

**Northern Boundary and Transboundary Rivers  
Restoration & Enhancement Fund**

**HUGH SMITH LAKE COHO SMOLT ESTIMATION  
AND MARKING 2017**

**Final Report**

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## **INTRODUCTION:**

Hugh Smith Lake, located 72 km southeast of Ketchikan, has served as indicator stock for management of fisheries for coho salmon since 1982 (Shaul et al. 2009; 2011). Located near the international boundary, the stock is harvested by commercial troll and net fisheries and recreational fisheries in both U.S. (Alaska) and Canada. The project is a core stock assessment program needed to manage fisheries for coho salmon in the northern Boundary Area. The Hugh Smith Lake coho salmon population is substantially exploited by mixed-stock fisheries in both the U.S. and Canada (Figure 1) and is, therefore, a key indicator stock used to monitor total adult abundance and escapements, and the pattern and intensity of exploitation by these fisheries on populations in the northern Boundary Area. Its location 70 km southeast of Ketchikan makes it a particularly strategic indicator stock for boundary area fisheries. It has also been one of three key coded-wire tagged indicator stocks used to measure the exploitation rate by the Alaska troll fishery and to estimate the overall abundance of wild coho salmon available to the fishery. Timely escapement projections are made from both the cumulative weir count and estimation models based on recovery of coded-wire tags (Shaul et al. 2009) to provide real-time information for management of fisheries for escapement goals.

A smolt weir was operated on the outlet of the lake from late-April through early-June in order to catch, sample and mark coho salmon smolts with coded-wire tags (CWT's). Smolts are enumerated at the weir, but the final smolt estimate is generated the following year based on a recovery sample of age 0-ocean jacks in fall of the sea-entry year and of adults in the year following tagging. Smolts were also sampled for age, length and weight.

## **OBJECTIVES:**

The specific objectives expected to be achieved by this project are:

1. Estimate the smolt outmigration from Hugh Smith Lake and the total adult return, such that each estimate has a coefficient of variation of 7% or less.
2. Estimate the exploitation rate in all marine fisheries for the stock such that the estimated coefficient of variation is 5% or less.
3. Estimate the proportional distributions of the marine harvest of the stock by gear type in Southeast Alaska and British Columbia.
4. Estimate the age composition of the smolt outmigration from Hugh Smith Lake from a sample of approximately 600 smolts distributed throughout the run at each location so that the estimated proportion of each age class is within 5% of the true value with at least 95% probability.

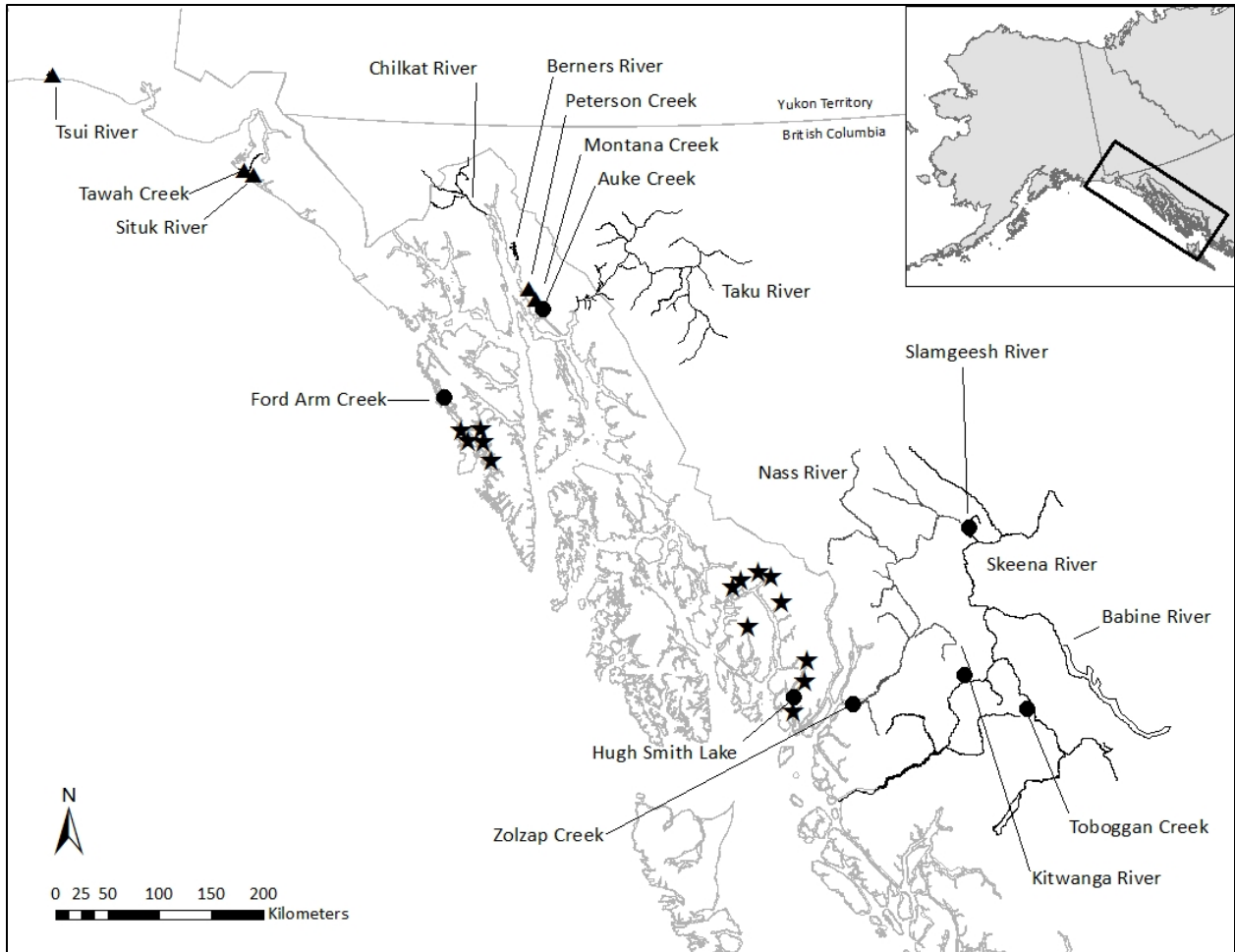


Figure 1.—Map of Southeast Alaska and northern British Columbia, showing the locations of recent coho salmon full indicator stock assessment projects. Stars mark area index streams and triangles mark surveyed streams with independent escapement goals.

## METHODS:

### *Smolt Abundance (objective 1)*

A smolt weir comprised of plastic screen panels supported by a cable was installed at the outlet of Hugh Smith Lake (Olmsted 1998). All coho smolts captured in the trap were removed, anesthetized, adipose-clipped, coded-wire-tagged using the method described by Magnus et al. (2006), and released. The Chapman estimate of the total smolt migration based on the number of marked smolts released and a recapture sample of all returning jacks (2017) and adults (2018) counted at the upstream migrant weir.

### *Marine Harvest and Exploitation Rate (objectives 2 and 3)*

Marine harvest of adult coho salmon returning to Hugh Smith Lake in 2018 will be estimated in various marine fisheries using procedures from Bernard et al. (1998). A stratified catch sampling approach will be used in marine commercial and recreational fisheries across Southeast Alaska. Returning adults will be enumerated and sampled for adipose clips and CWTs to estimate the

proportion marked. Resulting estimates of escapement and harvest will be used to estimate the total return and exploitation rate (Shaul and Crabtree 2017).

#### *Age Composition and Length (objective 4)*

A systematically drawn sample of coho salmon smolt scales was taken at a rate of one in every 100 healthy fish  $\geq 75$ mm (fork length). Each fish sampled for age had 12-15 scales removed from the preferred area on the left side of each fish and pressed between two microscope slides.

Coho salmon smolt (snout-to-fork) length was measured to the nearest millimeter and scales collected for aging from a target sample of 600 fish. The sample size was selected to achieve approximate 95% simultaneous confidence intervals assuming there to be three age classes, an infinite population size, and allowing for up to 20% unageable scale samples due to regeneration or other causes.

Samples will be collected according to the following daily schedule:

| <u>Dates</u>    | <u>Daily Sample</u> |
|-----------------|---------------------|
| 30 April–10 May | 16                  |
| 11–18 May       | 28                  |
| 19 May–3 June   | 16                  |

#### **RESULTS AND DISCUSSION:**

In 2017, 24,862 coho salmon smolts were captured with the smolt weir, of which 24,384 were adipose fin clipped, coded-wire tagged, and released live (Table 1). The weir, sampling and tagging operations were successful, with an above-average number of smolts captured and no evident problem with effectiveness of the weir. Coho smolt abundance and smolt survival for the 2017 release year will not be determined until the end of the 2018 adult coho salmon sampling season.

A total of 630 coho salmon smolts were sampled for age, length, and weight. The estimated age composition of coho salmon smolt sampled in 2016 is still pending age analysis. The mean length of coho salmon smolt in 2017 was 99 mm. The mean weight of coho salmon smolt in 2017 was 9.5 grams. The marine harvest of coho salmon will be estimated after adults from the 2016 release year have returned in 2018.

#### **CONCLUSION:**

In the spring of 2017, the Northern Fund was used to operate a smolt weir on Hugh Smith Lake to capture, mark and coded-wire tag coho salmon smolts as part of an important indicator stock program for wild coho salmon populations shared by Alaskan and Canadian fishermen in the northern boundary area. All field work was conducted from mid-April through early June, 2017. The additional funds provided by the Northern Fund doubled the effort and catches of ADF&G. Marking and sampling objectives were met. Final estimates of smolt production, survival and fishery exploitation will be generated after adult coho salmon return to Hugh Smith Lake in fall 2018. The project progressed very smoothly and was accomplished significantly under budget (Table 2), particularly in the area of personnel expenditure, largely due to the experience and efficiency of the crew, lower than normal difficulty with high water, and low infrastructure repair and replacement needs.

**Table 1.** Annual Hugh Smith Lake coho salmon smolt weir counts and total population estimates in 1982–2017 and estimated survival to adulthood the following year.

| Smolt Year     | Smolt Weir Count | Number Marked (M) | Returns Sampled (C) | Adjusted Ad Clips (R) <sup>a</sup> | Smolt Estimate (N) | 95% C.I. Lower Bound | 95% C.I. Upper Bound | Total Adult Return | Marine Survival (%) |
|----------------|------------------|-------------------|---------------------|------------------------------------|--------------------|----------------------|----------------------|--------------------|---------------------|
| 1982           | 5,925            | 5,573             | 1,160               | 221                                | 29,117             | 25,738               | 33,519               | 3,875              | 13.3                |
| 1983           | 27,552           | 9,647             | 1,242               | 224                                | 53,227             | 47,087               | 61,209               | 4,024              | 7.6                 |
| 1984           | 22,803           | 16,928            | 806                 | 422                                | 32,283             | 29,474               | 35,683               | 2,440              | 7.6                 |
| 1985           | 11,111           | 9,833             | 692                 | 288                                | 23,572             | 21,136               | 26,643               | 4,365              | 18.5                |
| 1986           | 6,819            | 5,716             | 508                 | 132                                | 21,878             | 18,705               | 26,349               | 2,244              | 10.3                |
| 1987           | 4,965            | 4,819             | 262                 | 34                                 | 36,218             | 27,276               | 53,883               | 1,473              | 4.1                 |
| 1988           | 5,319            | 5,292             | 341                 | 64                                 | 27,904             | 22,463               | 36,824               | 2,404              | 8.6                 |
| 1989           | 7,187            | 7,187             | 736                 | 198                                | 26,620             | 23,376               | 30,910               | 4,794              | 18.0                |
| 1990           | 11,106           | 11,106            | 1,582               | 530                                | 33,101             | 30,507               | 36,177               | 5,767              | 17.4                |
| 1991           | 13,371           | 13,269            | 1,059               | 601                                | 23,373             | 21,643               | 25,402               | 4,895              | 20.9                |
| 1992           | 5,519            | 5,514             | 835                 | 140                                | 32,657             | 28,042               | 39,092               | 4,242              | 13.0                |
| 1993           | 19,422           | 19,401            | 1,719               | 688                                | 48,434             | 45,069               | 52,341               | 9,464              | 19.5                |
| 1994           | 15,993           | 15,941            | 1,919               | 617                                | 49,516             | 45,898               | 53,752               | 6,708              | 13.5                |
| 1995           | 12,586           | 12,585            | 1,034               | 584                                | 22,267             | 20,597               | 24,230               | 3,948              | 17.7                |
| 1996           | 24,243           | 24,220            | 699                 | 524                                | 32,294             | 29,748               | 35,316               | 2,696              | 8.3                 |
| 1997           | 26,791           | 26,367            | 1,061               | 747                                | 37,436             | 34,932               | 40,327               | 4,371              | 11.7                |
| 1998           | 20,522           | 20,213            | 1,370               | 927                                | 29,875             | 28,068               | 31,930               | 4,221              | 14.1                |
| 1999           | 12,001           | 11,999            | 616                 | 371                                | 19,902             | 18,066               | 22,154               | 1,346              | 6.8                 |
| 2000           | 19,668           | 19,663            | 1,443               | 1,216                              | 23,327             | 22,086               | 24,716               | 3,119              | 13.4                |
| 2001           | 30,335           | 29,388            | 3,282               | 2,643                              | 36,487             | 35,147               | 37,933               | 5,406              | 14.8                |
| 2002           | 19,326           | 18,935            | 1,497               | 1,056                              | 26,841             | 25,315               | 28,564               | 3,676              | 13.7                |
| 2003           | 16,317           | 15,572            | 929                 | 629                                | 22,997             | 21,331               | 24,946               | 2,492              | 10.8                |
| 2004           | 24,379           | 23,517            | 1,807               | 1,064                              | 39,924             | 37,662               | 42,476               | 3,652              | 9.1                 |
| 2005           | 17,799           | 17,795            | 935                 | 590                                | 28,184             | 26,080               | 30,656               | 1,926              | 6.8                 |
| 2006           | 26,128           | 25,375            | 1,339               | 911                                | 37,267             | 34,996               | 39,854               | 3,309              | 8.9                 |
| 2007           | 19,602           | 19,306            | 1,732               | 1,161                              | 28,793             | 27,228               | 30,550               | 3,776              | 13.1                |
| 2008           | 10,131           | 10,046            | 2,277               | 952                                | 24,006             | 22,573               | 25,633               | 4,383              | 18.3                |
| 2009           | 18,988           | 18,722            | 2,876               | 2,086                              | 25,813             | 24,751               | 26,970               | 5,417              | 21.0                |
| 2010           | 25,727           | 25,437            | 2,131               | 1,436                              | 37,742             | 35,886               | 39,800               | 3,937              | 10.4                |
| 2011           | 21,359           | 21,359            | 1,851               | 1,217                              | 32,482             | 30,755               | 34,415               | 4,163              | 12.8                |
| 2012           | 21,638           | 21,456            | 3,069               | 1,602                              | 41,093             | 39,175               | 43,208               | 6,906              | 16.8                |
| 2013           | 24,398           | 24,113            | 4,075               | 2,079                              | 47,247             | 45,300               | 49,368               | 7,707              | 16.3                |
| 2014           | 18,908           | 18,675            | 988                 | 544                                | 33,860             | 31,238               | 36,962               | 1,978              | 5.8                 |
| 2015           | 9,860            | 9,787             | 1,058               | 266                                | 38,808             | 34,656               | 44,090               | 2,461              | 6.3                 |
| 2016           | 11,468           | 11,432            | 653                 | 232                                | 32,090             | 33,756               | 24,324               |                    |                     |
| 2017           | 24,862           | 24,384            |                     |                                    |                    |                      |                      |                    |                     |
| 1982-2015 Avg. |                  |                   |                     |                                    |                    |                      |                      |                    |                     |
| Average        | 16,994           | 16,022            | 1,439               | 787                                | 32,487             | 29,765               | 36,055               | 4,047              | 12.6                |

## DETAILED BUDGET SUMMARY:

**Table 2.-** Allocated and expended costs for major spending categories see in the Northern Fund project Hugh Smith Lake Coho Salmon Estimation and Marking, 2017.

| Line Item               | Allocations | Expenditures | Balance      |
|-------------------------|-------------|--------------|--------------|
| Personnel               | \$38,500.00 | \$28,190.91  | \$10,309.09  |
| Travel                  | \$2,200.00  | \$3,432.99   | (\$1,232.99) |
| Contractual             | \$6,480.00  | \$4,010.76   | \$2,469.24   |
| Commodities             | \$6,450.00  | \$4,987.73   | \$1,462.27   |
| Equipment               | \$0.00      | \$0.00       | \$0.00       |
| Administrative Overhead | \$8,797.00  | \$8,797.00   | \$0.00       |
| All Lines               | \$62,427.00 | \$49,419.39  | \$13,007.61  |

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