

# Lower Skeena River Coho Indicators Program (2019)

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## Abstract

The Terrace Salmonid Enhancement Society (TSES) has conducted the coded wire tagging (CWT) portion of the Zymachord Coho Harvest Distribution Project under Contribution Agreements with the Pacific Salmon Commission since 2014. In 2019, a pilot mark and recapture program and aerial counts of coho on lower Skeena tributaries were additionally conducted with the intention of expanding the project's scope (renamed as the 'Lower Skeena River Indicators Program'). The program produces (CWT) marked coho salmon (*Oncorhynchus kisutch*) yearlings which are released into the natural population of the Zymachord (*Zymagotitz*) River. Coded wire tagged fish are sampled in an international Mark Recovery Program, data that is essential to measuring exploitation rates.

In 2019, TSES applied 18,497 CWTs (including adipose clips) to Zymachord coho fry (2018 brood).

Tag application to adults and broodstock collection was conducted from October 9th until October 29<sup>th</sup>, 2019. A total of 67 coho were captured during 5 sampling days. Forty-one wild and 9 CWT coho were tagged and released. Seventeen individuals were taken for brood. Aerial counts were also completed to enumerate coho on the Zymachord, Extew, Exchamsiks, and Kasiks Rivers.

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## Introduction

The Terrace Salmonid Enhancement Society (TSES) has conducted the coded wire tagging (CWT) portion of the Zymachord Coho Harvest Distribution Project under Contribution Agreements with the Pacific Salmon Commission since 2014. In 2019, a pilot mark and recapture program and aerial counts of coho on lower Skeena tributaries were additionally conducted with the intention of expanding the project's scope (renamed as the 'Lower Skeena River Indicators Program').

The program produces (CWT) marked coho salmon (*Oncorhynchus kisutch*) yearlings which are released into the natural population of the Zymachord (*Zymagotitz*) River. Coded wire tagged fish are sampled in an international Mark Recovery Program, data that is essential to measuring exploitation rates. This project improves our scientific understanding of coho for stock assessment and resource management purposes. It is the only index of Alaska and Canadian coho fishing impacts to lower Skeena coho and its data becomes archived in an international database for future analysis and interpretation. It compliments other coho programs in the region by adding to and reinforcing existing knowledge. It has been made possible through volunteer partnerships in cooperation with DFO, and has a high degree of First Nation, Commercial, Public and Recreational management interest.

Coho salmon coded wire tag (CWT) and exploitation indicators play an important role in our understanding and management of coho in the northern boundary area. The “lower” Skeena coho have a distinctly different timing (mid-September) compared to the middle and upper Skeena coho (August 5<sup>th</sup>). There is considerable information from previous middle and upper Skeena coho CWT programs (Babine, Toboggan, Slamgeese and Kitwanga) but there have been no previous cwt programs for the lower river late timed stocks. It is assumed that the lower Skeena stocks have similar distribution and harvest impacts as the former Lachmach (outside Area 3) and current Zolzap (lower Nass River tributary) (*S. Davies, DFO; North Coast Stock Assessment, unpubl. data*).

Since 2014, the Zymachord River Coho CWT Harvest Distribution project has produced ~15,000 to 20,000 marked coho fry annually. Each year, Northern Funds have been graciously received for the purchase of coded-wire tags (CWTs) and the Terrace Salmonid Enhancement Society (TSES) tagging/clipping crew. In cooperation with volunteers of the Northwest Watershed Enhancement Society (NWES) broodstock has been collected and reared at the Eby Street hatchery in Terrace, BC. In the spring, the TSES applies CWTs and clips adipose fins before the coho are released into the Zymachord River the following year. True to its proposed intent, this pilot project has successfully fulfilled all of its objectives including the determination of harvest patterns of Zymachord coho in Alaskan and Canadian fisheries. The collection of broodstock, incubation of eggs, over-winter rearing and feeding of fry, and the clipping and releasing of smolts has been expertly conducted each without any issue; Its CWTs have been encountered in the primary Alaskan and Canadian fisheries; Total tag encounters have been estimated in all fisheries and within its escapement in a consistent manner; Zymachord River CWT encounter results have been compared to the Deena River Coho (Haida Gwaii 2E), Zolzap River Coho (Area 3 Lower Nass), and Toboggan Creek Coho (Area 4 Upper Skeena) (*S. Davies, DFO; North Coast Stock Assessment, unpubl. data*).

The pilot mark and re-capture program on the Zymachord River and peak helicopter surveys of indicator streams (Zymachord, Extew, Exchamsiks, and Kasiks Rivers) was conducted by the TSES and

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Fisheries and Oceans Canada. The international Mark Recovery Program samples fisheries for coded wire tagged fish in Canada and the United States, which provides the opportunity to measure exploitation rates of Zymachord coho. This project attempts to provide escapement estimates, data that is required for an exploitation rate indicator stock for Lower Skeena coho. In summary, the objectives are to:

- Apply 20,000 coded-sire tags to enhanced Zymachord coho smolts;
- Use the existing CWT recovery programs in Alaska and Canada to determine the number of tags intercepted within its fisheries;
- Correlate interceptions with interceptions of other coded-wire tagged stocks
- Assess the coho returning to the Zymachord River and estimate the hatchery (marked) and wild (unmarked) component of the return;
- Share stock assessment and fisheries management knowledge acquired for improved conservation, social, and economic decision making.

Available historic CWT data suggests Zymachord encounters within the Alaskan and Canadian Troll fisheries may be comparable or lower than Toboggan and/or Zolzap CWT encounters, (*Figure 1 and 2*). The Y-axis is the estimated number of CWTs, (from the Regional Mark Information System Database) divided by the number of tags released and multiplied by 10,000 (for presentation purposes). This project attempts to obtain a Zymachord mark and recapture estimate along with an estimate of escaped tag encounters in order to review and compare Zymachord fishing exploitations and survivals with that of Toboggan and Zolzap Rivers (*S. Davies, DFO; North Coast Stock Assessment, unpubl. data*).

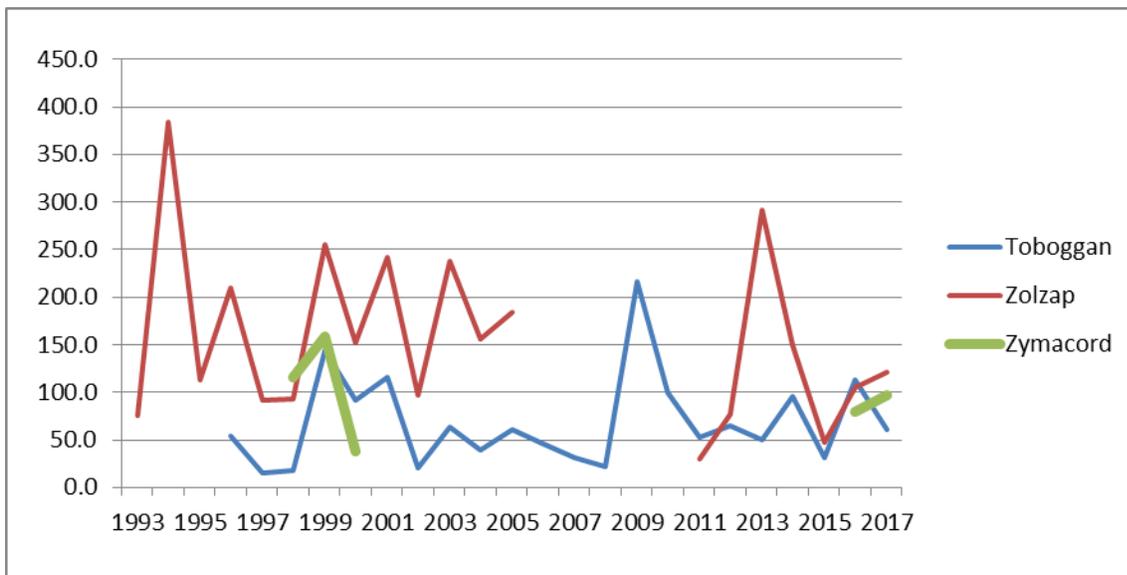


Figure 1. CWT Coho Related Encounters for Alaska Troll

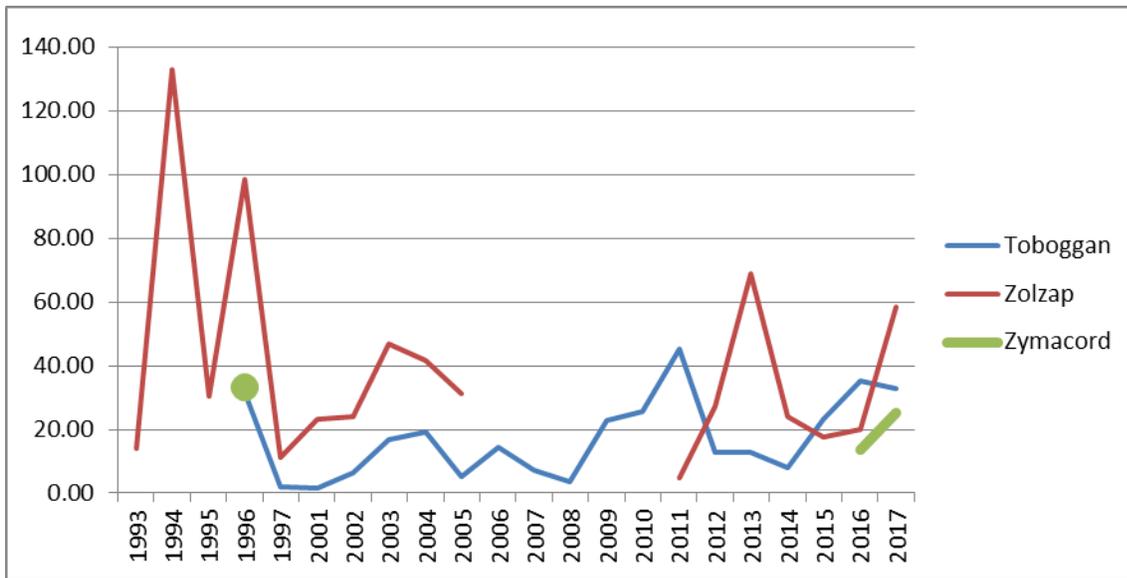


Figure 2. CWT Coho Related Encounters for Area F Canadian Troll

The secondary objective is to determine annual escapement estimates based on peak-live and Area-Under-the-Curve estimates from five aerial surveys for the Zymachord and other lower Skeena tributaries, (Kasiks, Exstew, and Exchamsiks). The Zymachord Mark and Recapture estimate is intended to be further used to calibrate, interpret, and to estimate precision of the aerial survey estimates.

## Methods and Materials

### Production

The project capitalizes on the existing Eby Street Hatchery facility that is operated by NWES volunteers with support by DFO Community Advisor; Rob Dams. Eby Street Hatchery currently has a production objective of 25,000 Zymachord coho smolts annually. The TSES completes a Chinook salmon CWT program at Deep Creek Hatchery during the first week of June, upon which time the same crew of 6 people then mark/clip ~20,000 of the coho fry at Eby Street Hatchery before being released into the natural population.

### Mark and Recapture

Feasible mark-recapture methods were investigated in order to carry out this pilot project. Since this has not yet been attempted on the Zymachord River, the primary objective was to determine the most efficient means of marking adult coho, utilizing different types of gear (gill nets and angling), and recapturing tagged fish through trial and error. Known obstacles on the Zymachord exist, such as limited access to viable sampling sites and dramatic water level fluctuations. It was predicted that due to the amount of river that is not accessible by foot as well as the elusive in-stream behaviour of coho, it would be unlikely that a representative sample of carcasses will be accessible to the crew for sampling (examination for tags, adipose clips, gender, age). Thus, an attempt to apply tags to adults staging in the

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lower river during the peak arrival period (mid September) and then sampling pools upstream throughout October was intended. However, unforeseeable staffing complications resulted in the field crew to begin adult marking efforts later than the optimal start date (began October 9<sup>th</sup>).

Tangle (gill) nets with mesh sizes ranging from 4 to 5.5 inches and angling gear were utilized depending on the location of staging fish (new arrivals). The fish were marked with brightly coloured spaghetti tags and were intended to be a different colour each week to allow for detection of residency time (unable to recover tag numbers while snorkeling during tag recovery), however, only 2 colours were used this season. Hatchery fish with adipose clips were intended to be marked with different tag colours than wild fish, however, both wild and hatchery fish received the same colour of tag. A secondary mutilation mark consisting of a hole punch through the operculum (using a heavy-duty paper punch) was placed to allow for detection of tag losses. Data collected for captured fish included date, location, gear type, gender, length (fork in inches), presence or absence of an adipose fin clip, and tag colour.

Sampling efforts (gill nets and angling gear) took place in key holding areas that were logistically accessible to the crew. Sample sites were selected based on known productivity of holding areas, accessibility, and visual confirmation of fish presence through helicopter flights. If it was found that a significant number of fish are holding in areas that the crew cannot effectively sample with nets or by angling, snorkeling took place in an attempt to provide a visual count and examination for tags (hence the use of brightly coloured tags).

### *Helicopter Surveys*

Aerial counts were completed to enumerate coho on the Zymachord, Extew, Exchamsiks, and Kasiks Rivers. The Lakelse and Gitnadoix Rivers were also flown because of their proximity to other rivers being counted for different projects conducted by DFO. The mark-recapture program on the Zymachord was intended to produce an escapement estimate allowing for the calibration of the aerial count. Flights of the Zymachord were also used to inform the crew where fish were holding and available for recapture.

### *Brood Collection*

In order to rear ~25,000 juveniles, approximately 30,000 eggs are collected for incubation each year. The collection of 7 to 9 females is required (depending on fecundity) and, in 2019, broodstock collection occurred simultaneously with mark-recapture efforts. Gametes from each brood female are fertilized with the that of 2 males.

Upon capture, males and females were examined for ripeness. Fish selected for brood were transported live to Deep Creek Hatchery. These Individuals were held in capillano troughs until they were observed to be ripe in late October to early November. Ripe fish were killed, hung, and bled out to allow the eggs or sperm to be devoid of any blood. Eggs were taken through an incision made in the body cavity, and placed in zip-lock bags. Sperm was taken from males and placed in whirl bags and a cooler with ice. Equipment and tools used in this process are cleaned and sterilized with ovidine after each fish to avoid contamination of each sample.

Each female collected for brood stock was screened for the presence of *Renibacterium salmoninarum*, which can cause bacterial kidney disease (BKD), to ensure infected offspring are not

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reared in the hatchery facility. A sterilized knife was used to take a sample of the kidney, which was placed in a whirl bag using latex gloves. BKD samples were shipped, frozen, to a Fisheries and Oceans Canada veterinarian for analysis once the brood stock collection was complete.

## Results

### *Production*

In 2019, TSES applied 18,497 CWTs (including adipose clips) to Zymachord coho fry (2018 brood). The objective of tagging 20,000 fry fell short due to size (2,387 individuals too small to tag, which will be released with no adipose clip). *Table 1* summarizes the number of fry tagged and released since 2014.

*Table 1. Zymachord River Coho Reared at Eby St. Hatchery*

Brood Year	Tagged Fry	Untagged Fry
2018	18,497	2,387
2017	19,693	1,247
2016	15,180	7,910
2015	15,033	12,295
2014	15,102	11,909
2013	19,423	1,023

### *Mark and Recapture*

Sampling was conducted from October 9th until October 29<sup>th</sup>, 2019. A total of 67 coho were captured during 5 sampling days (*Table 2 & 3*). Forty-one (41) wild and 9 CWT coho were tagged and released. Seventeen (17) individuals were taken for brood (one brood male taken was not recorded in field data). Only 3 of these individuals were recaptured (all wild), however, 2 of these individuals were recaptured in the net set immediately following their original capture on the same day.

A total catch summary (*Table 2 & 3*) was produced, displaying the number of wild and CWT coho caught, tagged, and brood kept.

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*Table 2. Zymachord River Catch Summary, 2019*

Location	Tagged (spaghetti)						Recaptures					Brood				
	Male		Female		Combined		Male		Female		C/b	Male		Female		
	W	CWT	W	CWT	W	CWT	W	CWT	W	CWT		W	CWT	W	CWT	
Wetsuit Run	1	3	1	0	2	3	0	0	0	0	0	0	0	0	0	0
Lower Erlandson	1	1	0	0	1	1	2	0	0	0	2	0	0	0	0	0
Erlandson	22	3	13	2	35	5	0	0	1	0	1	7	1	8	1	
Old Bridge	2	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>26</b>	<b>7</b>	<b>15</b>	<b>2</b>	<b>41</b>	<b>9</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>7</b>	<b>1</b>	<b>8</b>	<b>1</b>	

*Table 3. Timing of Adult Coho Marking, 2019*

Date	Daily Captures	Cumulative Captures	Recaptures	# Marked (less removals)	# Marked at Large
Oct. 9	33	33	0	25	0
Oct. 11	11	44	0	8	25
Oct. 17	2	46	0	2	33
Oct. 19	17	63	1	12	35
Oct. 29	3	66	0	3	47
<b>Total</b>	<b>66</b>	<b>66</b>	<b>1</b>	<b>50</b>	<b>50</b>

### Brood Collection

Nine (9) females were collected for brood stock during the tagging program. Two (2) of these fish did not ripen while being held at the hatchery and were released. The first female and accompanying males were collected for brood stock on October 9th, and the last brood collection occurred on October 19th.

Brood females collected during this ten-day period provided an estimate of ~28,035 eggs for incubation at Eby Street Hatchery. Once egg shocking, eyed egg picking and weight enumeration was completed, it was determined that the average survival to eyed egg stage was 97.3%.

Test results determined that 1 fish ranked as high-positive for BKD (*Appendix B*). Eggs taken from this female was removed from the hatchery and destroyed to avoid the risk of spreading the disease, totalling an estimated egg loss of approximately 3,472. This results in a total estimate of 23,900 live eggs on hand.

### Helicopter Surveys

Five flights occurred over the period of September 29<sup>th</sup> to October 30<sup>th</sup>, 2019, that visited the key tributaries on the lower Skeena system. Flights were often inhibited during known peak arrival times due to excessive rain, causing poor visibility in most or all of the lower Skeena tributaries.

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The Exchamsiks and Kasiks Rivers exhibited decreasing numbers of coho as time progressed and water visibility improved. The Extew River was difficult to enumerate because of its turbidity, which was predictable (commonly affected by glacial till).

*Table 4. Aerial Count Summary, 2019*

River	Date	Water Visibility	Water Level	# of Coho	Comments
Exchamsiks	1-Oct-19	Poor	Normal	64	Deep pools had poor vis
Exchamsiks	10-Oct-19	Fair	Low	190	Deep pools had poor vis
Exchamsiks	30-Oct-19	Good	Normal	36	Deep pools had poor vis. Most at Old Bridge
Extew	1-Oct-19	Cloudy	Normal	256	Clear enough up to 20km
Extew	30-Oct-19	Poor	Normal	76	Only flew up 5km
Gitnadoix	29-Sep-19	Fair	Normal	370	Most near Alastair Lake
Kasiks	30-Sep-19	Good	Normal	328	~150 in pool below falls
Kasiks	10-Oct-19	Good	Low	330	Most below falls
Kasiks	30-Oct-19	Excellent	Normal	20	All at pool below falls
Lakelse	29-Sep-19	Good	Normal	674	Deep pools had poor vis
Zymachord	30-Sep-19	Good	Normal	140	Most at Old Bridge
Zymachord	10-Oct-19	Good	Low	220	Deep pools had poor vis. Most at Old Bridge
Zymachord	30-Oct-19	Good	Normal	228	~50 at Old Bridge

## Discussion

Capture methods used during marking efforts (gill nets and angling gear) only occurred in sites where netting was feasible (minimal snags, current not too swift, etc.) and coho are known or were observed to hold in. Helicopter counts helped determine which pools contained holding coho. Marking efforts began later in the season than anticipated, by approximately 3 weeks, which did not allow the crew to focus on marking coho staging in the lowest section of the river. It is recommended that future attempts to undertake mark/recapture studies on Zymachord coho begin in mid-September in order to capitalize on these staging fish.

During the adult tagging component of the program, a total of 50 coho were tagged and released, and 17 were taken for brood (2 females released that did not ripen). Of these, 16.4% were observed to have adipose clips (11 of 67). Netting efforts by the crew in 2019, as well as in previous years by DFO, have been focused on the lower river sections because of accessibility. This may result in higher CWT coho captures because of the perceived tendency of hatchery fish to hold at or below their release site (Erlandson confluence). Subsampling protocols for CWT recovery may be explored for future programs.

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Generally, it is more difficult to count coho in lower Skeena tributaries during the early stages and peak arrival times of the run due to water height, clarity (most are glacial fed), depth of staging fish, and colouration of new arrivals. Water levels tend to drop and become clear as the season progresses and temperatures decrease, allowing for easier detection of fish. Additionally, ripening coho become dark, which creates more contrast with their surroundings than new arrivals. When the water clarity was optimal, it became apparent that the numbers of coho in key tributaries were very low (S. Hutchings, pers. comm.).

Recapture data was intended to be used collectively to develop a stratified Lincoln-Peterson estimate for the Zymachord coho return in 2019. This was not attempted, however, due to the lack recaptures during the field program. DFO may interpret and analyze the data collected; but for the purposes of this pilot project, the TSES can conclude that some minor adjustments to field procedures can provide a data set capable of producing escapement estimates in following years. This includes;

1. Begin marking adults as soon as they become available in staging areas near the Zymachord/Skeena River confluence (likely mid-September).
2. Focus sampling efforts on the two main holding areas upstream (Erlandson confluence and 'Old Bridge' sites) with tangle nets. Snorkeling was determined to be not effective since schools of spooky coho would avoid swimmers well before a chance was given to count them.
3. Numbered spaghetti tags will allow the ability to distinguish between recaptured individuals as well as residency time and distance travelled.

## Acknowledgments

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- Eby Street Hatchery Volunteers (Northwest Watershed Enhancement Society)
- Stan Hutchins (Creek Walker)
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