first-stage units (Cochran 1977). By this rule estimated variance for the proportion $\hat{p}_s$ in our study became:

$$v(\hat{p}_s) = \hat{S}_{1s}^2 + \frac{\sum_{t=1}^{T_s} a_{st} \hat{S}_{2st}^2}{\sum_{t=1}^{T_s} a_{st}} \tag{8}$$

where $\hat{S}_{1s}^2$ represents the variance of the expected value of the parameter across first-stage units, and the right-most term in Equation 8 the expected value of variances within first-stage units. Equation 8 was adapted from the standard mathematic framework in Thompson (1992). The variance $\hat{S}_{2st}^2$ represents the variance of our parameter from the samples taken at station *s* during trip *t*. Because of the weighting involved in our study, the product $\hat{W}_{st}\hat{p}_{st}$ was treated as a single parameter for expressing variance, making $\hat{S}_{2st}^2$ the variance of the product of two variates. Following procedures in Goodman (1960), variance for such a product was approximated as:

$$\hat{S}_{2st}^2 = v(\hat{W}_{st})\hat{p}_{st}^2 + \hat{W}_{st}^2 v(\hat{p}_{st}) - v(\hat{W}_{st})v(\hat{p}_{st}) \tag{9}$$

where variance for $\hat{p}_{st}$ was estimated as the variance of a binomial proportion:

$$v(\hat{p}_{st}) = \begin{cases} \dfrac{\hat{p}_{st}(1-\hat{p}_{st})}{m_{st}-1} & \text{if } m_{st} \geq 2; \\ \hat{p}_{st}(1-\hat{p}_{st}) & \text{if } m_{st} = 1; \end{cases} \tag{10}$$

(the alternative formulations simplify calculations at the expense of negligible bias in results). Variance for $\hat{W}_{st}$ was approximated as:

$$v(\hat{W}_{st}) \cong v(CPUE_{st})\left(\frac{\sum_{t',t'\neq t} CPUE_{st'}}{\left(\sum_{t'} CPUE_{st'}\right)^2}\right)^2 + \left(-\frac{CPUE_{st}}{\left(\sum_{t'} CPUE_{st'}\right)^2}\right)^2 \sum_{t',t'\neq t} v(CPUE_{st'})\,. \qquad (11)^3$$

The derivation of Equation 11, the equation for $v(CPUE_{st})$ is described in Appendix B.

While the processes and procedures we used to select samples of individual fish (second-stage sampling units) arguably mimicked random selection, the scheduling of trips (first-stage sampling units) was decidedly not random, but systematic. Under such systematic selection no

---

3 Note that in approximating the variance for a specific trip *t*, a summation over subscript *tà* indicates a sum over all trips in a station including trip *t*; the summation with configuration *tà*, *tà* ≠ *t* indicates a sum over all trips excluding trip *t*.

exact estimate of variance for our first-stage units is possible—only an approximate variance could be calculated. Wolter (1985) concluded that under most conditions the sum of the squared differences between sequential statistics is the most robust estimator of variance for systematic sampling. With adaption of this estimator for our study,

$$\hat{S}_{1s}^2 \cong \frac{\sum_{t=2}^{T_s} \lambda_{st}\lambda_{s(t-1)}(\hat{W}_{st}\hat{p}_{st} - \hat{W}_{s(t-1)}\hat{p}_{s(t-1)})^2}{2\left(\sum_{t=1}^{T_s} \lambda_{st}\lambda_{s(t-1)}\right)\left(\sum_{t=2}^{T_s} \lambda_{st}\lambda_{s(t-1)} - 1\right)} \tag{12}$$

was used to approximate variance of the expected value of the parameter across first-stage units. Here again the multipliers λ were used to adjust for missing data.

For the Sound

Estimated variance for the fraction of hatchery-produced salmon of the target species estimated for the Sound as a whole was approximated by again weighting with CPUE. The approximated variance for the Sound is the variance of the sum across stations of products:

$$v(\hat{p}) = v\left(\sum_{s=H01}^{H01\cdots M06} \hat{W}_s\hat{p}_s\right) \tag{13}$$

Application of the delta method to Equation 13 provided an approximate variance for $\hat{p}$:

$$v(\hat{p}) \cong \sum_{s=H01}^{H01\ldots M06} [\hat{W}_s^2 v(\hat{p}_s) + \left(\frac{\hat{p}_s - \hat{p}}{\sum_{s'} \overline{CPUE}_{s'}}\right)^2 v(\overline{CPUE}_s)] \tag{14}$$

Derivation of Equation 14 and of variance for $\overline{CPUE}_s$ is described in Appendix B. That formulation adapted for missing data is

$$v(\overline{CPUE}_s) = \frac{\sum_{t=1}^{T_s} \omega_{st} v(CPUE_{st})}{\left(\sum_{t=1}^{T_s} \omega_{st}\right)^2}. \tag{15}$$

Statistics for any combination of stations can be calculated by restricting weights only to the stations in those combinations. Weights used in the combination must sum to 1 over the number of stations used in the combination. Regardless, the general assumption is that catchability of the target species is the same for all stations included in the combination.

Results

Ocean Salmon Sampling

Extraneous factors that had an impact on fishing included fog, whales (humpback, orca, grey), Dahl's porpoises, sea lions, seals, otters, sport fisher vessels, tankers and/or tugs, rip tides, wind, and flotsam. The vessel captain actively watched for and avoided all such factors which at times either completely prevented a set or limited the set time and/or net fathoms set. The vessel captain also attached whale pingers which he reported may have prevented many close encounters with whales in 2015 as they did during 2014.

A total of 15,761 salmon were caught in the ocean test fishery during 2015. Fishing was conducted at all nine stations over a two (sometimes three) day period throughout the season. For analysis and graphic purposes, each fishing period is defined as a "Trip" with Trip 1 beginning on May 25, 2015 and Trip 31 ending on August 31, 2015. Pink Salmon were the most numerous salmon caught (12,060), followed by Chum Salmon (2,022), Sockeye Salmon (1,411), and then Coho Salmon (259). Nine Chinook Salmon were caught and released. From here on we focus on results for Pink Salmon and Chum Salmon only. Pink Salmon started showing up in the catch on May 18 (TRIP 2). Pink Salmon trended upward until the first peak on July 8 (TRIP 16). The highest peak occurred on July 23 (TRIP 20) and then trended downward until fishing ceased (Figure 2). Chum was the first species caught at the beginning of the season and were caught fairly consistently for the entirety of the season, but started to decline by July 5 (TRIP 16) (Figure 2).

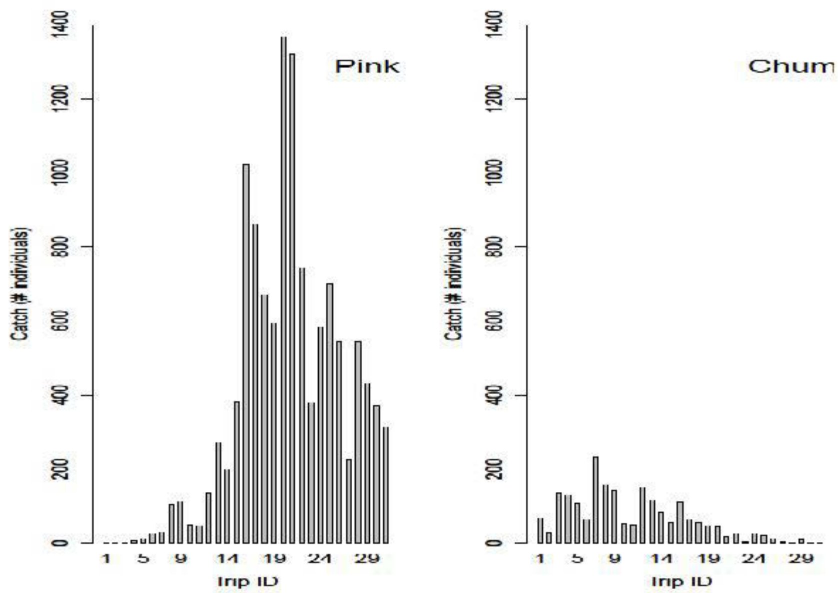


Figure 2. Total Pink Salmon (left) and Chum Salmon (right) caught at all stations during 2015 by TRIP ID.

Trends in CPUE (fish caught per hour per fathom of net length) were qualitatively similar across years, but the CPUE of Pink Salmon during 2015 appeared to be more protracted compared to the previous years, with relatively high catches through to the end of the test fishing period in late August (Figure 3).

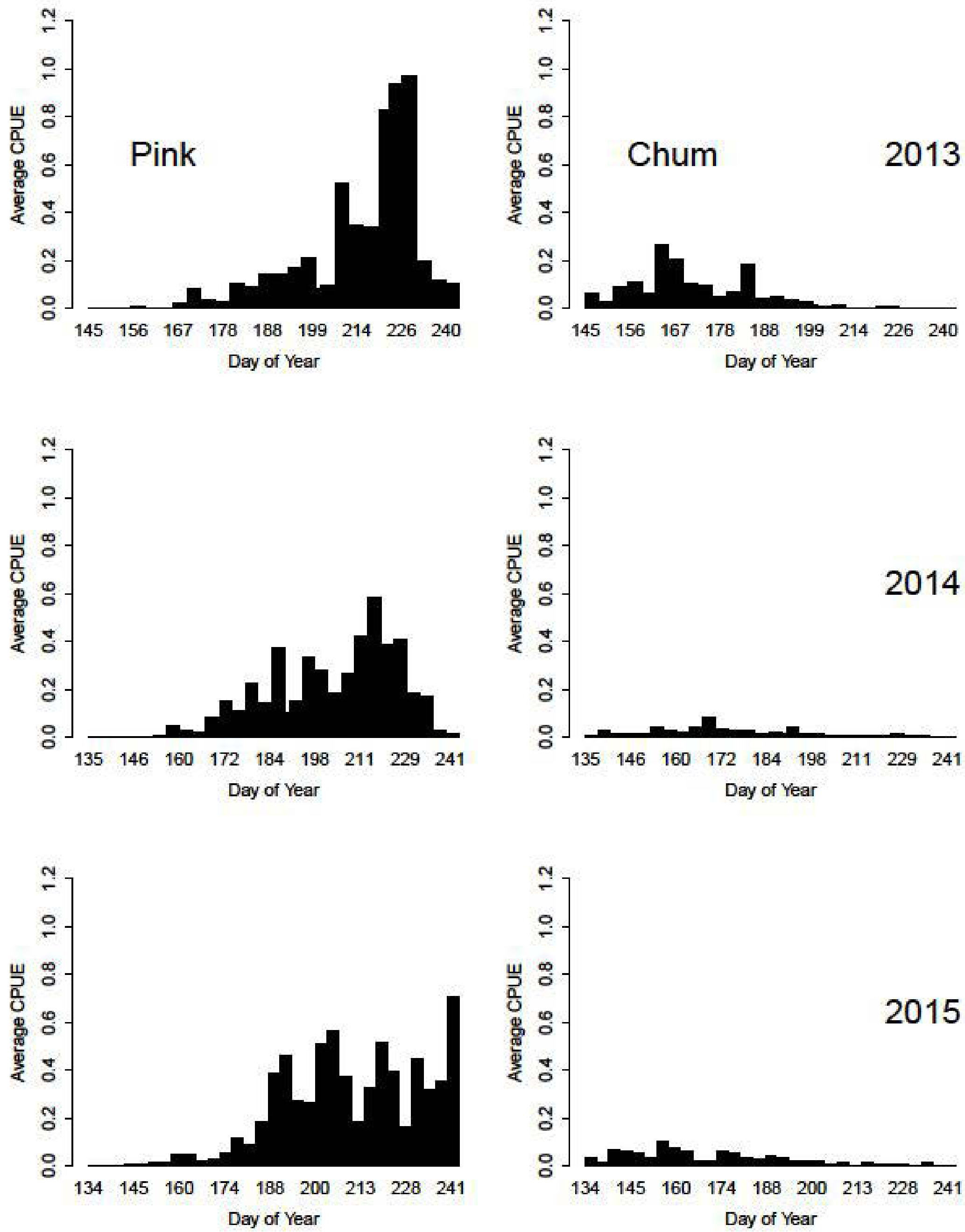


Figure 3. Mean CPUE for Pink Salmon (left) and Chum Salmon (right) by day of year during each year of the study.

Catches of salmon by station were variable in 2015. Station M02 had the greatest seasonal catch of Pink Salmon (2,197) while the fewest Pink Salmon (555) were caught at H02 (Figure 4). The station with the greatest Chum Salmon catch was M06 (330) and the lowest catch (93) was at

H02 (Figure 4), a station positioned near the center of the large Hinchinbrook Entrance (Figure 1).

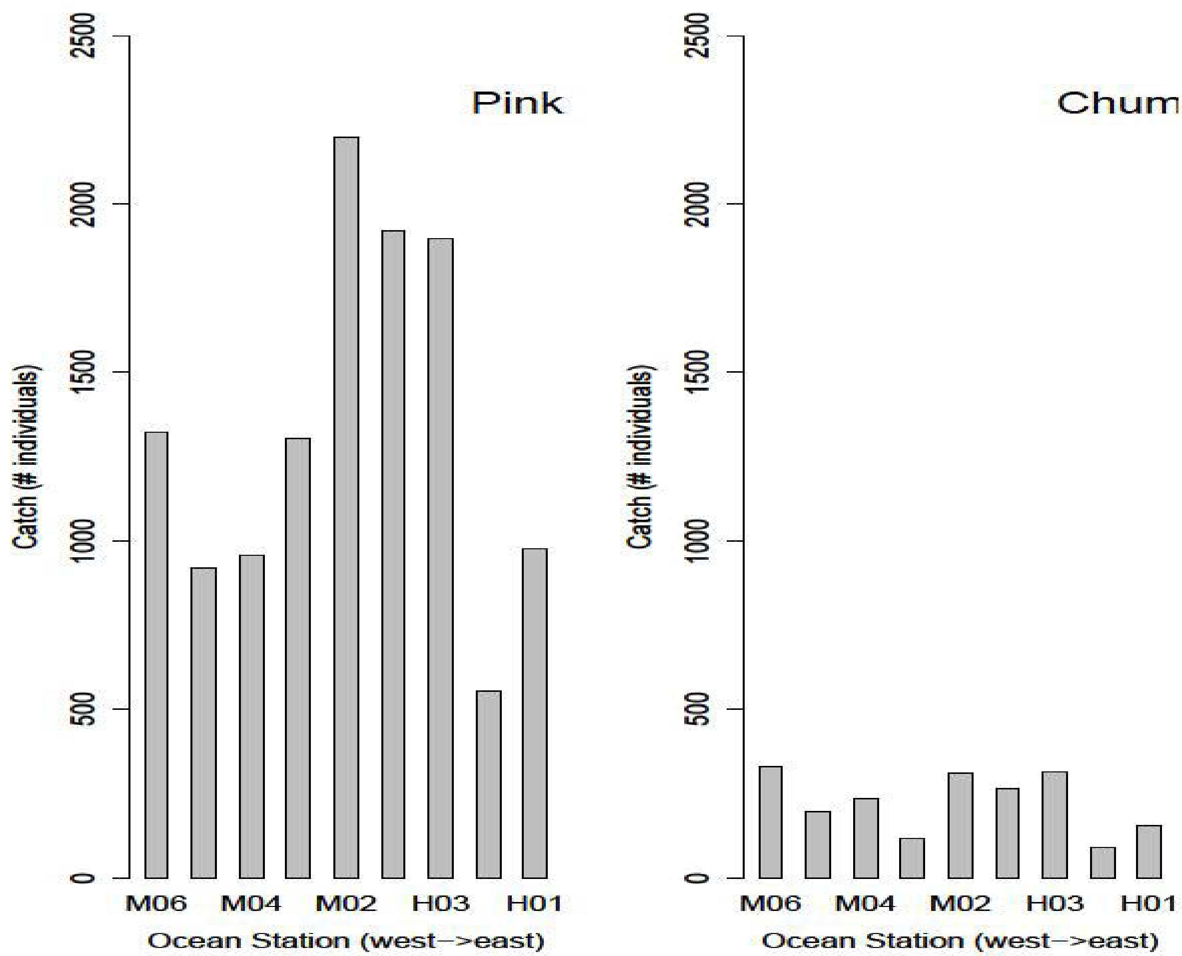


Figure 4. Total Pink Salmon and Chum Salmon caught by station from May 25 to August 31, 2015 (H=Hinchinbrook, M=Montague).

During 2015, mean CPUE by station for Pink Salmon ranged from 0.07 (H02) to 0.42 (M02) and for Chum Salmon ranged from 0.01 (H02) to 0.04 (H03) (Figure 5). Station M05 yielded the highest Pink Salmon CPUE for all three years, while the highest Chum Salmon CPUE by station was at M05 in 2013 and at H03 in 2014 and 2015 (Figure 5). Chum Salmon CPUE appeared to be more consistent across stations compared to Pink Salmon (Figure 5).

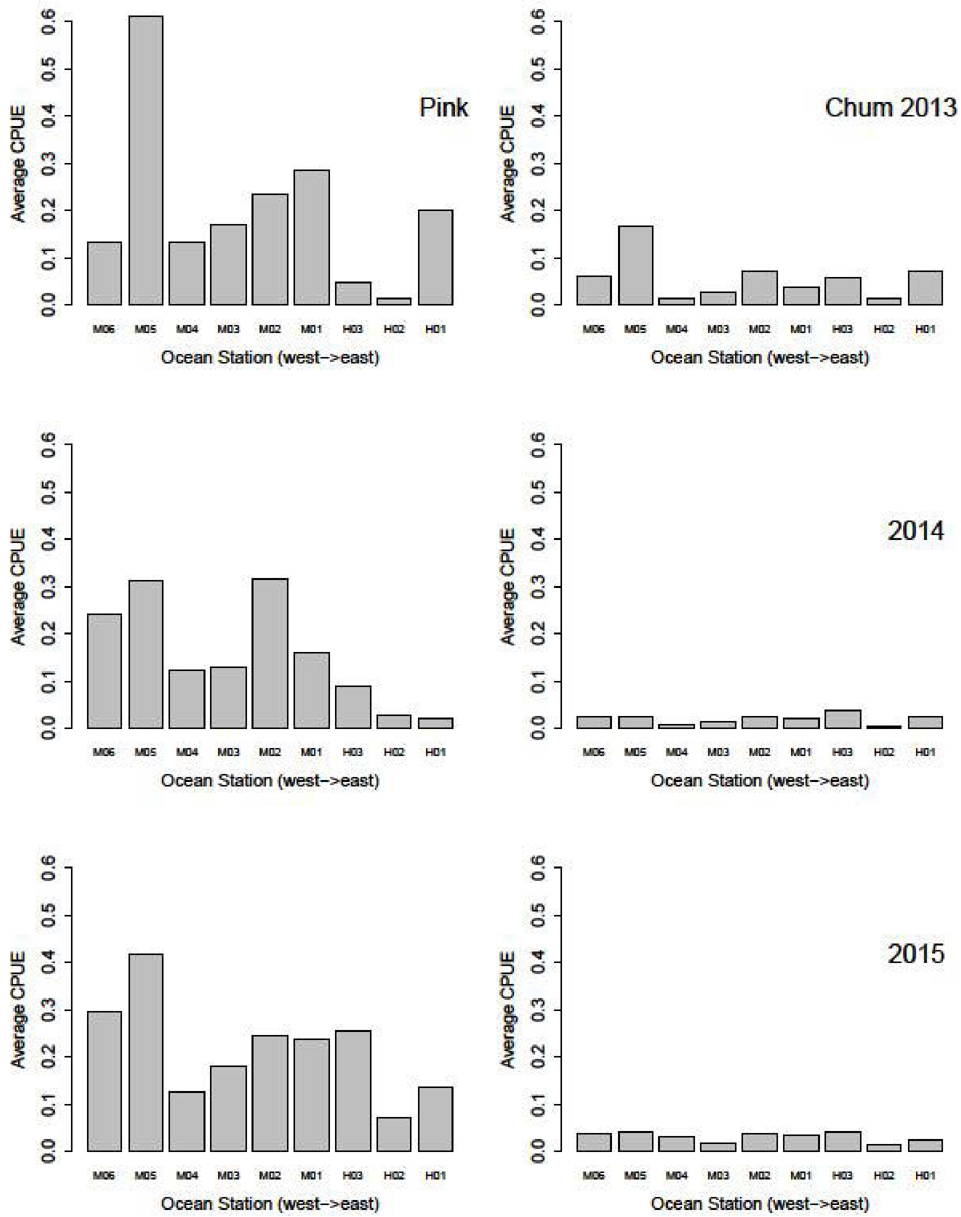


Figure 5. Mean CPUE for Pink Salmon (left) and Chum Salmon (right) by station during each year of the study.

Ocean Salmon Processing

A total of 3,716 salmon were processed for weight-length measurements and otoliths, including 2,278 Pink Salmon and 1,296 Chum Salmon. Mean standard lengths for Pink Salmon and Chum Salmon were 462 mm and 557 mm, respectively.

As in previous years, there was a marked male bias in the sex ratio of returning Pink Salmon. The processed Pink Salmon were 67.1% male while the sex ratio of Chum Salmon was more even (56.2% male, Table 1). The sex ratio of both wild and hatchery Pink Salmon at all stations was skewed toward males in 2015, as was observed in the previous years of the study (Figure 6). The disparity in sex ratios between wild and hatchery Chum Salmon was less marked than in previous years (Figure 6), and was generally closer to a 50:50 ratio (Figure 6). As in previous years, wild Chum Salmon sex ratios showed more variability across ocean stations (Figure 6) than did Pink Salmon.

Table 1. Sex ratios by total number and percentage for 2015.

Species Common Name	Metric	Female	Male	Unknown	Grand Total
Chum Salmon	count	566	728	2	1296
	percent	43.7%	56.2%	0.1%	
Pink Salmon	count	742	1529	7	2278
	percent	32.6%	67.1%	0.3%	

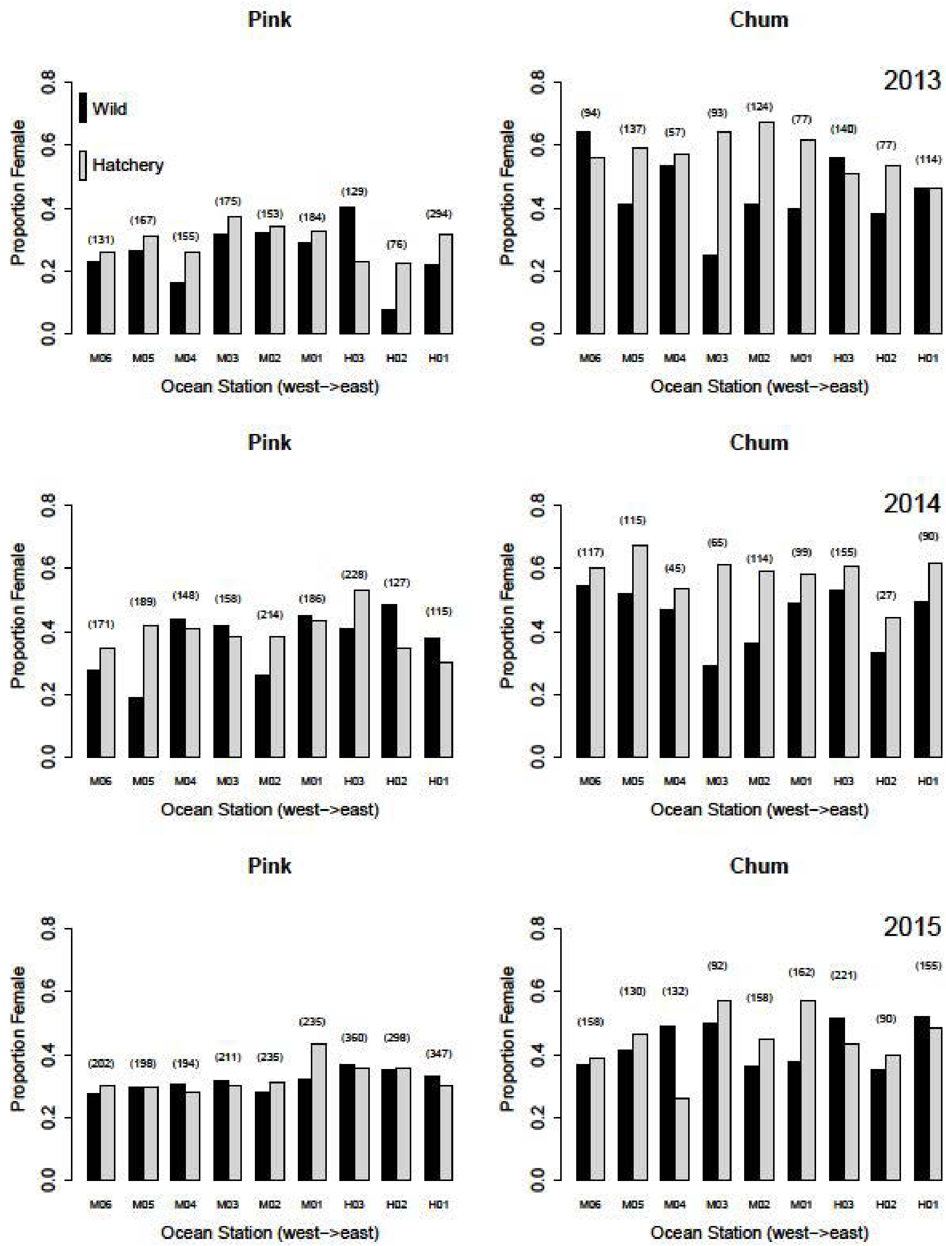
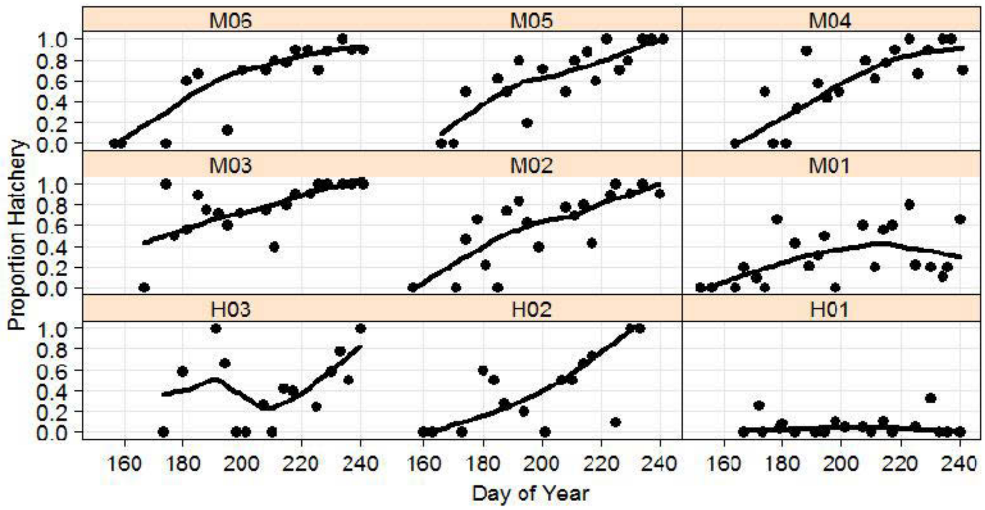


Figure 6. Proportion of female Pink Salmon (left) and Chum Salmon (right) by origin (wild and hatchery) and by ocean station for each year of the study. Numbers in parentheses are the sample size over the entire season at each station.

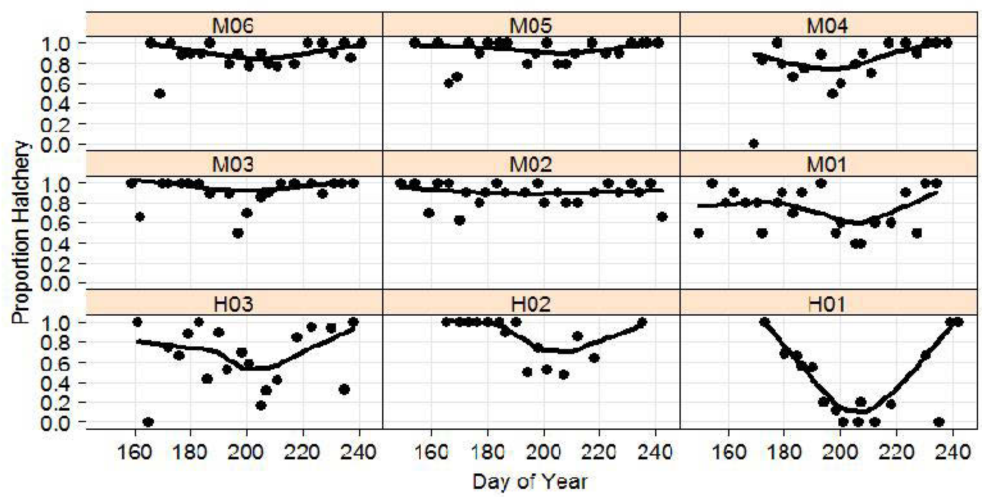
Ocean hatchery fractions

Unweighted hatchery proportions of processed fish varied by date and by station for both Pink Salmon and Chum Salmon (Figures 7 and 8). The same patterns generally held in 2015 compared to previous years. Odd years usually have greater run sizes of wild Pink Salmon in PWS than even years, and the effect of this phenomenon can be discerned in the plots, particularly at the Hinchinbrook stations (Figure 7). In both 2013 and 2015, the unweighted hatchery proportions of Pink Salmon were generally lower at all stations (particularly early in the season and at Hinchinbook stations) compared to 2014. Also, as in previous years, the H01 station in Hinchinbrook was a very important migratory corridor for wild Pink Salmon in 2015 (Figure 7). The wild proportion of the Pink Salmon run appeared to be greatest during the early part of the season in 2013 and 2015 (Figure 7).

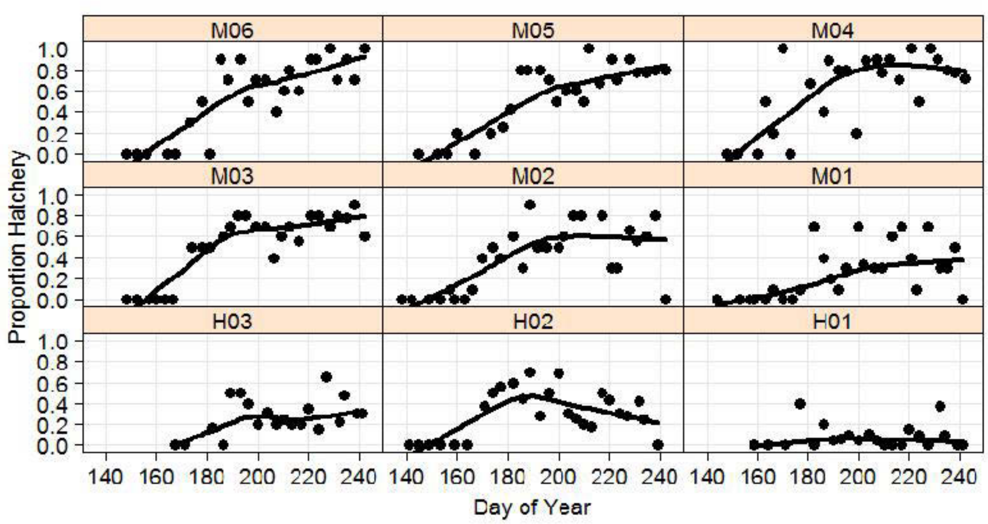
The temporal trends in the unweighted hatchery fractions for Chum Salmon were remarkably consistent across years and stations (Figure 8). Most of the early run of Chum Salmon in 2015 was composed of hatchery fish, as was observed in previous years. Wild Chum Salmon were predominately observed at the H01 station in Hinchinbrook Entrance (Figure 9), as documented above for Pink Salmon.



2013

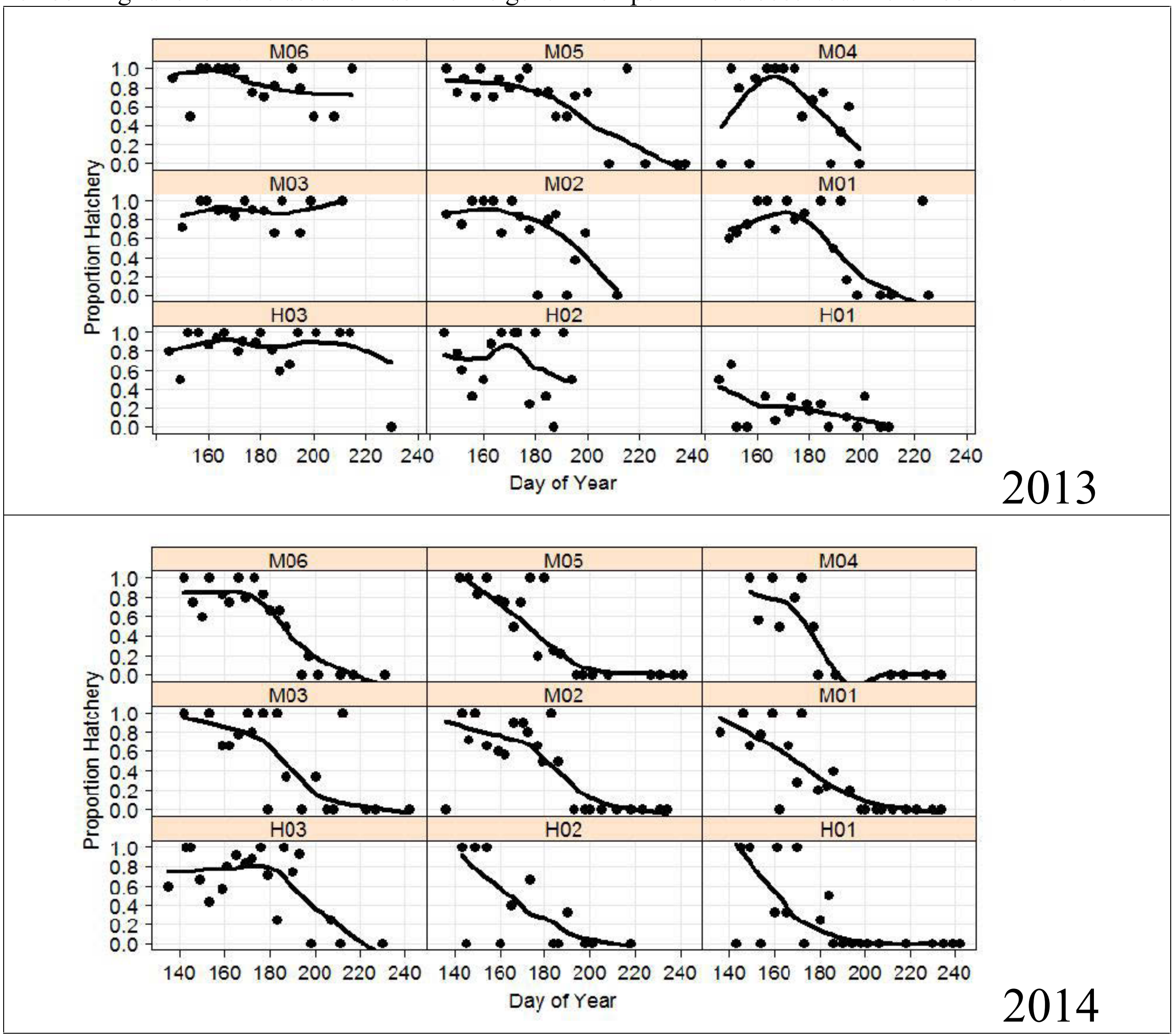


2014



2015

Figure 7. Pink Salmon unweighted hatchery proportion by day of year and Station ID by year. A loess smoothing function was used to illustrate the general temporal trend observed at each ocean station.



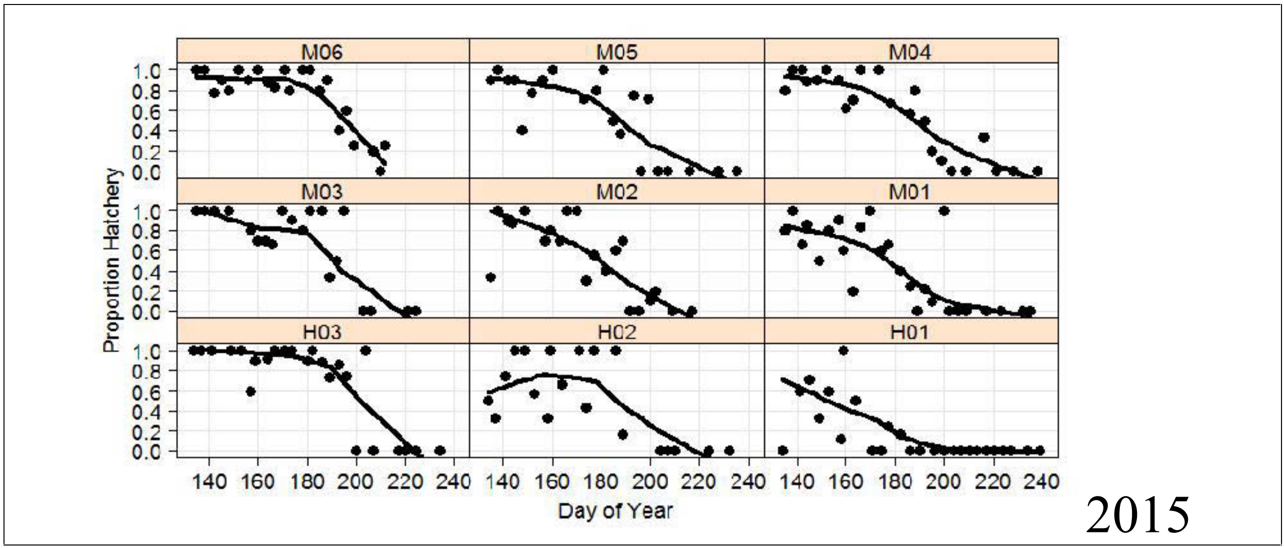


Figure 8. Chum Salmon unweighted hatchery proportions by day of year and Station ID by year. A loess smoothing function is included to illustrate the general temporal trend observed at each ocean station.

The 2015 weighted hatchery proportions calculated for Pink Salmon and Chum Salmon for all Prince William Sound entrances combined were 0.55 (SE = 0.004) and 0.69 (SE = 0.015), respectively. In 2015, Pink Salmon weighted hatchery proportions ranged from 0.08 (SE = 0.004) at station H01 to 0.79 (SE = 0.01) at M06 (Figure 9). Chum Salmon hatchery proportions ranged in 2015 from 0.20 (SE = 0.011) at H01 to 0.85 (SE = 0.046) at H03 (Figure 9). Weighted ocean-entry hatchery fractions can be compared across the three years for each species.

Species Common Name	**Year**	**Hatchery Proportion**	**SE**
Pink Salmon	2013	0.679	.016
	2014	0.864	.03
	2015	0.549	.004
Chum Salmon	2013	0.725	.019
	2014	0.511	.029
	2015	0.688	.015

The estimated relative proportion of hatchery Pink Salmon entering PWS was greatest in 2014 compared to the years of high wild returns (2013, 2015) while the reverse was the case for Chum Salmon (see also Figure 9). These differences, however, were not statistically tested.

Pink Salmon hatchery proportions indicate more hatchery fish were entering PWS at the Montague Strait stations than at the Hinchinbrook Entrance stations (Figure 9) and the hatchery-specific origin was variable across ocean stations (Figure 10). The A.F. Koernig and Solomon Gulch hatcheries appeared to be the largest contributors to Pink Salmon hatchery returns across most stations in 2015 (Figure 10).

Chum Salmon hatchery proportions were variable by ocean sampling stations for 2015 (Figure 9). In 2015 we once again observed lower hatchery proportions in the chum returns through the Hinchinbrook H01 station, as was documented in previous years (Figures 9 and 11). Also, as in previous years, most of the hatchery Chum Salmon originated from Wally Noerenberg Hatchery (Figure 11).

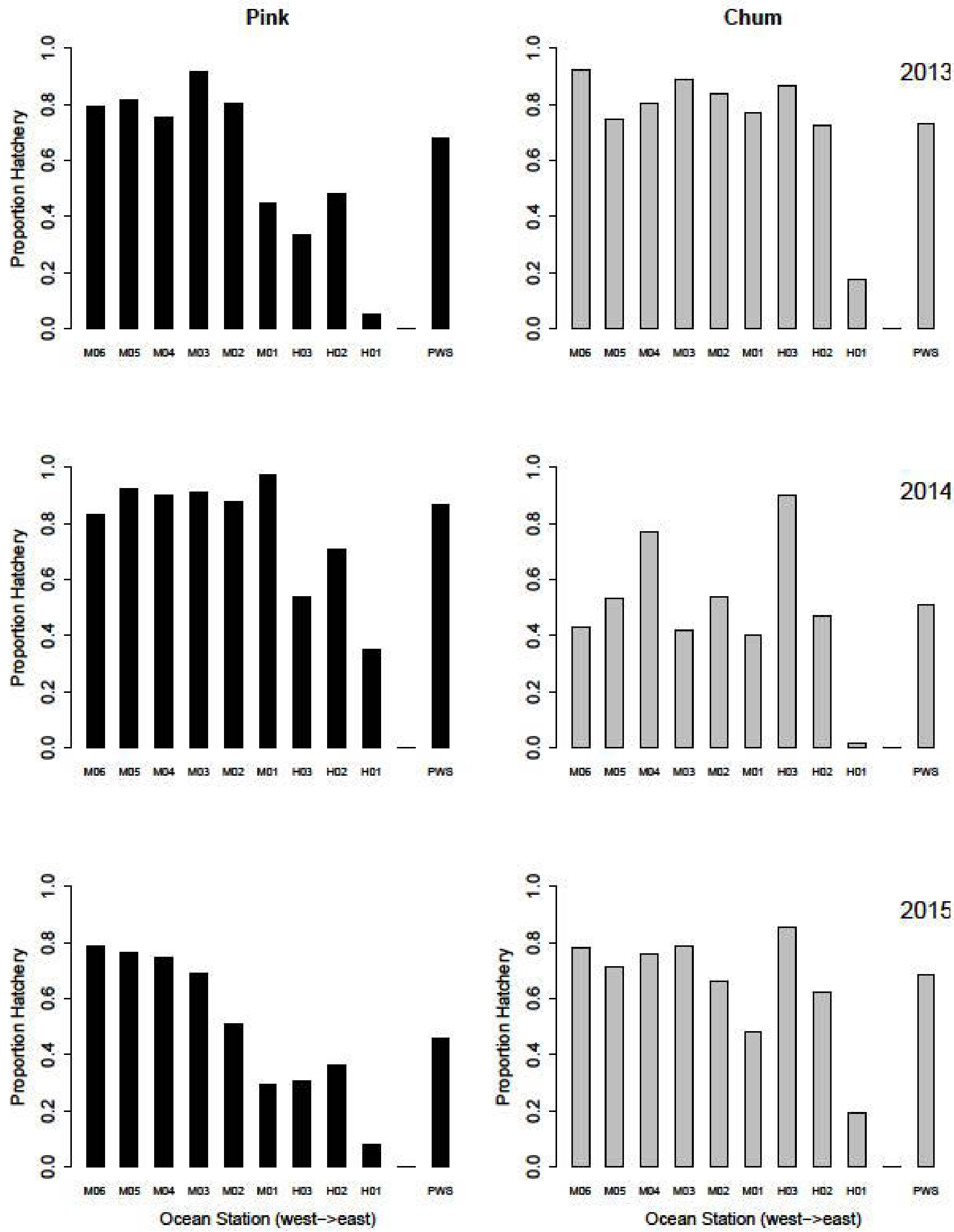


Figure 9. Weighted hatchery proportions of Pink Salmon (left) and Chum Salmon (right) by individual station in 2013-2015. Stations are oriented west to east, left to right. The right-most bar represents the hatchery proportion for the aggregate Prince William Sound run.

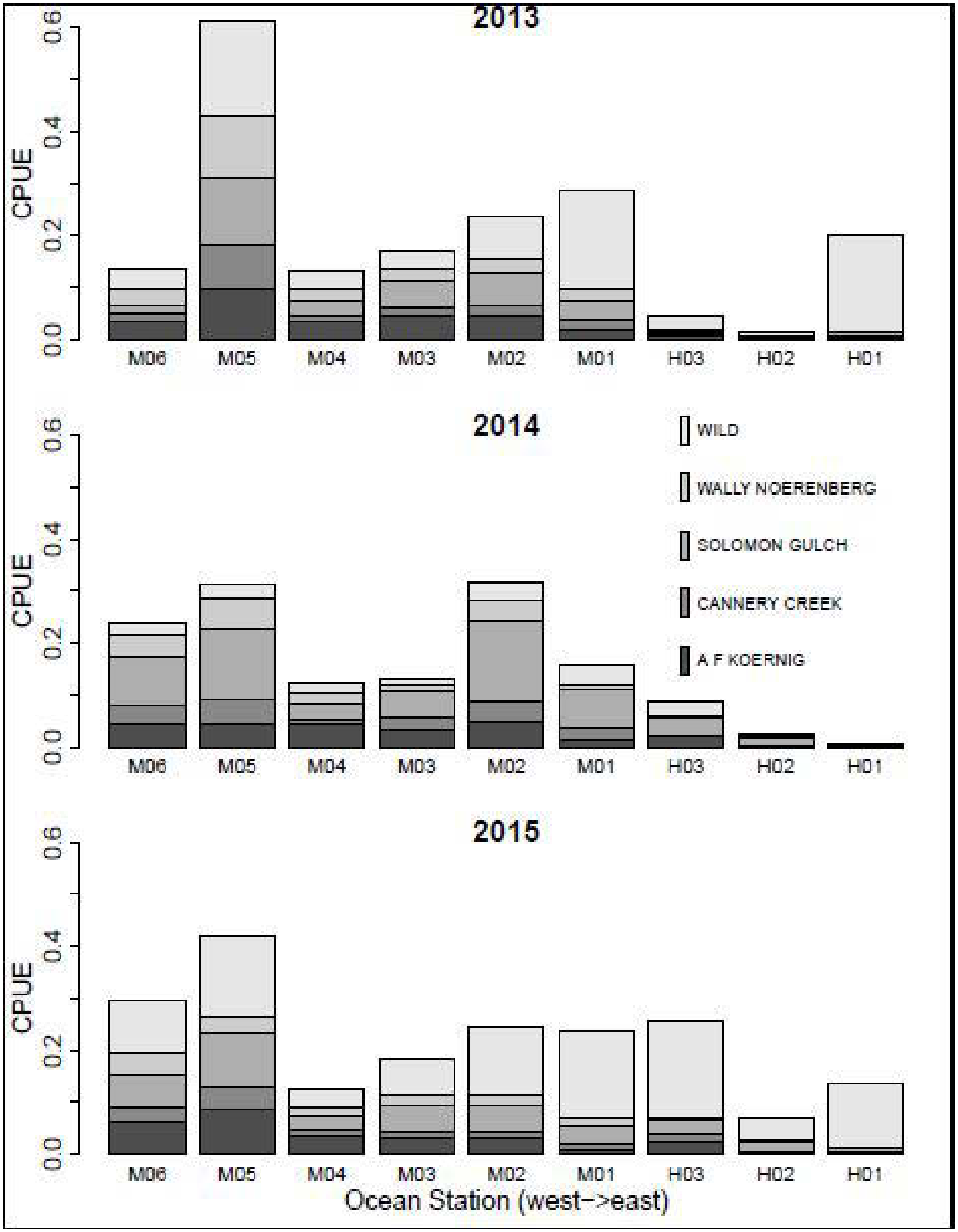


Figure 10. The CPUE of Pink Salmon captured by station during 2013-2015, apportioned by origin. The stations are oriented west to east, with the three Hinchinbrook stations on the right.

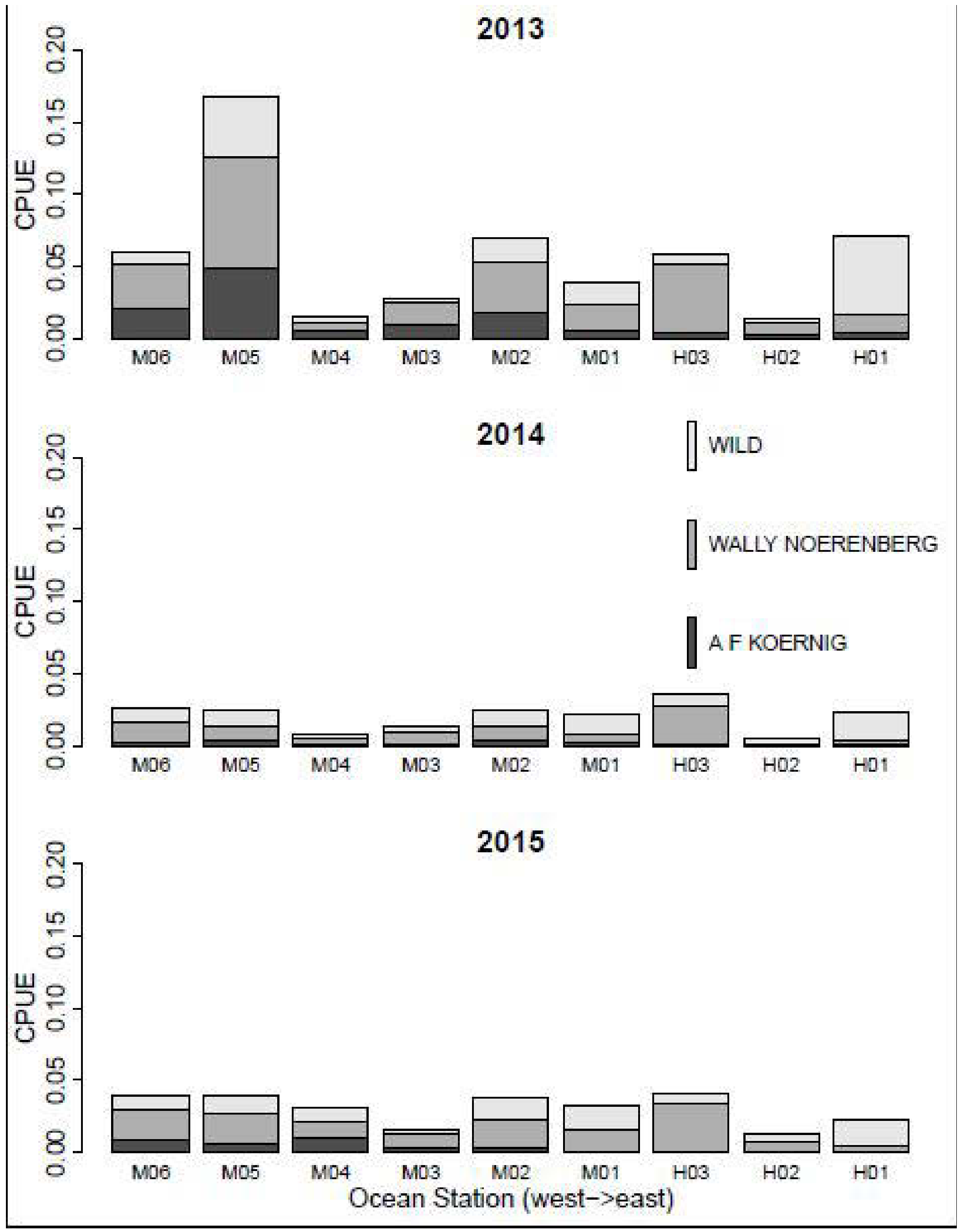


Figure 11. The CPUE of Chum Salmon captured by station during 2013-2015, apportioned by origin. The stations are oriented west to east, with the three Hinchinbrook stations on the right.

.

References

Botz, J., T. Sheridan, A. Wiese, S. Moffitt, R. Brenner. 2014. 2013 Prince William Sound area finfish management report. Alaska Department of Fish and Game, Fishery Management Report No, 14-43, Anchorage.

Cochran, W. G. 1977. Sampling techniques. John Wiley & Sons, New York.

Knudsen, E., M. Buckhorn, K. Gorman, D. Crowther, K. Froning, M. Roberts, L. Marcello, B. Adams, V. O'Connell, D. Bernard. 2015. Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska. Final Progress Report for 2013, For Alaska Department of Fish and Game Contract IHP-13-013, Cordova, Prince William Sound Science Center, Alaska.

Goodman, L. A. 1960. On the exact variance of a products. Journal of the American Statistical Association 55:708-713.

Thompson, S. K. 1992. Sampling. John Wiley & Sons, New York.

Wolter, K. M. 1985. Introduction to variance estimation. Springer-Verlag, New York.

ADULT SAMPLING IN STREAMS

Authors –Kristen Gorman, Ben Adams, Julia McMahon, Eric Knudsen, and Victoria O'Connell

Background

Based on the original RFP from ADF&G, there were two primary purposes for sampling adult Pink Salmon and/or Chum Salmon in streams: 1) to further assess the degree and the range of interannual variability in hatchery straying rates; and 2) determine the effects of hatchery fish spawning with wild populations on the fitness of wild populations. The former was determined by collecting otoliths from spawned out adults. The otoliths were examined in ADF&G laboratories to determine whether the individuals are of hatchery or wild origin. The results are estimates of the percent of hatchery fish that comprise each stream's spawning population. The latter was accomplished by collecting tissues for DNA analysis from adults in a subset of the same streams, referred to here as "fitness" streams. The DNA "markers" of these parents can be used to identify either their pre-emergent offspring collected the following spring, or progeny returning to the streams as adults, so that relative reproductive success (fitness) of hatchery- and natural-origin fish can be estimated for both males and females.

Methods

Data collection for this study required repeated sampling of 32 streams throughout PWS and 32 streams throughout SEAK (Figures 12 and 13) with only slight variations for improvement of the methods used in 2013 and 2014 (Knudsen et al. 2015a, b). The field effort was divided into two major activities: the PWS stream sampling was accomplished by field crews from PWSSC, while the stream sampling in SEAK was subcontracted to the SSSC. Final 2013 stream selection was made based on information provided in the RFP combined with some preliminary evaluations of some streams and discussions with ADF&G staff and the Science Panel, and those same streams were sampled in 2014 and 2015.

In PWS, otoliths were collected for the straying analysis from Pink Salmon adults in 28 of the 32 streams and Chum Salmon otoliths were collected from 18 of the streams (Figure 12). Each PWS stream was sampled during a minimum of three visits per stream. In SEAK, otoliths were collected from Chum Salmon (only) in all 32 streams during at least two, and often more, stream visits (Figure 13). For the fitness studies, DNA tissues were collected along with the otoliths from adult Pink Salmon in six of the PWS streams (Figure 12). DNA tissue samples were not collected from the four SEAK Chum Salmon fitness study streams in 2015 because the first adults from the baseline sampling in 2013 and 2014 will not return as three-year-olds until 2016.

The experimental design elucidated in the RFP for the straying analysis called for collecting a target of 384 otolith samples for each species in each straying study stream, with the sampling spread roughly evenly across the run timing and throughout the salmon-accessible stream length. Because it is extremely difficult to predict the timing and abundance of salmon that will eventually enter the stream, and because it is logistically impossible to arrive at each stream exactly at the best times to sample, we implemented a strategy for "oversampling" whenever possible during the early visits to each stream. This was to create a higher likelihood of achieving the target of 384 in cases where the early visits coincided with the peak availability of adults to sample and subsequent visits yielded fewer than the required samples. The outcomes of this process are described below.

The RFP originally specified that fitness study streams have sampling targets of 500 individuals in high-stray-rate streams and 1,000 individuals in streams with lower stray rates. Subsequent discussions with ADF&G Gene Conservation Laboratory staff and the Science Panel in late 2013, and again in December 2014 and April 2015, indicated the importance of exceeding the sampling targets from these streams. Therefore, a strategy of maximizing the number of samples from fitness streams was increased in 2015 to make every effort to sample the low-fraction fitness streams every day and the high-fraction streams every other day.

Overall Field Sampling Strategy – Prince William Sound

From July 10 through September 23, 2015, six crews sampled 32 streams for adult Pink and Chum Salmon otoliths and Pink Salmon DNA (Figure 12). These crews were directly employed or contracted by the PWSSC. For the straying study, 28 of the 32 streams were sampled for Pink Salmon otoliths and 18 streams were sampled for Chum otoliths. Six fitness streams sampled in 2013 and 2014 were also sampled in 2015 for adult Pink Salmon tissues for genetic tissue samples. The combined efforts of six PWS crews resulted in 311 stream visits and 78,098 otoliths were collected during 2015.

There were three live-aboard vessel based crews, two camping crews, and a Cordova-based crew. These crews required two training sessions and deployed on three different dates in 2015. The contracted vessels were the *M/V Cathy G*, *M/V Auklet* and *S/V Adelie*, the camping crews were Texas A&M University (TAMU) and Paddy Camp, and the local crew was based in Cordova. The *Cathy G*, TAMU, and Cordova crews received training July 13-17, 2015. The *Auklet* and Paddy Camp crews trained July 27-31, 2015. Training included boating, bear and firearms safety, CPR and First Aid, protocol review, tablet use, data entry, and field training. All field crews were deployed the Saturday after training except for the *Adelie* crew, which deployed August 19, 2015 to sample at Hogan Bay during the peak of the run.

All three vessels were contracted, live-aboards, housing between two and six people. First to deploy on July 18, 2015, the *Cathy G* completed three transits around PWS. They made 80 stream visits to 26 straying streams and sampled two fitness streams, Spring Creek and Hogan Bay Creek, late in the season. The *Cathy G* traveled between sampling locations early in the morning and these streams, scattered throughout PWS, were efficiently accessed with the *Cathy G's* landing craft the M/V *Bayhawk.* The *Cathy G* made three Cordova port calls on July 31, August 26 and September 17, 2015 to refuel and resupply. Another vessel-based crew aboard the *Auklet* deployed August 1, 2015 and made one port-call on August 21, 2015. In the beginning of the season, the *Auklet* crew sampled two straying streams and three fitness streams on Montague and Knight Islands. Later in the season, to maximize the number of samples collected during the peak-season, fitness sampling was conducted every day on Stockdale and Gilmore creeks. Last to deploy was the *Adelie* crew of two that took over Hogan Bay Creek fitness sampling from August 21 through August 30, 2015. In 2015, the *Auklet* made 67 stream visits and the *Adelie* made 10 stream visits.

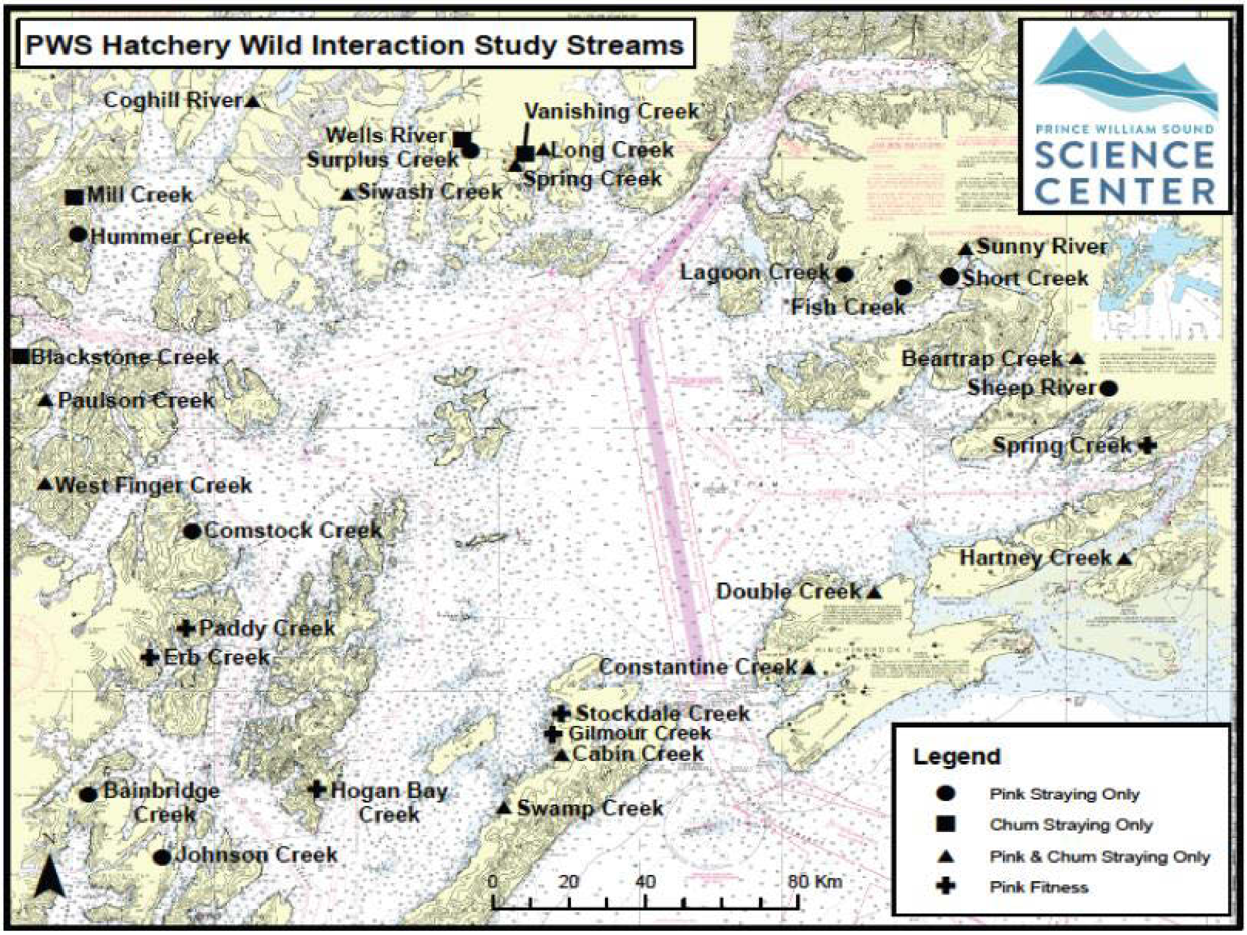


Figure 12. PWS streams sampled for Pink Salmon and Chum Salmon otoliths and DNA tissues.

There were two camping crews in 2015 - one four-person crew subcontracted to TAMU and based in Alice Cove, which sampled Spring Creek, and another four-person PWSSC crew based in Paddy Bay, which sampled Paddy and Erb Creeks. Both crews sampled their fitness streams daily and made a total of 144 stream surveys. The TAMU crew collected samples for six weeks from July 10 to August 21, 2015 making 36 visits to Spring Creek. TAMU returned from the field on August 22, 2015. Then the Cordova and *Cathy G* crews sampled Spring Creek 11 times following the TAMU crew departure with the last survey occurring on September 20, 2015. The Paddy crew was deployed for eight weeks, from August 1 to September 26, 2015 completing 97 fitness stream surveys at Erb and Paddy Creeks. The Paddy crew used a rigid hull inflatable skiff to navigate between camp in Paddy Bay and Erb Creek. The *Cathy G* assisted Paddy camp set-up and take-down by deploying camp on August 3 and taking the camp out on September 24, 2015.

The Cordova crew operated from July 10 through September 13, 2015 with two to seven people. They primarily sampled streams within vehicle and skiff distance of Cordova, but when necessary, they fulfilled time-sensitive sampling goals on more distant streams out of logistical reach by other crews. Many of these trips were made possible by chartering a gillnet vessel or float plane. The Cordova crew made 19 visits to two nearby streams and three distant streams. The nearby streams included Hartney and Spring Creeks (once TAMU left) and the distant streams accessed were Double Creek, Sheep River, and Coghill River.

Stream sampling is a dynamic process influenced by historic run timing, current ADF&G aerial surveys, weather, crew location, and distance between streams. The 2015 crew leaders were astute in making decisions to maximize efficiency and achieve sampling goals. Armed with historic data and current aerial surveys, the field crews strategized sample timing with suggestions from PWSSC, ADF&G, and their own observations to guide their sampling tactics.

Stream Sampling Methods and Execution

Upon arriving at a study stream, the crew leader would indicate where to begin and how to focus on post spawner and carcass collection depending on stream size and tide stage. Sampling began in either the upper stream reaches or lower intertidal zone, and crews worked together for speed or leapfrogged in separate teams for efficiency. Crews were equipped with shotguns and VHF radios for safety. All efforts were made to sample and survey as much of the stream length as possible, accounting for factors such as carcass availability, incoming tide, deep water, strong current, impassable barriers, and bears.

After determining and marking the start location of a survey, all crew members began targeted species collection. Sample collection success at any given processing area depended on carcass abundance and sampling goals. After collecting a sufficient number of carcasses at a processing area, the latitude and longitude of the processing area was marked on the tablet and the crew began processing carcasses.

On fitness study streams, carcasses were aligned in rows of eight by six, mimicking the 48 well deep well plates (DWP). On straying-only streams, carcasses were aligned in rows of 12 by eight; this mimicked the rows and columns of the 96-well otolith trays. The popular cutting technique for accessing both heart DNA tissue and otoliths was to make two cuts. First, a horizontal cut dorsal to the eye was made to expose the brain cavity and otoliths. Second, a ventral cut was made perpendicular to, and slightly posterior of, the isthmus below the gill juncture. This cut exposed tissue of the bulbous arteriosus, a piece of which was removed for genetic analysis. The otoliths and tissue were placed in DWP plates for fitness or stock structure streams. For straying only streams, the second cut was unnecessary and otoliths only were placed in 96-well, otolith trays (See Appendices C and D for specific stream sampling protocols).

The last phase of stream sampling was to perform a fish survey to establish a rough index of fish abundance at the time of the sampling visit. When fish sampling was close to completion, two or more crew members conducted both a live and dead estimate of all Pink Salmon and Chum Salmon throughout the system. If multiple people were counting the same species, estimates were discussed at the end of the survey and averaged to produce a final count. When the survey was complete, a responsible crew member marked the end location of the survey, checked the count numbers, and made any additional comments.

Communication and Data Transmission

All crews had float plans and checked in daily with the PWSSC stream PI on Delorme inReach devices, satellite phone, or personal cell phones. Crews checking in also told the PI the daily count and sample numbers. Satellite and cell phones were used when longer conversations were necessary. Each night all crews backed up data on their laptop computer and to a secondary external drive. Data was transmitted daily, or as soon as internet service was available. Between the tablets, laptop computers, external drive backup, and regular data upload to the host database, the likelihood of data being lost was very low and no data was lost in 2015.

After completion of a final quality control review in Cordova at the end of the season, the straying-only otoliths were delivered to the Cordova ADF&G office for processing on September 24, 2015. Similarly, fitness stream otoliths and tissues were shipped to ADF&G's Gene Conservation Laboratory in Anchorage on September 18 and October 7, 2015 where otoliths were extracted and shipped back to the Cordova ADF&G office for processing. Electronic data delivery to ADF&G followed the quality control review so that otolith and DNA results could be matched to the field observation data.

Overall Field Sampling Strategy – Southeast Alaska

The Sitka Sound Science Center (SSSC) coordinated sampling of 32 Chum Salmon streams across Southeast Alaska in 2015. In contrast to previous years, all 32 of these steams were sampled for otoliths, length, and sex only, to be used just for straying analyses (Figure 13).

The SSSC employed 13 field personnel on a total of four field crews in 2015. Field crews were comprised of three vessel-based crews and a land-based crew in Tenakee Springs. The Tenakee Springs crew was subcontracted; the other three crews were composed of seasonal employees of the SSSC.

Of the 32 otolith-only streams that were sampled, 29 streams were sampled by the vessel-based crews stationed aboard the *M/V Nepenthe, M/V Bear,* and *M/V Surveyor.* These crews sampled the Northernmost, North central, and Southernmost portions of Southeast Alaska, respectively. The crew based in Tenakee Springs sampled two streams in their vicinity and supported the vessel-based crew in sampling a third stream. SSSC employees based in Sitka also sampled from a creek 20 miles south of Sitka.

Field training was held between July 17-21, 2015 for the SSSC seasonal employees. Training included project orientation and goals, field safety, salmon identification, biological sampling techniques, and tablet use for data entry. The Tenakee subcontractors with prior experience did not attend training in Sitka, but received the project protocol in advance of sampling and were instructed on data entry and field methods by the SSSC project coordinator. On July 22, 2015 the three SSSC vessel-based crews departed Sitka to begin sampling. The *M/V Bear* stopped in Tenakee Inlet on July 24, 2015 where they delivered supplies to the Tenakee Springs crew.

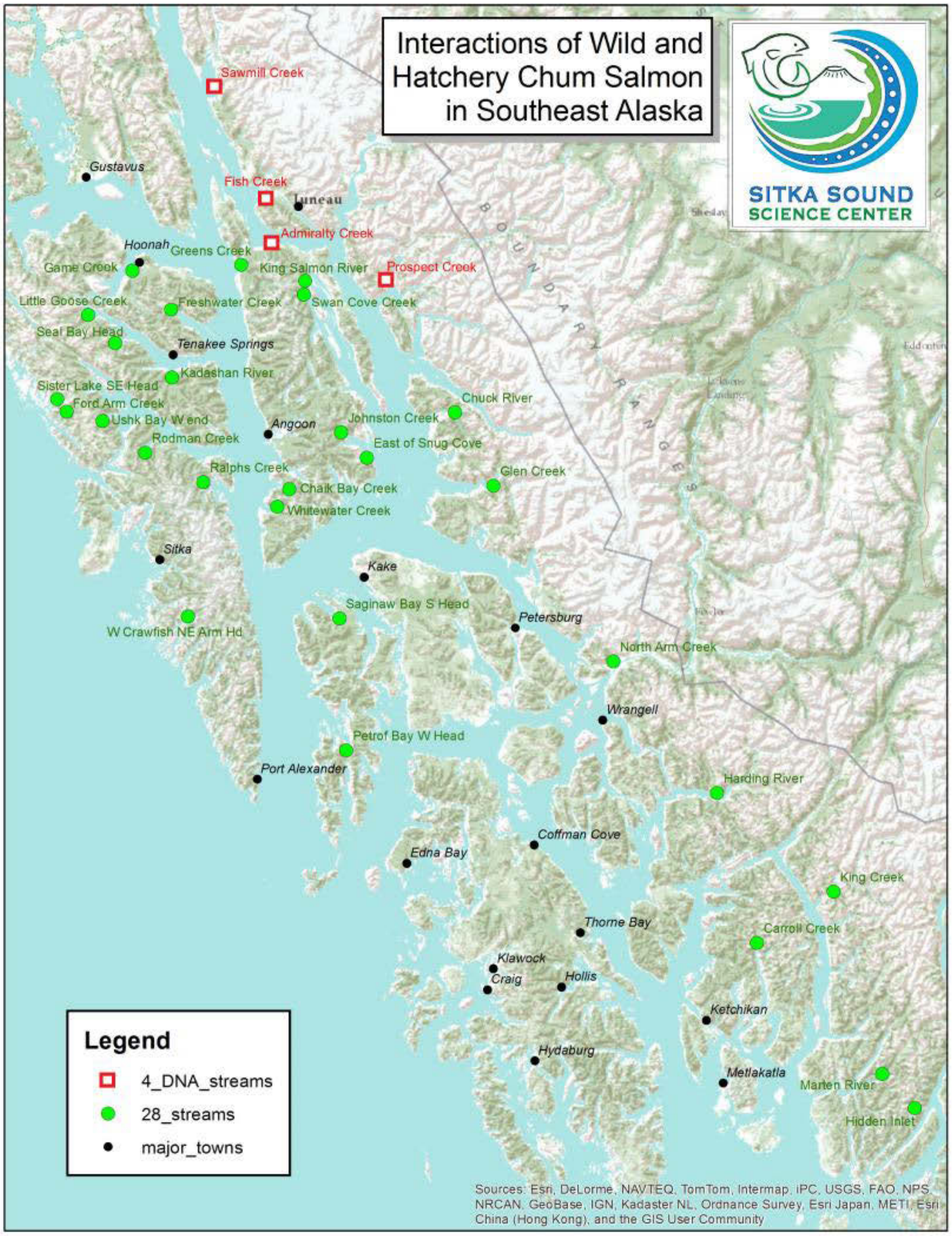


Figure 13. SEAK streams that were sampled for otoliths in 2015 (green dots and red squares). The 4 DNA fitness streams (red dots) were only sampled for otoliths in 2015, but will be sampled for otoliths and DNA tissues starting again in 2017.

Stream Sampling Methods and Execution

Field crews made 2-4 visits to each of the 32 streams in 2015. The *M/V Nepenthe* crew surveyed much of the northern portion of the study area, including streams on Admiralty and Chichagof Islands as well as Douglas Island and the mainland. The *M/V Bear* crew sampled from streams on Baranof, Chichagof, Admiralty, and Kuiu islands as well as the mainland. The *M/V Surveyor* crew focused on the southern portion of the study area, including streams on the mainland as well as Admiralty and Revillagigedo Islands. All vessels had skiffs for beach access and the *M/V Surveyor* crew was also equipped with a jet boat for travelling up the larger Southern area rivers and traversing long tide flats. The *M/V Bear* and *M/V Surveyor* carried three SSSC field crew members, as well as their own three-person crew. One or two of these vessel crewmembers accompanied SSSC personnel into the field to serve as bear protection for each otolith-only stream visit. The *M/V Nepenthe* carried four SSSC crewmembers, as well as their own two-person crew. The SSSC employees on this crew were trained in firearm and bear safety.

The two primary goals of routing vessels to visit the 32 streams were:

- To visit each stream a minimum of two times allowing sampling along the entire length of the anadromous reach.
- To structure visits so that they coincide with both the early and late stages of the run.

Pre-season stream visit itineraries were created for all vessel-based crews to best meet these goals. They took into account historical run timing, data from previous field seasons, distance between streams, and potential weather issues. The SSSC field crew leaders knew that it would be very likely that their schedules would change due to actual run timing and weather. Thus, after each stream visit, crew leaders reported to the SSSC project coordinator the numbers of live/dead fish seen, samples collected, water conditions, and other observations. This information, as well as information from ADF&G aerial and foot surveys, high water events, and other weather-related issues, comprised the basis for in-season schedule changes. Most transits between streams occurred in the evenings. Travel days were scheduled when stream-to-stream distances required over ten hours in transit. Each vessel had occasional resupply days in various ports.

The Northernmost crew sampled a total of seven streams, with support from a graduate student sampling one stream. The North central crew sampled a total of 11 streams, with support from the Tenakee crew sampling one stream, the Northernmost crew sampling three streams, and the Southernmost crew sampling one stream. Many of the streams in the Northernmost and North central portions of Southeast are within close enough proximity that mid-season changes and collaboration between crews could occur without difficulty.

The southern crew sampled a total of 10 streams with support from both Northern crews co-sampling one stream. The SSSC project coordinator and ADF&G foot survey crews also took supplementary samples on one stream. Many of the streams in the southern portion are larger and much farther apart than those in the northern portion (Figure 13). This, when coupled with bad weather, made for slightly fewer visits on the southern portion of Southeast.

The Tenakee Springs crew primarily sampled two otolith-only study streams: Little Goose Creek and Seal Bay Head. They also played a large role in sampling from Kadashan River. They furnished a skiff that was used for day-trips to each location.

Communication and Data Transfer

The SSSC project coordinator communicated daily with the vessel crews using Delorme inReach, satellite-based texting devices. Satellite or cell phone check-ins occurred when longer conversations were needed. The Tenakee area contractors communicated via email and phone and transmitted their stream survey data regularly. The vessel-based crews were able to transmit surveys when within cell phone service.

The three SSSC field crews returned to Sitka between August 31, 2015 and September 2, 2015 for gear storage and debriefing. The Tenakee Springs returned all gear via USPS shipping.

Specific Biological Sampling Methods

Every effort was made to use consistent field methodologies throughout the data collection in both regions. Detailed methodological protocols were developed to guide 2015 field data collection (Appendices C-D). The protocols were developed primarily from previous practices established within ADF&G, modified as necessary to facilitate the current study and from experience in 2013 and 2014. The protocols included specific methods for biological sampling including techniques for collecting post-spawned adult salmon, extracting otoliths, measuring lengths, determining sex, and collecting tissues for Pink Salmon DNA analysis in PWS fitness streams. Consistent methods and collection trays were used throughout the study. All otoliths were sent to the respective ADF&G labs for processing (Cordova and Juneau), while DNA tissue samples were sent to ADF&G's Gene Conservation Lab in Anchorage for processing.

All field data were collected on-site using electronic tablets running an Android application developed specifically for collecting this project's data (developed under a subcontract to Finsight LLC of Juneau). Guidance for the use of the field tablet application for data collection was integrated into the protocols. A more rigorous process of field and post-field quality control was implemented in 2014 and improved in 2015. All otolith and DNA samples were checked for completeness and accuracy at the end of each sample tray row, before leaving a processing area, and at the end of the day. Data errors were immediately corrected in the tablet or on the laptop.

A project SQL database was also established in 2013 and modified for the 2014 and 2015 seasons by Finsight LLC. Field data was backed up nightly on laptop computers and then uploaded to the host database from the laptops whenever the crews had access to the internet. The survey data were imported nightly from the tablets to laptop computers where they were run through a series of quality assurance checks on a custom laptop application.

Hatchery Fraction Data Analysis

As in 2013 and 2014, the objectives of the field sampling in 2015 on the spawning grounds of PWS and Southeast included estimates for the fractions of hatchery fish in each spawning population of Pink and Chum Salmon that year. Sampling followed a stratified, two-stage design in which districts are strata, streams are first-stage sampling units, and fish the second-stage units. Streams included in the study were chosen randomly with probability proportional to their size, based on the 25-year average of spawning abundance indices generated from aerial surveys by ADF&G over years 1986 through 2010 (see Botz et al. 2014). The number of streams to sample for the hatchery fraction study was allocated across PWS districts proportional to run size (summed abundance indices) according to procedures in Cochran (1972). Streams to be sampled within a district were selected with probability according to run size (again abundance indices) with replacement. Each sampled stream was visited at least three to five times from late July through late September in PWS and two to five times from late July to end of August in Southeast. The number of dead and live salmon of each species was usually counted in the stream during each visit, and otolith samples were taken from dead or moribund salmon during each visit. An otolith was excised from each sampled salmon, and its origin (hatchery or wild) was determined later after sampling had finished.

Estimated Fractions and Estimated Variances

By the District (PWS) or Sub-region (Southeast)

From Thompson (1992, p. 132), an unbiased estimate of the population total ^{2} from any multi-stage sampling design in which the first-stage units (here streams) were chosen proportional to their size with replacement is:

$$\tau = \frac{1}{n}\sum_{i=1}^{n}\frac{\tau_i}{\pi_i}, \qquad \pi_i = \frac{M_i}{M}, \quad \text{and} \quad \tau_i = M_i\bar{y}_i, \qquad \text{(1a, 1b, 1c)}$$

where in this study τ is an unbiased estimate of the number of hatchery fish on the spawning grounds in a district (PWS) or sub-region (Southeast), *n* is the number of first-stage units visited in that district, π_i is the relative size of the *i*th stream among all streams in the district[4], M_i is the number of second-stage units (hatchery and wild spawning fish) in *i*th stream in that district, *M* is the number of spawning fish in the district, τ_i is the estimated number of hatchery salmon on the spawning grounds in the *i*th stream, and $\bar{y}_i$ is the estimated fraction of hatchery spawning fish on the spawning ground of the *i*th stream. However, the objective of our field study is not to estimate the total number of hatchery-produced Chum Salmon or Pink Salmon on the spawning ground, but to estimate the mean hatchery fraction of the spawning population across all streams. The estimated mean fraction over all streams $\bar{q}$ is found by dividing the estimated number of salmon of hatchery origin in the spawning population (here τ) by the spawning abundance *M* of the target species in the district:

$$\bar{q} = \tau / M = \frac{1}{M}\frac{1}{n}\sum_{i=1}^{n}\frac{M_i\bar{y}_i}{M_i/M} = \frac{1}{n}\sum_{i=1}^{n}\bar{y}_i \qquad (2)$$

Thompson (1992) provides the following equation for estimating the variance for the population total under these circumstances:

---

[4] Identifiers τ, *y*, and *q* are estimates, while identifiers π, *M*, and *n* are actual values.

$$v(\tau) = \frac{1}{n(n-1)} \sum_{i=1}^{n} \left(\frac{\tau_i}{\pi_i} - \tau \right)^2 . \qquad (3)$$

Dividing the above equation by the square of the number on the spawning grounds within the district (*M*) provides the estimated variance for the estimated fraction of hatchery fish in the population:

$$v(\bar{q}) = v(\tau) / M^2 = \frac{1}{M^2} \frac{1}{n(n-1)} \sum_{i=1}^{n} \left(\frac{\tau_i}{\pi_i} - \tau \right)^2 = \frac{1}{n(n-1)} \left(\sum_{i=1}^{n} \bar{y}_i^2 - \frac{\left(\sum_{i=1}^{n} \bar{y}_i \right)^2}{n} \right) . \qquad (4)$$

By the Stream

Part of the sampling design described above is that a single sample of m_i salmon is drawn randomly from each of the *n* streams in a district[5]. Each fish in the sample is scored with a "1" if it's a hatchery fish, or a "0" if otherwise. The sum of these m_i recordings is divided by m_i to produce $\bar{y}_i$ for that stream. However, streams in our study were visited several times each to account for changes in the hatchery fraction in the stream over the season. A quasi-random sample from the spawning population was drawn during each visit to estimate the hatchery fraction during that visit. The term quasi-random is used because we assumed that natural forces were sufficient to have distributed hatchery fish evenly among the spawning population such that the sample was representative of the spawning population at the time of the visit. Under these circumstances, the weighted average for the *i*th stream across visits is:

$$\bar{y}_i \equiv \bar{q}_i = \sum_{v=1}^{V_i} w_{iv} q_{iv} \text{, where } w_{iv} = \frac{C_{iv}}{\sum_{v'=1}^{V_i} C_{iv'}} \text{ and } q_{iv} = \frac{\sum_{j=1}^{m_{iv}} y_{ijv}}{m_{iv}} \text{, and} \qquad (5a, 5b, 5c)$$

where *v* denotes a visit, V_i is the number of visits to the *i*th stream, C_{iv} the number of dead/live salmon counted during a visit, m_{iv} the number of fish of the target species sampled in a visit, and y_{ijv} is the result of sampling a fish (y_{ijv} = 1 if the fish is of hatchery origin, 0 otherwise). The estimated mean fraction across visits is an unbiased estimate for the mean hatchery fraction for the stream.

From Thompson (1992) the variance of the $\bar{y}_i$ is implied in Equation 4 when first-stage units are selected with a probability according to their size and second-stage units are selected randomly. While first-stage units were so selected in our study, second-stage units were not strictly selected randomly. Nevertheless, several factors ameliorate the need to explicitly consider the variance for $\bar{y}_i$:

1. the frequent visits to streams;
2. the large number of fish sampled during the season;

---

[5] Identifier *w*, *v*, *V*, *C*, and *m* are actual values.

3. weights were based on actual counts;
4. the effect of random (quasi) sampling in the design; and
5. fractions were often unchanging across visits (often near zero).

For these reasons Equation 4 as written was used to express uncertainty in estimated hatchery fractions for the spawning populations in the districts.

For the Entire PWS or Southeast

Equations above are germane to any population sampled according to a two-stage design, a population that in our situation is the spawning population in a district of PWS or sub-region of Southeast. Given that there are nine such districts in the Sound[6], there are potentially nine populations per species. Similarly, there are three sub-regions in Southeast. An unbiased estimate of the hatchery fraction for a species across all districts is:

$$\hat{q} = \sum_{h=221}^{221,\ldots,229} W_h \overline{q}_h \text{ , where } W_h = \frac{A_{h(2013)}}{\sum_{h'=221}^{221,\ldots,229} A_{h'(2013)}} \text{ , and} \qquad (6a, 6b)$$

where h denotes stratum (district), $A_{h(2013)}$ the aerial abundance index by ADFG for stratum (district) h in 2013, and $\overline{q}_h \equiv \overline{q}$ in Equation 2 (the specific district or sub-region is now explicitly identified), and $\hat{q}$ is the estimated fraction of hatchery fish across the entire Sound or Southeast. The estimated variance for the estimated sound-wide fraction $\hat{q}$ is:

$$v(\hat{q}) = \sum_{h=221}^{221,\ldots,229} W_h^2 v(\overline{q}_h) \text{ .} \qquad (7)$$

The calculations described above were first explicitly framed in Excel and then coded into R statistical software for repetitious analytical runs. Equations for calculating stray rates of hatchery Pink and Chum Salmon at the level of study stream, district or sub-region, and then region, for both PWS and SEAK, were implemented in R (R Core Team 2014) following the equations defined above.

Results

Overall, the stream sampling was successful relative to the goals of the project, as described further below. A total of 88,749 individual fish were sampled from all PWS and SEAK streams and species combined in 2015. Many streams were sampled beyond their targets and others were below the targets. A combination of increased effort on PWS fitness streams and better fish availability and weather generally contributed to increased success in 2015 compared to 2013 or 2014 when about 33,500 and 30,600 individuals were sampled.

---

[6] There are only 8 districts in regards to PWS Chum Salmon in that District 229 (the Unakwik District) has virtually no Chum Salmon spawning in the district.

PWS Stream Sampling Results

Pink Salmon and Chum Salmon were observed in all streams sampled across PWS, where the general pattern of Pink Salmon running in streams was earlier in the season in northeast PWS and later for the southwest portions of PWS. In 2015, record numbers of Pink Salmon returned to PWS. This significantly increased the sampling on fitness streams in order to sample the greatest proportion of returning fish.

Pink Salmon Hatchery Fraction Sampling

Across all 28 streams sampled for Pink Salmon otoliths (Figure 12), 70,815 pairs of otoliths were taken, reaching or exceeding the sampling goal in all streams (Table 2). Oversampling, as described in the general methods, occurred during the peak of the Pink Salmon run at most streams. Further, 2015 was a record year for Pink Salmon returns in PWS in general, especially as compared with 2013, which was also a record season at the time (Botz et al. 2014). The number of samples varied per stream visit (Appendix F). Foot survey-based live and dead counts were made on all stream surveys (Appendix F) and then later used to weight the hatchery fraction estimates per visit based on dead counts.

Table 2. Summary of sampling and hatchery fractions by stream for PWS Pink Salmon in 2015. Target sample size per stream was 384 for estimating the hatchery fraction. Counts of live and dead salmon were taken during each visit with dead counts used to weight the hatchery fraction of salmon sampled each visit to produce weighted average seasonal hatchery fractions for each stream.

Stream name	AWC code	Samples collected 2015	Number of stream visits 2015	Average hatchery fraction weighted by counts per visit (2013)	Average hatchery fraction weighted by counts per visit (2014)	Average hatchery fraction weighted by counts per visit (2015)
Hartney C	221-10-10020	557	9	0.024	0.072	0.011
Spring (fitness)	221-20-10200	12469	47	0.031	0.040	0.009
Sheep R	221-20-10360	576	3	0.000	0.013	0.002
Beartrap R	221-30-10480	480	3	0.025	0.001	0.013
Sunny R	221-40-10875	447	4	0.000	0.022	0.016
Short C	221-40-10880	580	3	0.006	0.081	0.039
Fish C	221-40-10890	606	3	0.000	0.054	0.026
Lagoon C	221-40-10990	628	3	0.016	0.077	0.055
Long C	222-10-12140	454	4	0.070	0.415	0.161
Spring C	222-10-12170	611	3	0.002	0.017	0.037
Delta C	222-20-12335	536	3	0.010	0.294	0.172
Siwash R	222-20-12640	599	3	0.098	0.367	0.324
Coghill R	223-30-13220	485	5	0.018	0.099	0.000
Hummer C	224-10-14240	553	3	0.020	0.197	0.206
Paulson C	224-10-14550	614	3	0.058	0.005	0.212
W. Finger C	224-40-14850	436	3	0.025	0.000	0.053
Comstock C	225-20-15040	445	4	0.868	0.899	0.807
Paddy C	226-20-16010	8710	47	0.154	0.595	0.328
Erb C	226-20-16040	13039	50	0.113	0.228	0.214
Bainbridge C	226-20-16300	620	3	0.174	0.000	0.169
Hogan Bay	226-30-16810	9441	29	0.640	0.915	0.583
Johnson C	226-40-16269	624	3	0.370	0.712	0.387
Swamp C	227-20-17390	628	5	0.063	0.125	0.130
Cabin C	227-20-17464	557	5	0.103	0.321	0.107
Gilmour C [b]	227-20-17480	6548	20	NA	0.557	0.225
Stockdale C	227-20-17520	8602	22	0.163	0.735	0.240
Double C	228-40-18310	400	3	0.002	0.048	0.013
Constantine C	228-60-18150	570	3	0.000	0.023	0.006

[a] Formerly erroneously designated as Surplus Creek in 2013 and 2014 reports but Delta Creek was actually sampled consistently in all three study years.

[b] Data collected and hatchery fraction calculated at the stream level but Gilmour Creek was not included in the district or PWS-wide hatchery fraction estimations because it was not part of the original hatchery fraction experimental design.

Chum Salmon Hatchery Fraction Sampling

A total of 6,492 Chum Salmon samples were taken with sampling goals reached or exceeded in 12 out of 17 streams in the analysis (Figure 12, Table 3). The least productive streams for Chum Salmon samples were Blackstone Creek (13.3% of the sampling goal), Siwash (32.8%), Paulson (37.2%), Spring (44.3%), and Swamp (52.1%) Creeks, and the Coghill River (60.9%). Because Blackstone Creek had such low numbers of Chum Salmon, we also surveyed nearby Tebenkof Creek, which added 45 samples (see Appendix H for more details). Tebenkof Chum Salmon samples were combined with those from Blackstone for the hatchery fraction analysis.

Oversampling was possible in many Chum Salmon systems such as Beartrap Creek, Vanishing Creek, and Mill Creek. The number of Chum samples varied per stream visit (Appendix G). Foot survey-based live and dead counts were made on most stream surveys (Appendix G) with dead counts later used to weight the hatchery fraction estimates per visit. See Appendix H for more details on the sampling of each PWS stream.

Table 3. Summary of sampling and hatchery fractions by stream for PWS Chum Salmon in 2015. Target sample size per stream was 384 for estimating the hatchery fraction. Counts of live and dead salmon were taken during each visit with dead counts used to weight the hatchery fraction of salmon sampled each visit to produce weighted average hatchery fractions for each stream.

Stream name	AWC code	Samples collected 2015	Number of stream visits 2015	Average fraction weighted by counts per visit 2013	Average fraction weighted by counts per visit 2014	Average fraction weighted by counts per visit 2015
Hartney C	221-10-10020	535	9	0.005	0.034	0.022
Beartrap R	221-30-10480	554	3	0.005	0.051	0.014
Sunny R	221-40-10875	384	4	0.001	0.038	0.003
Long C	222-10-12140	428	4	0.261	0.058	0.075
Vanishing C	222-10-12157	548	3	0.045	0.025	0.027
Spring C	222-10-12170	170	3	0.023	0.000	0.009
Wells R	222-20-12340	469	3	0.021	0.065	0.045
Siwash R	222-20-12640	126	3	0.049	0.120	0.326
Coghill R	223-30-13220	234	5	0.049	0.000	0.008
Mill C	224-10-14210	628	3	0.042	0.003	0.011
Tebenkoff[a]	224-10-14500	45	3	NA	NA	NA
Blackstone C	224-10-14510	6	3	0.093	0.000	0.065
Paulson C	224-10-14550	143	3	0.056	0.043	0.040
W. Finger C	224-40-14850	474	3	0.017	0.015	0.038
Swamp	227-20-17390	200	5	0.601	NA	0.794
Cabin C	227-20-17464	519	5	0.965	0.803	0.897
Double C	228-40-18310	422	3	0.039	0.001	0.026
Constantine C	228-60-18150	612	3	0.005	0.000	0.035

[a] Samples from Tebenkof Creek were combined under neighboring Blackstone Creek for the analyses described below.

PWS Pink Salmon Fitness Sampling

Overall, sampling was successful at all of the six selected Pink Salmon PWS fitness study streams in 2015 (Table 4). Unlike in 2014, Spring Creek was highly productive with large number of Pink Salmon running from early to late in the season. Because 2015 was a record year for Pink Salmon returns in PWS, sampling on fitness streams was intense in order to sample the greatest proportion of spawning fish on each stream (see Appendix H for more details on the sampling of each PWS stream).

Table 4. Total Pink Salmon DNA and otolith samples collected in Prince William Sound during July through September 2015.

Stream name	AWC code	Total collected	Visits
Erb Creek	226-20-16040	13,039	50
Gilmour Creek	227-20-17480	6,548	20
Hogan Creek	226-30-16810	9,441	29
Paddy Creek	226-20-16010	8,710	47
Spring Creek	221-20-10200	12,469	47
Stockdale Creek	227-20-17520	8,602	22
	Total	58,809	215

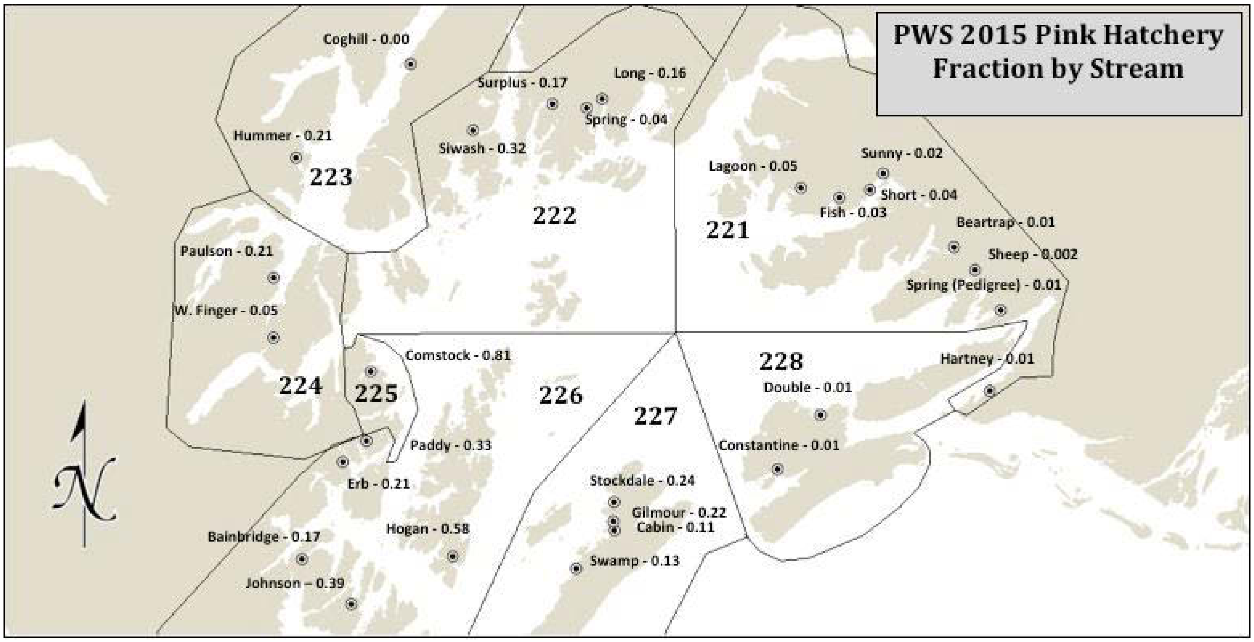
PWS Stream Hatchery Fraction Results

Pink Salmon and Chum Salmon hatchery fractions in the natural spawning streams were analyzed at the level of study stream, district, and then PWS-wide.

PWS Pink Salmon Hatchery Fractions

At the stream level (n = 28), fractions of straying hatchery Pink Salmon ranged from 0 at the Coghill River to 0.81 in Comstock Creek in 2015 (Table 2, Figure 14). Other study streams with notable straying fractions of hatchery Pink Salmon were Hogan Bay, Johnson, Paddy and Siwash Creeks (0.58, 0.39, 0.33, 0.32, respectively). All other study streams had hatchery fractions less than 0.25. Some 2015 straying fractions of hatchery Pink Salmon by study stream varied from those observed in 2013 and 2014 (Table 2).

Figure 14. PWS Pink Salmon hatchery stray rates by stream in 2015. Black lines represent district borders.



Hatchery Pink Salmon straying fractions in 2015, and their associated variances, across management districts in PWS are reported in Table 5 (n=27 as Gilmour Creek was excluded from district and sound-wide analyses, since it was not part of the original experimental design).

Table 5. Estimated PWS Pink Salmon district-wide stream hatchery fractions and their standard errors 2013 - 2015. The aerial survey fraction for each district was used to weight the contribution of each district to the overall fraction estimate.

District	Estimated hatchery fraction (2013)	Estimated hatchery fraction (2014)	Estimated hatchery fraction (2015)	Estimated hatchery SE (2015)	Number of streams sampled	Aerial survey fraction for district (2015)
Eastern (221)	0.013	0.045	0.021	<0.001	8	0.223
Northern (222)	0.045	0.273	0.173	0.003	4	0.109
Coghill (223)	0.018	0.099	0.000	NA	1	0.112
Northwestern (224)	0.034	0.067	0.157	0.003	3	0.063
Eshamy (225)	0.868	0.899	0.807	NA	1	0.010
Southwestern (226)	0.290	0.490	0.336	0.005	5	0.110
Montague (227)	0.110	0.394	0.159	0.002	3	0.090
Southeastern (228)	0.001	0.036	0.010	<0.001	2	0.283
Overall	0.044	0.148	0.095	0.035	27	1.000

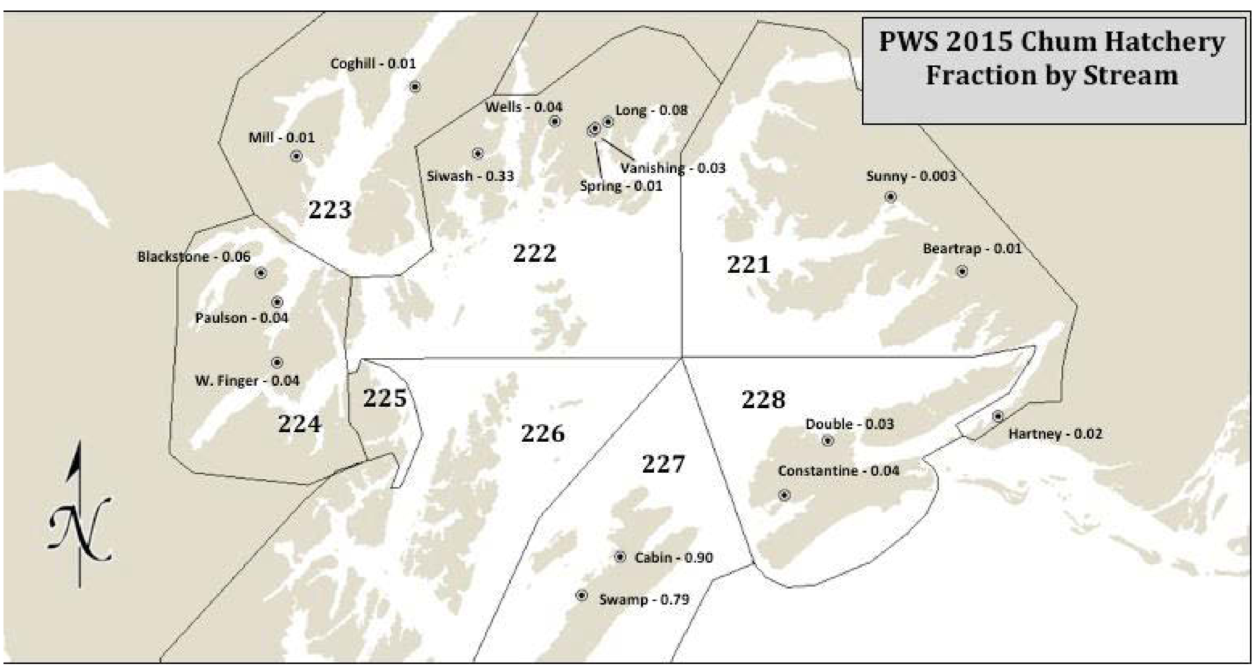
Based on these results, the Eshamy management district in PWS had the highest fraction of hatchery Pink Salmon due to the fact that Comstock Creek is the only study stream in this district and it had the highest straying fraction of hatchery Pink Salmon of all study streams. The

Southwestern district had the second highest district-wide straying fraction of hatchery Pink Salmon (0.34). The Northern, Northwestern, and Montague districts all had hatchery fractions close to 0.16. The remaining three districts had hatchery fractions ≤ 0.02. All districts except Eshamy (represented by one stream) exhibited apparently lower hatchery fractions in 2015 than 2014, but six out of eight districts had higher fractions in 2015 in comparison with 2013 (Table 5). For the entire PWS region in 2015, the straying fraction of hatchery Pink Salmon in all spawning streams was calculated to be 0.096 ± 0.035. This hatchery fraction estimate was apparently greater than it was in 2013, but lower than 2014 (Table 5).

PWS Chum Salmon Hatchery Fractions

At the stream level (n = 17), hatchery fractions of PWS Chum Salmon ranged from 0.003 to 0.90 in 2015 (Table 3, Figure 15). Straying of hatchery Chum Salmon was detected at all study streams in PWS. Like 2014, Cabin Creek had the highest Chum Salmon hatchery fraction among all study streams in 2015 (0.90). Swamp Creek had the next highest return of hatchery fish in 2015 (0.79). (Interestingly, no Chum Salmon returned to Swamp Creek in 2014.) Siwash Creek had a moderate fraction of hatchery fish observed in 2015 (0.33). All other study streams had lower hatchery fractions (< 0.09). Hatchery fractions of Chum Salmon by study stream in 2015 varied from those observed in 2013 and 2014, however, Swamp and Cabin Creeks consistently had large fractions of hatchery fish over all three years of the study (Table 3).

Figure 15. PWS Chum Salmon hatchery stray rates by stream in 2015. Black lines represent district borders.



Based on estimated hatchery fractions across management districts in PWS, the Montague management district had the highest fraction of hatchery Chum Salmon in 2015 (Table 6). Both Cabin and Swamp Creeks are in the Montague management district and these streams had the highest fractions of hatchery Chum Salmon among all study streams in 2015. The Coghill management district had the lowest fraction of hatchery Chum Salmon in PWS during 2015 (0.008). All but one district (Eastern) apparently had higher Chum Salmon hatchery fractions in 2015 than in 2014 (Table 6). For the entire PWS region in 2014, the straying fraction of hatchery Chum Salmon on spawning streams was estimated to be 0.031, very similar to the 2013 and 2014 estimates (0.028, 0.032, Table 6).

Table 6. Estimated PWS Chum Salmon district-wide stream hatchery fractions and their standard errors 2013-2015. The aerial survey fraction for each district was used to weight the contribution of each district to the overall fraction estimate.

District	Estimated hatchery fraction (2013)	Estimated hatchery fraction (2014)	Estimated hatchery fraction (2015)	Estimated hatchery fraction SE (2015)	Number of streams sampled	Aerial survey fraction for district (2015)
Eastern (221)	0.004	0.041	0.013	<0.001	3	0.457
Northern (222)	0.080	0.054	0.097	0.003	5	0.180
Coghill (223)	0.049	0.000	0.008	NA	1	0.064
Northwestern (224)	0.052	0.015	0.038	<0.001	4	0.030
Montague (227)	0.783	0.803	0.846	0.003	2	0.072
Southeastern (228)	0.022	0.000	0.031	<0.001	2	0.189
Overall	0.028	0.032	0.031	0.025	17	1.000

Southeast Alaska Stream Sampling Results

SSSC field crews were highly efficient in the 2015 season, conducting 116 stream visits in 45 days. There were fewer total stream visits in 2015 vs 2014 because we were not maintaining the nearly daily presence on fitness streams. The added benefit of having three vessel-based crews, each of which was covering a large geographic area, allowed for schedules to be easily manipulated and was the key to our success on many of the creeks in 2015. Roughly once a week a crew would either stay on a stream for two days in a row, or return to a stream at a different time than originally scheduled, both without consequence to later stream visits. This flexibility across the region was not possible in previous seasons.

The increase in visit frequency allowed us to keep track of run timing based on our own observations. Project coordinators still maintained good communication with ADF&G Area Management Biologists, but relied more heavily on their own findings in the field to decide future visit timing. In-season communication between field crews and project coordinators regarding sample numbers, field logistics, and other pertinent topics were discussed at length throughout the project, leading to multiple schedule revisions while maintaining proper visit timing as a priority. Altogether, the run coverage and average sample load on each creek was much better in 2015 than any other season to date.

Unlike the 2014 field season, where we saw historically high rainfall and low Chum Salmon returns, both of which greatly affected our success in accessing creeks and collecting samples, the 2015 season was met with good conditions and plentiful Chum Salmon across the region.

For most Southeast streams sampled in 2015, Chum Salmon numbers were much higher than in 2014. On others, we saw the most Chum Salmon of any season to date and on a select few, we saw fewer than any season to date. Lower counts were especially noticeable on Kadashan River, the King Salmon River, Little Goose Creek, and Seal Bay Head. On some streams we have now seen very low numbers of Chum Salmon three years in a row. This is especially true on Glen Creek and Saginaw Creek where we have yet to see over 200 Chum Salmon, live or dead, in the river during any visit in any year. On many occasions there never appeared to be a strong concentration of spawning fish, but rather a collection of small groups lingering in pools throughout the stream.

Higher counts were also seen, especially on Ford Arm, Game Creek, Hidden Inlet, King Creek, and the Marten River. While some of these higher counts may be attributed to more spatial coverage and time spent on the stream, there is no doubt that we saw more chums here than in any other year.

Several high water events occurred during the season, which created dangerous conditions where we were unable to safely wade in the upper reaches of streams. Despite these circumstances, our crews always got ashore and made the most of the day by sampling the lower reaches or tide flats during high water. However, our progress was never truly stopped because of flooding in 2015.

Strong winds were another factor that occasionally prevented us from travelling or adequately sampling. Occasionally, when we would know that a storm was brewing, we would rearrange the schedule in order to reach the more exposed creeks while travel was still possible. There were only a few occasions where crews had to stand down altogether and wait for conditions to improve. Once conditions did improve, we had to prioritize creeks and do our best to make up for lost time. This is especially true for the *M/V Bear* crew. See Appendix J for details of surveys on each Southeast stream.

Chum Salmon Hatchery Fraction Sampling

Chum Salmon were sampled for otoliths in 32 streams across Southeast Alaska (Figure 13). SSSC field crews visited the 32 otolith-only streams 2-4 times each from July 12 to September 2, 2015. Field crews collected a total of 10,651 pairs of otoliths across all Southeast Alaska streams (see Appendix I for a listing of each Southeast stream survey). We exceeded ADF&G's otolith sampling goal of 384 at 16 of the 32 streams (Table 7).

Table 7. Summary of sampling and hatchery fractions by stream for SEAK Chum Salmon in 2015. Target sample size per stream was 384 for estimating the hatchery fraction. Counts of live and dead salmon were taken during each visit with dead counts used to weight the hatchery fraction of salmon sampled each visit to produce weighted average hatchery fractions for each stream.

Stream name	AWC code	Samples collected 2015	Stream visits 2015	Average hatchery fraction weighted by counts per visit (2013)	Average hatchery fraction weighted by counts per visit (2014)	Average hatchery fraction weighted by counts per visit (2015)
Hidden Inlet	101-11-11010	409	2	0.063	0.062	0.052
Marten River	101-30-10600	593	3	0.047	0.091	0.030
Carroll Creek	101-45-10780	480	2	0.044	0.027	0.021
King Creek	101-71-10040-2006	423	4	0.084	0.023	0.021
Harding River	107-40-10490	92	2	0.167	0.050	0.127
North Arm Creek	108-40-10150-2007	363	3	0.043	0.031	0.036
Saginaw Bay S Head	109-44-10370	35	3	0.007	0.149	0.160
Petrof Bay W Head	109-62-10240	402	2	0.000	0.004	0.015
Johnston Creek	110-23-10100	503	3	0.026	0.000	0.006
East of Snug Cove	110-23-10210	549	3	0.000	0.000	0.042
Chuck River	110-32-10090	153	2	0.013	0.070	0.095
Glen Creek	110-34-10060	5	2	0.014	0.000	0.400
Swan Cove Creek	111-16-10450	334	4	0.029	0.000	0.010
King Salmon River	111-17-10100	311	3	0.028	0.002	0.010
Prospect Creek	111-33-10100	111	3	0.241	0.040	0.496
Admiralty Creek	111-41-10050	201	3	0.047	0.036	0.100
Fish Creek - Douglas	111-50-10690	629	3	0.728	0.719	0.873
Ralphs Creek	112-21-10060	442	3	0.007	0.000	0.002
Kadashan River	112-42-10250	5	3	0.000	0.028	0.200
Seal Bay Head[a]	112-46-10070	328	4	0.004	0.034	0.003
Little Goose Creek	112-48-10190	14	3	0.000	0.000	0.000
Freshwater Creek	112-50-10300	134	4	0.018	0.020	0.033
Greens Creek	112-65-10240	262	3	0.000	0.000	0.046
Chaik Bay Creek	112-80-10280	403	4	0.004	0.000	0.019
Whitewater Creek	112-90-10140	393	3	0.041	0.144	0.087
W Crawfish NE Arm	113-32-10050	576	2	0.019	0.009	0.010
Rodman Creek	113-54-10070	385	4	0.011	0.007	0.008
Ushk Bay W End[b]	113-56-10030	32	2	0.008	0.079	0.004
Sister Lake SE Head	113-72-10040-2025	513	2	0.015	0.022	0.027
Ford Arm Creek	113-73-10030	487	2	0.023	0.012	0.025
Game Creek	114-31-10130	500	4	0.036	0.000	0.011
Sawmill Creek	115-20-10520	564	22	0.465	0.193	0.381

[a] Both 112-46-10070 and nearby 112-46-10080 were sampled to increase the number of samples.

[b] Both 113-56-10030 and nearby 113-56-10020 were sampled to increase the number of samples.

Southeast Stream Hatchery Fraction Results

At the stream level (n = 32), hatchery fractions of Chum Salmon in SE Alaska ranged from 0 to 0.87 in 2015 (Table 7, Figure 16). No hatchery Chum Salmon were detected at Little Goose Creek. The highest fraction of hatchery Chum Salmon in 2015 was detected at Fish Creek (0.87), similar to 2014. All other study streams had lower hatchery fractions (< 0.18) in 2015 with the exception of Kadashan (0.20), Sawmill (0.38), Glen (0.40), and Prospect (0.50) Creeks (Table 7).

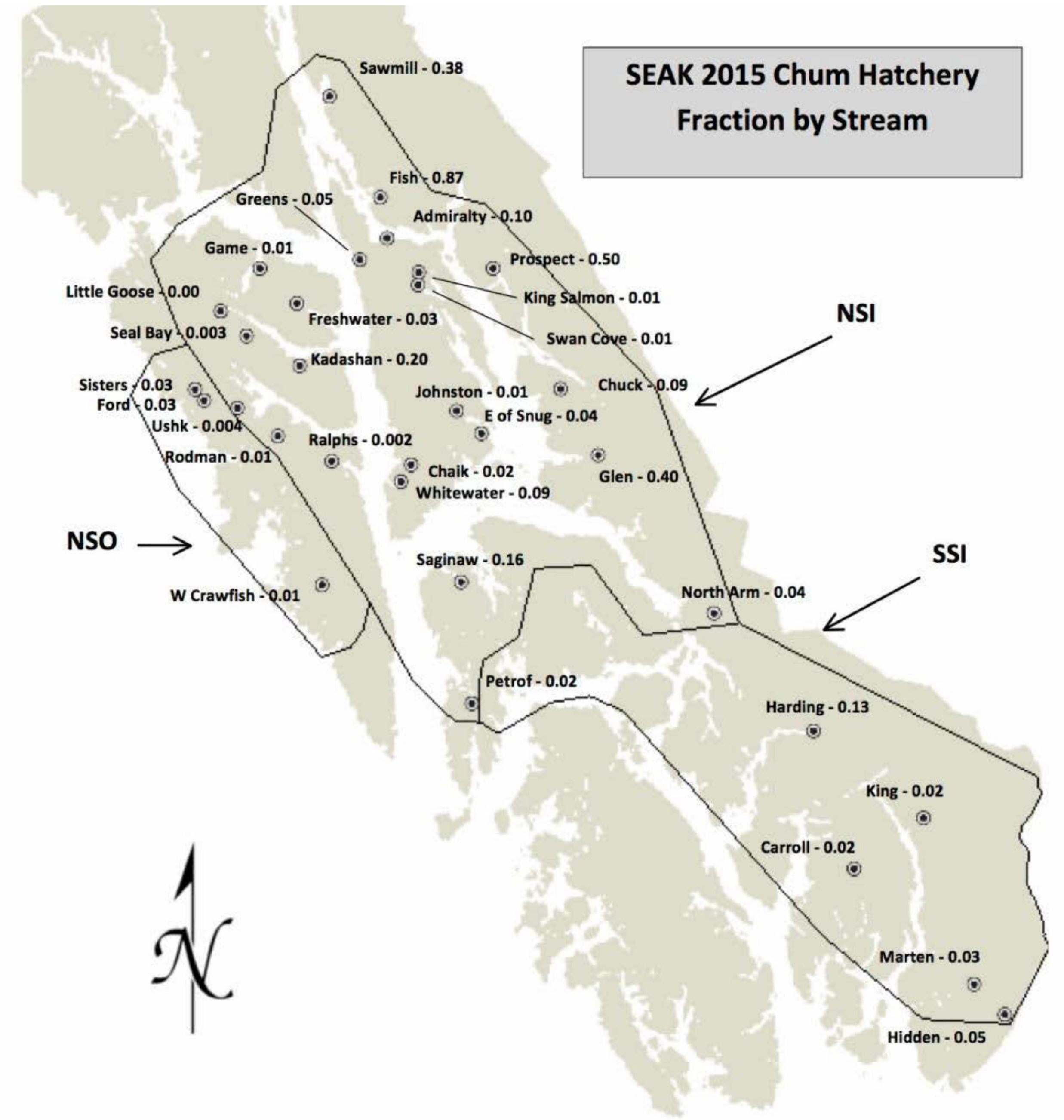


Figure 16. SEAK Chum Salmon hatchery proportions by stream in 2015. Black lines represent district borders.

Hatchery Chum Salmon straying fractions in 2015 across SEAK management sub-regions indicated that the Northern Southeast Inside had the highest fraction of hatchery Chum Salmon (0.127), which was about 2 times higher in 2015 than in 2014 and 2013 (Table 8). Fish Creek, which had the highest hatchery fraction of all study streams for Chum Salmon, is located within the Northern Southeast Inside sub-region along with other higher hatchery fractions streams such as Kadashan, Sawmill, Glen, and Prospect Creeks. The overall 2015 fraction of hatchery Chum Salmon in SEAK study streams was estimated to be 0.092, which was almost 2 times higher than the 2014 estimate (Table 8).

Table 8. Estimated SEAK Chum Salmon district-wide stream hatchery fractions and their standard errors 2013 - 2015. The aerial survey fraction for each district was used to weight the contribution of each district to the overall fraction estimate.

District	Estimated hatchery fraction (2013)	Estimated hatchery fraction (2014)	Estimated hatchery fraction (2015)	Estimated hatchery fraction SE (2015)	Number of streams sampled	Aerial survey fraction for district (2015)
Northern Southeast Outside	0.019	0.015	0.021	<0.001	3	0.075
Northern Southeast Inside	0.074	0.065	0.127	0.002	24	0.572
Southern Southeast	0.081	0.051	0.050	<0.001	5	0.353
Overall	0.073	0.054	0.092	0.035	32	1.000

DISCUSSION

The overall hatchery fractions in the study streams by species and region over the three-year hatchery fraction study were:

	2013	2014	2015
PWS Pink Salmon	0.044	0.148	0.095
PWS Chum Salmon	0.028	0.032	0.031
SEAK Chum Salmon	0.073	0.054	0.092

PWS Pink Salmon hatchery fractions appeared to vary from year, probably related to the huge differences in even-odd year wild run sizes influencing the fraction, while the other two Chum Salmon groups were somewhat more consistent between years. When considering stray rates by management unit, they varied by species and region (Tables 5, 6, and 10), but were generally low. Considering stray rates in individual streams, a few exhibited high strays, some exhibited medium stray rates, but a majority of streams had low or no straying (Tables 2, 3 and 7). As in 2013 and 2014, the hatchery fractions for 2015 generally reflect the same patterns of higher stray rates in streams closer to hatcheries than in more distant streams, as reported in Brenner et al

(2012) for PWS Pink Salmon and Chum Salmon and Piston and Heinl (2012) for Chum Salmon in SEAK.

REFERENCES

Botz, J., T. Sheridan, A. Wiese, S. Moffitt, R. Brenner. 2014. 2013 Prince William Sound area finfish management report. Alaska Department of Fish and Game, Fishery Management Report No, 14-43, Anchorage.

Brenner, R. E., S. D. Moffitt, and W. S. Grant. 2012. Straying of hatchery salmon in Prince William Sound, Alaska. Environmental Biology of Fish 94:179-195.

Cochran, W. G. 1977. Sampling techniques. John Wiley & Sons, New York.

Knudsen, E., M. Buckhorn, K. Gorman, D. Crowther, K. Froning, M. Roberts, L. Marcello, B. Adams, V. O'Connell, D. Bernard. 2015a. Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska. Final Progress Report for 2013, For Alaska Department of Fish and Game Contract IHP-13-013, Cordova, Prince William Sound Science Center, Alaska.

Knudsen, E., M. Buckhorn, K. Gorman, P. Rand, M. Roberts, B. Adams, V. O'Connell, D. Bernard. 2015b. Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska. Final Progress Report for 2014, For Alaska Department of Fish and Game Contract IHP-13-013, Cordova, Prince William Sound Science Center, Alaska.

Piston, A. W., and S. C. Heinl. 2012. Hatchery Chum Salmon Straying Studies in Southeast Alaska, 2008–2010. Alaska Department of Fish and Game, Fishery Manuscript Series No. 12-01, Anchorage.

R Core Team (2014). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Thompson, S. K. 1992. Sampling. John Wiley & Sons, New York.

RUN SIZE AND SPAWNING ABUNDANCE

David R. Bernard, Eric Knudsen, Pete Rand, and Kristen Gorman

Abundances of spawning Pink and Chum Salmon in both Prince William Sound (PWS) and Chum Salmon in Southeast Alaska (SEAK) are not estimated, but indexed with aerial surveys designed to provide information for in-season management of common property fisheries. Those fish counted from the air are either the progeny of fish that spawned a generation ago in the same streams, or were spawned in hatcheries and have strayed onto the spawning grounds. Because every hatchery-produced Chum Salmon and Pink Salmon in PWS and Chum Salmon in SEAK have thermally marked otoliths, the processes described above from the ocean and stream sampling in 2015 allowed estimates of the hatchery fraction of spawning populations, as described in the foregoing sections. While knowledge of the hatchery fraction of the spawning populations is of great interest in its own right, that statistic, along with others, can be used to estimate run size and spawning abundance as well.

Spawning abundance over a large geographic area can be estimated independent of aerial surveys with knowledge of:

- catches;
- the fraction of the total run comprised of hatchery salmon; and
- the fraction of escapement comprised of hatchery fish.

Current ADF&G catch sampling programs provide the needed knowledge on catches for both wild and hatchery-produced fish. These catch sampling programs for a common property fishery can also provide estimates on the fraction of the run comprised of hatchery fish if both wild and hatchery salmon have the same harvest rate in that fishery. However, when the stated policy of management is to concentrate on catching hatchery salmon in the common property fishery, separate ocean sampling is needed to get the statistic for the run before it is accessed by the fishery. Ocean sampling was impractical in Southeast Alaska due to the many ocean entrances but ocean sampling is theoretically not needed in SEAK because catches of Chum Salmon in common property fisheries there are incidental to catches of Pink Salmon, the targeted species. However, on closer examination of SEAK Chum Salmon catch sampling, it was decided that there were too many imprecisions in assigning the catches to summer Chum Salmon only, so a decision was made to not try to generate estimates for SEAK Chum Salmon. The stream sampling in this study has also provided the last bulleted statistic: the fraction of natural escapement comprised of hatchery fish.

METHODS

This section describes calculations of estimators for run size and spawning abundance for Pink and Chum Salmon in PWS. Methods for calculating approximate variances for estimates are also given. These methods were predicated on independent stream, ocean, and catch sampling programs to deliver statistics for input. The estimators could also work for Chum Salmon in SEAK in which catch sampling does double duty by replacing the ocean sampling to estimate the hatchery fraction of run size. However, the variance equations in this working paper are not correct for SEAK. (Approximate variance using catch sampling as a surrogate for ocean sampling will be described in a later working paper if so desired.)

Estimators

Notation and definition of variables:

R_H is the size of the run of hatchery fish;

R_W is the size of the run of wild fish;

S_H is the number of hatchery strays that survive the fishery (end up spawning);

S_W is the number of wild fish that end up spawning;

C_W is the "catch" of wild fish (in the common property, in cost recovery, and rack return);

C_H is the "catch" of hatchery fish (in the common property, in cost recovery, and rack return);

p is the fraction of the run comprised of hatchery fish; and

q is the fraction of the spawning population comprised of hatchery strays.

Note that by definition:

$$q = \frac{S_H}{S_W + S_H} \quad \text{or} \quad \frac{S_W}{S_H} = \frac{R_W - C_W}{R_H - C_H} = \frac{1-q}{q} = b\,, \tag{1}$$

where q can be estimated from stream sampling, and b is a redefined variable solely a function of stream sampling. Also note that by definition

$$p = \frac{R_H}{R_W + R_H} \quad \text{or} \quad \frac{R_W}{R_H} = \frac{1-p}{p} = a\,, \tag{2}$$

where p can be estimated from ocean sampling, and a is a redefined variable solely a function of ocean sampling. Equation 2 can be rearranged such that $R_W = aR_H$. When this relationship is plugged into Equation 1 and solved for R_H, the result is

$$R_H = \frac{C_W - bC_H}{a-b}\,. \tag{3}$$

Using the relationship $R_W = aR_H$ in the context of Equation 3,

$$R_W = aR_H = \frac{a(C_W - bC_H)}{a-b}\,. \tag{4}$$

Further relationships involving catch and spawning abundance are

$$S_W = R_W - C_W = \frac{a(C_W - bC_H)}{a-b} - C_W \tag{5}$$

$$S_H = R_H - C_H = \frac{C_W - bC_H}{a-b} - C_H \tag{6}$$

$$R = R_W + R_H = \frac{(1+a)(C_W - bC_H)}{a-b} \tag{7}$$

$$S = R - C = \frac{(1+a)(C_W - bC_H)}{a-b} - C \tag{8}$$

Substitution of estimates including statistics from ocean sampling ($\hat{p} \to p$), field sampling ($\hat{q} \to q$), and catch sampling ($\hat{C}_W \to C_W$ and $\hat{C}_H \to C_H$) changes Equations 3 – 5 into estimators of run size and spawning abundance.

Variances

By the delta method an approximate variance of a non-linear function of variables g[**X**] where **X** is the vector [x_1, x_2, … x_n] can be approximated with the non-quadratic terms in a Taylor series expansion of g[**X**] as follows:

$$v(g[\mathbf{X}]) \cong \sum_i v(x_i)\left(\frac{\partial g}{\partial x_i}\right)^2 + 2\sum_{i<j}\sum Cov(x_i, x_j)\left(\frac{\partial g}{\partial x_i}\right)\left(\frac{\partial g}{\partial x_j}\right).$$

In our study there are several non-linear functions (Equations 3–8) with variables $\hat{p}$, $\hat{q}$, $\hat{C}_W$, and $\hat{C}_H$. These variables serve as the x_i for the delta method. In that the stream, ocean, and catch sampling were conducted independently, covariances among statistics from those programs are zero with one possible exception. Some covariances do exist between $\hat{C}_W$, and $\hat{C}_H$ depending on how the catch sampling was conducted. At this time we have no information on a possible covariance so we have chosen to ignore the possibility. The consequence will be to slightly inflate our approximations of variance.

The first step in approximating variances for the right-hand sides of Equations 3 − 8 is to approximate variances for $\hat{a}$ and $\hat{b}$. First derivatives are

$$\frac{\partial \hat{a}}{\partial \hat{p}} = -\hat{p}^{-2} \quad \text{and} \quad \frac{\partial \hat{b}}{\partial \hat{q}} = -\hat{q}^{-2}.$$

The approximate variances are therefore

$$v(\hat{a}) \cong \frac{v(\hat{p})}{\hat{p}^4} \quad \text{and} \quad v(\hat{b}) \cong \frac{v(\hat{q})}{\hat{q}^4}.$$

The next steps were to apply the delta method to Equations 3 – 8 to get approximate variances for run size and spawning abundance. The next series of equations is just such an application.

Approximate variance for Equation 3:

$$v(\hat{R}_H) \cong v(\hat{a})\left(\frac{\partial \hat{R}_H}{\partial \hat{a}}\right)^2 + v(\hat{b})\left(\frac{\partial \hat{R}_H}{\partial \hat{b}}\right)^2 + v(\hat{C}_W)\left(\frac{\partial \hat{R}_H}{\partial \hat{C}_W}\right)^2 + v(\hat{C}_H)\left(\frac{\partial \hat{R}_H}{\partial \hat{C}_H}\right)^2$$

Derivatives: $\frac{\partial \hat{R}_H}{\partial \hat{a}} = -\frac{\hat{R}_H}{\hat{a}-\hat{b}}$ $\quad \frac{\partial \hat{R}_H}{\partial \hat{b}} = \frac{\hat{C}_W - \hat{a}\hat{C}_H}{(\hat{a}-\hat{b})^2}$ $\quad \frac{\partial \hat{R}_H}{\partial \hat{C}_W} = \frac{1}{\hat{a}-\hat{b}}$ $\quad \frac{\partial \hat{R}_H}{\partial \hat{C}_H} = -\frac{\hat{b}}{\hat{a}-\hat{b}}$

Approximate variance for Equation 4:

$$v(\hat{R}_W) \cong v(\hat{a})\left(\frac{\partial \hat{R}_W}{\partial \hat{a}}\right)^2 + v(\hat{b})\left(\frac{\partial \hat{R}_W}{\partial \hat{b}}\right)^2 + v(\hat{C}_W)\left(\frac{\partial \hat{R}_W}{\partial \hat{C}_W}\right)^2 + v(\hat{C}_H)\left(\frac{\partial \hat{R}_W}{\partial \hat{C}_H}\right)^2$$

Derivatives: $\frac{\partial \hat{R}_W}{\partial \hat{a}} = -\hat{b}\frac{\partial \hat{R}_H}{\partial \hat{a}}$ $\quad \frac{\partial \hat{R}_W}{\partial \hat{b}} = \hat{a}\frac{\partial \hat{R}_H}{\partial \hat{b}}$ $\quad \frac{\partial \hat{R}_W}{\partial \hat{C}_W} = \hat{a}\frac{\partial \hat{R}_H}{\partial \hat{C}_W}$ $\quad \frac{\partial \hat{R}_w}{\partial \hat{C}_H} = \hat{a}\frac{\partial \hat{R}_H}{\partial \hat{C}_H}$

Approximate variance for Equation 5:

$$v(\hat{S}_W) \cong v(\hat{a})\left(\frac{\partial \hat{S}_W}{\partial \hat{a}}\right)^2 + v(\hat{b})\left(\frac{\partial \hat{S}_W}{\partial \hat{b}}\right)^2 + v(\hat{C}_W)\left(\frac{\partial \hat{S}_W}{\partial \hat{C}_W}\right)^2 + v(\hat{C}_H)\left(\frac{\partial \hat{S}_W}{\partial \hat{C}_H}\right)^2$$

Derivatives: $\frac{\partial \hat{S}_W}{\partial \hat{a}} = \frac{\partial \hat{R}_W}{\partial \hat{a}}$ $\quad \frac{\partial \hat{S}_W}{\partial \hat{b}} = \frac{\partial \hat{R}_W}{\partial \hat{b}}$ $\quad \frac{\partial \hat{S}_W}{\partial \hat{C}_W} = \frac{\partial \hat{R}_W}{\partial \hat{C}_W} - 1$ $\quad \frac{\partial \hat{S}_W}{\partial \hat{C}_H} = \frac{\partial \hat{R}_W}{\partial \hat{C}_H}$

Approximate variance for Equation 6:

$$v(\hat{S}_H) \cong v(\hat{a})\left(\frac{\partial \hat{S}_H}{\partial \hat{a}}\right)^2 + v(\hat{b})\left(\frac{\partial \hat{S}_H}{\partial \hat{b}}\right)^2 + v(\hat{C}_W)\left(\frac{\partial \hat{S}_H}{\partial \hat{C}_W}\right)^2 + v(\hat{C}_H)\left(\frac{\partial \hat{S}_H}{\partial \hat{C}_H}\right)^2$$

Derivatives: $\frac{\partial \hat{S}_H}{\partial \hat{a}} = \frac{\partial \hat{R}_H}{\partial \hat{a}}$ $\quad \frac{\partial \hat{S}_H}{\partial \hat{b}} = \frac{\partial \hat{R}_H}{\partial \hat{b}}$ $\quad \frac{\partial \hat{S}_H}{\partial \hat{C}_W} = \frac{\partial \hat{R}_H}{\partial \hat{C}_W}$ $\quad \frac{\partial \hat{S}_H}{\partial \hat{C}_H} = \frac{\partial \hat{R}_H}{\partial \hat{C}_H} - 1$

Approximate variance for Equation 7:

$$v(\hat{R}) \cong v(\hat{a})\left(\frac{\partial \hat{R}}{\partial \hat{a}}\right)^2 + v(\hat{b})\left(\frac{\partial \hat{R}}{\partial \hat{b}}\right)^2 + v(\hat{C}_W)\left(\frac{\partial \hat{R}}{\partial \hat{C}_W}\right)^2 + v(\hat{C}_H)\left(\frac{\partial \hat{R}}{\partial \hat{C}_h}\right)^2$$

Derivatives: $\frac{\partial \hat{R}}{\partial \hat{a}} = \frac{\partial \hat{R}_H}{\partial \hat{a}} + \frac{\partial \hat{R}_W}{\partial \hat{a}}$ $\frac{\partial \hat{R}}{\partial \hat{b}} = \frac{\partial \hat{R}_H}{\partial \hat{b}} + \frac{\partial \hat{R}_W}{\partial \hat{b}}$ $\frac{\partial \hat{R}}{\partial \hat{C}_W} = \frac{1+\hat{a}}{\hat{a}-\hat{b}}$

$$\frac{\partial \hat{R}}{\partial \hat{C}_H} = -\frac{(1+\hat{a})\hat{b}}{\hat{a}-\hat{b}}$$

Approximate variance for Equation 8: $\hat{S} = \frac{(1+\hat{a})(\hat{C}_W - \hat{b}\hat{C}_H)}{\hat{a}-\hat{b}} - C$

Being that the total catch C here is a constant (known supposedly without error), $v(\hat{S}) = v(\hat{R})$.

Equations 3 – 8, their approximate variances, and the accompanying derivatives at first glance appear daunting. However, the calculations were adapted to a spreadsheet. Only eight numbers are needed as input to estimate spawning abundance and run size.

RESULTS

The eight numbers mentioned in the previous section for PWS Pink Salmon in 2015 are:

	p	q	C_W	C_H
Estimate→	0.549	0.09548429	25,558,145	73,326,971
Variance→	0.0000143	0.0012001	940000000	940000000

and for PWS Chum Salmon in 2015 are:

	p	q	C_W	C_H
Estimate→	0.688	0.03089557	237,430	2,455,950
Variance→	0.0002346	0.00063121	940000000	940000000

where p, q, C_W, and C_H are estimates from ocean, stream, and catch sampling programs[7]. Variances for $\hat{C}_W$ and $\hat{C}_H$ are not available at this writing, so their variances were roughly estimated to be 940,000,000 which one would expect from a catch of 4,000,000 with 1,000 fish sampled randomly from it to determine the hatchery fraction[8].

The total 2015 run size ($\hat{R}$) of Pink Salmon in PWS was estimated to be over 140 million (Table 9) which was record-setting. It was about 37% larger than the previous record in 2013 (Table 10). The 2015 run was more than 2.5 times larger than in 2014. Much of the interannual variation in run size is attributable to the wild component of the run whereas the hatchery production is somewhat more consistent from year to year (Table 10).

---

[7] Note the "^" are missing from the identifiers.

[8] HINT: Hardly affects precision of estimates at all.

PWS Chum Salmon total run size was about 3.6 million (Table 9) which was about 50% greater than in 2014 and was about 12% less than 2013 (Table 10). In Chum Salmon, the majority of the difference was apparently in hatchery returns because the wild run was quite consistent among the three years (Table 10).

Table 9. Run size estimates, approximated standard errors, and coefficients of variation for 2015.

	PWS Pink Salmon			PWS Chum Salmon		
Factor	**Estimate**	**Approx SE**	**Approx CV (%)**	**Estimate**	**Approx SE**	**Approx CV (%)**
$\hat{R}_H$	77,335,497	117,104	0.15	2,484,332	31,234	1.26
$\hat{R}_W$	63,530,617	1,062,591	1.67	1,127,706	82,832	7.35
$\hat{S}_W$	37,972,472	1,063,118	2.80	890,276	88,481	9.94
$\hat{S}_H$	4,008,526	112,227	2.80	28,382	2,821	9.94
$\hat{R}$	140,866,114	952,084	0.68	3,612,039	91,058	2.52
$\hat{S}$	41,980,998	952,084	2.27	918,659	91,058	9.91

Table 10. Comparative 2013 - 2015 population estimates in millions of fish (the 2013 and 2014 estimates are derived in Knudsen et al. 2015a,b).

	Wild spawners	**Hatchery spawners**	**Total spawners**	**Wild run**	**Hatchery run**	**Total run**
Pink Salmon						
2013	15.7	0.7	16.4	33.1	69.9	103.0
2014	5.1	0.7	5.9	7.0	42.8	49.7
2015	38.0	4.0	42.0	63.5	77.3	140.9
Chum Salmon						
2013	0.9	0.05	0.9	1.1	3.0	4.1
2014	0.9	0.05	1.0	1.2	1.2	2.4
2015	0.9	0.03	0.9	1.1	2.5	3.6

DISCUSSION

Our 2015 estimate above for PWS Pink Salmon spawning abundance (about 42 million, from $\hat{S}_W + \hat{S}_H$) is approximately 2 times larger than ADF&G's estimate of 20.6 million fish (S. Moffitt and T. Sheridan, pers. comm.). ADF&G's estimate was based on an aerial survey index expanded through area-under-the-curve methodology, which takes several assumptions into consideration, including stream life, observer efficiency, and a proportion of PWS streams flown as estimated in Bue et al. (1998). Possible reasons for this difference can include inaccurate assumptions being used for ADF&G's expansion and/or imprecise aerial survey indices due to reduced survey effort (T. Sheridan, pers. comm.). Budget limitations and poor weather have negatively impacted the PWS Pink Salmon and Chum Salmon aerial survey program in recent years, leading to fewer surveys being flown, and increasing duration between surveys (T. Sheridan, pers. comm.). Budget limitations in particular led ADF&G to systematically reduce the numbers of PWS streams flown in 2015 to 129 from the 214 historical index streams that had been flown during previous two field seasons (T. Sheridan, pers. comm.).

Another statistic of interest, from values in the table above, is the estimated 2015 Sound-wide harvest rate of wild fish $(\hat{C}_w/\hat{R}_w)$ which is 40.2% for PWS Pink Salmon and 21.1% for PWS Chum Salmon. These results compare to 2013 observations, when the estimated Sound-wide harvest rate of wild fish $(\hat{C}_w/\hat{R}_w)$ was 52.6% for PWS Pink Salmon and 21.6% for PWS Chum Salmon (Knudsen et al 2015a). Low Chum Salmon values for both years likely speak to the fact that most PWS fisheries do not target, and are not managed for, harvesting wild Chum Salmon (Fair et al. 2008). Lower wild Pink Salmon harvest rates in 2015 are likely due in part to a relatively conservative management approach in western PWS during early August to allow for hatchery escapement (T. Sheridan, pers. comm.). It should also be noted that, when compared to 2013, a relatively conservative management approach in western PWS in 2015 was also accompanied by higher hatchery stray rates as measured by the number of hatchery strays that ended up spawning in streams: 4.3% in 2013 and 10.0% in 2015.

REFERENCES

Botz, J., T. Sheridan, A. Wiese, S. Moffitt, R. Brenner. In Press. 2014 Prince William Sound area finfish management report. Alaska Department of Fish and Game, Fishery Management Report No. 14-43, Anchorage.

Knudsen, E., M. Buckhorn, K. Gorman, D. Crowther, K. Froning, M. Roberts, L. Marcello, B. Adams, V. O'Connell, D. Bernard. 2015a. Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska. Final Progress Report for 2013, For Alaska Department of Fish and Game Contract IHP-13-013, Cordova, Prince William Sound Science Center, Alaska.

Knudsen, E., M. Buckhorn, K. Gorman, P. Rand, M. Roberts, B. Adams, V. O'Connell, D. Bernard. 2015b. Interactions of Wild and Hatchery Pink Salmon and Chum Salmon in Prince William Sound and Southeast Alaska. Final Progress Report for 2014, For Alaska Department of Fish and Game Contract IHP-13-013, Cordova, Prince William Sound Science Center, Alaska.

HATCHERY-WILD ALEVIN SAMPLING 2015

Authors: Ben Adams, Julia McMahon, Megan Roberts, and Eric Knudsen

INTRODUCTION

The overarching purpose of sampling salmon alevins in March and April, 2015 was to assess the relative feasibility and costs of collecting offspring from the previous year's spawners for survival comparisons between hatchery- and natural-origin progeny for both males and females. Although the ultimate comparison of the relative survival between the two groups will be made when the offspring return to the streams as adults, assessing the relative survival at the alevin stage will help to reveal whether any differences in survival occur before or after the alevin stage. Samples were systematically collected from a designated proportion of the total spawning area from where adult DNA tissues were collected the previous summer. The origins of the two alevin groups from each stream will be determined by their DNA "fingerprints" corresponding to their parents DNA.

Objectives

The 2015 sampling for Chum Salmon in Fish Creek on Douglas Island, and Pink Salmon in Stockdale Creek on Montague Island was conducted similarly to 2014 to evaluate: a) the field sampling techniques, b) the relative success of capturing alevins, and c) the number of individual alevins required to successfully determine relative survival rates.

METHODS

Our goal in sampling alevins was to collect 1-25 fry in at least 250 redd samples in each stream by hydraulic sampling ("fry-pumping") in March and early April (Figure 17). The reason for collecting a large number of alevins is because only some of the parents were sampled for genetic tissue, and there may be many other alevins of unknown parentage mixed with those whose parentage can be identified. Specific, pre-season alevin sampling protocols are described in Appendix E. The methods below describe how the 2015 sampling was conducted.

Selecting Sample Locations

Sites were sampled with a standard redd pump sampler to collect alevins (Figure 18). Sampling was distributed approximately in proportion to spawning distribution in the previous summer. Because some sample sites produced no target alevins, we knew we would need to "oversample" so the target of 250 positive samples could be attained. However, we did not know in advance what proportion of samples would be positive. Therefore, we initially sampled throughout the entire spawning reach of each stream to assess the relative distribution and success rate. After passing through the stream reach once, we determined how many more positive samples would be required and approximately how they should be distributed throughout the stream to make another representative pass through the stream.

At each sampling location, the sampling net hoop was placed over the substrate wherever it was possible to get a reasonable "seal" of the bottom ring of the net to prevent escape of alevins under the bottom of the ring. If the net did not lay flat on the substrate, it was moved slightly until it sat as flat as possible.

The location of each sample was recorded with GPS coordinates, using the position averaging feature to get a better position. Some samples that were in close proximity were recorded with the same GPS fix. Sample sites were numbered sequentially in chronological order.

Pumping to Collect Alevins

At each sample site, one or two team members worked the 0.5-m net frame down into the substrate as far as practical so that alevins could not escape underneath the frame during pumping (Figure 17). The codend of the net was on the downstream flow side of the net frame.

With the 1½-in gas-powered water pump running, the injector probe was submerged into multiple locations within the net frame, to 12-24 inches deep whenever possible, repeating this action until all alevin had been released or it was thought that the 25 targeted alevin were in the codend. The amount of time the substrate was probed with pumped water from start to end was recorded.

Figure 17. Redd pumping on Stockdale Creek, April, 2014.

If alevins were observed on the surface within the net frame, they were scooped with a dip-net and retained in a water-filled container. After pumping, the net frame was removed and all materials were washed into the codend. The contents of the codend were emptied into a round container or on hard surface to reveal the alevins. All alevins from one pump sample were kept separate from any other sample.

Alevin Samples

All alevins from each sample site were sorted and counted by species and recorded. All non-target species, and excess target species, were released alive into the stream whenever possible. Up to 25 of the target species (if available in the sample) were retained for genetic analysis in sample-specific, pre-labeled, ethanol-filled vials (Isopropanol/Methanol/Ethanol - EtOH). The vials contained 4:1 EtOH to fish tissue. The date, stream, and sample number were written on a small, write-in-the-rain sample label and placed inside the bottle. The sample number corresponded to the last four digits from the vial's bar code. The number of fish was written on the outside of the bottle. The sample vial number was recorded on the data sheet, being certain that the vial number is associated with the GPS data for the same pump sample.

Field Approach – Fish Creek (Douglas Island)

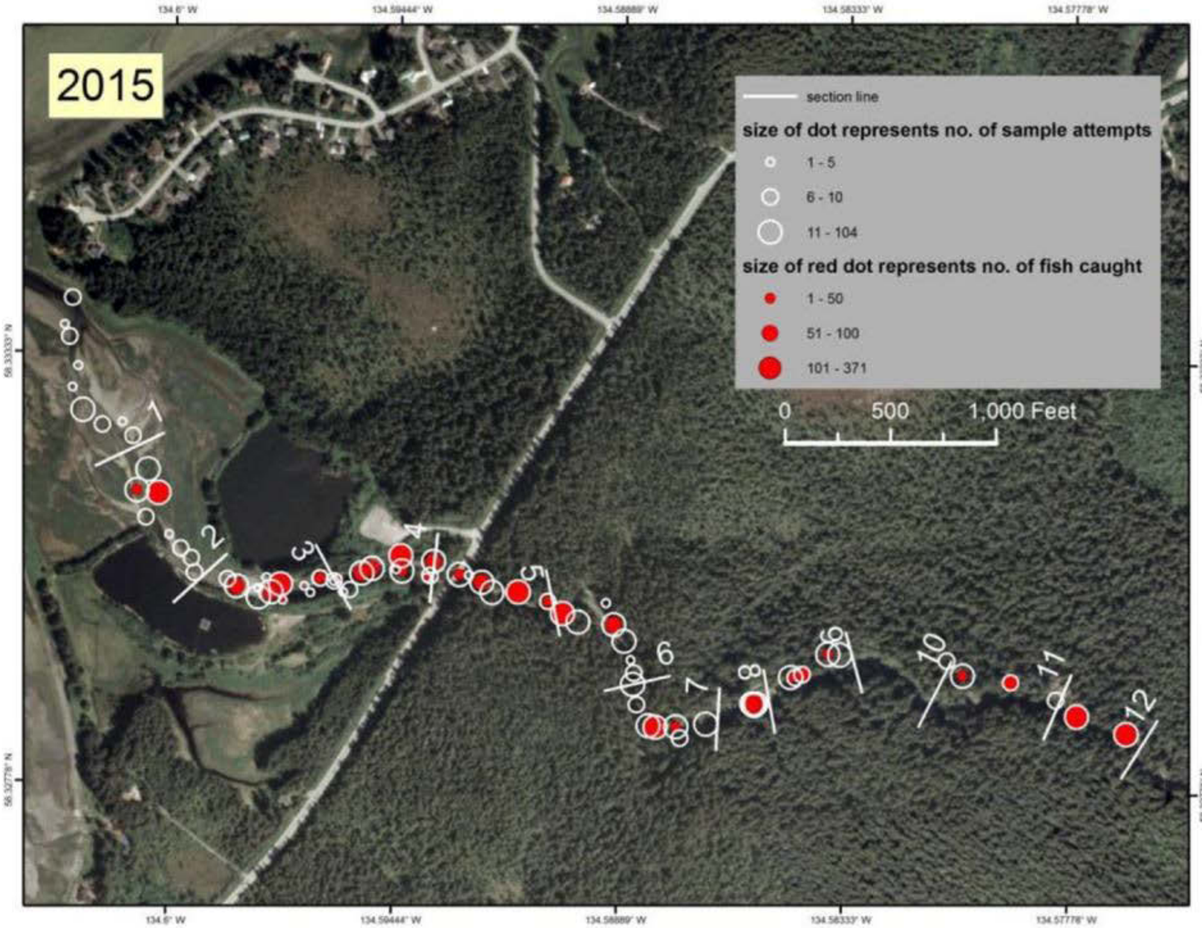
Chum salmon alevin were sampled in Fish Creek on Douglas Island near Juneau February 24-28, 2015. The weather was dry with temperatures ranging between about 18 and 36 degrees F daily. The stream was low and clear with no ice.

To help distribute the sampling throughout the known spawning areas, sampling was apportioned among 12 stream reaches, two of which extended past the existing 10 sections from 2014 (Figure 18). These uppermost two sections where not sampled in 2014 due to ice and lack of time and personnel. Sampling began in section 4 which corresponds to the area near the footbridge, the site of the most intensive spawning the previous summer. Sampling then progressed downstream into the intertidal zone to the downstream-most Chum salmon spawning observed in summer 2014. Sampling was then conducted from section 4 upwards, ending in the uppermost section where spawning was observed the previous summer and where chum abundance sharply tapers off.

Throughout the stream, success rates were much higher than in 2014, likely due to better access and earlier sampling when alevins were still present in the stream. We sampled very thoroughly throughout the stream except in sections 1 and 10, which corresponded to the lower intertidal reach and an area of large substrate that is not conducive to spawning whatsoever. In several areas, the large rock substrate prevented us from digging very deep, however we continued to sample everywhere until we had thoroughly sampled the entire stream.

Figure 18. Map of 12 stream reaches and sampling locations in Fish Creek in 2015. Size of open circles indicates number of redd digs attempted. Size of solid red circles indicates number of alevins captured at a sample

location.



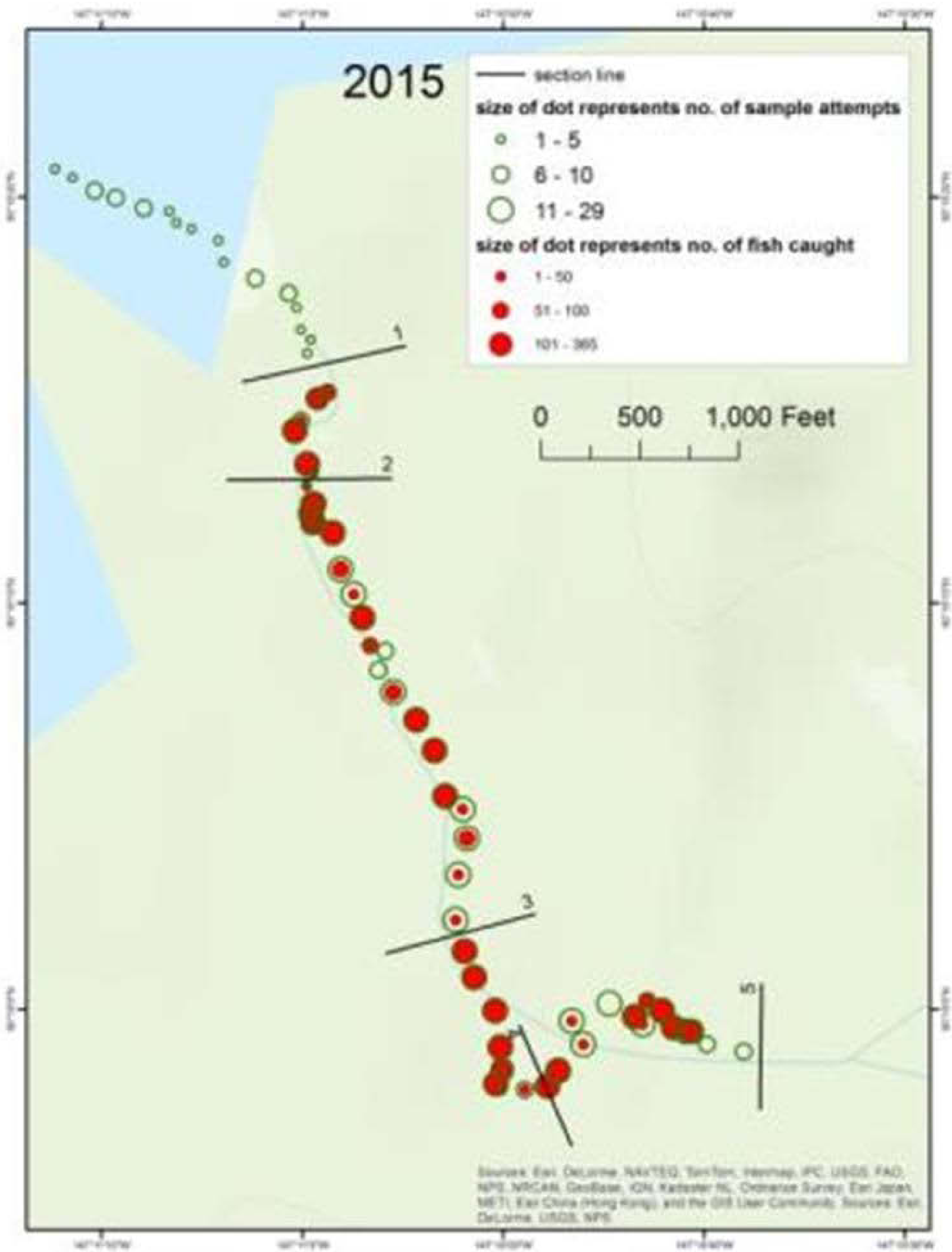
Field Approach – Stockdale Creek

Pink Salmon alevin were sampled in Stockdale Creek on Montague Island in Prince William Sound March 11-16, 2015. The sampling crew traveled to the study site aboard the *Auklet*, which anchored in Stockdale Harbor as a live-aboard vessel for the week. The five-person crew and sampling gear were transported daily by zodiac to the mouth of the study stream. Weather was variable; starting clear and cold, with ice thickening for three days. Then it snowed for a day, and then the wind blew 30-40 knots with sleet and flooding on the last day. Temperatures ranged from 10 to 40 degrees Fahrenheit daily.

The stream was divided into five sections, starting from the mouth: 1) the lower intertidal flat, 2) the high tide gravel bar, 3) the lower straight, 4) the upper straight and first bend and 5) the last sampled creek bends (Figure 19). The first sample site in the intertidal area was within 20 m of the first processing area from the summer 2014 adult sampling. The alevin dig furthest upstream was 650 m downstream of the uppermost summer 2014 adult sampling area and 400 m upstream of the highest alevin dig in 2014. The first five days were used to sample all sections of the stream, except where the ice was too thick. There was 125 m of unbreakable ice-covered sections which were scattered over the 1,000 total meters of stream sampled. The crew used rocks, axes and pry bars to break ice up to 15 cm thick. The sixth day was used to sample downstream from the uppermost point to attain the sampling goal of 250 positive samples.

Two teams sampled about 30 m apart, leapfrogging their way upstream. Each waypoint represents a new pump placement with multiple digs. In areas with a high density of alevins, the digs were about 1 m apart and in low density areas, digs were about 3 m apart. Each dig site was pumped for 50-60 seconds. Digs were terminated early if a large number of alevins were seen in the net in order to avoid unnecessary destruction of the redd.

Figure 19. Stockdale redd sampling stream reaches and sample locations in 2015. Size of open circles indicates number of redd digs attempted. Size of solid red circles indicates number of alevins captured at a sample location.



RESULTS

Results – Fish Creek (Douglas Island)

We conducted 975 sample attempts throughout the anadromous reach in Fish Creek from February 24 to 28. In total, we collected 160 positive samples (Table 11). The total number of Chum Salmon alevins captured ranged between 1 and 147 for all positive samples. Pink Salmon alevin were caught as well and were present in 29 sample attempts. The total number of chum alevin caught in all positive samples was 3,243 and the total number of pinks caught was 591.

In general, positive samples were obtained in large clusters spread out across the stream and in areas of medium to fine substrate. We had the highest sampling success midway along the reach and at the uppermost areas (sections 2-9, 11, and 12) where the most spawning was seen the previous summer (Table 12). When on the creek, we noted that our most successful areas from 2014 continued to yield good results. In 2015, we also obtained positive samples in many places where we had no success in 2014. Occasionally dead alevin and decomposing eggs were flushed out of the gravel throughout the stream, but less frequently than in 2014. Live eggs were also found and assumed to be Coho Salmon.

Table 11. Sampling success of alevins on Fish Creek in March 2015. Sample attempts represent one sampling event in a specific location and positive samples represents the occasions when we captured live Chum Salmon alevin. Percentages of successful sampling attempts are noted as well as total Chum Salmon and Pink Salmon alevins for all positive samples within that section. Average pump time (duration of sampling event) is noted in seconds.

Section #	Sample Attempts	Positive Samples	% Positive Samples	Avg Pump Time	Total Chum Caught	Total Pink Caught
1	35	0	0.00%	32.7	0	0
2	92	2	2.17%	39.8	122	318
3	104	16	15.38%	54.4	296	15
4	85	20	23.53%	65.5	559	170
5	95	17	17.89%	69.8	304	0
6	123	30	24.39%	60.2	481	26
7	93	15	16.13%	60.9	224	0
8	88	25	28.41%	61.3	511	5
9	109	11	10.09%	52.3	236	0
10	7	0	0.00%	47.6	0	0
11	29	2	6.90%	45.1	53	1
12	114	22	19.30%	55.1	457	56
Totals	**974**	**160**	**16.43%**	**53.7**	**3243**	**591**

The Fish Creek Chum Salmon alevin sampling results exhibited a higher success rate in 2015 than in similar sampling in 2014. This may have been because sampling was later in 2014 so that alevin were missed because they had emerged from the gravel.

Year	Sampling dates	Number of attempts	Positive Chum samples	Percent sampling success	Total Chum captured	Chum samples sent to laboratory
2014	March 25-31	774	69	8.9	757	569
2015	February 24-28	975	160	16.4	3,243	1,985

The number sent to the laboratory was less than the number captured because only a maximum of 25 alevins were submitted from samples that exceeded 25 in one pump sample attempt.

Table 12. Total chum and Pink Salmon alevins captured by section over the five days of sampling Fish Creek in 2015. Pumping time for each positive sample is recorded in seconds. This table shows the 160 positive samples obtained out of 974 sampling attempts. Sculpin presence and intertidal influence was also noted as was the coordinates for each positive sample collected.

Section #	Date	Chum Alevin	Pink Alevin	Sculpin Presence	Pump time (sec)	Intertidal	Latitude	Longitude
2	2/24/2015		1	Y	30	YES	58.33183	-134.6006
2	2/24/2015		1	Y	34	YES	58.33153	-134.60033
2	2/24/2015		2		50	YES	58.33156	-134.60087
2	2/24/2015	110	16		36	YES	58.33153	-134.60033
2	2/24/2015		23	Y	32	YES	58.33153	-134.60033
2	2/24/2015		25		50	YES	58.3324	-134.60174
2	2/24/2015		26	Y	18	YES	58.33153	-134.60033
2	2/24/2015		47		27	YES	58.33183	-134.6006
2	2/24/2015		62	Y	42	YES	58.33153	-134.60033
2	2/24/2015		115	Y	35	YES	58.33183	-134.6006
2	2/24/2015	12			45	YES	58.33156	-134.60087
3	2/25/2015	5	1		61	NO	58.33026	-134.59753
3	2/25/2015	59	1	Y	44	NO	58.33026	-134.59753
3	2/25/2015		1		53	NO	58.33026	-134.59753
3	2/25/2015		1	Y	60	NO	58.33026	-134.59753
3	2/25/2015		11		60	NO	58.33036	-134.5973
3	2/24/2015	1			48	NO	58.33045	-134.59632
3	2/24/2015	1			27	NO	58.33033	-134.59838
3	2/24/2015	4			70	YES	58.33016	-134.59724
3	2/24/2015	7		Y	70	NO	58.33044	-134.59588

3	2/24/2015	9			30	NO	58.33033	-134.59838
3	2/24/2015	16		Y	50	YES	58.33016	-134.59724
3	2/24/2015	47			30	NO	58.33033	-134.59838
3	2/25/2015	1		Y	40	NO	58.33026	-134.59753
3	2/25/2015	1			50	NO	58.33036	-134.5973
3	2/25/2015	4			77	NO	58.33026	-134.59753
3	2/25/2015	8			75	NO	58.33036	-134.5973
3	2/25/2015	30			100	NO	58.33036	-134.5973
3	2/25/2015	49			75	NO	58.33036	-134.5973
3	2/25/2015	54			60	NO	58.33036	-134.5973
4	2/25/2015		0		45	NO	58.33052	-134.5953
4	2/25/2015		1		43	NO	58.33052	-134.5953
4	2/25/2015		1		105	NO	58.33075	-134.59433
4	2/25/2015		3	Y	100	NO	58.33075	-134.59433
4	2/25/2015	59	15		120	NO	58.33075	-134.59433
4	2/25/2015	12	50		80	NO	58.33058	-134.59504
4	2/25/2015		100	Y	85	NO	58.33058	-134.59504
4	2/25/2015	1			65	NO	58.33058	-134.59504
4	2/25/2015	1			70	NO	58.33075	-134.59433
4	2/25/2015	3			45	NO	58.33052	-134.5953
4	2/25/2015	5			65	NO	58.33058	-134.59504
4	2/25/2015	6			125	NO	58.33075	-134.59433
4	2/25/2015	8			75	NO	58.33075	-134.59433
4	2/25/2015	13		Y	49	NO	58.33047	-134.59369
4	2/25/2015	18			47	NO	58.33055	-134.5943
4	2/25/2015	19			125	NO	58.33075	-134.59433
4	2/25/2015	22			140	NO	58.33075	-134.59433
4	2/25/2015	26			90	NO	58.33075	-134.59433
4	2/25/2015	30			95	NO	58.33075	-134.59433
4	2/25/2015	35			135	NO	58.33075	-134.59433
4	2/25/2015	37			80	NO	58.33058	-134.59504
4	2/25/2015	38			65	NO	58.33058	-134.59504
4	2/25/2015	46			60	NO	58.33075	-134.59433
4	2/25/2015	89			35	NO	58.33052	-134.5953
4	2/25/2015	91			120	NO	58.33075	-134.59433
5	2/25/2015	2			55	NO	58.33068	-134.59352
5	2/25/2015	6			50	NO	58.33068	-134.59352
5	2/25/2015	9			60	NO	58.33052	-134.59289
5	2/25/2015	25			80	NO	58.33052	-134.59289
5	2/25/2015	62			50	NO	58.33068	-134.59352
5	2/26/2015	1			90	NO	58.33042	-134.59233
5	2/26/2015	1			80	NO	58.33042	-134.59233
5	2/26/2015	2			60	NO	58.33042	-134.59233

5	2/26/2015	3			56	NO	58.3303	-134.59143
5	2/26/2015	7			130	NO	58.33042	-134.59233
5	2/26/2015	7			125	NO	58.33042	-134.59233
5	2/26/2015	7			190	NO	58.33042	-134.59233
5	2/26/2015	16			80	NO	58.33042	-134.59233
5	2/26/2015	21			105	NO	58.33042	-134.59233
5	2/26/2015	37			140	NO	58.33042	-134.59233
5	2/26/2015	39			60	NO	58.3303	-134.59143
5	2/26/2015	59			58	NO	58.3303	-134.59143
6	2/26/2015		1		35	NO	58.32968	-134.5888
6	2/26/2015	5	25		60	NO	58.33003	-134.59033
6	2/26/2015	1			120	NO	58.33003	-134.59033
6	2/26/2015	1			110	NO	58.33003	-134.59033
6	2/26/2015	1			40	NO	58.32989	-134.58906
6	2/26/2015	2			100	NO	58.33003	-134.59033
6	2/26/2015	3			120	NO	58.33003	-134.59033
6	2/26/2015	3			60	NO	58.33003	-134.59033
6	2/26/2015	4			50	NO	58.3303	-134.59143
6	2/26/2015	4			50	NO	58.33003	-134.59033
6	2/26/2015	5			70	NO	58.33003	-134.59033
6	2/26/2015	7			35	NO	58.33003	-134.59033
6	2/26/2015	7			55	NO	58.33003	-134.59033
6	2/26/2015	7			110	NO	58.32989	-134.58906
6	2/26/2015	8			55	NO	58.3303	-134.59143
6	2/26/2015	9		Y	45	NO	58.3303	-134.59143
6	2/26/2015	11			75	NO	58.33003	-134.59033
6	2/26/2015	12			40	NO	58.33003	-134.59033
6	2/26/2015	14			100	NO	58.33003	-134.59033
6	2/26/2015	17			53	NO	58.3303	-134.59143
6	2/26/2015	17			54	NO	58.33018	-134.59069
6	2/26/2015	17			50	NO	58.32989	-134.58906
6	2/26/2015	26			40	NO	58.33003	-134.59033
6	2/26/2015	27			45	NO	58.33003	-134.59033
6	2/26/2015	27			45	NO	58.33003	-134.59033
6	2/26/2015	29			90	NO	58.33003	-134.59033
6	2/26/2015	30			30	NO	58.32989	-134.58906
6	2/26/2015	34			140	NO	58.33003	-134.59033
6	2/26/2015	39			40	NO	58.33003	-134.59033
6	2/26/2015	50			50	NO	58.33003	-134.59033
6	2/26/2015	64			45	NO	58.33003	-134.59033
7	2/27/2015	1			60	NO	58.32857	-134.58801
7	2/27/2015	1			75	NO	58.32857	-134.58801
7	2/27/2015	1			80	NO	58.32857	-134.58801

7	2/27/2015	1		90	NO	58.32857	-134.58801
7	2/27/2015	2		57	NO	58.32858	-134.5875
7	2/27/2015	6		45	NO	58.32857	-134.58801
7	2/27/2015	6		140	NO	58.32857	-134.58801
7	2/27/2015	8		60	NO	58.32857	-134.58801
7	2/27/2015	8		59	NO	58.32858	-134.5875
7	2/27/2015	12		110	NO	58.32857	-134.58801
7	2/27/2015	13		60	NO	58.32857	-134.58801
7	2/27/2015	15		60	NO	58.32858	-134.5875
7	2/27/2015	20		52	NO	58.32858	-134.5875
7	2/27/2015	45		30	NO	58.32857	-134.58801
7	2/27/2015	85		105	NO	58.32857	-134.58801
8	2/27/2015	1	5	90	NO	58.32887	-134.58558
8	2/27/2015	1		60	NO	58.32887	-134.58558
8	2/27/2015	1		105	NO	58.32887	-134.58558
8	2/27/2015	1		53	NO	58.32889	-134.58553
8	2/27/2015	1		48	NO	58.32889	-134.58553
8	2/27/2015	1		60	NO	58.32889	-134.58553
8	2/27/2015	1		56	NO	58.32889	-134.58553
8	2/27/2015	1		80	NO	58.32889	-134.58553
8	2/27/2015	1		45	NO	58.32889	-134.58553
8	2/27/2015	2		90	NO	58.32887	-134.58558
8	2/27/2015	2		61	NO	58.32889	-134.58553
8	2/27/2015	2		52	NO	58.32889	-134.58553
8	2/27/2015	2		45	NO	58.32889	-134.58553
8	2/27/2015	6		42	NO	58.32889	-134.58553
8	2/27/2015	7		47	NO	58.32889	-134.58553
8	2/27/2015	7		65	NO	58.32889	-134.58553
8	2/27/2015	12		40	NO	58.32889	-134.58553
8	2/27/2015	14		95	NO	58.32887	-134.58558
8	2/27/2015	16		50	NO	58.32887	-134.58558
8	2/27/2015	37		46	NO	58.32889	-134.58553
8	2/27/2015	45		50	NO	58.32887	-134.58558
8	2/27/2015	53		40	NO	58.32889	-134.58553
8	2/27/2015	70		55	NO	58.32887	-134.58558
8	2/27/2015	80		40	NO	58.32887	-134.58558
8	2/27/2015	147		36	NO	58.32889	-134.58553
9	2/27/2015	5		120	NO	58.32889	-134.58562
9	2/27/2015	50		40	NO	58.32889	-134.58562
9	2/28/2015	1		50	NO	58.32924	-134.58468
9	2/28/2015	1		70	NO	58.32924	-134.58468
9	2/28/2015	1		50	NO	58.32924	-134.58468
9	2/28/2015	1		52	NO	58.32928	-134.5844

9	2/28/2015	8		100	NO	58.32924	-134.58468
9	2/28/2015	20		45	NO	58.32924	-134.58457
9	2/28/2015	27		49	NO	58.32955	-134.58377
9	2/28/2015	36		95	NO	58.32924	-134.58468
9	2/28/2015	86		35	NO	58.32928	-134.5844
11	2/28/2015	2	1	44	NO	58.32929	-134.58044
11	2/28/2015	51		47	NO	58.32921	-134.57925
12	2/28/2015	3	1	40	NO	58.32878	-134.57761
12	2/28/2015		5	30	NO	58.32878	-134.57761
12	2/28/2015		50	45	NO	58.32878	-134.57761
12	2/28/2015	1		45	NO	58.32878	-134.57761
12	2/28/2015	2		30	NO	58.32878	-134.57761
12	2/28/2015	4		55	NO	58.32878	-134.57761
12	2/28/2015	4		65	NO	58.32878	-134.57761
12	2/28/2015	5		50	NO	58.32878	-134.57761
12	2/28/2015	7		120	NO	58.32878	-134.57761
12	2/28/2015	7		60	NO	58.32878	-134.57761
12	2/28/2015	14		60	NO	58.32856	-134.57639
12	2/28/2015	14		45	NO	58.32856	-134.57639
12	2/28/2015	15		30	NO	58.32878	-134.57761
12	2/28/2015	17		45	NO	58.32878	-134.57761
12	2/28/2015	18		40	NO	58.32878	-134.57761
12	2/28/2015	20		50	NO	58.32878	-134.57761
12	2/28/2015	22		60	NO	58.32878	-134.57761
12	2/28/2015	23		60	NO	58.32878	-134.57761
12	2/28/2015	24		75	NO	58.32878	-134.57761
12	2/28/2015	35		60	NO	58.32878	-134.57761
12	2/28/2015	40		50	NO	58.32878	-134.57761
12	2/28/2015	45		100	NO	58.32878	-134.57761
12	2/28/2015	62		120	NO	58.32878	-134.57761
12	2/28/2015	75		60	NO	58.32856	-134.57639

Results – Stockdale Creek

Sampling for Pink Salmon alevins at Stockdale Creek from March 11-16 was successful, yielding the goal of 250 positive samples out of 720 sample attempts (Tables 13, 14), 200 more digs than in 2014. A total of 5,737 alevin were counted and 3,091 alevin were retained for the study. Positive pumps had an average of 23 alevin. Samples were spread throughout the spawning area with distinct regions of low and high alevin densities. No positive samples were collected in the lower intertidal flat (Section 1) where substrate was very fine grained and silty. Positive digs were relatively evenly distributed between the remaining 4 sections. Section 2, with 44% positive digs was centered around the highest tide line with a mix of gravel and cobble. The largest portion of positive digs came from man-made holes within the 200 m reach of stream covered in thick ice (Section 3). A moderate number of positive samples were found in section 4, substrate was a mix of cobble, small gravel and some larger rocks. Section 5 was sampled over two days and had the highest number of digs and alevin caught. Overall, the success rate of positive digs was 35% throughout the 1,000 m study area. Stream flow was low in comparison to summer sampling.

Table 13. Sampling success of alevins at Stockdale Creek in April 2015.

Section #	Sample Attempts	Positive Samples	% Positive Samples	Average Pump Time (sec)	Total Chum Caught	Total Pink Caught
1	73	0	0.00%	47.9	0	0
2	47	22	46.81%	58	0	388
3	265	111	41.89%	57.5	0	2,425
4	130	47	36.15%	51.3	0	893
5	205	70	34.15%	49.7	0	1,332
Total	720	250	34.72%	52.88	0	5038

The Stockdale Pink Salmon alevin sampling results exhibited a greater success rate per pump sample in 2014 than in similar sampling in 2015 even though the sampling was later in 2014 and possibly subject to emergence from the gravel. The success rate for sampling Pink Salmon alevins in Stockdale Creek was notably greater than it was in Fish Creek for Chum Salmon in both years (see above).

Year	**Sampling dates**	**Number of attempts**	**Positive Pink Salmon samples**	**Percent sampling success**	**Total Pink Salmon captured**	**Pink Salmon samples sent to laboratory**
2014	April 3-6	520	250	48.0	4,229	2,098
2015	March 11-16	720	250	34.7	5,038	3,091

The number sent to the laboratory was less than the number captured because only a maximum of 25 alevins were submitted from samples that exceeded 25 in one pump sample attempt.

Table 14. Total Pink alevins caught over six days of sampling at Stockdale Creek in April 2015. Table represents the 250 positive Pink alevin samples by stream section and location.

Section #	Date	# Chum Caught	# Pink Caught	Sculpin	Pump Time (sec)	Intertidal	Latitude	Longitude
1	3/11/2015	0	3	1	35	YES	60.30418	147.18315
1	3/11/2015	0	28	0	59	YES	60.30422	147.18301
1	3/11/2015	0	121	0	20	YES	60.30418	147.18315
1	3/11/2015	0	24	0	15	YES	60.30418	147.18315
1	3/11/2015	0	18	0	45	YES	60.30418	147.18315
1	3/11/2015	0	2	0	35	YES	60.30422	147.18301
1	3/11/2015	0	6	0	57	YES	60.30422	147.18301
1	3/11/2015	0	1	0	45	YES	60.30418	147.18315
1	3/11/2015	0	1	0	50	YES	60.30418	147.18315
1	3/11/2015	0	3	2	50	YES	60.30418	147.18315
2	3/11/2015	0	114	0	40	YES	60.30396	147.18346
2	3/11/2015	0	1	0	40	YES	60.30396	147.18346
2	3/11/2015	0	2	0	30	YES	60.30396	147.18346
2	3/11/2015	0	36	0	80	YES	60.30403	147.18338
2	3/11/2015	0	2	0	60	YES	60.30396	147.18346
2	3/11/2015	0	2	0	50	YES	60.30396	147.18346
2	3/11/2015	0	8	0	60	YES	60.30396	147.18346
2	3/11/2015	0	1	0	57	YES	60.30367	147.18320
2	3/11/2015	0	9	0	45	YES	60.30396	147.18346
2	3/11/2015	0	1	0	113	YES	60.30367	147.18320
2	3/12/2015	0	1	0	50	NO	60.30373	147.18329
2	3/12/2015	0	2	0	48	NO	60.30358	147.18330
2	3/12/2015	0	4	0	40	NO	60.30373	147.18329
2	3/12/2015	0	5	0	38	NO	60.30358	147.18330
2	3/12/2015	0	9	0	60	NO	60.30373	147.18329
2	3/12/2015	0	117	0	25	NO	60.30373	147.18329
2	3/12/2015	0	2	0	60	NO	60.30373	147.18329
2	3/12/2015	0	48	0	48	NO	60.30373	147.18329
2	3/12/2015	0	4	0	67	NO	60.30373	147.18329
3	3/12/2015	0	2	0	120	NO	60.30339	147.18324
3	3/12/2015	0	3	0	66	NO	60.30339	147.18324
3	3/12/2015	0	66	0	44	NO	60.30339	147.18324
3	3/12/2015	0	5	1	60	NO	60.30339	147.18324
3	3/12/2015	0	7	0	45	NO	60.30346	147.18320
3	3/12/2015	0	3	0	62	NO	60.30339	147.18324
3	3/12/2015	0	21	0	63	NO	60.30339	147.18324
3	3/12/2015	0	49	0	30	NO	60.30346	147.18320
3	3/12/2015	0	1	0	67	NO	60.30339	147.18324
3	3/12/2015	0	1	0	77	NO	60.30339	147.18324
3	3/12/2015	0	41	0	40	NO	60.30346	147.18320

3	3/12/2015	0	159	0	63	NO	60.30339	147.18324
3	3/12/2015	0	1	0	57	NO	60.30333	147.18321
3	3/12/2015	0	9	0	50	NO	60.30328	147.18324
3	3/12/2015	0	8	0	47	NO	60.30333	147.18321
3	3/12/2015	0	1	0	50	NO	60.30328	147.18324
3	3/12/2015	0	26	0	53	NO	60.30333	147.18321
3	3/12/2015	0	54	0	62	NO	60.30333	147.18321
3	3/12/2015	0	43	0	43	NO	60.30333	147.18321
3	3/12/2015	0	2	0	53	NO	60.30333	147.18321
3	3/12/2015	0	81	0	62	NO	60.30326	147.18294
3	3/12/2015	0	6	0	77	NO	60.30326	147.18294
3	3/12/2015	0	55	0	56	NO	60.30333	147.18321
3	3/12/2015	0	65	0	46	NO	60.30326	147.18294
3	3/12/2015	0	25	0	55	NO	60.30326	147.18294
3	3/12/2015	0	14	0	62	NO	60.30326	147.18294
3	3/12/2015	0	2	1	61	NO	60.30301	147.18283
3	3/12/2015	0	1	0	45	NO	60.30326	147.18294
3	3/12/2015	0	22	0	48	NO	60.30301	147.18283
3	3/12/2015	0	6	0	57	NO	60.30326	147.18294
3	3/12/2015	0	1	0	57	NO	60.30301	147.18283
3	3/12/2015	0	21	0	75	NO	60.30326	147.18294
3	3/12/2015	0	1	0	76	NO	60.30301	147.18283
3	3/12/2015	0	1	0	60	NO	60.30301	147.18283
3	3/12/2015	0	4	0	56	NO	60.30326	147.18294
3	3/12/2015	0	13	0	52	NO	60.30301	147.18283
3	3/12/2015	0	46	0	20	NO	60.30326	147.18294
3	3/12/2015	0	23	0	53	NO	60.30301	147.18283
3	3/12/2015	0	18	0	30	NO	60.30326	147.18294
3	3/12/2015	0	21	0	35	NO	60.30326	147.18294
3	3/12/2015	0	1	0	43	NO	60.30301	147.18283
3	3/12/2015	0	2	0	60	NO	60.30268	147.18253
3	3/12/2015	0	2	0	70	NO	60.30284	147.18265
3	3/12/2015	0	11	0	55	NO	60.30268	147.18253
3	3/12/2015	0	1	0	50	NO	60.30268	147.18253
3	3/12/2015	0	16	0	40	NO	60.30268	147.18253
3	3/12/2015	0	1	0	55	NO	60.30268	147.18253
3	3/12/2015	0	8	0	42	NO	60.30268	147.18253
3	3/12/2015	0	42	0	35	NO	60.30268	147.18253
3	3/12/2015	0	25	0	15	NO	60.30268	147.18253
3	3/12/2015	0	1	0	51	NO	60.30284	147.18265
3	3/12/2015	0	22	0	30	NO	60.30268	147.18253
3	3/12/2015	0	4	0	60	NO	60.30268	147.18253
3	3/12/2015	0	37	0	55	NO	60.30284	147.18265
3	3/12/2015	0	1	0	60	NO	60.30284	147.18265
3	3/12/2015	0	84	0	40	NO	60.30249	147.18242

4	3/13/2015	0	5	0	50	NO	60.30217	147.18210
4	3/13/2015	0	4	0	35	NO	60.30217	147.18210
4	3/13/2015	0	1	0	69	NO	60.30217	147.18210
4	3/13/2015	0	8	0	65	NO	60.30217	147.18210
4	3/13/2015	0	26	0	81	NO	60.30217	147.18210
4	3/13/2015	0	158	0	51	NO	60.30198	147.18178
4	3/13/2015	0	17	0	15	NO	60.30217	147.18210
4	3/13/2015	0	115	0	63	NO	60.30198	147.18178
4	3/13/2015	0	25	0	18	NO	60.30177	147.18153
4	3/13/2015	0	1	0	55	NO	60.30198	147.18178
4	3/13/2015	0	2	0	43	NO	60.30177	147.18153
4	3/13/2015	0	91	0	27	NO	60.30198	147.18178
4	3/13/2015	0	1	1	79	NO	60.30177	147.18153
4	3/13/2015	0	42	0	50	NO	60.30177	147.18153
4	3/13/2015	0	181	0	25	NO	60.30146	147.18138
4	3/13/2015	0	6	0	55	NO	60.30177	147.18153
4	3/13/2015	0	12	0	60	NO	60.30177	147.18153
4	3/13/2015	0	2	0	72	NO	60.30177	147.18153
4	3/13/2015	0	79	0	18	NO	60.30177	147.18153
4	3/13/2015	0	11	0	33	NO	60.30177	147.18153
4	3/13/2015	0	1	0	58	NO	60.30146	147.18138
4	3/13/2015	0	23	0	62	NO	60.30177	147.18153
4	3/13/2015	0	1	0	53	NO	60.30146	147.18138
4	3/13/2015	0	1	0	65	NO	60.30177	147.18153
4	3/13/2015	0	4	0	54	NO	60.30146	147.18138
4	3/13/2015	0	58	2	25	NO	60.30177	147.18153
4	3/13/2015	0	23	0	60	NO	60.30177	147.18153
4	3/13/2015	0	7	0	25	NO	60.30177	147.18153
4	3/13/2015	0	1	0	57	NO	60.30177	147.18153
4	3/13/2015	0	6	0	53	NO	60.30146	147.18138
4	3/13/2015	0	9	1	63	NO	60.30137	147.18114
4	3/13/2015	0	1	0	68	NO	60.30137	147.18114
4	3/13/2015	0	22	0	60	NO	60.30117	147.18108
4	3/13/2015	0	43	0	45	NO	60.30117	147.18108
4	3/13/2015	0	1	0	48	NO	60.30137	147.18114
4	3/13/2015	0	19	0	50	NO	60.30137	147.18114
4	3/13/2015	0	1	0	66	NO	60.30137	147.18114
4	3/13/2015	0	5	0	50	NO	60.30117	147.18108
4	3/13/2015	0	1	0	45	NO	60.30117	147.18108
4	3/13/2015	0	7	0	55	NO	60.30117	147.18108
4	3/13/2015	0	1	0	75	NO	60.30092	147.18120
4	3/13/2015	0	3	0	45	NO	60.30117	147.18108
4	3/13/2015	0	3	0	57	NO	60.30117	147.18108
4	3/13/2015	0	1	0	55	NO	60.30117	147.18108
4	3/13/2015	0	5	0	81	NO	60.30092	147.18120

4	3/13/2015	0	16	0	65	NO	60.30092	147.18120
4	3/13/2015	0	1	0	75	NO	60.30092	147.18120
4	3/13/2015	0	1	0	85	NO	60.30092	147.18120
4	3/14/2015	0	17	0	65	NO	60.30040	147.18111
4	3/14/2015	0	12	0	78	NO	60.30040	147.18111
4	3/14/2015	0	4	0	47	NO	60.30040	147.18111
4	3/14/2015	0	15	0	52	NO	60.30061	147.18124
4	3/14/2015	0	26	0	67	NO	60.30040	147.18111
4	3/14/2015	0	2	0	64	NO	60.30040	147.18111
4	3/14/2015	0	5	0	45	NO	60.30061	147.18124
4	3/14/2015	0	8	0	60	NO	60.30040	147.18111
4	3/14/2015	0	25	0	55	NO	60.30040	147.18111
4	3/14/2015	0	6	0	63	NO	60.30040	147.18111
4	3/14/2015	0	9	0	54	NO	60.30040	147.18111
4	3/14/2015	0	11	0	65	NO	60.30040	147.18111
4	3/14/2015	0	1	0	40	NO	60.30040	147.18111
5	3/14/2015	0	61	0	30	NO	60.30022	147.18098
5	3/14/2015	0	11	0	48	NO	60.30022	147.18098
5	3/14/2015	0	28	0	48	NO	60.30022	147.18098
5	3/14/2015	0	12	1	45	NO	60.29999	147.18069
5	3/14/2015	0	21	0	50	NO	60.30022	147.18098
5	3/14/2015	0	1	0	48	NO	60.30022	147.18098
5	3/14/2015	0	45	0	50	NO	60.29999	147.18069
5	3/14/2015	0	1	0	50	NO	60.30022	147.18098
5	3/14/2015	0	22	0	30	NO	60.29999	147.18069
5	3/14/2015	0	31	0	33	NO	60.30022	147.18098
5	3/14/2015	0	16	0	30	NO	60.29999	147.18069
5	3/14/2015	0	1	0	55	NO	60.30022	147.18098
5	3/14/2015	0	78	0	50	NO	60.29999	147.18069
5	3/14/2015	0	11	0	48	NO	60.29999	147.18069
5	3/14/2015	0	51	0	36	NO	60.29999	147.18069
5	3/14/2015	0	37	0	45	NO	60.29999	147.18069
5	3/14/2015	0	1	0	50	NO	60.29949	147.18068
5	3/14/2015	0	42	0	20	NO	60.29949	147.18068
5	3/14/2015	0	1	0	48	NO	60.29974	147.18062
5	3/14/2015	0	9	0	40	NO	60.29949	147.18068
5	3/14/2015	0	21	0	30	NO	60.29974	147.18062
5	3/14/2015	0	15	0	45	NO	60.29949	147.18068
5	3/14/2015	0	23	0	10	NO	60.29974	147.18062
5	3/14/2015	0	3	0	35	NO	60.29949	147.18068
5	3/14/2015	0	36	0	20	NO	60.29974	147.18062
5	3/14/2015	0	25	1	58	NO	60.29949	147.18068
5	3/14/2015	0	2	0	55	NO	60.29974	147.18062
5	3/14/2015	0	22	0	45	NO	60.29949	147.18068
5	3/14/2015	0	7	0	58	NO	60.29974	147.18062

5	3/14/2015	0	1	0	45	NO	60.29974	147.18062
5	3/14/2015	0	74	0	20	NO	60.29949	147.18068
5	3/14/2015	0	1	0	50	NO	60.29974	147.18062
5	3/14/2015	0	38	0	48	NO	60.29974	147.18062
5	3/14/2015	0	4	0	50	NO	60.29945	147.18028
5	3/15/2015	0	2	0	64	NO	60.29958	147.17982
5	3/15/2015	0	1	0	42	NO	60.29480	147.18010
5	3/15/2015	0	1	0	64	NO	60.29480	147.18010
5	3/15/2015	0	57	0	30	NO	60.29480	147.18010
5	3/15/2015	0	9	0	56	NO	60.29958	147.17982
5	3/15/2015	0	51	0	54	NO	60.29480	147.18010
5	3/15/2015	0	14	0	50	NO	60.29480	147.18010
5	3/15/2015	0	18	0	50	NO	60.29958	147.17982
5	3/15/2015	0	6	0	65	NO	60.29958	147.17982
5	3/15/2015	0	25	0	50	NO	60.29480	147.18010
5	3/15/2015	0	22	0	49	NO	60.29958	147.17982
5	3/15/2015	0	27	0	45	NO	60.29480	147.18010
5	3/15/2015	0	45	0	56	NO	60.29958	147.17982
5	3/15/2015	0	51	0	51	NO	60.29958	147.17982
5	3/15/2015	0	2	0	47	NO	60.29958	147.17982
5	3/15/2015	0	4	0	45	NO	60.29976	147.17947
5	3/15/2015	0	7	0	50	NO	60.29958	147.17982
5	3/15/2015	0	4	0	45	NO	60.29958	147.17982
5	3/15/2015	0	1	0	45	NO	60.29992	147.17963
5	3/15/2015	0	3	0	43	NO	60.29992	147.17963
5	3/15/2015	0	23	0	38	NO	60.29992	147.17963
5	3/15/2015	0	5	0	53	NO	60.29976	147.17947
5	3/15/2015	0	1		63	NO	60.29976	147.17947
5	3/15/2015	0	8	0	59	NO	60.29976	147.17947
5	3/15/2015	0	1	0	50	NO	60.29995	147.17876
5	3/15/2015	0	21	1	46	NO	60.29995	147.17876
5	3/15/2015	0	2	0	45	NO	60.29995	147.17876
5	3/15/2015	0	31	0	51	NO	60.29995	147.17876
5	3/15/2015	0	33	0	50	NO	60.29995	147.17876
5	3/15/2015	0	13	0	75	NO	60.29981	147.47787
5	3/15/2015	0	1	0	45	NO	60.29995	147.17876
5	3/15/2015	0	24	0	45	NO	60.29981	147.47787
5	3/15/2015	0	68	0	27	NO	60.29995	147.17876
5	3/15/2015	0	79	0	60	NO	60.29981	147.47787
5	3/15/2015	0	1	0	60	NO	60.29981	147.47787
5	3/15/2015	0	1	0	55	NO	60.29981	147.47787
5	3/15/2015	0	9	0	45	NO	60.29981	147.47787
5	3/15/2015	0	75	0	53	NO	60.29985	147.17798
5	3/15/2015	0	1	0	45	NO	60.29985	147.17798
5	3/15/2015	0	1	0	50	NO	60.29985	147.17798

5	3/15/2015	0	1	0	48	NO	60.29985	147.17798
5	3/15/2015	0	28	0	42	NO	60.29985	147.17798
5	3/16/2015	0	5	0	45	NO	60.29999	147.17838
5	3/16/2015	0	31	0	50	NO	60.29999	147.17838
5	3/16/2015	0	81	0	50	NO	60.29999	147.17838
5	3/16/2015	0	1	0	60	NO	60.29985	147.17805
5	3/16/2015	0	2	0	45	NO	60.29985	147.17805
5	3/16/2015	0	4	0	45	NO	60.29999	147.17838
5	3/16/2015	0	5	0	55	NO	60.29985	147.17805
5	3/16/2015	0	4	0	40	NO	60.29999	147.17838
5	3/16/2015	0	17	0	35	NO	60.29999	147.17838
5	3/16/2015	0	2	0	45	NO	60.29999	147.17838
5	3/16/2015	0	4	0	30	NO	60.29985	147.17805
5	3/16/2015	0	11	0	40	NO	60.29990	147.17865
5	3/16/2015	0	2	0	37	NO	60.29990	147.17865
5	3/16/2015	0	5	0	45	NO	60.29990	147.17865
5	3/16/2015	0	4	0	45	NO	60.29990	147.17865
5	3/16/2015	0	5	0	45	NO	60.29990	147.17865
5	3/16/2015	0	11	0	42	NO	60.29990	147.17865
5	3/16/2015	0	1	0	70	NO	60.30006	147.17859
5	3/16/2015	0	4	0	63	NO	60.30006	147.17859
5	3/16/2015	0	6	0	4	NO	60.30006	147.17859
5	3/16/2015	0	15	0	45	NO	60.30006	147.17859
5	3/16/2015	0	2	0	46	NO	60.30006	147.17859
5	3/16/2015	0	113	0	50	NO	60.29959	147.18059
5	3/16/2015	0	1	0	32	NO	60.29959	147.18059
5	3/16/2015	0	3	0	40	NO	60.29945	147.18060
5	3/16/2015	0	137	0	20	NO	60.29959	147.18059
5	3/16/2015	0	12	0	43	NO	60.29945	147.18060
5	3/16/2015	0	67	0	7	NO	60.29959	147.18059

INTERACTIONS OF WILD AND HATCHERY PINK SALMON AND CHUM SALMON IN PRINCE WILLIAM SOUND AND SOUTHEAST ALASKA

Final Progress Report for 2015

For Alaska Department of Fish and Game Contract IHP-13-013

Volume 2

APPENDIX A. OCEAN SAMPLING FIELD AND LAB PROTOCOL

APPENDIX B. ESTIMATING VARIANCES OF THE PROPORTION OF HATCHERY CHUM SALMON AND PINK SALMON ENTERING PRINCE WILLIAM SOUND

APPENDIX C. STREAM SURVEYS AND ADULT SALMON COLLECTION

APPENDIX D. PROTOCOLS FOR COLLECTING, PROCESSING, AND SHIPPING BIOLOGICAL SAMPLES FROM INDIVIDUAL SALMON

APPENDIX E. METHODS FOR ALEVIN SAMPLING

APPENDIX A. OCEAN SAMPLING FIELD AND LAB PROTOCOL

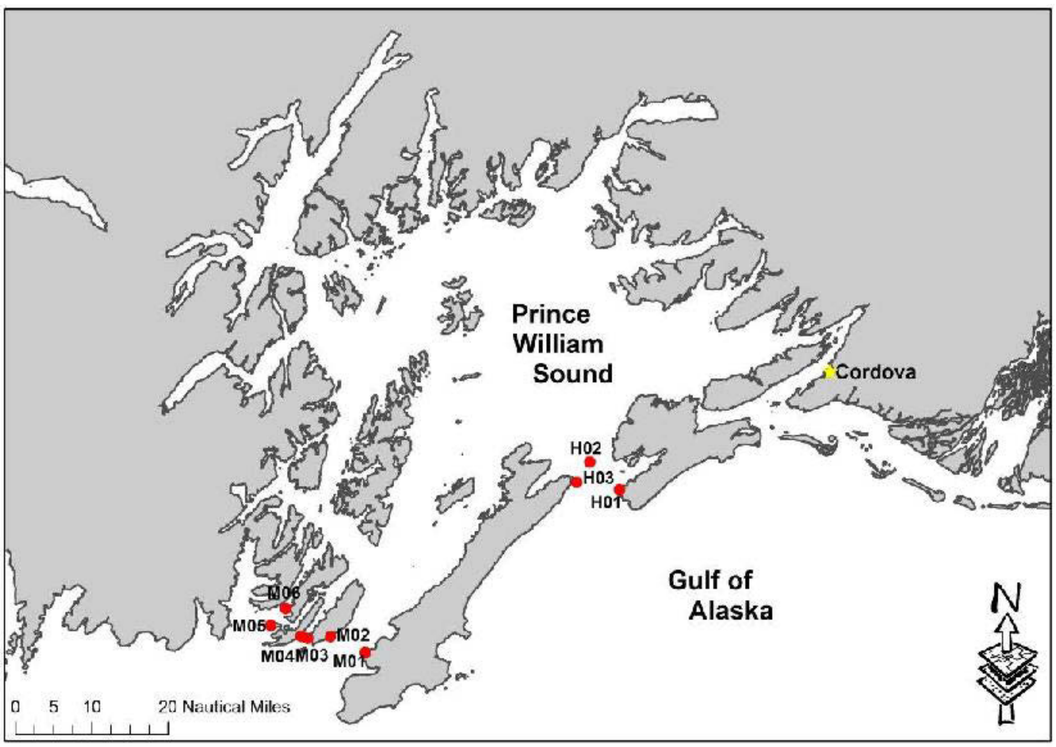
Always use the H-W data software to enter data. If the electronic data unit or software is malfunctioning, record all data manually for later entry.

Ocean Net Sets

Sampling Stations

The nine sampling stations are shown in Figure A1. There may be some latitude in station location, based on the relative catches at various stations, but only in consultation with the PI, Project Manager, and the Science Panel. The most important thing is to maintain as much consistency in station locations as is reasonable throughout the season.

Figure A1. PWS hatchery-wild interactions study ocean sampling station locations.



Sampling Schedule

Each set of stations will be fished twice a week, alternating between Hinchinbrook and Montague areas.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Fish delivery to PWSSC	No fishing	Fish three Hinchinbrook stations	Fish six Montague stations	Fish delivery to PWSSC	Fish three Hinchinbrook stations	Fish six Montague stations

If the captain is unable to fish any of the stations at any of the scheduled times, the fishing days may be adjusted accordingly.

Any time a station is not sampled twice per week, a haul should be created in the database for each missed sample, with a comment explaining why the sampling was not completed, but no other information for that haul should be entered.

Net setting at each sampling station

At each sampling station location, set sufficient net, up to 160 fathoms, to capture and retain 20 pink and 20 chum salmon at each Hinchinbrook station and 10 pink and 10 chum salmon at each Montague station each sample day.

Four net panels of different mesh sizes (4-3/8, 4-3/4, 5-1/8, 5-1/2) will normally be shackled together in a prescribed order. If the same net configuration is fished for a week without using its full length in most sets, then it should be turned end-to-end at the beginning of the following week. There may be times when a panel is missing due to damage, etc. Regardless of the number or order of panels, the important thing is to record which panel went into the water first, second, etc. so that CPUE can be calculated later.

Use the HW laptop app to record:

1) the start and end of any periods of net setting,
2) the beginning and end of any drifts,
3) the start and end of any net retrievals, and
4) the end of retrieval.

Any pause in setting or retrieving greater than 2-3 minutes should be treated as a drift and the start and end times of the drift are recorded. The beginning of setting and the end of retrieval should be recorded using the software because the specific time and the geographic coordinates will be recorded automatically by the software. Drift start and end times can be recorded on paper and then entered to the software after the set is completed.

Ocean Netting Fog Protocol

Maintaining visibility of the gear is important for avoiding excessive catch and entangling whales; The fog protocol is as follows:

> If foggy and winds are calm, arrive at site and shut down. Listen for whales, vessels. Use radar and AIS to detect approaching traffic.
>
> If no traffic is detected, set 50 fathoms of gear or comfortable length so long as end buoy is visible. Shut down and listen except when gear tending is needed. Adjust net length according to visibility.

At-Sea Salmon Processing Protocol

If more than the required number of fish is captured, systematically select (i.e. not random) the sample from the catch (e.g., every other, every third, or every fourth, etc.,). Fish to be analyzed will be killed by concussion, bled, and stored on ice in slushy bags until delivery. Individuals will be marked by station using color coded floy tags, as follows (chum and pinks can be stored in the same bags):

H01-Black,
H02-Yellow,
H03-Pink,
M01-Dk. Green,
M02-Red,
M03-Baby Blue,
M04-Lime,
M05-Orange,
M06-Dk. Blue~~)~~

Disposition of Excess Catch

If salmon are captured in excess of the required samples, every effort will be made to bleed the fish and keep them iced and in marketable condition. Excess fish will be either sold or returned to PWSSC for donation to food programs. The captain has a permit card to sell fish; all proceeds from the sales go to ADFG.

Netting Steps and Data Entry
Use the “Ocean Haul” Tab to enter data

When to enter data	**Software Entry**	**Info Recorded by software***	**Comments**
Arrive at station	Add New Haul	Station ID, Date	Select station and date from dialog box

	Net configuration	Panel mesh size in order of first, second, third. etc. panels out	Select a configuration from list, or use the “Settings” tab to create a new configuration, in order of deployment, regardless of whether they will all be deployed. Both “Code” and “Description” of the net configuration should be the numbers with no punctuation, e.g., 434500518 means three panels 4-3/4,5, and 5-1/8
Immediately before setting net	Set Begin	Time, Latitude, Longitude	If manual, use number pad to enter times and lat/lon degrees (to 3 decimal places)
	Cancel set begin		Use if false beginning net set – reset to begin net set
Start a drift	Start Drift	Time,	Record time. Repeat as necessary for any drift, or any setting or retrieving pause > 2-3 minutes.
	Fathoms	Net fathoms out	Length of net out
End a drift	End drift	Time	Repeat for end of each drift or pause
End of net retrieval	Retrieve End	Time, Latitude, Longitude	Enter as soon as the last of the net is pulled from water
After picking and sampling fish	Total pinks caught	Total pinks caught	Type number in
	Pinks retained	Pinks retained	Type number in
	Total chum caught	Total chum caught	Type number in
	Chum	Chum	Type number in

	retained	retained	
	Other species name	Other species name	Select from drop-down. If not on list, go to "Settings"
	Other species total catch	Other species total catch	Type number in
	Other species total retained	Other species total retained	Type number in
During net set or before leaving station	Sky cover	Sky cover	Select from drop-down
	Wind Direction	Wind Direction	Select from drop-down
	Wind speed	Wind speed	Select from drop-down
	Tide stage	Tide stage	Select from drop-down
	CTD	CTD	Check box if CTD was taken
	Haul Operator	Names of people on boat	Select from list, or use "Settings" tab to enter a new person. Repeat as necessary if more than one person on boat
	Comments	Comments	Any comments about the set

* Or by hand if software unavailable

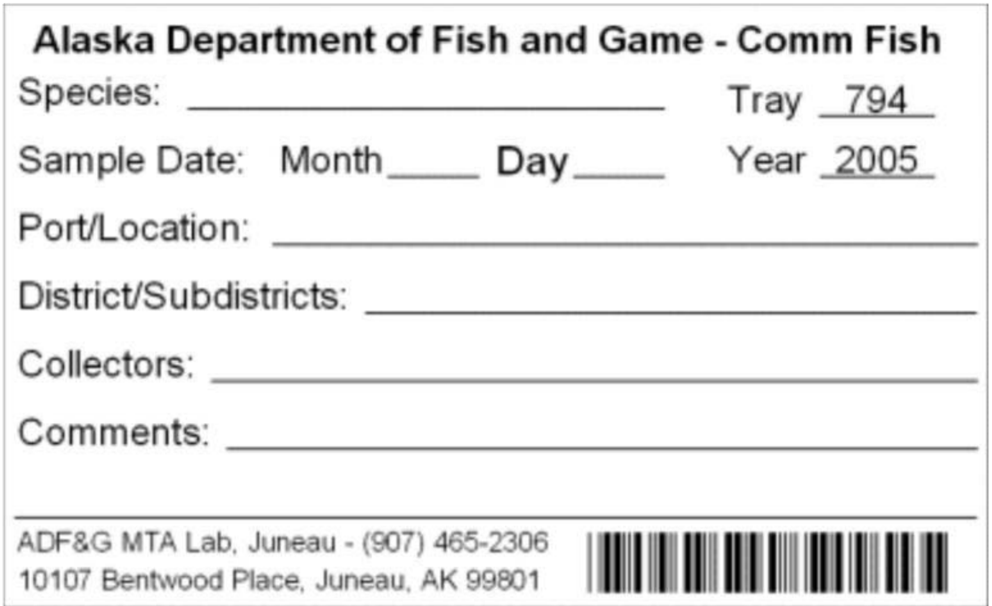
After all the data is entered and double-checked for a given sampling trip, the last step is to conduct the QA process and "transmit" the data to the host database via the internet.

Ocean Salmon Processing Protocols

Otolith Tray Preparation

Try to use otolith tray labels in sequential order. Before processing fish fill out the otolith tray label (shown below) with the appropriate data and adhere it to the tray. **<u>Use #2 pencil to fill these out</u>**. The date is the date the sample was taken from the water. In "Port/Location", enter the site name (Hinchinbrook or Montague). In

"Districts/Subdistricts" write the station numbers. Write "PWSSC H-W Ocean sampling" in Comments.



Alaska Department of Fish and Game - Comm Fish

Species: ____________ Tray 794

Sample Date: Month____ Day____ Year 2005

Port/Location: ____________

District/Subdistricts: ____________

Collectors: ____________

Comments: ____________

ADF&G MTA Lab, Juneau - (907) 465-2306
10107 Bentwood Place, Juneau, AK 99801

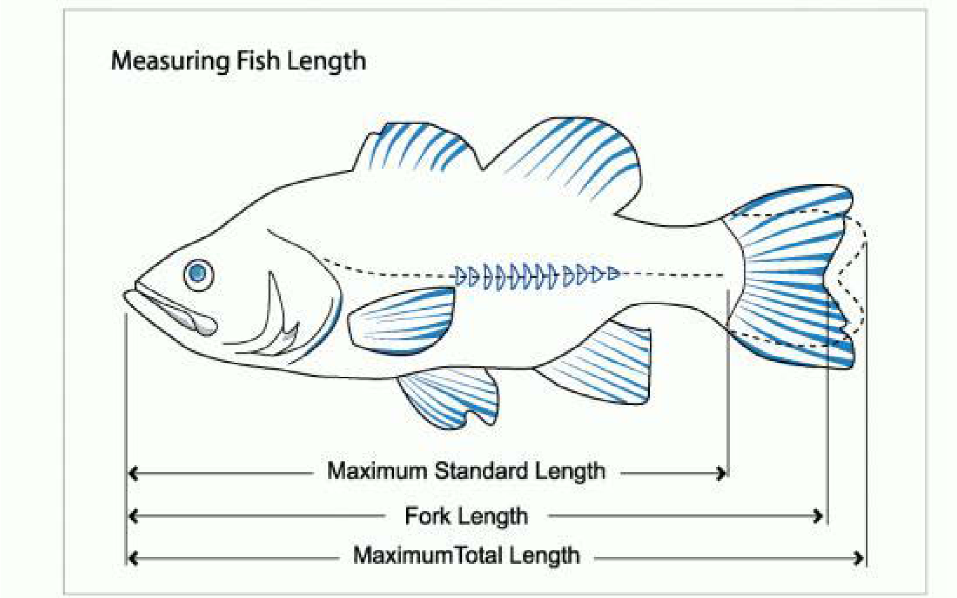
Processing Steps

Separate the fish by tag color in order to process one station at a time. **Always process batches by sampling date, species, and station.** This is because the otolith trays must be separate by date, species, and station, even if there is only or a few samples per tray.

Data collection order for each specimen:

1. Date of capture
2. Station ID
3. Species
4. Weight (g) -- Place a 5 gal bucket onto the Ohaus washdown bench scale and make sure the digital scale is zeroed. Then place the fish to be weighed inside bucket and take the measurement to the nearest gram.
5. Total Length (mm) -- Place the fish on the Ichthystick with the snout facing the black barrier at the zero mark. Make sure the cursor is in the cell for Total Length for the fish being measured. Lay the fish as flat as possible and place the magnetic stylus at the tip of the tail. The measurement has been taken if you see the blue light flash and/or the fish logo flash on the computer. If the sound is turned on the computer, a sound will emit as well and you can

proceed to the next measurement.



6. Standard Length (snout to hypural) -- Repeat above except make cursor is in the cell for Standard Length for the fish being measured and take the measurement at the end of the hypural bone. It may help visualize the hypural by folding the caudal fin towards the body.
7. Mid-eye-hypural length (mm) -- For this measurement, place the middle of the eye at the 10 cm mark and take the measurement at the end of the hypural bone, being sure the cursor is in the MEH cell. If the automatic Icthystick is unavailable, use a measuring tape from the mid-eye to the hypural bone, and enter the data into the software manually.
8. Mid-eye-Fork length (mm) -- Place the middle of the eye at the 15 cm mark and take the measurement at the closest point in the fork, being sure the cursor is in the MEF cell. If the automatic Icthystick is unavailable, use a measuring tape from the mid-eye to the closest point in the fork, and enter the data into the software manually.
9. Gonad weight (g) (if viable) -- If the fish appears in good condition and hasn't started to degrade, enlarge the slice made to examine the gonads and gently pull them out. Cut the ends to remove from the body, clean any obvious excess tissue from the gonads, and weigh on the digital balance to the nearest hundredth of a gram.
10. Sex – Record male or female.
11. Otolith tray number (corresponds to white preprinted label)
12. Otolith cell number
13. Comments on fish or otoliths

Extracting otoliths

It is **extremely important** that the otolith tray and cell number correspond to the sex, length, etc. data so, if you cut heads in batches, you MUST keep the heads and bodies in the same order for which the sex and length data was taken until all the tray cells are filled and double-checked for that batch.

There are several methods for cutting the heads to access otoliths. This is one method:

- Grasp the fish by the eye sockets with the holding hand under the jaw. Scalp the top of the head off by cutting straight back (Figure A2). The best place to make the cut will be easy to determine after you've cut a few fish.

Figure A2. Example of where to make the first incision for collecting otoliths in the field.

- Cut far enough so that the scalp flap can be pulled back and out of the way to expose the brain cavity (Figure A3).

Figure A3. Slice far enough to expose the brain cavity – the depression in the center of the cut shown here.

Spread the head open and expose the brain cavity. If necessary remove the brain material to reveal the otolith wells (Figure A4).

Figure A4. Remove the brain tissue if necessary.

- With tweezers, pluck the left sagittal otolith from its sagittal well (Figure A5). The sagittal well is a depression in the most posterior-ventral portion of the brain cavity. (Pink salmon otoliths are about ¼ inch long, chum otoliths are about 3/8-inch long.) Place the otolith onto the back of your hand and then recover the right otolith from the right sagittal well. It may take some probing, especially if the cut is not just right, or the carcass is old.

♦ 

Figure A5. Removing otolith from well under brain cavity.

- ♦ The otoliths are encased in a tissue bag surrounded by fluid. Gently rub or tweeze the tissue off the otoliths by rubbing them on a neoprene glove or cuff. Clean off any blood, and place both of them into the next well of the otolith tray.
- ♦ If an otolith is accidentally cut in half, place both halves in the well.
- ♦ If one of the two otoliths is lost during the process, place a colored bead into the well with the recovered otolith. If both are lost, place two beads in the cell for that fish. Always move to the next cell for the next fish.
- ♦ If an otolith or two are accidentally placed or fall into a cell that has previously been filled, do not guess which otolith is which. Instead, discard all those otoliths, clear the data for the suspect cells, and enter new otoliths and data for those cell (do not leave any cells empty).

Filling the Trays

Note that the first specimen for every tray should go into the highlighted cell, A1 (Figure A6). Cells in a tray should be filled left to right by row (like reading a book): A1-A12, B1-B12,…. H1-H12.

Repeat the dissection procedure until all the fish for that date, species, and station are processed. .Keep the heads and bodies in order until you have the batch of otoliths in the tray. Before disposing of the heads and bodies, check the cells to be sure that every fish is represented in the tray and that tray cells match the fish.

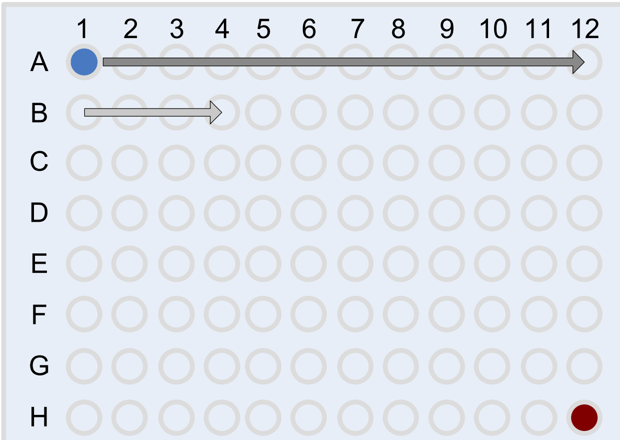


Figure A6. Fill otolith trays from left to right, top row first.

Finishing a Tray

Before ending a tray, check to be sure that every cell in the tray contains two otoliths, one otolith and one bead, or two beads. Check to be sure that the number of filled cells matches the number of fish entered into the data. If there are discrepancies that cannot be rectified by studying the number of fish processed, or by finding more than two items in one cell, make a note in the comments of every cell from the cell in question to the last cell in the tray.

Place two plastic inserts on top of the cells (or one if the inserts are thick enough) to avoid otoliths jumping from one cell to another during handling. Then cover the tray with a lid, and seal it tightly with three rubber bands. Be sure all trays are handled and stored right side up to avoid jostling the otoliths to adjacent cells,

Data Entry – Ocean Specimens

All data will be entered into the project software for uploading to the project database. There are two steps for entering data for a given sample date, species, and station.

1. Go to the "Ocean Haul" tab.

When to enter value	Software Entry	Info Recorded by software*	Comments
Before processing a sample for one date, species,	Ocean Haul	Station, Date	Highlight haul from pre-recorded list on left side of screen. If the haul is not displayed, click "Add New Haul" at bottom and select the transect (station) and date

station			that the sample was collected. Click "Save". Highlight the Haul to be processed.

* Or by hand if software unavailable

2. Do not change anything else on the "Ocean Haul" screen, but then switch to the "Ocean Specimens" tab.

When to enter value	Software Entry	Info Recorded by software*	Comments
Before starting to process fish	Ocean Haul		Be sure the correct Ocean haul station and date are displayed in the upper left. If not, go back to "Ocean Haul" tab and select or creat correct haul.
	Species	Species code	Select from drop-down
	Add specimens - count and species	Specimen ID and species code	Count and enter the number of fish to be processed.
	Add specimens – otolith tray number	Otolith tray number	Enter the full tray label number beginning with 2014 (eg 20148000)
	Samplers	Samplers name	Select from list, or use "Settings" tab to enter a new person. Repeat as necessary if more than one person is working on process
Processing fish-by-fish	Sex	Sex	Select from drop-down
	Weight	Weight	Nearest gram
	Total length	Total length	Nearest mm
	Standard length	Standard length	Nearest mm
	Mid-eye – hypural length	Mid-eye – hypural length	Nearest mm
	Mid-eye – fork length	Mid-eye – fork length	Nearest mm

	Otolith tray number	Otolith tray number	Entered in software
	Otolith cell number	Otolith cell number	Should be auto-filled by software. If not, enter cell number: A1 through H12. (Every fish has a cell number, even if no ototliths are recovered).
	Gonad weight	Gonad weight	To the nearest hundredth of a gram
	Fish comments	Fish comments	Any comments about individual fish, their measurements, or otolith peculiarities

* Or by hand if software unavailable

Sample Fish Disposition

Each week, depending on the run strength, up to 240 chum salmon and 240 pink salmon will be delivered to the portable fish processing lab on the PWSSC dock in Cordova. The fish will be kept on ice to maintain their freshness for sampling. After sampling, the fish will be sold to local buyers if they are marketable or given to local food banks. If there is no buyer or outlet for the sample fish, they will be taken back out to sea for disposal.

APPENDIX B. ESTIMATING VARIANCES OF THE PROPORTION OF HATCHERY CHUM SALMON AND PINK SALMON ENTERING PRINCE WILLIAM SOUND

Variance of CPUE

Catch in a standardized unit of fishing effort is considered to be distributed according to a Poisson probability distribution with mean μ and variance μ. If C_j is the catch in a standardized drift *j* during a trip to a specific station, the expected value of C_j is μ, which makes

$$\hat{\mu} = \frac{\sum_{j=1}^{n} C_j}{n}.$$

where n is the number of drifts during that trip. In our study, the variable *CPUE* for a specific trip to a specific station is not based on specific drifts, but on summing catches of the target species over several drifts at each trip to each station such that

$$CPUE = \frac{\sum_{j=1}^{n} C_j}{E} = \frac{n\hat{\mu}}{E}$$

where *E* is the sum of the fishing effort in fathom-hours across drifts. Remembering that the variance of a Poisson variate is equal to its mean, the variance for *CPUE* for a specific trip to a specific station is

$$v(CPUE) = \frac{n^2\hat{\mu}}{E^2} = \frac{n}{E}\left(\frac{n\hat{\mu}}{E}\right) = \frac{n}{E}CPUE\,. \tag{A1}$$

The mean of CPUE across trips for a station in our study is the arithmetic mean

$$\overline{CPUE}_s = \frac{\sum_{t=1}^{T_s} CPUE_{st}}{T_s}.$$

Equation 7 is the above formulation only adapted for the occurrence of missing data. Because estimates of CPUE were independent across trips, the variance of mean CPUE is the sum of the trip variances multiplied by the square of the reciprocal of the number of trips:

$$v(\overline{CPUE})_s = \frac{\sum_{t=1}^{T_s} v(CPUE_{st})}{T_s^2}.$$

Equation 15 is the above formulation only adapted for the occurrence of missing data.

Variance of $\hat{W}_{st}$

By the delta method the variance of a non-linear function of variables g[**X**] where **X** is the vector [x_1, x_2, … x_n] can be approximated with the non-quadratic terms in a Taylor series expansion of g[**X**] as follows:

$$v(g[\mathbf{X}]) = \sum_i v(x_i)\left(\frac{\partial g}{\partial x_i}\right)^2 + 2\sum\sum_{i<j} Cov(x_i, x_j)\left(\frac{\partial g}{\partial x_i}\right)\left(\frac{\partial g}{\partial x_j}\right).$$

Here the non-linear function is $\hat{W}_{st}$ and the x's are the $CPUE_{st}$ as given in Equation 3. The derivatives under these circumstances are:

$$\frac{\partial \hat{W}_{st}}{\partial CPUE_{st}} = \frac{\sum_{t',t'\neq t} CPUE_{st'}}{\left(\sum_{t'} CPUE_{st'}\right)^2} \qquad \frac{\partial \hat{W}_{st}}{\partial CPUE_{st'}} = -\frac{CPUE_{st}}{\left(\sum_{t'} CPUE_{st'}\right)^2}.$$

Note that summation over subscript t' indicates a sum over all trips <u>including</u> trip t; the summation with configuration t', $t' \neq t$ indicates a sum over all trips <u>excluding</u> trip t. With substitution of the derivatives and some rearranging of summations, the result is Equation 11:

$$.\, v(\hat{W}_{st}) \cong v(CPUE_{st})\left(\frac{\sum_{t',t'\neq t} CPUE_{st'}}{\left(\sum_{t'} CPUE_{st'}\right)^2}\right)^2 + \left(-\frac{CPUE_{st}}{\left(\sum_{t'} CPUE_{st'}\right)^2}\right)^2 \sum_{t',t'\neq t} v(CPUE_{st'}).$$

Because catch per unit of effort was measured independently across trips within a station, there are no covariances involved in the above formulation.

Variance for PWS

Equation 13 can be formulated as follows to simplify derivation of an approximate variance:

$$v(\hat{p}) = v\left(\sum_{s=H01}^{H01\cdots M06} \frac{\overline{CPUE}_s}{\sum_{s'} \overline{CPUE}_{s'}} \hat{p}_s\right)$$

By the delta method the variance of a function of variables g[**X**] where **X** is the vector [x_1, x_2, … x_n] can be approximated with the non-quadratic terms in a Taylor series expansion of g[**X**] as follows:

$$v(g[\mathbf{X}]) \cong \sum_i v(x_i)\left(\frac{\partial g}{\partial x_i}\right)^2 + 2\sum\sum_{i<j} Cov(x_i, x_j)\left(\frac{\partial g}{\partial x_i}\right)\left(\frac{\partial g}{\partial x_j}\right)$$

The x's here are the set of 18 variables $\{\overline{CPUE}_{H01},\ldots\overline{CPUE}_{M06}, \hat{p}_{H01},\ldots\hat{p}_{M06}\}$. Because each variable (estimate) in this set came from different samplings, the variables are independent with $Cov(x_i, x_j) = 0$. The derivatives under these circumstances are:

$$\frac{\partial g}{\partial \overline{CPUE}_s} = \frac{(\sum_{s'}\overline{CPUE}_{s'} - \overline{CPUE}_s)\hat{p}_s}{(\sum_{s'}\overline{CPUE}_{s'})^2} - \frac{\sum_{s',s'\neq s}\overline{CPUE}_{s'}\,\hat{p}_{s'}}{(\sum_{s'}\overline{CPUE}_{s'})^2} = \frac{\hat{p}_s - \hat{p}}{\sum_{s'}\overline{CPUE}_{s'}}$$

$$\frac{\partial g}{\partial \hat{p}_s} = \frac{\overline{CPUE}_s}{\sum_{s'}\overline{CPUE}_{s'}} = \hat{W}_s$$

Note that a summation over subscript *s*à indicates a sum over all stations <u>including</u> station *s*; the summation with configuration *s*à, *s*à ≠ *s* used below indicates a sum over all stations <u>excluding</u> station *s*. With substitution of the derivatives and some rearranging of summations, the result is Equation 14:

$$v(\hat{p}) \cong \sum_{s=H01}^{H01\ldots M06}[\hat{W}_s^2 v(\hat{p}_s) + \left(\frac{\hat{p}_s - \hat{p}}{\sum_{s'}\overline{CPUE}_{s'}}\right)^2 v(\overline{CPUE}_s)]\,.$$

APPENDIX C. STREAM SURVEYS AND ADULT SALMON COLLECTION

This protocol will be used to prepare for and conduct surveys of streams for the hatchery-wild interactions study in Southeast (SEAK) and Prince William Sound (PWS) in 2015. There are two major purposes of the study: 1) to collect salmon otolith samples, and data on sex, fish length, and fish height, as a basis for estimating the fraction of hatchery-origin salmon in 64 streams (32 each in SEAK and PWS) and 2) to additionally collect DNA tissue samples on a subset six “fitness” streams in PWS for estimating the relative survival of hatchery- and wild-origin Pink Salmon. Selected PWS streams will also be sampled for other purposes: additional DNA samples for the ADF&G genetic stock structure study and a suite of tissues for stable isotope analyses for a preliminary analysis of foraging ecology. Tables B1 and B2 designate the streams and species to be sampled and the types of sampling at each stream in 2015. Details about collecting measurements and biological samples from each specimen are described in the next protocol (Appendix C). This protocol is about collecting fish from streams.

Targeted Number of Fish to Sample

Otolith-only Streams

For each SEAK otolith-only stream, a minimum of two visits per season are required, but more will be conducted if needed and if time allows. In PWS, at least three visits per otolith-only stream per species are required, but more are preferable. The targeted number of individual samples for analysis in each otolith-only stream (both SEAK and PWS) is 384 over all the seasonal visits. The samples collected at each stream will be representative of all individuals within that population. **Therefore, the samples should be spread as evenly as possible over the multiple visits to each stream and throughout the stream length as much as possible. More stream visits are preferable to less. The crew leader can elect to spend more than one day per stream visit if that will help to complete sampling goals.**

When collecting samples on otolith-only streams, only carcasses or post-spawners are eligible for processing. Live, pre-spawned fish must be released to continue spawning.

Although the overall target number of samples in otolith-only streams is set at 384 spread over all the visits, the crew should always attempt to collect as many samples as possible in the first and second visits to compensate for the possibility of a lack of fish on subsequent visits. If there are enough fish available on the first visit, try to sample 300 fish. On the second visit, if between 192 and 300 were collected on the first visit, collect approximately 192 on the second visit. If less than 192 were collected on the first visit, collect 300 on the second visit if possible. During the third and subsequent visits, sample 200 or all spawned-out salmon present, whichever is the smaller number.

Table B1. Streams to be sampled in Southeast Alaska in 2015. No fitness sampling will be conducted in Southeast Alaska in 2015.

Stream name	Stream code	Sampling events per season
Carroll Creek	101-45-10780	2-4
Chaik Bay Creek	112-80-10280	2-4
Chuck River	110-32-10090	2-4
East of Snug Cove*	110-23-10210	2-4
Ford Arm Creek	113-73-10030	2-4
Freshwater Creek	112-50-10300	2-4
Game Creek	114-31-10130	2-4
Glen Creek	110-34-10060	2-4
Greens Creek	112-65-10240	2-4
Harding River	107-40-10490	2-4
Hidden Inlet*	101-11-11010	2-4
Johnston Creek	110-23-10100	2-4
Kadashan River	112-42-10250	2-4
King Creek	101-71-10040-2006	2-4
King Salmon River	111-17-10100	2-4
Little Goose Creek	112-48-10190	2-4
Marten River	101-30-10600	2-4
North Arm Creek	108-40-10150-2007	2-4
Petrof Bay W Head*	109-62-10240	2-4
Ralphs Creek	112-21-10060	2-4
Rodman Creek	113-54-10070	2-4
Saginaw Bay S Head*	109-44-10370	2-4
Seal Bay Head*	112-46-10070	2-4
Sister Lake SE Head*	113-72-10040-2025	2-4
Swan Cove Creek	111-16-10450	2-4
Ushk Bay W End*	113-56-10030	2-4
W Crawfish NE Arm Hd*	113-32-10050	2-4
Whitewater Creek	112-90-10140	2-4
Admiralty Creek	111-41-10050	2-4
Prospect Creek	111-33-10100	2-4
Fish Creek	111-50-10690	2-4
Sawmill Creek	115-20-10520	2-4

* These streams are not officially named

Table B2. Streams and species to be sampled in PWS in 2015, indicating the fitness streams, the number of sampling events per season, and the targeted number of samples for the associated stock structure study (see also the "Tote Board" on Google Drive).

Stream name	Stream code	Target species	Fitness stream	Sampling events per season	DNA for stock structure*
Hartney C	221-10-10020	pink, chum		3 to 5	240
Sheep R	221-20-10360	Pink		3 to 5	
Beartrap R	221-30-10480	pink, chum		3 to 5	
Fish C	221-40-10890	Pink		3 to 5	240
Lagoon C	221-40-10990	Pink		3 to 5	240
Short C	221-40-10880	Pink		3 to 5	
Sunny R	221-40-10875	pink, chum		3 to 5	
Long C	222-10-12140	pink, chum		3 to 5	260
Spring C	221-20-10200	DNA pink	Yes	Daily	
Spring C	222-10-12170	pink, chum		3 to 5	
Vanishing C	222-10-12157	Chum		3 to 5	
Siwash R	222-20-12640	pink, chum		3 to 5	200
Surplus C	222-20-12338	Pink		3 to 5	
Wells R	222-20-12340	Chum		3 to 5	
Hummer C	224-10-14250	Pink		3 to 5	
Mill C	224-10-14210	Chum		3 to 5	
Coghill R	223-30-13220	pink, chum		3 to 5	240
Blackstone C	224-10-14510	Chum		3 to 5	
Tebenkof C	224-10-14500	Chum		3 to 5	
Paulson C	224-10-14550	pink, chum		3 to 5	240
W. Finger C	224-40-14850	pink, chum		3 to 5	
Comstock C	225-20-15040	Pink		3 to 5	
Bainbridge C	226-20-16300	Pink		3 to 5	
Erb C	226-20-16040	DNA pink	Yes	Daily	
Paddy C	226-20-16010	DNA pink	Yes	Daily	
Hogan Bay	226-30-16810	DNA pink	Yes	Every other day	
Johnson C	226-40-16269	Pink		3 to 5	
Cabin C	227-20-17464	pink, chum		3 to 5	260
Gilmour C	227-20-17480	DNA pink	Yes	Every other day	
Stockdale C	227-20-17520	DNA pink	Yes	Every other day	
Swamp C	227-20-17390	pink, chum		3 to 5	
Double C	228-40-18310	pink, chum		3 to 5	
Constantine C	228-60-18150	pink, chum		3 to 5	240
Humpback C	221-10-10110	pink		2**	240
Windy C	228-30-18610	pink		2**	240
Snug Harbor C	226-30-16820	pink		3**	371

* Approximately half of the samples taken early in the run, the other half taken late in the run
** Stock structure sampling only

In many cases the total number of carcasses and post-spawners in a stream will be small enough that the crew can process them all during that visit. If the resulting number of samples collected that day is very small, it may be necessary to amend the crew schedule and prioritize re-visiting these streams in which the fewest samples have been collected. On other occasions, especially during the peak stages of the run, there may be more carcasses and post spawners in the stream than the crew can process on that visit. On these occasions, the crew will need to collect as many samples as possible, while keeping sampling effort spread out across the entire stream reach.

Fitness Streams

The analytical goal for otolith and DNA tissue samples from each fitness stream is the maximum number of samples possible. Three of the fitness study streams will be sampled every day (Spring, Paddy, Erb). The three other streams may be sampled every other day (Table B2) although every day is preferable (Gilmour, Stockdale and Hogan Bay Creeks). These latter streams will be sampled every day for 2 weeks during the peak runs in late August. Sampling will thus be maximized and distributed evenly to best represent the run.

PWS Pink Salmon Stock Structure Sampling

Twelve streams will be sampled for Pink Salmon genetic tissues in PWS in addition to the fitness streams. The sampling targets are shown in Table B2 except Snug Harbor Creek (below). The methods for the Stock Structure sampling are the same as for the fitness sampling, as described below. In the Stock Structure streams (except Snug), try to take the first half of the goal early in the run, and the second half of the goal in the later part of the run. All stock structure samples should be taken upstream of the intertidal zone. All stock structure samples should be from either live fish or fish with pink gills – no deteriorated fish please. This can include pre-spawn fish. Because the stock structure samples will include otoliths, they will be counted as part of the otolith-only sampling targets. At Snug Harbor Creek, the 1st collection of 96 samples is targeted for the last week of July (early run). The 2nd collection of 125 fish will happen in the middle of August (2~2.5 weeks after the 1st collection). The 3rd collection of 150 fish (late run) will happen in the end of August or early September.

PWS Pink Salmon Foraging and Breeding Performance Sampling

Ten streams will be sampled for additional attributes to investigate the relative biological and ecological performance of fish from different streams and hatcheries. A separate protocol will guide this sampling.

Priorities for Stream Visits

In pedigree/fitness streams, continue sampling your streams as often and as much as possible, or at least according to the schedule shown in Table B2. The more samples the better for the fitness analysis.

For otolith-only streams, the overall goal is to sample each stream over the run timing and over the entire accessible extent of each stream throughout the season. The priorities for sampling depend on a mix of the status of previous sampling, fish availability (run timing), and your total stream assignments (schedule). This information will be in flux as the season progresses and as we learn from additional ADF&G aerial survey information. The tote board is your basic guide and tracking system.
The relative priorities as established by the Science Panel are:

- Try to meet the overall sampling goals on all streams
- If necessary, prioritize getting a good sampling on all streams over getting maximum numbers on fewer streams.
- Upon reaching the goal in some streams, increase effort on the less sampled streams.
- Try to get a thorough sampling of the entire accessible reach at least once per season (if not during every visit).

Tote Board

Individual sampling goals for each visit to a stream, and a method for tracking progress toward the goals, is established in separate spreadsheets for PWS and SEAK. These are each located in their respective folders of the project Google Drive. Crew leaders with access to the Google Drive should update the tote board each day. If there is no access to the internet, crew leaders should text their final sample numbers daily to their coordinator who will update the tote board.

Preparations for Surveys

Preliminary preparations for your survey (usually the night before) at base camp or on live-aboard boats are as follows.

√ *Charge all tablets and scanners fully*
The tablets are key to data collection and organization. One tablet may not last all day for sampling, so having and keeping a full charge is essential to success. Charge tablets preferably on 110 ac – they will charge quicker. (See separate instructions for scanner set-up in needed.)

* To conserve tablet battery life,

- Turn wi-fi off in the field, put into airplane mode, and turn sound off
- Turn power all the way off when not using for more than a few minutes
- Set the display time-out to 1 minute or less
- Change the display to automatic rather than keeping it on high all the time.
- Do not use tablet after charging until in the field (or recharge)
- Do not leave the tablet connected to a computer or battery pack when the source unit is off – the tablet may discharge.

√ *Clean and inspect guns and other safety gear*
Be sure shotguns are unloaded and clean guns according to standard method. Unless in the field, guns should be kept unloaded. Be sure all safety gear is ready and operable.

√ *Dry and patch waders*

√ *Prepare for the next sample visit*
Study maps and other info for streams to be visited. The crew leader will consult tote board or, if in doubt, call the project coordinator to ascertain species to be collected, number of each, sample types, and gear needed to accomplish task. Crew leader will consult tide graph and based on that (and the target species), determine the sampling survey strategy. Crew leader assigns tasks to personnel accordingly (see stream surveys below). Make every effort to visit each stream during a time that encompasses one low tide and plan your survey so that the low intertidal is included in sampling.

√ *Prepare otolith and/or DNA sampling kits*
Select the trays and labels that will be needed for the next survey and be sure they are ready for field deployment (take extras). Be sure you have all the necessary tools, back-up data sheets, and safety gear ready (see other protocols).

Stream Surveys

A stream survey is defined as a set of Processing Areas on one stream and one date, with a beginning and ending point along the stream. A survey includes information about a day's activity on a stream such as demarcating the beginning and end locations of the survey. A careful count of the total number of observed alive and dead target species in the survey area will also be made for each survey. The survey can be conducted as the crew moves either upstream or downstream.

Arriving at the Study Stream
Work with the skipper of your landing craft to deploy as close as possible to the starting location of your day's work. Know your estimated pick-up time and location if the landing craft is not staying on shore. Establish radio contact. Ascertain bear safety. Know who is carrying your first aid kit and sampling permit(s).You may need to hike to the start of the stream survey.

Depending on the situation, the Crew Leader designates tasks among personnel according to real-time need which will vary by reach and stream. This is to expedite sampling while ensuring safety.

Starting a Survey

The starting point of the survey will depend on the tide stage and will be determined by the Crew Leader. It is important to include the lowest point of the stream at the day's low tide because carcasses often accumulate there.

> <u>If the tide is low and will be incoming while at the stream</u>, start at the lowest point and work upstream. Designate one or two team members to count pink and chum salmon, live and dead, as you progress upstream. Conduct specimen sampling as you go (see Specimen protocol below).
>
> <u>If the tide is high or medium upon arrival but dropping</u>, then start the survey upstream and begin your survey heading downstream. Count live/dead fish as you progress upstream, but sample specimens and/or fitness stream mapping as you move back downstream.
>
> <u>If the stream is forked or braided, or if there are two study streams in very close proximity</u>, you may break into two teams but only if there are at least two people on each team and both teams have a gun. At no time should anyone work alone. Treat a tributary or separate stream as a separate survey, by logging beginning and ending survey points for the tributary or separate stream (see the special case below).

The survey Begin Location and End Location to be entered into the tablet are meant to describe the linear extent of your daily survey on each stream. The Begin Location or End Location do not need to be at the most downstream or upstream point in your survey, as long as, between the two, they described the entire survey extent.

In PWS, both pink and chum otoliths will be collected in some streams. Depending on the number of fish that can be sampled, decide whether to split into two teams or all work together. You may use one tablet for both species, being very careful that data are entered under the correct species, or you may use two separate tablets. (**If you use two tablets, add the live/dead counts to only one tablet, unless you are working on separate tributaries under separate surveys.**)

If it hasn't already been established, try to ascertain the upper access extent of pink and chum salmon. Pink salmon and chum salmon usually do not jump more than about 3-4 foot vertical falls or ascend long, steep cascades, but watch for narrow slots that are accessible. If necessary, try to assess this during your first visit so that you and other teams will know how far to go in future surveys. Only mark the upper access extent in the tablet if you actually observe an obvious barrier (do not try to guess where it is). The following streams' extents are already documented, so no need to re-do:

Southeast		PWS	
107-40-10490	Harding River	226-40-16269	Johnson C
109-62-10240	Petrof Bay W Head	227-20-17480	Gilmour C
110-23-10210	East of Snug Cove	226-20-16300	Bainbridge C
110-32-10090	Chuck River	226-30-16810	Hogan Bay
111-16-10450	Swan Cove Creek	227-20-17464	Cabin C
111-50-10690	Fish Creek	227-20-17480	Gilmour C
115-20-10520	Sawmill Creek	227-20-17520	Stockdale C
		226-20-16040	Erb C
		226-20-16010	Paddy C
		221-10-10020	Hartney C
		225-20-15040	Comstock C
		221-20-10200	Spring C
		224-10-14550	Paulson C
		221-20-10360	Sheep R
		224-10-14510	BlackStone C
		221-40-10890	Fish C
		221-40-10880	Short C
		221-40-10990	Lagoon C
		224-10-14210	Mill C
		222-20-12640	Siwash R
		222-10-12157	Vanishing C
		223-30-13220	Coghill R

Some streams are too large to effectively survey on foot and may need to be surveyed by drifting in a raft or by running a jetboat upstream. In those cases, be observant for accumulation of spawn-outs. In turbid waters, watch for clearer side sloughs and small tributaries as good locations to sample.

Designate one tablet as the primary survey tablet. If that tablet is lost, malfunctions, or the battery is close to dying, continue with another tablet. Re-establish the survey in the second tablet. There is no need to enter the same data previously entered on the previously used tablet (except the live/dead counts – see below).

A special case occurs when two separate surveys are independently conducted on the same day and stream. An example is when one team starts surveying at the upper end, the other from the lower end, and they meet in the middle. Using two tablets, establish separate surveys each with their own locations, processing areas, specimen data, etc. However, before uploading both surveys into the laptop app be sure 1) to number the processing areas differently between the two surveys, 2) combine the live/dead counts from both surveys into the final totals, either in one tablet, or when you are editing the surveys in the laptop app, and 3) make sure that the overall begin/end points for the total survey (uppermost and lowermost point surveyed on the stream that day) are either in one tablet, or entered when you are editing the surveys in the laptop app.

<u>Data Entry</u>
At the beginning point of the survey,

- Turn on the tablet and the HW App
- Hit the Stream Survey tab in the HW app
- Select ADD SURVEY
- Tap the bar under Stream Code and select the stream from the drop-down list
- Tap Survey Date bar to set the date. A calendar will pop up with today's date highlighted. Be sure it is correct. You can change it if necessary by touching the calendar. Finish by selecting "Set".
- Add comments – anything about the survey such as weather conditions, stream water levels and flows, or especially anything unusual about the survey. You should come back to this screen anytime you note something that should be reported for this survey.
- Tap Survey Samplers. Tap and enter First Name and Last Name and then tap Add Person for anyone not on the list. Check the boxes of all the people who are conducting this survey and hit Save Samplers. Close with the tablet back button.
- When you are at the physical beginning point of the survey, select Survey Locations. Wait for the GPS accuracy number to go down and the number of satellites to go up, then tap in the Begin Location box and tap Capture Location. Let the App average lat/long for about a minute and then hit Finish (The lat/long can also be manually entered from a different unit if necessary.)

Counting Salmon

Either before, or while progressing through, a survey, usually moving upstream, count the number of live and dead salmon. In Southeast, count only chum and Chinook salmon. In PWS, count pink, chum, Chinook, coho, and sockeye salmon separately. It will be preferable to have one person count all live and another dead of each species. Allow the people counting to do so before the fish are disturbed by collecting fish for sampling. In many, but not all, lighting conditions, it will help to wear polaroid glasses. Include all dead fish from previous sampling in your dead count if their carcasses are still visible on the survey.

Use hand tally-whackers, although at times you may be counting by tens, hundreds, or even thousands, so you need to be aware of integrating the counting units. Use the counting accumulator on the tablet to enter counts at natural stopping points, or if you stop to process fish, as a way to get a grand tally of the counts. (If the primary tablet is expected to quit due to low battery, try to transfer the live/dead count into the replacement tablet.) The live/dead counts will be used as a component of the statistical analysis for this data. Therefore, every effort should be made that these counts are of good quality. If the conditions do not allow for a complete count, do the best you can. Then enter the codes for survey quality into the live/dead count page in the tablet.

The count pertains to the stretch of stream between the Begin Survey and End Survey locations, so don't be too concerned about getting counts from exactly the same stretch of stream every time – they will be adjusted fir the stream length surveyed.

On fitness streams that are visited every day, you may skip counting live/dead salmon for two days, but do a complete count of the entire stream every third day. If you are visiting a fitness stream every-other-day, you may skip live/dead counts every other visit (i.e., do a complete count every fourth day). This is because getting more samples is a higher priority.

<u>Data Entry</u>
To accumulate salmon counts:

- From the Survey page, hit the Live/Dead Counts bar
- Select Species to Count for your target species and hit Add
- In the species box, enter the number in each category and hit Save on the top bar
- To add counts to the accumulator, select Add Live/Dead Counts from the drop-down menu. Select the species you want to add counts for and enter the additional numbers to the species dialogue box and hit Save (notice that the accumulator adds these numbers to the tally).
- To add more species to the list, select Add Species to Count from the drop down menu.
- Check the "No Alive Count" or "No Dead Count" checkboxes ONLY if you did not count fish. If the count was zero, enter 0 in the count spaces.

Processing Areas

Processing Areas are defined as locations on a stream during a survey where a set of specimens are gathered, measured, and sampled. Details on Processing Areas and associated data entry are found in Appendix C.

Fish Collection

Fish to be sampled can be collected by any practical means. **Only collect spawned out, dying, or dead adults** (except on PWS fitness and stock structure streams, as noted below). Use gaffs, spears, snagging gear (rod and reel with treble hooks), dip nets, or hands to gather fish. Use a beach seine if practical (only if a school is observed to contain spawn-outs) but select only the spawn-outs and release the rest. Spawn-outs will usually have flatter, flaccid abdomens than pre-spawning or spawning fish. If eggs or milt flow very freely from a gently squeezed individual, it should be released to continue spawning. Some spawned out females will have a few remaining eggs spurt out when squeezed – if many eggs come out of a live fish, release the fish. Spawning males have pure white milt - if squeezing a male produces watery or no milt, sample it, otherwise release it. Try to avoid catching and squeezing the same individuals repeatedly. Eventually they will appear to be post spawned even though they aren't. Sample all dead fish, regardless of their remaining egg or milt content.

Unlike in previous years' sampling in fitness streams, if a fish's gonads have been removed by predators, sample it. (Gonad-predated individuals will have a small hole in the abdomen and the gonads will be entirely missing.) Check the "Preyed Upon" box on the tablet as appropriate. Also in fitness streams, if the fish is sampled (dead or alive) with more than a little eggs or milt, check the "Partial Spawner" box on the tablet.

Completing the Survey

There are two steps to completing a survey. One occurs at the physical end point of a survey. Take the "End Location" GPS data. Please also always make general comments about the survey such as weather conditions, stream water levels and flow, or especially anything unusual about the survey.

The other step occurs after all samples have been collected (but before leaving the stream). Review all the data in the tablet for that survey, including all the Processing Area and Specimen data for every sampling tray, to make sure it all makes sense and is complete (more detail on this in the next protocol)

<u>Data Entry</u>
To finish a survey:

- Hit "Finish Survey" on the top menu bar or go to the Surveys page and re-select the current survey.
- Select Survey locations
- Tap on the End Location box, wait for the GPS accuracy number to go down and the number of satellites to go up, then hit Capture Location, wait for a minute, and hit Finish
- Add final, detailed comments about the survey.

Post-Survey Data Management

Immediately upon return to your base camp or live-aboard boat take the following steps to process data while the entire crew remembers the events of the day the events of the day are still fresh. This is important to complete the following list immediately to ensure that the data are of highest quality and any errors that could've occurred during the day are addressed immediately.

√ *Enter data if necessary*
Enter any data that was necessary to have been collected on paper that day into a tablet for the appropriate survey (or you may enter it in the QA procedure on the laptop, as described below).

√ *Back up all data collected to date onto laptop*
1) Every evening after every survey, regardless of whether you have connection to the internet, connect the tablet to the laptop. Start the tablet and open the tablet HW app. Tap on Export Surveys to create a file ready to move to the laptop from the tablet.

2) Using Windows Explore on the computer, go to the tablet's directory and find the folder called "Exports". Copy that text file to the subdirectory "C:\HW\Exports from tablets".

3) Rename each day's text file by adding the date to the end of the name, such as "exportedSurveys 7-21-15".

4) Then insert a thumb drive and copy the text file on the laptop directory to back it up on the thumb drive.

5) Open the HW application on the laptop. Use the "Import Surveys" to import data from the text file to the SQL database on the laptop. This step is to again back up the data into the SQL database on the laptop and preserve the data from loss.

√ *QA Procedure*
1) Review the data on the tabs called Stream Surveys, Processing Areas, and Stream Specimens, to be sure it is all correct. This is your chance to edit the data if there are any errors. Expand on the Stream Survey Comments, the Processing Area descriptions, or the comments for individual fish as much as necessary.

2) On the Stream Surveys tab, open and run the QA process tray-by-tray, for all trays from each survey. Carefully open each tray, and look in all the cells to be sure the samples match the data. Enter the information requested in each row of the QA dialogue box, and be sure the first and last cells in the tray match the data, and that all missing otoliths and DNA samples match between the tray and the data. Continue with that process until all the errors and warnings are resolved.

IMPORTANT -- If you discover errors in the **otolith** or **DNA** tray cells that cannot be easily resolved, please keep the samples but flag the data from the first questionable cell forward by adding the comment "UNCERTAIN PAIRING" plus any other potentially helpful details, in each data row for potentially erroneous data. If you find more than two otoliths in a cell, do not guess which one is in the wrong cell – make comments as described above for every uncertain cell (data row).

3) After reviewing otolith trays for the QA process, leave them in a very secure and stable place with the lids off so the samples will dry for at least 24 hours. Then replace the lids securely with rubber bands and pack them away in a safe storage location.

After inspecting DNA trays, fill every cell with alcohol to 3/4 cell volume, replace the lids, and wrap the tray tightly with plastic wrap. It is critical that all DNA tray wells be filled ¾ with ethanol and that the entire tray is wrapped tightly with saran wrap. The ethanol WILL EVAPORATE if this is not done properly, which will compromise the integrity of the sample for DNA extraction. Store the DNA trays in separate containers from otolith trays for safe transport.

4) Once a QA is successfully finished, note that it is locked. If you later discover that edits are needed, use the Unlock Survey button, then make the changes and redo the QA process.

√ *Upload data to database*
As soon as the internet is available, use the "Transmit Stream Surveys" tab in HW laptop app to upload the most recent survey data from the laptop to the host database. Enter the names of all the people who participated in a survey if/when prompted. Check the boxes of the surveys you want to transmit and hit the Transmit Surveys button. There is usually no harm in retransmitting previous surveys, but only do that if you have modified a previous survey for some reason (which should only be done if you realize there is a mistake in a previous survey or its associated data). Usually it will be preferable to make your corrections in the HW Laptop App.

√ *Update the tote board*
Also whenever internet is available, access the tote board on Google Drive, update it with the date of the stream visit, number of samples obtained, and the number of live and dead of the target species observed during the day's surveys. If no internet, call, text, or in-reach your project coordinator to report daily survey numbers. Then use the tote board to help plan the next day's activities and sampling goals.

APPENDIX D. PROTOCOLS FOR COLLECTING, PROCESSING, AND SHIPPING BIOLOGICAL SAMPLES FROM INDIVIDUAL SALMON

The purpose of this protocol is to describe the background and methods for sexing, measuring, and for collecting, processing, and shipping otolith and DNA tissue samples from streams in the Hatchery-Wild Interactions Study. See the Appendix B for protocols on which streams and how to collect fish.

Background

Otoliths removed from specimens will be used to differentiate "stray" hatchery–reared salmon from salmon that originated from natural spawning in all our study streams. DNA tissues will be collected in a sub-set of "fitness" streams to reconnect offspring, subsequently collected as fry or as returning adults, to their parents so that relative reproductive success of hatchery- and natural-origin fish can be estimated for both males and females.

Otoliths (All Streams)

Thermal marking is one of the methods being utilized to identify and manage hatchery-released Pink Salmon and chum salmon. When the embryonic fish are incubating in hatcheries, the water temperature is raised and lowered according to a pre-determined schedule that results in a predictable sequence of visibly enhanced growth increments or "thermal rings" on the fishes' otolith bones. We will collect the sagittal otoliths and send them to ADF&G's Thermal Mark Laboratory (SEAK crews) or to the Cordova ADFG lab (PWS crews) for processing. In the lab, the left sagittal otolith is glued to a glass slide and then ground down on fine grit sandpaper. When the center of the otolith is reached, it is examined under a microscope for the presence of a thermal mark. Fish with no thermal mark are then designated as wild, while fish having a thermal mark can be identified as to their hatchery release group.

DNA Tissues (Fitness Streams)

The ADFG Gene Conservation Lab (GCL) will use bulbus arteriosus tissue samples (described below) that we collect from dead or moribund fish for genotyping. These genotypes will allow for the reconstruction of individual pedigrees (family trees) that, when paired together with identification as hatchery or wild-origin fish from otoliths, will provide the basis for comparing the relative survivals of stream-spawned natural, hatchery, or natural x hatchery crosses.

Preparing for Specimen Sampling

Tray Preparation

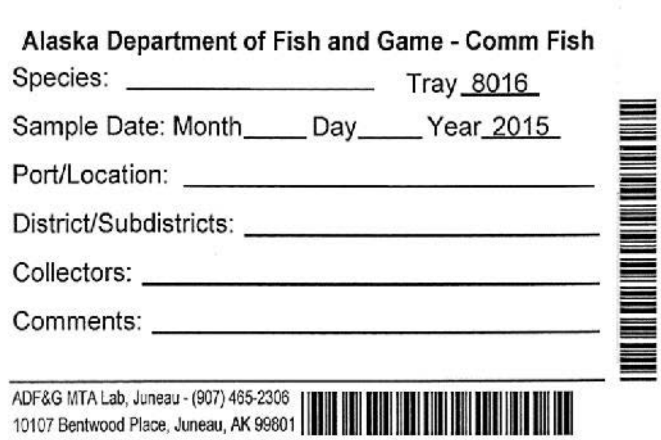
Prepare the sampling trays in advance of field work. Adhere labels to the trays and always try to use tray numbers in sequence. <u>In otolith-only streams</u>, you will use the 96-cell otolith trays. <u>In "fitness" streams, use 48 deep well plates (dwp) or trays</u>. When using

48dwp trays, add the otoliths and the DNA tissue from each fish to same well (the otoliths will be separated out of the 48dwp trays into new trays at the GCL lab).

Preparing Otolith Trays

Please adhere the adhesive tray labels to the sides and bottom of the 96-cell otolith sampling tray (Figures C1 and C2) before it is filled with otoliths. **<u>This step is critically important to maintaining the integrity of each sample</u>!** Keep the tray numbers in sequential order throughout a given week and sampling season. Because the sample number on each tray label is unique, you cannot use a label to identify more than one tray of 96 otoliths. **<u>Do not place sample labels on the otolith tray lid because the lids can get separated from the sample tray!</u>**

<u>Before</u> processing fish, fill out one otolith tray label (Figure C1) with the appropriate data. Use number 2 pencil to fill these out. The date is the date the sample was taken from the stream. In "Port/Location", enter the stream name. In "Districts/Subdistricts" write the stream number (see Table B1 or B2 or your tablet app). Put all the team members' names in the Collectors space. Write "PWSSC H-W Stream Sampling" in Comments. To avoid spilling otoliths from a tray, the labels must be affixed to the bottom of a tray and completely filled out ***before*** filling them with otoliths. Take extra trays into the field but only fill out the data just before beginning a new tray.



Alaska Department of Fish and Game - Comm Fish

Species: ____________ Tray 8016

Sample Date: Month____ Day____ Year 2015

Port/Location: ____________

District/Subdistricts: ____________

Collectors: ____________

Comments: ____________

ADF&G MTA Lab, Juneau - (907) 465-2306
10107 Bentwood Place, Juneau, AK 99801

TRAY NUMBER: provides a unique sample number for

Figure C1. Example of otolith tray label – note that the tray is pre-numbered.

Figure C2 Vertical barcode to be cut away and affixed to side of otolith tray (opposite of notched side). Remainder of label, including horizontal barcode is to be affixed to bottom of tray.

Labels should be attached on the 96-well trays as shown in Figure C3. Use clear packing tape to cover and protect the bar-code labels only. It will be critical in the field to keep the labels as dry as possible. When it rains a lot the written information on the label can get smudged and become illegible. So, be sure to double check the written information on all labels once a tray has been completed.

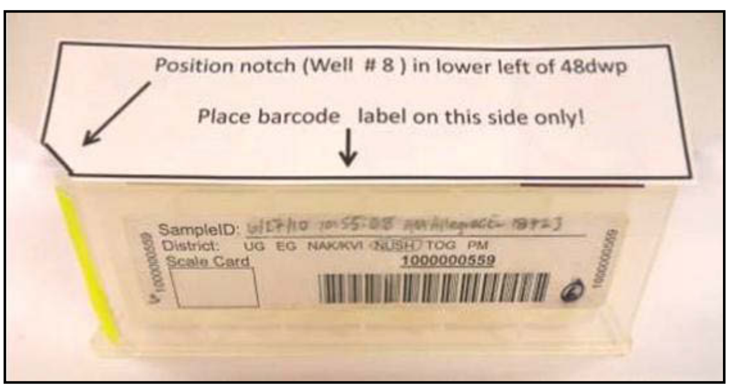
Figure C3. A plastic 96-cell otolith tray filled with label n the bottom and side.

Preparing DNA/Otolith 48dwp Trays

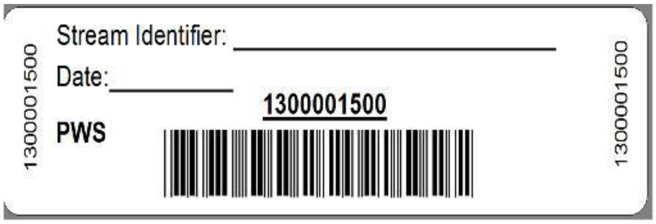
Trays for DNA sampling in fitness streams (Figure C4) are different than otolith-only trays. They hold only 48 samples and they will be used to collect and store both the otoliths and the DNA tissue from the same fish in each well.

Figure C4. An empty 48dwp tray for DNA tissue and otoliths (cover off).

Pre-printed barcode labels for each 48dwp have been provided by GCL. Keep label sheets packed in ZipLoc bag to keep them dry prior to application. Labeling 48dwp trays should be done beforehand in a dry area to insure the label adheres. Apply label on notched side (picture below) of each plate. Barcode label should be facing the sampler as you take samples. When adhering labels, cover the barcode in clear packing tape to protect it from wear.



Before processing samples on a given day, it will be important for genetic tray bar code labels to be covered with clear packing tape before leaving the boat or camp. Blank fields on the labels should be filled out using pencil (No. 2 soft) as you use the trays. Record the following information: Stream Identifier:_______ (Stream Name and AWC Number), Date:_mm/dd/yy (see photo of label). Each plate will hold 48 samples. By the end of each day, . add clear packing tape to the written portion of the label to insure the label information is retained even if ethanol for some reason leaks out. Further, during very rainy conditions, having tape on the label will help preserve the label information. Please avoid pre-labeling and taping trays that will NOT be used in a given day as to avoid incorrect information being used the following day.



Field Equipment for Sampling Otoliths Only or Otoliths/DNA

Pack the following items for field sampling otoliths (and DNA in fitness streams):

OTOLITH DISSECTION TOOLS

1) Butcher knives with deep 6-8” blade
2) Forceps (fine point)
3) Cotton gloves
4) 96-cell otolith trays with compression plates & lids, labels attached
5) Carrying case for trays – spill prevention
6) Calipers and Measuring tape
7) Pencils – No.2 soft
8) Cutting boards
9) Knee pads
10) Brightly colored beads
11) Neoprene cuffs
12) Tablets

ADDITIONAL DNA DISSECTION TOOLS – FITNESS STREAMS

1) 48dwp trays with labels attached
2) Tray cover mats
3) EtOH in large nalgene bottle
4) Nalgene squirt bottles for EtOH
5) DNA tray carrying case for trays – spill prevention
6) Tray holders
7) Plastic wrap for sealing full trays

Processing Specimens

Processing Areas

Collect spawn-outs or carcasses from the study stream (as described in Appendix B) into an area where you can work on cutting the heads and extracting the otoliths. Processing Areas are defined as locations on a stream during a survey where a set of specimens are gathered, measured, and sampled. Every time you stop to process fish, create a new Processing Area. Limit the length of a given Processing Area stream reach to no more than approximately 200 meters and try to process your samples approximately in the middle of the <200m stream reach (this is because we want to track approximately which portion of the surveyed stream the adults were collected from). Each Processing Area will be uniquely identified within a survey.

Data Entry

To establish a Processing Area:

- On the main menu, tap Processing Areas
- Select "Add Processing Area" from the top menu
- Enter a sequential number for the Processing Area ID, starting with 1 (the PA ID numbers do not need to be spatially sequential on the stream)
- Add a written description of the Processing Area
- Tap on the Processing Area Location box. Wait for the GPS accuracy number to go down and the number of satellites to go up, then hit "Capture Location"

Processing Samples

Line fish up in groups of 12 per row for processing otoliths only (by separate species, if working on a stream where both pinks and chum are being sampled) or in groups of 8 if working on otoliths and DNA. The line-up helps to keep track of which fish has been sampled for each required attribute or specimen sample and parallels the filling order of the 96-cell or 48dwp trays.

At each Processing Area, **work through collecting specimen information in the following order: sex, length, height, DNA tissues (fitness only), otoliths, and morbidity condition (fitness only).** You can enter data into the tablet for more than one row at a time prior to processing these fish, but you must double check each row after the otoliths/DNA are collected, before moving on to the next one. **After you have collected the required samples from a fish, leave it in place within its row**. This allows for a final physical comparison of the data in the tablet with the actual fish. There are several types of errors that can be resolved if the fish are still lying in place on the gravel bar, in the exact order that they were in when the data was entered into the tablet. Once you have finished working up all your fish for the Processing Area, spread the fish carcasses into the stream, move to next Processing Area and create a new Processing Area in HW App.

All data recording for specimens is associated with the tray where the specimens are deposited. Before you can start recording data about specimens, you must set up a tray in the HW tablet application. Use a portable barcode scanner to enter the full tray number into the tablet. If for some reason your scanner is inoperable, you may type the full number into the HW app. Have one person read the number, while another types, and then read it back to verify. For otolith tray numbers, be sure to add "2015" before the 4-digit tray number. (See separate instructions for scanner set-up if necessary.)

Data Entry

To establish a specimen tray:

- From the Processing Area page, Tap the Sampling Trays bar
- On the Sample Trays page, hit ADD SAMPLE TRAY in the upper right corner
- Scan the tray barcode ID or type the tray ID number and
- If necessary, select the species and/or the tray type and hit DONE

Sex, Length, and Height Measurements

Collect sex, height, and length before dissecting for otoliths and DNA.

Male chum are usually identifiable by their kype (a secondary characteristic of extension of jaw and enlargement of teeth). Male Pink Salmon also have a kype, but are more noticeable by the hump in their dorsal outline. Sometimes the sex is not obvious so, if in doubt, squeeze the area just anterior of the vent to see evidence of milt or eggs.

Measure the mid-eye to hypural (MEH) length of each fish (in mm) using calipers. For this measurement, place one end of caliper at the middle of the eye and take the measurement at the end of the hypural bone. If uncertain where the hypural bone is, grab the caudal fin and flex it laterally – it will flex at the end of the hypural bone. Once you learn where the hypural bone is, you will be able to feel it with your thumb. When measuring, stretch the tape taut. If a carcass is emaciated or mostly just skeleton, align the carcass in its normal form before measuring. If any portion of the skeleton between the head and tail is missing, do not measure length or height (but still sample for otoliths).

Please also measure and record body height unless there is damage or advanced deterioration that would compromise the measurement. Measure body height with calipers from the anterior insertion of the dorsal fin to the anterior insertion of the pelvic fin.

If for some reason you do not have calipers for measuring length and height, please use a measuring tape, but be sure to note in the survey or individual fish comments that you used a measuring tape.

<u>Data Entry</u>

To record sex, length, and body height:

- On the Sample Trays page, tap the new tray. This will bring you to the tray list view (notice the cell numbers are pre-entered)
- Tap on the first cell to open the card view for the first specimen.
- Be sure that the Species, Processing Area ID, Tray #, and Cell # are correct
- Select the sex of the first fish – if unknown, leave “Unknown” checked
- Enter the MEH length in mm for the first fish – if unable to measure full length, check “No Length”
- Enter the body height in mm for the first fish
- To enter data for the next fish, swipe to the left, and continue for the first 8 or 12 fish (depending on the tray type)
- At anytime, you can return to the SPECIMEN LIST (upper right) to be sure you are tracking the correct fish in the row and view all the data you have collected thus far.

Cutting Heads for Sampling DNA and/or Otoliths

There are several possible methods for cutting salmon heads to retrieve otoliths. The method described below works well for sampling both DNA tissue and otoliths.

Place the fish on a cutting board so that you can safely cut the head completely off just posterior to the posterior edge of the operculum (Figure C5). If sampling for DNA tissue, this will expose the heart with the bulbus arteriosus attached (Figure C6). See description below for further instructions on sampling DNA tissue.

Figure C5. Cut head off.

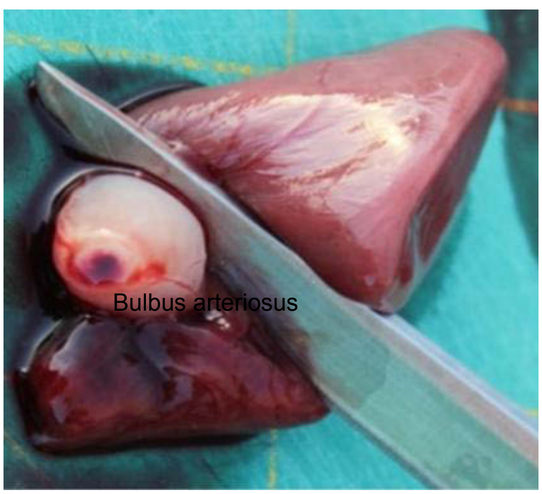


Figure C6. Bulbus arteriosus attached to heart.

Place the cut head on the cutting board and slice the top off (Figure C7). This should reveal the brain cavity. Remove the brain tissue (Figure C8). The ototliths will be in two wells just posterior of the brain cavity (Figure C9).

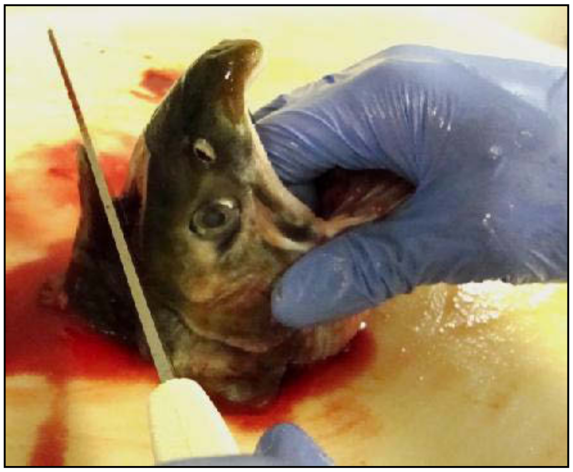


Figure C7. Slice the top of head off.

Figure C8. Remove brain tissue.

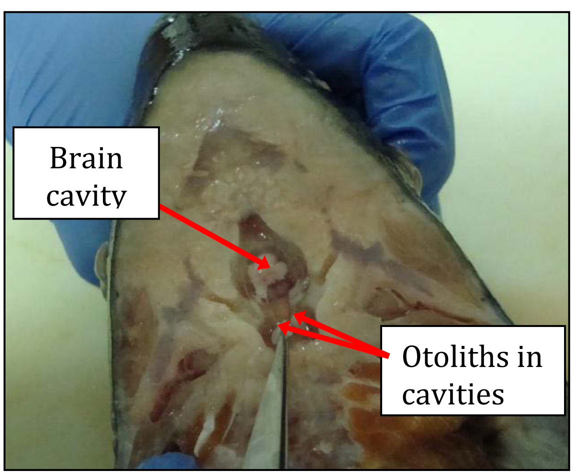


Figure C9. Otoliths in two later wells posterior to brain cavity.

Using 96-cell Plates for Otoliths Only

Use one 96-cell tray per stream, date, and species (or more if necessary). **Never place otoliths from more than one stream or sampling visit into the same tray!** Mixing otoliths from various streams or visits results in massive confusion and an irrevocable loss of data. Even if you have a tray containing only ONE otolith for a stream visit, send it that way.

- ♦ Note that otoliths can be collected from even the most deteriorated fish – the carcasses don't have to be fresh.
- ♦ With tweezers, pluck the left otolith from its well (Figure C9). The otoliths are about ¼ inch long in Pink Salmon and 1/3-inch long in chum salmon. Place the otolith onto the back of your hand or neoprene cuff and then recover the right otolith from the right well. It may take some probing, especially if the cut is not just right, or the carcass is old.
- ♦ The otoliths are encased in a tissue bag surrounded by fluid. Gently rub or tweeze the tissue off the otoliths, clean off any blood and place both of them into the next well of the otolith tray (Figure C10).

Figure C10. Cleaning an otolith on a neoprene glove or sleeve.

- ♦ Place the pair of otoliths from one fish into the tray wells following the left-to-right, top-to-bottom scheme shown in Figure C11 so that when you are done, the tray looks like Figure C12.
- ♦ If an otolith is accidentally cut in half, place both halves in the appropriate tray well. If one of the two otoliths is lost during the process, place a colored bead into the well with the other otolith. If both otoliths are lost, place two colored beads in the cell for that fish (Figure C12).
- ♦ After each row is complete, check all the cells in that row to be sure none were skipped and that every cell has two otoliths (or beads). If you find discrepancies, go

back to the last known accurate sample, and start over with new fish. Discard any otoliths that may be confused. Do not try to guess which otoliths in the confused cells go with which fish.

- Be sure to close the otolith tray properly each time you finish adding samples. Use the plastic inserts to cover the otolith wells and place the lid on top to ensure that otoliths will not shift cells when transporting. Secure the lid to the tray with at least two tight rubber bands crosswise to each other (Figure C13). Any time you are opening an otolith tray that contains samples, slide the plastic sheet across the surface of the tray so that any otoliths that got stuck to the sheet will fall back into their respective wells.

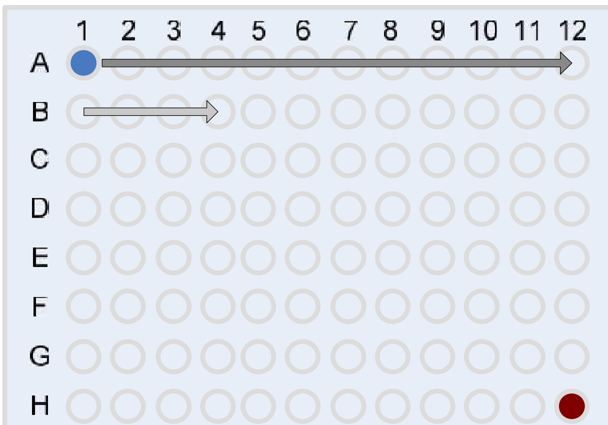


Figure C11. How to fill a 96-cell otoltih-only tray.

Figure C12. An otolith tray filled to cell G8. Note yellow beads to represent missing otoliths.

Figure C13. Proper arrangement of otolith tray for storage and movement. One thick sheet of thick plastic lie over the top of the otolith wells with the plastic tray lid on top. Secure tightly with three rubber bands as illustrated.

<u>Data Entry</u>
The tray and cell numbers have already been entered into the HW tablet app:

- Be extremely careful that the otoliths are deposited in the cell that corresponds to the correct fish
- For any fish missing one or two otoliths, check the missing otolith boxes on the specimen card for that specific fish (and add beads to the cell).
- Add any comments in the comment space pertinent for the fish being sampled

Using 48dwp Trays for DNA Tissue and Otoliths

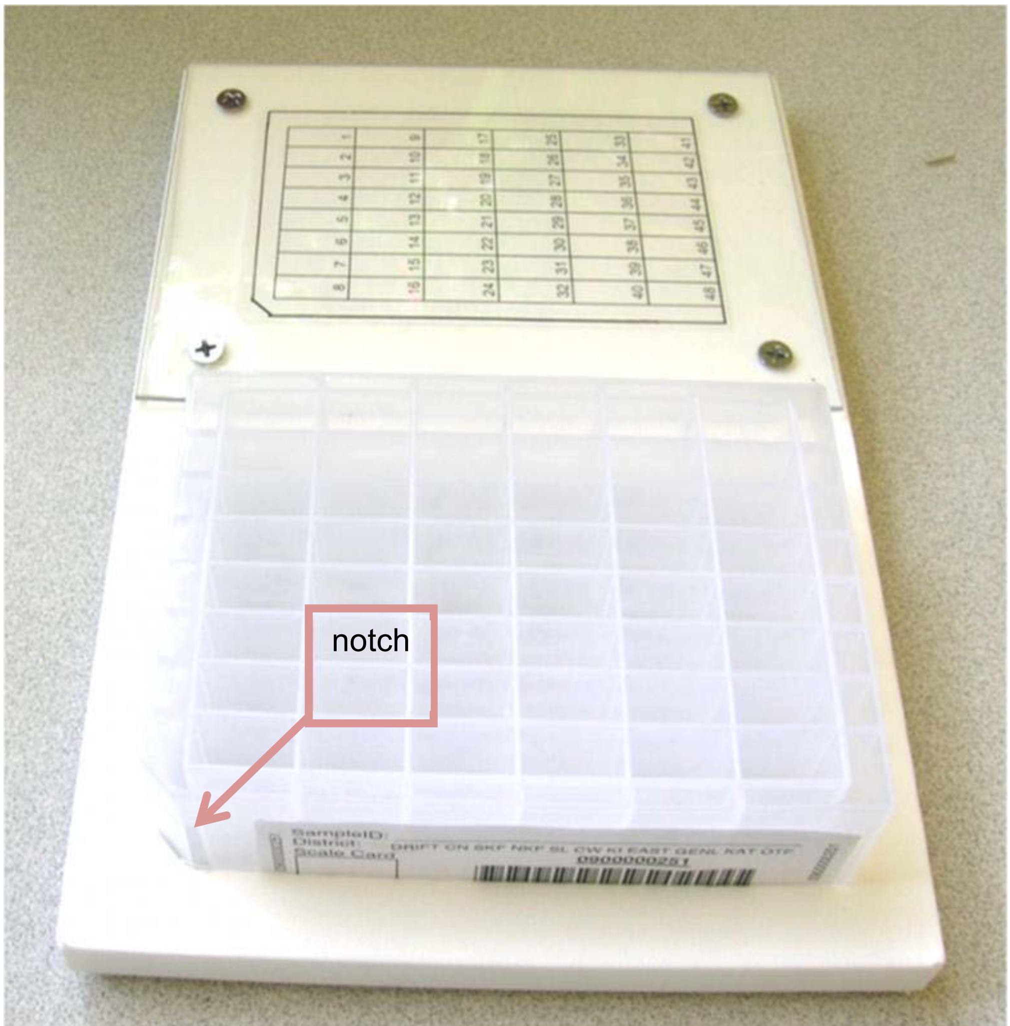
If you are working on a pedigree-fitness stream, or if you are collecting DNA tissue in PWS for the stock structure study, use a 48dwp tray for both the DNA tissue and the otoliths (Figure C4).

It is important to try to collect the best **quality DNA tissue samples to give quality results**. Tissue quality degrades after death, so moribund and recently-dead fish will yield best results. Frequent visits to streams will provide better opportunity to sample fresher spawn-outs. Sample any previously unsampled fish you can find, regardless of state. Be sure to record the morbidity state in the tablet. Tissue samples must be immersed in ethanol (EtOH) immediately after sampling. Add EtOH from the squirt bottle after you deposit the tissue and otoliths into the tray cells. Please be sure to fill each well at least ¾ full of ethanol.

As with otolith trays, use one (or more) 48dwp trays per stream, date, and species. **<u>Never place otoliths and DNA tissue from more than one stream or sampling visit into the same 48dwp!</u>** Even if you have a 48dwp containing only ONE otolith/DNA tissue sample for a stream visit, send it that way.

Steps for sampling fitness stream otoliths and DNA tissues into **48dwp** are:

a. Set the pre-labeled 48dwp into the tray holder so that the notched edge of the tray aligns with the holder. This will guide you to the correct numbering of the individual wells and the order of sample placement. Be sure the label is filled out and facing the sampler as you sample (Figure C14).



Set-up for sampling:
1. Place 48dwp in sampling guide; barcode label should be facing you as you sample. Use numbered well sample grid for referencing well position and for sampling direction. **DO NOT DEVIATE** from individual well sampling pattern.

Figure C14. proper set-up of 48dwp in sampling tray holder.

b. For each fish, cut about ¼-inch piece of the bulbus arteriosus from a fish (see picture) and place it in the appropriate well within the 48dwp (Figure C6).

c. **FROM SAME FISH,** follow the steps above for otolith excision and deposit the otoliths into the well that corresponds to the fish number. Put **two** otoliths in **same** well as bulbus arteriosus.

d. Deposit otoliths and DNA tissue samples into 48dwp one <u>column</u> (vertical) at a time, top to bottom, starting with the left-most column. After each column is filled, move right and start at the top of the next column (see numbered sample grid below). Use rubber mat to cover sampled and un-sampled (empty) rows to protect the samples and to guide yourself to the correct column.

1	9	17	25	33	41
2	10	18	26	34	42
3	11	19	27	35	43
4	12	20	28	36	44
5	13	21	29	37	45
6	14	22	30	38	46
7	15	23	31	39	47
8	16	24	32	40	48

e. If one or both otoliths are lost or missing, place one or two beads into the well, respectively. If the bulbus arteriosus is lost, use other heart tissue of approximately the same size for the DNA sample. If the heart is missing or lost, sample other tissue of approximately the same size in the following order: other heart tissue, muscle, liver, or fin (avoid fungus). Check "Alternate DNA tissue" in the HW App. If there is no DNA tissue sample, skip putting tissue in that well and Check DNA tissue missing. Make other comments about the fish accordingly.

f. Be sure to record the "morbidity" state in the tablet: alive, pink gills, grey gills, rotten.

g. **Wipe or rinse knife blade and/or tweezers between fish to reduce cross contamination among samples**.

h. After each column is complete, check all the cells to be sure none were skipped and that every cell has one tissue sample and two otoliths (or beads). If you find discrepancies, go back to the last known accurate sample, and start over with new fish. Discard confused samples. Do not try to guess which tissues or otoliths in the confused cells go with which fish.

h. After tissue samples are taken, make sure **all tissues are covered with EtOH** before sealing plates with rubber mats. Use the squirt bottle to fill wells ¾ full, if needed. EtOH/tissue ratio should be **at least 3:1** to preserve tissues.

i. Cover finished trays with a rubber mat lid pushed tightly down into cells and secure with two perpendicular rubber bands. Place the tray(s) upright into a used plastic tray bag for transport in a pack from the field. Keep the trays upright in the pack to reduce leakage.

j. The squirt bottle should be emptied after **each sampling session; it will leak** if not emptied.

<u>Data Entry</u>
Tray and cell numbers have already been entered for 48dwp otolith and DNA tissues. However, please enter:

- In the Card View, Select the correct morbidity state for each fish sampled
- Add comments about missing otoliths and/or DNA issues in the Card View Comments

Cleaning, Storing, and Shipping Samples

Inspecting DNA and Otolith Samples

Soon after return to the live-aboard boat or other lodging, while performing the data QA on the HW laptop, carefully inspect the 96-cell and 48dwp trays for any damage or mis-location of the samples. If samples do not match data, carefully adjust data if appropriate. If there are any questions about the alignment of data with samples in their cells, keep the samples but flag the data from the first questionable cell forward by adding the comment "UNCERTAIN PAIRING" plus any other potentially helpful details, in each data row for potentially erroneous data. If you find more than two otoliths in a cell, do not guess which one is in the wrong cell – make comments as described above for every uncertain cell (data row). If this occurs for a large number of samples, it may be necessary to return to the stream, to collect additional samples.

If for any reason there is confusion, be sure to make notes in the laptop data accordingly at the survey and specimen level as appropriate.

After inspection of DNA trays, replace the rubber mat tightly into the cells. Then use the plastic wrap to tightly seal the tray by wrapping several times in both directions. Store the finished DNA trays in a safe place separate from otolith trays until delivery to the Science Center.

Drying 96-cell Otolith-Only Trays

The otoliths in 96-well trays will be shipped dry so, if there is any water in the cells the tray must be allowed to dry. When opening the otolith tray for the first time since sample collection, first inspect the cells through the lids to see if any otoliths are trapped between the rim and the lid. Tap the lid and then tap the acetate to get sticky otoliths to drop into the correct cells. If any otoliths are still stuck to the acetate, carefully remove the lid and then slide the plastic sheet across the surface of the tray so that any otoliths that got stuck to the sheet will fall back into their respective wells. Once open, visually ensure each pair of otoliths is at the bottom of the cell. Push any otoliths that are along the edge of the cell to the bottom of the cell using forceps. Set the tray on anti-skid matting and allow to dry uncovered in a location where they will not get bumped or spilled. It is very important to let the tray of otoliths dry before they are stored or shipped. Dry otoliths are more likely to stay in their cells.

After 24 hours of drying, replace the plastic sheets, the tray lids, and rubber bands and store the trays, preferably in order, in boxes for delivery to the respective Science Centers. After replacing the lids securely, carefully write the number of otoliths in the tray on the label.

Pre-Shipment QA Process

It is critically important for all otolith trays, and especially DNA trays, to be delivered to each study's respective science center during each port call, or as often as possible throughout the season. This will ensure that samples are stored as safely as possible and also that DNA trays get delivered to ADF&G's Gene conservation lab as quickly as possible to avoid any possible issues with ethanol evaporating from the tray wells.

When the trays are returned to the respective science centers, it is important that each tray is documented to have been received at the Center and that it be visually inspected to the ensure that the number of samples matches the number of records in the database. This will be accomplished for every batch of trays arriving to a center by:

1. Download the most recent version of the Tray Inventory report from the keta web site and save it as an Excel spreadsheet.
2. Sort the tray inventory so it's convenient to compare to the batches of trays.
3. Create two new columns in the spreadsheet: "Tray received" and "Samples verified".
4. Scan the first tray code into the first "Tray received" cell.
5. Count/observe the number of samples (filled cells) in the tray to verify that it contains the same number of samples as indicated in the spreadsheet.
6. If the sample numbers match, scan the tray code into the "Samples verified" cell.

If the sample numbers do not match, follow the procedures on the previous page under *Inspecting DNA and Otolith Samples* to rectify the data and the samples.

SHIPPING

All transfers of trays from PWSSC/SSSC to ADF&G must be done according to the protocols established below. All shipments must be accompanied by an inventory list showing the stream names and AWC numbers and the number of trays collected, by date, as well as the inspection verification described above. See separate file for the Cordova Delivery Slip packing list.

96-cell Trays

1. Pack the trays into a box, cushioning them with packing material.

2. Seal the box with tape and affix with the adhesive shipping labels provided:

SHIPPING SUPPLIES

1) Ziploc plastic bags	4) Pre-addressed and numbered shipping labels*
2) Packing tape	5) Inventory list
3) Packing boxes	6) 4G fibreboard box (for 48dwp trays only)

SEAK 96-cell trays will be shipped as follows:

SHIP TO: Alaska Department of Fish and Game
Otolith Processing Lab
ATTN: Megan Lovejoy
10107 Bentwood Place
JUNEAU, ALASKA 99801

PWS 96-cell trays will be delivered to the ADF&G office in Cordova, attention Elena Fernandez. These can be delivered directly and do not need to be shipped to ADF&G in Cordova.

48dwp Trays

All 48-dwp trays will be shipped to the ADF&G GCL lab in Anchorage. These are hazardous materials shipments because of the EtOH, so haz-mat packing and shipping procedures must be followed.

Ship to: Alaska Department of Fish and Game
Gene Conservation Laboratory
333 Raspberry Road
Anchorage, AK 99518

Questions on shipping the 48dwps to the GCL should be directed to Judy Berger 907-267-2175.

Delivery Slip for HWI Samples to Cordova Otolith

Page _____ of ______

(An Excel sheet like this can be created starting with the download of a Tray Inventory report from the Keta.Finsight web site.)

Sample Date	Sample Location (AStream #)	Species	# Otos Sampled	Tray #	Sample Type	Comments
e.g.: 7/4/2013	*Erb Creek* *(226-20-16040)*	*Pink*	*48*	*1300001757*	*Pedigree*	*One oto in cells A5, D2* *Samplers: J. Doe, B. Smith*

Date sent to Cordova Lab: **Date received by Cordova Lab:**

Person responsible for delivery: **Recipient:**

APPENDIX E. METHODS FOR ALEVIN SAMPLING

Our goal in sampling alevins is to collect 1-25 fry in at least 250 redd samples in each stream by hydraulic sampling (“fry-pumping”) in March and early April. The reason for collecting a large number of alevins is because only some of the parents were sampled for genetic tissue, and there may be many other alevins of unknown parentage mixed in with those whose parentage can be identified.

General Approach

Sites will be sampled with a standard redd pump sampler to collect alevins. It is important that the sampling be distributed approximately in proportion to spawning distribution in the previous summer. A stratified sampling grid will be developed for each stream with a total of 1,000 sample sites equally spaced to cover the entire area of spawning mapped the previous summer. This includes all spawning areas, whether large, mass spawning areas, small patches of multiple redds, or single redds.

Because some sample sites will produce no target alevins, it will be important to “oversample” so the target of 250 positive samples can be attained. Therefore, the initial sampling distribution will include 300 sampling sites. A successful sample will contain up to 25 alevins of the target species.

It is possible that, after sampling the first 300 sites distributed throughout the stream, the target of 250 positive samples will not be met. In that case, determine how many more positive samples are required and estimate the percentage of sampling success in the first pass. Use this information to estimate how many more samples are required and approximately how they should be distributed throughout the stream to make another pass through the stream.

Selecting Sample Locations

The spawning areas from which adult DNA was collected the previous summer will be provided on a list with the GPS locations and descriptions of the starting point and dimensions of the spawning area. Each spawning area will be assigned a proportional number of the preliminary 300 sample sites. Roughly spread the designated number of samples across the area to be sampled.

Sampling will begin at the lower left “corner” of the designated spawning area (facing downstream). The lower left “corner” will be provided to you as a combination of GPS location, and descriptions of references, bearings, and distances to nearby markers or obvious landmarks.

Sampling will normally proceed in a left to right and upstream direction. Estimate the spacing distance to the right, or if no more sites are spaced to the right then upstream, to establish the second sample site location, and so on.

Place the sampling net hoop over the substrate wherever you can get a reasonable "seal" of the bottom ring of the net to prevent escape of alevins under the bottom of the ring. If the net does not lay flat on the substrate, move it slightly sideways, or up- or downstream, until it sits as flat as possible. Caution should be taken to not disturb the next sampling site to the right or upstream until that sample is taken.

Record the location of each sample with a GPS location. Use the position averaging feature of the GPS to get a better position. Sample sites will be numbered sequentially for all sample sites in one stream in chronological order.

Pumping to Collect Alevins

At each sample site, one or two team members will work the 0.5-m net frame down into the substrate as far as practical so that alevins cannot escape underneath the frame during pumping. The codend of the net should be on the downstream flow side of the net frame.

Work the injector probe 6-8" into the stream substrate inside the net frame. Start the water pump, being sure that the intake is in sufficiently deep water and that the pump is primed according to directions. Submerge the probe into multiple locations within the net frame, to 12-18" deep if possible, repeating this action until all possible fry have been released. Record the amount of time the substrate was probed with pumped water from start to end.

If alevins are observed on the surface within the net frame, they may be scooped with a dip-net and retained in a water-filled container. Additionally, remove the net frame and wash materials into the codend. Dump the contents of the codend into a round container and swish the contents until the alevins come to the surface. Scoop them out with an aquarium net and retain in the same container as any previous alevins from that sample. Be sure to keep alevins from one pump sample separate from another sample.

Alevin Samples

All alevins from each sample site will be sorted and counted by species and recorded. (See salmonid fry keys for species recognition.) All non-target species, and excess target species, should be released alive into the stream. If no target species are captured, record zero for the target species and move to the next sample site.

Up to 25 of the target species (if available in the sample) will be retained for genetic analysis in sample-specific, pre-labeled, ethanol-filled vials (use Isopropanol/Methanol/Ethanol (EtOH)). The vials should contain 4:1 EtOH to fish tissue. Minimize excess water in the vials and top them off from a squirt bottle of EtOH. On a small, write-in-the-rain sample label, record, the date, stream, and sample number and place it inside the bottle. The sample number corresponds to the last four digits from the vial's bar code. Write the number of fish on the outside of the bottle. Store the sample bottle in a safe location.

Record or scan the sample vial number on the data sheet, being certain that the vial number is associated with the GPS data for the same pump sample.

LETHAL WHOLE ALEVIN TISSUE SAMPLING FOR DNA ANALYSIS

ADF&G Gene Conservation Lab, Anchorage

Section 1.01

Section 1.02 I. General Information

We use the whole alevin as tissue samples from individual fish to determine the genetic characteristics and profile of a particular run or stock of fish. The most important thing to remember in collecting samples is that **only quality tissue samples give quality results**. If sampling from carcasses: tissues need to be as "fresh" and as cold as possible and recently moribund, do not sample from fungal alevin.

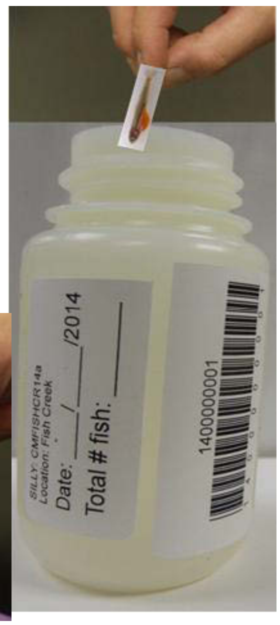
Preservative used: Isopropanol/Methanol/Ethanol (EtOH) preserves tissues for later DNA extraction. Avoid extended contact with skin.

II. Sampling Method

- Wipe excess water and/or slime off the whole alevin prior to placing into bulk bottle to avoid getting either water or fish slime to reduce dilution of preservative (see diagram to left).
- Repeat procedure for **up to 25 individual fish** into the same bottle. If you don't reach this number of fish, that's ok, it's the limit for proper preservation of whole alevin.
- Using pencil, record on pre-printed label on outside of bottle: sample date (mm/dd/yy), total number of fish placed in each bottle. This ensures correct data with each collection.

- Using pencil, record the last 4 digits of the barcode on Rite-in-Rain paper and insert inside each bottle with samples.
- After collection is complete and 24 hours have passed since the last alevin was sampled, “refresh” the samples as follows: carefully pour off ¾ EtOH and pour fresh EtOH into the bottle containing the alevin. Cap and invert bottle twice to mix EtOH and alevin.
- If collection occurs over 4-5 day period, “refresh” and end of the collection.
- **Tissue samples must remain in 125ml EtOH at all times.** Store sample bottle containing alevin at room temperature but away from heat. In the field: keep samples out of direct sun, rain and store capped bottle(s) in a dry, cool location. Freezing not required.

- Place 2 labels/bottle in vertical position (barcode, date/ # fish) before each sampling event. This should be done in dry area.
- Pre-filled bulk bottle with EtOH.
- Pat slime/water off alevin.
- Place whole alevin into 125ml bulk bottle until sample goal met.
- Capacity: 25 alevin/125ml bulk.
- Pencil; record date, # fish sampled.



III. Supplies included in sampling kit:

1. 125ml bulk bottle – pre-filled with EtOH
2. EtOH –in bulk bottle(s) for “refresh” step.
3. Sampling instructions - laminated.

Section 1.03 IV. Shipping: **HAZMAT paperwork is required for return shipment of these samples.**

Section 1.01 Return to ADF&G Anchorage lab:	**ADF&G – Genetics**	**Lab staff: 907-267-2247**
	333 Raspberry Road	Judy Berger: 907-267-2175
	Anchorage, Alaska 99518	**Freight code:** ___________

Shipping samples
As soon as possible, store sample vials at room temperature, away from heat, until shipping to ADFG.

Paying attention to Hazmat issues, ship samples to:
ADF&G – Genetics Conservation Laboratory
333 Raspberry Road
Anchorage, Alaska 99518
Attn: Judy Berger

ADFG Lab staff: 907-267-2247
Judy Berger: 907-267-2175

HWI Alevin Collection Data Sheet (Use number 2 pencil) -- GPS Serial #(s)______________________

Stream Name_________________ Stream AWC number___________

Date______________________

Crew Leader______________ Crew members____

General Comments

____

____

____

Site #	Inter tidal (√)	Waypoint #	Pump time (secs)	Species	# caught	# in vial	Sample comments

INTERACTIONS OF WILD AND HATCHERY PINK SALMON AND CHUM SALMON IN PRINCE WILLIAM SOUND AND SOUTHEAST ALASKA

Final Progress Report for 2015

For Alaska Department of Fish and Game
Contract IHP-13-013

Volume 3

APPENDIX F. PWS PINK SALMON SURVEY SUMMARY BY STREAM AND DATE

APPENDIX G. PWS CHUM SALMON SURVEY SUMMARY BY STREAM AND DATE

APPENDIX H. PWS STREAM SUMMARIES

APPENDIX F. PWS PINK SALMON SURVEY SUMMARY BY STREAM AND DATE

Stream Name	AWC Code	Survey Date	Otolith Specimens	Live Pink	Dead Pink	Live Chum	Dead Chum
Spring C*	221-20-10200	7/15/2015	169	824	489	0	0
Spring C*	221-20-10200	7/17/2015	96	1557	833	0	0
Spring C*	221-20-10200	7/18/2015	48	3259	588	0	0
Spring C*	221-20-10200	7/19/2015	48	1738	492	0	0
Spring C*	221-20-10200	7/20/2015	192	1320	401	0	0
Spring C*	221-20-10200	7/21/2015	240	1731	538	0	0
Spring C*	221-20-10200	7/22/2015	288	1575	670	0	0
Spring C*	221-20-10200	7/23/2015	240	2278	603	0	0
Spring C*	221-20-10200	7/24/2015	192	2224	1201	0	0
Spring C*	221-20-10200	7/25/2015	288	1209	612	0	0
Spring C*	221-20-10200	7/26/2015	192	2454	1548	0	0
Spring C*	221-20-10200	7/27/2015	240	2183	666	0	0
Spring C*	221-20-10200	7/28/2015	288	1560	933	0	0
Spring C*	221-20-10200	7/29/2015	336	757	1419	0	0
Spring C*	221-20-10200	7/30/2015	336	2230	1458	1	0
Spring C*	221-20-10200	7/31/2015	288	2850	-	1	0
Spring C*	221-20-10200	8/1/2015	240	1821	2297	0	0
Spring C*	221-20-10200	8/2/2015	288	1935	2389	0	1
Spring C*	221-20-10200	8/3/2015	288	1730	-	0	0
Spring C*	221-20-10200	8/4/2015	288	1750	3421	0	0
Spring C*	221-20-10200	8/5/2015	288	1930	1646	0	0
Spring C*	221-20-10200	8/6/2015	288	1034	1017	0	0
Spring C*	221-20-10200	8/7/2015	336	2415	2712	0	0
Spring C*	221-20-10200	8/8/2015	240	-	-	-	-
Spring C*	221-20-10200	8/10/2015	240	3270	1744	0	0
Spring C*	221-20-10200	8/11/2015	336	933	691	0	0
Spring C*	221-20-10200	8/12/2015	288	2599	2144	0	0
Spring C*	221-20-10200	8/13/2015	336	2079	2125	0	0
Spring C*	221-20-10200	8/14/2015	240	3647	1558	0	0
Spring C*	221-20-10200	8/15/2015	288	2581	-	0	0
Spring C*	221-20-10200	8/16/2015	288	1760	1944	0	0
Spring C*	221-20-10200	8/17/2015	288	-	-	-	-
Spring C*	221-20-10200	8/18/2015	228	2947	1400	0	0
Spring C*	221-20-10200	8/19/2015	336	700	951	0	0
Spring C*	221-20-10200	8/20/2015	288	-	-	-	-

Spring C*	221-20-10200	8/21/2015	336	3728	2203	0	0
Spring C*	221-20-10200	8/23/2015	288	4000	1635	0	0
Spring C*	221-20-10200	8/24/2015	192	2250	1400	0	0
Spring C*	221-20-10200	8/28/2015	192	4450	1850	0	0
Spring C*	221-20-10200	8/29/2015	192	-	-	-	-
Spring C*	221-20-10200	9/2/2015	192	3854	3100	0	0
Spring C*	221-20-10200	9/8/2015	144	6650	3344	0	0
Spring C*	221-20-10200	9/13/2015	144	5750	2746	0	0
Spring C*	221-20-10200	9/18/2015	216	2000	1200	0	0
Spring C*	221-20-10200	9/19/2015	480	185	1000	0	0
Spring C*	221-20-10200	9/20/2015	576	150	2000	0	0
Spring C*	221-20-10200	9/21/2015	624	1080	4900	0	0
Paddy C*	226-20-16010	8/4/2015	0	10	0	0	0
Paddy C*	226-20-16010	8/5/2015	1	25	1	1	0
Paddy C*	226-20-16010	8/6/2015	2	20	3	1	0
Paddy C*	226-20-16010	8/9/2015	0	0	0	0	0
Paddy C*	226-20-16010	8/10/2015	30	234	30	4	2
Paddy C*	226-20-16010	8/11/2015	35	289	71	3	1
Paddy C*	226-20-16010	8/12/2015	32	304	83	6	2
Paddy C*	226-20-16010	8/13/2015	52	218	77	5	3
Paddy C*	226-20-16010	8/14/2015	33	293	91	7	5
Paddy C*	226-20-16010	8/15/2015	39	312	156	2	8
Paddy C*	226-20-16010	8/16/2015	76	581	209	3	9
Paddy C*	226-20-16010	8/17/2015	36	405	175	0	5
Paddy C*	226-20-16010	8/18/2015	53	1280	107	2	3
Paddy C*	226-20-16010	8/19/2015	88	1635	216	3	6
Paddy C*	226-20-16010	8/20/2015	132	1640	380	1	3
Paddy C*	226-20-16010	8/21/2015	48	250	147	1	7
Paddy C*	226-20-16010	8/22/2015	192	1296	254	1	5
Paddy C*	226-20-16010	8/23/2015	240	-	-	1	0
Paddy C*	226-20-16010	8/24/2015	169	-	-	-	-
Paddy C*	226-20-16010	8/25/2015	432	1148	1195	0	3
Paddy C*	226-20-16010	8/26/2015	169	-	-	-	-
Paddy C*	226-20-16010	8/27/2015	240	-	-	-	-
Paddy C*	226-20-16010	8/28/2015	288	1105	1342	0	1
Paddy C*	226-20-16010	8/29/2015	384	-	-	-	-
Paddy C*	226-20-16010	8/30/2015	480	-	-	-	-
Paddy C*	226-20-16010	8/31/2015	336	663	905	0	2
Paddy C*	226-20-16010	9/1/2015	432	-	-	-	-

Paddy C*	226-20-16010	9/2/2015	272	-	-	-	-
Paddy C*	226-20-16010	9/3/2015	329	873	1428	0	0
Paddy C*	226-20-16010	9/4/2015	384	-	-	-	-
Paddy C*	226-20-16010	9/5/2015	192	-	-	-	-
Paddy C*	226-20-16010	9/6/2015	240	3599	2175	0	2
Paddy C*	226-20-16010	9/7/2015	288	-	-	-	-
Paddy C*	226-20-16010	9/9/2015	0	2821	3089	-	-
Paddy C*	226-20-16010	9/10/2015	0	2140	993	0	0
Paddy C*	226-20-16010	9/12/2015	0	1574	1909	0	0
Paddy C*	226-20-16010	9/13/2015	384	-	-	-	-
Paddy C*	226-20-16010	9/14/2015	240	-	-	-	-
Paddy C*	226-20-16010	9/15/2015	372	571	2006	0	0
Paddy C*	226-20-16010	9/16/2015	384	-	-	-	-
Paddy C*	226-20-16010	9/17/2015	262	243	2083	0	0
Paddy C*	226-20-16010	9/18/2015	336	-	-	-	-
Paddy C*	226-20-16010	9/19/2015	192	-	-	-	-
Paddy C*	226-20-16010	9/20/2015	240	33	1116	0	0
Paddy C*	226-20-16010	9/21/2015	288	-	-	-	-
Paddy C*	226-20-16010	9/22/2015	144	11	1903	0	0
Paddy C*	226-20-16010	9/23/2015	144	-	-	-	-
Erb C*	226-20-16040	8/3/2015	32	3310	40	5	5
Erb C*	226-20-16040	8/4/2015	74	625	115	44	13
Erb C*	226-20-16040	8/5/2015	96	1015	181	33	16
Erb C*	226-20-16040	8/6/2015	85	1115	241	24	27
Erb C*	226-20-16040	8/7/2015	113	1456	277	28	27
Erb C*	226-20-16040	8/8/2015	72	1885	444	28	34
Erb C*	226-20-16040	8/9/2015	121	1532	453	18	36
Erb C*	226-20-16040	8/10/2015	80	3000	229	10	23
Erb C*	226-20-16040	8/11/2015	178	3725	724	19	35
Erb C*	226-20-16040	8/12/2015	178	3865	417	13	20
Erb C*	226-20-16040	8/13/2015	199	2982	674	11	38
Erb C*	226-20-16040	8/14/2015	336	2877	527	10	34
Erb C*	226-20-16040	8/15/2015	288	3569	615	7	40
Erb C*	226-20-16040	8/16/2015	211	3518	796	8	47
Erb C*	226-20-16040	8/17/2015	144	2900	450	0	4
Erb C*	226-20-16040	8/18/2015	288	3427	800	1	3
Erb C*	226-20-16040	8/19/2015	336	2960	1915	2	10
Erb C*	226-20-16040	8/20/2015	384	-	-	-	-
Erb C*	226-20-16040	8/21/2015	432	2810	849	4	7

Erb C*	226-20-16040	8/22/2015	384	-	-	-	-
Erb C*	226-20-16040	8/23/2015	336	-	-	-	-
Erb C*	226-20-16040	8/24/2015	336	3450	2450	0	0
Erb C*	226-20-16040	8/25/2015	96	-	-	-	-
Erb C*	226-20-16040	8/26/2015	480	-	-	-	-
Erb C*	226-20-16040	8/27/2015	288	4170	2551	0	0
Erb C*	226-20-16040	8/28/2015	288	-	-	-	-
Erb C*	226-20-16040	8/29/2015	384	-	-	-	-
Erb C*	226-20-16040	8/30/2015	288	3441	3822	0	0
Erb C*	226-20-16040	8/31/2015	384	-	-	-	-
Erb C*	226-20-16040	9/1/2015	288	-	-	-	-
Erb C*	226-20-16040	9/2/2015	288	3827	5639	0	0
Erb C*	226-20-16040	9/3/2015	432	-	-	-	-
Erb C*	226-20-16040	9/4/2015	384	-	-	-	-
Erb C*	226-20-16040	9/5/2015	720	11241	3084	0	0
Erb C*	226-20-16040	9/6/2015	288	-	-	-	-
Erb C*	226-20-16040	9/7/2015	432	8221	9570	0	0
Erb C*	226-20-16040	9/9/2015	0	7445	4847	0	0
Erb C*	226-20-16040	9/10/2015	0	4621	1515	0	0
Erb C*	226-20-16040	9/12/2015	0	3899	2849	0	0
Erb C*	226-20-16040	9/13/2015	336	-	-	-	-
Erb C*	226-20-16040	9/14/2015	384	-	-	-	-
Erb C*	226-20-16040	9/15/2015	288	2100	4704	0	0
Erb C*	226-20-16040	9/16/2015	384	-	-	-	-
Erb C*	226-20-16040	9/17/2015	288	656	2401	0	0
Erb C*	226-20-16040	9/18/2015	336	-	-	-	-
Erb C*	226-20-16040	9/19/2015	288	-	-	-	-
Erb C*	226-20-16040	9/20/2015	288	342	2165	0	0
Erb C*	226-20-16040	9/21/2015	288	-	-	-	-
Erb C*	226-20-16040	9/22/2015	240	144	3217	0	0
Erb C*	226-20-16040	9/23/2015	176	-	-	-	-
Hogan Bay*	226-30-16810	8/1/2015	0	550	0	0	0
Hogan Bay*	226-30-16810	8/4/2015	0	160	2	0	0
Hogan Bay*	226-30-16810	8/5/2015	7	-	-	-	-
Hogan Bay*	226-30-16810	8/6/2015	25	2000	25	0	0
Hogan Bay*	226-30-16810	8/9/2015	217	825	220	0	1
Hogan Bay*	226-30-16810	8/10/2015	39	2511	84	1	0
Hogan Bay*	226-30-16810	8/12/2015	172	500	324	0	0
Hogan Bay*	226-30-16810	8/14/2015	498	1443	575	0	0

Hogan Bay*	226-30-16810	8/16/2015	296	1362	613	0	2
Hogan Bay*	226-30-16810	8/18/2015	130	2636	511	0	2
Hogan Bay*	226-30-16810	8/20/2015	363	5091	400	0	0
Hogan Bay*	226-30-16810	8/21/2015	0	2425	629	0	0
Hogan Bay*	226-30-16810	8/22/2015	192	2540	402	0	0
Hogan Bay*	226-30-16810	8/23/2015	198	3900	815	0	0
Hogan Bay*	226-30-16810	8/24/2015	240	-	-	-	-
Hogan Bay*	226-30-16810	8/25/2015	192	2646	2494	0	0
Hogan Bay*	226-30-16810	8/26/2015	288	345	1579	0	0
Hogan Bay*	226-30-16810	8/27/2015	288	2512	3570	0	0
Hogan Bay*	226-30-16810	8/28/2015	240	311	313	0	0
Hogan Bay*	226-30-16810	8/29/2015	240	1360	3497	0	0
Hogan Bay*	226-30-16810	8/30/2015	144	1127	3436	0	0
Hogan Bay*	226-30-16810	9/1/2015	672	907	5930	0	0
Hogan Bay*	226-30-16810	9/2/2015	528	-	-	-	-
Hogan Bay*	226-30-16810	9/5/2015	768	2500	5291	0	0
Hogan Bay*	226-30-16810	9/8/2015	960	-	-	-	-
Hogan Bay*	226-30-16810	9/11/2015	816	3380	4949	0	0
Hogan Bay*	226-30-16810	9/14/2015	784	-	-	-	-
Hogan Bay*	226-30-16810	9/17/2015	632	2855	5610	0	0
Hogan Bay*	226-30-16810	9/23/2015	512	200	5000	0	0
Gilmour C*	227-20-17480	8/2/2015	0	65	0	13	54
Gilmour C*	227-20-17480	8/5/2015	0	47	0	10	64
Gilmour C*	227-20-17480	8/7/2015	3	200	3	3	101
Gilmour C*	227-20-17480	8/9/2015	9	357	9	2	98
Gilmour C*	227-20-17480	8/11/2015	3	640	9	6	68
Gilmour C*	227-20-17480	8/12/2015	6	940	11	6	37
Gilmour C*	227-20-17480	8/15/2015	46	515	68	3	35
Gilmour C*	227-20-17480	8/17/2015	29	1790	44	0	28
Gilmour C*	227-20-17480	8/18/2015	17	2713	40	0	3
Gilmour C*	227-20-17480	8/20/2015	130	-	-	-	-
Gilmour C*	227-20-17480	8/24/2015	610	2654	666	1	3
Gilmour C*	227-20-17480	8/26/2015	775	-	-	-	-
Gilmour C*	227-20-17480	8/28/2015	192	858	1675	0	0
Gilmour C*	227-20-17480	8/29/2015	808	-	-	-	-
Gilmour C*	227-20-17480	8/31/2015	606	1327	2901	0	0
Gilmour C*	227-20-17480	9/4/2015	576	-	-	-	-
Gilmour C*	227-20-17480	9/7/2015	768	3162	2023	0	0
Gilmour C*	227-20-17480	9/10/2015	723	-	-	-	-

Gilmour C*	227-20-17480	9/13/2015	720	1495	3164	0	0
Gilmour C*	227-20-17480	9/16/2015	527	131	2405	0	0
Stockdale C*	227-20-17520	8/2/2015	8	986	9	6	8
Stockdale C*	227-20-17520	8/5/2015	32	837	37	8	7
Stockdale C*	227-20-17520	8/7/2015	51	1082	75	11	11
Stockdale C*	227-20-17520	8/9/2015	72	4601	78	3	14
Stockdale C*	227-20-17520	8/10/2015	4	-	-	-	-
Stockdale C*	227-20-17520	8/11/2015	7	6479	15	2	3
Stockdale C*	227-20-17520	8/13/2015	29	4277	95	5	15
Stockdale C*	227-20-17520	8/15/2015	91	4017	145	0	9
Stockdale C*	227-20-17520	8/17/2015	50	-	-	-	-
Stockdale C*	227-20-17520	8/19/2015	302	8207	300	0	12
Stockdale C*	227-20-17520	8/23/2015	540	-	-	-	-
Stockdale C*	227-20-17520	8/24/2015	162	6480	936	1	2
Stockdale C*	227-20-17520	8/25/2015	833	-	-	-	-
Stockdale C*	227-20-17520	8/27/2015	1008	2420	1535	0	0
Stockdale C*	227-20-17520	8/28/2015	288	-	-	-	-
Stockdale C*	227-20-17520	8/30/2015	808	8370	5705	0	1
Stockdale C*	227-20-17520	9/3/2015	1008	-	-	-	-
Stockdale C*	227-20-17520	9/6/2015	768	8881	6430	0	0
Stockdale C*	227-20-17520	9/9/2015	896	-	-	-	-
Stockdale C*	227-20-17520	9/12/2015	705	1060	1973	0	0
Stockdale C*	227-20-17520	9/15/2015	601	-	-	-	-
Stockdale C*	227-20-17520	9/18/2015	339	123	3918	0	0
Hartney C	221-10-10020	7/10/2015	1	11094	3	1326	34
Hartney C	221-10-10020	7/17/2015	34	170	12	69	21
Hartney C	221-10-10020	7/20/2015	0	16704	29	1919	134
Hartney C	221-10-10020	7/22/2015	80	5825	7	1600	211
Hartney C	221-10-10020	7/31/2015	30	2845	117	700	353
Hartney C	221-10-10020	8/3/2015	96	16275	3341	285	362
Hartney C	221-10-10020	8/12/2015	56	3600	1232	40	115
Hartney C	221-10-10020	8/14/2015	68	3200	700	95	430
Hartney C	221-10-10020	8/25/2015	192	4350	3850	15	49
Sheep R	221-20-10360	7/29/2015	192	1870	487	1075	485
Sheep R	221-20-10360	8/7/2015	192	10250	902	731	566
Sheep R	221-20-10360	8/26/2015	192	15500	3000	51	48
Beartrap R	221-30-10480	7/18/2015	96	10485	477	3195	1504
Beartrap R	221-30-10480	8/7/2015	96	20700	1820	250	2610
Beartrap R	221-30-10480	8/29/2015	288	20830	15428	340	1750

Sunny R	221-40-10875	7/20/2015	12	27	13	10	6
Sunny R	221-40-10875	8/9/2015	243	161	302	97	50
Sunny R	221-40-10875	8/31/2015	0	770	606	602	914
Sunny R	221-40-10875	9/2/2015	192	667	900	148	330
Short C	221-40-10880	7/20/2015	240	586	270	1	2
Short C	221-40-10880	8/9/2015	192	630	900	0	1
Short C	221-40-10880	8/30/2015	148	700	750	0	0
Fish C	221-40-10890	7/19/2015	192	2190	330	4	3
Fish C	221-40-10890	8/8/2015	202	4550	1706	4	31
Fish C	221-40-10890	9/1/2015	212	2247	2238	3	5
Lagoon C	221-40-10990	7/21/2015	240	1395	225	161	68
Lagoon C	221-40-10990	8/10/2015	272	1321	1375	100	70
Lagoon C	221-40-10990	8/30/2015	116	610	2150	4	40
Long C	222-10-12140	7/22/2015	58	2269	9	330	89
Long C	222-10-12140	8/11/2015	138	683	175	62	60
Long C	222-10-12140	8/12/2015	151	616	750	17	185
Long C	222-10-12140	9/3/2015	107	7024	3220	6	51
Spring C	222-10-12170	7/23/2015	7	655	9	88	131
Spring C	222-10-12170	8/13/2015	304	3201	765	2401	725
Spring C	222-10-12170	9/4/2015	300	868	2950	0	6
Delta C[a]	222-20-12335	7/24/2015	288	1620	400	3	5
Delta C[a]	222-20-12335	8/14/2015	120	3300	600	0	0
Delta C[a]	222-20-12335	9/5/2015	128	300	750	0	0
Siwash R	222-20-12640	7/25/2015	50	2752	6	81	25
Siwash R	222-20-12640	8/15/2015	300	2463	475	73	60
Siwash R	222-20-12640	9/7/2015	249	1070	1420	4	39
Coghill R	223-30-13220	7/27/2015	76	1560	62	125	20
Coghill R	223-30-13220	8/15/2015	192	21000	2950	0	5
Coghill R	223-30-13220	8/17/2015	25	2334	6350	9	400
Coghill R	223-30-13220	9/1/2015	132	18500	4300	0	0
Coghill R	223-30-13220	9/9/2015	60	500	4500	0	13
Hummer C	224-10-14240	7/26/2015	0	9	1	3	2
Hummer C	224-10-14240	8/16/2015	301	437	303	34	115
Hummer C	224-10-14240	9/8/2015	252	100	1750	11	60
Paulson C	224-10-14550	7/28/2015	183	800	123	42	79
Paulson C	224-10-14550	8/18/2015	240	1900	1180	7	66
Paulson C	224-10-14550	9/10/2015	191	850	3600	1	11
W. Finger C	224-40-14850	7/29/2015	16	2240	25	209	120
W. Finger C	224-40-14850	8/20/2015	288	2250	830	55	295

W. Finger C	224-40-14850	9/11/2015	132	200	2000	3	80
Comstock C	225-20-15040	7/29/2015	0	0	0	0	0
Comstock C	225-20-15040	8/20/2015	25	392	25	0	10
Comstock C	225-20-15040	9/6/2015	300	400	550	0	0
Comstock C	225-20-15040	9/11/2015	120	560	900	0	0
Bainbridge C	226-20-16300	8/3/2015	300	5907	276	11	11
Bainbridge C	226-20-16300	8/21/2015	152	3040	2400	3	3
Bainbridge C	226-20-16300	9/12/2015	168	500	2500	1	1
Johnson C	226-40-16269	8/4/2015	96	540	60	1	13
Johnson C	226-40-16269	8/22/2015	288	1850	1300	0	6
Johnson C	226-40-16269	9/13/2015	240	2400	5500	0	0
Swamp C	227-20-17390	8/3/2015	96	6705	1091	118	34
Swamp C	227-20-17390	8/4/2015	148	-	-	-	-
Swamp C	227-20-17390	8/8/2015	228	13810	1587	10	166
Swamp C	227-20-17390	8/24/2015	96	5810	1360	0	9
Swamp C	227-20-17390	9/15/2015	60	550	1001	0	0
Cabin C	227-20-17464	8/3/2015	0	5519	9	100	321
Cabin C	227-20-17464	8/5/2015	48	3810	6	15	332
Cabin C	227-20-17464	8/6/2015	0	2514	63	119	810
Cabin C	227-20-17464	8/23/2015	209	1400	581	0	0
Cabin C	227-20-17464	9/14/2015	300	375	2100	1	0
Double C	228-40-18310	7/24/2015	16	10905	14	295	98
Double C	228-40-18310	8/5/2015	192	6700	3451	441	321
Double C	228-40-18310	8/19/2015	192	6600	910	72	93
Constantine C	228-60-18150	8/6/2015	186	2236	174	346	500
Constantine C	228-60-18150	8/25/2015	240	4852	1190	330	1250
Constantine C	228-60-18150	9/16/2015	144	200	8000	0	700

* Fitness study stream

[a] Delta Creek was erroneously referred to as Surplus Creek in the 2013 and 2014 annual reports although the same creek was sampled in all three study years.

Dash (-) indicates live/dead estimates were not made

APPENDIX G. PWS CHUM SALMON SURVEY SUMMARY BY STREAM AND DATE

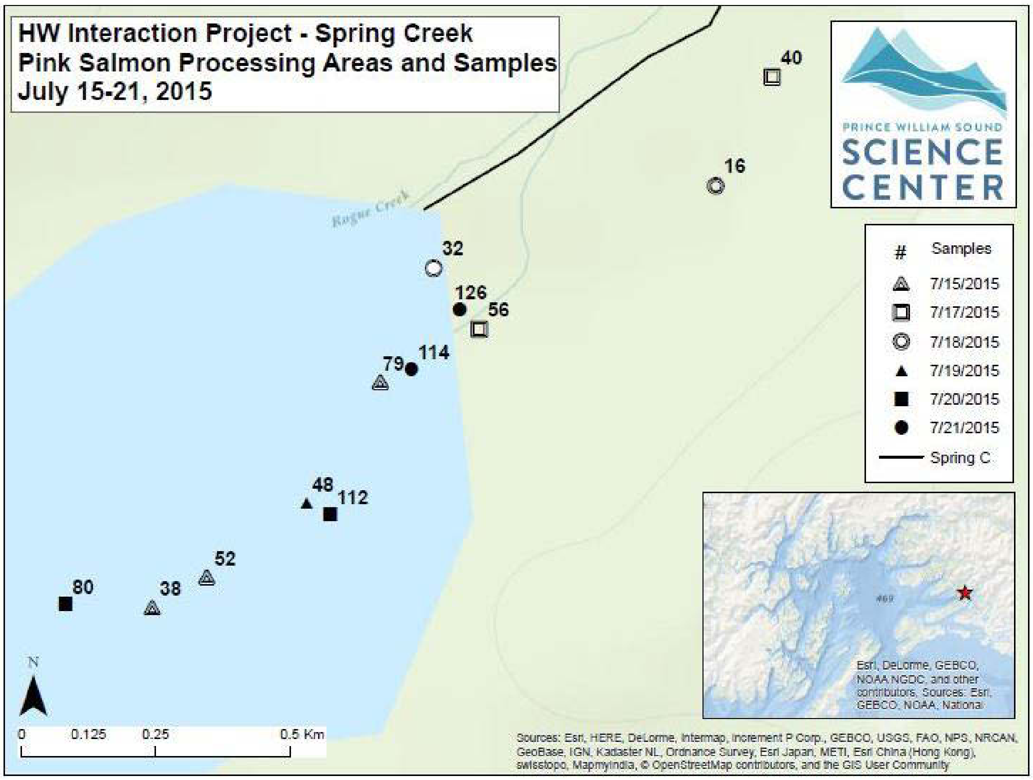
Stream Name	AWC Code	Survey Date	Otolith Specimens	Live Pink	Dead Pink	Live Chum	Dead Chum
Hartney C	221-10-10020	7/10/2015	28	11094	3	1326	34
Hartney C	221-10-10020	7/17/2015	19	170	12	69	21
Hartney C	221-10-10020	7/20/2015	128	16704	29	1919	134
Hartney C	221-10-10020	7/22/2015	0	5825	7	1600	211
Hartney C	221-10-10020	7/31/2015	53	2845	117	700	353
Hartney C	221-10-10020	8/3/2015	96	16275	3341	285	362
Hartney C	221-10-10020	8/12/2015	19	3600	1232	40	115
Hartney C	221-10-10020	8/14/2015	192	3200	700	95	430
Hartney C	221-10-10020	8/25/2015	0	4350	3850	15	49
Beartrap R	221-30-10480	7/18/2015	218	10485	477	3195	1504
Beartrap R	221-30-10480	8/7/2015	264	20700	1820	250	2610
Beartrap R	221-30-10480	8/29/2015	72	20830	15428	340	1750
Sunny R	221-40-10875	7/20/2015	4	27	13	10	6
Sunny R	221-40-10875	8/9/2015	62	161	302	97	50
Sunny R	221-40-10875	8/31/2015	318	770	606	602	914
Sunny R	221-40-10875	9/2/2015	0	667	900	148	330
Long C	222-10-12140	7/22/2015	165	2269	9	330	89
Long C	222-10-12140	8/11/2015	50	683	175	62	60
Long C	222-10-12140	8/12/2015	183	616	750	17	185
Long C	222-10-12140	9/3/2015	30	7024	3220	6	51
Vanishing C	222-10-12157	7/23/2015	224	1257	0	433	235
Vanishing C	222-10-12157	8/13/2015	192	800	240	212	130
Vanishing C	222-10-12157	9/4/2015	132	1595	14500	160	1570
Spring C	222-10-12170	7/23/2015	122	655	9	88	131
Spring C	222-10-12170	8/13/2015	43	3201	765	2401	725
Spring C	222-10-12170	9/4/2015	5	868	2950	0	6
Wells R	222-20-12340	7/24/2015	288	7356	62	4350	454
Wells R	222-20-12340	8/14/2015	161	6410	2050	386	192
Wells R	222-20-12340	9/5/2015	20	1895	3100	6	24
Siwash R	222-20-12640	7/25/2015	29	2752	6	81	25
Siwash R	222-20-12640	8/15/2015	60	2463	475	73	60
Siwash R	222-20-12640	9/7/2015	37	1070	1420	4	39
Coghill R	223-30-13220	7/27/2015	13	1560	62	125	20
Coghill R	223-30-13220	8/15/2015	1	21000	2950	0	5

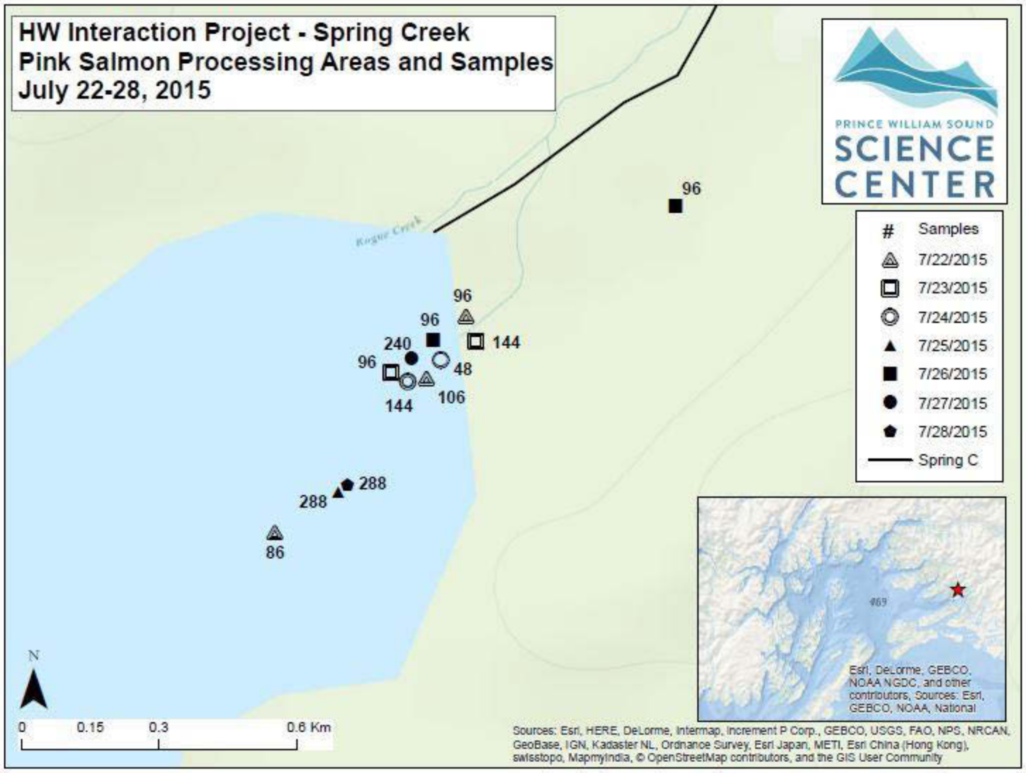
Coghill R	223-30-13220	8/17/2015	208	2334	6350	9	400
Coghill R	223-30-13220	9/9/2015	12	500	4500	0	13
Mill C	224-10-14210	7/26/2015	256	923	16	210	278
Mill C	224-10-14210	8/19/2015	288	2050	970	814	859
Mill C	224-10-14210	9/8/2015	84	300	1500	50	200
Tebenkof C	224-10-14500	7/28/2015	12	95	22	82	15
Tebenkof C	224-10-14500	8/18/2015	27	1250	369	256	28
Tebenkof C	224-10-14500	9/10/2015	6	800	640	2	6
BlackStone C	224-10-14510	7/28/2015	0	300	15	0	0
BlackStone C	224-10-14510	8/18/2015	5	8902	1250	3	5
BlackStone C	224-10-14510	9/10/2015	1	850	2100	0	1
Paulson C	224-10-14550	7/28/2015	69	800	123	42	79
Paulson C	224-10-14550	8/18/2015	63	1900	1180	7	66
Paulson C	224-10-14550	9/10/2015	11	850	3600	1	11
W. Finger C	224-40-14850	7/29/2015	105	2240	25	209	120
W. Finger C	224-40-14850	8/20/2015	288	2250	830	55	295
W. Finger C	224-40-14850	9/11/2015	81	200	2000	3	80
Swamp C	227-20-17390	8/3/2015	24	6705	1091	118	34
Swamp C	227-20-17390	8/4/2015	101	-	-	-	-
Swamp C	227-20-17390	8/8/2015	67	13810	1587	10	166
Swamp C	227-20-17390	8/24/2015	8	5810	1360	0	9
Cabin C	227-20-17464	8/3/2015	312	5519	9	100	321
Cabin C	227-20-17464	8/5/2015	0	3810	6	15	332
Cabin C	227-20-17464	8/6/2015	204	2514	63	119	810
Cabin C	227-20-17464	8/23/2015	3	1400	581	-	3
Cabin C	227-20-17464	9/14/2015	0	375	2100	1	0
Double C	228-40-18310	7/24/2015	98	10905	14	295	98
Double C	228-40-18310	8/5/2015	192	6700	3451	441	321
Double C	228-40-18310	8/19/2015	132	6600	910	72	93
Constantine C	228-60-18150	8/6/2015	288	2236	174	346	500
Constantine C	228-60-18150	8/25/2015	192	4852	1190	330	1250
Constantine C	228-60-18150	9/16/2015	132	200	8000	-	700

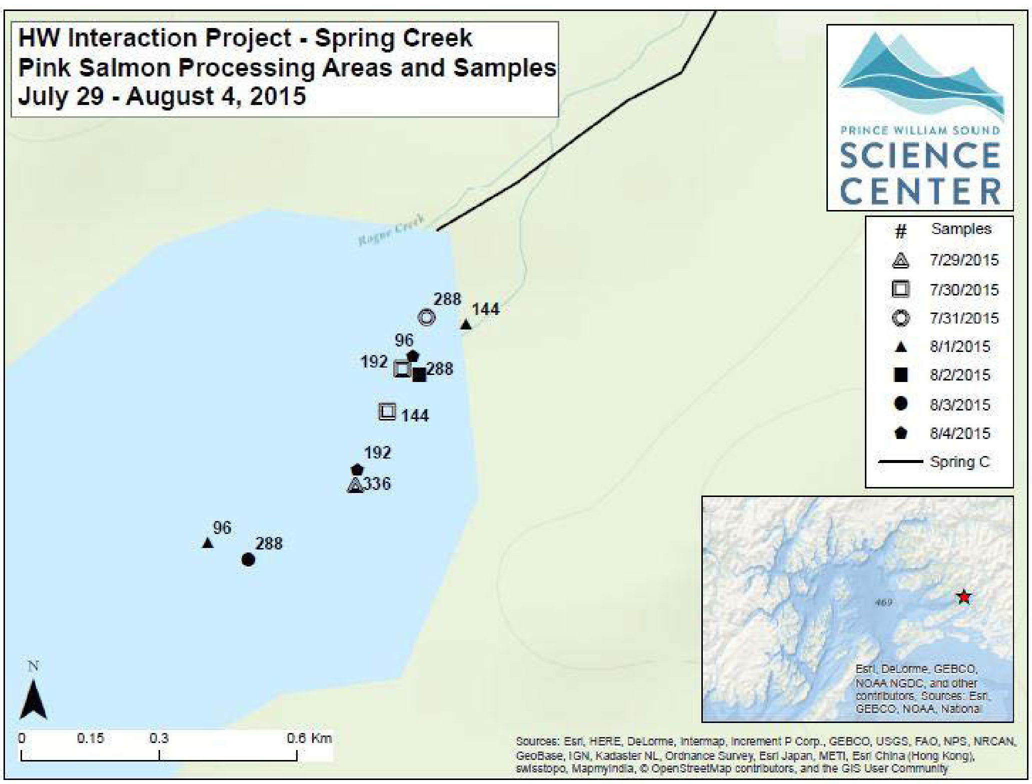
Dash (-) indicates live/dead estimates were not made

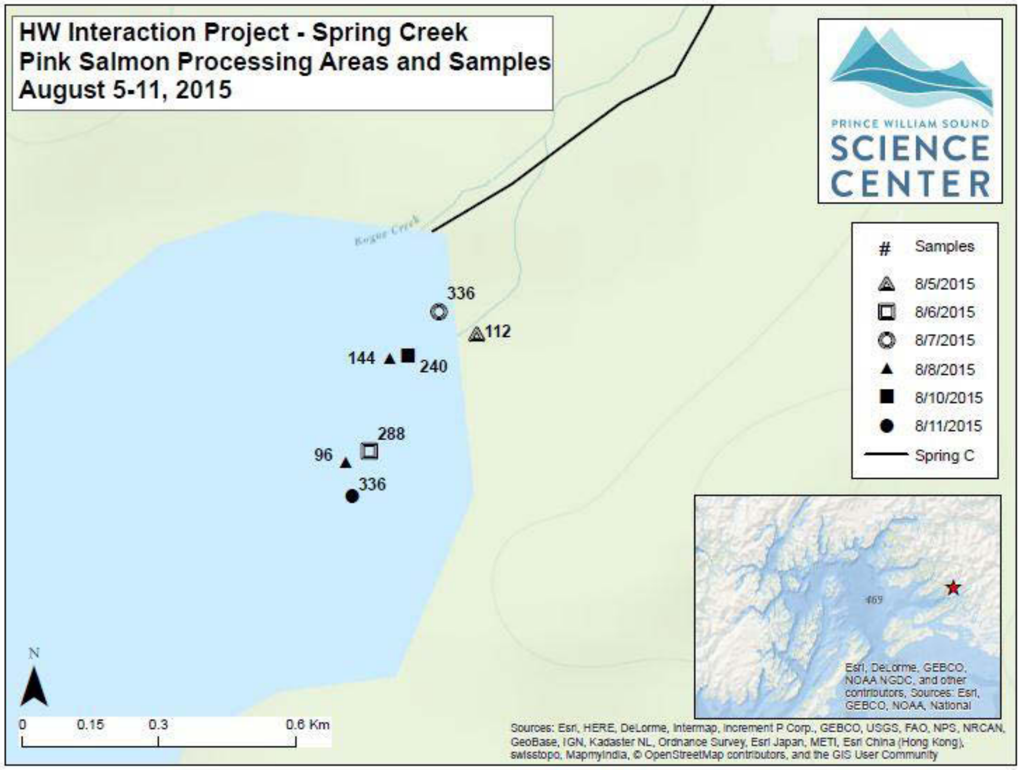
APPENDIX H. PWS STREAM SUMMARIES

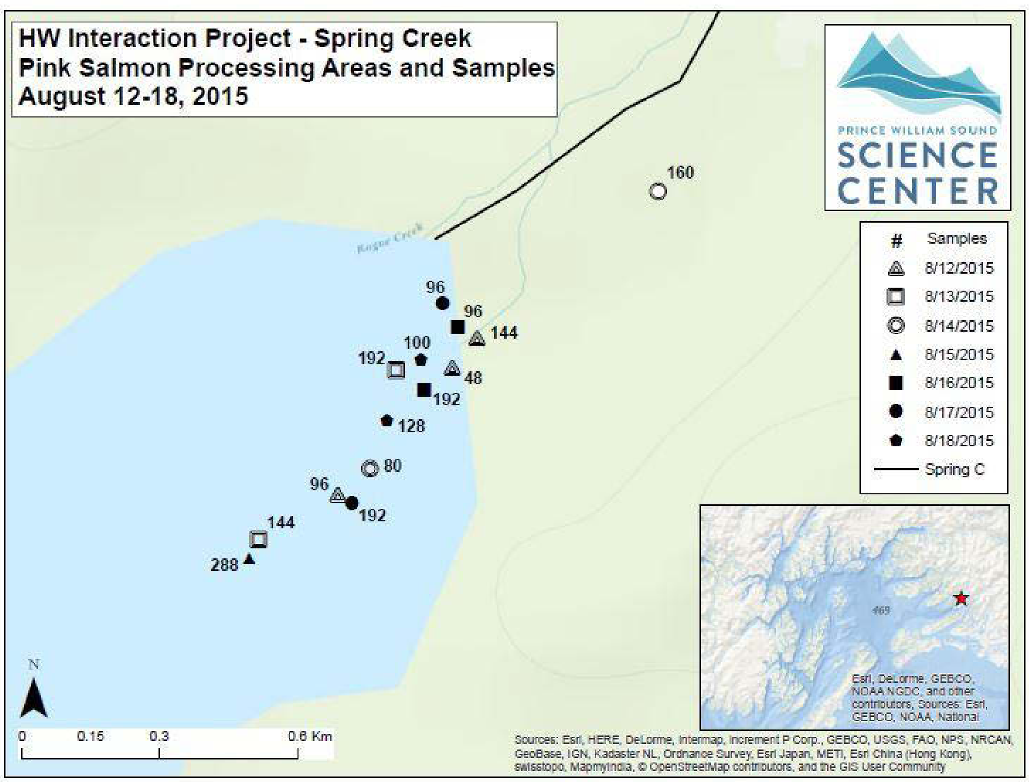
Spring Creek
221-20-10200
Pink Salmon Fitness

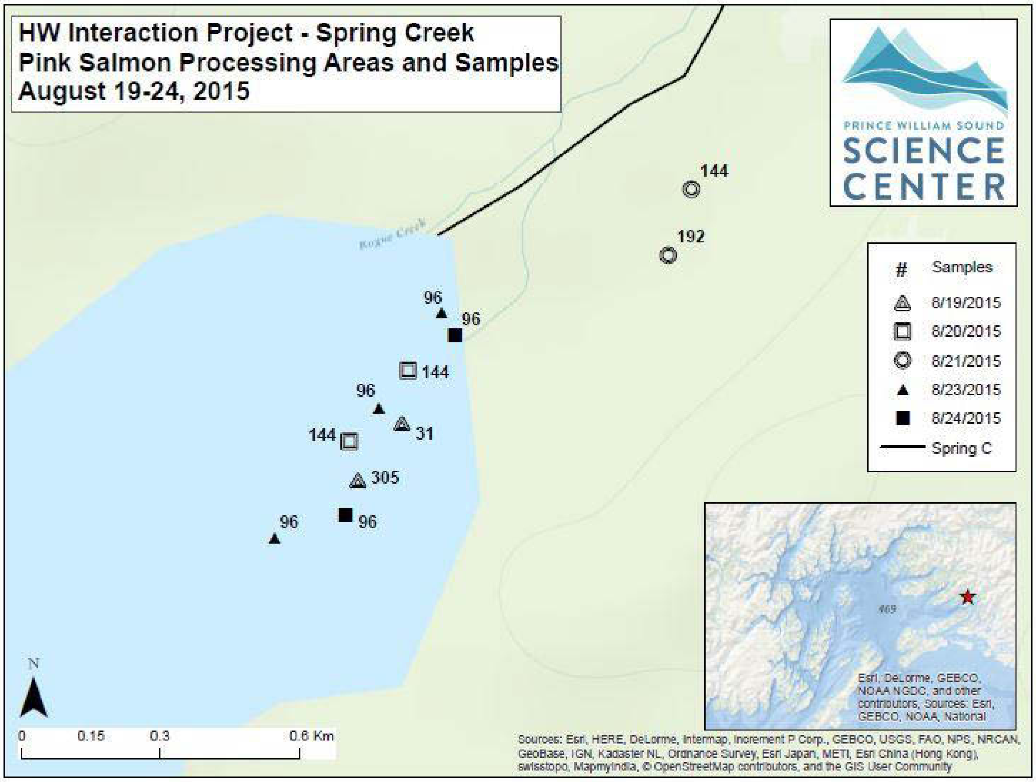


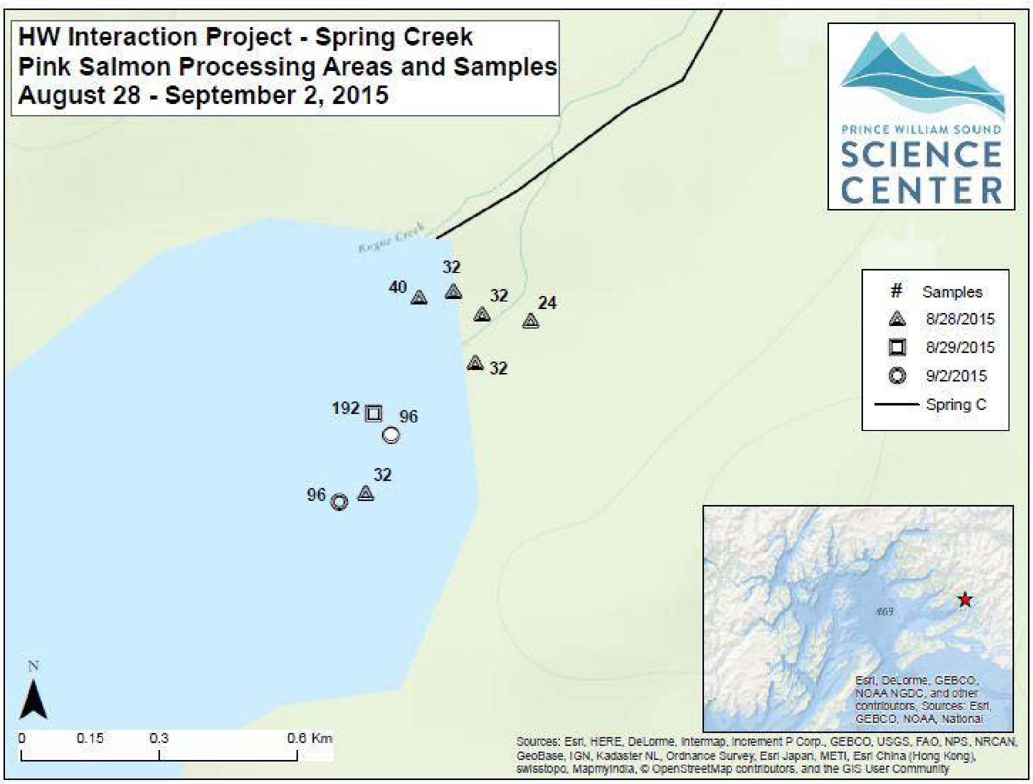

HW Interaction Project - Spring Creek
Pink Salmon Processing Areas and Samples
July 22-28, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
96
96
96
240
144
96
48
144
106
288
288
86
Samples
7/22/2015
7/23/2015
7/24/2015
7/25/2015
7/26/2015
7/27/2015
7/28/2015
Spring C
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
N
0 0.15 0.3 0.6 Km
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

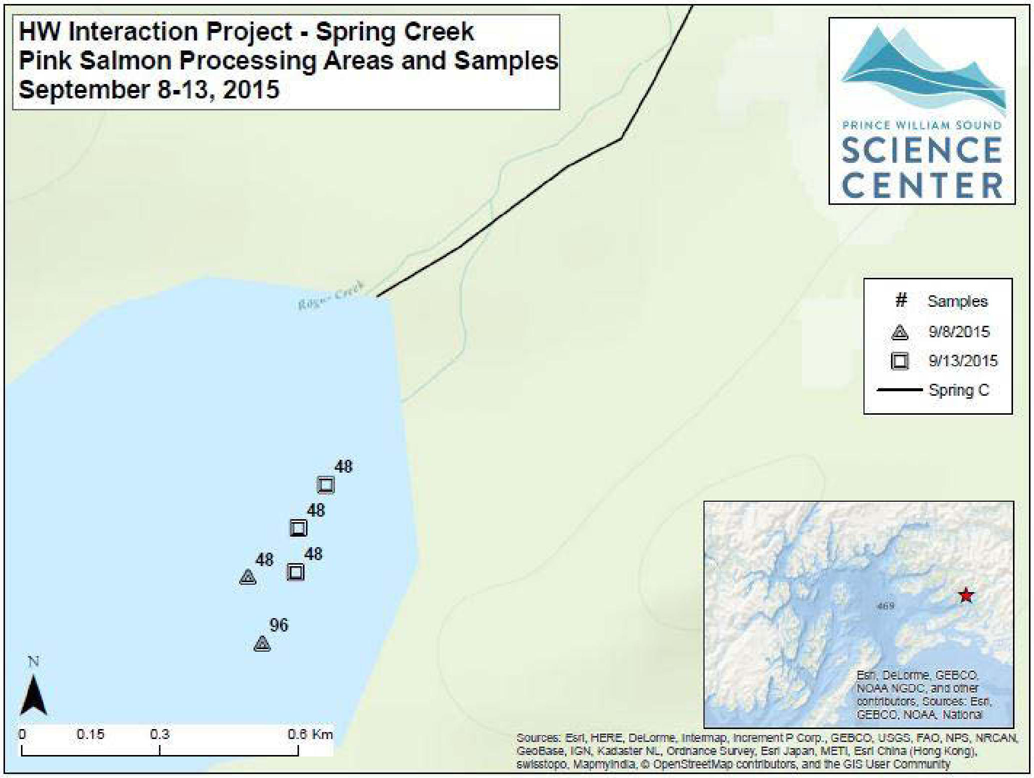

HW Interaction Project - Spring Creek
Pink Salmon Processing Areas and Samples
July 29 - August 4, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
288
144
96
192
288
144
192
336
96
288
Samples
7/29/2015
7/30/2015
7/31/2015
8/1/2015
8/2/2015
8/3/2015
8/4/2015
Spring C
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
N
0 0.15 0.3 0.6 Km
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

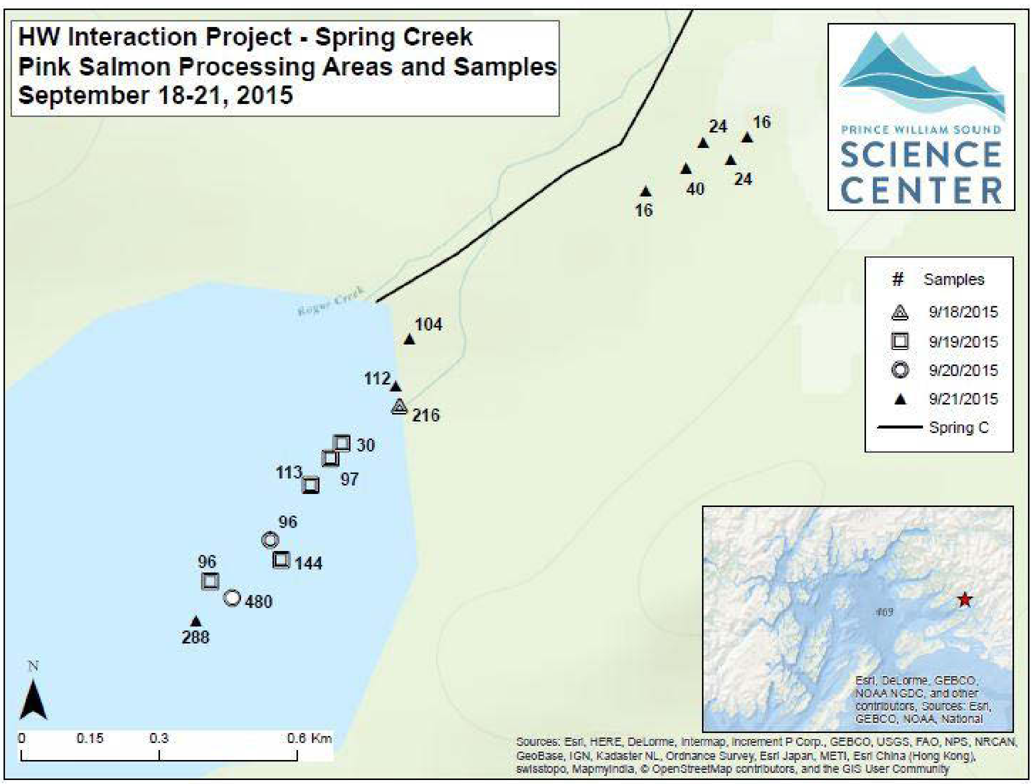

HW Interaction Project - Spring Creek
Pink Salmon Processing Areas and Samples
August 5-11, 2015
PRINCE WILLIAM SOUND SCIENCE CENTER
Samples
8/5/2015
8/6/2015
8/7/2015
8/8/2015
8/10/2015
8/11/2015
Spring C
336
112
144
240
288
96
336
N
0 0.15 0.3 0.6 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Spring Creek
Pink Salmon Processing Areas and Samples
August 12-18, 2015
PRINCE WILLIAM SOUND SCIENCE CENTER
Samples
8/12/2015
8/13/2015
8/14/2015
8/15/2015
8/16/2015
8/17/2015
8/18/2015
Spring C
160
96
96
144
100
192
48
192
128
80
96
192
144
288
N
0 0.15 0.3 0.6 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Spring Creek
Pink Salmon Processing Areas and Samples
August 19-24, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
Rogue Creek
144
192
96
96
144
96
31
144
305
96
96
Samples
8/19/2015
8/20/2015
8/21/2015
8/23/2015
8/24/2015
Spring C
469
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
N
0 0.15 0.3 0.6 Km
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Spring Creek
Pink Salmon Processing Areas and Samples
August 28 - September 2, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
Rogue Creek
32
40
32
24
32
192
96
32
96
Samples
8/28/2015
8/29/2015
9/2/2015
Spring C
469
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
N
0 0.15 0.3 0.6 Km
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community





2015 samples collected and run timing: Three PWS crews visited Spring Creek 47 times between 7/15/2015 and 9/21/2015, collecting 12,469 Pink Salmon samples. The subcontracted

Texas A&M University (TAMU) crew and the *Cathy G* crew collected the most samples and the Cordova crew visited Spring Creek when the TAMU or *Cathy G* crews could not. This year Spring Creek had a long Pink Salmon run - there were live fish counted in every survey. Counts taken daily or on alternate days indicate the peak run may have been in late August and early September.

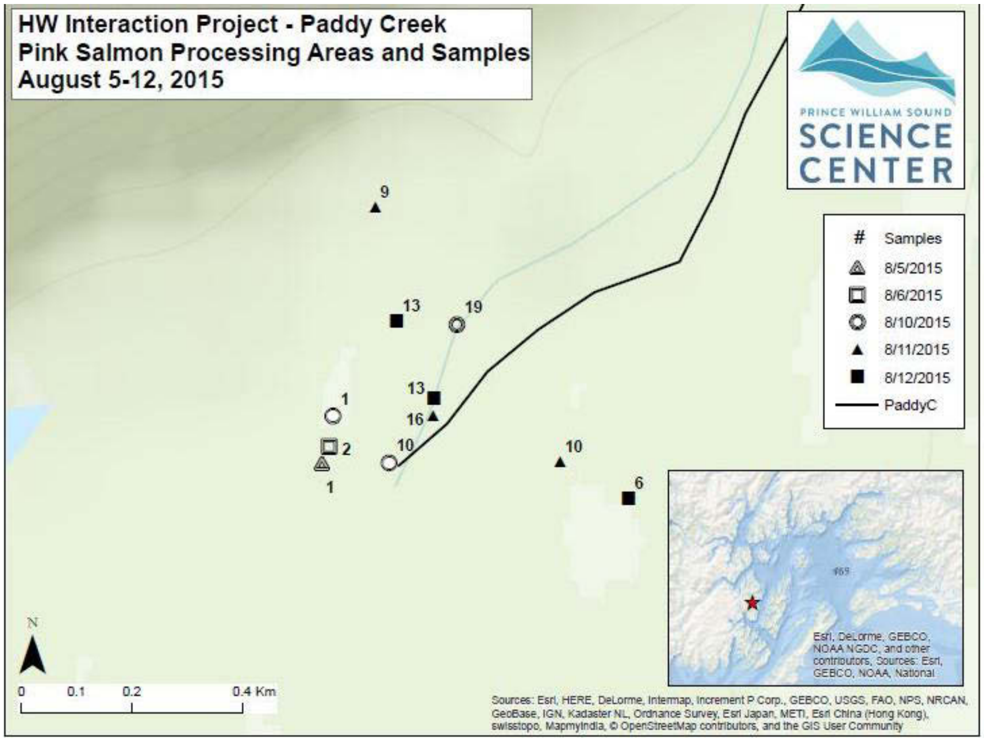
Extent of stream sampled: Surveys found spawning Pink Salmon as far as the documented extent of this stream in 2015. This contrasts greatly with the 2014 season. Although Pink Salmon spawned as far as 1 km upstream, most Pink Salmon spawned in a 200 m stretch between the upper intertidal and start of the forest where the stream narrows.

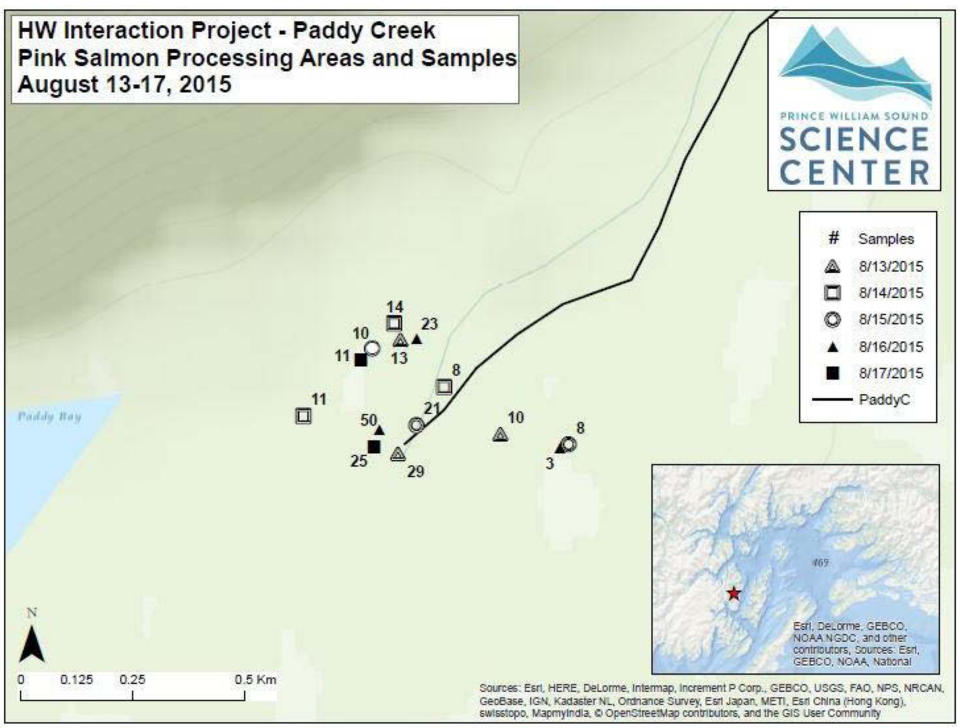
Unusual events: This summer was a very low rain year for many streams in PWS, however, Spring Creek retained running water throughout the entire summer. Even though there was running water all summer, many fish became stranded after high tides and subsequently died prior to spawning.

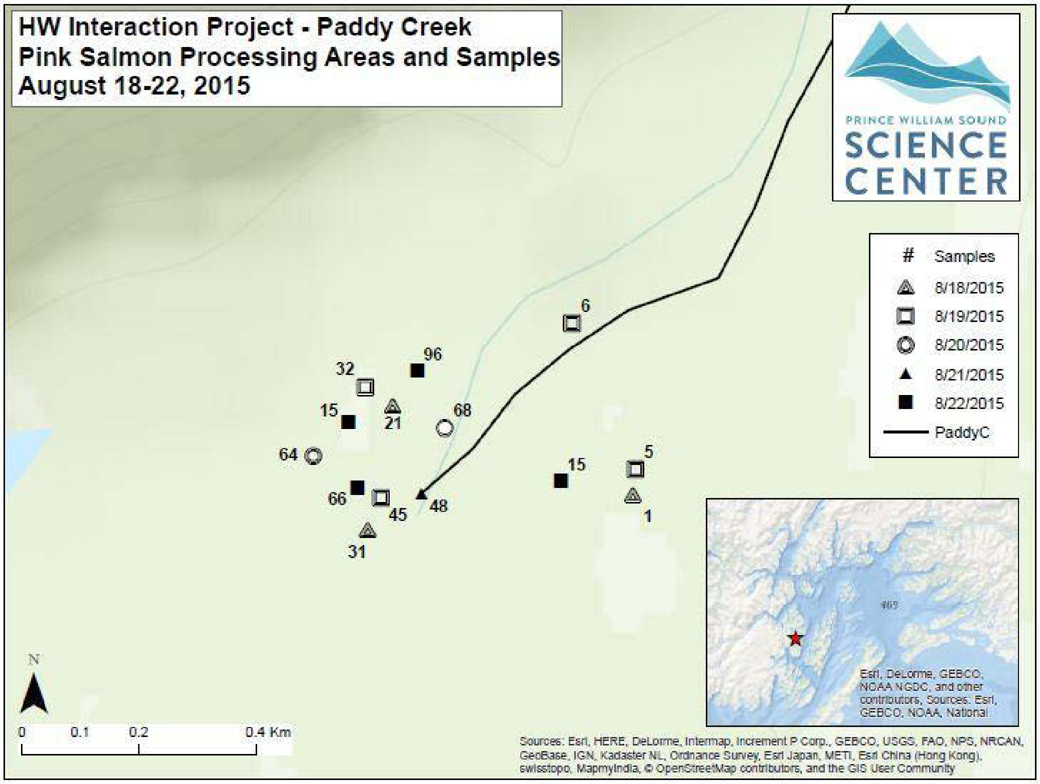
Access, safety, or logistics issues: The Texas A&M (TAMU) crew, subcontracted by PWSSC, consistently accessed this stream throughout the season. TAMU maintained a permanent base camp at Alice Cove, as they did last year, which is a short skiff ride from Spring Creek. Late season windy weather made it difficult for the Cordova based crew to access Spring Creek via skiff. Wind is a limiting factor that affects access to Spring Creek and a couple days had to be cut short in order to ensure a safe skiff ride home by both TAMU and Cordova-based crews.

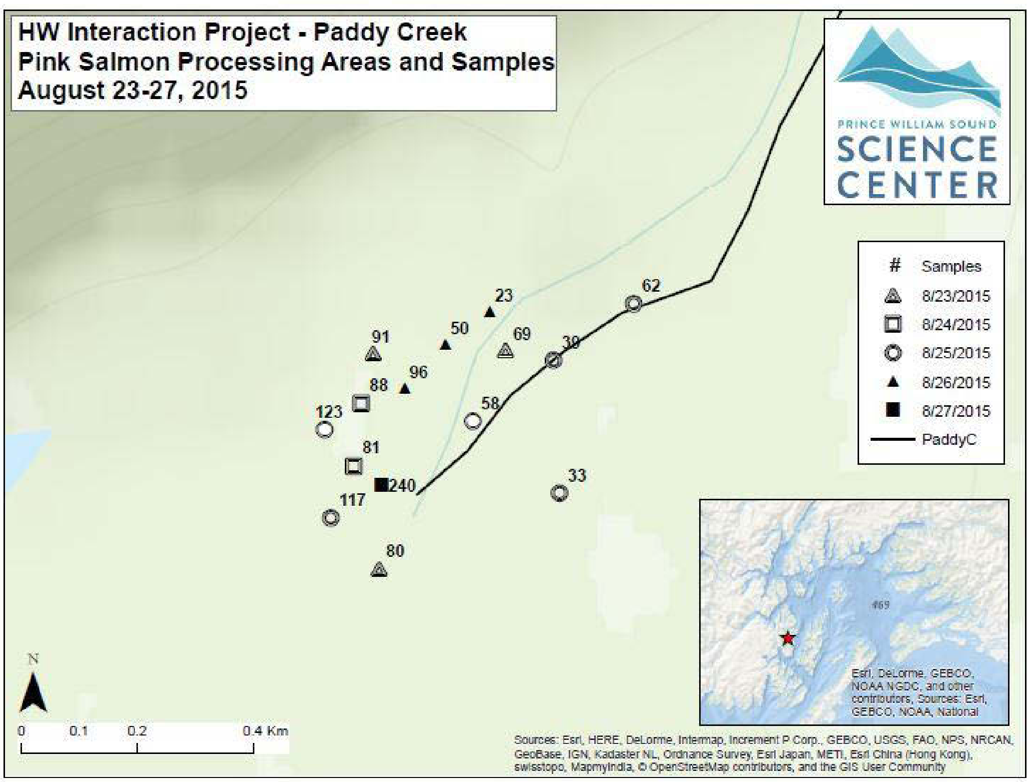
Recommendations, changes, and other notes: Should Spring Creek be sampled in 2016, we suggest renting a nearby cabin that would allow crews to walk to Spring Creek, eliminating the need for skiff transport that can be influenced by weather.

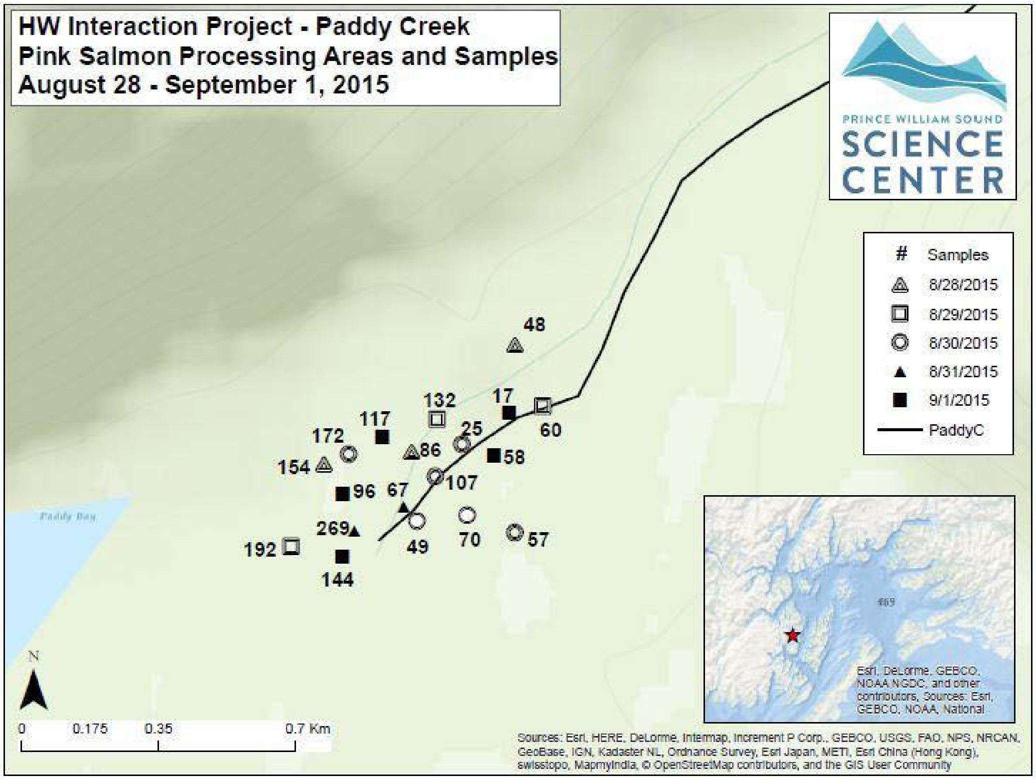
Paddy Creek
226-20-16010
Pink Salmon Fitness

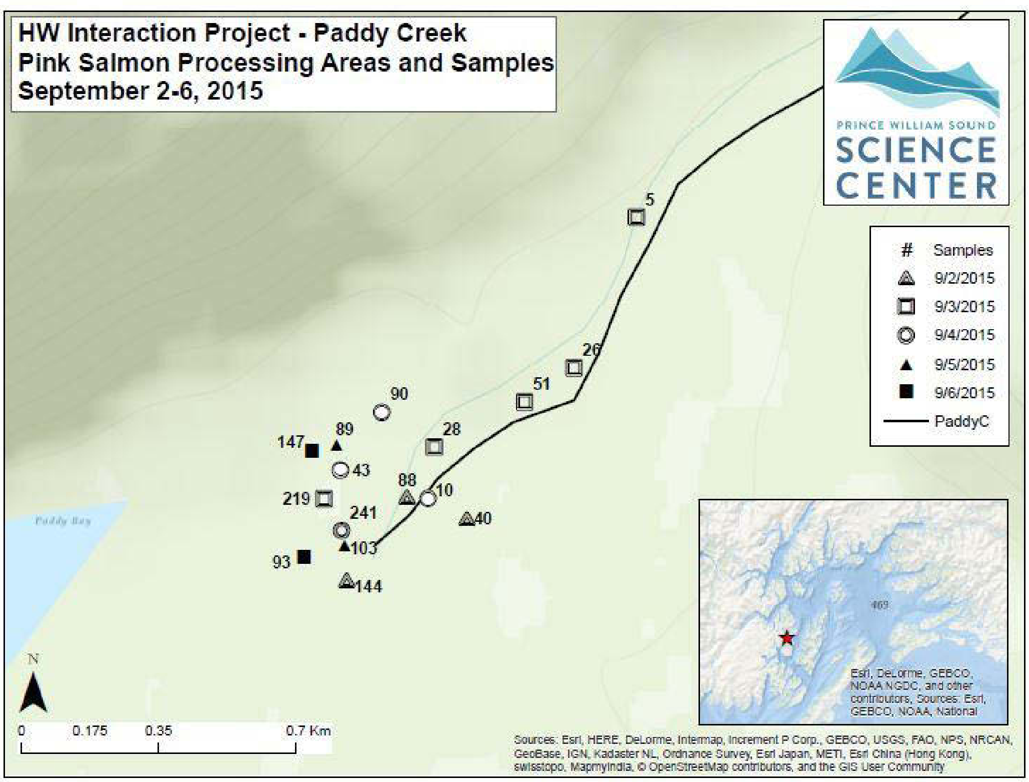


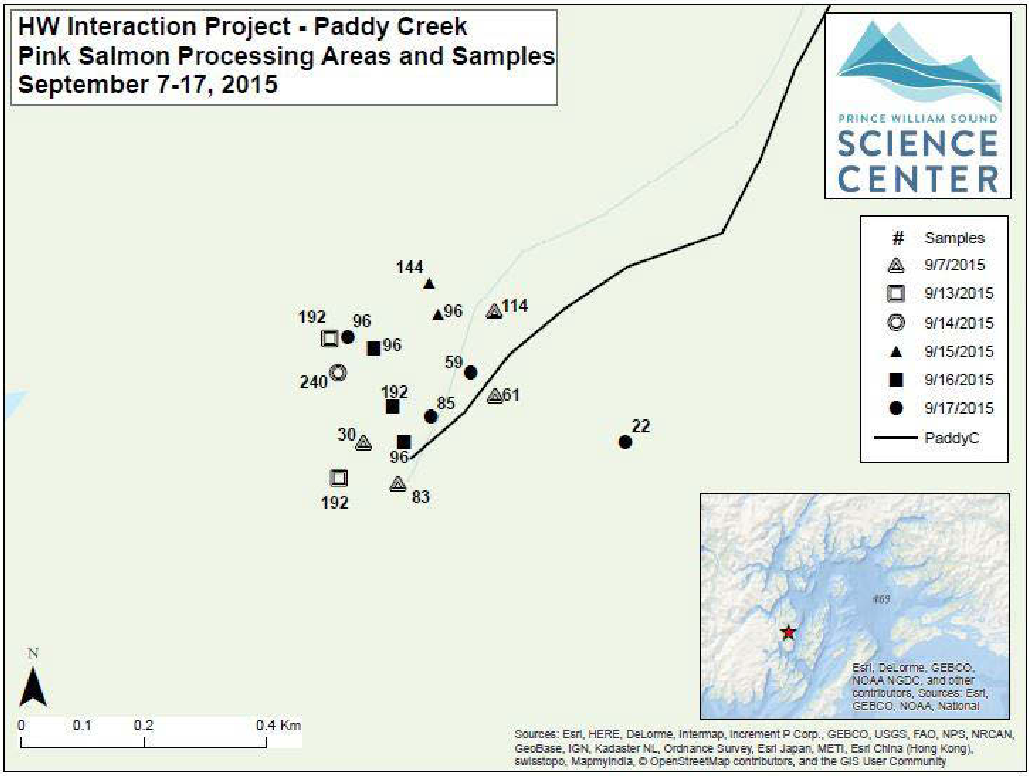


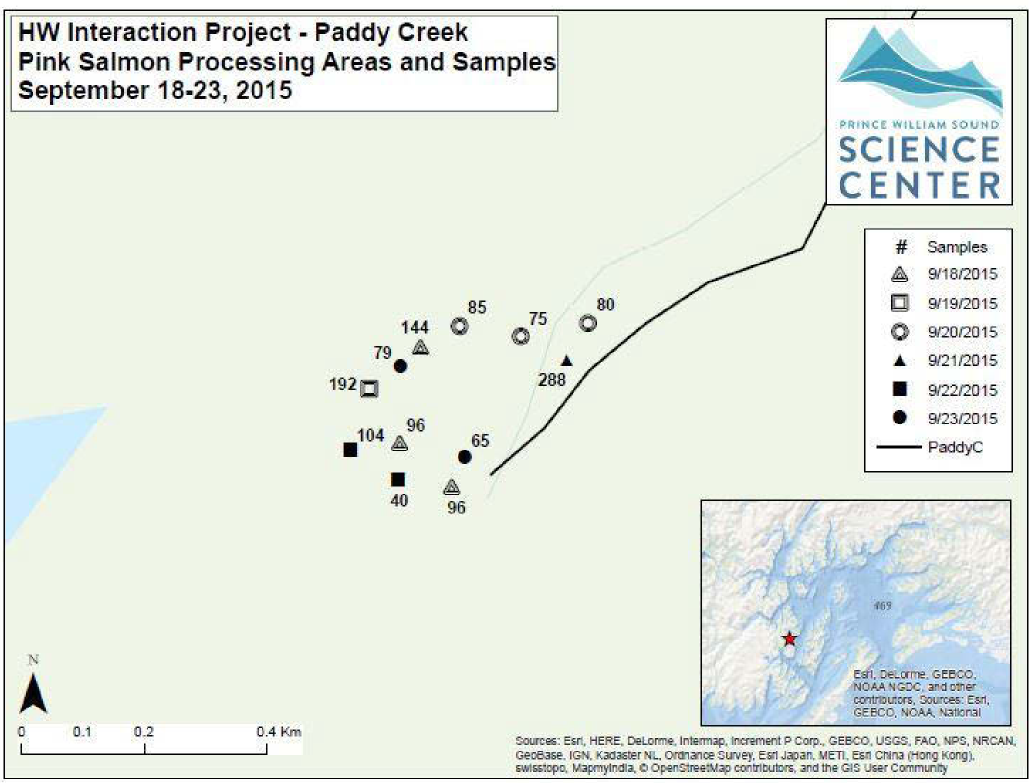

HW Interaction Project - Paddy Creek
Pink Salmon Processing Areas and Samples
August 18-22, 2015
PRINCE WILLIAM SOUND
SCIENCE
CENTER
Samples
8/18/2015
8/19/2015
8/20/2015
8/21/2015
8/22/2015
PaddyC
6
96
32
15
21
68
64
15
5
66
45
48
1
31
N
0 0.1 0.2 0.4 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Paddy Creek
Pink Salmon Processing Areas and Samples
August 23-27, 2015
PRINCE WILLIAM SOUND
SCIENCE
CENTER
Samples
8/23/2015
8/24/2015
8/25/2015
8/26/2015
8/27/2015
PaddyC
23
62
50
91
69
30
96
88
58
123
81
33
240
117
80
N
0 0.1 0.2 0.4 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Paddy Creek
Pink Salmon Processing Areas and Samples
August 28 - September 1, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
Samples
8/28/2015
8/29/2015
8/30/2015
8/31/2015
9/1/2015
PaddyC
48
132
17
60
117
25
172
86
58
154
107
96
67
269
49
70
57
192
144
Paddy Bay
N
0
0.175
0.35
0.7 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Paddy Creek
Pink Salmon Processing Areas and Samples
September 2-6, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
Samples
9/2/2015
9/3/2015
9/4/2015
9/5/2015
9/6/2015
PaddyC
5
26
51
90
28
89
147
43
88
10
219
40
241
103
93
144
Paddy Bay
N
0
0.175
0.35
0.7 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Paddy Creek
Pink Salmon Processing Areas and Samples
September 7-17, 2015
PRINCE WILLIAM SOUND
SCIENCE
CENTER
Samples
9/7/2015
9/13/2015
9/14/2015
9/15/2015
9/16/2015
9/17/2015
PaddyC
144
96
114
192
96
96
59
240
192
85
61
30
22
96
192
83
N
0
0.1
0.2
0.4 Km
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National


HW Interaction Project - Paddy Creek
Pink Salmon Processing Areas and Samples
September 18-23, 2015
PRINCE WILLIAM SOUND
SCIENCE
CENTER
Samples
9/18/2015
9/19/2015
9/20/2015
9/21/2015
9/22/2015
9/23/2015
PaddyC
85
75
80
144
79
288
192
96
104
65
40
96
N
0
0.1
0.2
0.4 Km
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National

2015 samples collected and run timing: The PWSSC camping crew visited Paddy Creek 47 times between 08/04/2015 and 09/23/2015 collecting 8,710 Pink Salmon otolith and tissue samples. The beginning of the run started with 234 fish in the creek on 08/10/2015. Following that, there were two peak runs observed, the first was from 08/18/2015 to 08/28/2015 with over 1,000 fish in all Paddy Creek branches each day. The run tapered to 663 fish on 08/31/2015. A second peak was observed on 09/06/2015 with 3,599 live fish in all three branches of the creek. The peak runs directly correlated with rain events. Live fish numbers steadily dropped to 11 fish on 09/22/2015. The spawning run was a total of 49 days in 2015. The total run was estimated to be 10,000 Pink Salmon. This was based on the crew estimating the percent of the freshly dead that they sampled each day, then expanding the known number sampled to account for the unsampled fresh dead, and summing that over all sampling days. There were also an estimated 25 live Chum and 10 live Coho Salmon observed in Paddy Creek in 2015.

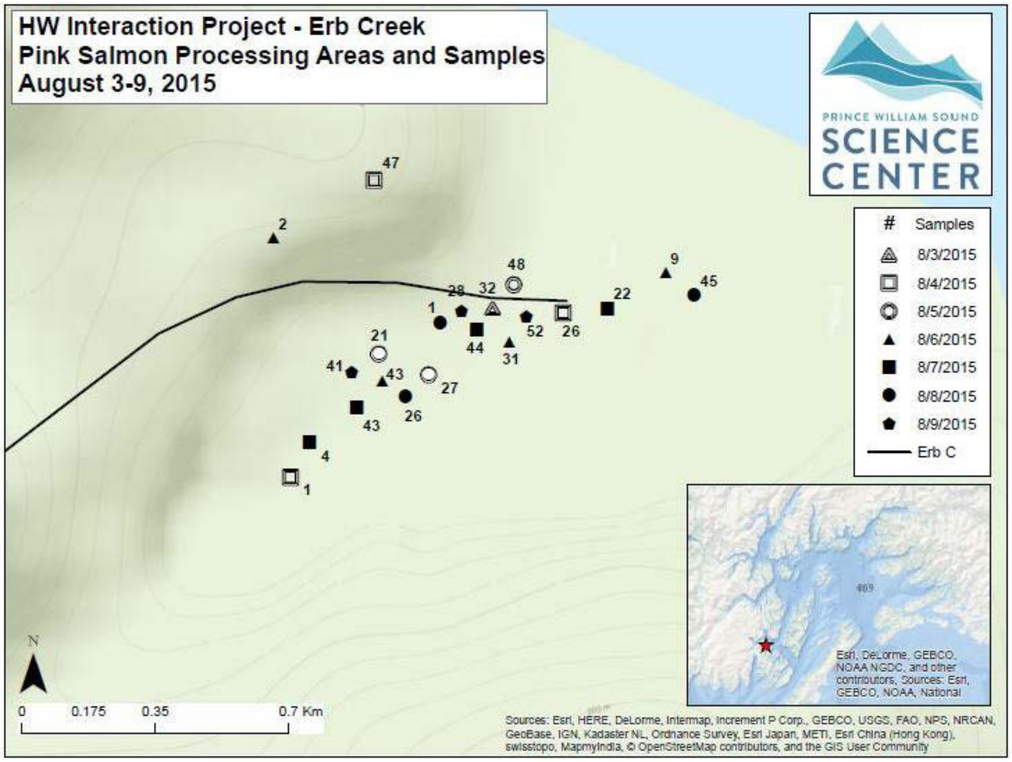
Extent of stream sampled: There are two creeks that flow into the head of Paddy Bay, one from the northeast and one from the east. If you are in the bay, looking upstream, Paddy proper is the stream on the left side (NE) and an unnamed creek flows from the right (E). Paddy proper has a small tributary roughly 100 m from average high tide. Looking upstream, it flows from the left. The extent of all three creeks was determined and live/dead counts included the entirety of each. The extent of the unnamed creek was a 2.5 m bedrock slide, we never saw fish above that point, live or dead, even during the highest stream flow. The extent of Paddy proper is a small muskeg lake about 2.5 km from the mouth. The extent of Paddy tributary is a 1.5 m log-jam sieve where water drains through a buildup of loose cobble before trickling through the log-jam. Live Pink Salmon were not seen past a small pool at a bend where the tree-line meets the muskeg in Paddy proper. The majority of spawning activity occurred in the unnamed creek to the right. There were some spawning beds in the large cobble of Paddy proper but they were few and far between.

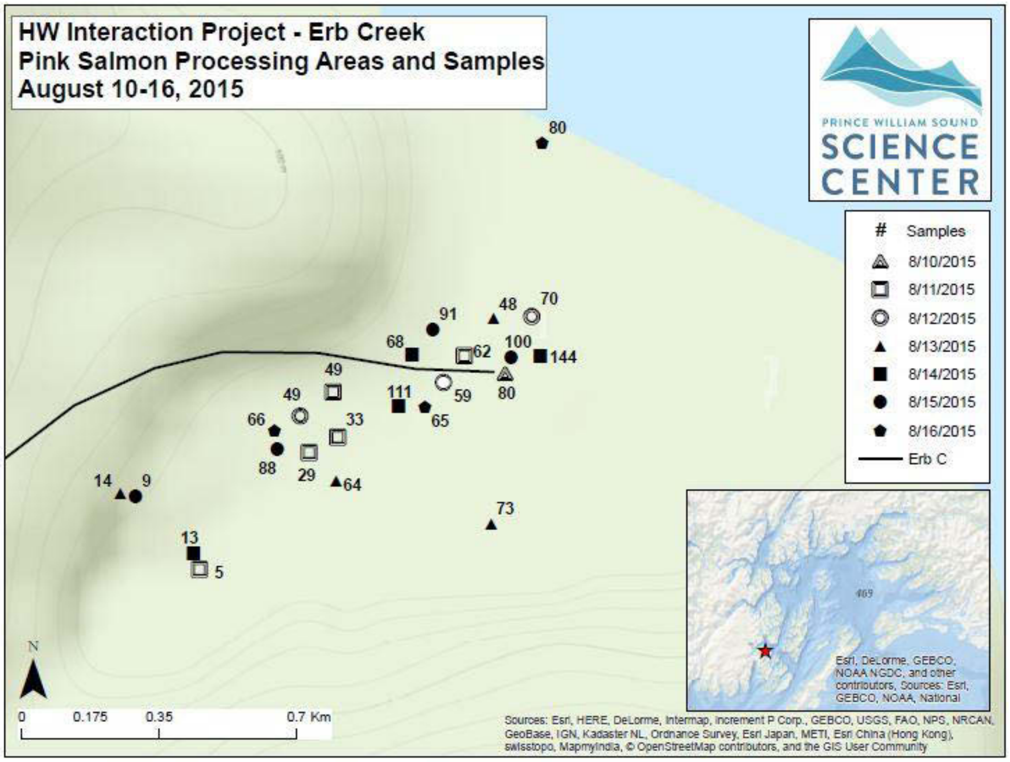
Unusual events: There was very little rain during the summer of 2015. The water was so low that fish were not able to swim past average high tide until the first big rain event on 08/09/2015. Water levels were so low that high tides stranded many pre-spawn fish through the season. Later in the season multiple Coho also became stranded and died.

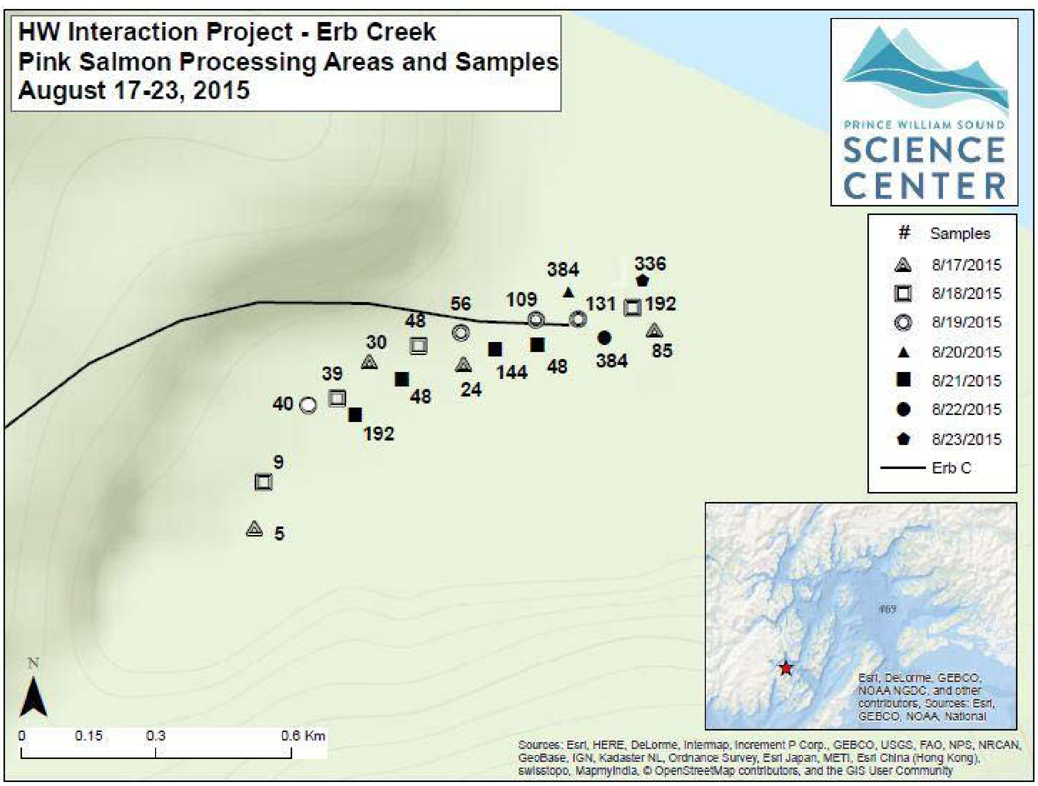
Access, safety, or logistics issues: Paddy Creek is approximately 1 km from camp - access is easy and dependable.

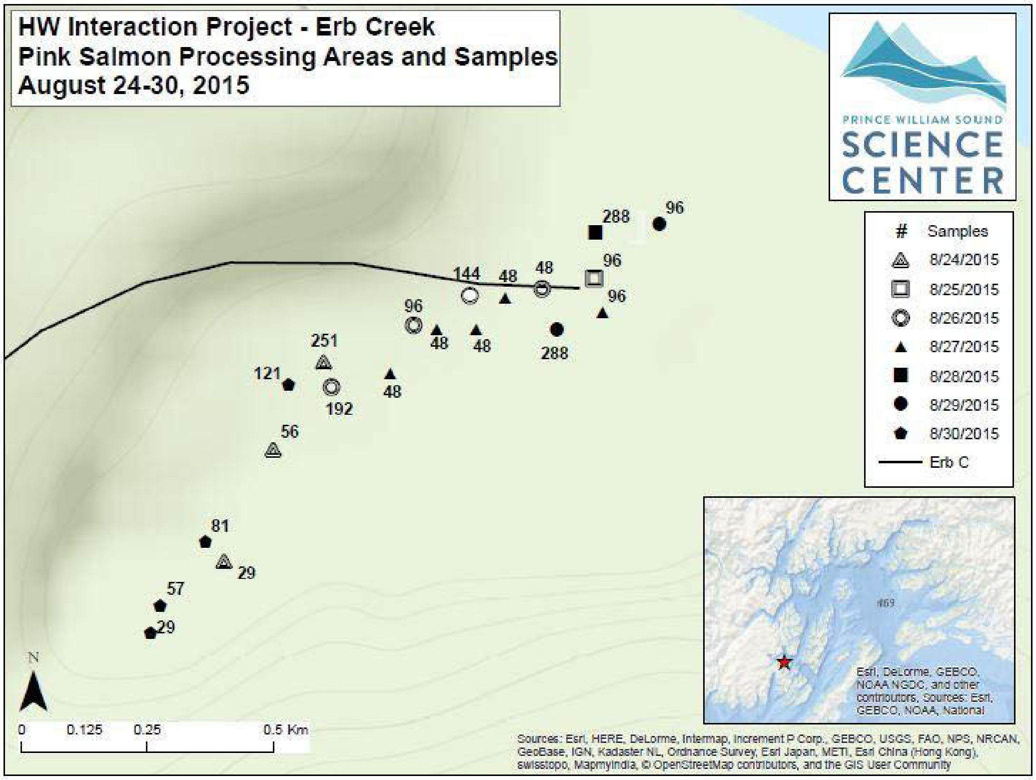
Recommendations, changes, and other notes: There was some confusion about which creek to sample at the start of this season. The next crew leader should read these reports before heading out. This season Paddy camp used walkways in high traffic areas, greatly reducing impact on the muskeg. Wooden pallets worked very well as a low impact porch in front of the weatherport.

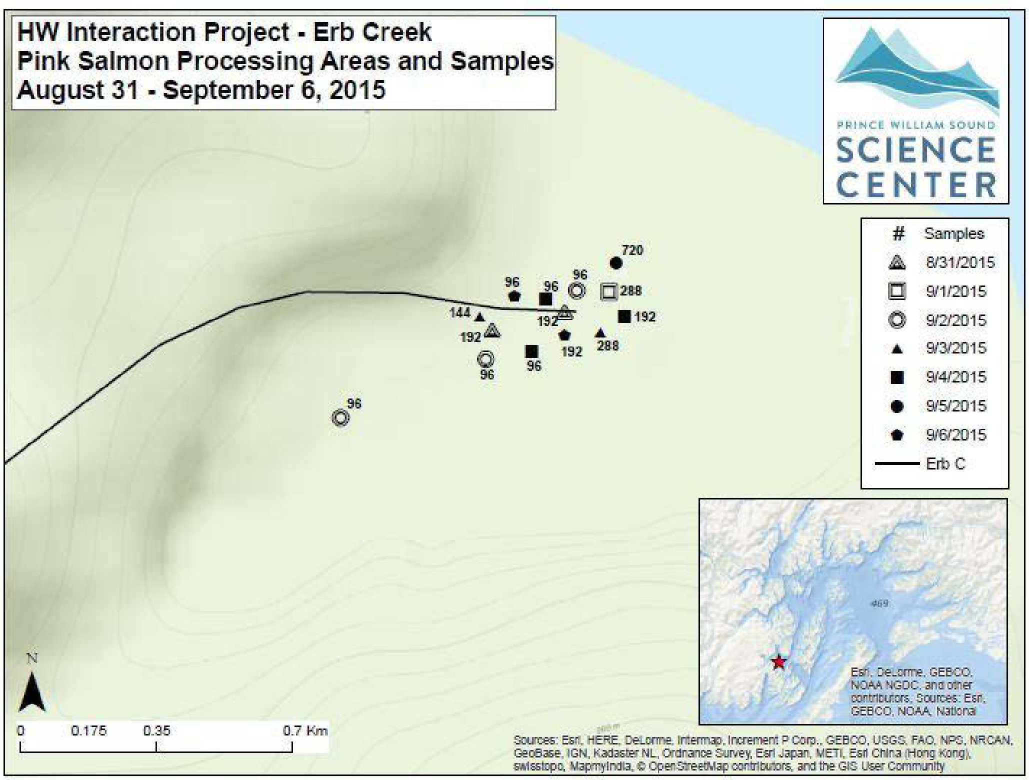
Erb Creek
226-20-16040
Pink Salmon Fitness

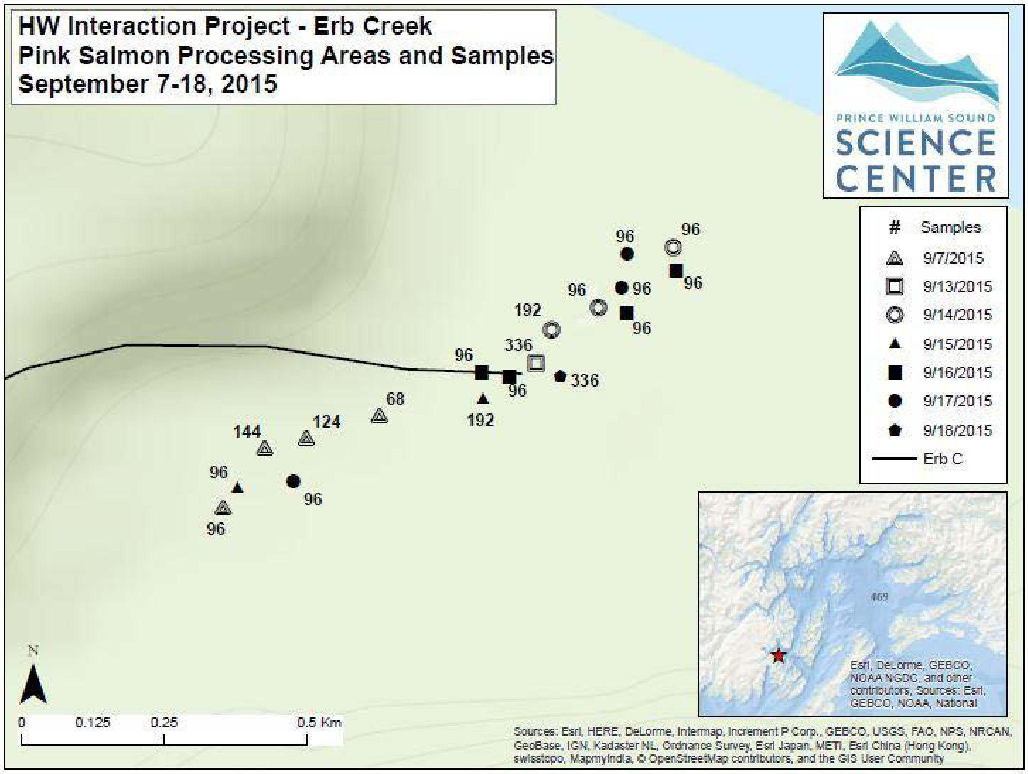


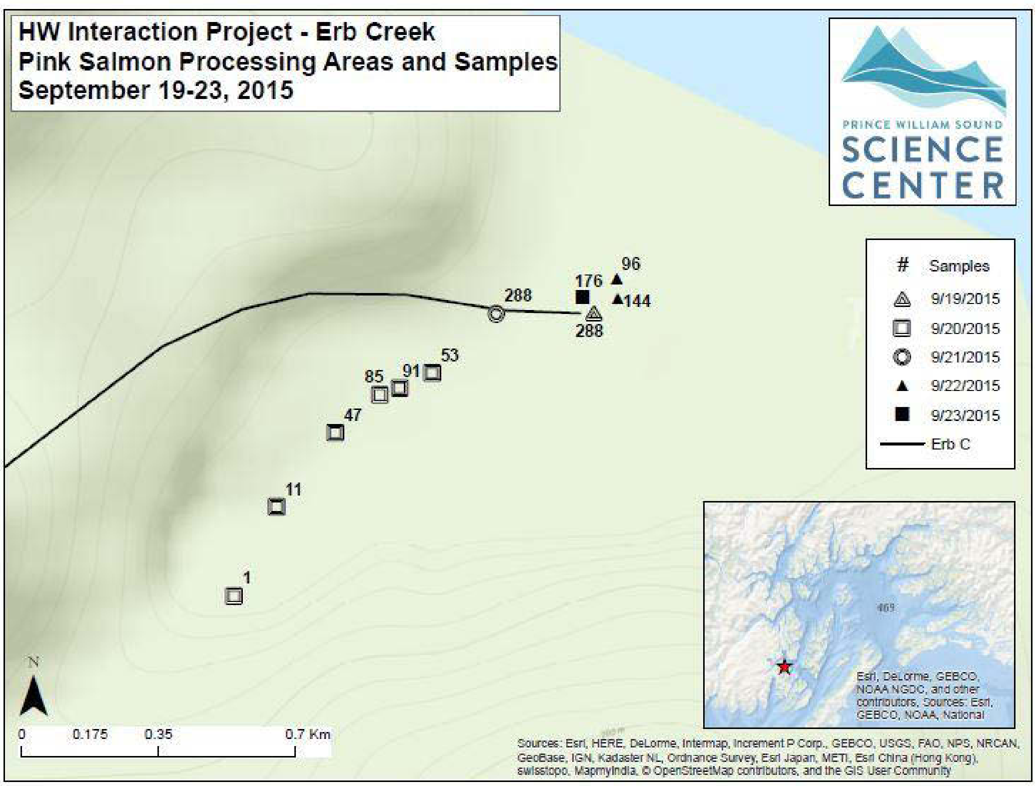

HW Interaction Project - Erb Creek
Pink Salmon Processing Areas and Samples
August 10-16, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
Samples
8/10/2015
8/11/2015
8/12/2015
8/13/2015
8/14/2015
8/15/2015
8/16/2015
Erb C
80
48
70
91
68
62
100
144
49
49
111
59
80
66
33
65
88
29
64
14
9
73
13
5
N
0 0.175 0.35 0.7 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Erb Creek
Pink Salmon Processing Areas and Samples
August 17-23, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
Samples
8/17/2015
8/18/2015
8/19/2015
8/20/2015
8/21/2015
8/22/2015
8/23/2015
Erb C
384
336
56
109
131
192
48
30
144
48
384
85
39
48
24
40
192
9
5
N
0 0.15 0.3 0.6 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Erb Creek
Pink Salmon Processing Areas and Samples
August 24-30, 2015
PRINCE WILLIAM SOUND SCIENCE CENTER
Samples
8/24/2015
8/25/2015
8/26/2015
8/27/2015
8/28/2015
8/29/2015
8/30/2015
Erb C
288
96
144
48
48
96
96
96
48
48
288
251
121
192
48
56
81
29
57
29
0 0.125 0.25 0.5 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Erb Creek
Pink Salmon Processing Areas and Samples
August 31 - September 6, 2015
PRINCE WILLIAM SOUND SCIENCE CENTER
Samples
8/31/2015
9/1/2015
9/2/2015
9/3/2015
9/4/2015
9/5/2015
9/6/2015
Erb C
720
96
96
96
288
144
192
192
192
192
288
96
96
96
0 0.175 0.35 0.7 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community





2015 samples collected and run timing: The Hatchery-Wild camping crew visited Erb Creek 50 times and collected 13,039 Pink Salmon otolith and tissue samples between 08/03/2015 and

09/23/2015. Fish were not observed in the creek each visit, and the run started on 8/9/2015. There were consistently about 3,500 fish in Erb Creek from 08/10/2015 to 09/02/2015. The run peaked with 11,241 fish on 09/05/2015 and steadily decreased to 144 fish by 09/22/2015. Total run is estimated to be between 32,000 and 40,000 fish. This was based on the crew estimating the percent of the freshly dead that they sampled each day, then expanding the known number sampled to account for the unsampled fresh dead, and summing that over all sampling days. An estimated 300 Chum Salmon entered Erb Creek with the majority of these fish observed in August.

Extent of stream sampled: In the second half of August, and for all of September, dead counts were too high for us to sample in one day. The creek was divided into thirds and each section was sampled more intensively on alternating visits. These sections included the upper creek, main spawning grounds, and intertidal. The upper creek was sampled every 3-5 days because there were fewer fish upstream and samples per effort were low. The main spawning grounds were sampled every 2-3 days and the intertidal was sampled every other day to accommodate sampling efforts upstream. Most spawning activity was in the first 1 km, but spawning was observed from the upper intertidal to the marked survey extent below a long cascade of boulders.

Unusual events: Many Pink Salmon stranded and died during the peak run because of low water. Most of the peak run mortality was pre-spawn and found in the first third of the creek after high tide cycles. The weather can be very different in Erb vs. Paddy Creeks and rainfall was not necessarily the same in both places.

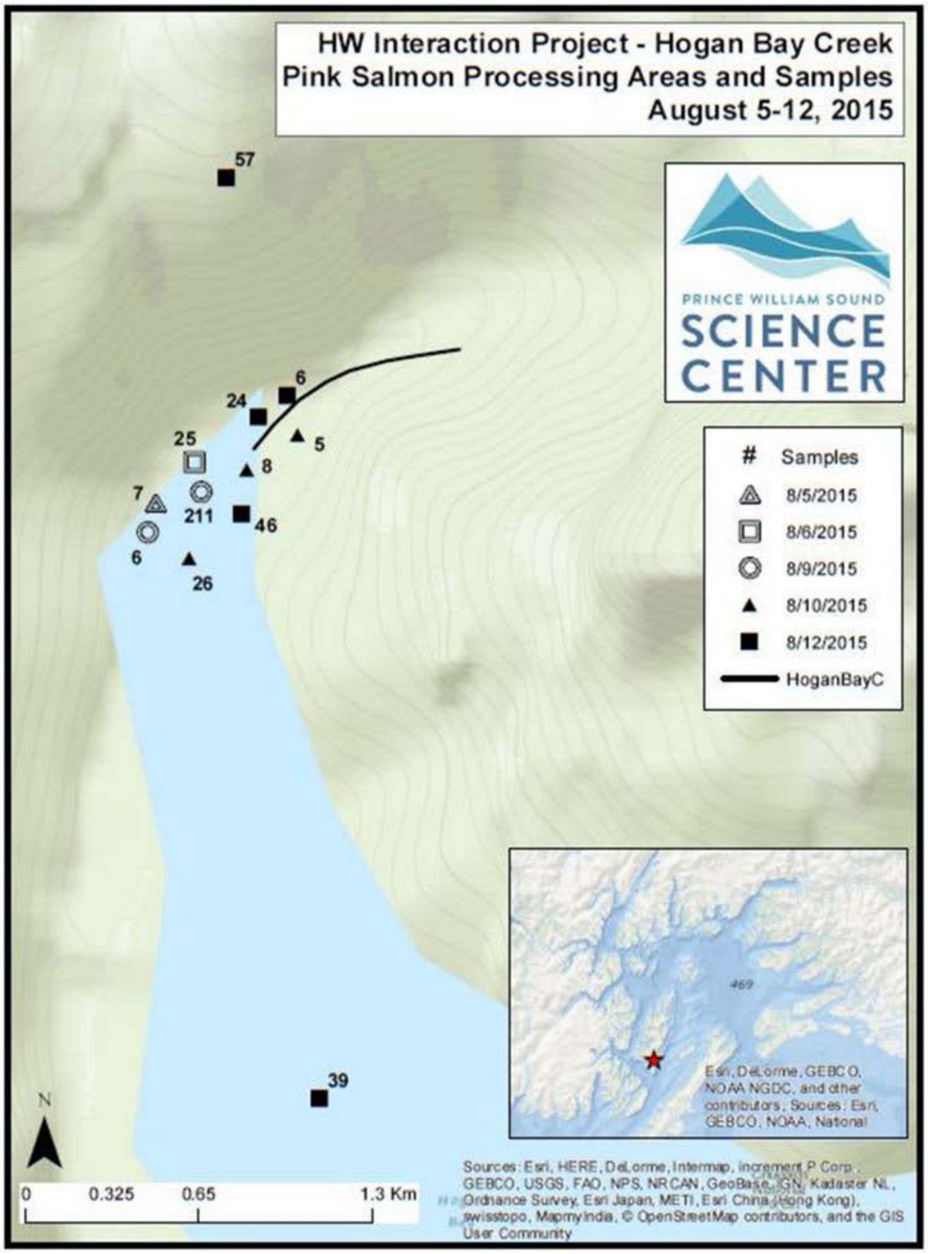
Access, safety, or logistics issues: There is a tidal flat in front of Erb creek would be a very long dry wait if you boated up at high tide. The best place to keep the skiff is a tiny bite to the northwest of the creek mouth. To keep the skiff even safer and not have to push it to water every low tide, we made a quick pulley system across this bite. After implementing the pulley system we could sample uninterrupted.

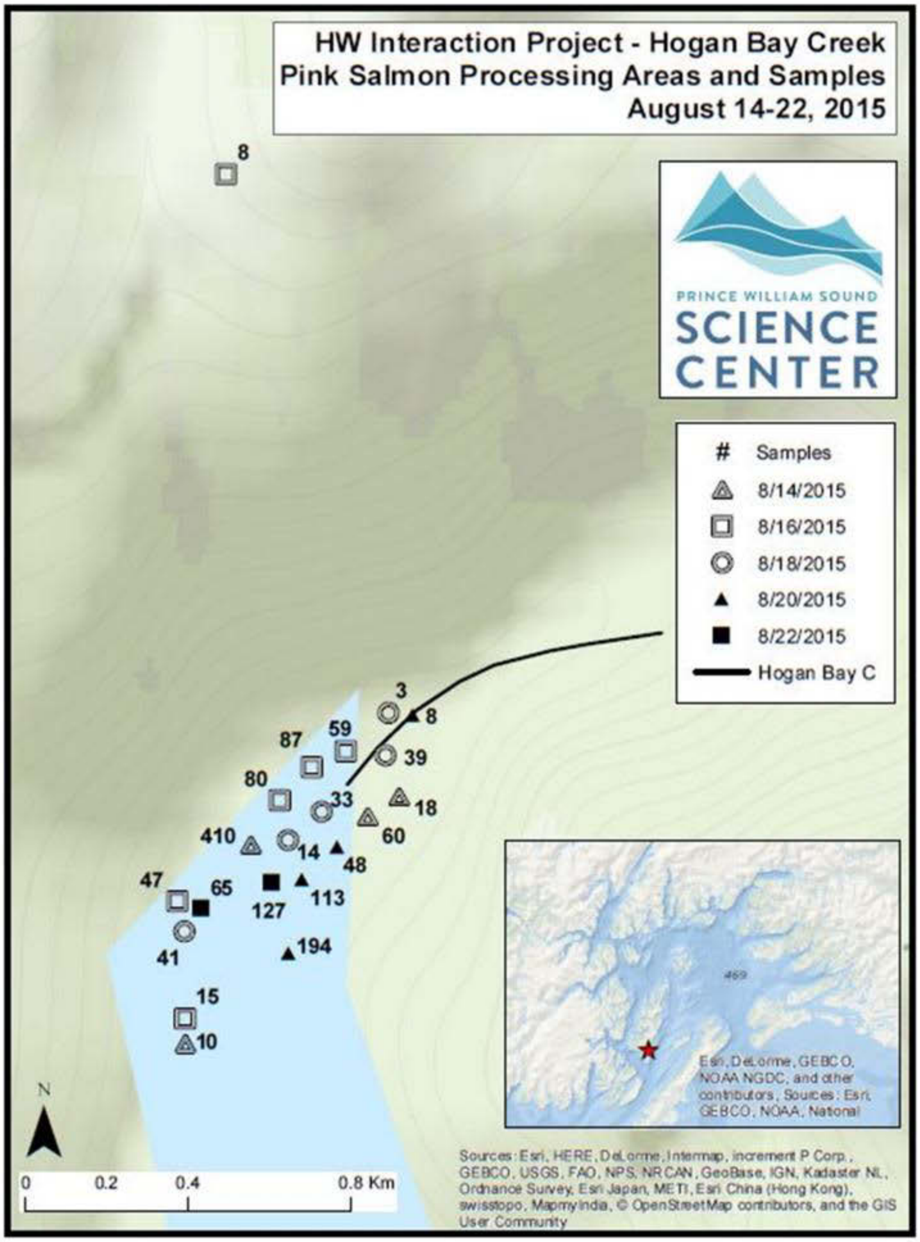
Inter-crew communications between Paddy creek and Erb creek were one way; the inReach could text the sat-phone, but the sat-phone could not reply. We were unable to have a two-way check in. This is a serious concern in the case of an emergency or a boat breakdown because as a crew, we are our closest help. The best solution is to have a second inReach for the camp crew if they split up every day. Alternatively, the sat-phone should be able to text, although its texting technology is cumbersome, but we were unable to set up texting in the field. This should be set up before going into the field before next season.

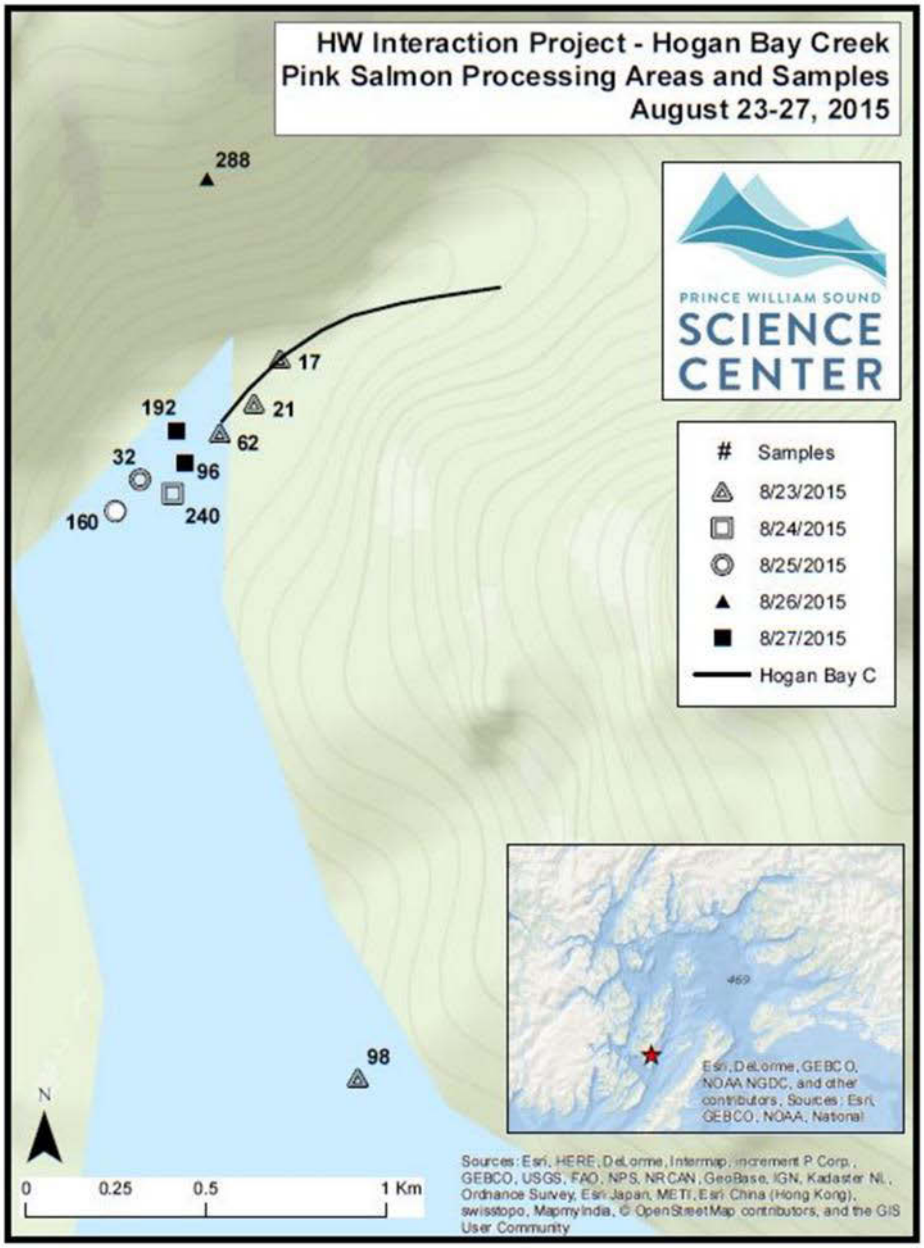
We always carried a sealed emergency bucket in the skiff with a portable stove, stove fuel, food and a shelter tarp.

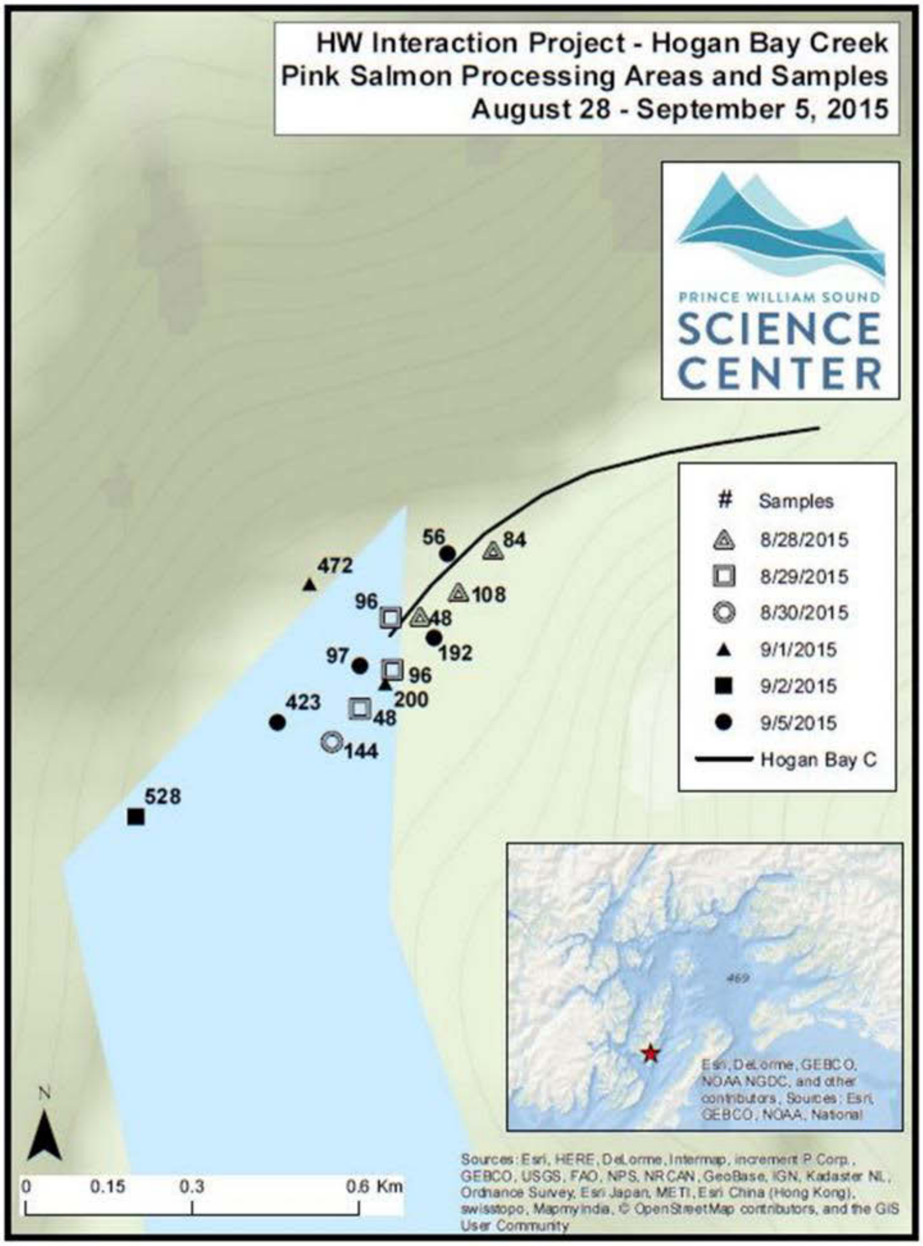
Recommendations, changes, and other notes: A second inReach for better inter-crew communications is advised.

Hogan Bay Creek
226-30-16810
Pink Salmon Fitness

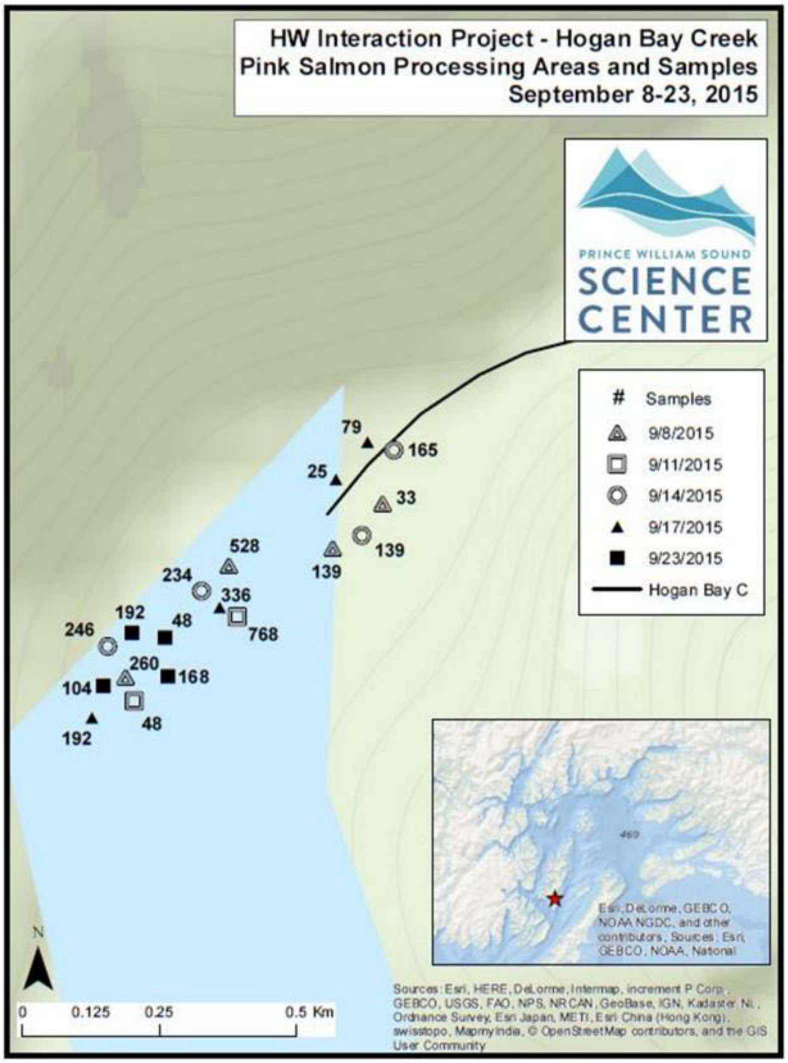



HW Interaction Project - Hogan Bay Creek
Pink Salmon Processing Areas and Samples
August 14-22, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
Samples
8/14/2015
8/16/2015
8/18/2015
8/20/2015
8/22/2015
Hogan Bay C
8
3
8
87
59
39
80
33
18
410
14
60
48
47
65
127
113
41
194
15
10
N
0
0.2
0.4
0.8 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Hogan Bay Creek
Pink Salmon Processing Areas and Samples
August 23-27, 2015
PRINCE WILLIAM SOUND
SCIENCE CENTER
288
17
21
192
62
32
96
160
240
98
Samples
8/23/2015
8/24/2015
8/25/2015
8/26/2015
8/27/2015
Hogan Bay C
469
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
N
0 0.25 0.5 1 Km
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



HW Interaction Project - Hogan Bay Creek
Pink Salmon Processing Areas and Samples
August 28 - September 5, 2015
PRINCE WILLIAM SOUND
SCIENCE
CENTER
Samples
8/28/2015
8/29/2015
8/30/2015
9/1/2015
9/2/2015
9/5/2015
Hogan Bay C
56
84
472
96
108
48
192
97
96
200
423
48
144
528
N
0
0.15
0.3
0.6 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



Note: The outliers in the above illustrations have been resolved and relocated on the stream course.

2015 samples collected and run timing: Sampling for Pink Salmon fitness at Hogan Creek was successful with 29 visits and 9,441 samples collected over the entire run. We saw a steady increase in live fish between visits one and nine (8/1/2015 - 8/16/2015) and then numbers held steady for trips ten through twenty-nine (8/18/2015 – 9/23/2015). We still saw a large number of live, fresh Pinks moving upstream on the last visit. The crew roughly estimated that the run was around 15,000 Pink Salmon. A minimal number of Chum and Sockeye Salmon were observed in this system during our visits.

Extent of stream sampled: The crew was able to sample the entire extent of the stream with no physical barriers. All spawning habitat was sampled when fish numbers were manageable and water levels allowed. When the dead counts were too overwhelming to manage in one day, the creek was divided in half and each section was sampled more intensively on alternating visits. Mass spawning was observed and mapped from the intertidal to the stream's extent.

Unusual events: There were a number of times when water levels were low and/or water temperatures were high. These instances resulted in mass die-offs of pre-spawn fish, especially during high tide cycles. The high tide allowed fish up the main channel and when the tide retreated, many fish concentrated in the small creek pools and died. There was also a period when there was no surface water flowing from the upper reaches of the stream to the intertidal. This was an unusually dry year in PWS and Hogan Creek seems to heavily rely on rainwater.

Access, safety, or logistics issues: We never had any problems walking to the upper reaches of the stream because Hogan Creek is a very short system and a very easy walk. Hogan lies at the bottom of a narrow ravine and high mountains with steep inclines surrounding the channel on both sides. The mountain slopes funnel rain to the creek, and water levels can change dramatically with rainfall. This rarely becomes a safety issue because the creek is so short and water levels are normally low.

The tidal cycles influence where and when work can take place at the mouth of the stream. Hogan has a long, shallowly inclined intertidal area with a sharply sloped gravel bank on the left side of the creek mouth. During extreme low tides, about 50 m of *Fucus*-covered intertidal are available to sample on and extreme high tides will cover all of this. The gravel bank is the only good processing surface at the mouth, so at high tides, processing stations have to move to a raised, grass covered overhang about 100 m upstream. This overhang is the largest processing area available during high tide. There are not many large processing surfaces upstream.

The mouth of the creek is a hot point for productivity. The stream is so short that fish carcasses are quickly flushed from the upper reaches and collect at the mouth of the creek and in the tidal flat. Days of extreme low tides should be taken advantage of to collect fish that were flushed out since previous visits.

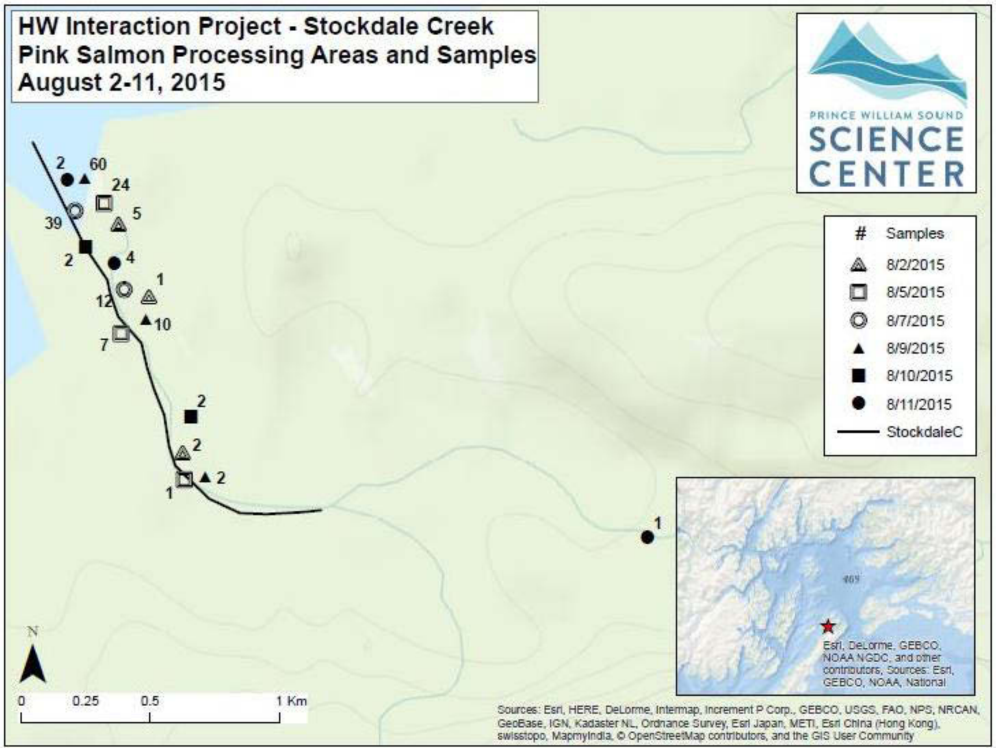
This area has many black bears and extra caution is advised while sampling at this stream. We only had two separate black bear sightings at Hogan Creek this year, but there was numerous bear sign where we frequently processed fish.

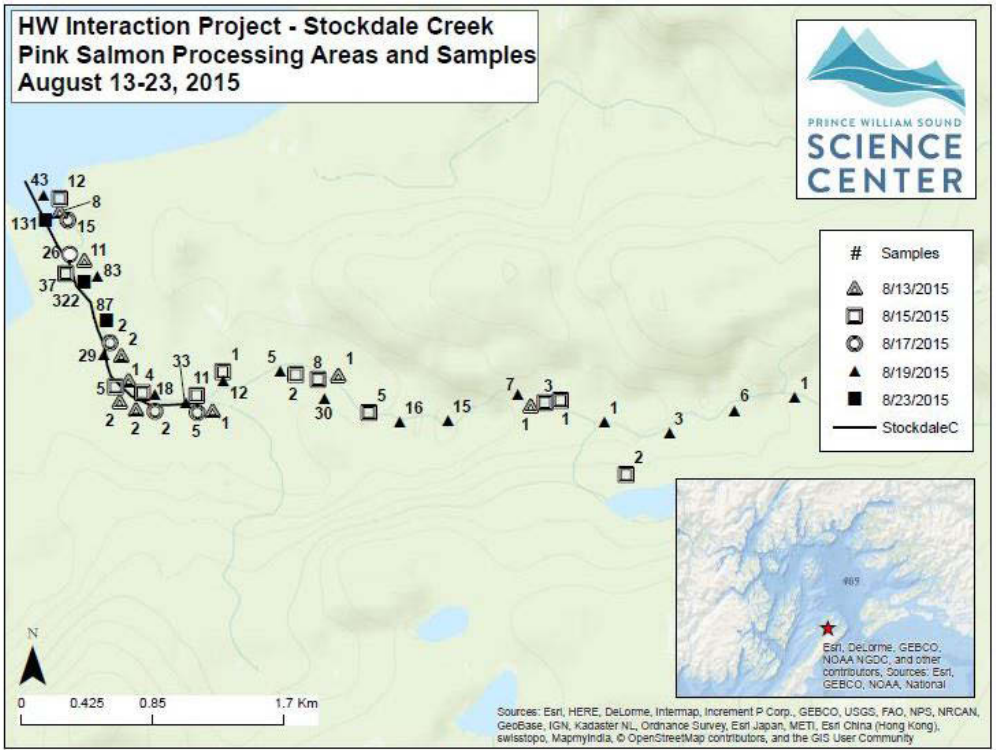
Recommendations, changes, and other notes: This stream still had a large number of live fish in the system when the *Auklet* team finished their sampling contract.

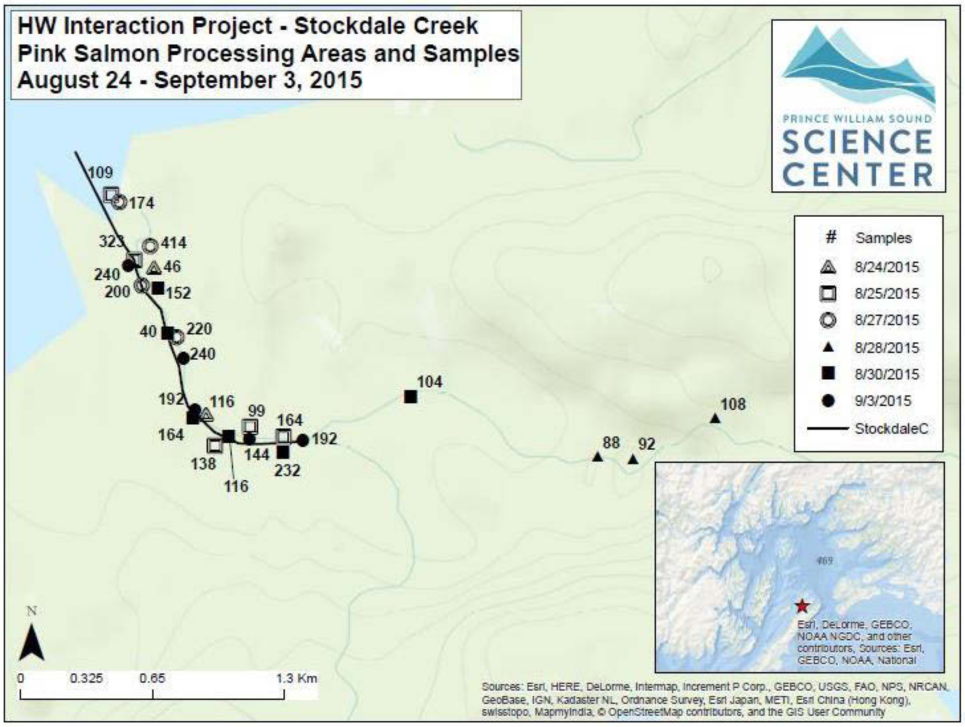
We deployed the temperature/pressure sensor on our last visit to the stream (9/17/2015). The main channel and lower reaches of Hogan are impacted by the extreme (14 ft+) high tides so we deployed the sensor ~150 m up the channel, in front of the first small log-jam in the stream. Capt. Dave Janka of the *Auklet* commented that the cinderblock would most likely degrade quickly in the high flow of a stream, so he lent us a shovel and we completely buried the whole unit. The sensor is tethered to the log and shouldn't have any problems with debris or ice moving downstream. It would have been beneficial to have these supplies earlier in the season so we could monitor the sensor under a variety of conditions to ensure the stability of the structure and the suitability of the location.

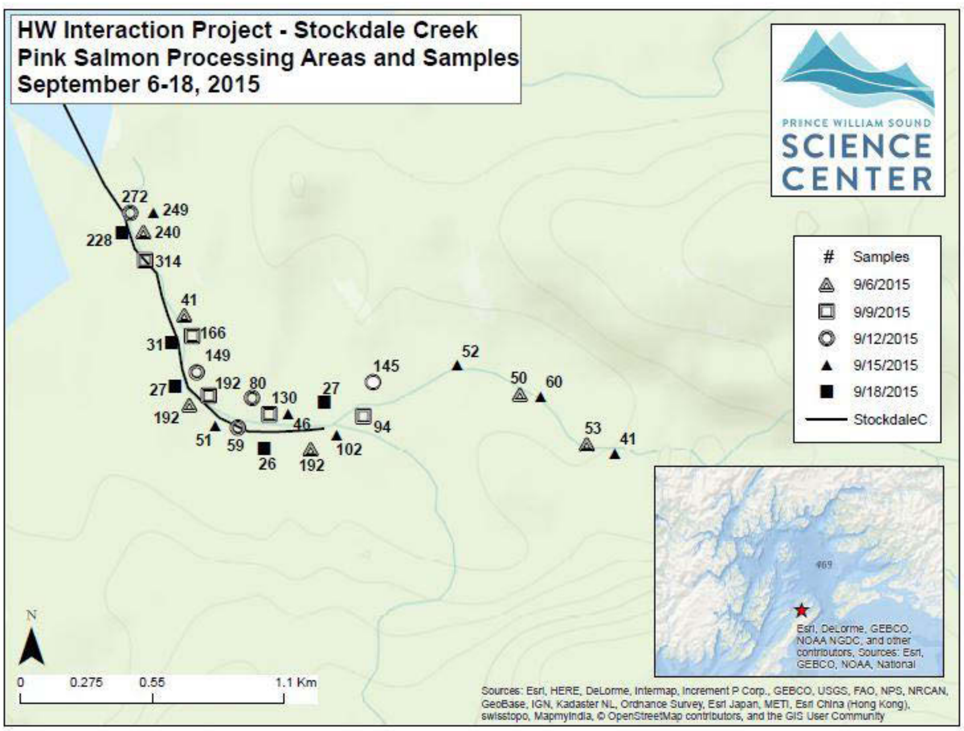
We noticed a number of unusually small fish (usually males) on all of our sampling streams this year including Hogan Bay Creek.

Stockdale Creek
227-20-17520
Pink Salmon Fitness









2015 samples collected and run timing: Pink Salmon fitness sampling at Stockdale Creek was successful with 8,602 otolith and tissue samples collected over 22 visits. Samples were collected throughout the entire run. We saw a steady increase in live fish between visits one and six (8/2/2015-8/11/2015), and then numbers held steady between visits seven and 18 (8/13/2015-

9/6/2015). Numbers decreased from visits 19 through 22 (9/9-9/18). There were a little over a hundred ragged looking live fish on our last visit and many carcasses remained caught in branches and root systems lining the mouth of the creek. The crew roughly estimated that the run was 20,000-25,000 Pink Salmon. A small number of Chum Salmon were counted early in the run, and a Coho population was documented near the end of the season.

Extent of stream sampled: Mass spawning was observed and mapped from the top of the intertidal to about 4km upstream. There may not be any physical barrier to act as an extent for this stream. The first right fork that branches off the main channel of the stream was not included in sampling efforts. The left fork was more extensively surveyed than the right fork because the majority of fish were moving in that direction. This year we documented fish moving much farther upstream than last year. Fish go much farther upstream than indicated on the ADF&G map and we saw fish up to the last fork in the stream. In the initial phases of sampling we were able to survey to the extent of the stream. It is a 4 km hike up and the survey takes about 4.5 hours round-trip. When fish became too dense to sample the entire stream in one day we concentrated on the main channel, before the fork, to ensure high sample numbers and to cover areas that were sampled in previous years.

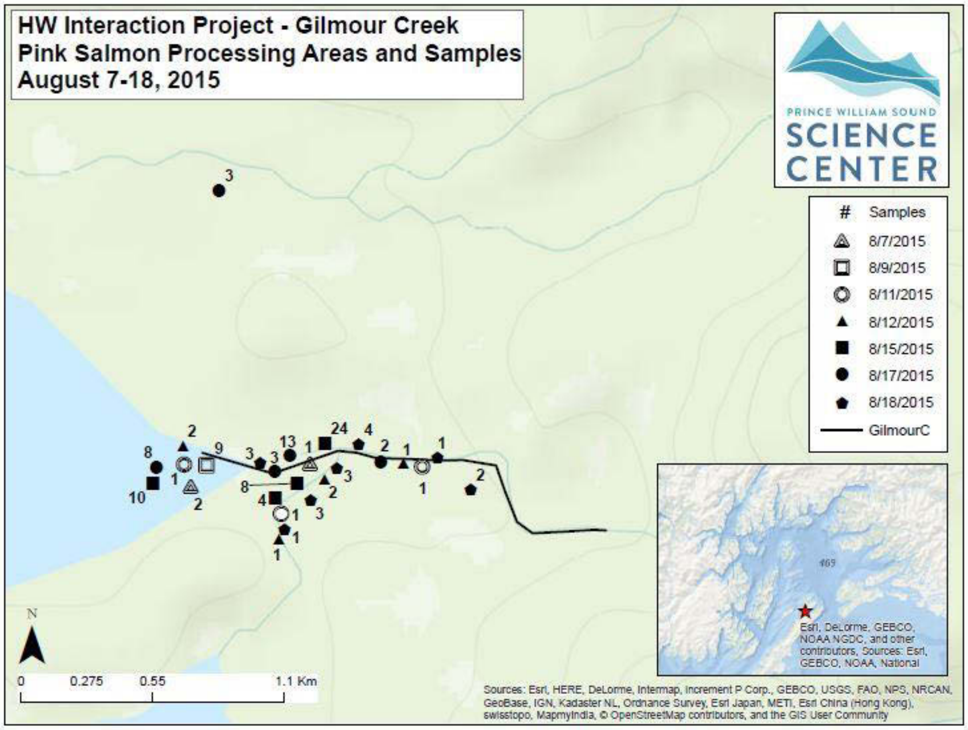
Unusual events: There were a number of times when water levels were low and/or water temperatures were high. These instances resulted in mass die-offs of pre-spawn fish, especially during high tide cycles. The high tide allowed fish up the main channel and when the tide retreated, many fish concentrated in the small creek pools and died.

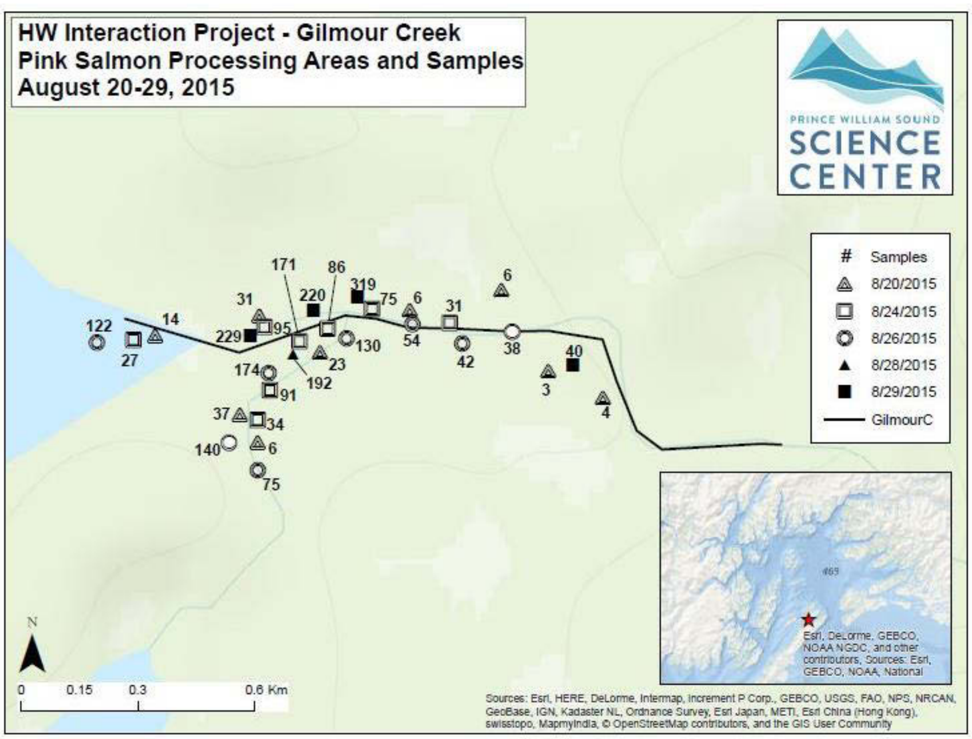
Access, safety, or logistics issues: The team experienced very few challenges during visits to this stream. Once, water levels were too high for safe passage during an extreme rain event. We turned back about 100 m upstream of the first left fork. There are game trails on the right and left banks that can aid movement through more difficult passages and should be used during days of high flow. There were no bear sightings on the stream this year, though signs of bear scat and fish predation were abundant. Caution should be taken while sampling at this stream.

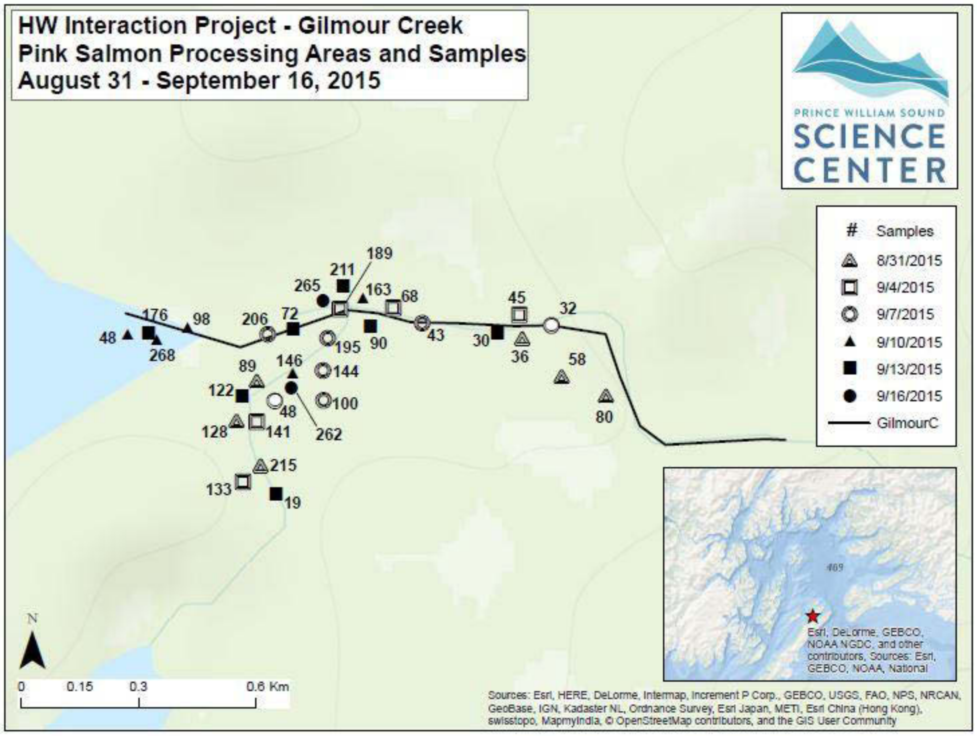
Recommendations, changes, and other notes: Include the left fork of the stream in all sampling visits and surveys. Water flow seems to be stronger in left fork and a significant part of the Pink population was traveling up the left fork during spawning. This year's exploration proved that the extent of the fish was much farther than suspected in previous sampling years. It is impossible for one team to do an adequate job in sampling the entire length of this stream.

We deployed the temperature/pressure sensor on our last visit to the stream (9/18/2015). The main channel and lower reaches of Stockdale Creek are impacted by the extreme (14 ft+) high tides. The best location for the sensor was not ideal because it was pretty far up from the mouth, about ~250 m up the main channel, tethered to the second fallen tree in the stream. Capt. Dave Janka of the *Auklet* commented that the cinderblock would most likely degrade quickly in the high flow of a stream, so he lent us a shovel and we completely buried the whole unit. The sensor is tethered to the log and shouldn't have any problems with debris or ice moving downstream. It would have been beneficial to have these supplies earlier in the season so we could monitor the sensor under a variety of conditions to ensure the stability of the structure and the suitability of the location. We noticed a number of unusually small fish (usually males) on all of our sampling streams this year.

Gilmour Creek
227-20-17480
Pink Salmon Fitness







2015 samples collected and run timing: Pink Salmon fitness sampling at Gilmour Creek was successful with 6548 otolith and tissue samples collected over 20 visits. Samples were collected throughout the entire run. Live fish numbers steadily increased between visits one and nine (8/2/2015 - 8/18/2015), with numbers holding steady between visits 10 and 17 (8/202015 - 9/7/2015), and then decreasing sharply between visits 18 and 20 (9/10/2015 - 9/16/2015). We were still seeing live fish on our last visit to the stream, though they were only numbering in the hundreds and looking spawned out. There were also a number of un-sampled carcasses that had washed out into the mouth and the intertidal. The crew roughly estimated that the run was 8,000-10,000 Pink Salmon. A large number of live and dead Chum Salmon were seen early in the season, unlike last year. There were also a few Sockeye on the stream early in the season. Towards the end of the season, we saw a steady presence of Coho moving into the stream.

Extent of stream sampled: Mass spawning was observed and mapped from the intertidal up both forks of the stream. Surveys of both forks ended at waterfalls that exceeded 4 ft in height, whose latitudes and longitudes were recorded as extent locations in the tablet last year.

The crew was able to sample the entire extent of the stream with no physical barriers. All spawning habitat was sampled when fish numbers were manageable and water levels allowed. When the dead counts were too overwhelming to manage in one day, or when water levels were too high for working space to be accessible in the upper forks, the creek was divided in half and each section was sampled more intensively on alternating visits.

Unusual events: There were a number of times when water levels were low and/or water temperatures were high. These instances resulted in mass die-offs of pre-spawn fish, especially during high tide cycles. The high tide allowed fish up the main channel and when the tide retreated, many fish concentrated in the small creek pools and died.

Access, safety, or logistics issues: The team experienced very few challenges during visits to this stream. There were no bear sightings, but there was evidence of bear predation and we saw a bear ‘bed’ created at the extent of the left fork. The grasses had been trampled down and there were a number of carcasses piled to the side of the ‘bed’. The right fork has pretty dense section of brush about 200 m upstream that was occasionally difficult to carry sampling gear through. During intense rain events, the right fork also can be difficult to walk up once you’re off the main channel. This fork connects to the lake and water levels can rise very rapidly with rain.

Gilmour Creek’s upper branches are very narrow. When water flows are high after rain events, it is almost impossible to do high volume sampling in the upper reaches of these stream branches.

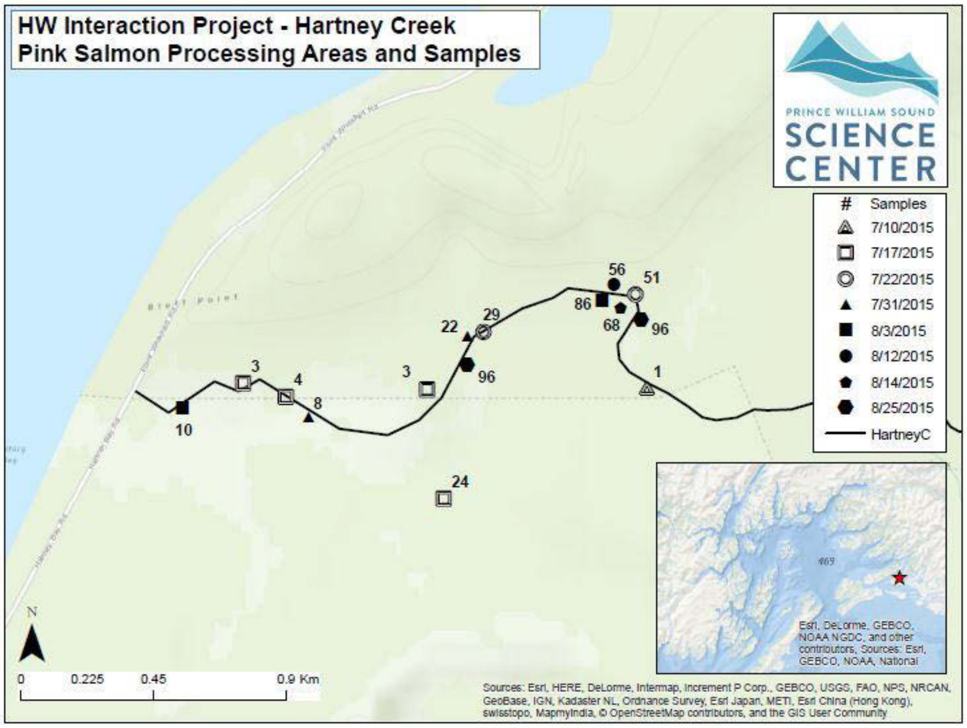
Recommendations, changes, and other notes: Even though both forks were included in each survey, all end locations associated with the database are based on movements up the left fork.

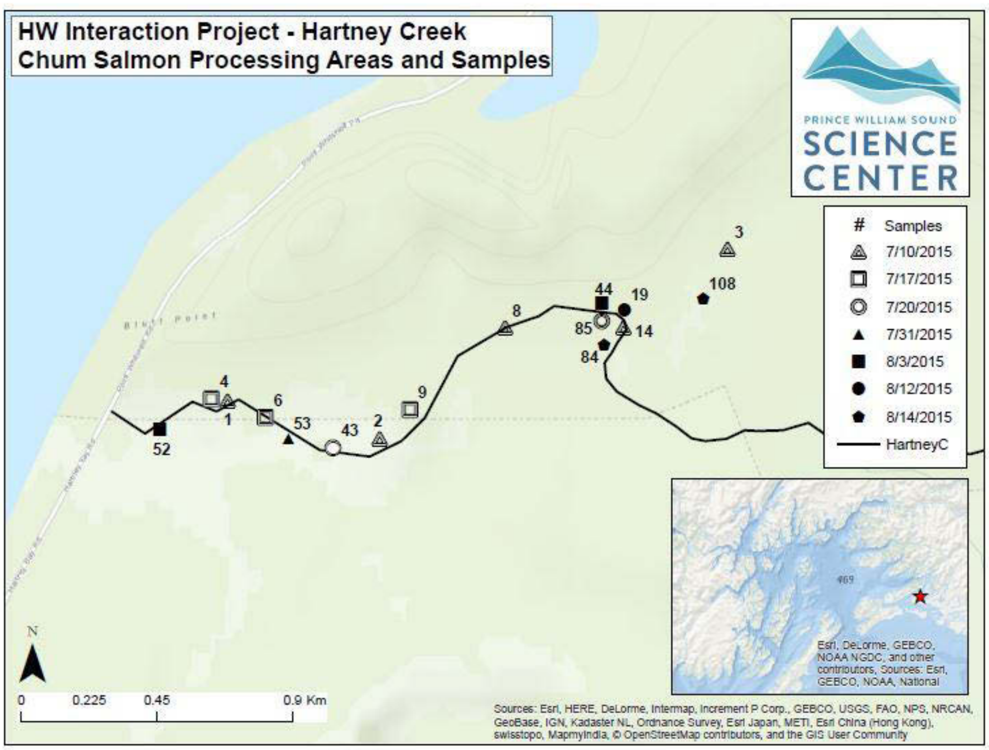
There is a log-jam about 200 m up the left fork that fish can pass when water levels are very high. We had samples of fish above the log-jam in the beginning and mid-season, but then water levels dropped to the point where the fish were unable to pass this obstacle.

We deployed the temperature/pressure sensor on our last visit to the stream (9/16/2015). The main channel and lower reaches of each fork on Gilmour are impacted by the extreme (14 ft+) high tides. We deployed the sensor ~150 m up the left fork, just before the third bend in the stream. Capt. Dave Janka of the *Auklet* commented that the cinderblock would most likely degrade quickly in the high flow of a stream, so we made attempts to bury the unit below the substrate. The substrate was difficult to modify. It would have been beneficial to have these supplies earlier in the season so we could monitor the sensor under a variety of conditions to ensure the stability of the structure and the suitability of the location.

We noticed a number of unusually small fish (usually males) on all of our sampling streams this year including at Gilmour Creek.

Hartney Creek
221-10-10020
Pink and Chum Salmon





2015 samples collected and run timing: The local crew visited Hartney Creek a total of nine times from 7/10/2015 to 8/25/2015 collecting 557 Pink and 535 Chum Salmon otoliths. In addition, 253 DNA samples were collected for ADF&G's genetic stock structure study, surpassing the sampling goal of 240. Sampling goals for Pink and Chum Salmon were met.

Pink- Sampling for Pink Salmon at Hartney Creek was successful with 557 otolith pairs collected; 145% of the 384 minimum goal. Samples were collected throughout the run, however, it is difficult to determine run timing because visits to Hartney Creek were variable in survey length. There were two peak Pink Salmon counts. The first count on 7/20/2015 was 16,704 fish and the second count on 8/3/2015 was 16,275 fish. Most Pink Salmon carcasses sampled for otoliths were only just available by 7/22/2015. By visit nine, the numbers of Pink Salmon were starting to taper but still plentiful with 4,350 live and 3,850 dead on 8/25/2015. Pink Salmon runs in Hartney Creek started and finished later than Chum Salmon, with the peak run being in early August and done by mid-August. Peak live numbers of 16,704 were recorded on 7/20/2015 and peak dead numbers of 3,850 were recorded on 8/25/2015. Dead counts never exceeded live counts and the end of the run was not observed.

Chum- Sampling for Chum Salmon otoliths was successful with 535 samples collected, 139% of the minimum goal (384). We saw 1,326 Chum Salmon on the first visit to Hartney on 7/10/2015. This count suggests we missed the very first wave of fish. The bulk of the Chum run was in early July and peaked towards the end of July with 1,919 live fish observed on 7/20/2015. The run dwindled into late September with 15 live fish recorded on 8/25/2015. Peak dead numbers were around 7/31/2015 and 8/3/2015 with 352 and 362 carcasses. The Chum Salmon run was significantly smaller in numbers than the Pink Salmon run in Hartney Creek during 2015, but about twice as large as the Chum run in 2014. The end of the run probably coincided with the last visit.

Extent of stream sampled:
Pink- Pink Salmon were observed spawning throughout the upper stream and to the extent reaches of two smaller channels (lagoons) to the east of the main channel. No spawning was observed in the intertidal. More than 10,000 Pink Salmon were observed past the Hartney trail bridge at 2 km on 8/3/2015 but the majority of this season's samples were collected between the intertidal and at the confluence of the two eastern channels at 1 km. Most live Pinks were collected at the fork between the two eastern channels.

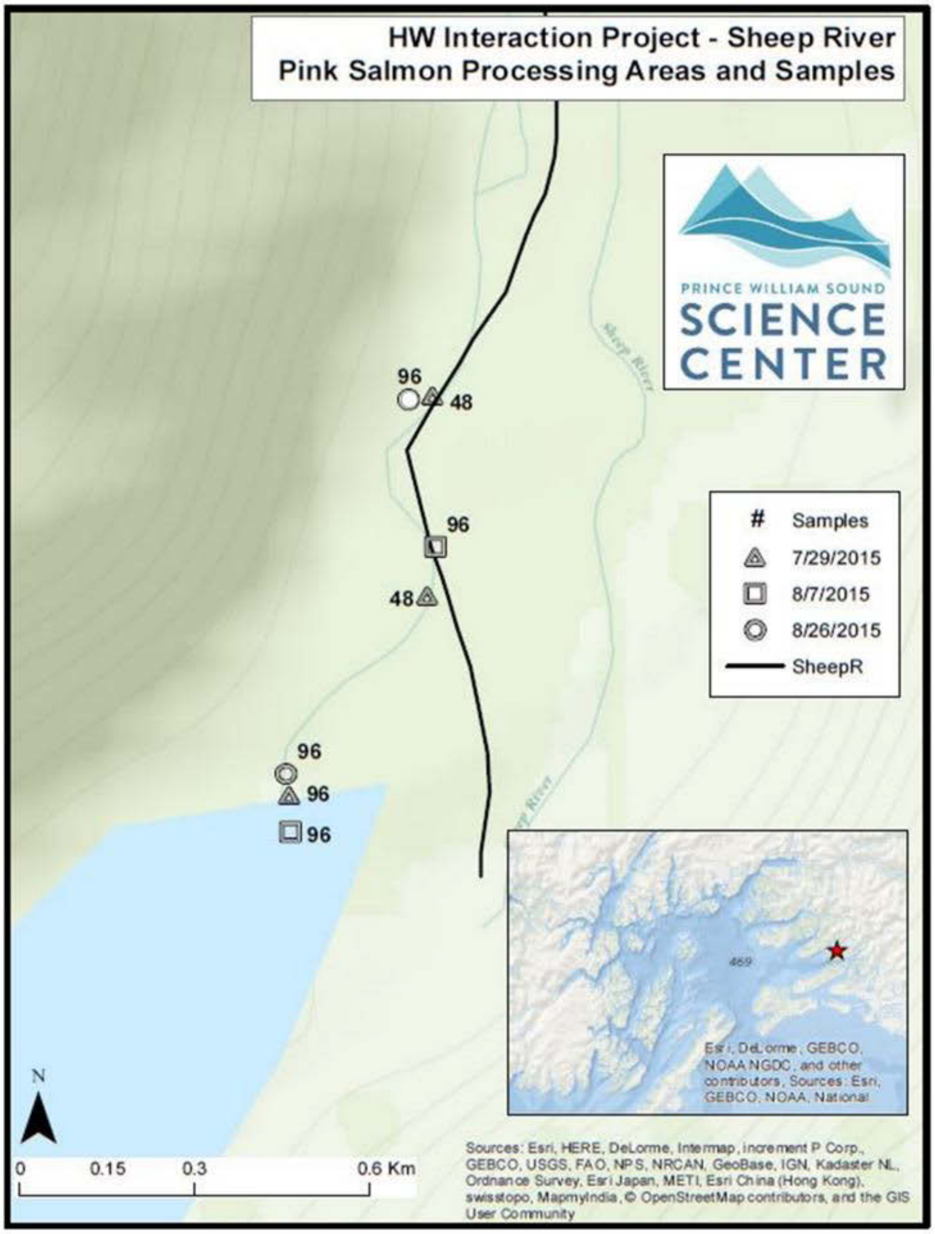
Chum- Chum spawning areas in Hartney Creek seemed more restrictive than Pink spawning. Two large sloughs about 1 km upstream served as their primary spawning ground. These channels were shallower and slower moving than the main channel. The majority of Chum Salmon were collected in the first and shorter eastern channel off the main stream, at about 1 km from the intertidal area. Some Chum Salmon were seen using the shallower fingers of the main channel just upstream from the bridge as spawning ground. Overall, Chum Salmon traveled less far and utilized the lagoons more than Pink Salmon in Hartney Creek during the 2015 spawning season.

Unusual events: Five spawning colored Sockeye Salmon were seen far up in the eastern sloughs. Four live and one dead King Salmon were seen in spawning colors in the mid and upper reaches of the creek. We visited Hartney Creek in early September to assess collection of more samples, but the water levels were so high we could not safely walk in the water. This is a very big stream system and heavy rainfall can make the creek unsafe to walk.

Access, safety, or logistics issues: This stream is easily accessible by road and Forest Service trail.

Recommendations, changes, and other notes: Because of the many types of samples collected at Hartney, more visits than what was originally scheduled are necessary. During peak run it may be better to go twice a week, for example; in late July before the rainy season starts. Live Pink samples for stock structure analysis were the most difficult and time consuming to collect.

Sheep River
221-20-10360
Pink Salmon



2015 samples collected and run timing: Sampling at Sheep River was successful with 576 samples collected, 150% of the 384 minimum sampling goal. The local crew visited Sheep River on 7/29/2015, 8/7/2015 and 8/26/2015. The Pink run in this river may start and end earlier than other sampling sites the local crew samples. Each time Sheep River was sampled the lagoon below Sheep River proper held thousands of fish. The highest live/dead counts were from visit three on 8/26/15, with an estimated 15,500 live, very dark Pinks, 3,000 dead, and no bright Pinks. Pink Salmon were the most abundant fish species, but 1,075 live and 485 dead Chum were counted on 7/29/15. Chum numbers dropped to 51 live and 48 dead by 8/26/15, the last visit. The only other species observed was one dead Coho on 8/26/15.

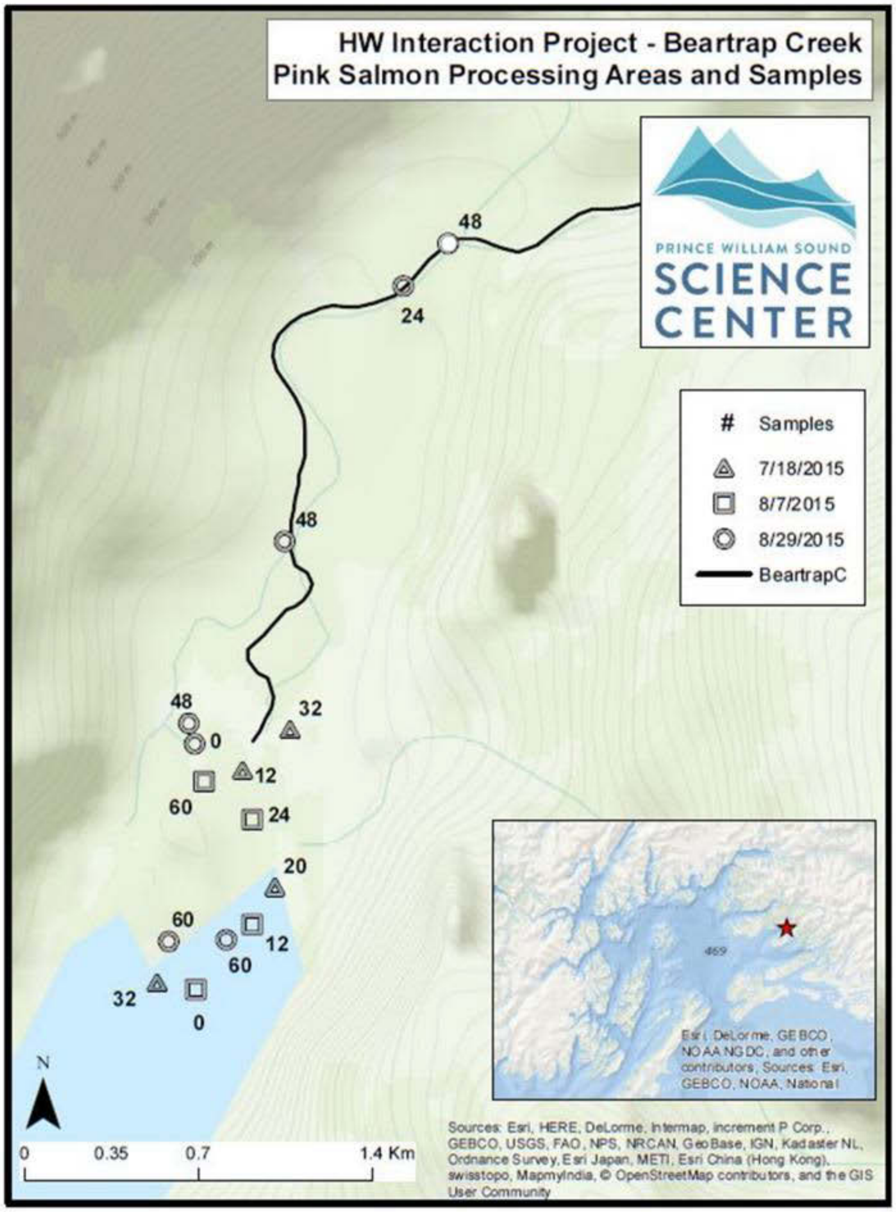
Extent of stream sampled: This season, about 1.5km of stream was surveyed, twice the distance than 2013 or 2014, but an extent location has not been determined. Turbidity was very high on all visits, especially the last, and this makes visual observations less reliable. The majority of spawning salmon were in the first 300 m of stream.

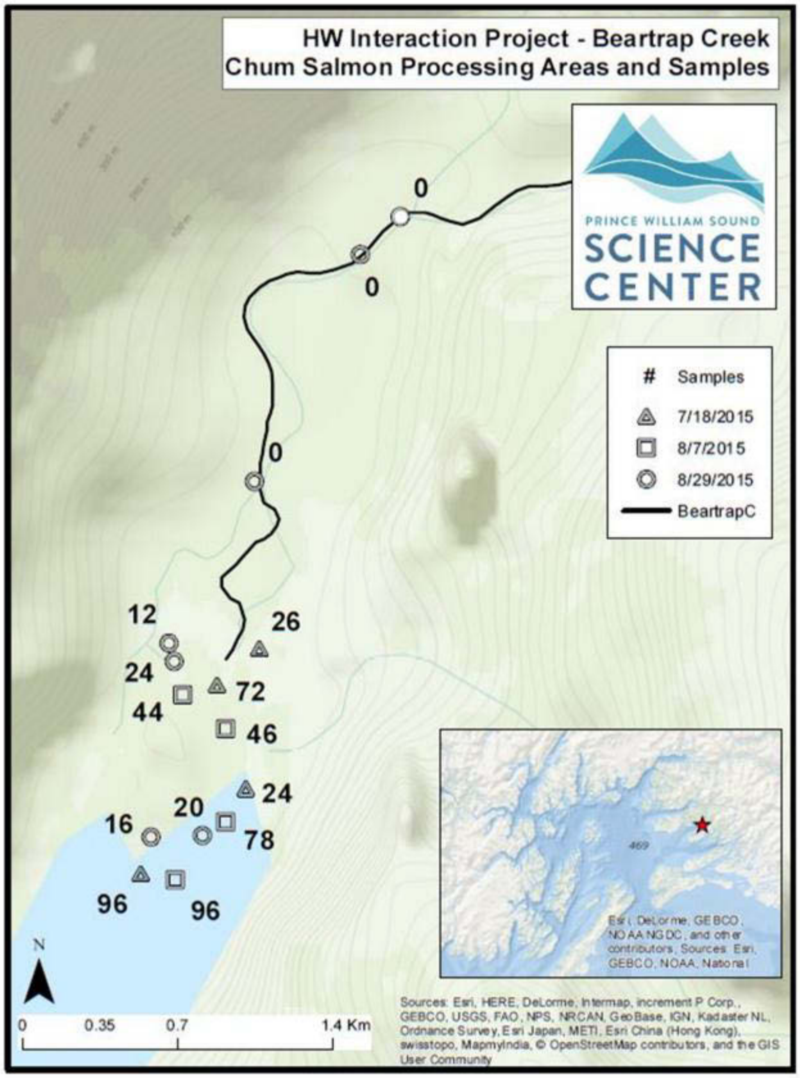
Unusual events: None.

Access, safety, or logistics issues: This year, a gillnetter was chartered to transport the Cordova crew to Sheep River. Once there, the easiest way to get into Sahlin lagoon is by kayak or canoe as high tide floods the lagoon. It is still doable at low tide by walking along the edge of the stream dragging your boat, but it is much easier to come in with the tide. Once in the lagoon, the height of the tide does not limit access to the mouth of Sheep River. Past a log-jam 300 m upstream, the river becomes much deeper and swifter. Because this river is deep and swift it might not be good to sample after a heavy rain. Watch the weather closely and send crews accordingly. There were no bear sightings this year.

Recommendations: Continue using the larger boat for transport, this is too far to use a skiff from Cordova.

Beartrap Creek
221-30-10480
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* crew visited Beartrap Creek three times between 7/18/2015 and 8/29/2015 for the collection of Pink and Chum otolith samples. Sampling effort on this stream was successful, and the minimum sampling goals for both Pink and Chum were met. The first two visits weighed in favor of Chum samples, with Pinks receiving heavy focus on the final survey trip.

Pinks- Sampling for Pink Salmon was successful with the collection of 480 otolith pairs, 125% of the 384 sample goal. This run peaked in late August, with 20,830 live and 15,428 dead Pinks observed on 8/29/2015. The majority of samples were taken during the peak run. Live Pinks were present in Beartrap each visit and the end of the run was not observed. Large numbers of Pinks were observed spawning in the intertidal zone.

Chum- Sampling for Chum was successful with the collection of 554 otolith pairs, 144% of the 384 sample goal. This run peaked in late July with 3,195 live and 1,504 dead Chum observed on 7/18/2015. Live Chum counts dropped significantly for the final two visits on 8/7/2015 and

8/29/2015 with only 250 and 340 live fish observed. The end of the run was not observed and Chum Salmon were never observed upstream of tidal influence.

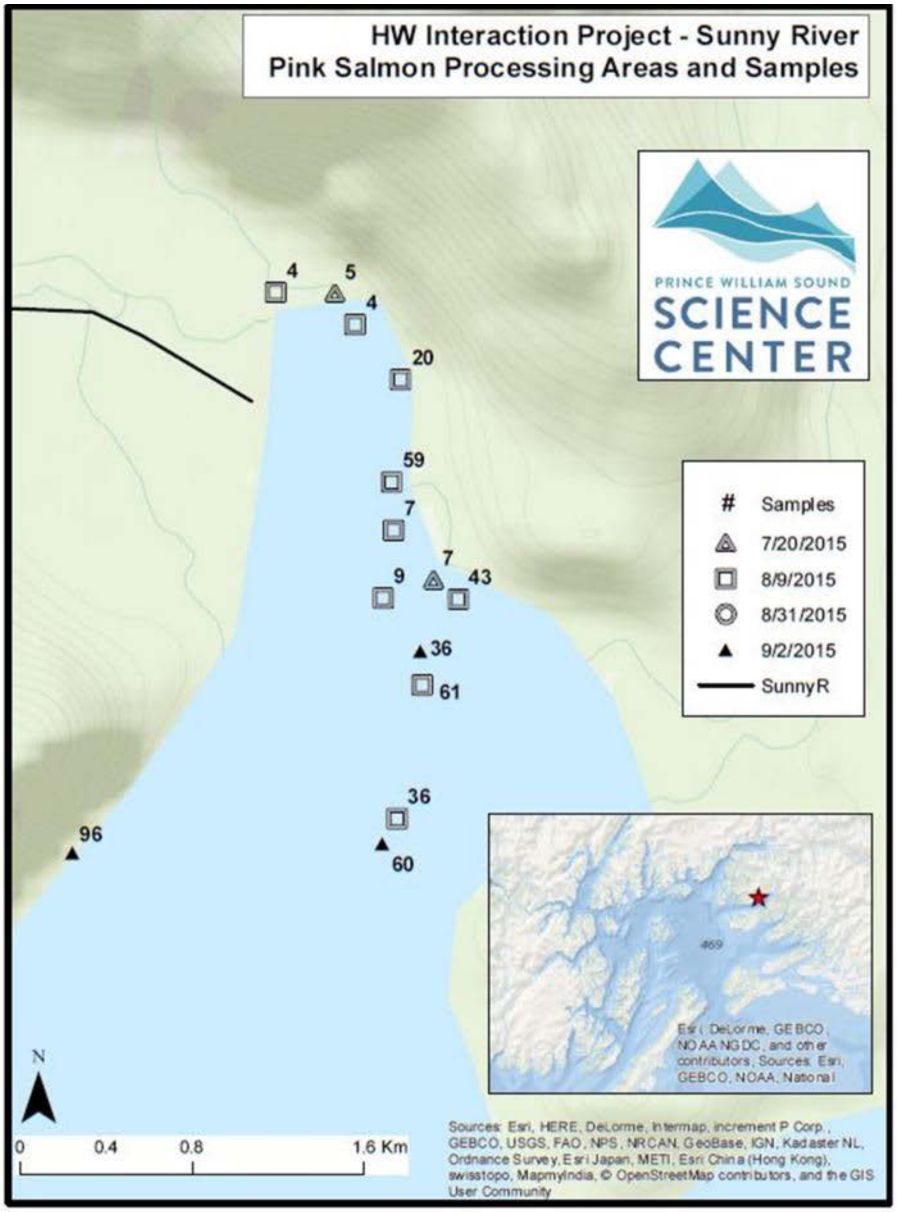
Extent of the stream surveyed: Beartrap Creek was surveyed from the intertidal area to a little more than 1.5 km upstream. Chum Salmon were not observed above tidal influence on any visit, but extent of Pink presence was never established.

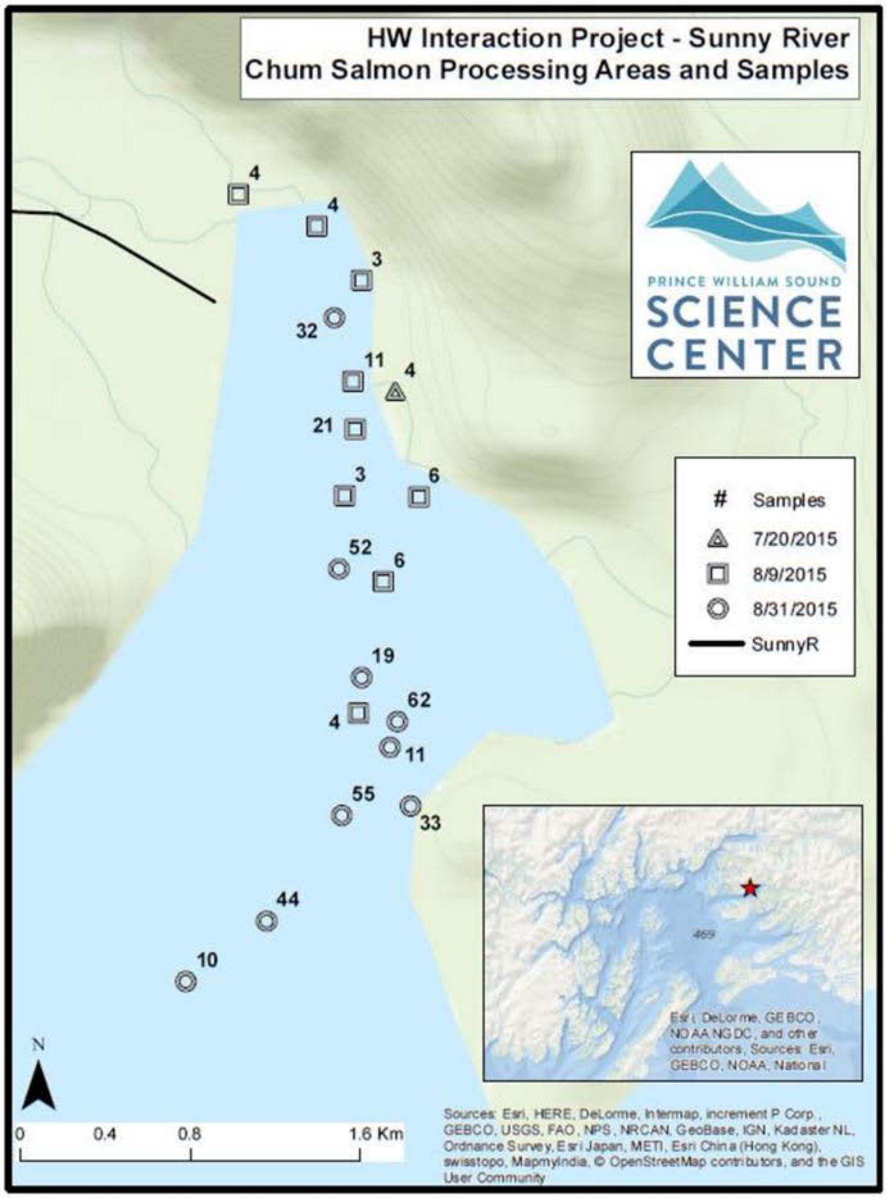
Unusual events: Low water this season left some redds high and dry on the second and third visits.

Access, safety, or logistical issues: Beartrap Creek is easily accessible at both high and low tides. Stream crews were dropped off in an adjacent inlet separated from Beartrap creek by a small peninsula of land. At low tide, the stream is sufficiently shallow at the mouth to cross, and at high tide, trails along the shore provide safe access to upper reaches of the stream. Upstream sections of the stream are shallow enough to hike up. Beartrap Creek should be surveyed on a low tide to allow easier access to salmon carcasses near the mouth. No bears were encountered on this stream.

Recommendations, changes and other notes: Stream crews should keep in mind that this stream supports high numbers of Chum early in the season, while Pinks peak later.

Sunny River
221-40-10875
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* crew visited Sunny River four times between 7/20/2015 and 9/2/2015 for the collection of Pink and Chum otolith samples. Sampling effort was successful and the minimum sample goals for Pink and Chum Salmon were met.

Pinks- Sampling was successful with the collection of 447 otolith pairs, 116% of the 384 minimum sampling goal. The run peaked in late August, with 770 live and 606 dead Pinks observed on 8/31/2015. Live Pinks were observed in Sunny River on each visit and the end of the run was not observed. Turbidity was high on the first visit but visibility steadily increased as this dry summer progressed. Our early fish counts missed many live and dead fish, which makes our fish counts and run peak projection questionable.

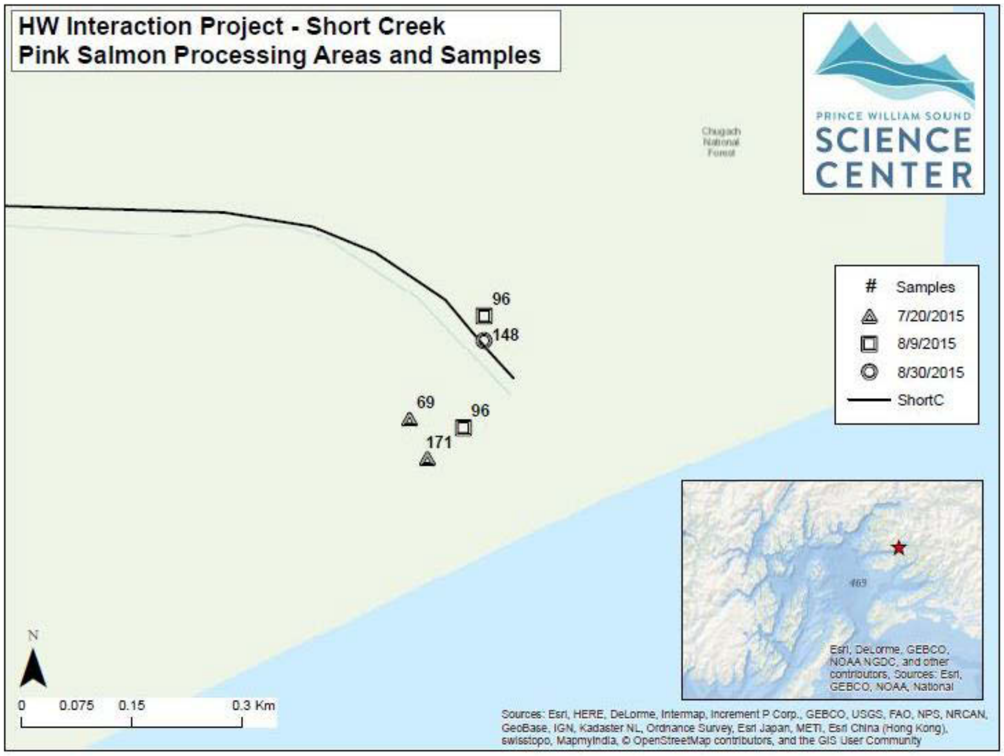
Chum- Chum Salmon sampling was successful with the collection of 384 otolith pairs, 100% of the sampling goal. This run may have peaked in late August, with 602 live and 914 dead Chum observed on 8/31/2015. However, since the highest counts came from our most extensive upstream sampling effort, it is possible that this run peaked in September and the crew simply did not walk far enough upstream to get counts that could be reasonably compared to this earlier sampling date. The majority of samples taken came from the 8/31/2015 trip. Live Chum were observed in Sunny River on each trip and the end of the run was not observed. Turbidity was high on the first visit but visibility steadily increased as this dry summer progressed. Our early fish counts missed many live and dead fish, which makes our fish counts and run peak projection questionable.

Extent of the stream surveyed: Sunny River was surveyed about 2 km upstream on 7/20/2015, past the large landslide that comes all the way down to the river. Crew continued upstream until willow and alder growth made further walking difficult. No extent was established and nearly every sample from Sunny River comes from the intertidal zone.

Unusual events: Low rainfall over this part of PWS caused turbidity to decrease with each successive visit.

Access, safety, or logistical issues: Sunny River is accessible at both high and low tides. There is an expansive mudflat at the outlet and at low tide a hike of well over 2 km may be required to access the stream mouth. The low gradient of this flat causes the tide to rise very quickly, be extremely mindful of the tide when sampling the mudflats. At high tide, the river is deep enough to allow a skiff to run up the main channel to drop off or pick up crew members upstream. During extreme high tides the grassy estuary can become a very difficult maze of high grass and deep sloughs. High turbidity makes crossing even small tidal tributaries hazardous. Stream crews should exercise caution when attempting to cross the river, especially during high tide. Brown bear tracks and sign were observed on each trip, but no bears were ever sighted.

Recommendations, changes and other notes: This river has substantial input of glacial silt, making the water turbid and seriously restricting visibility. It is difficult to put much faith in the numbers of our live counts.



2015 samples collected and run timing: The *Cathy G* crew visited Short Creek three times from 7/20/2015 to 8/30/2015 to collect Pink Salmon otolith samples. Sampling effort on this stream was successful with the collection of 580 otolith pairs, 151% of the 384 sample goal. This run peaked in early to late-August, with 700 live and 750 dead Pinks observed on 8/30/2015. Live Pinks were observed in Short Creek at each sampling visit, the end of the run was not observed.

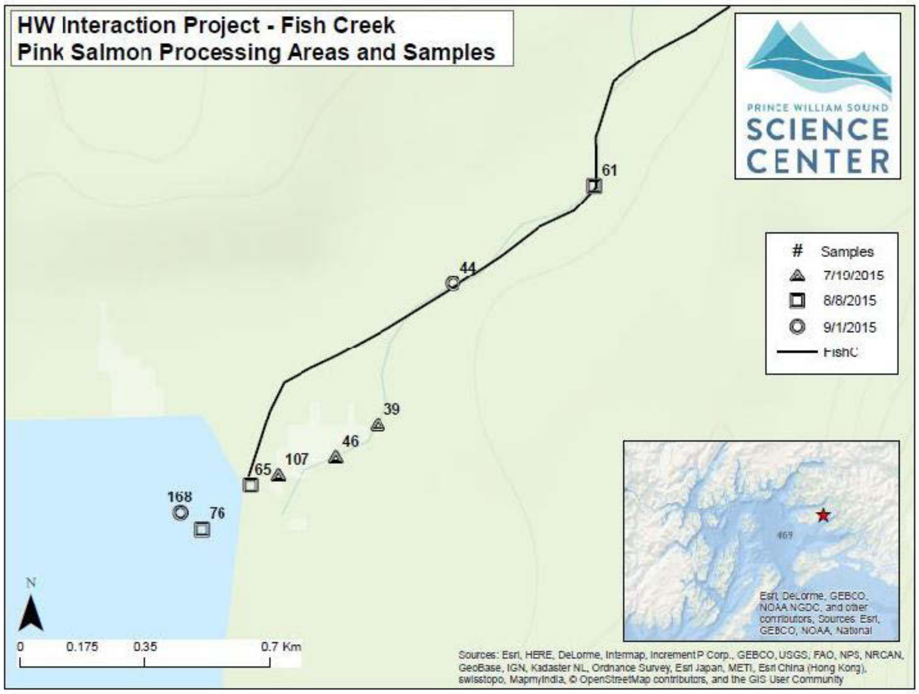
Extent of the stream surveyed: Short creek doesn't have much to it. The extent is located right on the edge of the tidal zone and consists of a cascading bedrock waterfall. All spawning habitat, with the possible exception of the waterfall plunge pool, is intertidal.

Unusual events: A mature black bear was seen on our first day here in 2015, but it wandered casually away upon seeing our skiff.

Access, safety, or logistical issues: Short Creek is easily accessible at both low and high tide by a very short hike along a rocky beach to the stream mouth. Deep water surrounds the stream and Short Creek is best surveyed at low tide so that fish and carcasses in the intertidal stream channel are accessible for sampling. At high tide, the stream is less than 100 m long. Short is easily hiked and forded, no major safety issues.

Recommendations, changes and other notes: None noted.

Fish Creek
221-40-10890
Pink Salmon



2015 samples collected and run timing: The *Cathy G* crew visited Fish Creek three times from 7/19/2015 to 9/1/2015 to collect Pink otolith and tissue samples. Sampling effort on Fish Creek was successful with the collection of 606 Pink otolith pairs, 158% of the 384 sampling goal. In addition, 246 DNA samples were collected for ADF&G's genetic stock structure study, surpassing the sampling goal of 240. This run peaked in early August, when 4,550 live and 1,706 dead Pinks were observed on 8/8/2015. Live Pinks were present in the stream on each visit. The end of this run was not observed.

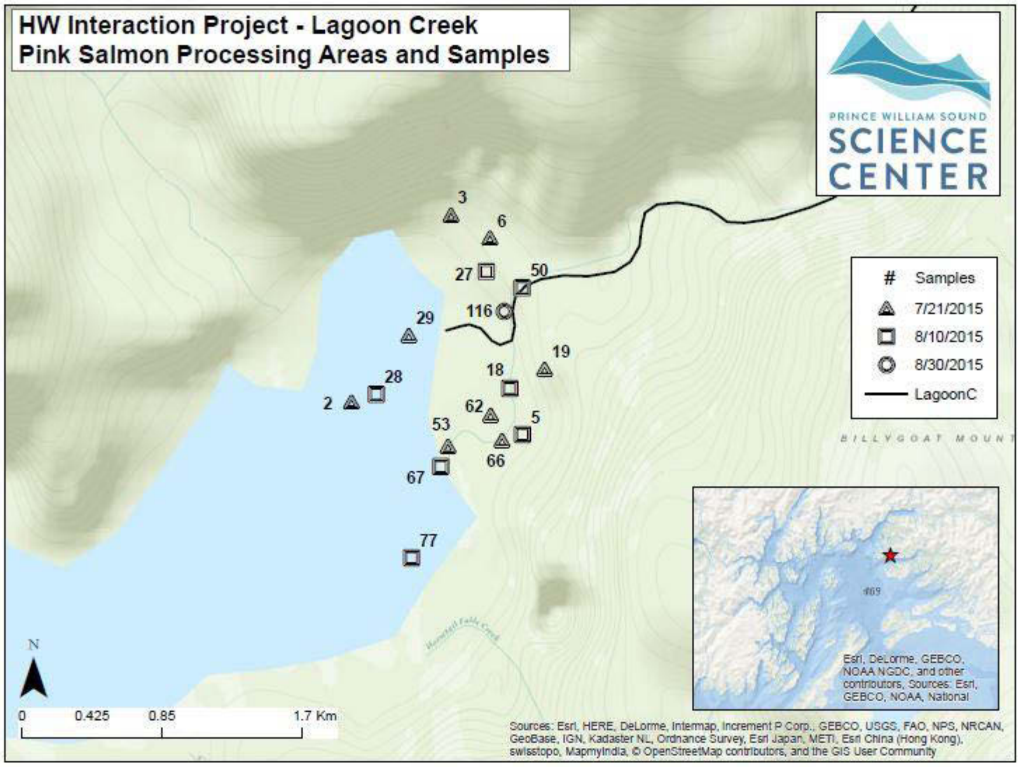
Extent of the stream surveyed: Fish Creek was not surveyed further than 500m above the mouth of the stream. Pinks seemed to be most numerous in the intertidal zone, with their numbers and density thinning out 500 m from the mouth. No extent location was determined.

Unusual events: Some bear sign observed at this stream, and an unidentified bear was once observed at a great distance, but otherwise no bears encountered. A high flow event must have occurred between 8/8/2015 and 9/1/2015, as the stream jumped its bank, knocked down a few trees, and moved some logs.

Access, safety, or logistical issues: Fish Creek is easily accessible at both high and low tides. At high tide, a skiff can directly access the mouth of the stream for crew drop off and pick up. At low tide, drop off can occur 400 m from the mouth, down the rocky beach. The lower reaches of the stream are tidal and shallow enough to cross on foot at low and mid-tide.

Recommendations, changes and other notes: Pink-gilled dead fish were collected here for stock structure analysis, as well as some live fish that were taken with a dipnet and seine.

Lagoon Creek
221-40-10990
Pink Salmon



2015 samples collected and run timing: The *Cathy G* crew visited Lagoon Creek three times from 7/21/2015 to 8/30/2015 to collect Pink otolith and tissue samples. Sampling effort on this stream was successful with the collection of 628 Pink otolith pairs, 163% of the 384 minimum sampling goal. In addition, 244 tissue samples were collected for ADF&G's stock structure study, exceeding the 240 sample goal. Live fish were present in Lagoon Creek on each visit. This run peaked in early August, with 1,321 live and 1,325 dead Pink Salmon observed on 8/10/2015. The end of the run was not observed. Chum Salmon were spawning exclusively in the west lagoon and were not seen in the main branch.

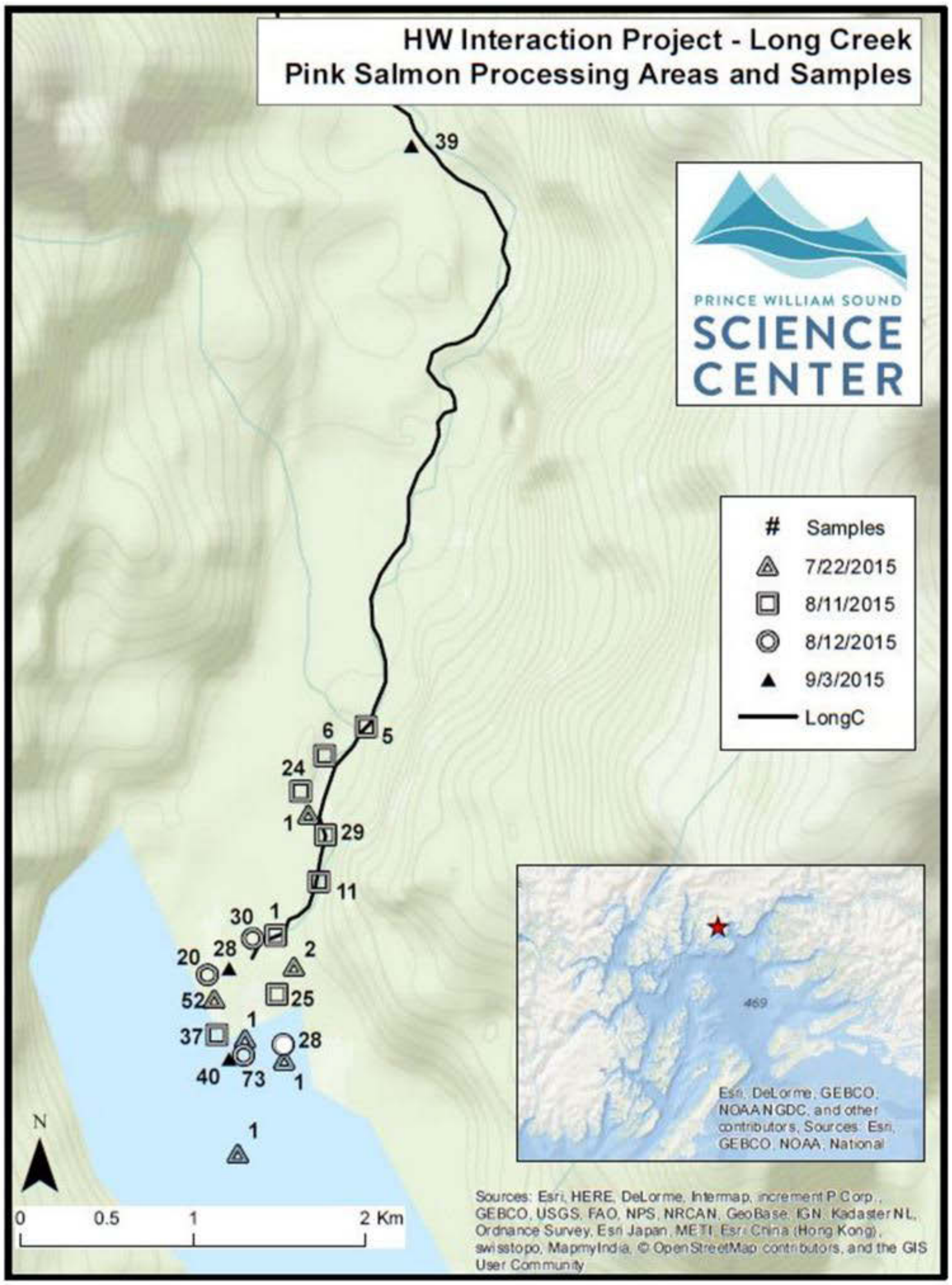
Extent of the stream surveyed: The extent of Pink habitat is a 20-minute, 800-m hike up Lagoon Creek at a bedrock waterfall. On the second and third visit, the vast majority of the Pinks observed in the main branch were in the intertidal or at the waterfall pool.

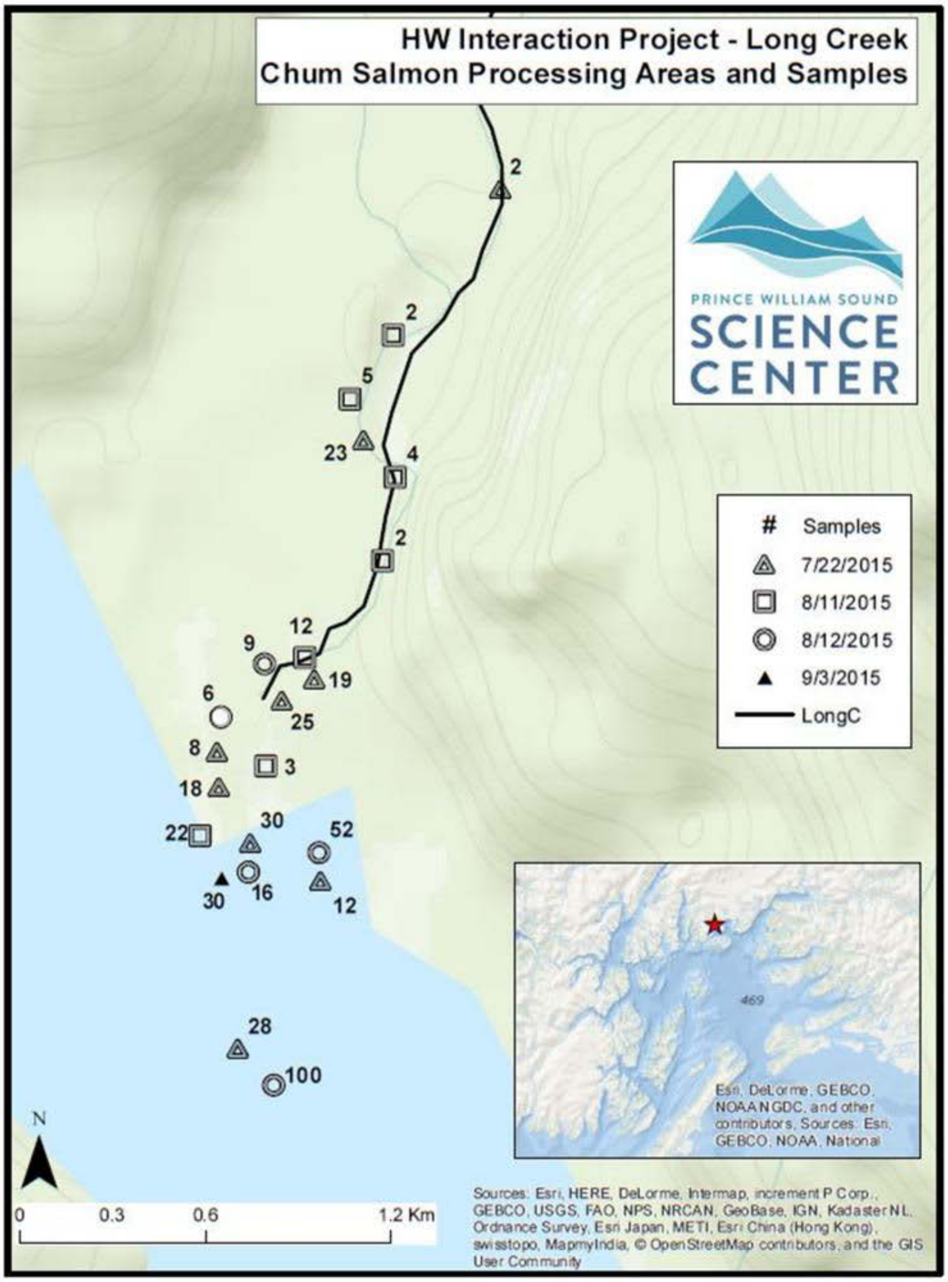
Unusual events: On 8/30/2015, water was extremely low and most of the streambed was completely dry. Between the tidal zone and the waterfall extent, there were only occasional, small and disconnected pools packed with barely living fish. In other places, dry depressions that had clearly contained water in the last day or two were packed with still-moist, Pink-gilled, dead fish. Redds were high and dry in places and it is possible that many redds in Lagoon Creek have been lost. Fish that spawned in the intertidal main branch and the intertidal west branch lagoon may have been more successful.

Access, safety, or logistical issues: Lagoon Creek is easily accessible at both high and low tides. The east and west branches of the stream are separated by a grassy intertidal zone. The west branch of the stream previously flowed into a tidal lagoon, and then flowed out into Landlocked Bay through a rocky gap. Lagoon Creek has since diverted entirely to the east branch, but fish continue to use the lagoon (west branch) for spawning. Fish were observed moving into the lagoon with the incoming tide and spawning in this intertidal lagoon.

Recommendations, changes and other notes: Had no problem sampling dead pink-gilled fish for genetic stock structure study.

Long Creek
222-10-12140
Pink and Chum Salmon





2015 samples collected and run timing: The Cathy G crew surveyed Long Creek four times from 7/22/2015 to 9/3/2015 to collect Pink and Chum samples. Sampling effort on this stream was successful; minimum sampling goals for both Pink and Chum Salmon were met.

Pinks- Pink Salmon sampling was successful with 454 otolith pairs, 118% of the minimum sampling goal of 384 Pink otolith pairs. In addition, 266 Pink Salmon DNA samples were collected for ADF&G's stock structure study, exceeding the goal of 260 samples. This run peaked in late-July or possibly late September, with 2269 live and 9 dead Pinks observed on 7/22/2015 and 7,024 live and 3220 dead Pinks observed on 9/3/2015. Live Pinks were observed in Long Creek on each visit. The end of the run was not observed.

Chum- Chum Salmon sampling was successful with 428 otolith samples collected, 111% of the 384 sampling goal. This run peaked in late July, when 330 live and 254 dead Chum were observed on 7/22/2015. Live Chum were observed in Long Creek on each visit and this run's peak seems to have a very gradual decline. The end of this run was not observed, but the presence of only 6 live Chum on the final survey date indicates that it was likely over during early or mid-September.

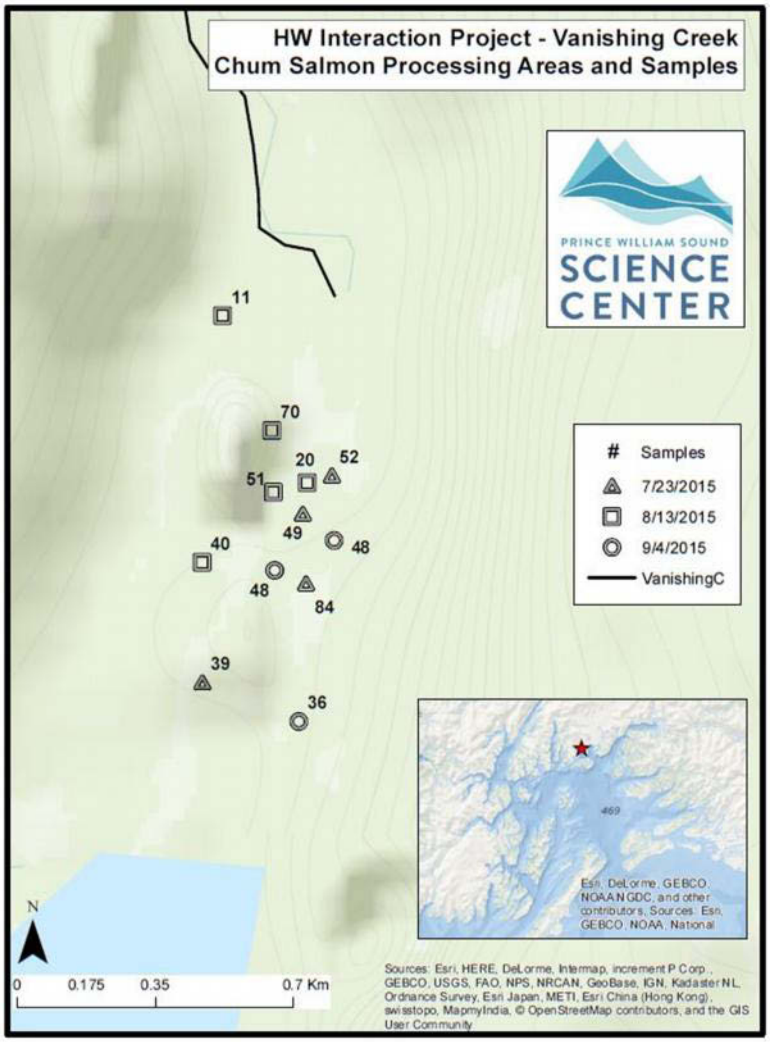
Extent of the stream surveyed: Long Creek was surveyed to 3 km above the mouth, and in the upper reaches the stream's morphological characteristics change dramatically. This stream is characterized by a low gradient braided floodplain, which turns into a steep sided and deep gorge. Large Pink Salmon were noticed in this gorge. No Pink Salmon were seen in the last 200 m of the stream leading up to the end survey point taken that day. It seems unlikely that this indicates the extent. No known extent was determined.

Unusual events: On 9/3/2015, during the furthest survey done here this season, we found a 400 m long stretch of river that was completely dry.

Access, safety, or logistical issues: Long Creek is accessible at high and low tides, but pick-up and drop-off are easiest and safest when the tide is rising. This shallow and turbid estuary is hazardous for a vessel to pick-up or drop-off a crew because there are large submerged trees hidden in the murky water. There is one deep slough with channels that are constantly reforming and eroding the banks. It is a dangerous stream for the landing craft, most notably during a receding tide when the skiff can become stranded. Communication with the landing craft here is more critical than other streams.

Recommendations, changes and other notes: None.

Vanishing Creek
222-10-12157
Chum Salmon



2015 samples collected and run timing: The Cathy G crew surveyed Vanishing Creek three times between 7/23/2015 and 9/4/2015. Sampling effort on this stream was successful with the collection of 548 Chum otolith pairs, 143% of the 384 sample goal. This run peaked in late-July when 433 live and 235 dead Chum where observed on 7/23/2015. Live Chum Salmon were observed in Vanishing Creek from 7/23/2015 to 9/4/2015.

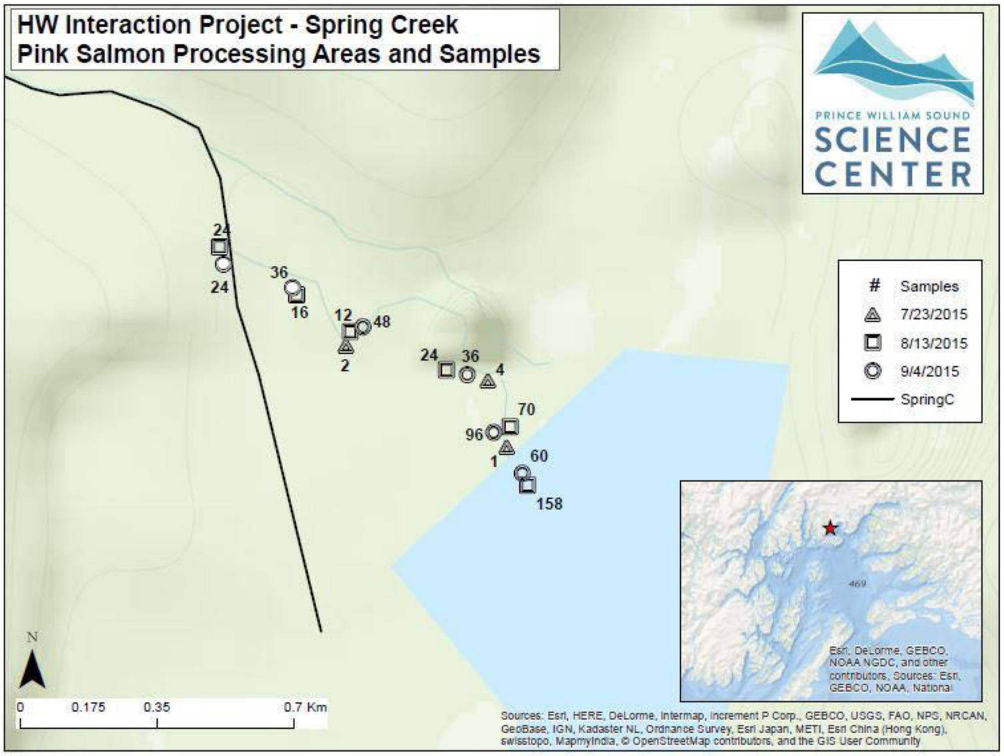
Extent of the stream surveyed: Vanishing Creek was surveyed to 800 m from the stream mouth. At this point, upstream travel was prohibited by thick alder growth over the stream and along the banks. No Chum were observed above the estuary, and appeared to be spawning in the brackish water exclusively.

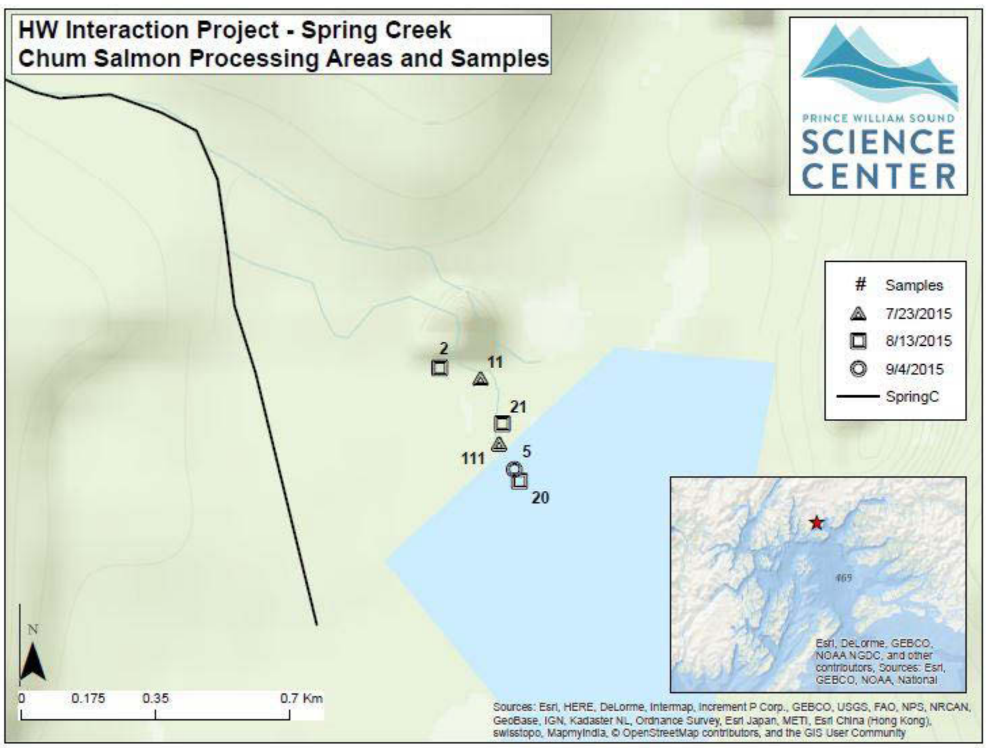
Unusual events: Vanishing Creek had veritably "vanished" above the tidal zone on 9/4/2015. Thousands of prespawn Pink Salmon were lying dead in the dry channel, and every redd above the tidal zone has probably been compromised. None of the Chum appeared to be using the stream above tidal influence and this dry spell may have less impact on them than the Pinks. On our final visit there were some unusual Sockeye with dark and yellow Chum-looking bar marks. There were also Chum Salmon with greenish Sockeye-looking heads.

Access, safety, or logistical issues: Vanishing Creek is accessible at both high and low tides. At low tide, a crew can walk from nearby Spring Creek to Vanishing Creek. At high tide, the water between Spring and Vanishing is too deep to cross on foot, but a longer route along the shore can be taken. At high tide, the stream becomes deep enough that a skiff could drive to the mouth of Vanishing Creek for crew drop off or pick up. This stream is best surveyed in conjunction with Spring Creek.

Recommendations, changes and other notes: None.

Spring Creek
222-10-12170
Pink and Chum Salmon





2015 samples collected and run timing: The Cathy G crew visited Spring Creek three times from 7/23/2015 to 9/04/2015. The minimum sampling goal was met for Pink Salmon, but was not met for Chum Salmon.

Pinks- Sampling effort for Pink Salmon was successful with the collection of 611 otolith pairs, 159% of the 384 sample goal. Live Pink Salmon were observed in Spring Creek on each visit. This run may have peaked in mid-August, with 3,201 live and 675 dead Pinks observed on 8/13/2015.

Chum- Sampling for Chum was unsuccessful with the collection of 170 otolith pairs, 44% of the 384 sampling goal. Live Chum were observed in Spring Creek on two out of three visits, 7/23/2015 and 8/13/2015. This run may have peaked in mid-July when 88 live and 133 dead Chum where observed on 7/23/2015. An earlier visit would have been needed to reach our sampling goals on this stream.

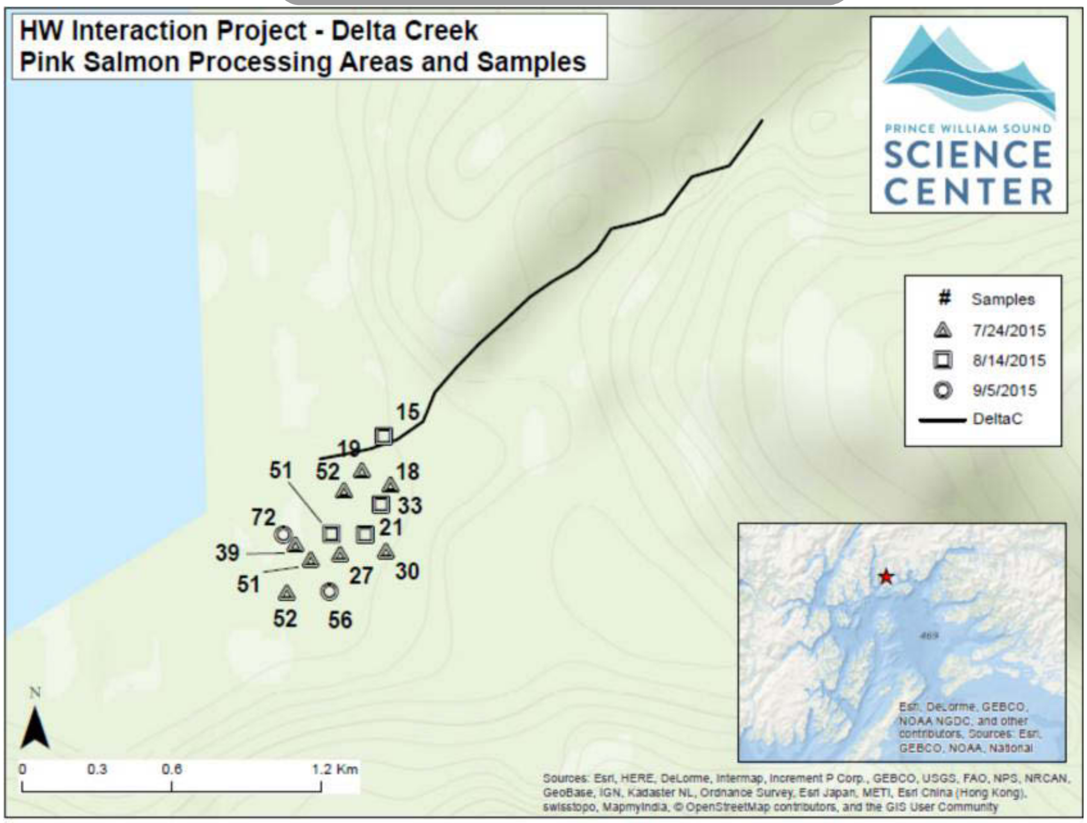
Extent of the stream surveyed: Spring Creek was surveyed to its extent location; a series of small cascades about 1 km from the mouth of the stream. Pinks were using all available habitat to the extent, but were most numerous in the intertidal zone and in the first 400 m of stream. During peak Pink run on this stream, live Pinks were observed as far as the plunge pool below the extent waterfall and dead Pinks were counted in the same pool on the final visit. No Chum were observed above tidal zone.

Unusual events: On 8/13/2015, there were many dead fish in the stream, most of these were pre-spawn and the water was extremely low.

Access, safety, or logistical issues: Spring Creek is easily accessible at both high and low tides. At high tide, a skiff can approach the stream mouth for crew drop off. At low tide, drop-off is a short hike away. While this stream has a large intertidal area, many areas remain accessible even at high tide. Spring is easily hiked and forded with no major safety issues.

Recommendations, changes and other notes: This stream is within walking distance to Vanishing Creek, a stream that is more easily accessed on foot at low tide. The stream crew would generally visit Spring Creek on a falling tide, and then walk to Vanishing at low tide and work their way upstream. An earlier start to the sampling season could potentially get Chum samples numbers up to adequate levels. This is such an early Chum run that we appear to have sampled too late.

Delta Creek
222-20-12335
Pink Salmon



(Delta Creek has erroneously been called Surplus Creek in the 2013 and 2014 annual reports.)

2015 samples collected and run timing: The *Cathy G* crew visited Delta Creek three times between 7/24/2015 and 9/05/2015 to collect Pink Salmon otolith samples. The sampling effort yielded a collection of 536 otolith pairs, 140% of the minimum 384 sample goal. Live fish were observed in the stream during each visit. The run peaked in mid-August, when 3,300 live and 600 dead Pinks were documented on 8/14/2015. The end of this run was not observed.

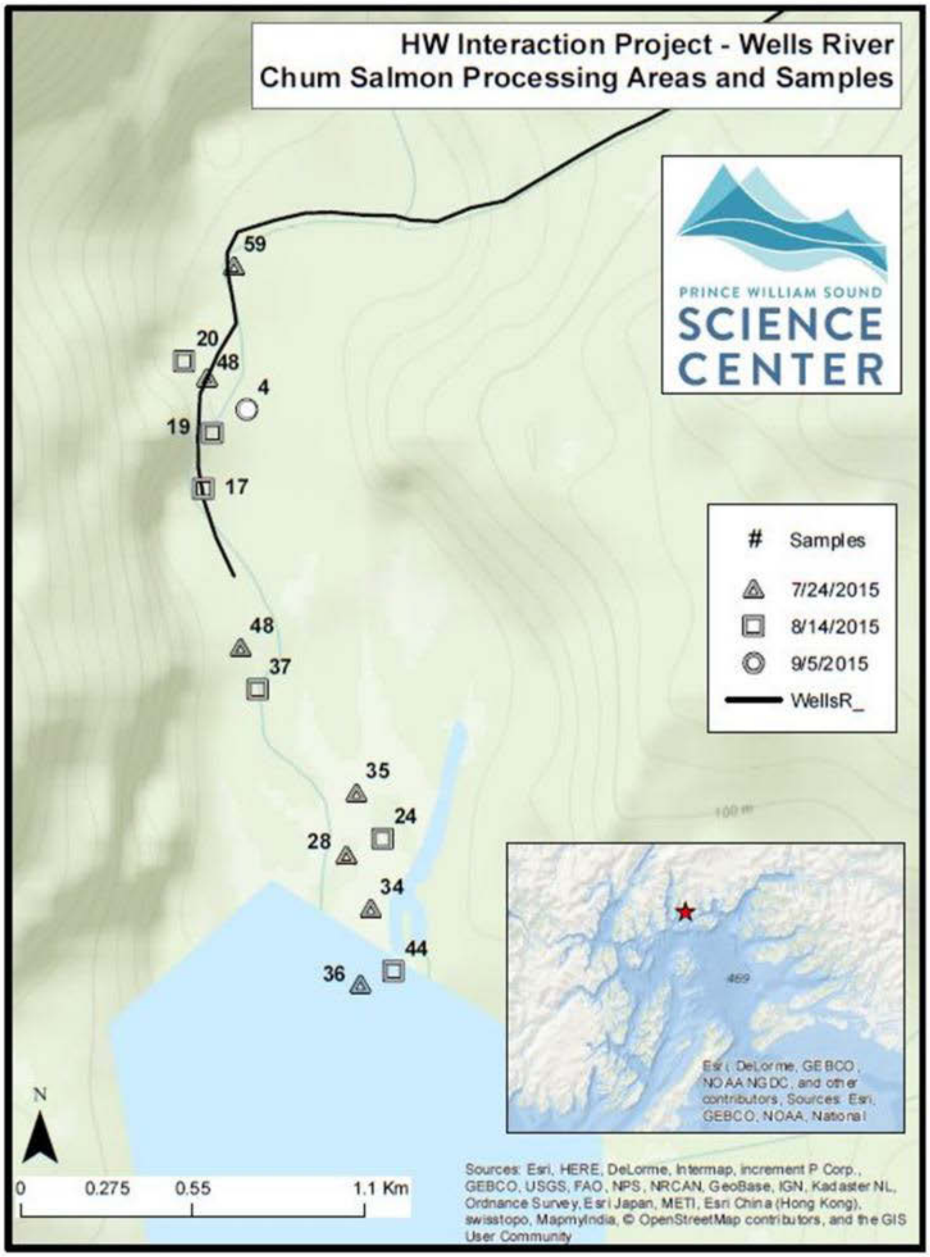
Extent of the stream surveyed: Delta Creek was surveyed about 400 m upstream, past a set of cascading plunge pools roughly 200 m above the mouth. Pink Salmon had no difficulty making it above this physical barrier and the extent of Delta Creek was not found.

Unusual events: Saw a single mature black bear fishing close to the cascades on our first visit, it ran off upon spotting us.

Access, safety, or logistical issues: This stream is accessible at high and low tides, but processing areas in the lower stretch are dry only at low and mid-tides. The stream is a deeply incised, bedrock-controlled channel above the tidal zone, and it is challenging to find upstream processing areas. The outwash plain is short compared to other study streams and the crew can be dropped off right at the mouth where there is enough deep water for a skiff. This stream was always sampled in conjunction with Wells River, just across the bay.

Recommendations, changes and other notes: None.

Wells River
222-20-12340
Chum Salmon



2015 samples collected and run timing: The *Cathy G* crew visited Wells River three times between 7/24/2015 and 9/05/2015 to collect Chum otolith samples. The sampling effort on Wells River was successful, with the collection of 469 otolith samples, 122% of the minimum sampling goal. Live fish were observed in the stream on each visit. This run may have peaked in late July, with 7,356 live and 62 dead Chum observed. Though the end of the run was not observed, extremely low counts on 9/05/2015 would indicate it may have occurred in mid-September.

Extent of the stream surveyed: Wells River was surveyed to a large waterfall roughly 900 m upstream. No Chum were observed this far upstream, the greatest concentration was near the mouth.

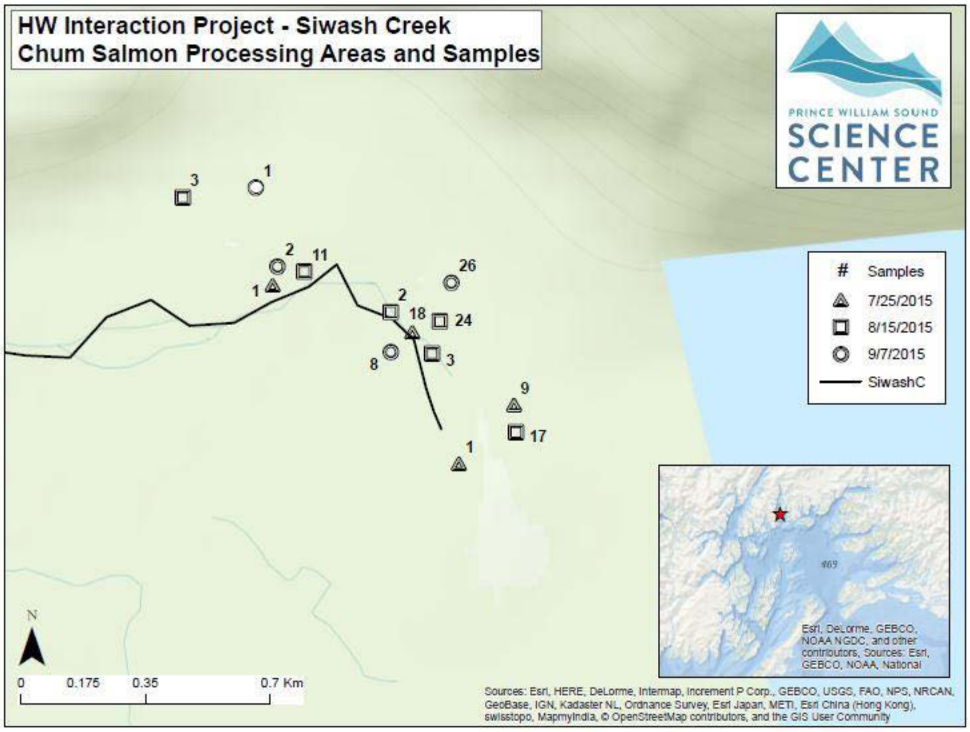
Unusual events: None

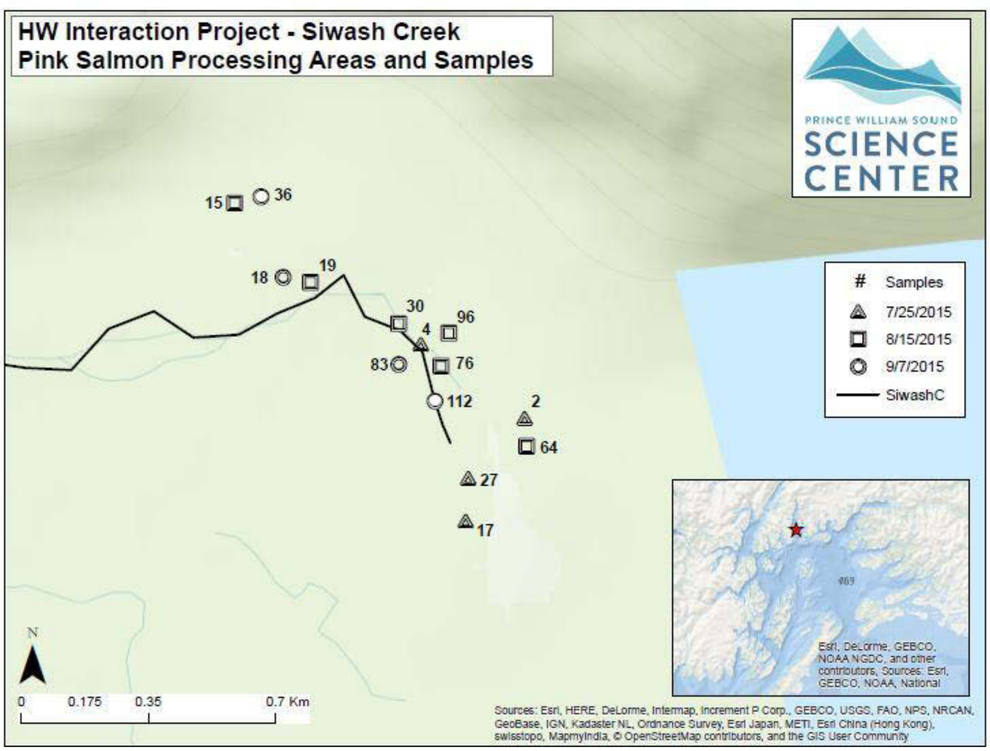
Access, safety, or logistical issues: Wells River is accessible at high and low tides; however, crews should be dropped off on the west bank of the river and picked up on a rising tide. The east bank is cliffs and deep pools of water and the mudflat at the mouth of this river can trap a vessel in falling tides. Wells is a powerful river with logs stuck in the estuary and a shallow slough that needs to be followed to reach shore.

This river is braided near its mouth, with most river braids being crossable on foot when the river is low. Wells River can flood during heavy rainfall and the deep fast moving water prevents safe stream crossing and upstream travel.

Recommendations, changes and other notes: This stream should be surveyed at low- or mid-tide to access carcasses in the extensive intertidal area and to easily cross the river. This run peaks early in the field season and stream crews should concentrate sampling effort in July and the beginning of August to ensure the collection of sufficient samples to meet the sampling goal.

Siwash Creek
222-20-12640
Pink and Chum Salmon





2015 samples collected and run timing: The Cathy G crew visited Siwash River three times between 7/25/2015 and 9/7/2015 for the collection of Pink and Chum otolith samples. The minimum Pink otolith and DNA sampling goals were met but the minimum otolith sampling goal for Chum Salmon was not met.

Pink- Sampling for Pink Salmon was successful, with 599 otolith pairs collected, 156% of the minimum 384 sample goal. In addition, 200 DNA samples were obtained for ADF&G's genetic stock structure study, meeting their goal of 200 samples. This run peaked in mid-August, with 2,463 live and 475 dead Pink Salmon observed on 8/15/2015. Live fish were observed from on each visit and the end of this run was not observed.

Chum- Sampling for Chum Salmon was unsuccessful, with 126 otolith samples collected, 33% of the minimum sampling goal. The peak run may have occurred between late-July and mid-August when 81 live and 25 dead Chum were observed on 7/25/2015, and 73 live and 60 dead Chum were observed on 8/15/2015. It appears this run had a gradual peak over 3-4 weeks, but fish were never present in high densities. Live fish were observed on each visit, and the end of this run was not observed. An earlier start to the sampling season would be helpful in procuring the minimum number of Chum samples.

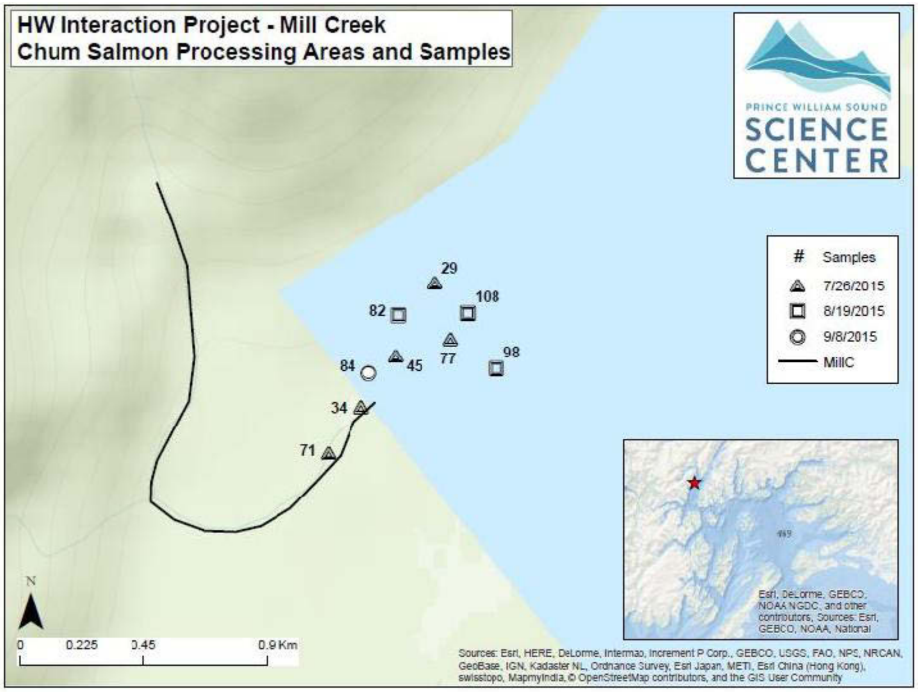
Extent of the stream surveyed: Siwash River was surveyed about 1.5 km upstream. Dense willow and alder over the stream and along the banks prevented travel beyond this point. Pink Salmon were seen through the surveyed length, with greater numbers in the lower reaches. Chum were seen higher in the stream at Siwash than was typical for other study streams. Chum appeared to be using spawning habitat almost as far as our furthest end-survey point. No extent was established.

Unusual events: On each visit there were large Dolly Varden Char in the stream that may have been anadromous spawners.

Access, safety, or logistical issues: At low tide an expansive mudflat leads to Siwash River. At mid to high tide, the stream mouth is accessible by skiff via a small channel. However, surveying this stream at low tide allows access to carcasses in the intertidal zone.

Recommendations, changes and other notes: Dead, Pink-gilled fish were sampled for ADF&G's stock structure analysis, along with some live fish taken with a dip-net and seine. An earlier visit could help get sample numbers higher for Chum Salmon.

Mill Creek
224-10-14210
Chum Salmon



2015 samples collected and run timing: The *Cathy G* crew visited Mill Creek three times between 7/26/2015 and 9/8/2015 for collection of Chum otolith samples. The sampling effort was successful, with 628 otolith pairs collected, 164% of the minimum 384 sample goal. This run peaked in mid-August, when 814 live and 859 dead Chum were observed on 8/19/2015. Live fish were observed during each visit and the end of this run was not observed.

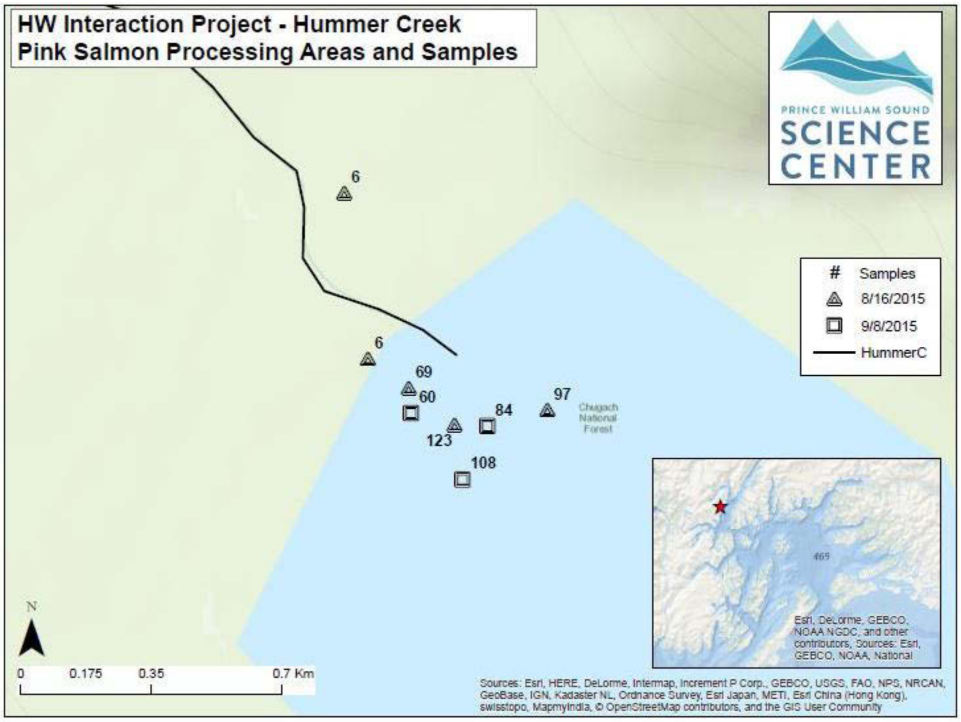
Extent of the stream surveyed: Mill was surveyed to its extent location, a long, cascading waterfall approximately 1 km from the stream mouth at low tide. Chum Salmon were not seen near or at the extent location. All Chum were observed below a large Y in Mill Creek approximately 500 m from the stream mouth at low tide.

Unusual events: None.

Access, safety, or logistical issues: Mill Creek is accessible at both high and low tides. This stream cuts through an expansive mudflat that is exposed at low tide. At high tide, a skiff can access the stream mouth directly. At low and mid-tides, the stream crew was dropped off on the south end of the island in Bettles Bay, requiring a moderate hike across the mudflats to the mouth of the stream. Mill Creek supports a large Chum run that persists late in the season. The stream has many potential processing areas, and it is sufficiently shallow to collect carcasses and spawned out fish. Even when flooded, Mill remained safely crossable on foot.

Recommendations, changes and other notes: None noted.

Hummer Creek
224-10-14240
Pink Salmon



2015 samples collected and run timing: The Cathy G crew visited Hummer Creek three times from 7/26/2015 to 9/8/2015 to collect Pink otoliths. The sampling effort was successful, with 553 otolith pairs collected, 144% of the minimum 384 sample goal. The run may have peaked in late-August, with 437 live and 303 dead observed on 8/16/2015, and 100 live and 1,750 dead Pinks observed on 9/8/2015. Live fish were observed on each visit and the end of the run was not observed.

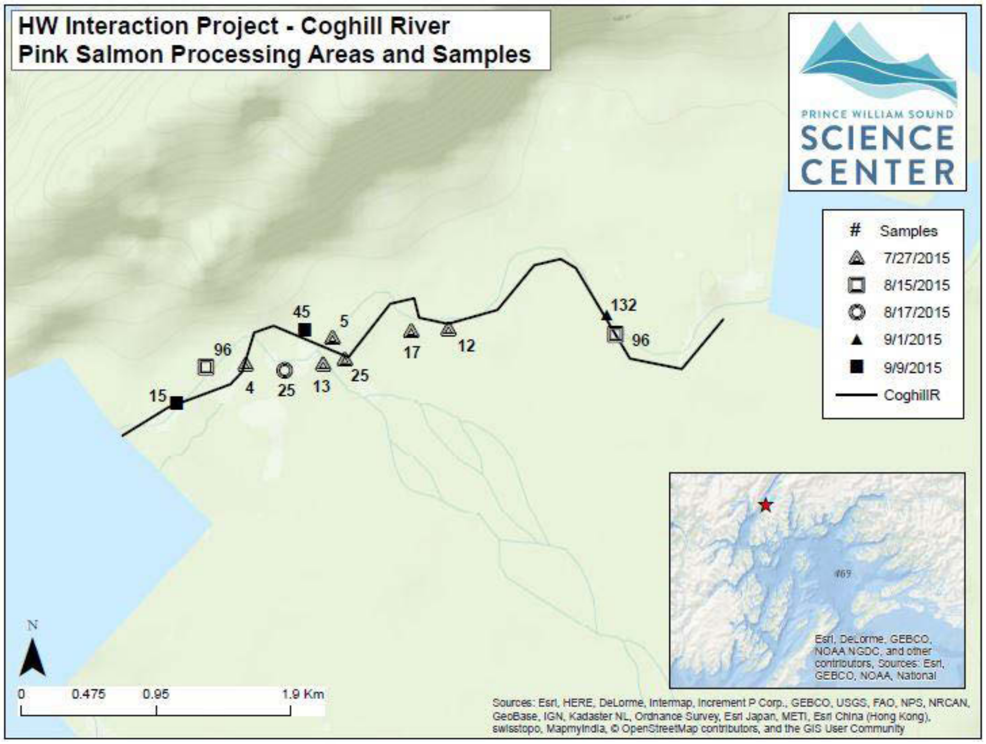
Extent of the stream surveyed: Hummer Creek was surveyed about .5 km upstream. At this point the stream drains from a lattice of beaver dams that prevented further timely upstream hiking. The extent location was not determined. Pinks were most numerous in the intertidal zone.

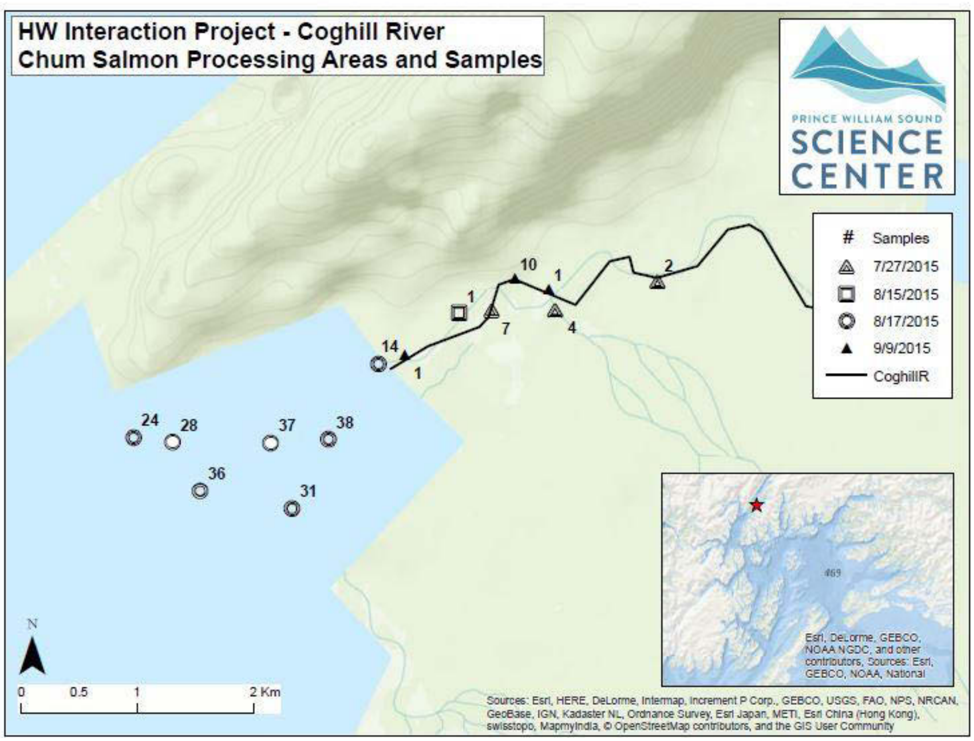
Unusual events: On 7/26/2015, the first visit to this stream, no live or dead Pinks were observed.

Access, safety, or logistical issues: Hummer Creek is easily accessible at both high and low tides. Stream crews can be dropped off on the beach and hike a short way to reach the stream outlet. Hummer is easily hiked and forded with no major safety issues.

Recommendations, changes and other notes: None noted.

Coghill River
223-30-13220
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* and local crews visited Coghill River five times from 7/27/2015 to 9/9/2015 to collect Pink and Chum otolith samples and Pink tissue samples for ADF&G's stock structure study. The minimum sampling goal for Pink Salmon otolith and DNA was met, while the minimum goal for Chum otolith samples was not.

Pinks- Sampling for Pink Salmon otoliths was successful, with 485 pairs collected; 126% of the minimum 384 sample goal. 251 samples were taken for ADF&G's DNA stock structure project, exceeding the 240 sample goal. This run may have peaked in mid-August, when 21,000 live and 2,950 dead Pinks were observed on 8/15/2015. However, Coghill River had highly turbid water on each visit, making accurate fish counting very difficult. For this reason all our fish count numbers at Coghill are questionable, as is our peak run estimation. Live fish were seen on each visit, and the end of the run was not observed.

Chum- Sampling for Chum was only partly successful, with 234 otolith pairs collected, 61% of the 384 sample goal. Chum Salmon were only found in the intertidal zone where high tide or an upstream drop-off location could prevent them from being included in the survey. The highly turbid water also makes our peak run estimate questionable. With these issues in mind, the run may have peaked in mid-August when 9 live and 400 dead Chum Salmon were seen on 8/17/2015. There were certainly more live fish in the river that day, but turbid conditions prevented the crew from counting them. Live fish were seen on each visit, and the end of the run was not observed.

Extent of the stream surveyed: Coghill River was surveyed from the mouth of the stream at low tide to lower Coghill Lake, a distance of approximately 5.5 km. All 5.5 km was not surveyed each time due to weather, high water and time constraints. Live and dead Pink Salmon were observed across this entire reach while Chum Salmon were only seen in the intertidal zone. No extent was established.

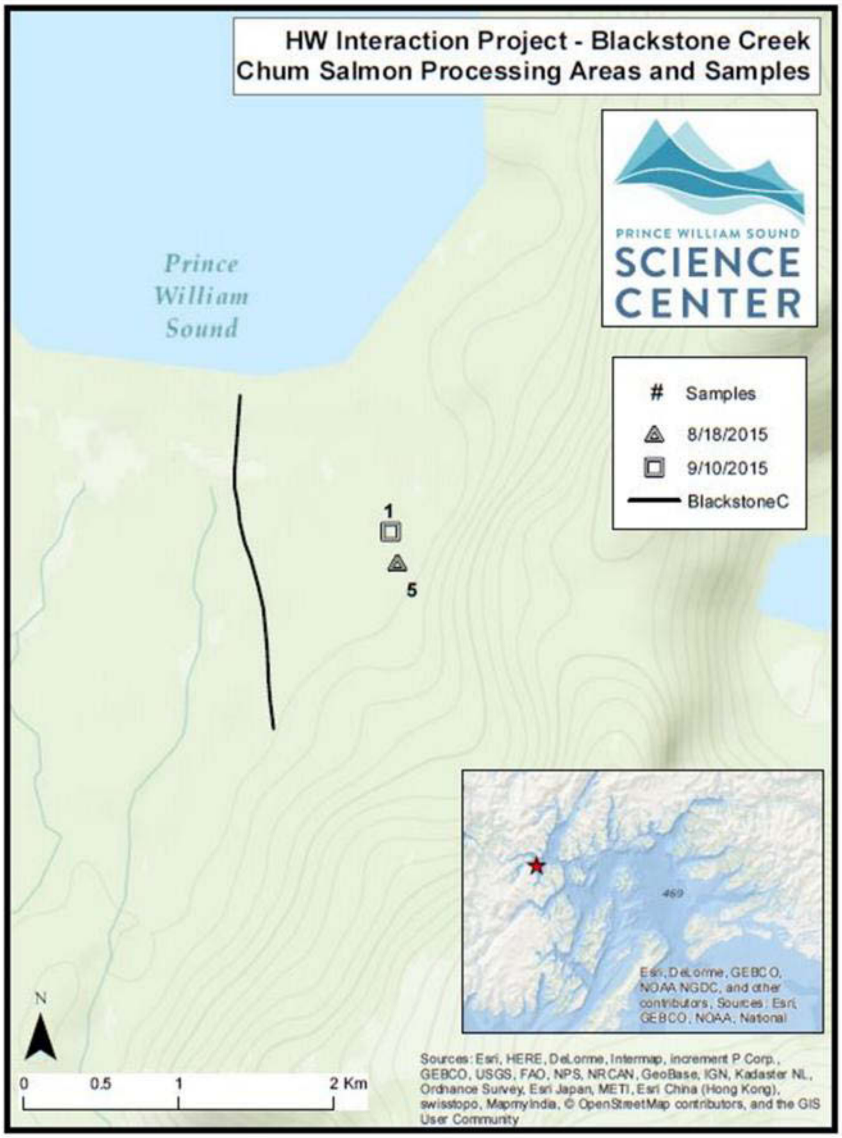
Unusual events: None

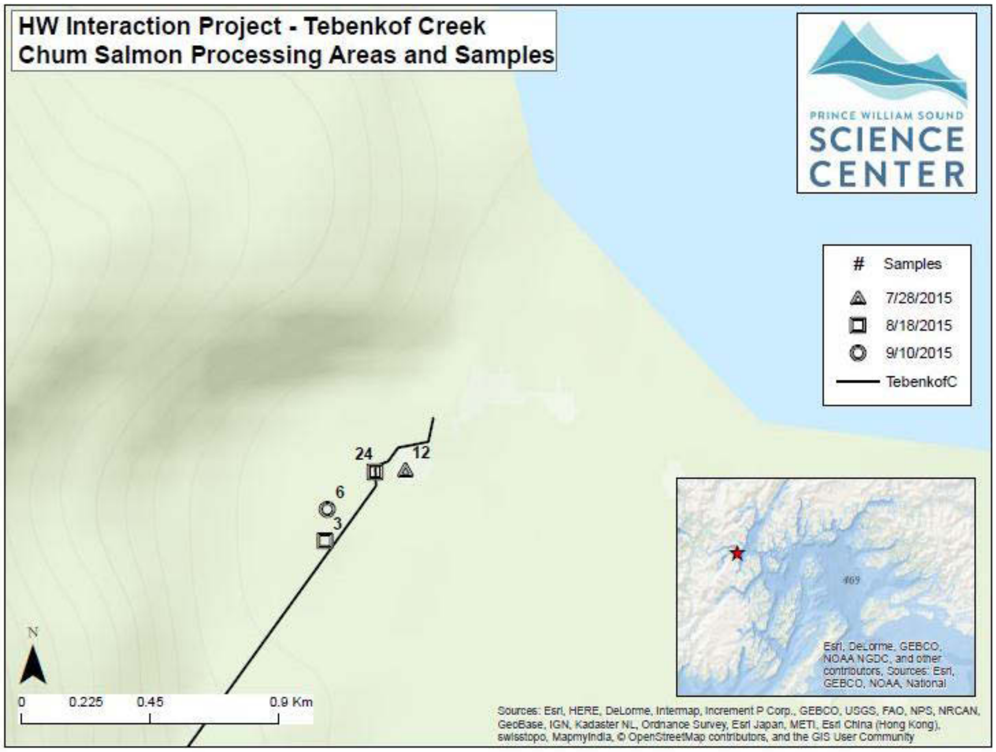
Access, safety, or logistical issues: Coghill River is accessible at high and low tides. An incoming tide is best for both drop-off and pick-up because the mudflats here are longer than any other stream or river in this project. Like Wells River and Long Creek, this mudflat can be hazardous to a landing craft. There are many sunken trees and shallow sloughs, and the silty water makes spotting hazards difficult. We did not use the mudflats during outgoing tides because a mistake made during pick-up by the landing craft as the tide ebbs could easily leave a crew stranded overnight. Our crew used the USFS Coghill Lake Trail for access during receding tides. It is not efficient to attempt to sample from the path as you walk along it but we found that after 2 km (which takes about an hour to hike in waders with heavy gear packs) there is a short bush-whack through some ferns to the edge of the tidal zone when the river comes into view. An overnight stay at the USFS Coghill Lake Cabin may allow for additional time to sample the upstream stretches of the river.

During periods of heavy rain the river rose so much that stream crews could not cross the main channel or many smaller branches. Even during dry periods, when the river was running low, crew members had to exercise extreme caution when attempting to cross Coghill River. Even at low flows this river is strong and dangerous and it is best to not cross this river at all, especially if crews are not comfortable with it.

Recommendations, changes and other notes: Coghill River is silty and deep, prohibiting accurate live/dead fish counts on all visits. Stream crews only saw fish in small shallow pools or when they rose in the main channel; fish could not be seen swimming upstream in the main channel. This river is very deep and fast moving and it takes considerable amount of time to travel upstream safely. Multiple days should be planned for Coghill River visits, so that crews can access and sample from the full extent of the river.

Blackstone and Tebenkof Creeks
224-10-14510
224-10-14500
Chum Salmon





2015 samples collected and run timing: The *Cathy G* crew visited Blackstone and Tebenkof Creeks three times from 7/28/2015 to 9/10/2015 to collect Chum otolith samples. Chum were extremely hard to come by at both streams. Sampling effort on Blackstone and Tebenkof was unsuccessful, with only 51 samples collected of the 384 sample goal representing 13% of the sampling goal. Only six Chum were sampled from Blackstone Creek on visits 8/18/2015 and 9/10/15. No live Chum were found in Blackstone on 7/28/2015. The remaining 45 Chum were sampled from Tebenkof Creek between 7/28/2015 and 9/10/15. This run appeared to peak in mid-August, when 256 live and 28 dead Chum were observed in Tebenkof.

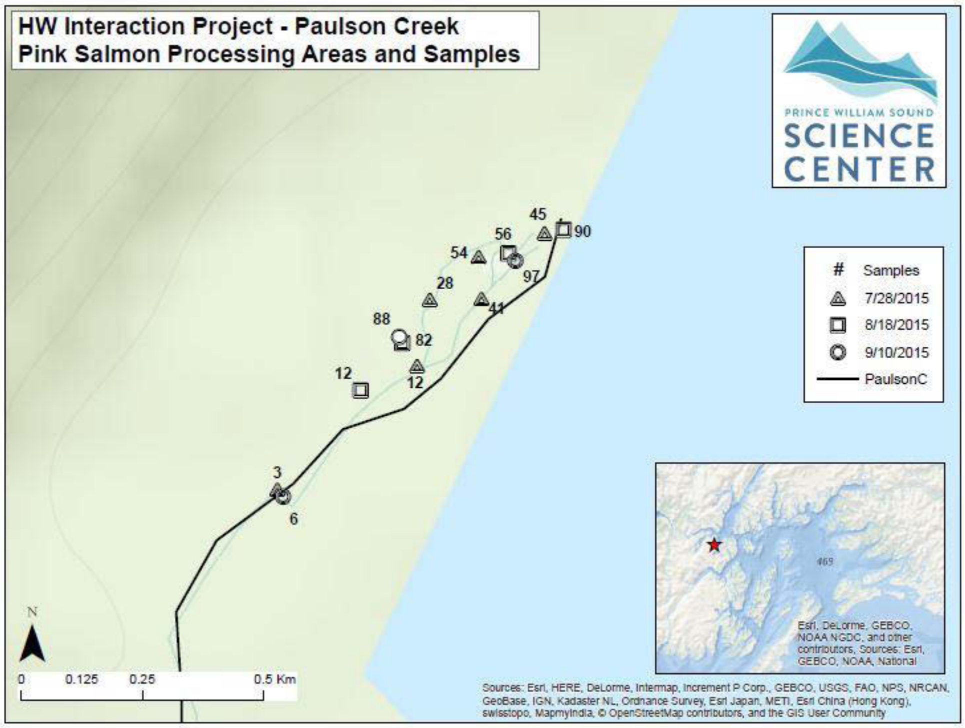
Extent of the stream surveyed: Blackstone was surveyed to its extent location - a tall waterfall approximately 700 m from the mouth at low tide. Tebenkof was surveyed to approximately 600 m upstream, where the creek slowed to a trickle. In Tebenkof, Chum carcasses were found in the first 400 m of the stream. The only Chum carcasses found in Blackstone were located about 500 m upstream.

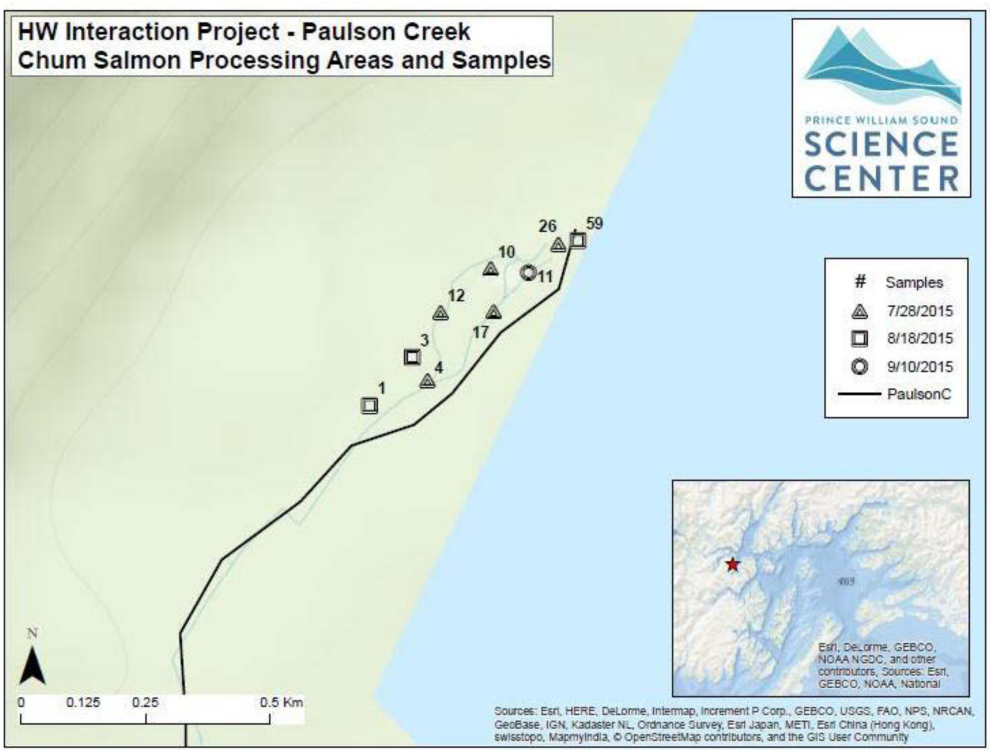
Unusual events: Blackstone had the most bear sign we saw anywhere this season, 10-20% of the fish carcasses we observed had been depredated by black bears, and a black bear was observed fishing on 7/28/2015.

Access, safety, or logistical issues: Blackstone and Tebenkof Creeks are both easily accessible at both high and low tides. A large, glacial river that is not easily crossed by foot and requires transport by boat separates these two streams from one another. Both streams are easily hiked and forded, no major safety issues.

Recommendations, changes and other notes: None

Paulson Creek
224-10-14550
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* crew visited Paulson Creek three times from 7/28/2015 to 9/10/2015 to collect Pink and Chum otoliths and Pink tissue samples for stock structure analysis. Minimum sampling goals for this stream were met for Pink Salmon, but were not met for Chum.

Pinks- Sampling for Pink otoliths and tissues was successful. The minimum sampling goal of 384 otolith pairs was met with 614 pairs collected, 160% of the goal. Additionally, 246 samples tissue samples for ADF&G's stock structure study were collected, reaching the 240 sample goal. This run may have peaked in mid-August, with 1900 live and 1,180 dead Pinks observed on 8/18/2015. Live fish were observed on each visit, the end of the run was not observed.

Chum- Sampling for Chum on Paulson Creek was partly successful, with only 143 otolith samples collected, 37% of the minimum 384 sampling goal. This run may have peaked prior to the first visit; the highest numbers seen were on 7/28/2015, when 42 live and 69 dead Chum were observed. Live fish were observed on each trip however, the last sampling trip on 9/10/2015, only documented one live Chum; it appears this run was over as of early September.

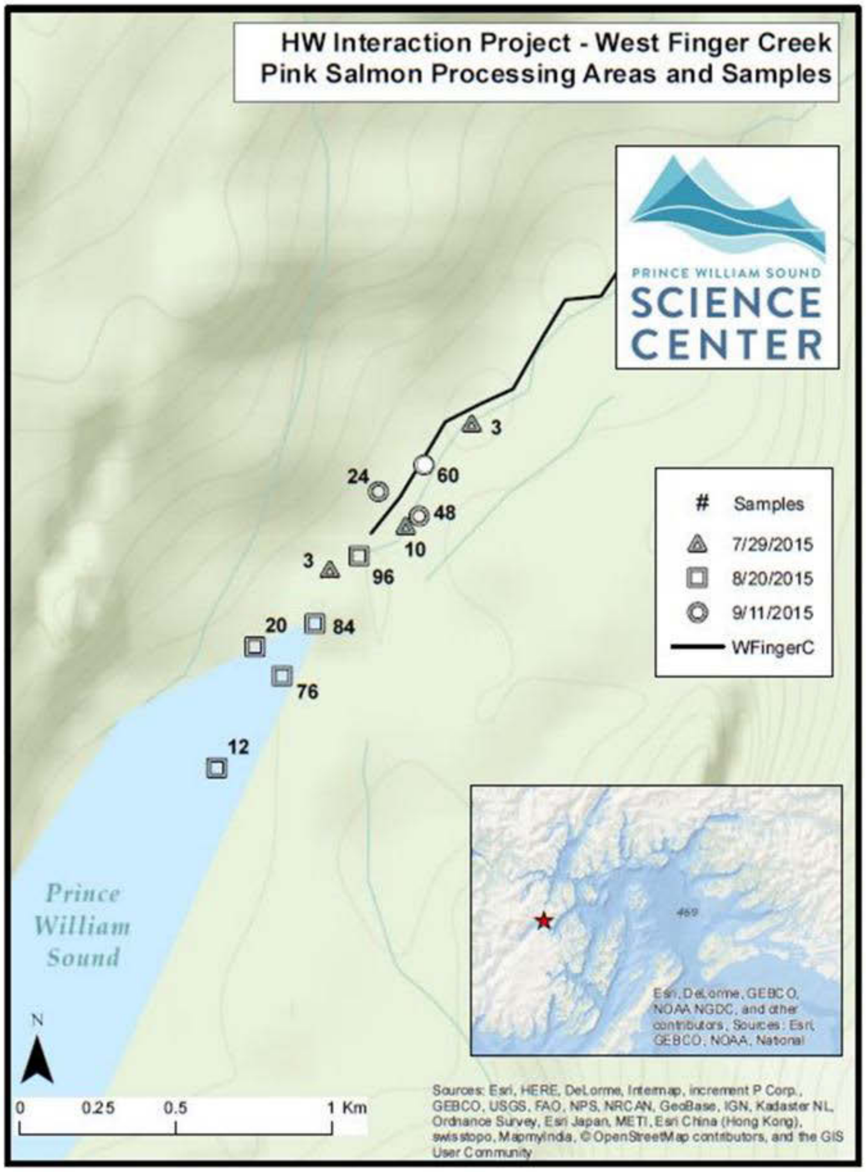
Extent of the stream surveyed: Paulson Creek was surveyed about 600 m upstream. A series of small cascades exists 400 m from the mouth. Pink Salmon were seen upstream of these cascades but Chum Salmon were not seen above tidal zone. Very few Pinks were observed in vicinity of the farthest survey end location. The greatest concentration of both Pinks and Chum was found within 200 m of the mouth of Paulson Creek. The extent location was not determined.

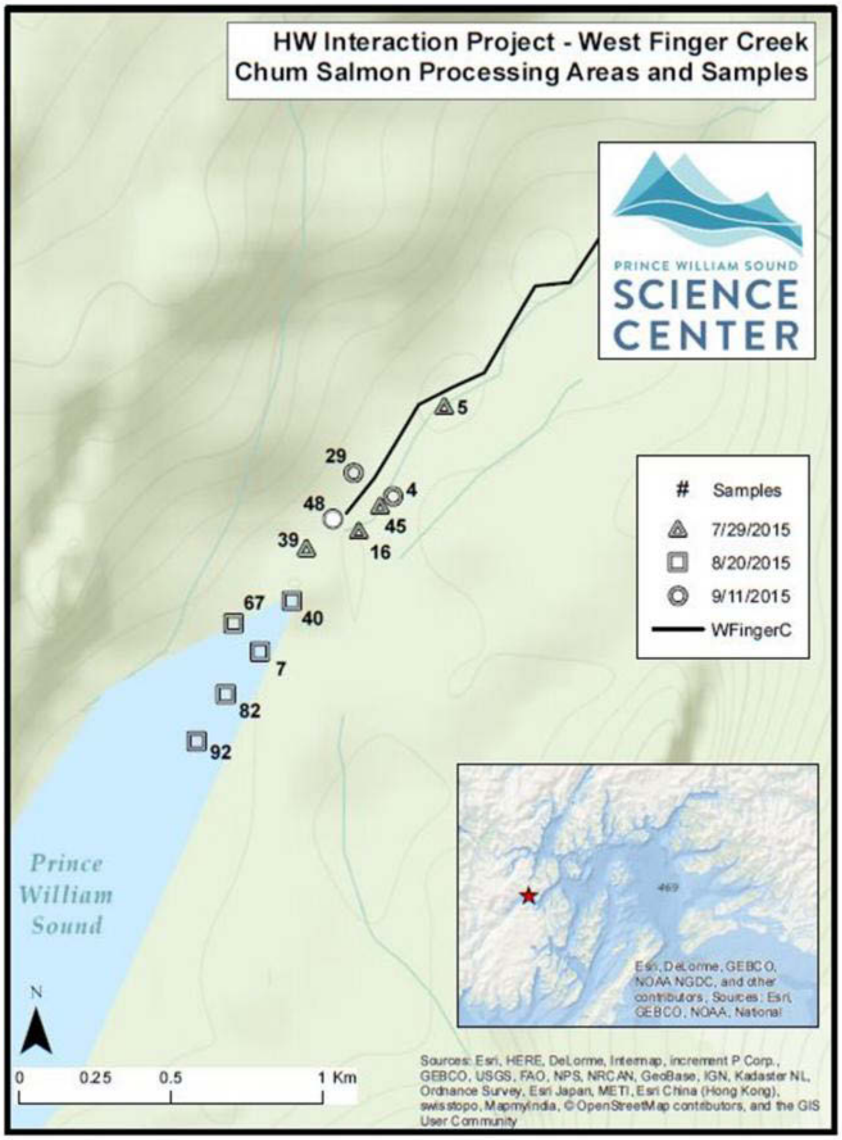
Unusual events: On our first trip 7/28/2015, a 6.3 earthquake struck just as we were getting ready to leave.

Access, safety, or logistical issues: This stream is easily accessed at both high and low tides. Paulson Creek drains into a small bay that is mostly dry at low tide, but a small peninsula of land separates this small bay from the larger, deeper Cochrane Bay. During low tide, the stream crew was picked up and dropped off from the Cochrane Bay side of the peninsula, which allowed immediate access to the mouth of Paulson Creek.

Recommendations, changes and other notes. Visits earlier in the month of July would help reach higher Chum sample numbers. Dead pink-gilled Pink Salmon were gathered for stock structure, and spawned-out Pinks were sampled with the seine and dip-net.

West Finger Creek
224-40-14850
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* crew visited West Finger Creek three times from 7/29/2015 to 9/11/2015 to collect Pink and Chum otolith samples. Sampling goals were met for both Pinks and Chum.

Pinks- Pink Salmon sampling was successful, with 436 otolith samples collected, 114% of the minimum sampling goal of 384. Live Pink Salmon were present in the stream on all three visits. The run may have peaked gradually in August, with 2,240 live and 25 dead observed on 7/29/2015 and then 2250 live with 830 dead observed on 8/20/2015.

Chum- Sampling for Chum on West Finger Creek was successful, with 474 otolith samples collected, 123% of the minimum 384 sample goal. Live Chum Salmon were present on each visit. This run may have peaked sometime before late-July when we made our first sampling visit; 209 live and 120 dead Chum were observed on 7/29/2015. Counts dropped on each subsequent visit, and only three live fish were observed on the final visit of 9/11/2015. This run likely ended in mid-September.

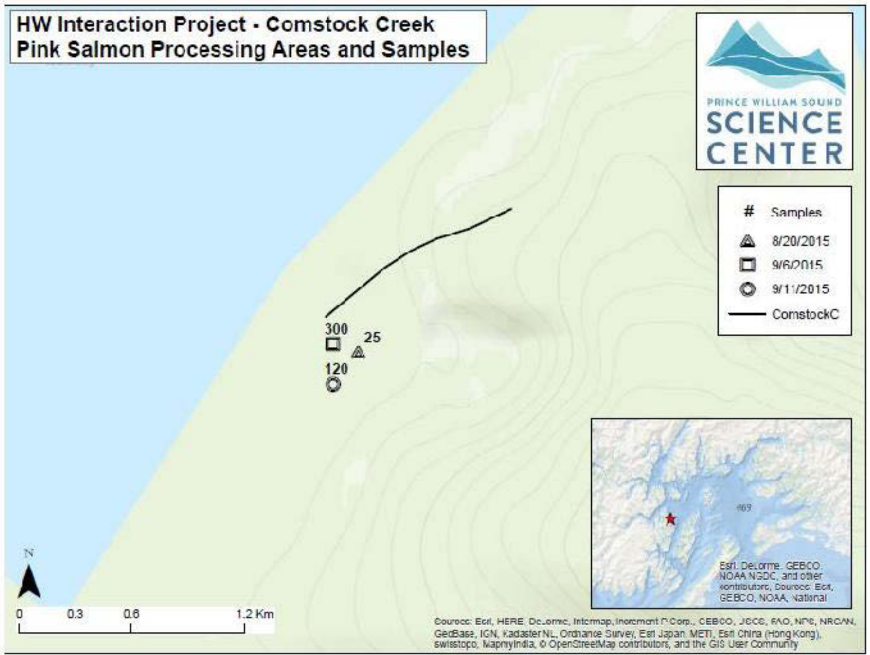
Extent of the stream surveyed: West Finger Creek was surveyed from the stream mouth to about 500 m upstream. The extent location was not determined. The upstream stretches of this stream have deep, fast moving water, and shrubby, steep banks, which prohibited the stream crew from going further. Pink Salmon were observed at the survey end location, but Chum were not seen above tidal influence. Pink and Chum Salmon were seen in the greatest concentration in the first 500 m of the stream.

Unusual events: None

Access, safety, or logistical issues: West Finger Creek is easily accessible at both high and low tides. At low tide it takes a short hike over mudflats to get to the mouth of the stream. This stream must be sampled at low tide to get adequate Chum numbers.

Recommendations, changes and other notes: A visit to this stream in mid-July would provide better sampling numbers for Chum Salmon.

Comstock Creek
225-20-15040
Pink Salmon



2015 samples collected and run timing: The *Cathy G* crew visited Comstock Creek four times from 7/29/2015 to 9/11/2015 to collect Pink otolith samples. Sampling effort was successful, with 445 otolith pairs collected, 116% of the minimum sampling goal. No Pinks had arrived at the first sampling trip on 7/29/2015, and only a few were trickling in on 8/20/2015. The run began in earnest during early-September and peaked in mid-September when 560 live and 900 dead were observed. The end of the run was not observed.

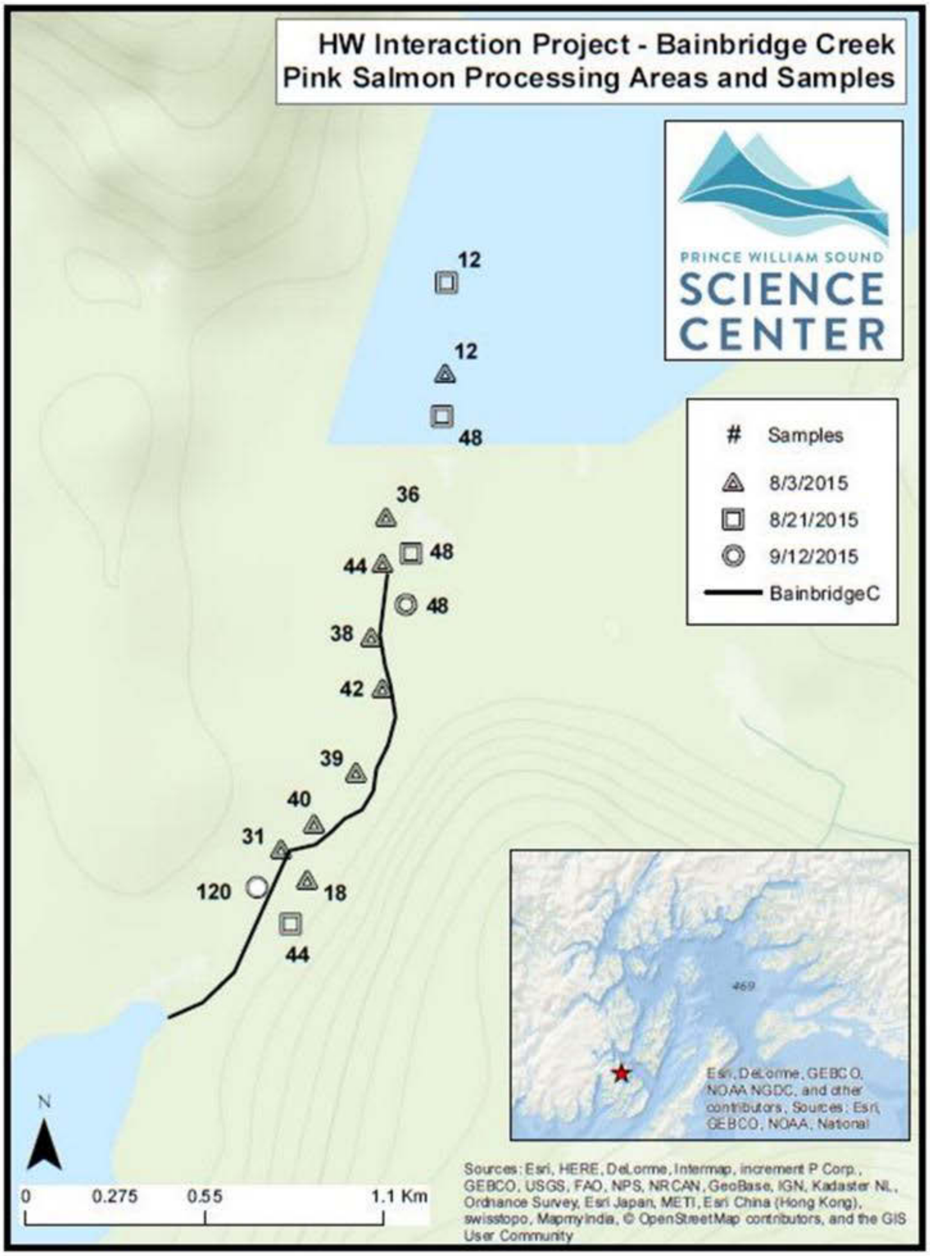
Extent of the stream surveyed: Comstock Creek is an unusual stream; Pinks were only spawning in the intertidal zone and were not observed above tidal influence. Above the tidal zone the steep bedrock creek bed provides very poor spawning habitat. The gradient increases around 200 meters from the stream mouth. Without a clinometer it is difficult to say where the true Pink Salmon extent is located, but water was fairly high during our visits and no fish were seen above the tidal zone.

Unusual events: Pinks do not appear to use this stream above the tidal zone.

Access, safety, or logistical issues: This stream is easily accessible at both high and low tides, but is best surveyed at a low or mid-tide. Nearby deep water allows easy access for crew drop off and minimal hiking along a rocky beach to the stream mouth. This stream was not greatly affected by heavy rainfall or flood conditions. Comstock is easily hiked and forded, no major safety issues.

Recommendations, changes and other notes: This is a flashy run that hits hard and fast late in the season, this needs to be kept in mind for sampling.

Bainbridge Creek
226-20-16300
Pink Salmon



2015 samples collected and run timing: The *Cathy G* crew visited Bainbridge Creek three times from 8/3/2015 to 9/12/2015 to collect Pink otolith samples. Sampling was successful, with 620 otolith pairs collected, 161% of the minimum sampling goal of 384. Live fish were observed on each visit. This run may have peaked in early August when 5,907 live and 296 dead Pinks were observed on 8/3/2015. The end of this run was not observed.

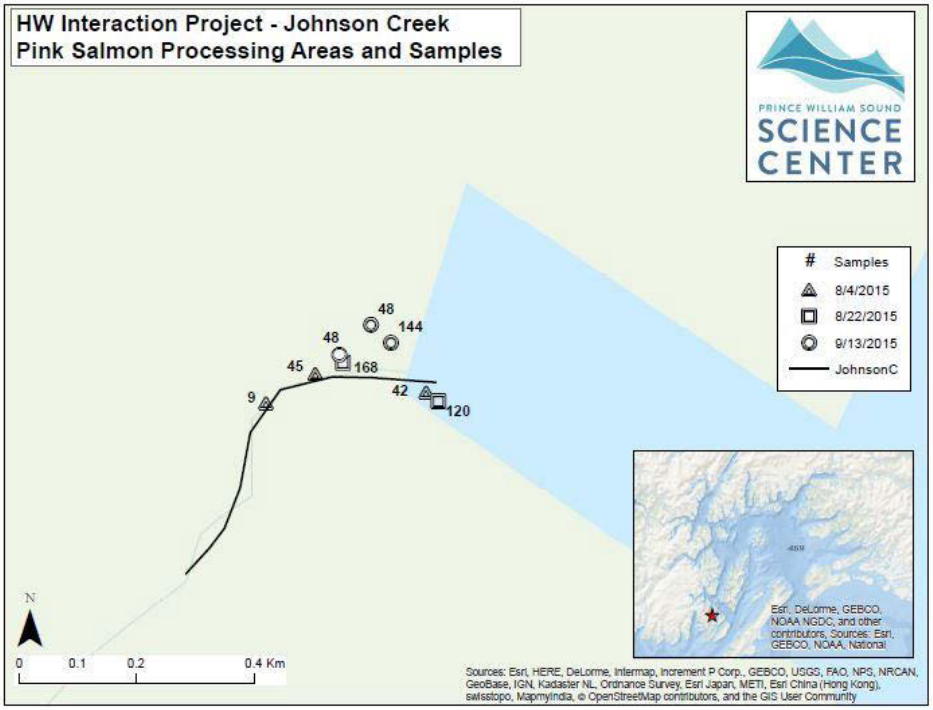
Extent of the stream surveyed: Bainbridge Creek drains from a large lake approximately 1.25 km from the stream mouth. This lake was never reached during this survey season. The greatest concentration of Pink Salmon was found close to the mouth.

Unusual events: This is the only stream of the study where we observed all five species of salmon this season. Two dead Chinook Salmon were seen on our first trip.

Access, safety, or logistical issues: Bainbridge Creek is easily accessible at both high and low tides. Nearby deep water channels allow for close skiff access, and minimal hiking is required to reach the stream mouth.

Recommendations, changes and other notes: None noted.

Johnson Creek
226-40-16269
Pink Salmon

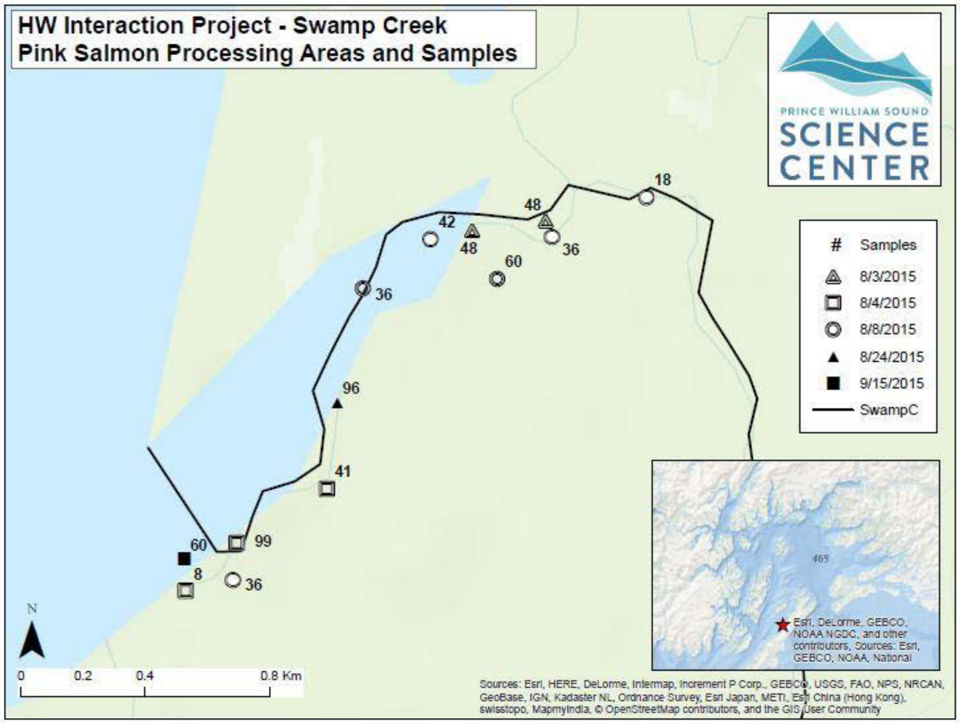


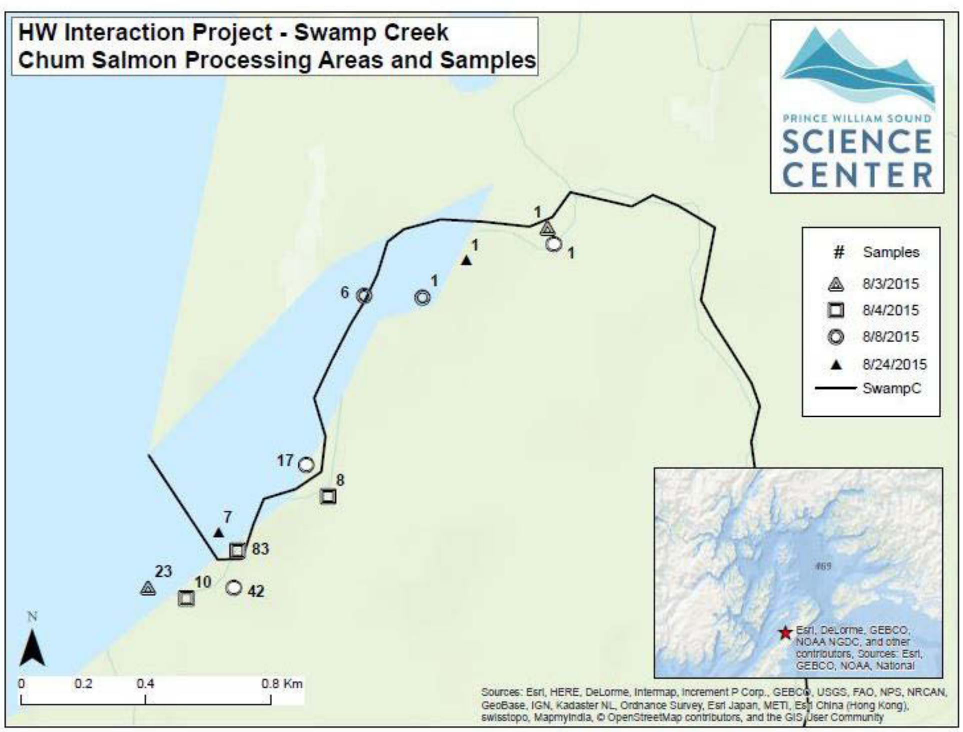
2015 samples collected and run timing: The *Cathy G* crew visited Johnson Creek three times from 8/4/2015 to 9/13/2015 to collect Pink otolith samples. Sampling was successful with the collection of 624 otolith pairs, 163% of the minimum sampling goal of 384. Fish were observed on each trip. This run may have peaked in mid-September, with 2,400 live and 5,500 dead Pinks observed on 9/13/2015. This was the last trip of the season, and the end of the run was not observed.

Extent of the stream surveyed: Johnson Creek was surveyed to its extent location, a large waterfall less than 200 m from the stream mouth. Pink, Sockeye, and Coho Salmon were observed in pools directly above the first set of cascades, but they were not found beyond. Pink Salmon were observed spawning in great abundance throughout the length of the stream.

Unusual events: Some unusual Sockeye with dark and yellow Chum-looking bar marks were observed on our first trip on 8/4/2015. There were also Chum Salmon with greenish Sockeye-looking heads. More typically patterned Sockeye and Chum were also present.
Access, safety, or logistical issues: This stream is easily accessible at both high and low tides. It has a fairly short outwash plain, and just above the mouth gradient ramps up and it becomes a deeply incised bedrock channel. The best processing areas are all in the tidal zone so this stream is best surveyed during low and mid-tides.
Recommendations, changes and other notes: None noted.

Swamp Creek
227-20-17390
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* crew visited Swamp Creek five times from 8/3/2015 to 9/15/2015 to collect Pink and Chum otolith samples. The sample goal for Pink otoliths was met, while the goal for Chum otoliths was not.

Pink- Sampling for Pink Salmon at Swamp Creek was successful with 628 otolith pairs collected, 164% of the 384 minimum sampling goal. This run may have peaked in early-August, when 13,810 live and 1,587 dead Pink Salmon were observed on 8/8/2015. Live fish were observed on each visit. The end of the run was not observed.

Chum- Sampling for Chum Salmon at Swamp Creek was partly successful with only 200 otolith samples collected, 52% of our minimum sampling goal of 384. The peak run may have been in early August, when 118 live and 34 dead Chum Salmon were observed on 8/3/2015.

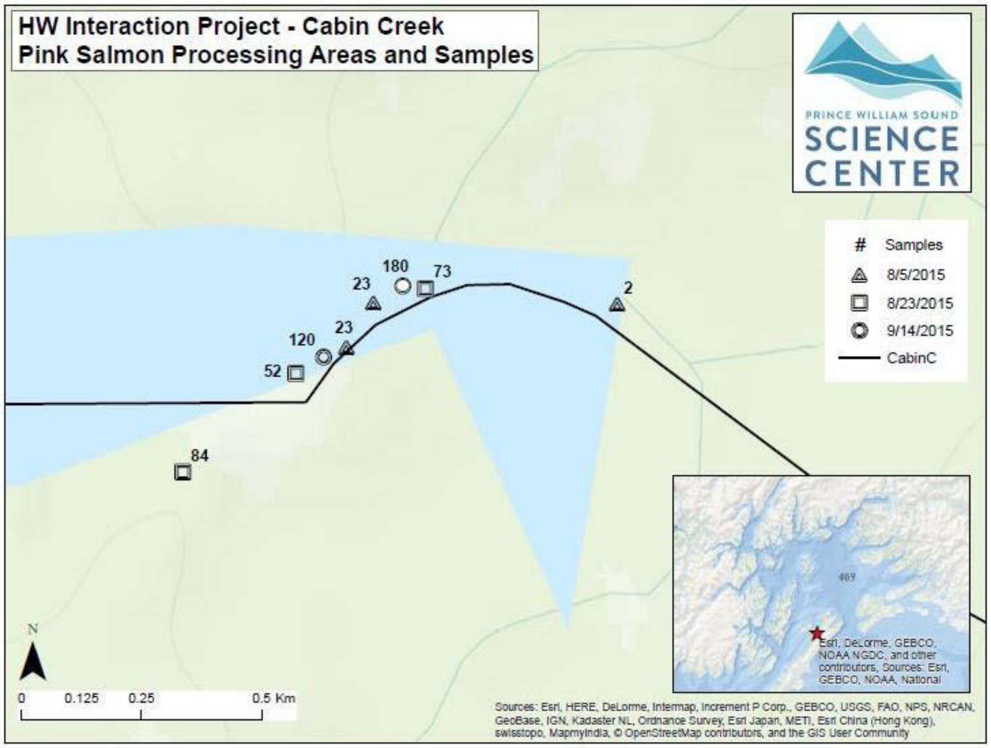
Extent of stream sampled: Swamp Creek was surveyed from the stream mouth to about 800 m upstream. This stream winds through fairly flat terrain at a low gradient with excellent spawning habitat. Extent was not established and no significant increase in gradient above 2% was observed.

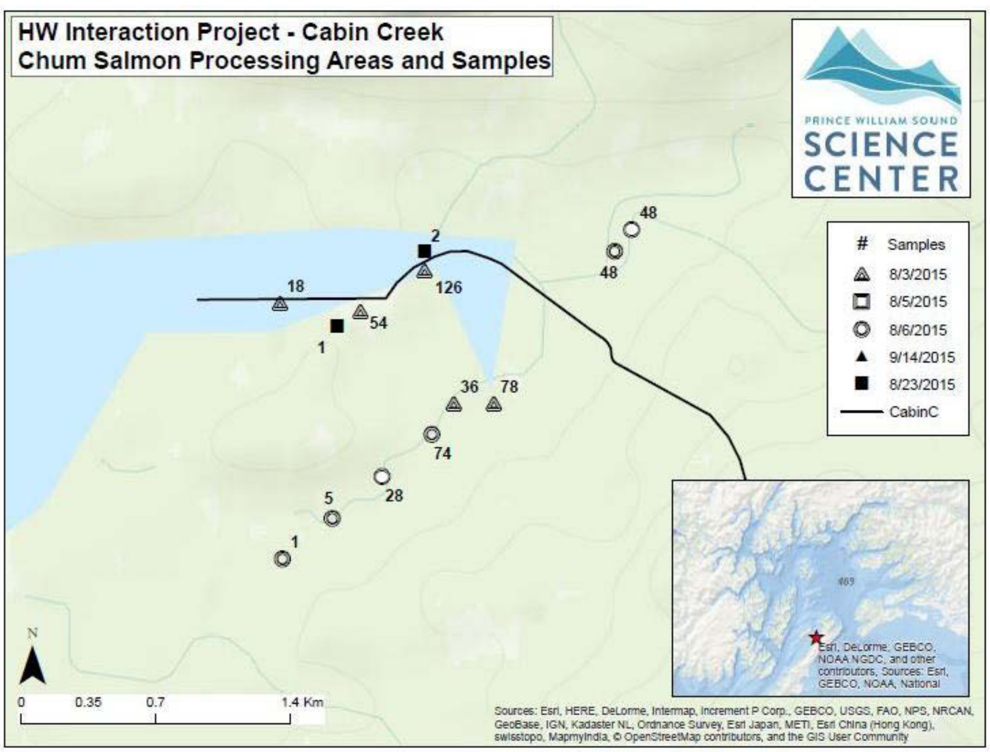
Unusual events: There was a brief encounter with a brown bear on the first visit, but the bear ran away upon seeing the crew. River otters were also present; there were two places where they had dens dug into the bank.

Access, safety, or logistics issues: This stream is easy to access at any tide. The landing is on an unprotected beach and strong winds from the north could make pick-up and drop-off hazardous for the crew and skiff.

Recommendations, changes, and other notes: This is another stream that needs to be visited earlier in the season if we hope to sample sufficient numbers of Chum.

Cabin Creek
227-20-17464
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* and *Auklet* crews visited Cabin Creek five times from 8/3/2015 to 9/14/2015 to collect Pink and Chum otolith samples and Pink DNA samples for ADF&G's stock structure analysis. The sample goals for Pink otoliths, Pink genetic samples and Chum otoliths were all met.

Pink- Sampling for Pink Salmon at Cabin Creek was successful with 557 otolith pairs collected, 145% of our sampling goal of 384. 260 genetic samples for stock structure analysis were also collected, achieving the goal of 260 samples. Live fish were observed with each visit. This run may have peaked in early August, when 5,519 live and 9 dead Pinks were observed on 8/3/2015. All subsequent visits documented slowly declining live numbers and increasing dead numbers. This is unusual when compared with other streams in the study this year - it appears that the fish here showed up in one big push that slowly dwindled. The end of the run was not observed.

Chum- Sampling for Chum Salmon at Cabin Creek was successful with 519 otolith samples collected, 135% of the minimum sampling goal of 384. Live fish were only present during the first three visits to Cabin Creek. This run may have peaked in early-August when 119 live and 810 dead fish were observed on 8/6/2015, the third visit. The run was complete by the next survey on 8/23/2015.

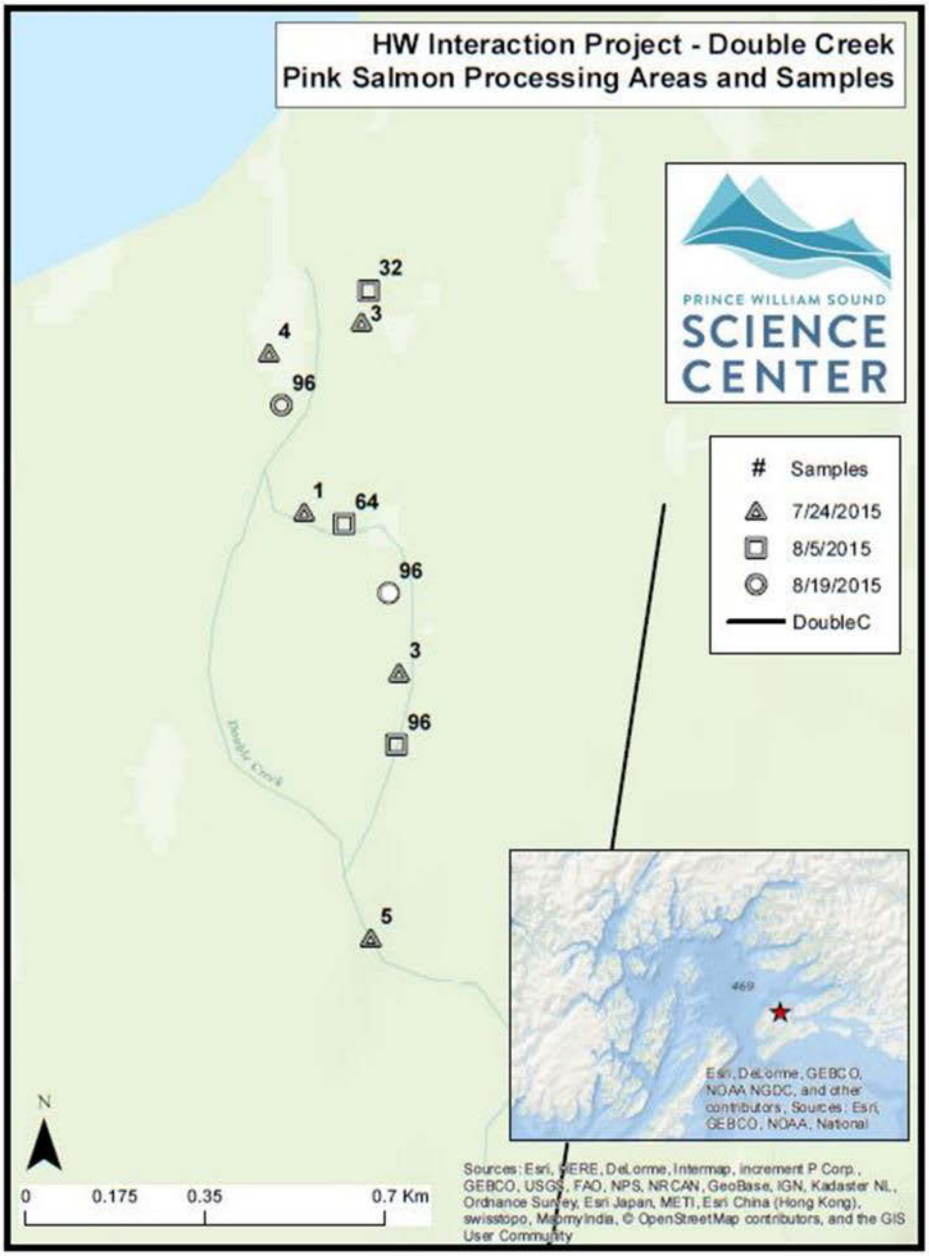
Extent of stream sampled: The *Auklet* crew sampled above the lake in two of the feeder streams for Chum Salmon on 8/3/2015 and 8/6/2015. The *Cathy G* crew did not collect fish from the lake or streams above Cabin Creek. No extent was reached on this stream. Pink Salmon were observed spawning from tidal all the way up to the feeder streams above the lake, but most samples were collected close to the intertidal zone. Chum Salmon were found in the tidal zone and feeder streams early in the season and only in the tidal zone later in the season.

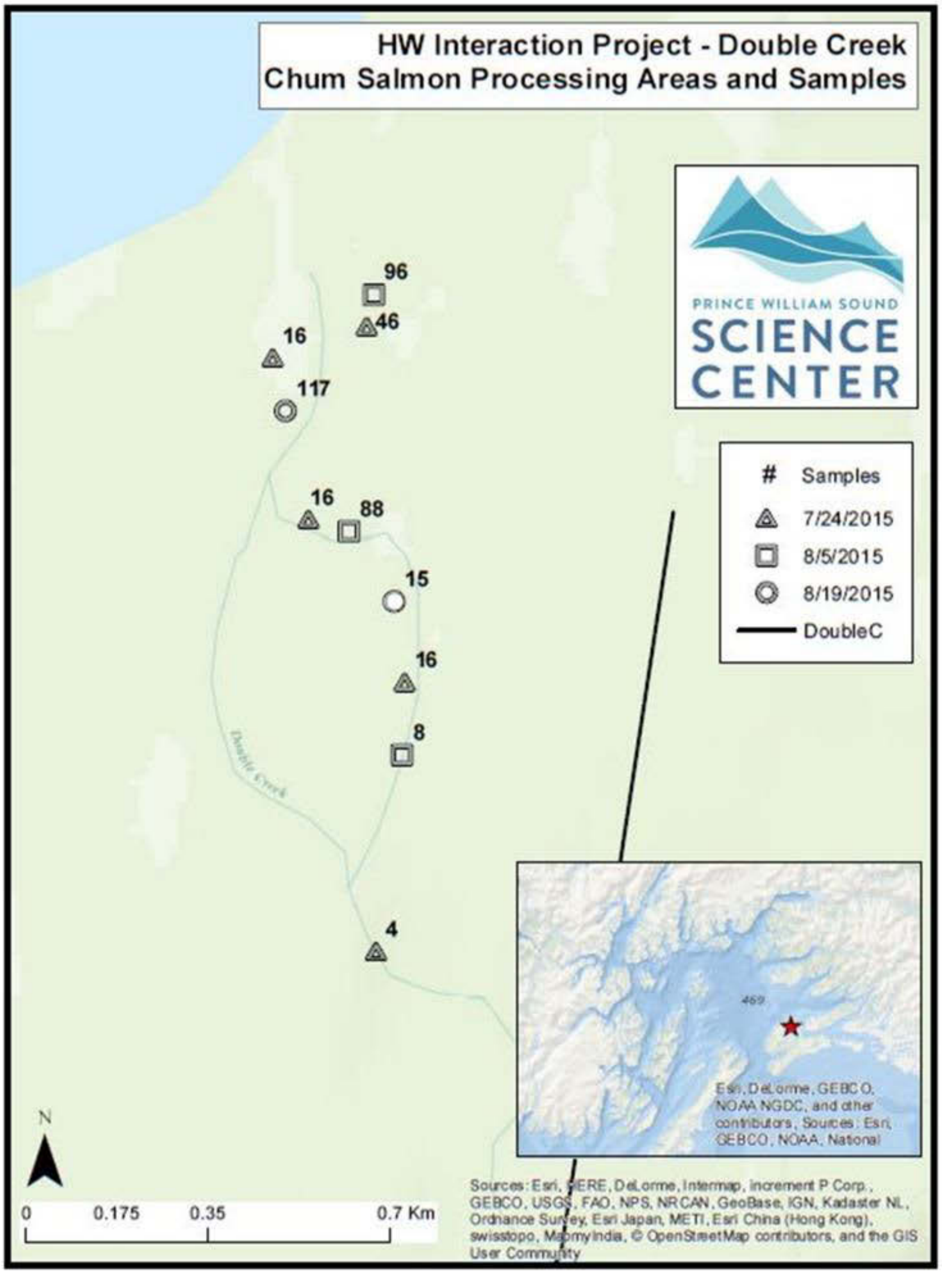
Unusual events: None

Access, safety, or logistics issues: This stream is accessible during all tides. Low and mid tides are best for sampling because it is difficult to find large processing areas far above tidal influence. Cabin is easily hiked and forded, no major safety issues.

Recommendations, changes, and other notes: Stock structure samples were mostly taken from dead Pink-gilled fish and some live fish were collected with the dip-net.

Double Creek
228-40-18310
Pink and Chum Salmon





2015 samples collected and run timing: The local crew visited Double creek three times from 7/24/2015 to 8/19/2015 to collect Pink and Chum otoliths. Sampling for Pink Salmon was successful with 400 otolith pairs collected, 104% of the minimum sampling goal of 384. Likewise, sampling for Chum was successful with 422 otolith pairs collected, 110% of our sampling goal of 384.

Pink- Pink Salmon were observed on each visit. They were most numerous on 7/24/2015 with about 11,000 live fish and 16 dead. The peak run was sometime after this date. On 8/5/2015 there were 6,700 live and 3,451 dead Pinks, the majority of the dead were bright and pre-spawned.

Live numbers held steady around 6,000 for the last two visits. The end of the run was not observed.

Chum- Chum Salmon, while not as numerous as Pinks, had a significant and steady presence in Double Creek. There were over 150 fish during all three visits with a high of 441 live and 321 dead observed on 8/5/2015.

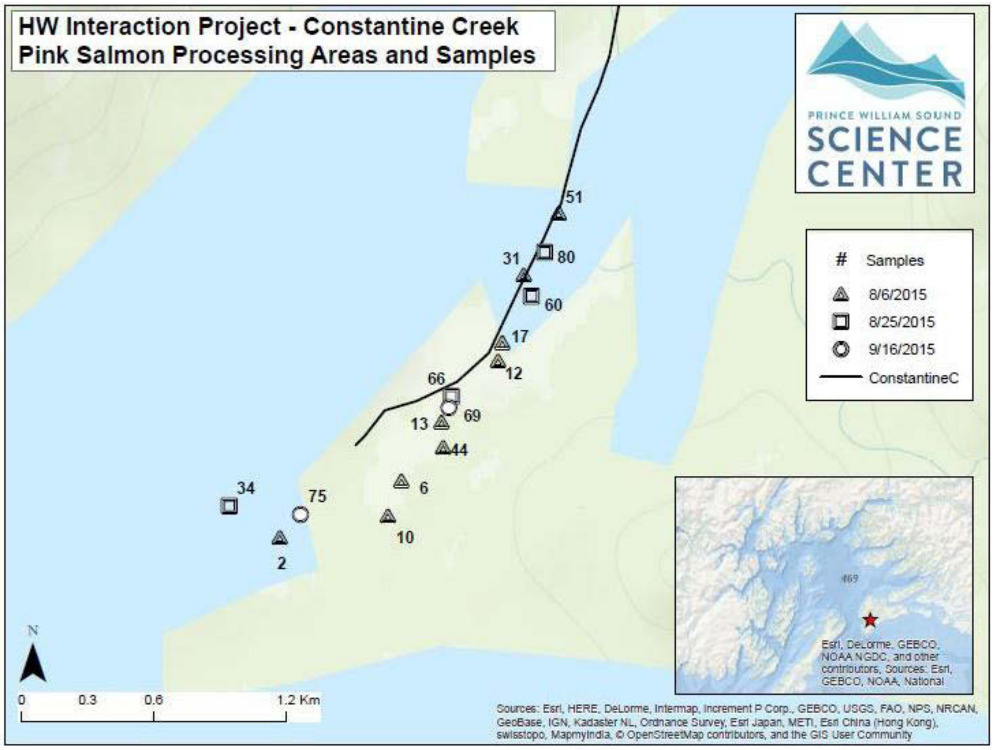
Extent of stream sampled: Double Creek's longest survey was about 1,700 m upstream where the stream pools at a sharp bend against a rock-face. Ninety percent of the surveyed stream is well graveled spawning substrate with a mellow gradient that continued past the furthest observed point. The extent was not determined. Fish gathered in deep pools early in the season.

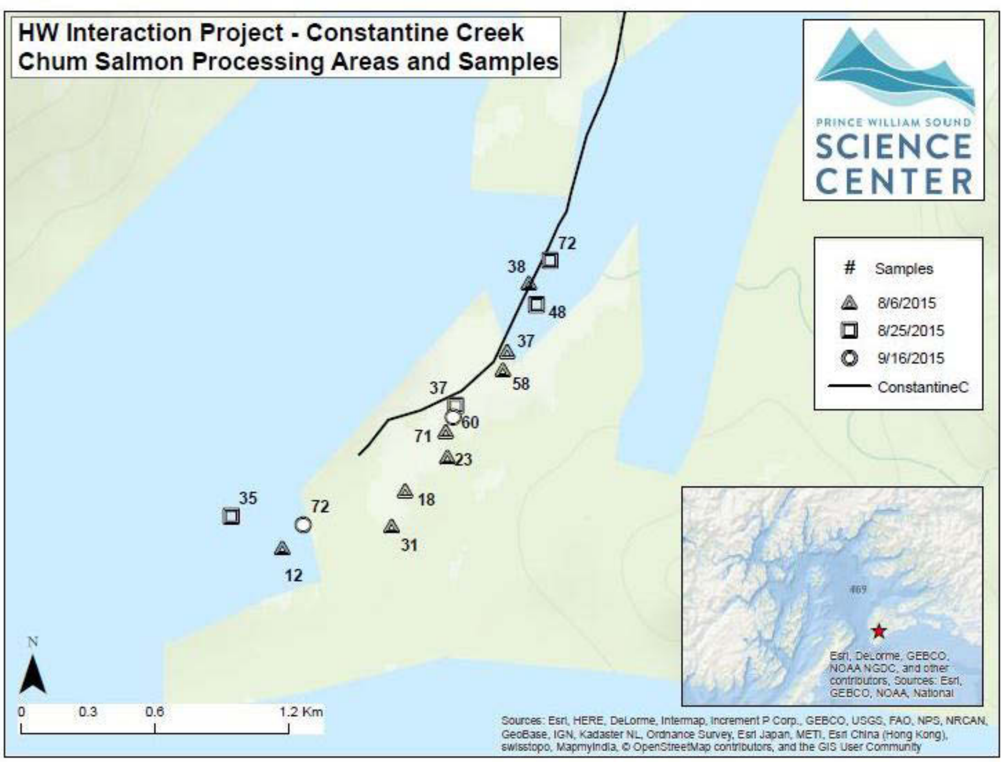
Unusual events: A large die-off of bright pre-spawn Pinks occurred on 8/5/2015.

Access, safety, or logistics issues: This creek flows into a shallow lagoon that can be tricky to navigate at any tide, especially low tide. There were many bear tracks but no encounters.

Recommendations, changes, and other notes: This year had a strong run in the beginning of August that lasted through September, a generous amount of time to sample.

Constantine Creek
228-60-18150
Pink and Chum Salmon





2015 samples collected and run timing: The *Cathy G* crew visited Constantine three times from 8/6/2015 to 9/16/2015 to collect Pink and Chum otolith samples and Pink tissues for stock structure analysis. The minimum sampling goals for Pink otolith and stock structure analysis were met, as was the minimum sampling goal for Chum otoliths.

Pinks- Sampling for Pink otoliths was successful, with 570 otolith pairs collected, 148% of the sampling goal of 384. Sampling Pink Salmon for stock structure was not fully successful, with 248 samples collected, which only approached the goal of 260 samples requested. This run may have peaked in late August, with an estimated 4,852 live and 1,190 dead Pinks observed on 8/25/2015. Live fish were observed on each visit. The end of this run was not observed. Live fish and dead pink-gilled fish were sampled for DNA, live fish were taken with the seine and dip-net.

Chum- Chum sampling was successful, with 612 otolith pairs collected, 159% of the minimum sampling goal of 384. This run peaked slowly throughout the month of August with 346 live and 500 dead observed on 8/6/2015, and then 330 live and 1,250 dead observed on 8/25/2015. By our final trip on 9/16/2015 there were no live Chum Salmon, this run was over by mid-September.

Extent of the stream surveyed: Constantine Creek was never surveyed above the tidal zone due to time constraints. The extent location was not determined. Chums and Pinks are present throughout the tidal area.

Unusual events: Saw a brown bear on 9/16/2015 bear from a distance on our last visit but it quickly moved off.

Access, safety, or logistical issues: This stream is located deep within shallow, muddy Constantine Harbor and is a difficult pick-up and drop-off. During low tides crew must be dropped off about 800 m from the stream mouth, but at higher tides a skiff can travel upstream 100 m or more. If there are high seas in Hinchinbrook Entrance, it is possible for stream crews to be weathered out and unable to enter or leave the study site.

Recommendations, changes and other notes: Scheduling for this stream should take weather into account, as safe access to this stream is largely dependent on seas and wind conditions.

INTERACTIONS OF WILD AND HATCHERY PINK SALMON AND CHUM SALMON IN PRINCE WILLIAM SOUND AND SOUTHEAST ALASKA

Final Progress Report for 2015

For Alaska Department of Fish and Game
Contract IHP-13-013

Volume 4

APPENDIX I. SEAK CHUM SALMON SURVEY SUMMARY BY STREAM AND DATE

APPENDIX J. SEAK STREAM SUMMARIES

APPENDIX I. SEAK CHUM SALMON SURVEY SUMMARY BY STREAM AND DATE

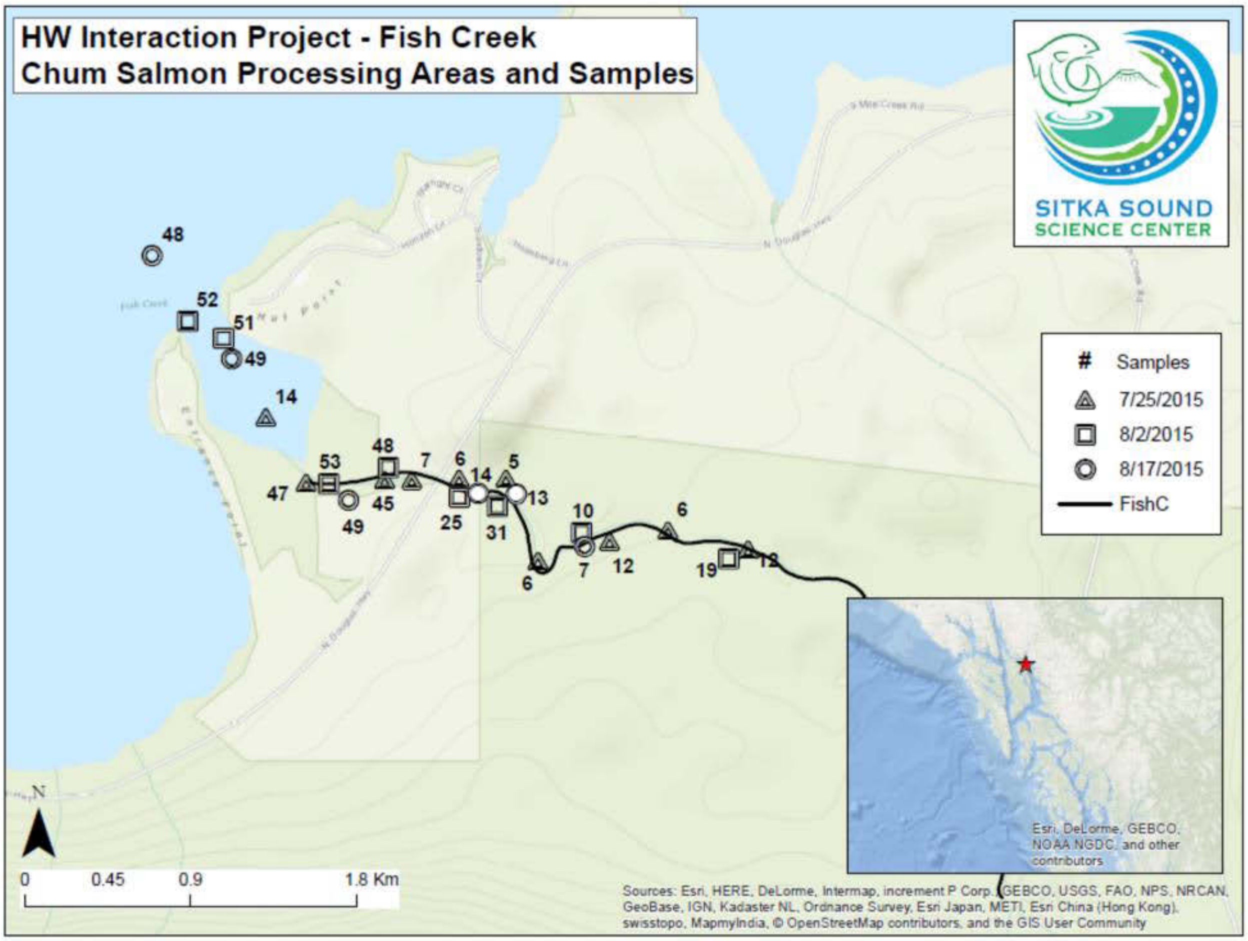
Stream Name	Visit date	Samples collected	Alive count	Dead count
Admiralty Creek	7/31/2015	29	111	11
Admiralty Creek	8/8/2015	140	125	125
Admiralty Creek	8/19/2015	32	4	39
Carroll Creek	8/14/2015	288	162	322
Carroll Creek	8/25/2015	192	109	356
Chaik Bay Creek	7/25/2015	1	184	0
Chaik Bay Creek	8/6/2015	30	769	6
Chaik Bay Creek	8/22/2015	36	N/A	N/A
Chaik Bay Creek	9/2/2015	336	42	361
Chuck River	7/27/2015	0	N/A	N/A
Chuck River	7/30/2015	28	51	15
Chuck River	8/10/2015	125	73	127
East of Snug Cove*	7/30/2015	0	83	1
East of Snug Cove*	8/10/2015	153	186	97
East of Snug Cove*	8/22/2015	196	55	206
Fish Creek	7/25/2015	160	874	59
Fish Creek	8/2/2015	285	790	361
Fish Creek	8/17/2015	180	104	651
Ford Arm Creek	8/16/2015	300	298	385
Ford Arm Creek	8/26/2015	187	158	326
Freshwater Creek	7/27/2015	4	107	2
Freshwater Creek	8/5/2015	40	115	25
Freshwater Creek	8/14/2015	50	108	47
Freshwater Creek	8/16/2015	40	13	39
Game Creek	7/26/2015	3	812	2
Game Creek	8/4/2015	89	927	89
Game Creek	8/6/2015	253	275	275
Game Creek	8/15/2015	155	1016	377
Glen Creek	7/29/2015	0	0	0
Glen Creek	8/11/2015	5	4	4
Greens Creek	7/28/2015	62	84	15
Greens Creek	8/3/2015	103	93	88
Greens Creek	8/7/2015	96	50	145
Harding River	8/13/2015	54	N/A	N/A
Harding River	8/27/2015	38	10	41

Hidden Inlet*	8/11/2015	217	752	231
Hidden Inlet*	8/21/2015	192	N/A	268
Johnston Creek	7/29/2015	0	244	1
Johnston Creek	8/8/2015	196	640	178
Johnston Creek	8/21/2015	307	166	320
Kadashan River	7/24/2015	0	28	0
Kadashan River	8/1/2015	0	41	0
Kadashan River	8/12/2015	0	N/A	N/A
Kadashan River	9/1/2015	5	23	5
King Creek	8/7/2015	120	557	87
King Creek	8/19/2015	288	91	310
King Creek	8/29/2015	13	6	16
King Salmon River	7/24/2015	0	N/A	N/A
King Salmon River	7/26/2015	96	89	97
King Salmon River	8/1/2015	74	38	80
King Salmon River	8/4/2015	141	250	100
Little Goose Creek	7/29/2015	1	N/A	N/A
Little Goose Creek	8/8/2015	6	32	9
Little Goose Creek	8/21/2015	7	8	9
Marten River	8/9/2015	173	284	137
Marten River	8/10/2015	228	65	219
Marten River	8/21/2015	192	11	203
North Arm Creek	7/28/2015	3	52	3
North Arm Creek	8/3/2015	72	229	56
North Arm Creek	8/16/2015	288	111	284
Petrof Bay W Head*	8/20/2015	102	238	117
Petrof Bay W Head*	8/29/2015	300	389	331
Prospect Creek	8/1/2015	15	30	5
Prospect Creek	8/9/2015	75	141	61
Prospect Creek	8/20/2015	21	11	22
Ralphs Creek	7/23/2015	96	247	104
Ralphs Creek	7/27/2015	137	210	313
Ralphs Creek	8/2/2015	209	113	285
Rodman Creek	8/3/2015	65	791	49
Rodman Creek	8/17/2015	196	306	267
Rodman Creek	8/18/2015	5	N/A	N/A
Rodman Creek	8/27/2015	119	0	127
Saginaw Bay S Head*	8/11/2015	12	115	5
Saginaw Bay S Head*	8/19/2015	19	55	20
Saginaw Bay S Head*	8/30/2015	4	N/A	N/A
Saginaw Bay S Head*	8/31/2015	0	0	0

Sawmill Creek (SSSC ONLY)	7/24/2015	37	81	57
Sawmill Creek (SSSC ONLY)	7/29/2015	36	54	27
Seal Bay Head*	7/26/2015	34	241	0
Seal Bay Head*	8/5/2015	64	84	66
Seal Bay Head*	8/20/2015	86	167	88
Seal Bay Head*	8/26/2015	143	127	154
Sister Lake SE Head*	8/15/2015	315	1300	1095
Sister Lake SE Head*	8/25/2015	198	124	400
Swan Cove Creek	7/24/2015	4	4	3
Swan Cove Creek	7/25/2015	63	191	36
Swan Cove Creek	7/31/2015	35	N/A	N/A
Swan Cove Creek	8/9/2015	232	57	241
Ushk Bay W End*	8/13/2015	13	91	12
Ushk Bay W End*	8/25/2015	88	78	78
Ushk Bay W End*	9/1/2015	151	79	153
W Crawfish NE Arm Hd*	8/20/2015	243	250	270
W Crawfish NE Arm Hd*	8/28/2015	333	151	278
Whitewater Creek	7/26/2015	0	259	0
Whitewater Creek	8/7/2015	41	377	41
Whitewater Creek	8/21/2015	352	119	351

APPENDIX J. SOUTHEAST ALASKA STREAM SUMMARIES

Fish Creek (Douglas Island)
111-50-10690
Chum Salmon



Number of Visits: 3
Total Number Sampled: 625

2015 Samples Collected & Run timing: There were large numbers of chum present on every visit but most dead fish were seen in mid-August. During the first visit on 7/25, over 90% of fish in the stream were live and the crew collected 160 samples. By the second visit on 8/02 there were more dead fish and we were able to collect 285. The final visit was on 8/17, the vast majority of chums were dead and we collected 180 samples.

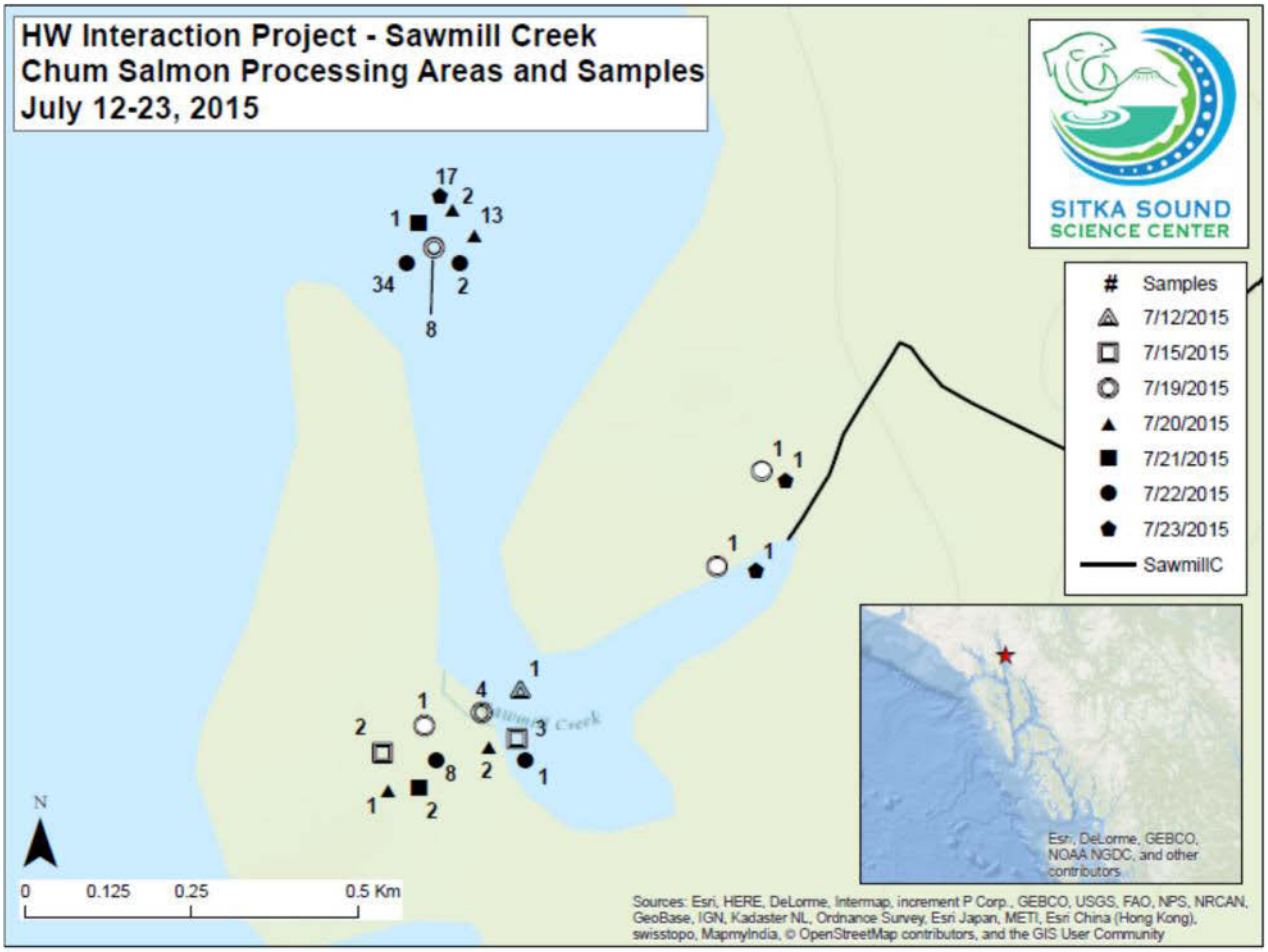
Extent of stream surveyed: The crew maintained a process of sampling from the mouth up to the foot bridge, and then at various locations from the highest spawning areas back down. The uppermost extent of the stream surveyed was the large gravel area nicknamed "Valhalla" 58.3266536, -134.5697708 which has proven to be the extent of spawning in the past.

Unusual events: Chinook were present along stream but in fewer numbers than seen in 2014.

Access, safety, or logistics issues: The majority of samples come from the section of stream between the foot bridge and tide flats, where fish numbers are much more abundant. It is difficult to get an accurate stream sample distribution in a single day visit due to large numbers of fish.

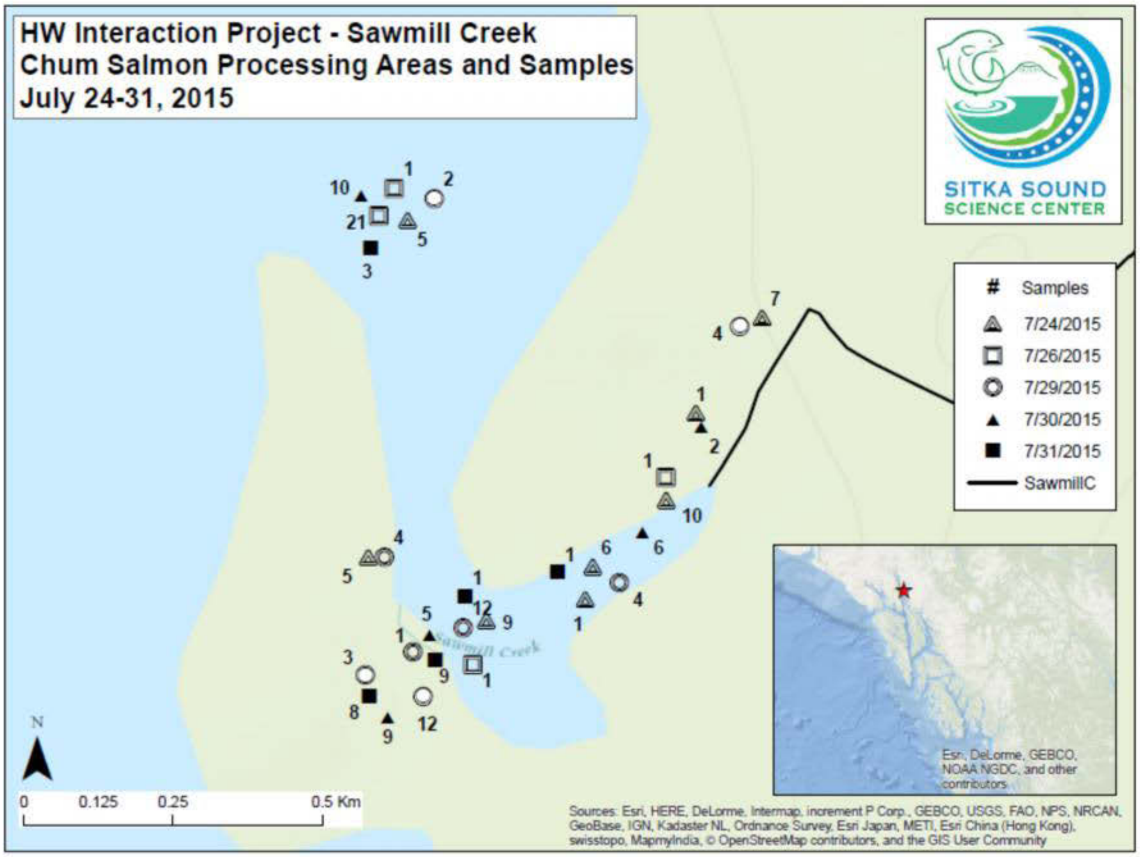
Recommendations, changes, and other notes: If we maintain an "otolith only" approach on Fish Cr, 2-day visits should be scheduled in order to better survey the stream.

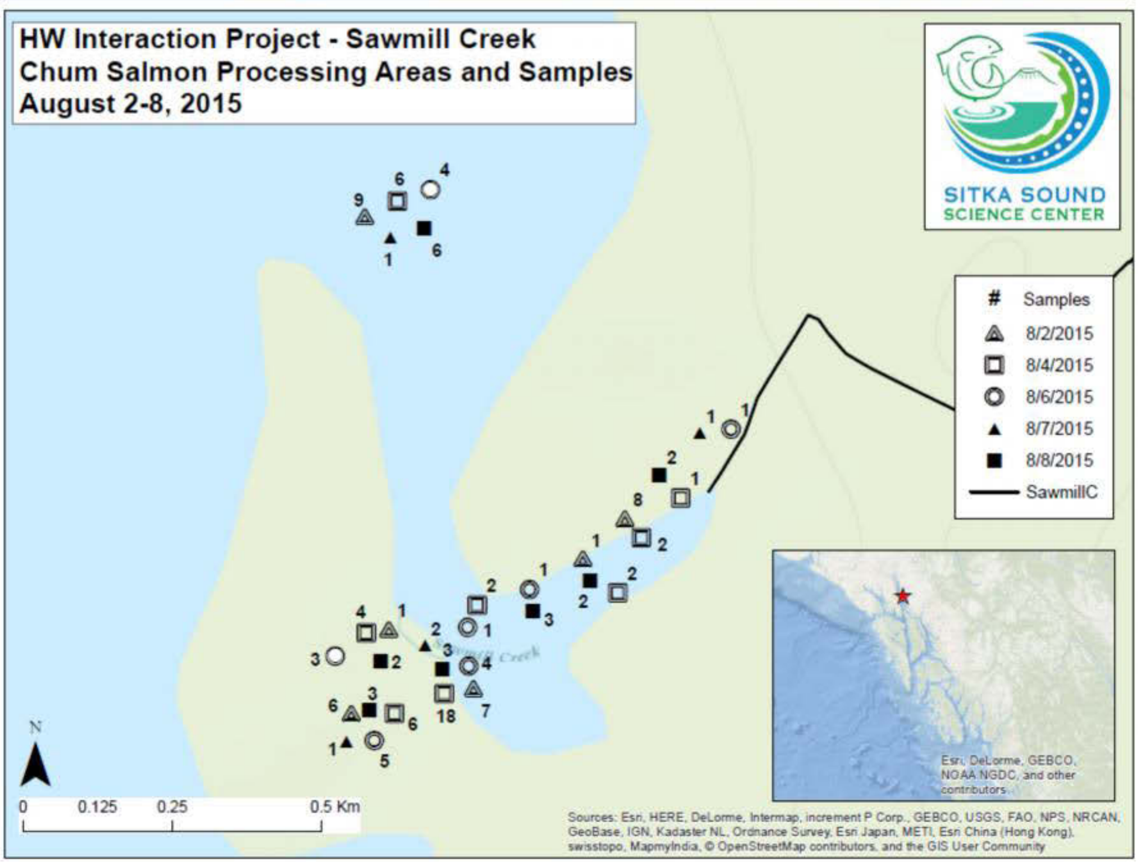
Sawmill Creek
115-20-10520
Chum Salmon

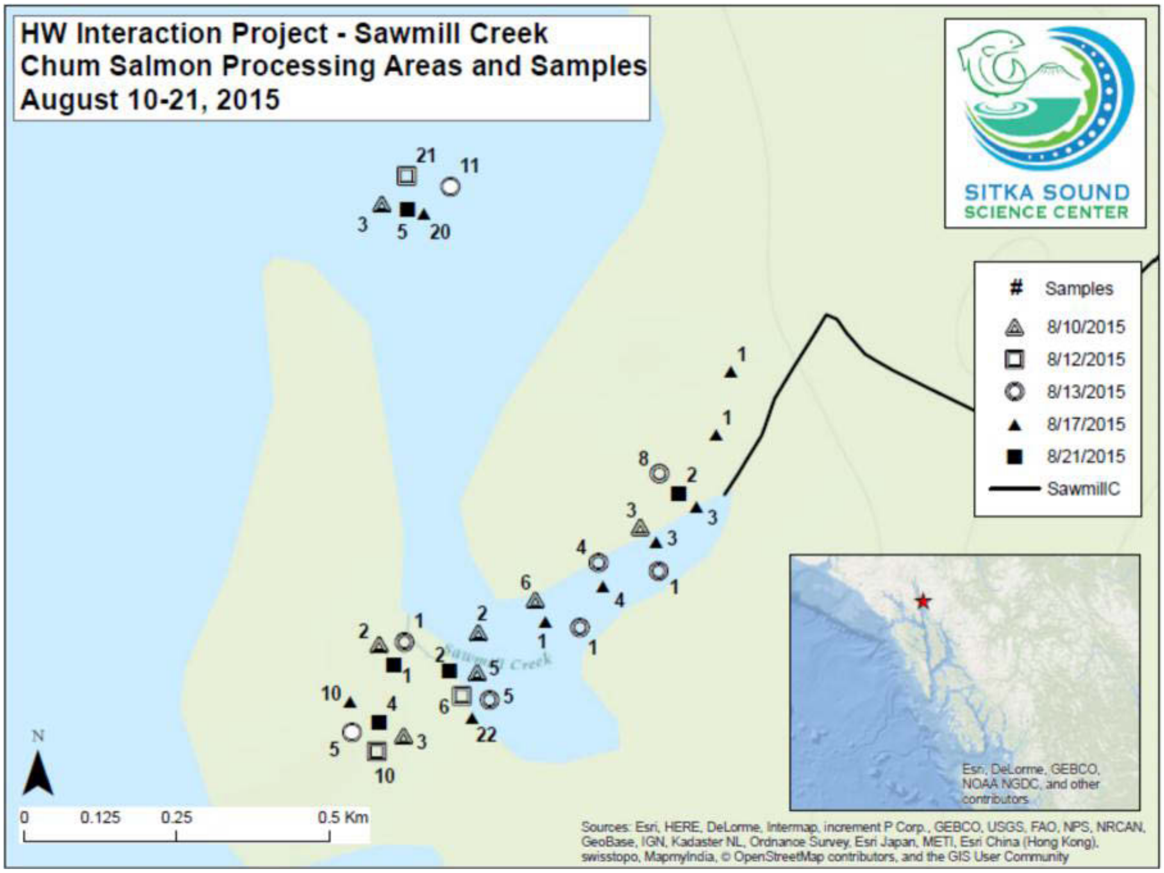


Number of Visits by SSSC crew: 2
Total Number Sampled: 563

2015 Samples Collected & Run timing: SSSC crews sampled Sawmill Creek a total of 2 times in 2015 where we collected a total of 73 samples. The bulk of the total samples came from Casey McConnell, a graduate student at the University of Alaska Southeast who was conducting otolith and stress studies on the Sawmill Creek chum salmon population. Our first visit was on 7/24, where we collected 37 samples and first met with Casey. We returned for a second visit on 7/29 to help him sample. On this visit we collected a total of 36 samples from dead fish that were not eligible for Casey's study. After this visit, Casey maintained a nearly daily presence on the creek. By the end of the season, his total sample size was 490, which in combination with ours totals 563.


HW Interaction Project - Sawmill Creek
Chum Salmon Processing Areas and Samples
July 24-31, 2015
SITKA SOUND SCIENCE CENTER
Samples
7/24/2015
7/26/2015
7/29/2015
7/30/2015
7/31/2015
SawmillC
Sawmill Creek
N
0 0.125 0.25 0.5 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community


HW Interaction Project - Sawmill Creek
Chum Salmon Processing Areas and Samples
August 2-8, 2015
SITKA SOUND SCIENCE CENTER
Samples
8/2/2015
8/4/2015
8/6/2015
8/7/2015
8/8/2015
SawmillC
Sawmill Creek
N
0 0.125 0.25 0.5 Km
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



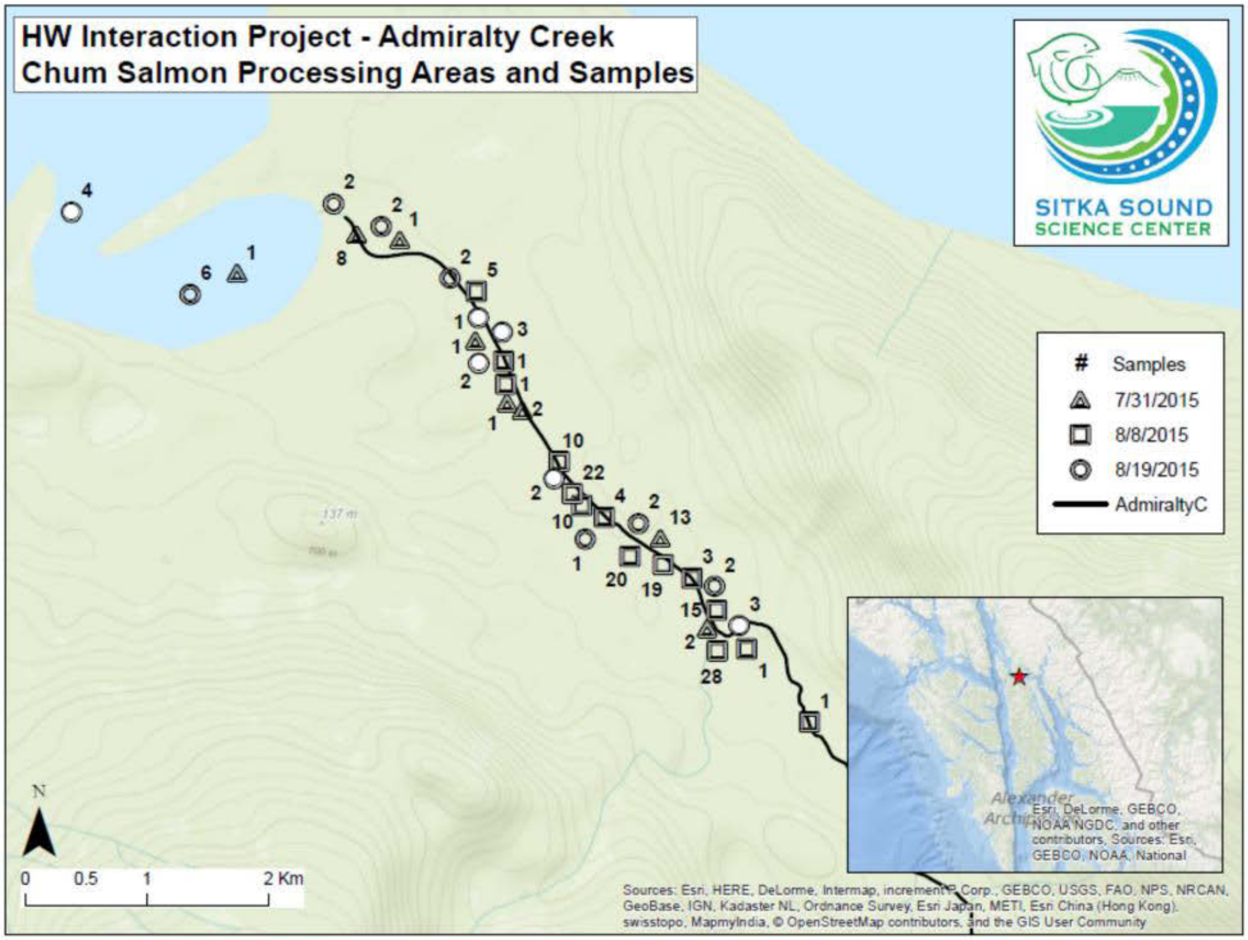
Extent of stream surveyed: The stream was surveyed from low tide on multiple visits. The highest extent surveyed was the waterfall 58.71667, -134.93874.

Unusual events: None

Access, safety, or logistics issues: None

Recommendations, changes, and other notes: In 2014, while in transit to Sawmill Creek from Echo Cove, the crew reported running aground on a -4 tide. Future crews should stick to the mainland side of the channel during minus tides, and move slowly. Have surveys on stream aware of other help involved as well as protocol for live/dead counts when other samplers present.

Admiralty Creek
111-41-10050
Chum Salmon



Number of Visits: 3
Total Number Sampled: 201

2015 Samples Collected & Run timing: We sampled Admiralty on 7/31, 8/8, and 8/19. The first visit was not very productive with just 29 samples. During the second visit the crew sampled 140 and observed a peak count of 125 live and 125 dead. A high water event occurred just before the third visit, which affected live/dead counts and sample numbers. Fewer chum salmon were observed during this visit and the crew was only able to collect 32 samples.

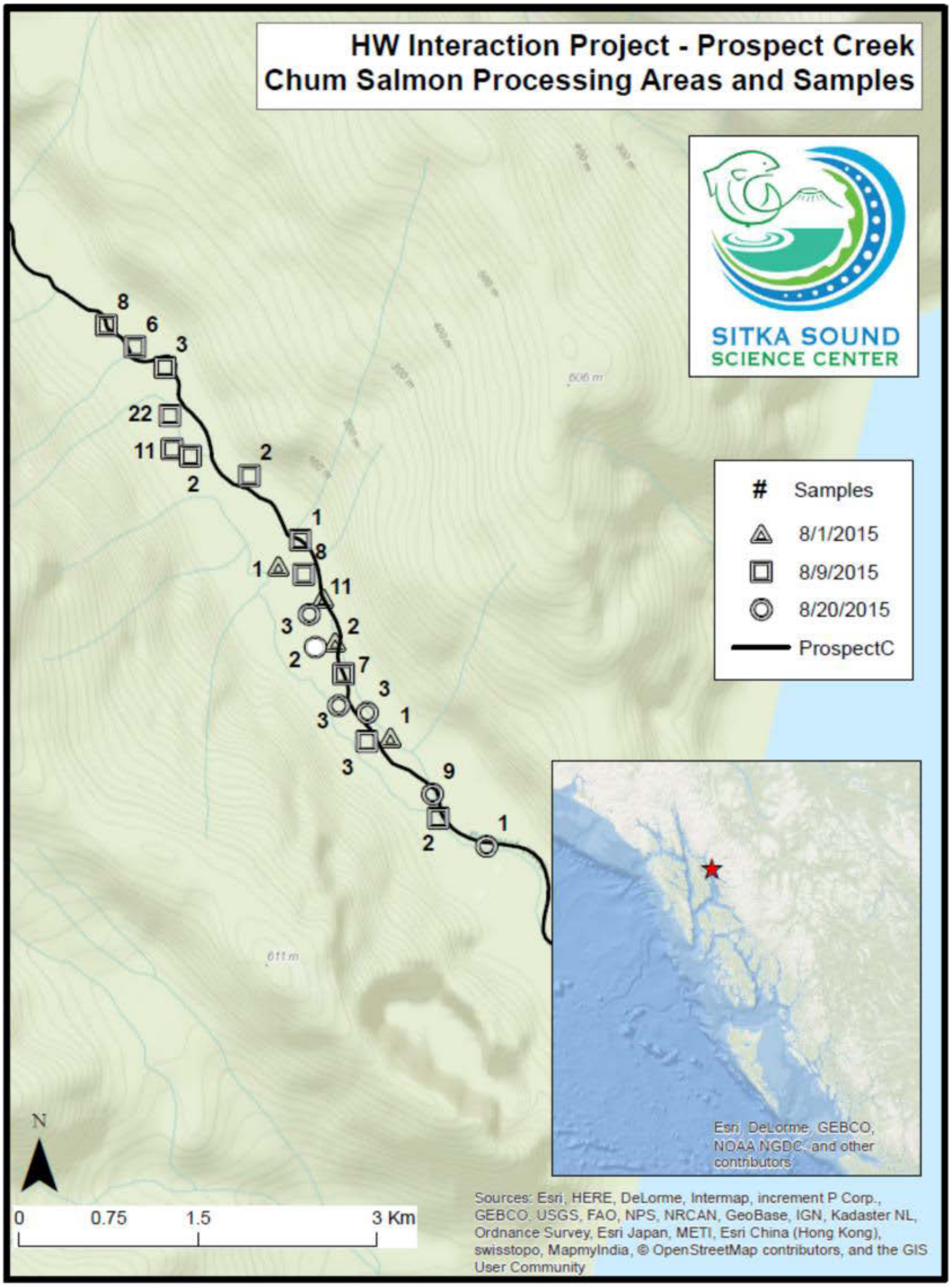
Extent of stream surveyed: The highest survey point was roughly 4.25 miles upstream from mouth 58.14854747, -134.5153638. No chums were ever observed within a 20 minute walk downstream of this location. Much of the substrate in the upper portion is not conducive to chum spawning. Very few chums were ever found in the intertidal sections of the creek either, but the flats were surveyed on multiple occasions.

Unusual events: The crew reported that a small side channel had productive chum numbers during the second visit only. A high water flushed the fish out of this area before the final visit.

Access, safety, or logistics issues: There is a USFS trail running along the east side of the creek, which provides easy access. The crew was usually dropped off at this trail head where they hiked to the upper extent, roughly 1.25 hours of hiking. Once above the fish, the crew would then sample downstream. During extended heavy rain events the creek becomes swift and impassable. Visibility is greatly reduced and most pools become impossible to see into or collect samples.

Recommendations, changes, and other notes: Admiralty Creek is characterized by many braided channels, large woody debris, and undercut banks throughout the upper sections where the creek runs through an old growth forest. Here chum visibility is limited.

Prospect Creek
111-33-10100
Chum Salmon



Number of Visits: 3
Total Number Sampled: 111

2015 Samples Collected & Run timing: We sampled Prospect Creek on 8/1, 8/9, and 8/20. High water prevented us from surveying most of the stream on 8/1 and 8/20. The peak count was observed on 8/9 where the crew counted 141 live and 61 dead chum. The visit on 8/20 was great timing, however high water flushed many of these fish out and prevented the crew from reaching the upper extends of the stream.

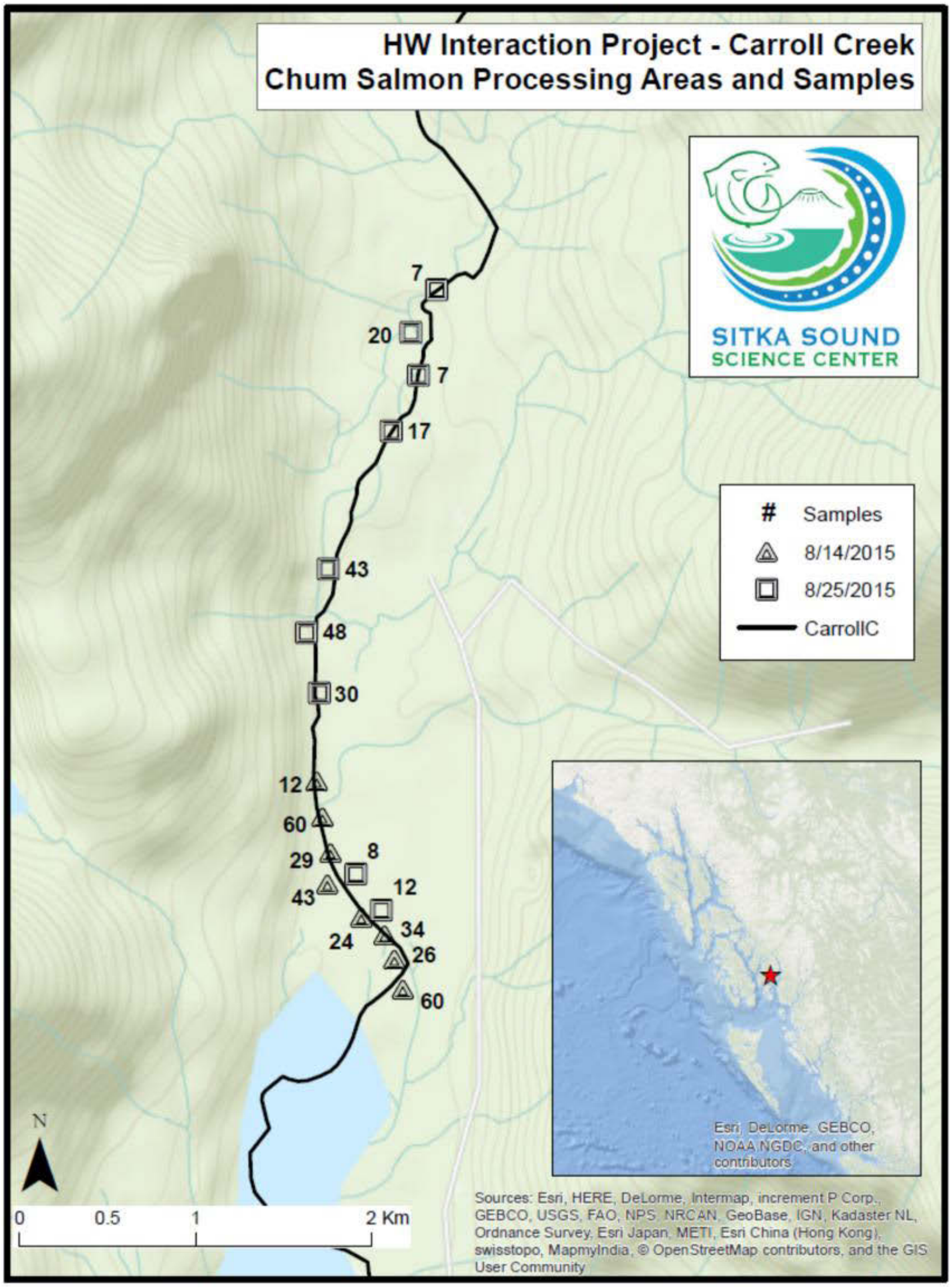
Extent of stream surveyed: The highest survey point in 2015 was approximately 2.5 miles upstream from the mouth of the creek 58.07543, -133.85381.

Unusual events: none reported

Access, safety, or logistics issues: During heavy rain events, Prospect creek rises quickly, and becomes difficult and dangerous to hike. During the heaviest rain events, sampling the majority of the upper creek is not feasible due to murky water conditions and dangerous flow level. On one visit in 2015, the creek was observed to rise well over a foot in a matter of an hour. It is still possible to sample from the lowest sections of the creek, even during the highest water conditions, although snagging is more challenging.

Recommendations, changes, and other notes: Prospect Creek is characterized by multiple long riffle and pool sections. There are numerous gravel bars and the stream is flanked by alders in most of the upper reaches. There is one small section of the stream that has fast moving rapids that can be treacherous to hike, therefore our crew created a bypass trail in the woods to the east of the stream.

Carroll Creek
101-45-10780
Chum Salmon



Number of Visits: 2

Total Number Sampled: 480

2015 Samples Collected & Run timing: Carroll Creek was visited on 8/14 and 8/25. During the visit on 8/14 we counted 162 live chums and 322 dead, collecting 288 samples. On 8/25 we counted 109 live and 356 dead and collected 192 samples. These visits encompassed the run well and with such a strong run the crew easily exceeded the target goal with 480 total samples in just 2 visits.

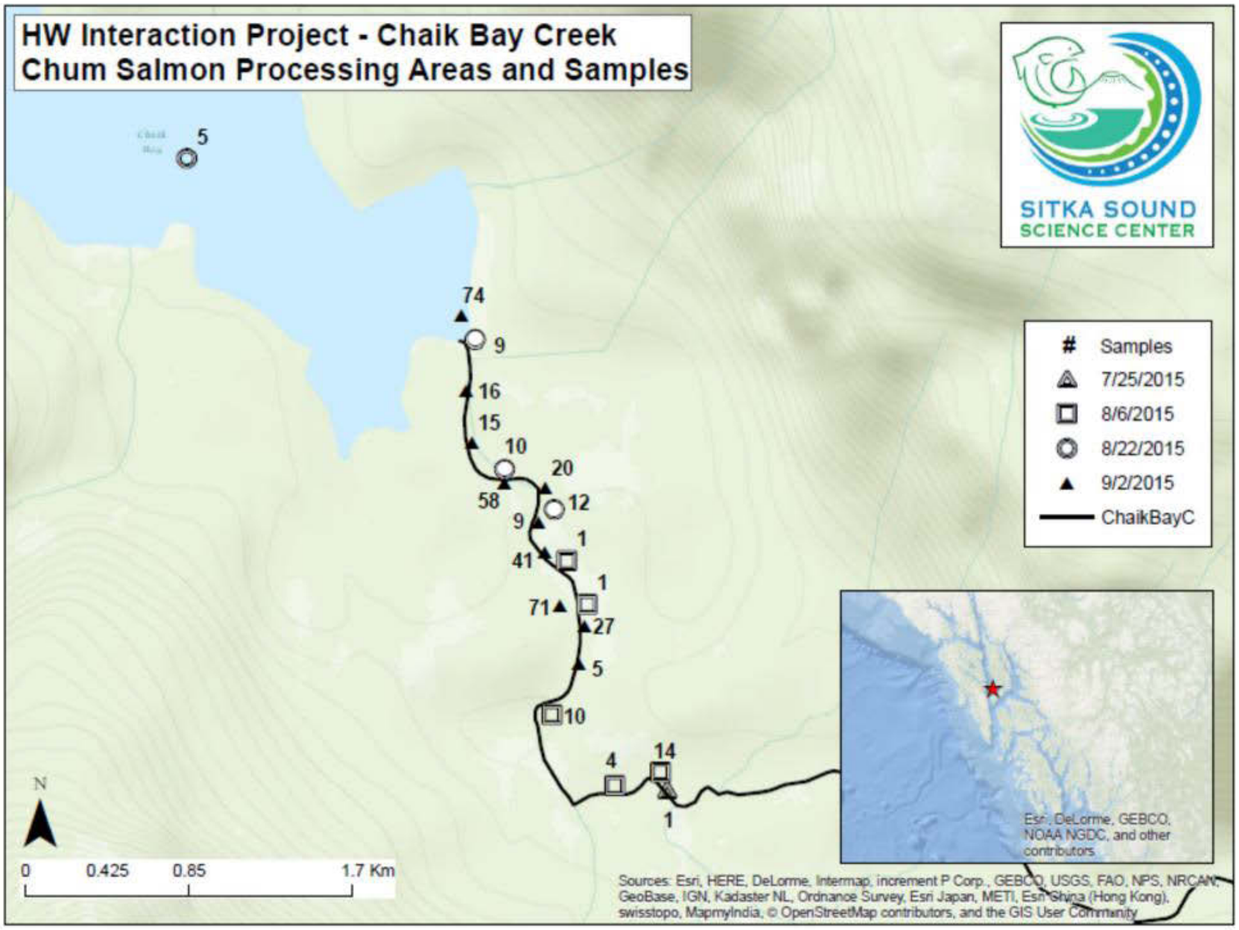
Extent of stream surveyed: We surveyed approximately 3.5 miles of stream, from the tide flat up to where the stream became braided and few fish were seen 55.67220073, -131.3532226.

Unusual events: None reported

Access, safety, or logistics issues: None reported

Recommendations, changes, and other notes: We sampled this stream with the use of the jet boat to get across the tide flat. At low tide navigating the lower stretches of this creek can be tough but by mid tide you can easily jet boat up to where chums are actively spawning.

Chaik Bay Creek
112-80-10280
Chum Salmon



Number of Visits: 4
Total Number Sampled: 403

2015 Samples Collected & Run timing: The first visit on 7/25 was early. Only 184 bright chum were seen on this survey, many in the lower stretches and large pools. Very few new redds were observed. When the crew returned on 8/6, 769 live chum were observed and all but 2 samples came from live chum. Many bright chums were seen holding in the intertidal zone on this visit. On the third visit on 8/22 the creek was flooding and murky. We surveyed through the intertidal and grass flats, up through the first few log jams before turning around. No live/dead count was conducted because of the poor visibility and high water, but still some live chums were seen. A separate crew visited Chaik a 4th time on 9/3 and counted 42 live and 361 dead chums, collecting 336 samples.

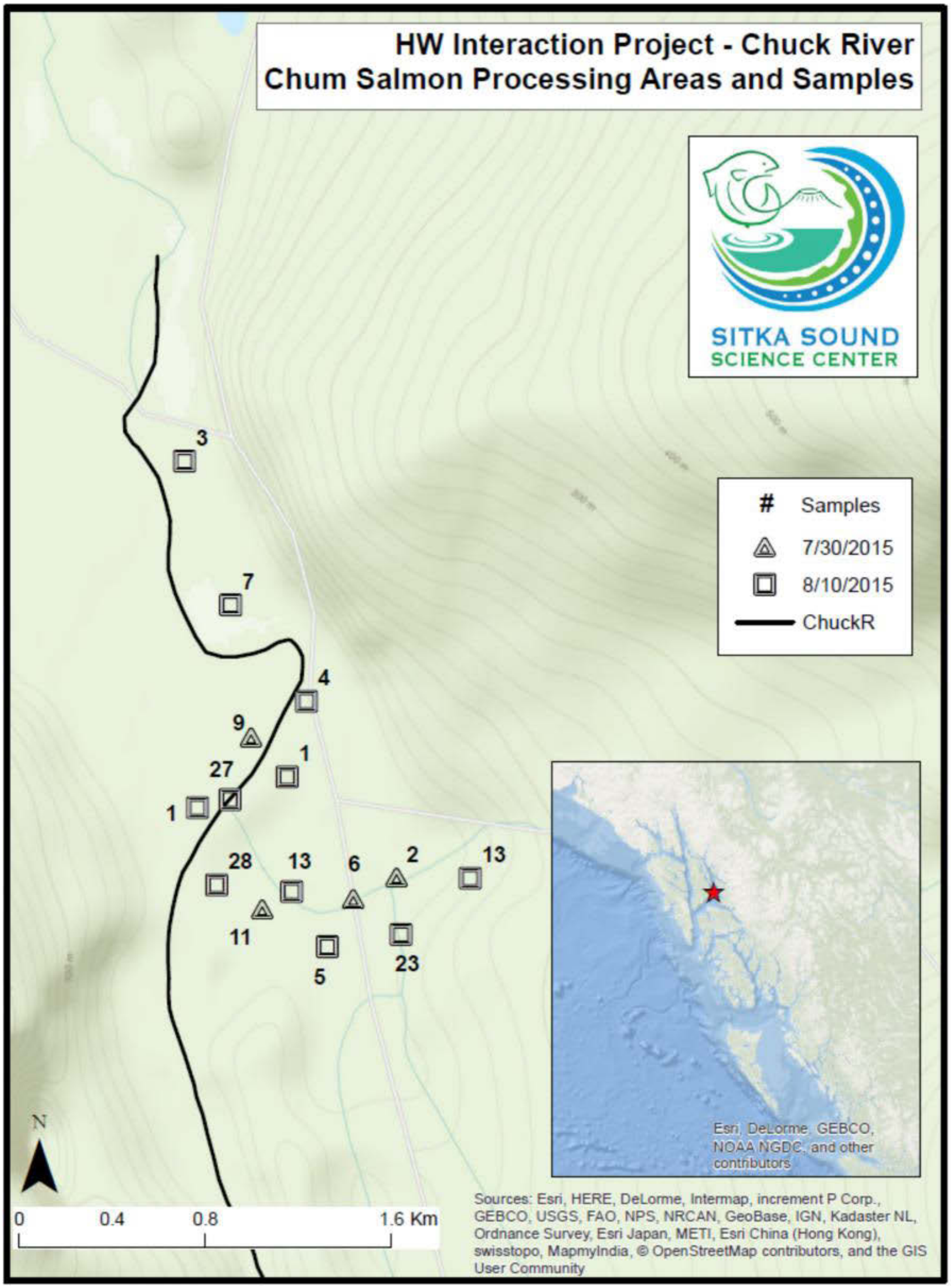
Extent of stream surveyed: Crews surveyed roughly 2.75 miles above the tree line of the stream, at that point where both forks become braided and brushy. The highest point surveyed was 57.29271221, -134.4233196.

Unusual events: None reported

Access, safety, or logistics issues: Chaik has a large tide flat. If a drop-off cannot be arranged, it is best to schedule your survey so that you can go in and come out on a 10' or higher tide. This allows you to avoid walking the 2 mile tide flat or skirting sloughs and down trees at a very high tide. The skiffs can be anchored in the channel of the stream.

Recommendations, changes, and other notes: The stream itself is fairly easy to negotiate, aside from multiple log jams.

Chuck River
110-32-10090
Chum Salmon



Number of Visits: 3

Total Number Sampled: 153

2015 Samples Collected & Run timing: The first visit on 7/27 was during a high water event and the crew was unsuccessful in sampling. High water occurred again on 7/30, but with the river dropping the crew was able to conduct sampling in late afternoon. Only 51 live chums and 15 dead were seen. The final visit was on 8/10 during which 73 live and 127 chum salmon were observed. All samples came from the main stem below Sylvia Creek (a major tributary), or Sylvia Creek itself.

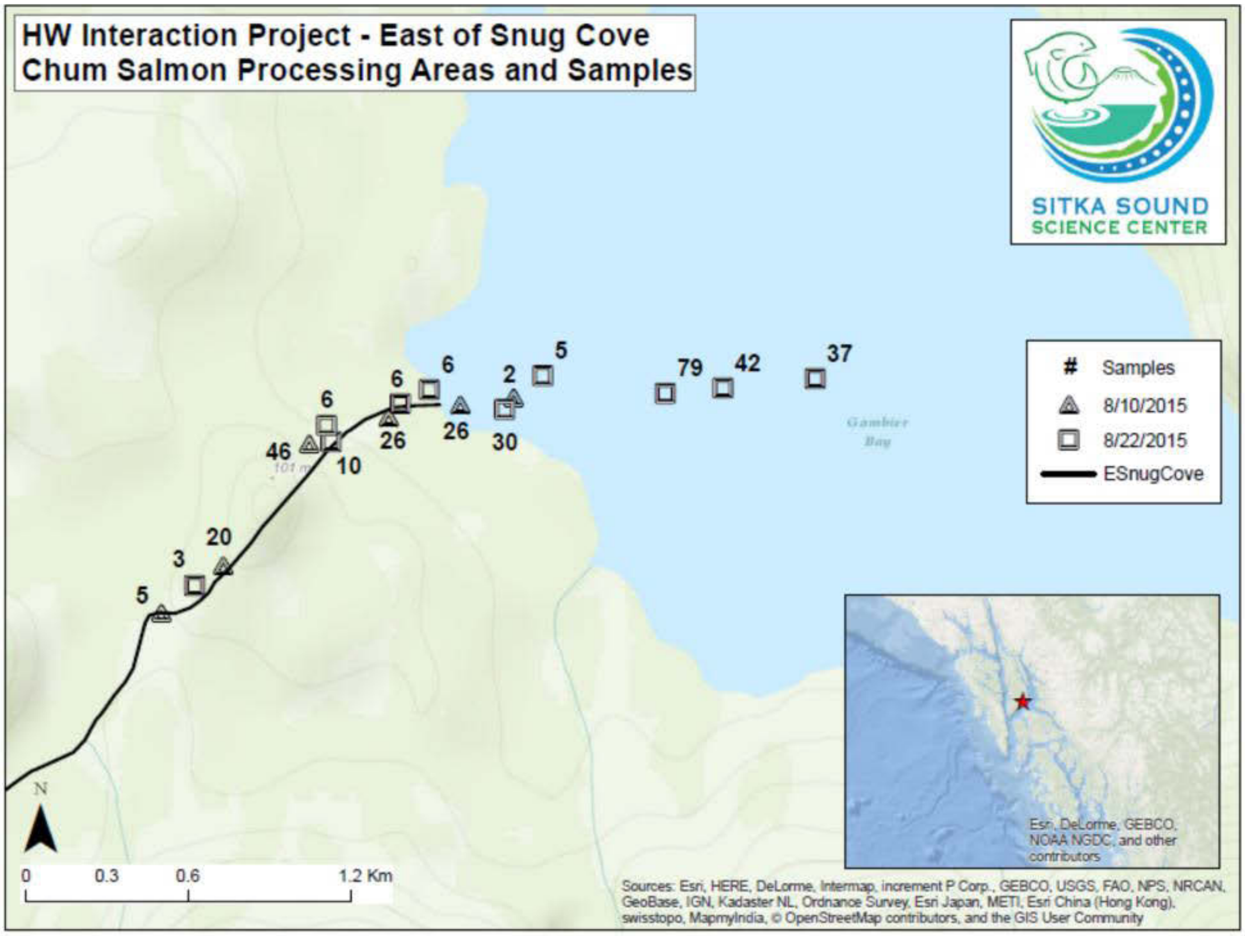
Extent of stream surveyed: The Chuck River was surveyed from the mouth of the main stem, to the bottom of the canyon 57.56281338, -133.3518048. This point is just upstream from the Sylvia Creek tributary and approximately 1.75 miles from the mouth. Sylvia Creek was also surveyed from the confluence with the Chuck River (1.25 miles from mouth) to the natural barrier falls (0.5 miles from the confluence) 57.56558148, -133.3395466.

Unusual events: None reported

Access, safety, or logistics issues: The jet boat can be used to access most of the main river below Sylvia Creek, although the crews have reported that occasionally the main channel is blocked by fallen trees. The main channel below Sylvia Creek is sandy, braided, and easily negotiable, either by foot or by jet boat under normal conditions. However, just upstream from Sylvia Creek is a gorge with large boulders and swift water, which has made wading upstream impossible thus far. Crews have attempted to skirt the canyon, but without success. The Chuck River discharges an extremely large volume of water during periods of high rainfall.

Recommendations, changes, and other notes: The chuck River has many miles of stream, however the majority of chum spawning is believed to take place below the confluence of Sylvia Cr. In 2014 we were unable to get permission from the USFS or Goldbelt to land a helicopter in the upper reaches and search for chums above the gorge. Upon realizing that accessing these upper reaches without a helicopter would require a tremendous amount of effort, time, and resources, for little reward, it was decided that sampling Sylvia Cr and the lower Chuck River would suffice.

East of Snug Cove
110-23-10210
Chum Salmon



Number of Visits: 3
Total Number Sampled: 349

2015 Samples Collected & Run timing: Our first visit was on 7/30, which was too early. The crew only saw 83 chums, all of which were pre spawners or actively spawning. No samples were collected. The second survey was conducted on 8/10. During this visit we were able to snag many post spawners and sampled 153, but the majority of chum were still alive. We sampled a third time on 8/22 during which we saw 55 live and 206 dead chums and collected 196 samples. The majority of fish sampled here were found on the tide flats during low tide. It appears that high water washed out and piled up carcasses at the mouth.

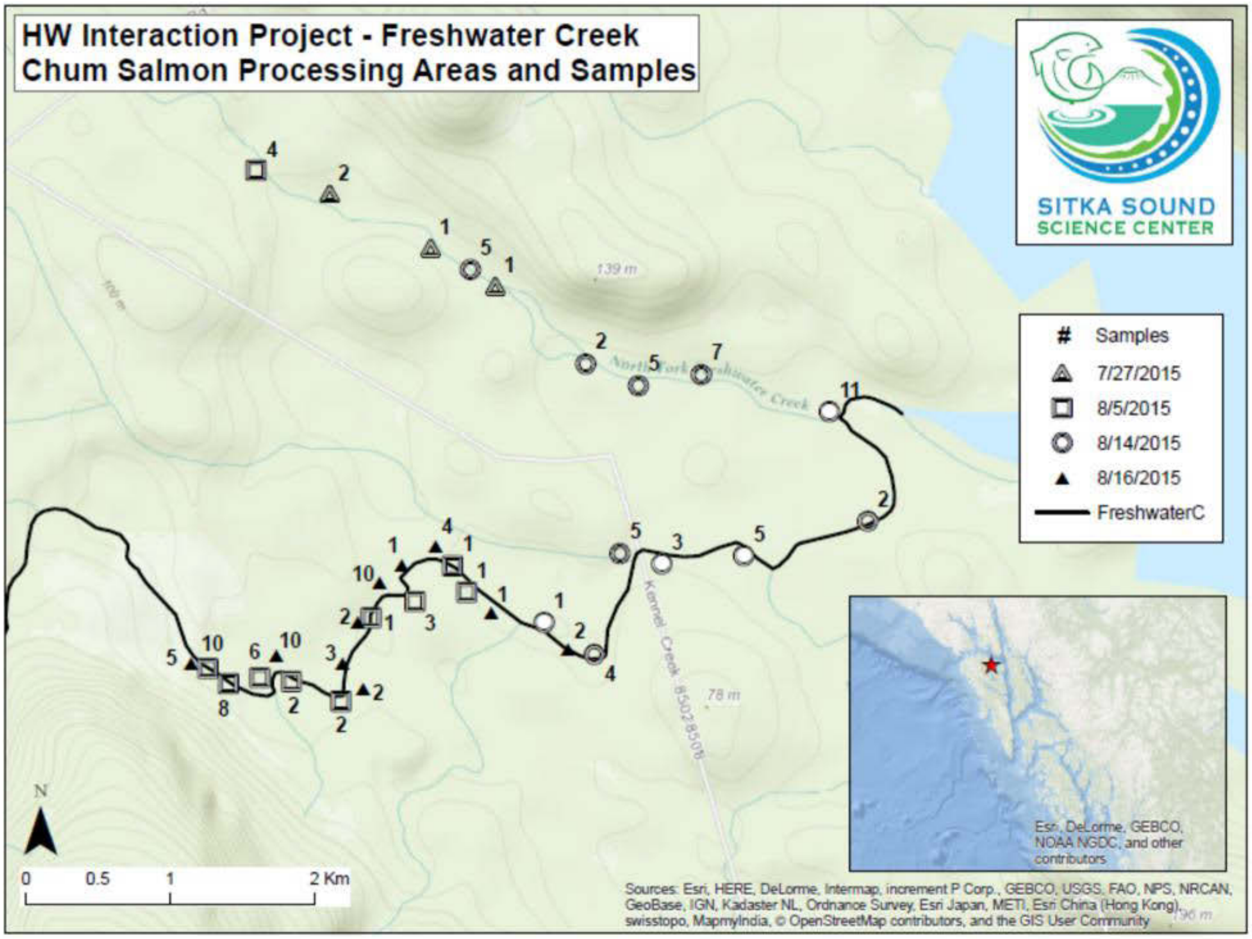
Extent of stream surveyed: The crew surveyed approximately 1 mile upstream from mouth until canyon narrowed and deep pools prevented the crew from walking the stream. On 8/10 the water was low enough in the creek for some of the crew to walk into the gorge, but no chums were observed just above the pool. The highest point surveyed there was 57.41373835 -133.9421679.

Unusual events: None reported

Access, safety, or logistics issues: None reported

Recommendations, changes, and other notes: Crews can anchor skiffs near the USFS cabin and walk the tide flat to get to the stream. On the tide flat, the stream fans out into a series of shallow braids and the main channel can be hard find in low water conditions. It is a small stream with a high gradient throughout. Being a small system, Snug is more likely to be wade able during flooding periods.

Freshwater Creek
112-50-10300
Chum Salmon



Number of Visits: 4
Total Number Sampled: 134

2015 Samples Collected & Run timing: We sampled Freshwater on 7/27, 8/5, 8/14, and 8/16. We sampled various parts of the creek on each visit, never observing over 155 chums in a single day. On 7/27 we had enough people to survey both forks below the road bridges and collected only 4 samples. The next 3 visits the crew was able to hone in on the more concentrated areas of chum spawning (just below barrier falls on North fork, and just above canyon upstream of the road bridge on the South fork. On these last 3 visits the crew collected 40, 50, and 40 samples respectively.

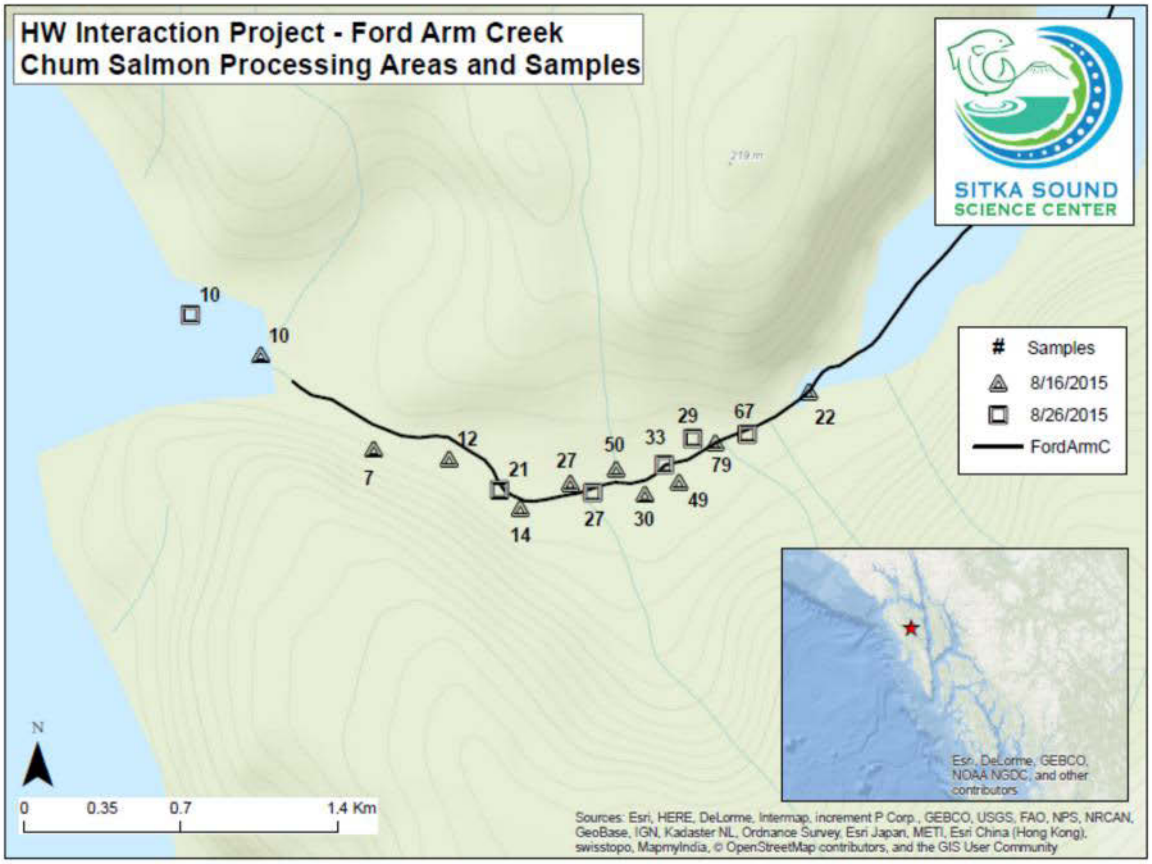
Extent of stream surveyed: Freshwater Creek was accessed entirely from the road system in 2015. On 7/27 we had enough people to survey both forks. One crew worked from the road bridge on the South fork to the salt water, the other worked down from an entry point on the North fork, approximately 2 miles upstream from the confluence 57.94754, -135.26258. The confluence is about 1.25 miles from the salt water. During the second visit on 8/5, efforts were focused upstream from the road bridge on the South fork and then from the road bridge on the North fork, down to the drop-off point from 7/27. During this visit the crew discovered a barrier falls on the North fork at 57.95241, -135.27285, just upstream of the entry point on 7/27. The crew reported that the area just below this falls was excellent chum habitat. The crew also discovered that there was good spawning above the canyon upstream of the road bridge on the South fork. During the third visit on 8/14, the crew walked form the entry point on the North fork, down to the confluence and then back up the South fork to the road bridge. On the last survey, the crew sampled upstream form the road bridge on the South fork. The highest point sampled on the North fork was the road bridge 4 miles from salt water, 57.95468953, -135.2900664. The highest point surveyed on the South was 3 miles from salt water 57.93482574, -135.2713241

Unusual events: None reported

Access, safety, or logistics issues: Freshwater Creek cannot be safely waded from the bridge in high water. With rain the creek gets very stained with tannins from the muskegs. During regular or low water levels the creek is very easily walked aside for a series of large log jams. Future crews should be aware of the entry point from the road that terminates on the stream at 57.94754, -135.26258.

Recommendations, changes, and other notes: The creek can easily be surveyed from the mouth, however, with the road system providing easy access to the bridge 2 miles upstream, it is much more beneficial to have the support vessel port in Hoonah and rent a vehicle for the crew to use instead. Having a crew that is based in Hoonah over the course of the season would be highly beneficial. It might be possible to hire a crew that lives in Hoonah to sample from both Game and Freshwater creeks when conditions and fish numbers are favorable. Survey Freshwater Creek at least once in late August.

Ford Arm Creek
113-73-10030
Chum Salmon



Number of Visits: 2
Total Number Sampled: 487

2015 Samples Collected & Run timing: The first visit was conducted on 8/16, which was a perfectly timed first visit. The crew counted 298 live chums, roughly 200 of which were fresh and seen in the last big pool before the ADF&G weir. 385 dead chum were observed. Our second visit was on 8/26. Two large storms had come through between these two visits and the weir operators informed us that our second visit had the best visibility and lowest level they had seen since our first visit. The stream had flooded over the weir during one storm event. Despite these events, we were still able to collect 187 samples and observed 158 live and 326 dead chum. This stream had several log jams that catch carcasses even in high water events and has a strong enough run that sampling is not highly impacted by flood events.

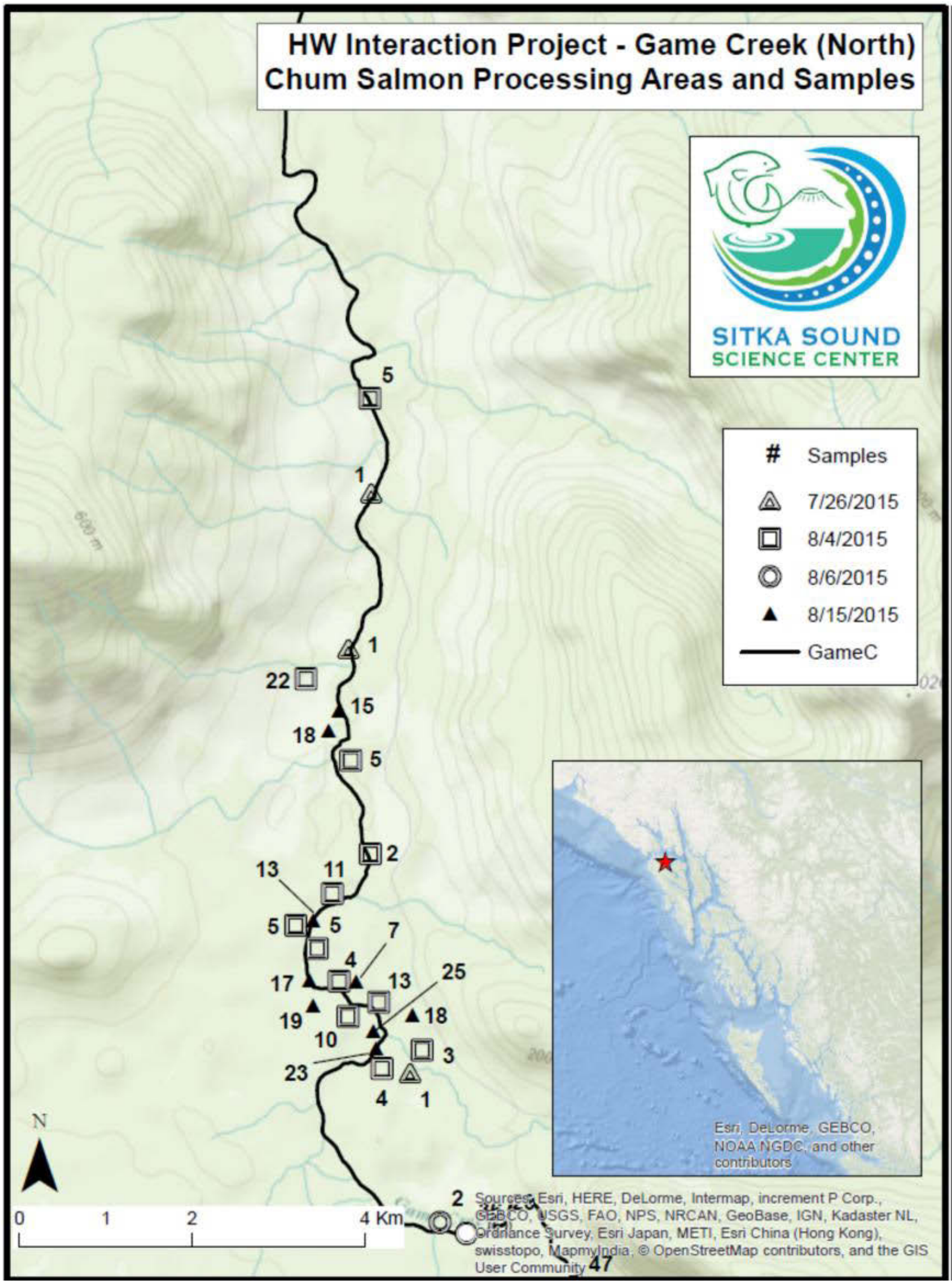
Extent of stream surveyed: The stream was surveyed from the tidal flats to the ADF&G weir, approximately 1.25 miles upstream 57.58176734, -135.8944974.

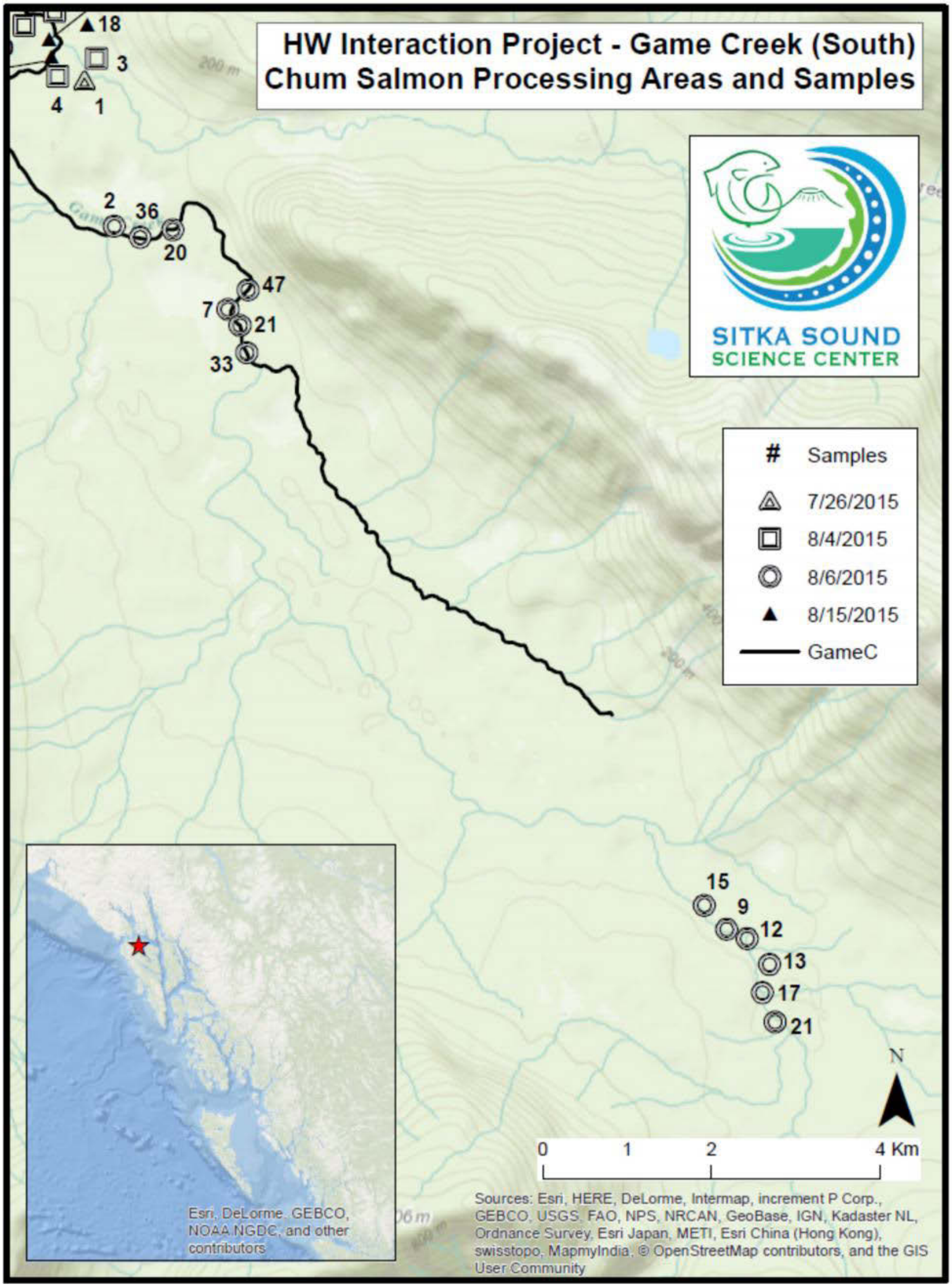
Unusual events: None reported

Access, safety, or logistics issues: The first ¼ mile of the stream is characterized by large slippery boulders, which can be difficult to safely traverse in high water and low visibility situations. There is a poor, barely maintained trail (as no power tools are allowed in the wilderness area for maintenance) on the left side of the creek that bypasses this section, but ADF&G informed us that due to low water at the beginning of the season, the trail was not used at all in 2015 and is highly overgrown with devils club. We did not look for the trail and opted for the creek route on both visits.

Recommendations, changes, and other notes: When accessing this creek, anchor to the left of the mouth. There is a lake with a weir approximately 2 miles upstream. If the vessel cannot make it to the outer coast of Chichagof due to bad weather, the crew should be prepared to fly into these outer coast streams when the timing is right. If the vessel-based crew is unavailable, a Sitka-based crew could be made available to fly into these outer coast streams.

Game Creek
114-31-10130
Chum Salmon





Number of Visits: 4

Total Number Sampled: 500

2014 Samples Collected & Run timing: We sampled Game Cr on 7/26, 8/4, 8/6, and 8/15. On the first visit, we had enough people to split into 2 groups. Together, we covered the lower 6.5 miles from the road bridge to the tide flats. We observed 812 live fish which were either pairing up or actively spawning, however we only saw 2 dead and collected just 3 samples. The second and third visits occurred just 2 days apart while the vessel was in Hoonah. During these visits the crew covered various 0.5 mile sections near all of the bridges across the 15 miles of stream. They also sampled from the mouth. It is not possible to get an accurate count of the entire stream by foot, but our fragmented count over the course of both visits was 1,202 live and 364 dead. Most of the dead fish were seen in the lower reaches and the crew collected 342 samples in total. During the final visit the crew counted 1,016 live and 377 dead chums and collected 155 samples in the 2 mile stretch below the second road bridge.

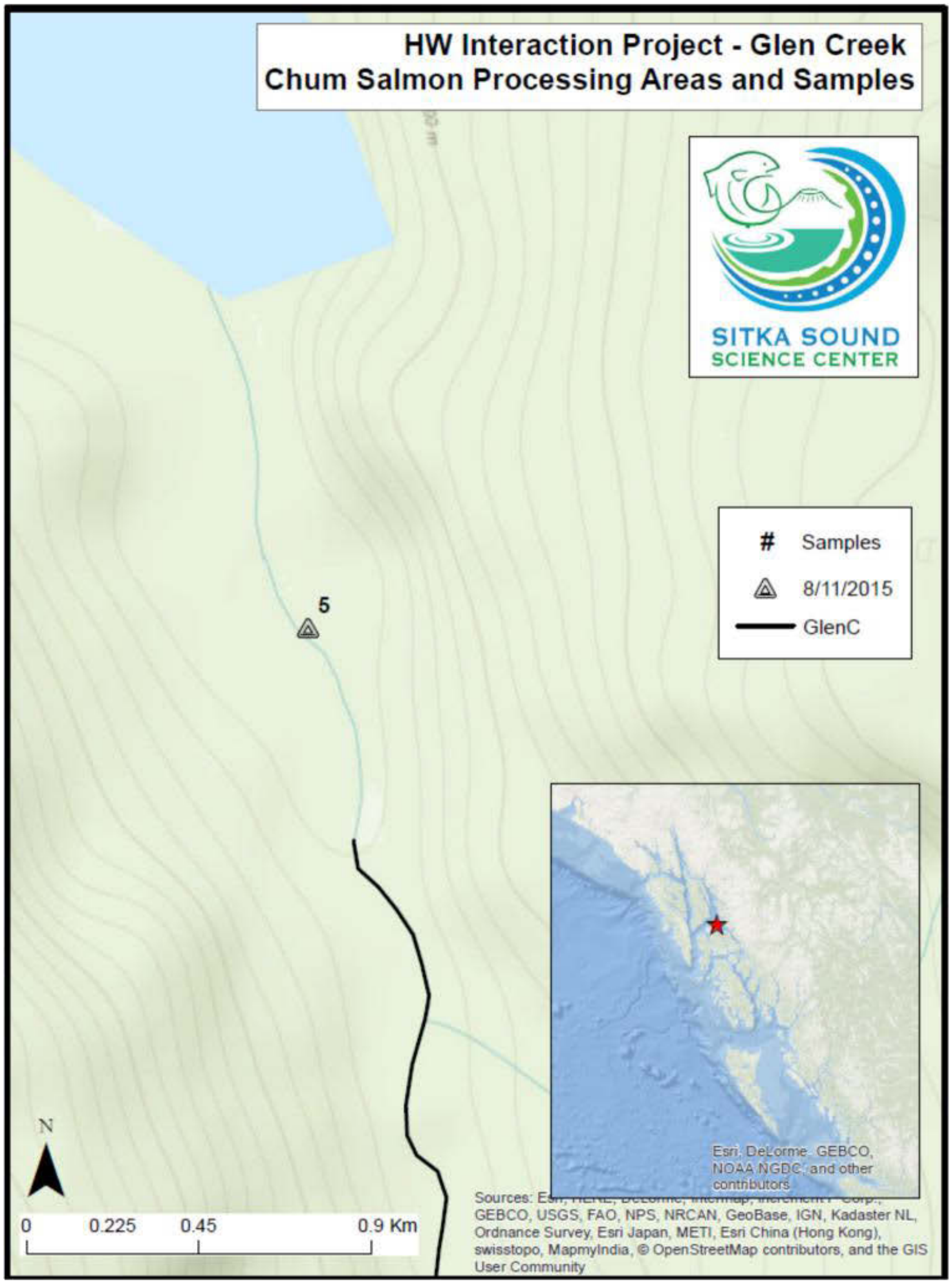
Extent of stream surveyed: Game Creek was accessed entirely from the road system in 2015. Crews surveyed several long stretches in the lower 17 miles of stream. The highest point surveyed was 57.94405446, -135.4064363.

Unusual events: SeaAlaska pink salmon surveyors informed us that there were spawned out chums at uppermost reach, while spawning activity in the lower reaches was minimal.

Access, safety, or logistics issues: Game Creek cannot be safely waded from the bridges in high water. During high water events, the creek gets very stained with tannins from the muskegs. The road system is handy when properly utilized for sampling the different portions. This stream is so long that help from another crew during the peak stages of the run makes a big difference in sample distribution throughout the stream.

Recommendations, changes, and other notes: To make the best use of time, crews should have an assigned person to drive the car between pick up and drop off points. During fair stream conditions, a single crew can easily walk most of the lowest nine miles of stream in 2 days, if the road system is efficiently utilized. If enough personnel are present, multiple sections can be walked simultaneously. Having a crew that is based in Hoonah over the course of the season would be highly beneficial. It might be possible to hire a crew that lives in Hoonah to sample from both Game and Freshwater creeks when conditions and fish numbers are favorable.

Glen Creek
110-34-10060
Chum Salmon



Number of Visits: 2

Total Number Sampled: 5

2015 Samples Collected & Run timing: The crew first visited Glen Creek on 7/29. They saw no sign of a chum salmon whatsoever. A second visit occurred on 8/11 where the crew observed 4 live and 4 dead chum and collected 5 samples.

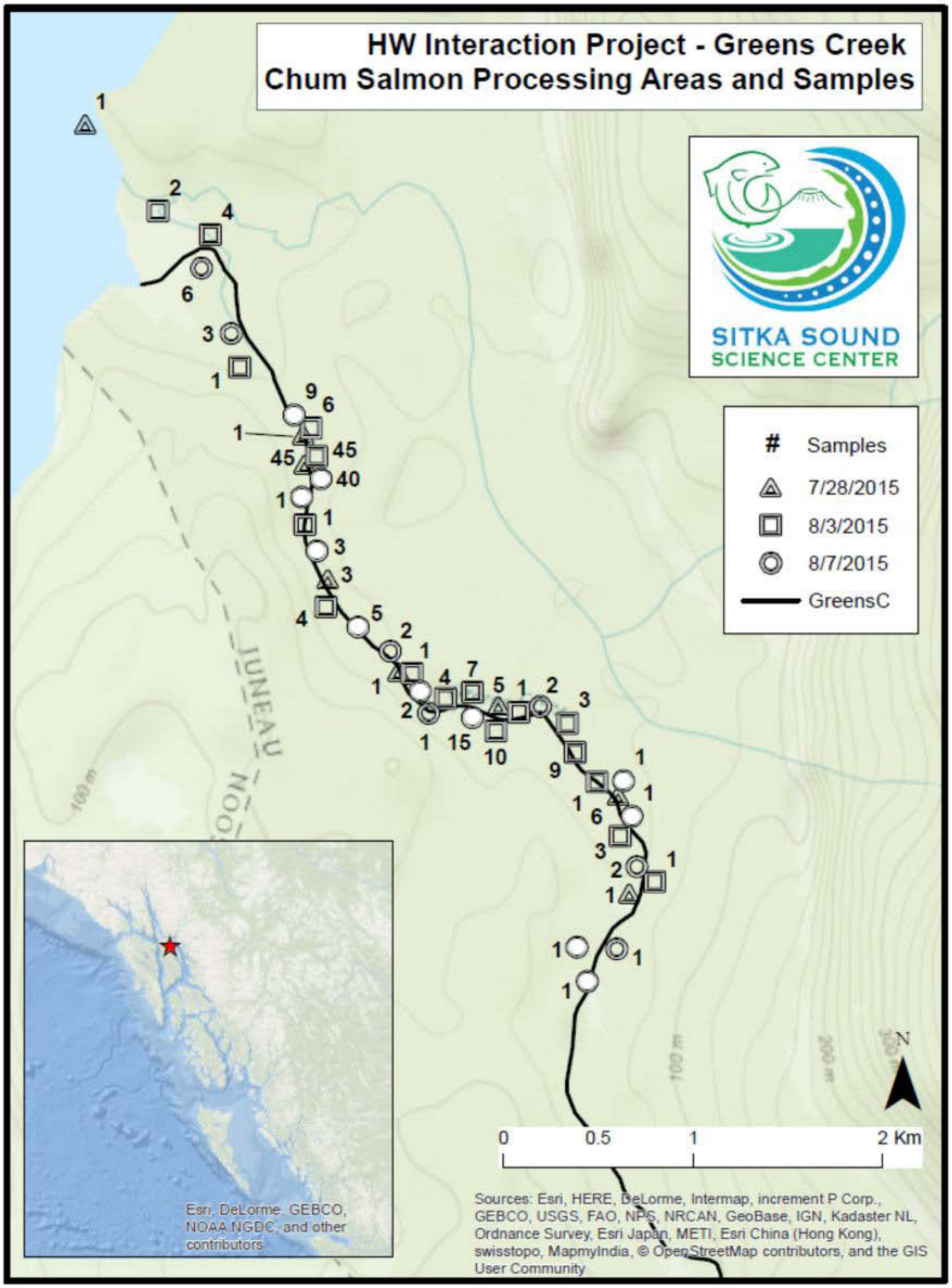
Extent of stream surveyed: We surveyed from the mouth until we got above a large boulder strewn canyon, approximately 2 miles upstream. . 57.30840719, -133.0925087

Unusual events: None reported

Access, safety, or logistics issues: At low tide, two downed trees in the main channel block the river. At high tide it is easy to drive around these trees and drop the crew off, but the crew should not park the boat above these downed trees if the tide is receding or they will likely not be able to get back out. Glen is a tough stream to walk as the substrate is large slippery cobblestone; there are multiple log jams, and some swift water crossings. The gradient of this creek is steep. The drainage has high walls on either side and is subject to flash flooding during heavy rain.

Recommendations, changes, and other notes: We saw no chums with good visibility throughout the first survey and very few in the second visit. This is the second year in a row in which chums were exceedingly scarce on Glen Cr. We believe that it is highly unlikely that we will be able meet our sampling goal on Glen Creek in future years.

Greens Creek
112-65-10240
Chum Salmon



Number of Visits: 3
Total Number Sampled: 261

2015 Samples Collected & Run timing: We sampled Greens Cr on 7/28, 8/3, and 8/7. The crew counted approximately 100 total chums on the first visit and 200 total chums on each subsequent visit. The peak dead count was observed on the third visit at 145. During each visit, the crew collected between 62-93 samples.

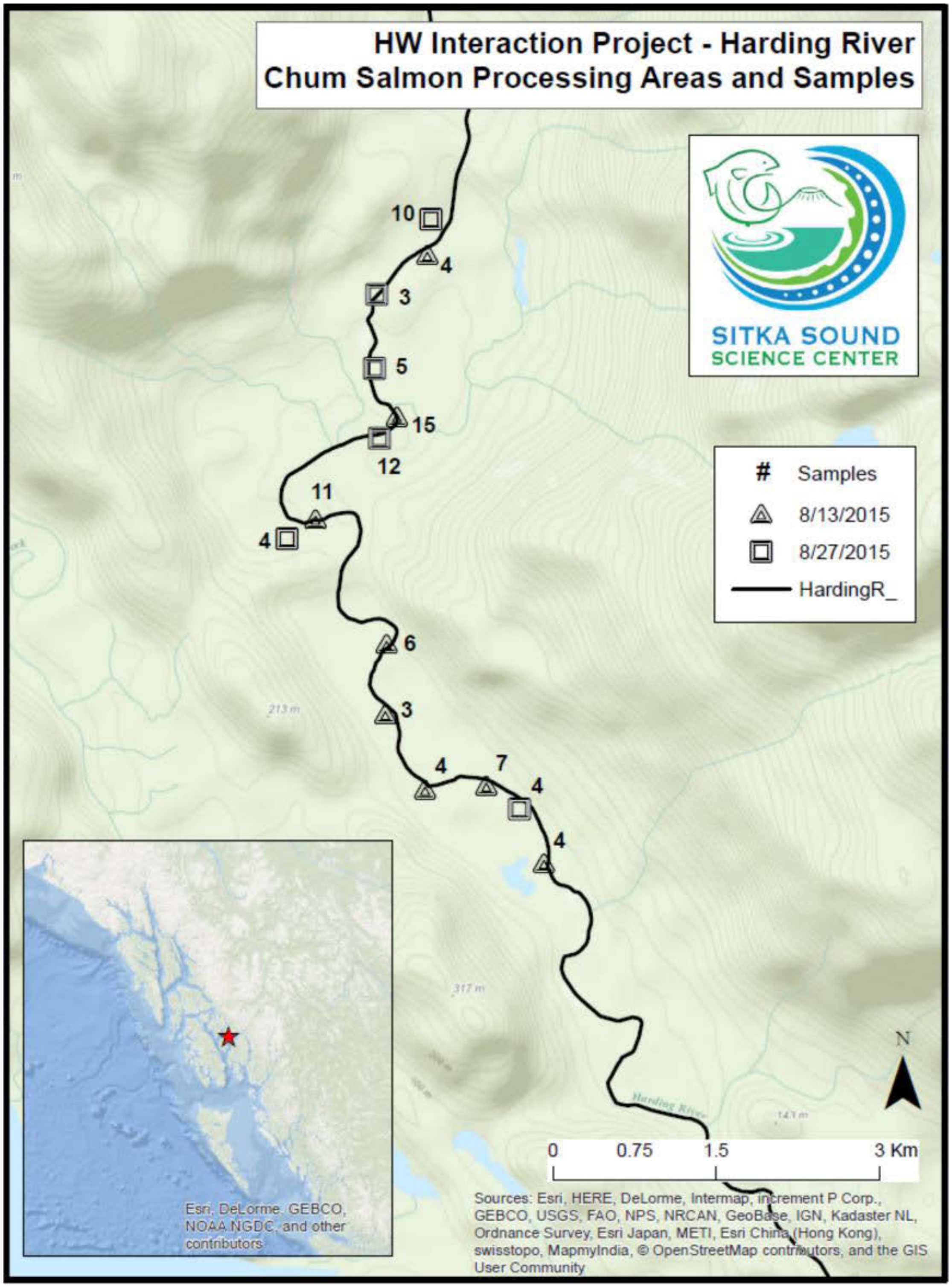
Extent of stream surveyed: The creek was surveyed roughly 2.25 miles of stream up from mouth. The crew hiked backed to the mouth through a rough trail in the forest 58.08031297, -134.7407397.

Unusual events: None reported

Access, safety, or logistics issues: There is a well-marked trail that leads away from the creek, possibly to the mine or road system.

Recommendations, changes, and other notes: None

Harding River
107-40-10490
Chum Salmon



Number of Visits: 2

Total Number Sampled: 92

2015 Samples Collected & Run timing: Our 2 visits to the Harding were on 8/13 and 8/27. With the frequent high water conditions encountered this year, the Harding flights had to be postponed and rescheduled several times. The crew was originally scheduled to fly on 8/6, but this was cancelled due to poor visibility. On the first actual visit, the crew encountered very high dark water. Due to the poor visibility no live count was possible, however 53 dead were counted. On the second visit, the crew saw 10 live and 41 dead. The timing of the first visit may have been perfect, however several more flood events occurred before the next visit which likely limited our success.

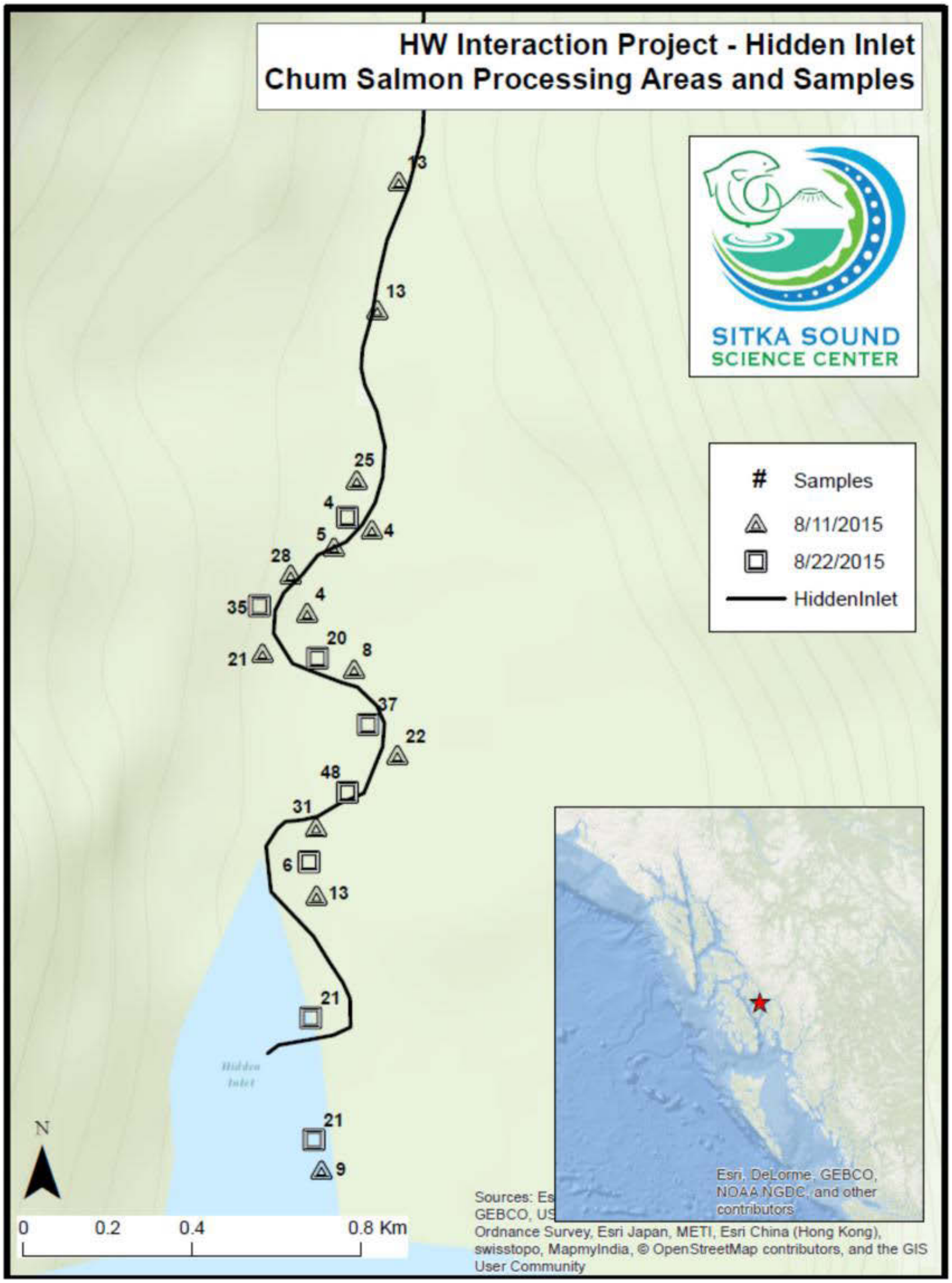
Extent of stream surveyed: We sampled this river solely by helicopter. The crew flew the entire length of the stream between the salt water and the lake stopping on most gravel bars and anywhere carcasses were spotted and accessible. The crew leader spotted what was believed to be a barrier at 56.25683, -131.65035. The highest processing area was just below this barrier, 5.5 miles upstream 56.25243, -131.65277.

Unusual events: None reported

Access, safety, or logistics issues: Sampling by helicopter greatly reduces the risk of injury whilst also allowing for the crew to concentrate in the places where chums are actually accessible. On our first visit with high flows and low visibility, any wading was impossible or unsafe. With better flows on the second visit some wading and crossing was possible but we still encountered many impassable points, even far up river.

Recommendations, changes, and other notes: As in 2014, field crews flew into the Harding River via helicopter in 2015. This is absolutely essential for sampling success there as the Harding River is far too deep, wide, and swift to safely wade. Additionally, the best spawning grounds are several miles upstream. Temsco helicopters in Ketchikan were again chartered to fly us on two separate occasions in 2015. The best approach is to have the vessel port in Ketchikan, where the crew can meet the helicopter at the airport to fly directly into the Harding. If the vessel were to meet the helicopter at the mouth of the river, it would add an extra day or two of travel time. Because of the need to time visits during fair conditions, and its difficulty during poor conditions, the Harding remains to be a very challenging river to sample.

Hidden Inlet
101-11-11010
Chum Salmon



Number of Visits: 2

Total Number Sampled: 409

2015 Samples Collected & Run timing: The first visit by the vessel crew was on 8/11, and the crew reported seeing 752 live and 231 dead chum. No chums were seen in the tide flat but immediately upon entering the mouth of the creek, spawning chums were seen. The next visit was on 8/22, and the crew saw 268 dead but was unable to conduct a live count due to heavy rains and poor visibility. There appeared to still be many live chums scattered throughout the survey.

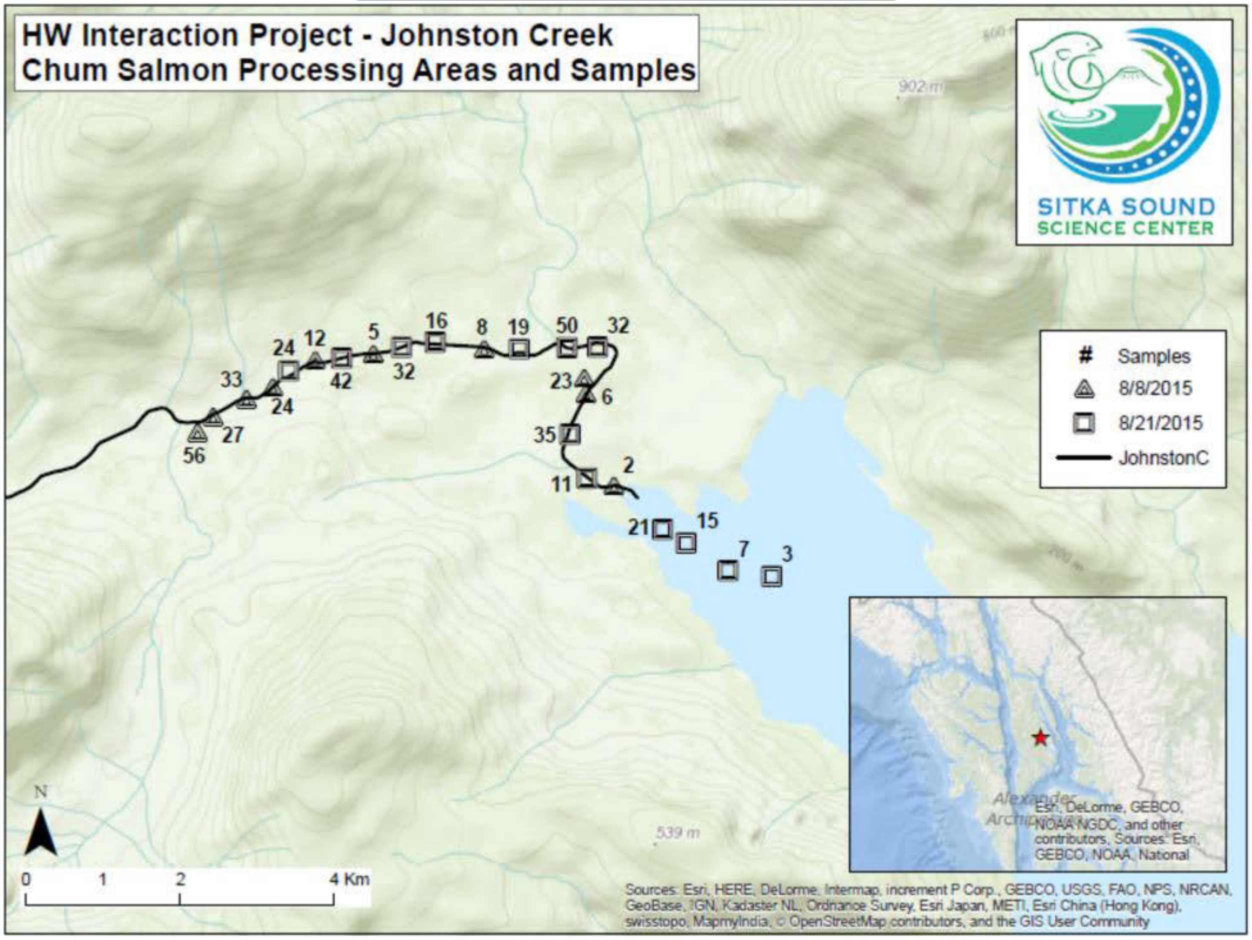
Extent of stream surveyed: The creek was surveyed approximately 2.5 miles upstream from the mouth to 55.04422348, -130.3137573.

Unusual events: None reported

Access, safety, or logistics issues: The support vessel should anchor off of Jack's Lodge at the mouth of the inlet and skiff in, since the narrows are too treacherous for the support vessel. When entering Hidden Inlet through the narrows, it is safest to drive the skiff down the center of the channel, as it is deepest and free of rocks. The inlet is prone to early morning fog, so crews should take caution when driving the skiff.

Recommendations, changes, and other notes: On the 8/22 visit the stream started out with very manageable flows and with heavy rains water level rapidly climbed throughout the survey. Wading back downstream proved very difficult and took much longer than wading upstream.

Johnston Creek
110-23-10100
Chum Salmon



Number of Visits: 3
Total Number Sampled: 503
2015 Samples Collected & Run timing: The first visit to Johnston was on 7/29, which was too early as all observed chum were pre spawners or actively spawning. No samples were collected on this visit. The second visit was conducted on 8/8, where most of the 196 samples came from dead chum in the top 2 miles of the survey. During the third visit on 8/21, 166 live and 320 dead fish were observed.

Extent of stream surveyed: Crews surveyed upstream approximately 5.5 miles from the tree line 57.51280999, -134.1628716. At this point the stream begins to braid, narrow, and become overgrown. Only the West fork was surveyed.

Unusual events: None reported
Access, safety, or logistics issues: This stream is long, but wide and relatively easy to hike.

Recommendations, changes, and other notes: None reported

Kadashan River
112-42-10250
Chum Salmon

Number of Visits: 4
Total Number Sampled: 5

2015 Samples Collected & Run timing: Both the vessel-based and Tenakee crews visited Kadashan on 7/24, where they counted 28 live and 0 dead chum on both forks. This creek is generally very dark, which makes fish identification difficult. Therefore, the actual number of live fish in the creek could be higher than indicated by our count. This visit was too early for the run, as no new redds were observed and all fish were seen holding in deep pools. The vessel based crew returned to the stream on 8/1. On this visit we were not able to get any samples, but observed 41 live fish, again over both forks, however most of these fish were seen on the East fork. The Tenakee crew visited the stream two additional times during the season, on 8/12 and 9/1. The visit on 8/12 was during high water and roughly 10 live fish were seen in the dark pools. On 9/1 the crew scoured the flats and found 5 carcasses to sample. They then counted 23 live upstream which they did not sample.

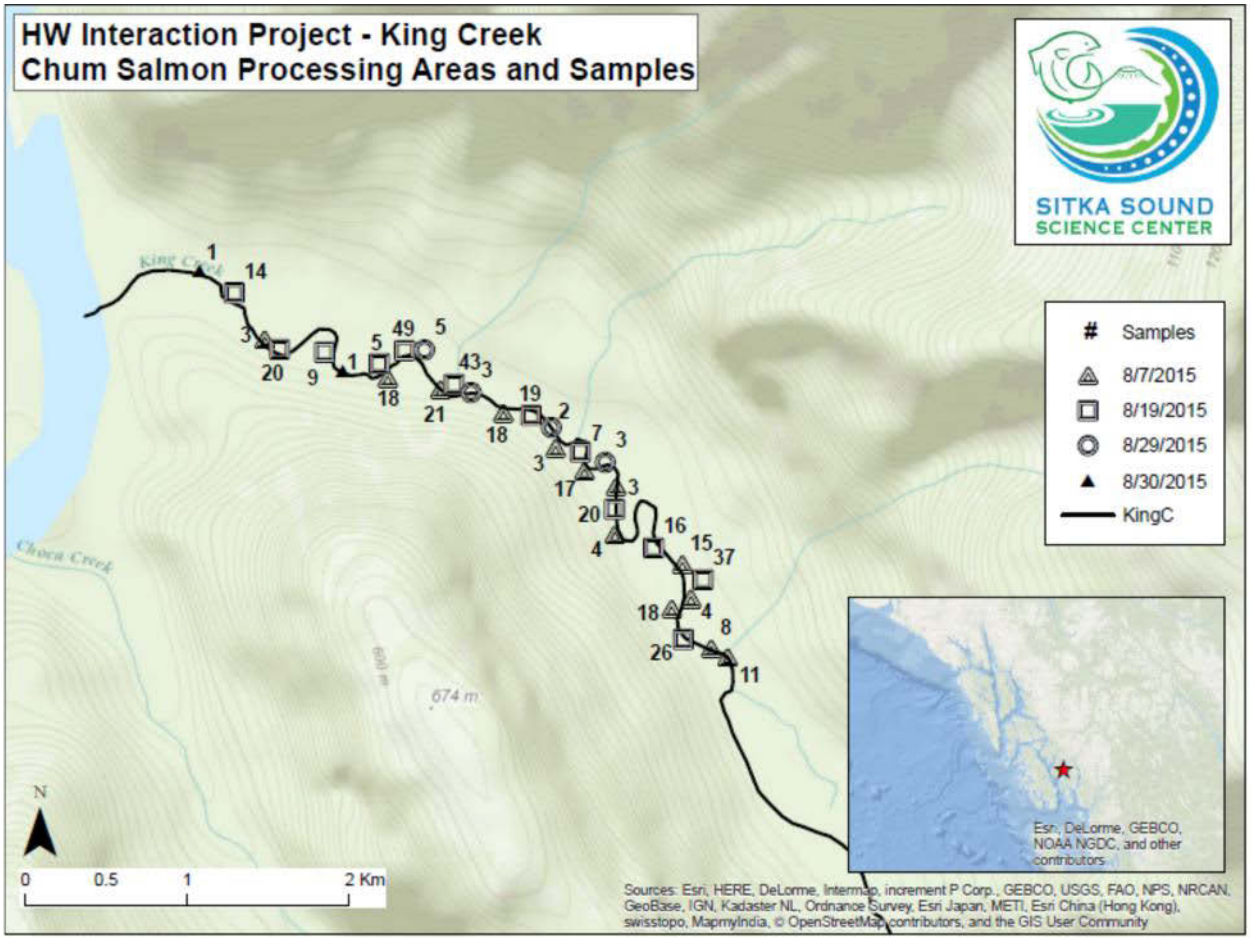
Extent of stream surveyed: Crews surveyed each main fork of the river. The highest point surveyed on the East fork was 1 mile above the fork 69338014, -135.2171912. Habitat beyond this point looks conducive to chum spawning, but few chum were seen on this fork whatsoever. The highest point surveyed on the West fork was 0.75 miles above the fork where the stream becomes braided and brushy 57.68894, -135.22171.

Unusual events: None reported

Access, safety, or logistics issues: Kadashan has a very large tide flats which can be troublesome for anchoring skiffs.

Recommendations, changes, and other notes: The contracted Tenakee crew reported that Kadashan has been an unproductive system for chums for multiple years.

King Creek
101-71-10040-2006
Chum Salmon



Number of Visits: 4

Total Number Sampled: 423 (360)

2015 Samples Collected & Run timing: The first visit took place on 8/7. The crew counted 557 live and 87 dead chum, and collected 120 samples. During the second visit, on 8/19, the crew counted 91 live and 310 dead chum, and collected 288 samples. The third and 4th visits were high water events on 8/29 and 8/30. On 8/29 the crew counted 6 live, 16 dead and retrieved 13 samples. On 8/30 no live chum were seen and samples were removed from the 2 dead chums that were found. The high water seemed to have flushed Chum Salmon out of the system. Overall, our timing seemed good and we were able to encompass most of the run with our visits. Unfortunately, on the first visit 63 otolith pairs were knocked from the tray. While these otoliths are still present in the tray they are of unknown origin. Therefore although 423 samples were taken, it is possible that only 360 of these are useable.

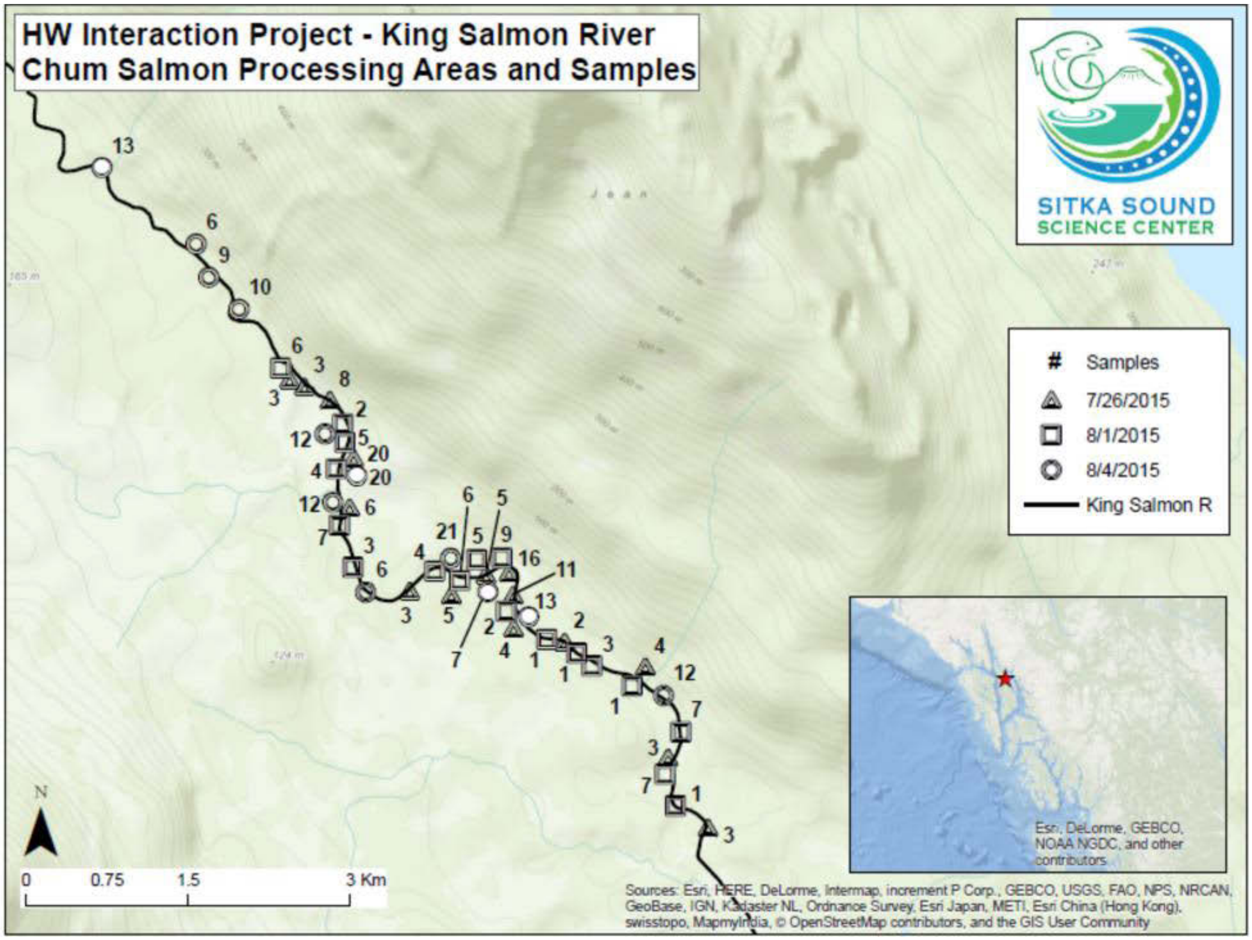
Extent of stream surveyed: The crew sampled from the confluence of King Creek and the Chickamen River, upstream 2.5 miles 55.82966081, -130.8163002.

Unusual events: As reported above, an otolith tray was spilled with the first 63 samples present.

Access, safety, or logistics issues: The mouth of the Chikamen River can become very exposed to high winds creating some possible anchoring issues for the support vessel and bumpy skiff rides in and out of the river. Weather should be planned for accordingly.

Recommendations, changes, and other notes: We were able to anchor the skiff and jet boat at the confluence of King Creek and the Chickamen River for each survey. In the high water events, we were able to take the jet boat quite a ways up King Creek, allowing access to some smaller side channels that collect carcasses in high water conditions. On the final survey, the water was flowing over the bank and we surveyed the lower section from the jet boat. Even with the high water, King Creek remains clear.

King Salmon River
111-17-10100
Chum Salmon



Number of Visits: 3

Total Number Sampled: 170

2015 Samples Collected & Run timing: The first visit to King Salmon River took place on 7/24. On this visit the crew was unable to survey due to a high water event. The second visit took place on 7/26 and 89 live and 97 dead chum were seen, 96 samples were collected. No chums were seen in the lower stretches of river and numbers seemed to increase as we moved further up river. The third visit was 8/1 and 74 samples were collected. The crew counted 38 live and 80 dead on this visit. Although timing seemed appropriate for these visits, high water likely played a role in how successful our sampling events were. A final visit was conducted when SSSC personnel accompanied an ADF&G foot survey crew on a helicopter trip into the upper reaches. This crew surveyed the 3 most upstream miles of the 5 total miles surveyed

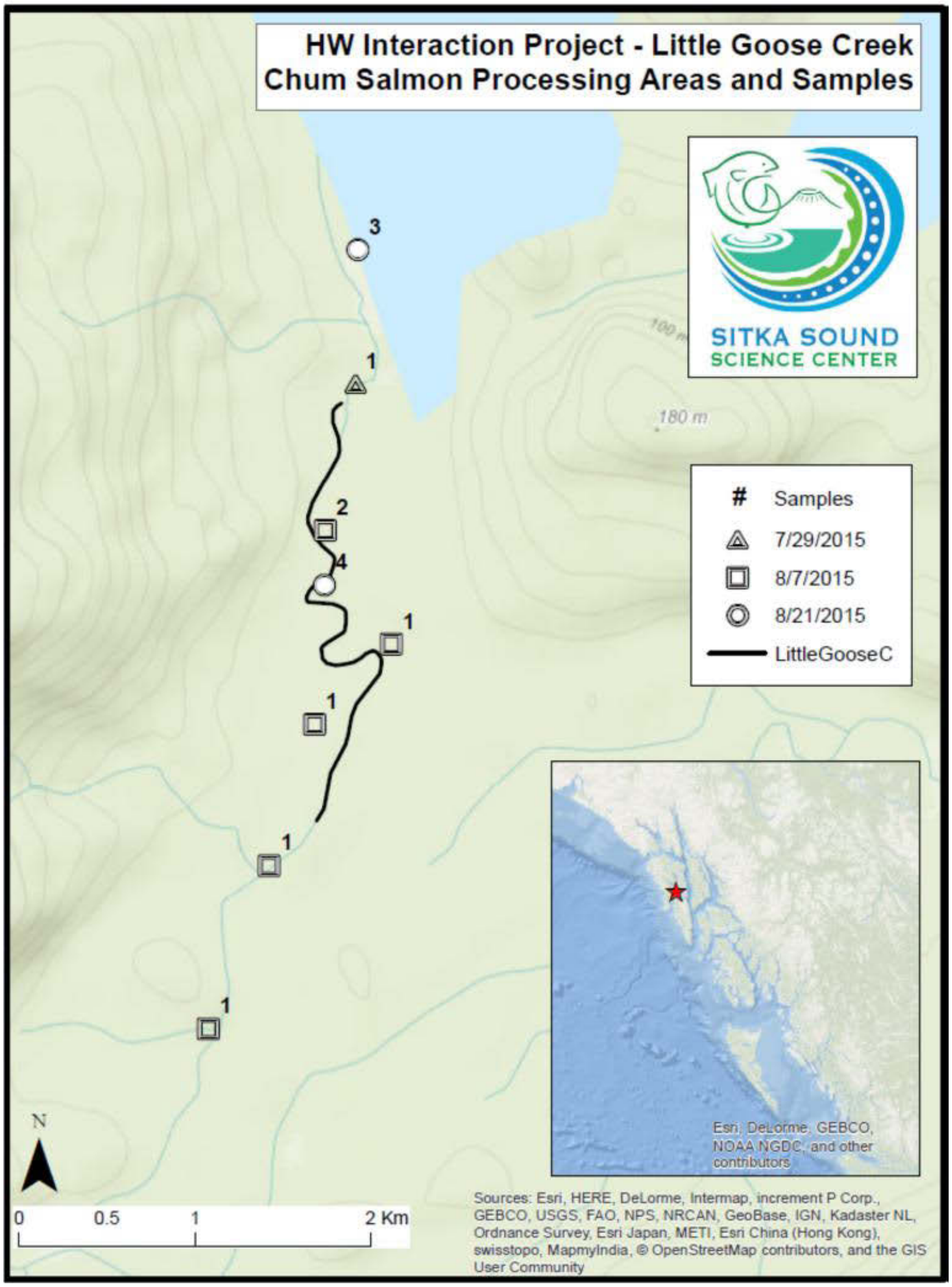
Extent of stream surveyed: The highest point surveyed was just above the helicopter drop off point, roughly 5 miles upstream 58.07847531, -134.4006132.

Unusual events: None reported

Access, safety, or logistics issues: There is a good chance that the jet boat will run aground on the tide flats in low water. When leaving the river, the jet boat should carry all the gear out on the first trip. This way, if it were to run aground, the crew could hike rather than have to go back to pick up gear and carry it out.

Recommendations, changes, and other notes: Coordinating with ADF&G foot survey crews was highly advantageous in 2014, and was done again in 2015 on the final visit. A previous visit with ADF&G was scheduled but cancelled due to flooding. This arrangement is highly beneficial to us since the cost of the flights is covered by ADF&G and they generously help us collect carcasses and snag post-spawned chum. We will strive to preserve this relationship, and do what we can to benefit ADF&G crews as well.

Little Goose Creek
112-48-10190
Chum Salmon



Number of Visits: 3
Total Number Sampled: 14

2014 Samples Collected & Run timing: Little Goose was visited 3 times by the Tenakee crew on 7/29, 8/8, and 8/21. During the first visit the stream was flooding and the crew counted 4 chums in the dark water, collecting just one sample. During the second visit, they saw 32 live and 9 dead, sampling 6. On the last visit, the crew saw 8 live and 9 dead, sampling 7.

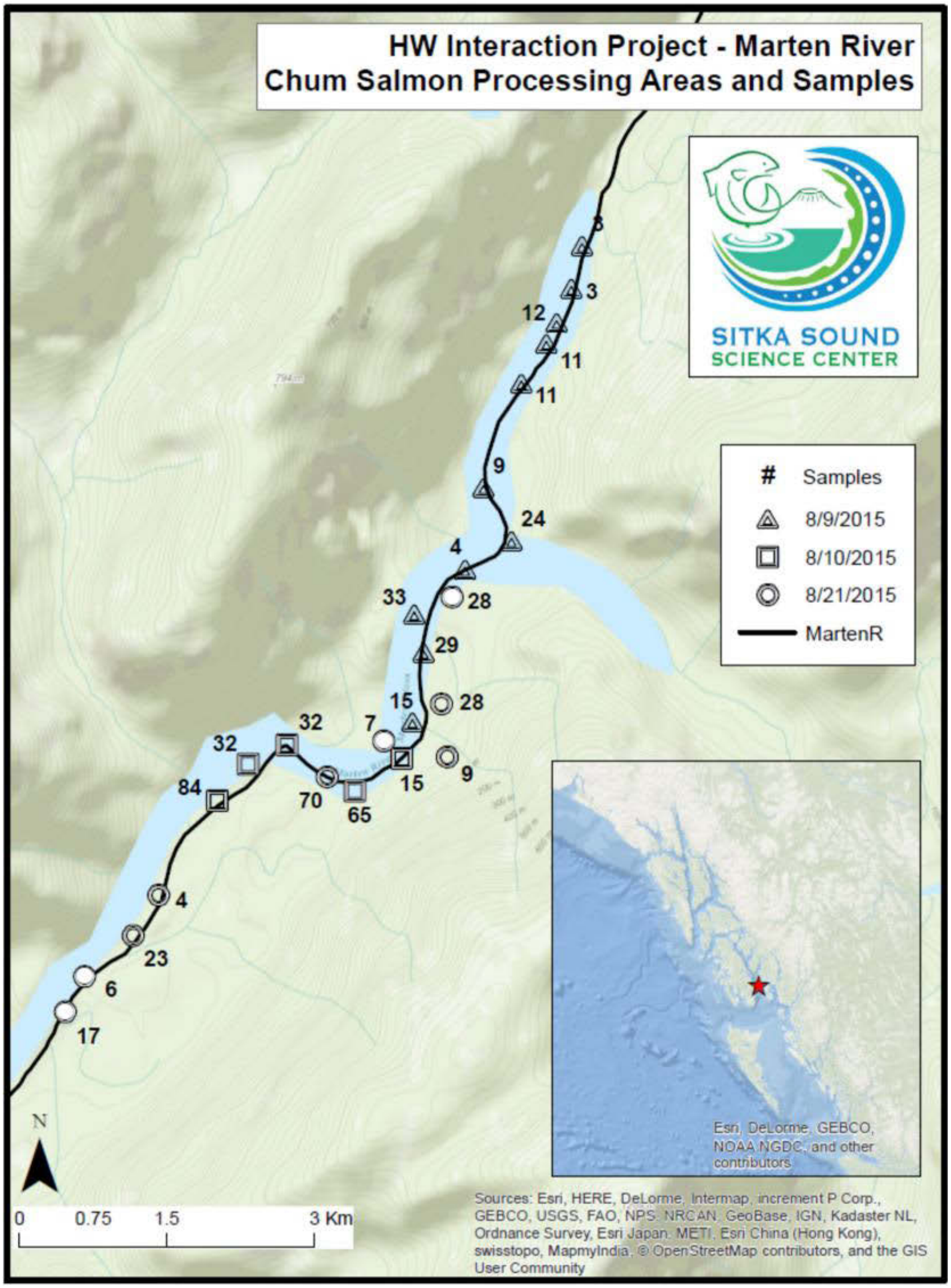
Extent of stream surveyed: The crew sampled the lower 3 miles of stream, much farther than in 2014. The highest point surveyed was 57.90446069, -135.7805207.

Unusual events: None reported

Access, safety, or logistics issues: The crew reported that there is heavy downed timber for roughly half a mile on the stream, which requires a lot of time to negotiate, so crews should be aware of this.

Recommendations, changes, and other notes: It is quite possible that the run at Little Goose occurred prior to sampling, however chum numbers are still low in the area.

Marten River
101-30-10600
Chum Salmon



Number of Visits: 3

Total Number Sampled: 593

2015 Samples Collected & Run timing: The first visit to the Marten River was on 8/9. The crew collected 173 samples, and counted 284 live and 137 dead chum. The crew opted to spend an extra day to cover the lower reaches of the river and try to get samples while they could in case of a major flood event. The second visit on 8/10 resulted in another 228 samples. In this survey 65 live and 219 dead chum were seen. The third and final visit was on 8/16. The crew collected 288 samples on this visit and counted 11 live and 203 dead. The chum run on the Marten River was very impressive compared to previous years. On each visit, many live and dead chum salmon were seen.

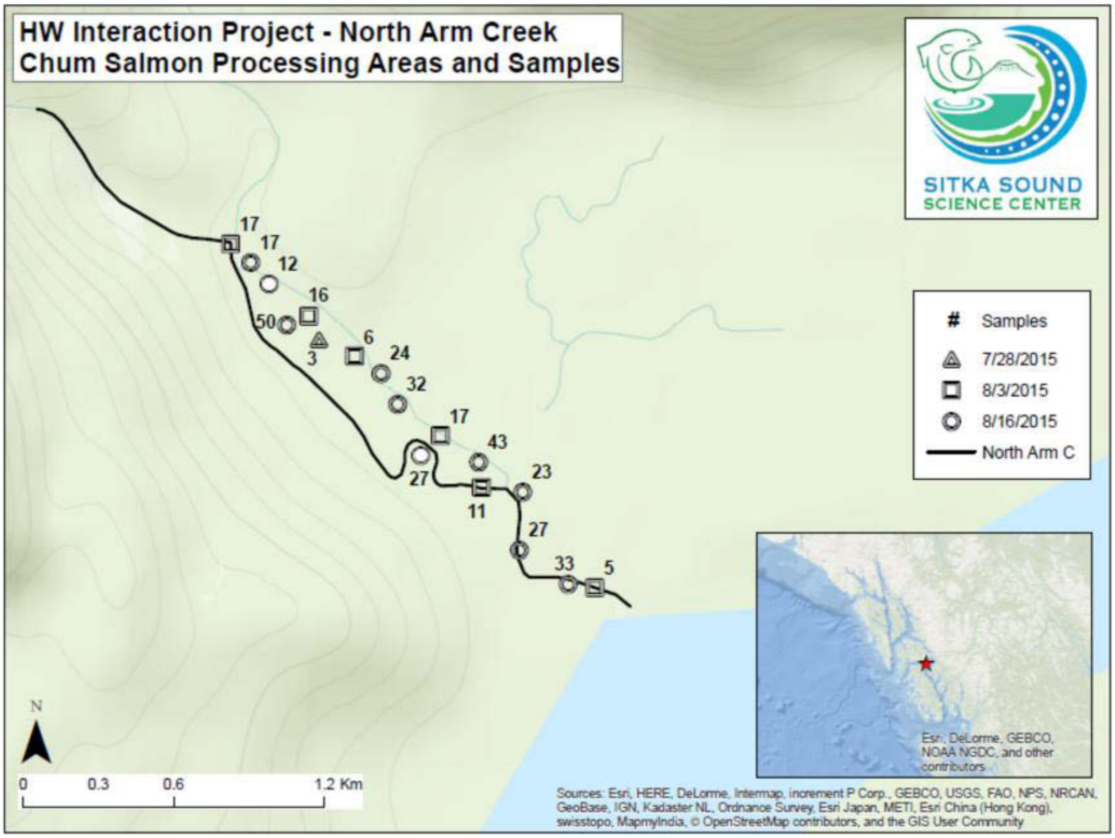
Extent of stream surveyed: The mouth of Marten River is very wide slow and deep. We surveyed lower stretches just above this area as well as good spawning ground approximately 7 miles upstream 55.21595748, -130.4477132

Unusual events: None Reported

Access, safety, or logistics issues: Because of its length, depth, and volume, it is difficult to sample the Marten River on foot. An abundance of fish this year made sampling much easier, and we were able to find carcasses washed up on shore throughout the river.

Recommendations, changes, and other notes: On the first visit, the river was slightly higher than usual and this allowed the jet boat to make it further up the river than usual and thus allowed the crew to sample a bit higher than in previous years. We utilized a beaver flight over this system to look at concentrations of chums for this first visit. The highest point of our survey on our first visit is nearing the upper extent of chum salmon as we observed from the air. Where we turned around the gradient picks up and the substrate changes to large boulders. Not far above this is a landslide that blocks the river and we observed no fish above this point from the air. Our crews covered the river well this year and in some cases a bit more water greatly helped for navigation in the jet boat and crew members were still able to successfully wade the river. It is impossible for crews to cover the whole river in a day, so crews must decide whether to do the upper section or the lower section. Alternatives would be to use two days, or consider splitting the crew up.

North Arm Creek
108-40-10150-2007
Chum Salmon



Number of Visits: 3

Total Number Sampled: 363

2015 Samples Collected & Run timing: The first visit was on 7/28, and the majority of fish were still very fresh. The crew counted 52 live and 3 dead, and collected 3 samples. The crew was unable to survey the whole way up on this visit due to high water conditions. The second visit was on 8/3 and the crew counted 229 live and 56 dead chum and sampled 72. The final visit was on 8/19 and the crew saw 111 live, 284 dead, and sampled 288 chum.

Extent of stream surveyed: The creek was surveyed for 1.5 miles upstream from the North Arm confluence with the Stikine River 56.69587256, -132.3221411.

Unusual events: None reported

Access, safety, or logistics issues: This creek requires 45 minutes to 1 hour jet boat ride up the north arm of the Stikine River. The mouth of the creek is hard to see from the river so good topo maps and GPS coordinates are necessary for those who have not been there before to find it.

Recommendations, changes, and other notes: None reported

Petrof Bay W Head
109-62-10240
Chum Salmon

Number of Visits: 2
Total Number Sampled: 402

2015 Samples Collected & Run timing: The first visit on 8/20 was good timing. The crew counted 238 live and 117 dead chums, and collected 102 samples. Most of these samples came from dead fish that looked fresh, many of which had not yet spawned. Most of the creek was less than 15cm deep on this visit. Several fresh chums were seen holding in the intertidal zone. During the second visit on 8/29 the crew counted 389 live, 331 dead, and collected 300 samples, roughly 1/3 of the samples came from live fish. This creek could have been sampled at an even later date if needed.

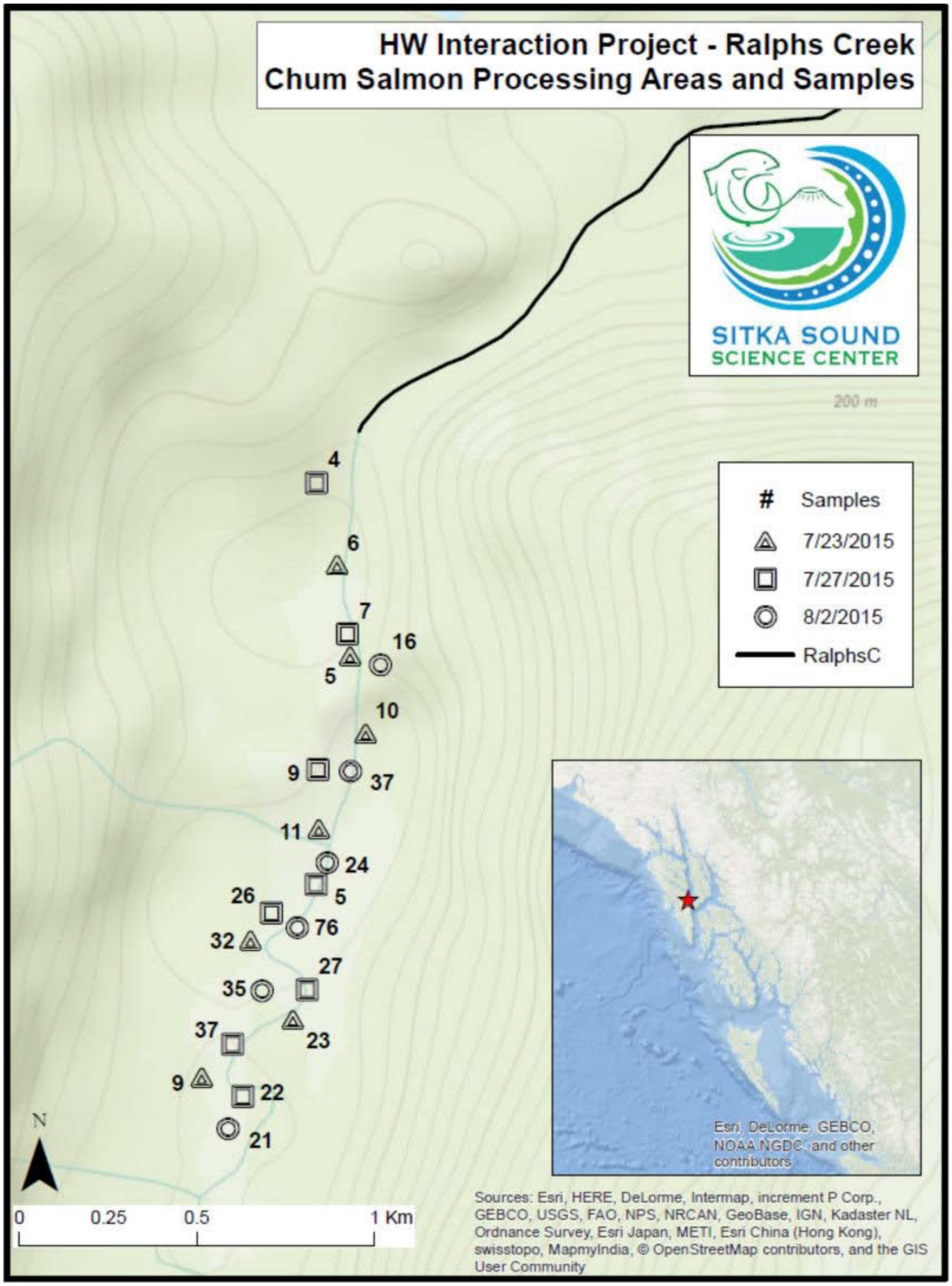
Extent of stream surveyed: The highest point surveyed was 0.75 miles upstream from the tree line, where the creek begins to cascade 56.35222974, -134.0688686.

Unusual events: None reported.

Access, safety, or logistics issues: None reported.

Recommendations, changes, and other notes: This stream is shallow and narrow throughout, weaving through alders and brush. These characteristics along with the run size, make this an easy creek to sample provided wind and ocean conditions allow the crew to navigate to the stream. Taking advantage of good weather windows to survey this stream via vessel or arranging fly in surveys are necessary in order to access this stream. Crews are advised not to anchor the skiff on the island in the main channel as the water is too deep to wade across at high tide.

Ralphs Creek
112-21-10060
Chum Salmon



Number of Visits: 3

Total Number Sampled: 442

2015 Samples Collected & Run timing: Our first visit to Ralphs Creek on 7/23 worked well because most of the 96 samples came from preyed upon, post-spawn fish. All chums spawning was seen above the canyon and all fish seen below the canyon were fresh. During this visit the crew saw 247 live chums. The second survey was conducted on 7/27. On this visit 137 samples were collected, and most live chum appeared to be active or post-spawn. The final visit was on 8/02, and the crew saw 113 live, 285 dead, and collected 209 samples. Our visits covered the run well, however Ralphs should be carefully watched as it is a fairly early run compared to many other streams in the project.

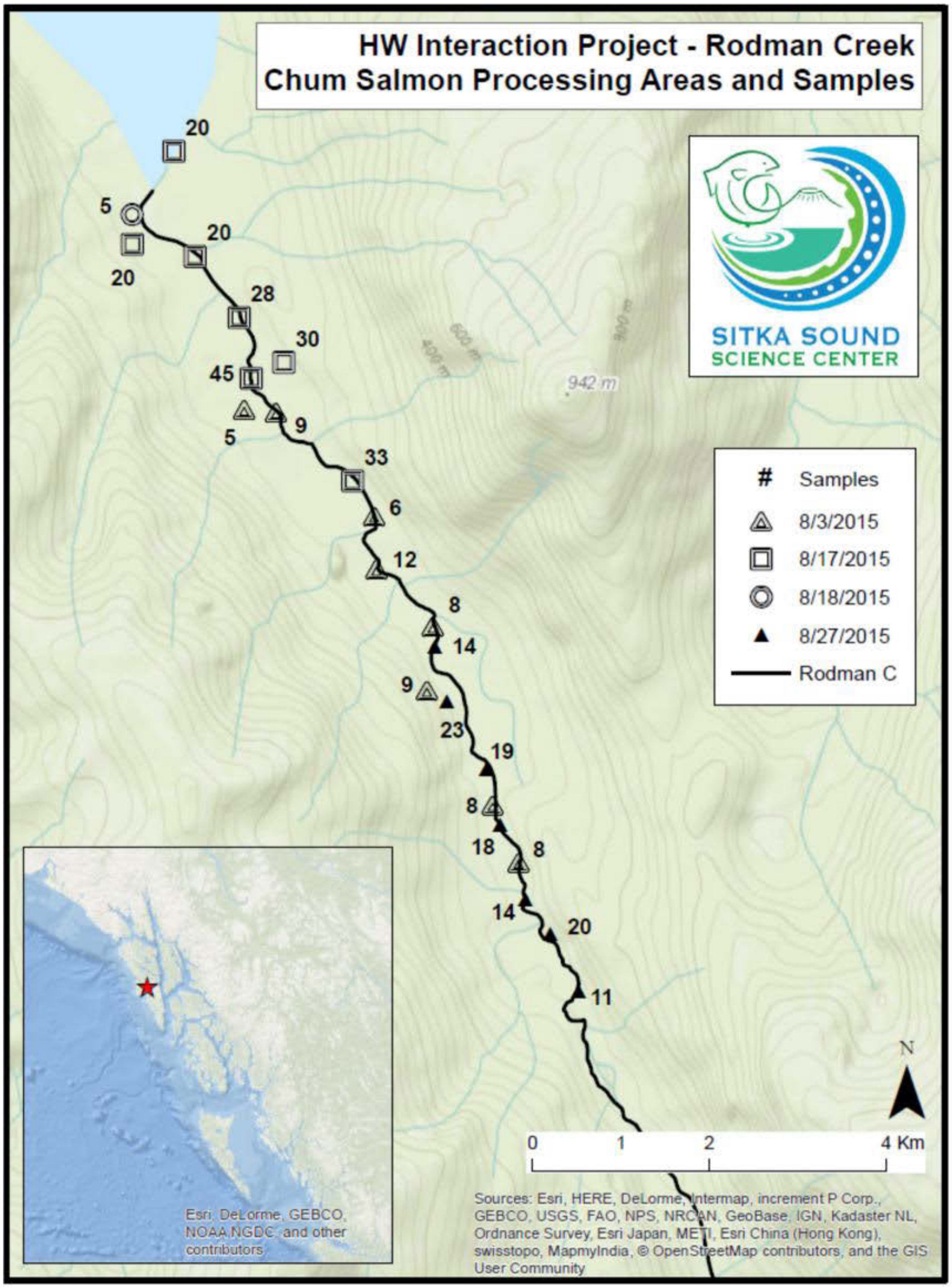
Extent of stream surveyed: The crew surveyed approximately 1 mile above the canyon until the stream became braided and very brushy 57.31723886, -135.0290636.

Unusual events: None reported.

Access, safety, or logistics issues: The canyon on Ralph's Creek is an area where bears cannot easily vacate as the crew approaches. Therefore, bear encounters should be handled with extreme caution in this area. Water levels must be normal in order for the crew to get above the canyon, as it is impossible to wade upstream in this area when it is flooded.

Recommendations, changes, and other notes: None reported

Rodman Creek
113-54-10070
Chum Salmon



Number of Visits: 4

Total Number Sampled: 385

2015 Samples Collected & Run timing: The first visit was on 8/03 and slightly early in the run. The crew counted 791 live and 49 dead chum, and collected 65 samples. The second visit was on 8/17, but the crew was only able to sample the lower half of the creek due to a change of plans after a cancelled float plane pickup in the morning. The crew counted 306 live, 267 dead, and collected 196 samples. The crew went back the following day to survey the top half of the stream, but due to heavy rain overnight, were not able to access the stream beyond the intertidal zone. Five samples were collected in the intertidal and grass flats. The final visit was on 8/27, and only the top half of the stream extent was surveyed on this visit in order to spread the season's sampling efforts out throughout the geographic extent of the stream. The crew counted 0 live, 127 dead, and collected 119 samples, many of which came from highly decomposed carcasses. The last visit was later than desirable.

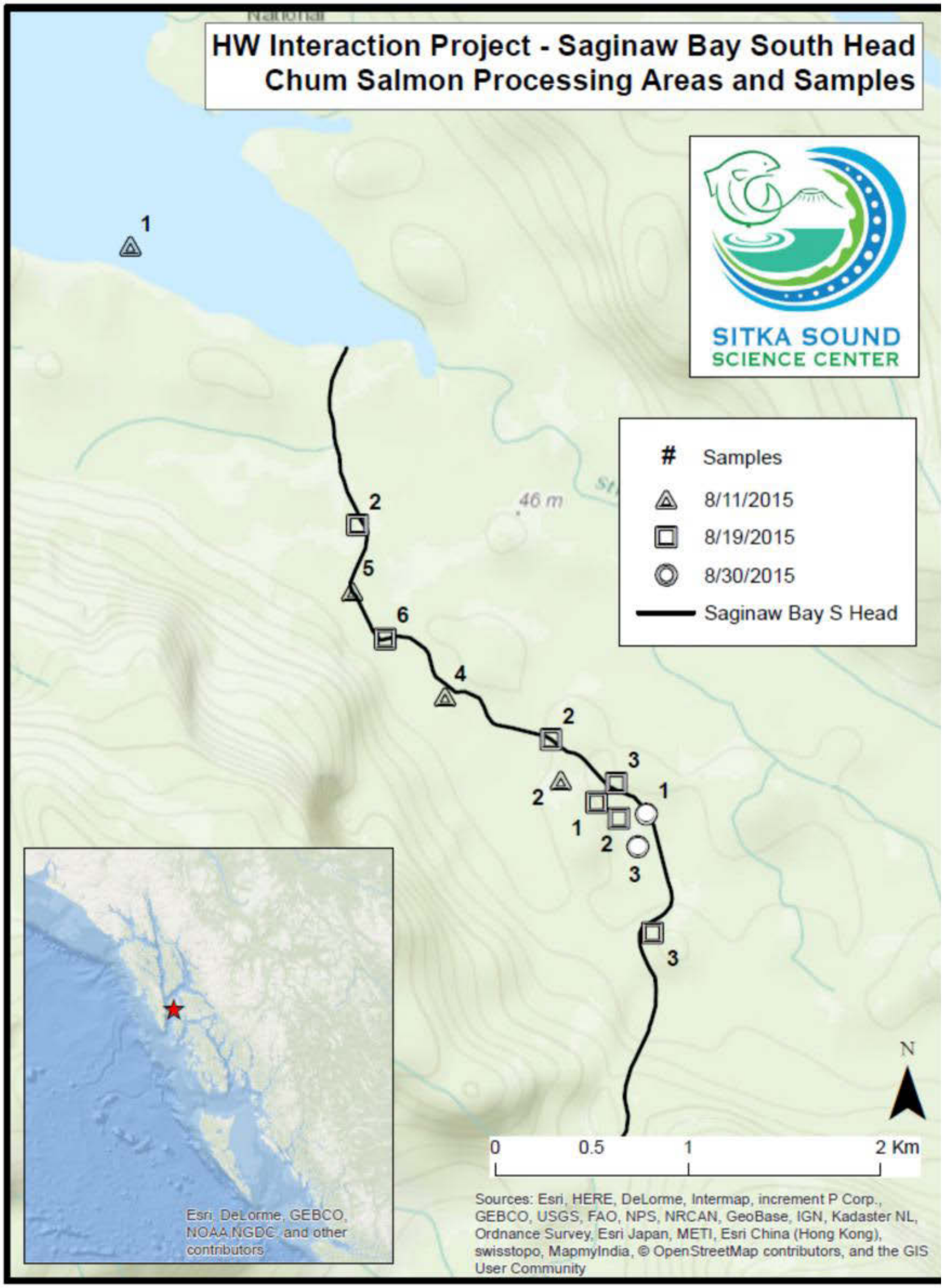
Extent of stream surveyed: The highest point surveyed was roughly 5 miles upstream from tree line 57.39021096, -135.3521089.

Unusual events: None reported

Access, safety, or logistics issues: This stream has a long chum run and may need to be sampled on consecutive days during peak run.

Recommendations, changes, and other notes: Crews are advised to anchor the skiff to the left of the river mouth. Given its relatively close proximity, Rodman could be sampled by a crew from Sitka in future field seasons.

Saginaw Bay S Head
109-44-10370
Chum Salmon



Number of Visits: 4 (including 1 visit to Straight Creek, 109-44-10350, described below)

Total Number Sampled: 35

2015 Samples Collected & Run timing: The first visit was conducted on 8/11. On this visit the crew reported counting 115 live, 5 dead, and collected 12 samples. The second visit was on 8/19. The crew counted 55 live, 20 dead, and sampled 19 chums. The third visit was conducted on 8/30. The crew was unable to count live and dead chum as the creek flooded during this survey. Four samples were collected before the crew had to bushwhack their way out of the stream. Thus far we seen fewer than 400 chums total in Saginaw over all 3 years.

Extent of stream surveyed: On the second visit, the crew was able to hike through the canyon to locate the extent of chum migration at a 5' waterfall, approximately 2.5 miles upstream. No chums were seen within 0.5 miles of the extent location 56.82090138, -134.1037475.

Unusual events: None reported

Access, safety, or logistics issues: Saginaw is characterized by numerous log jams and thick brush on the banks. The stream separates into 2 channels for 0.25 miles. Chum were seen and sampled in both channels, although the East channel seemed to be more productive.

Recommendations, changes, and other notes: Crews have consistently found that most of the chums are present in the creek above the bridge. Future surveys should still look for chums in the stream below the bridge but focus more intensely on the upper reaches to acquire the most samples. Crews can anchor near the float house, walk the road (1 mile) to the bridge, then walk the stream from there.

Additional Stream - Straight Creek (109-44-10350)

Number of Visits: 1

Total Number Sampled: 0

2015 Samples Collected & Run timing: Due to a lack of samples produced from Saginaw Bay S Head, 109-44-10370, the crew sampled Straight Creek, which shares the same drainage. The visit took place on 8/31. The crew hiked roughly 0.75 miles past the tree line, but did not observe any live or dead chum in this creek. The creek substrate was sandy or muddy throughout, with very little spawning habitat.

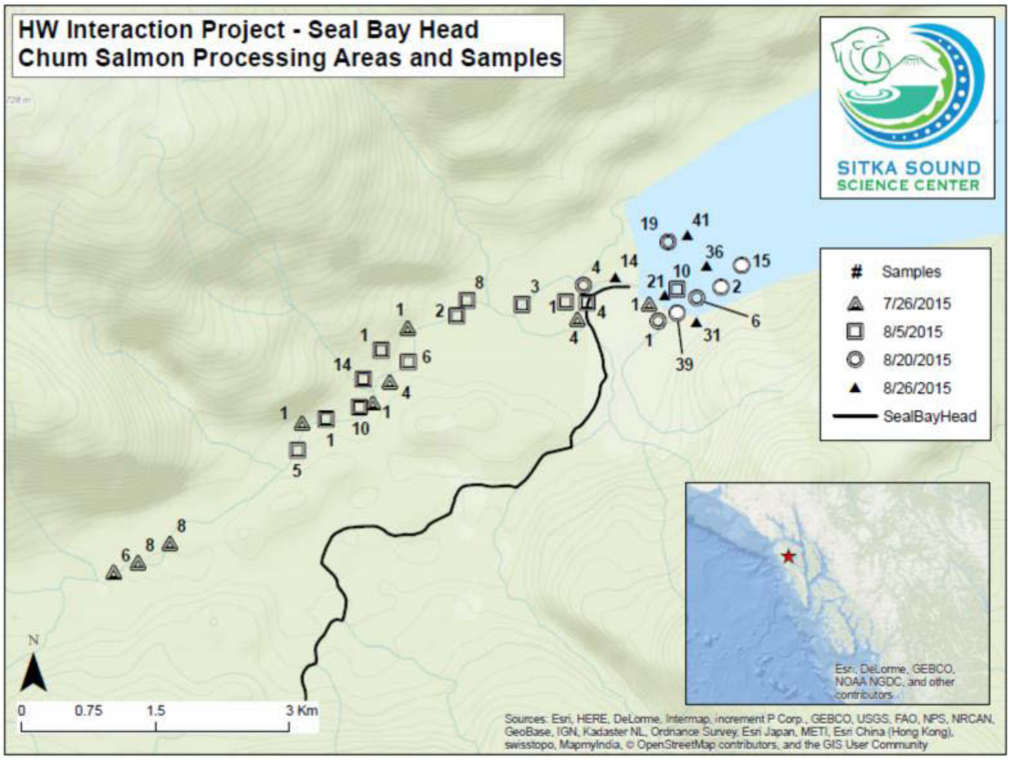
Extent of stream surveyed: The highest point surveyed on Straight Cr was 0.75 miles up from the tree line.

Unusual events: None reported

Access, safety, or logistics issues: None reported

Recommendations, changes, and other notes: This stream does not appear to be a viable chum sampling location.

Seal Bay Head
112-46-100370
Chum Salmon



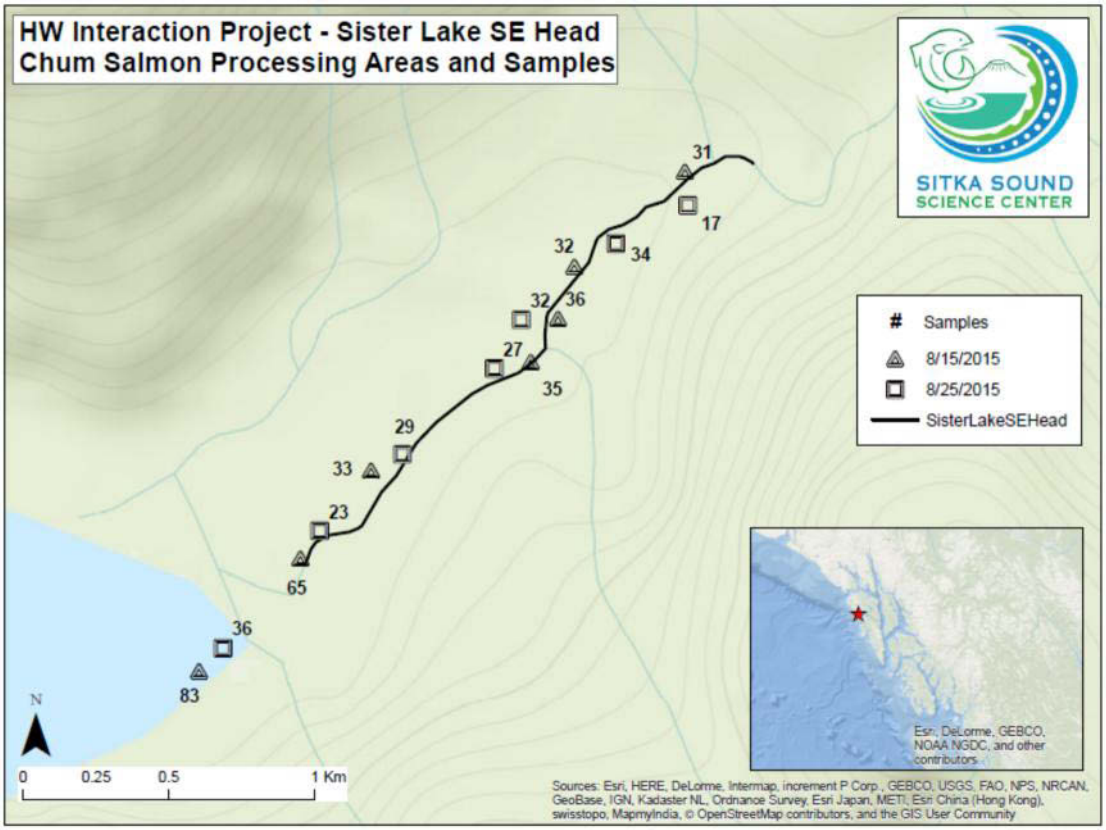
Number of Visits: 4
Total Number Sampled: 327

2015 Samples Collected & Run timing: Our first visit on 7/26 was early. The Tenakee based crew counted 241 live and dead, sampling 34 chums. The next two visits were conducted on 8/5 and 8/20, where the crew counted 150 and 255 chums respectively, with the live dead ration about 50/50. The crew collected 150 samples over the course of these 2 visits. During the final visit on 8/26, the crew counted 127 live and 154 dead, sampling 143 chums.
Extent of stream surveyed: There are two streams at the head of Seal Bay: the target stream is 112-46-100370 which is smaller and referred to by our crew as the east fork; just to the west is 112-46-100380 which is larger. Crews surveyed each main fork of the river, but favored the West Fork which is larger and holds more fish. The highest point reached was 3 miles upstream from the flats 57.80784691, -135.6467797.
Unusual events: The lower portions of the main river channel have undergone major changes in recent years. The channel has been rerouted leaving much of the former (good) spawning habitat dry.

Access, safety, or logistics issues: The West fork has many blow downs and log jams, requiring extra time to negotiate.

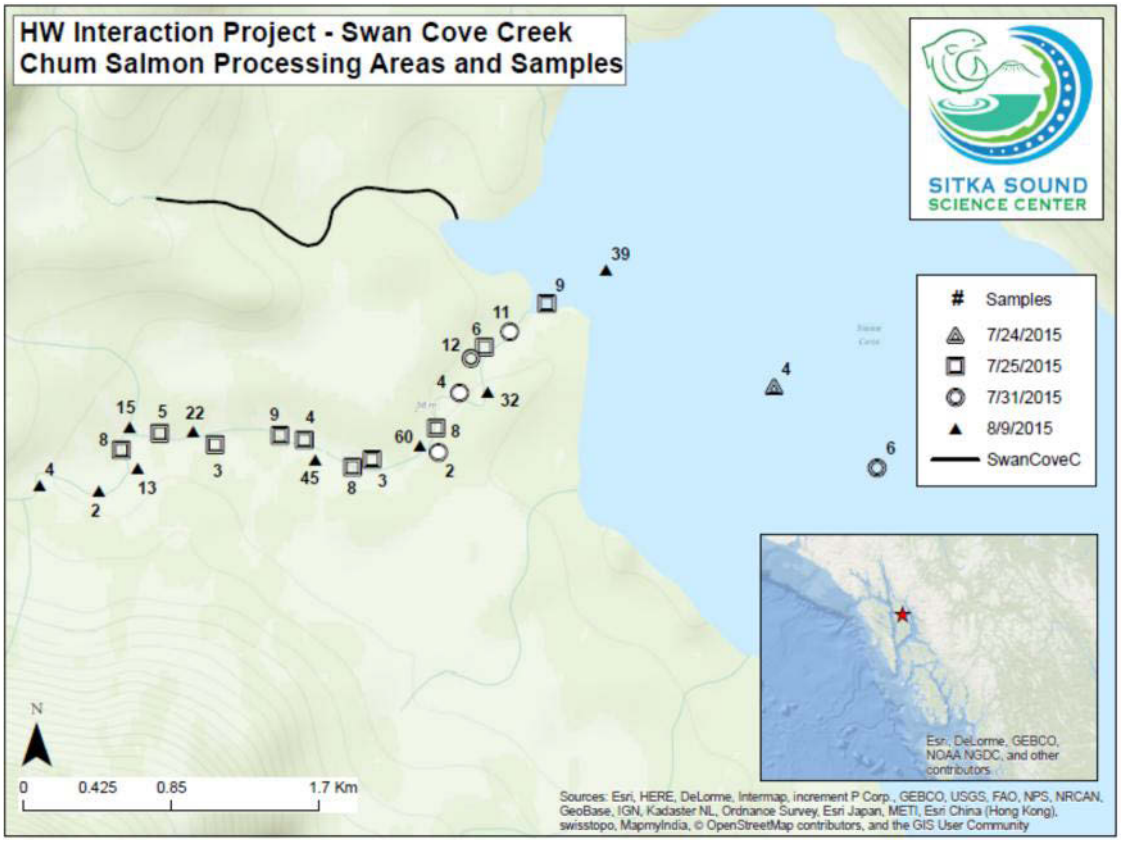
Recommendations, changes, and other notes: Both forks were investigated. Fish numbers quickly tapered off on the East fork but the West fork held many fish and had a lot of good spawning habitat.

Sister Lake SE Head
113-72-10040-2025
Chum Salmon



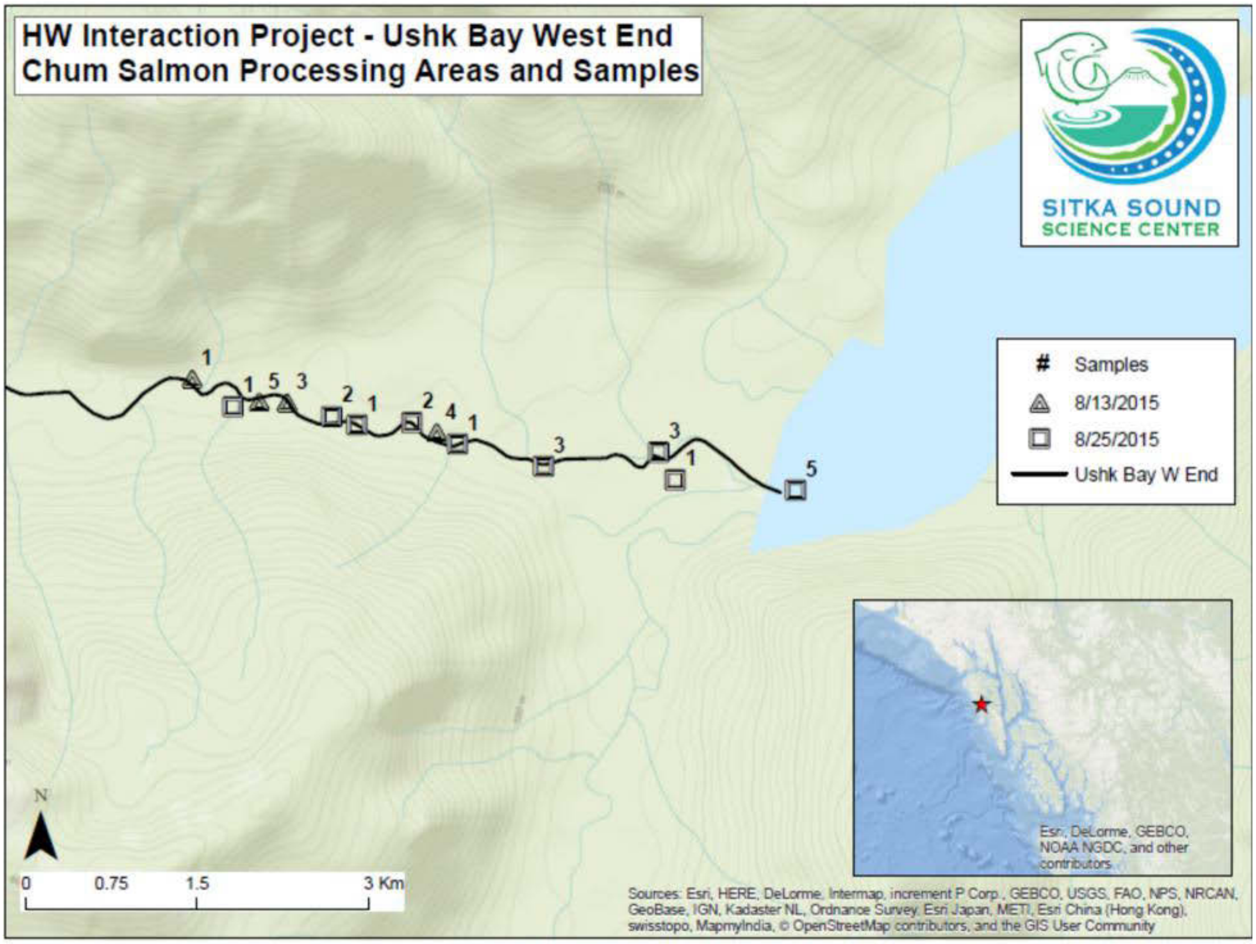
Number of Visits: 2
Total Number Sampled: 513
2015 Samples Collected & Run timing: Our first visit to Sisters Lake occurred on 8/15. We collected 315 samples with 1300 live and 1095 dead chum observed. The second visit took place on 8/25, after a major flood event, which drastically changed many channels and pools within the stream. During this visit we collected 198 samples and saw 124 live and 400 dead chum. Many carcasses were buried in new gravel bars. All live chums observed were moldy and likely post-spawn. This highly productive system was bracketed well with this year's survey dates, but attention should be paid to flooding events early in the run timing.
Extent of stream surveyed: The highest point surveyed was 1 mile upstream from the tree line 57.63255722, -135.9647467.
Unusual events: None reported.
Access, safety, or logistics issues: Accessing Sister Lake via float plane could be considered in future field seasons when the weather is too rough for the vessel to travel to the outside coast of Chichagof. The alternative is to build flexibility into the schedule and seize good weather windows to head to the outside coast for both Sister Lake and Ford Arm.
Recommendations, changes, and other notes: None reported.

Swan Cove Creek
111-16-10450
Chum Salmon



Number of Visits: 4
Total Number Sampled: 334
2015 Samples Collected & Run timing: The first visit on 7/24 was a high water event and the crew was unable to survey much more than just the tide flat. In this small stretch they counted 4 live chum and 3 dead and retrieved 4 samples. With good weather the crew surveyed again on 7/25 and counted 191 live, 36 dead, and sampled 63 chums. During the third visit on 7/31 we counted 17 live, 43 dead, and sampled 35 chums. During the 4th visit on 8/9, 232 samples were collected and 57 live and 241 dead chum were observed. All live chum were moldy and post-spawn.
Extent of stream surveyed: We surveyed from the bottom of the tide flat 1.5 miles upstream to a series of small falls which together serve as a barrier 57.98688273, -134.3743681
Unusual events: None reported.
Access, safety, or logistics issues: Crews are advised to not attempt to cross the tide flats in the jet boat as it generally runs aground. Swan Cove Creek is made up of large slimy boulders which make wading difficult and good studs in wading boots essential.
Recommendations, changes, and other notes: None reported.

Ushk Bay W End
113-56-10030
Chum Salmon



Number of Visits: 2
Total Number Sampled: 32

2015 Samples Collected & Run timing: The first visit was conducted on 8/13, which was early. Only 91 live chums were seen, 90% of which were fresh, and 12 dead. The crew collected 13 samples. The second visit was conducted on 8/25, during which the crew observed 29 live and 17 dead, and sampled 19 chums.

Extent of stream surveyed: The highest point surveyed was 3 miles upstream, the stream becomes highly braided and chum sightings had diminished 57.55310418, -135.7465059

Unusual events: None reported.

Access, safety, or logistics issues: The USGS topo map and forks does not accurately show location of forks.

Recommendations, changes, and other notes: It is best to anchor skiffs on the sand beach to the right of mouth. The creek indicated in the project protocol is the main channel. It is a smaller stream with fairly easy walking until you get up high and it becomes smaller with more logjams. Discuss the possibility of surveying only south channel that is more productive on future visits.

Additional Stream at Ushk Bay W End (113-56-10020)

This stream was sampled in addition to the adjacent 113-56-10030 so that the number of samples could be increased. Data from the two streams was combined under stream 10030 for the hatchery fraction analysis.

Number of Visits: 2
Total Number Sampled: 220

2015 Samples Collected & Run timing: Crews surveyed the first ¼ mile of the stream on 8/25 during which the crew was able to collect 69 samples. A second visit was then scheduled for 9/1 to survey the entire creek. Both of these visits bracketed the run timing well, although there were still live post spawned fish observed during the last visit.

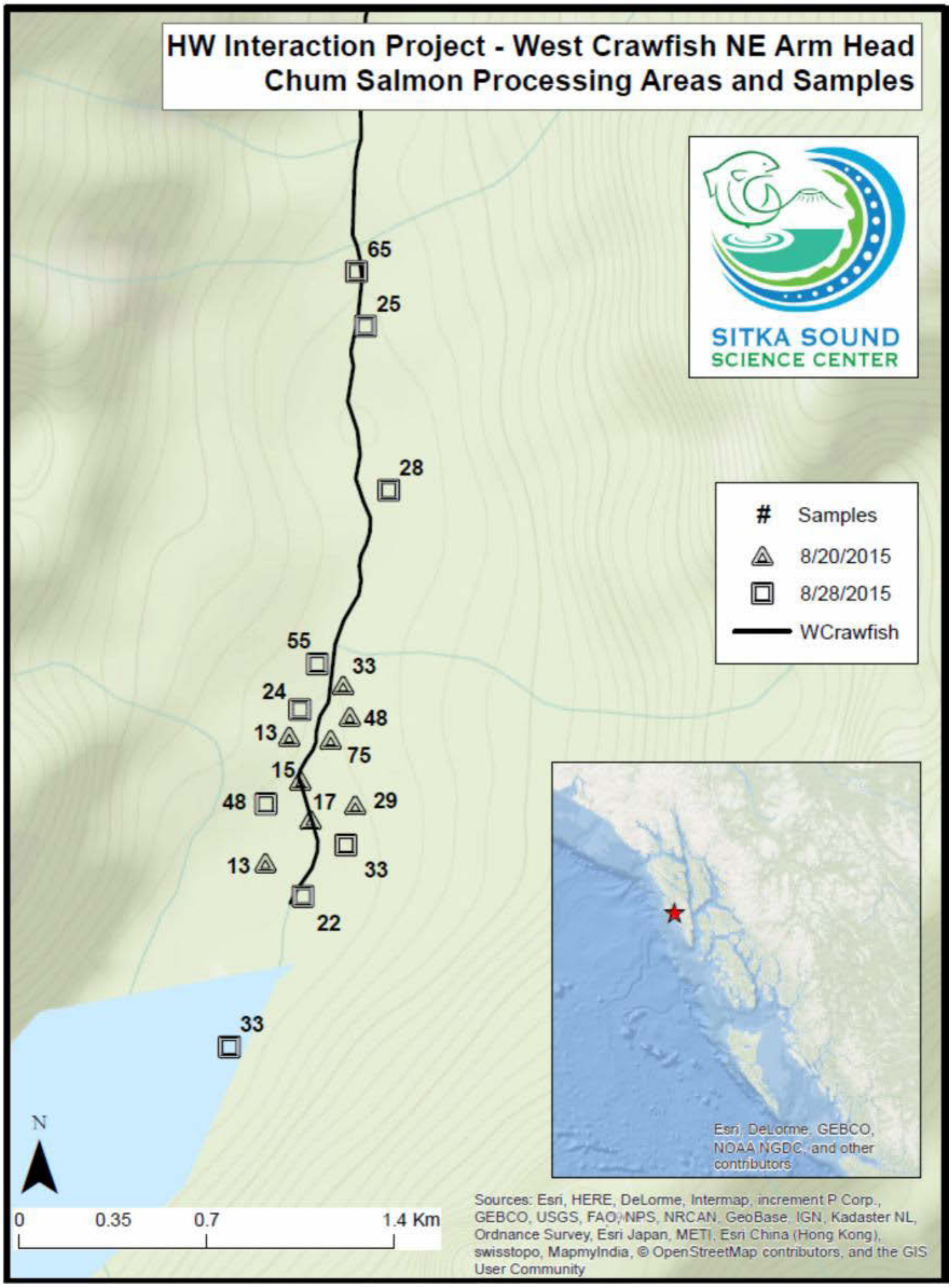
Extent of stream surveyed: This stream ends in a large waterfall about 1.5 miles upstream from the tree line, all of which was surveyed during our 9/1 visit. 57.5332528, -135.6943005

Unusual events: None reported.

Access, safety, or logistics issues: None reported

Recommendations, changes, and other notes: It is worthwhile to survey the intertidal zone at low tide on this creek as carcasses were found to have washed out into the intertidal zone.

West Crawfish NE Arm Hd
113-32-10050
Chum Salmon



Number of Visits: 2
Total Number Sampled: 576

2014 Samples Collected & Run timing: Our first planned visit was delayed due to recurring high water and bad weather. We were able to conduct a first visit on 8/20 where we counted 250 live 270 dead, and collected 262 samples. Our second visit was on 8/28. Here we counted 151 live, 278 dead, and collected 333 samples. This visit was timed well with the late stages of the run.

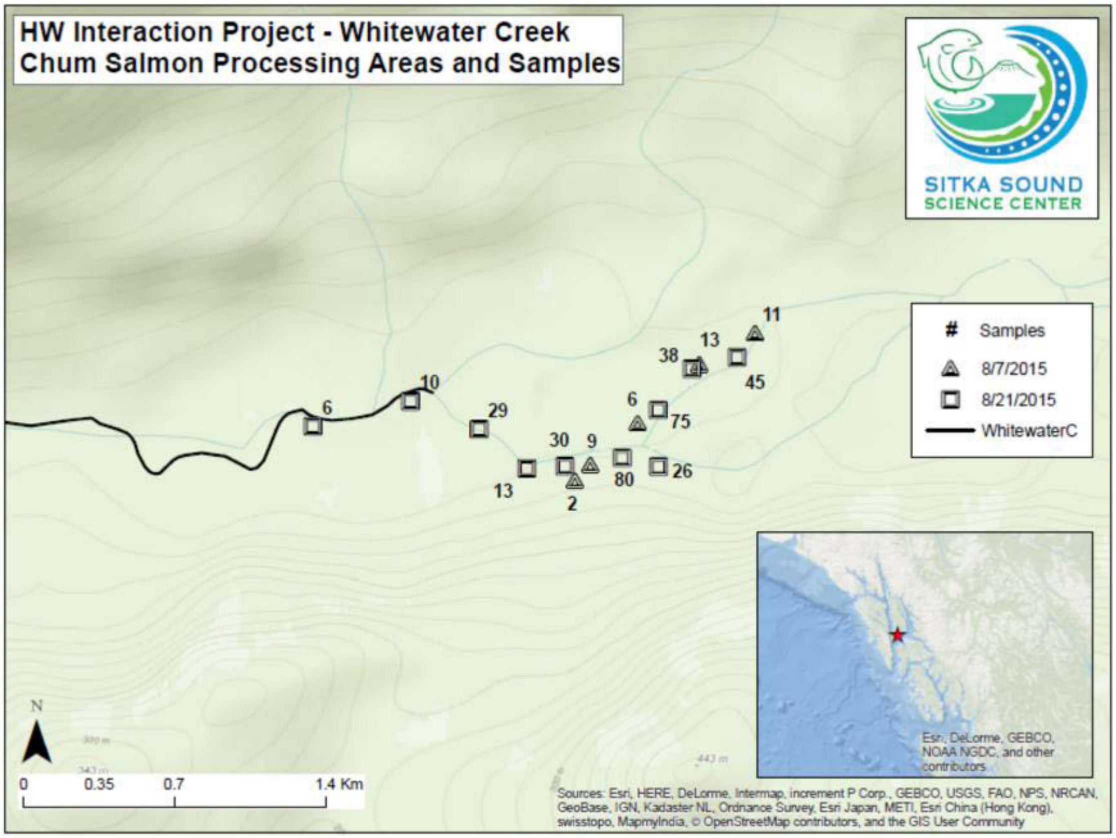
Extent of stream surveyed: The highest point sampled was 1.5 miles upstream at the point where the gradient picks up and is less conducive to chum spawning.

Unusual events: None

Access, safety, or logistics issues: None

Recommendations, changes, and other notes: This stream is likely the most remote of the 28 otolith steams. This stream was visited twice by SSSC personnel and volunteers, who travelled to the stream via skiff and float plane from Sitka. This approach was very successful in that it allowed for the North vessel to concentrate their efforts elsewhere. Furthermore, by establishing that a Sitka crew will sample this stream, there is a higher degree of flexibility as to when it can be sampled.

Whitewater Creek
112-90-10140
Chum Salmon



Number of Visits: 3

Total Number Sampled: 393

2015 Samples Collected & Run timing: Our first visit on 7/26 was early. Our crew saw 259 live and 0 dead chum, and took 0 samples. No post-spawn chum and few new redds were observed on this visit. On the second visit on 8/07 the crew counted 377 live and 36 dead chum, and took 41 samples. Most of the live chums were fresh on this visit. The crew returned on 8/21, and collected 352 samples from 119 live and 351 dead chum observed in the stream. At this time, most of the live chum appeared to be post-spawn, but the majority of carcasses sampled were freshly dead.

Extent of stream surveyed: The highest point surveyed was 1.75 miles upstream on the North fork, at this point the stream narrows, braids, and becomes brushy 57.24469108, -134.4855679.

Unusual events: None reported.

Access, safety, or logistics issues: Whitewater Creek has a very large tide flat. There needs to be a 10 foot high tide in order for the skiff to approach the flats. Walking in at a lower tide can be dangerous to hike due to sinking into silty, muddy substrate.

Recommendations, changes, and other notes: The creek forks upstream and the North fork has the most water, however both forks split again shortly thereafter. Some chums were seen in all forks, but most were seen in the North.