

# **2015 West Coast of Vancouver Island Salmon Extensive Escapement Stream Summary**

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Canada

2016

**Canadian Data Report of  
Fisheries and Aquatic Sciences 1266**



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STREAM SUMMARY

by

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## ABSTRACT

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McHugh, D., King, S.A., and Dobson, D., 2016. 2015 West Coast of Vancouver Island Salmon Extensive Escapement Stream Summary. Can. Tech. Rep. Fish. Aquat. Sci. 1266: vii + 269.

In 2015, spawner surveys were conducted on 63 streams on the west coast of Vancouver Island, DFO statistical areas 20 to 27. The individual survey counts by species are presented in this data report as well as the expansion factors used to make annual estimates of escapement. The escapement estimates are accompanied by data quality levels and commentary on the general observations of the return with respect to previous years, unusual conditions and survey timing. The stream protocols are briefly described with emphasis on any deviations from the standard snorkel survey assessment method. General observations on environmental conditions and any changes in the physical characteristics of the stream or surrounding area are also reported. Enhancement activities and biosamples are described. These observations and results have been discussed and agreed upon by surveyors and DFO stock assessment biologists. The in-season and post-season bulletins are shown in the final section.

## RÉSUMÉ

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McHugh, D., King, S.A., and Dobson, D., 2016. Cours d'eau comptant de nombreuses échappées de saumon sur la côte ouest de l'île de Vancouver. Rapp. stat. can. sci. halieut. aquat. 1266: vii + 269.

En 2015, des relevés des reproducteurs ont été effectués dans 63 cours d'eau de la côte ouest de l'île de Vancouver, dans les secteurs statistiques 20 et 27 de Pêches et Océans Canada (MPO). Les décomptes individuels par espèce sont présentés dans le présent rapport de données, de même que les facteurs d'expansion utilisés pour estimer le nombre d'échappées annuel. Les estimations des échappées sont accompagnées de niveaux de qualité des données et de commentaires sur les observations générales relatives à la montaison par rapport aux années passées, aux conditions inhabituelles et au moment du relevé. Les protocoles des cours d'eau sont brièvement décrits, et l'accent est mis sur les dérogations à la méthode standard d'évaluation des relevés en plongée avec tuba. Les observations générales sur les conditions environnementales et tout changement aux caractéristiques physiques du cours d'eau ou de la zone environnante sont également consignés. De plus, les activités de mise en valeur et des échantillons biologiques sont décrits. Ces observations et résultats ont été examinés et approuvés par les inspecteurs et les biologistes chargés de l'évaluation des stocks du MPO. Les bulletins en cours de saison et d'après-saison sont présentés dans la section finale.

## INTRODUCTION

---

West Coast Vancouver Island (WCVI) salmon are managed using a system of ‘intensive’ and ‘extensive’ indicator stocks that are used to assess stock status and fishery impacts, and provide recommendations for harvest management.

Intensive indicator stocks describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution (e.g. Somass/Robertson Creek Hatchery). This information is collected through the coast-wide Mark-Recovery Program (MRP) where select stocks are tagged with coded-wire-tags as juveniles and then survival and exploitation rates are estimated through recoveries of these tags in fisheries and escapement.

Extensive indicator stocks provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

In this report we present the 2015 data for surveys conducted on the extensive indicator and non-indicator systems. The survey data have been used to make annual escapement estimates and the estimates have been evaluated for data quality with respect to how they can be used in fisheries management decisions. The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic

visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

*STREAMS IN AREA 20*



## 1. AREA 20 SUMMARY OF OBSERVATIONS IN 2015

Almost 28 streams and major tributaries in Area 20 have records of spawning salmon in the DFO escapement database (1952 – 2015). Most systems are surveyed using the snorkel method described in the DFO snorkel survey manual, and occasionally by stream or bank walks. The San Juan watershed is too large to be surveyed using our standard snorkel method, but a counting fence installed from early-September to mid-October generally allows for a good estimate of Chinook. The San Juan River Chinook and Coho populations have also been enhanced by the Port Renfrew Salmon Enhancement Society since the 1980s. Chinook populations in Harris Creek and the Sooke River have also been regularly enhanced since the 1980s. The Coho estimates come from a combination of the fence data and a few peak counts from the tributaries. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups.

In 2015, 6 streams were surveyed (Figure 1-1). The San Juan River was surveyed frequently enough to allow a reliable application of the Area Under the Curve (AUC) estimation method for Chinook because the fence was not installed as planned. Other systems were surveyed less frequently with the intent of making a less reliable, minimum estimate of escapement, usually based on the expanded Peak Live + Dead count.

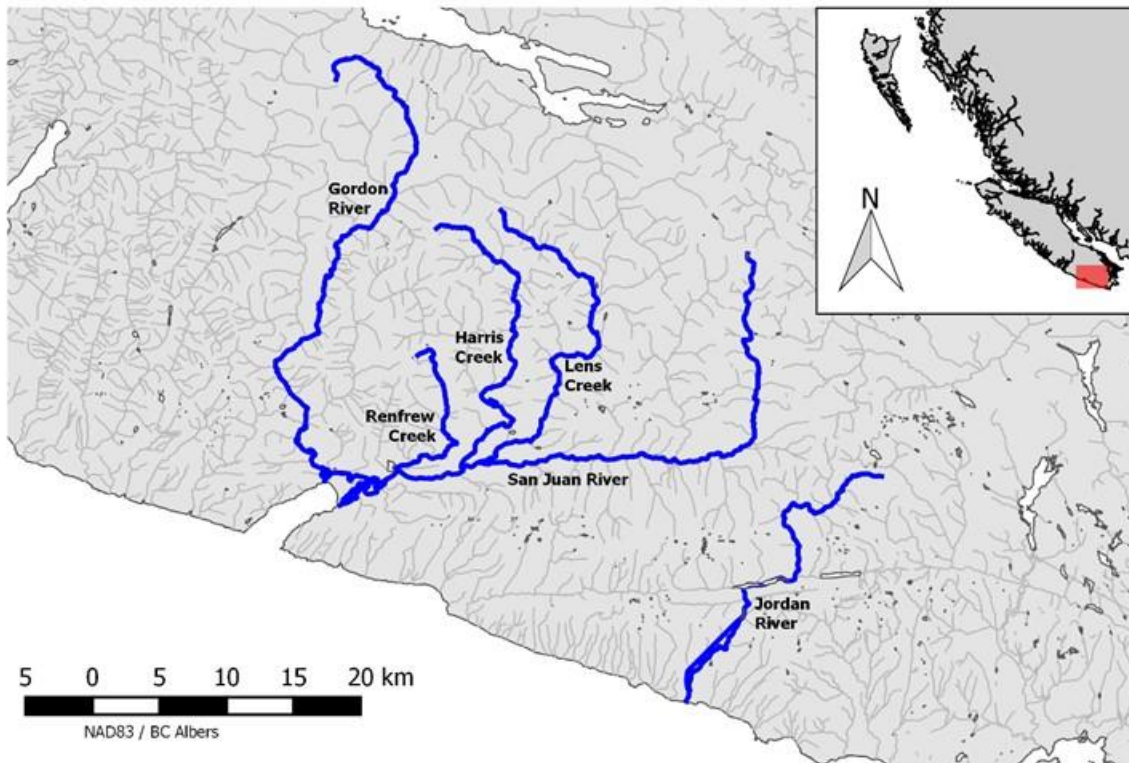


Figure 1-1. Streams in Area 20 that were surveyed in 2015 (highlighted blue).

## 2. SAN JUAN RIVER

### 2.1. Stream Summary

The San Juan River flows south then west into Port San Juan near the town of Port Renfrew. The mainstem is over 50 km long and is fed by many tributaries from the surrounding mountains. The largest tributaries are Renfrew Creek, Harris Creek, and Lens Creek.

### 2.2. Survey Results and Escapement Estimate

Survey Crew: Pacheedaht First Nation (Helen and Jeff Jones)

Stock Assessment Biologist: Diana McHugh

#### Individual Survey Data:

Table 2-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
13-Sep-15	85		8		172				772	1
27-Sep-15	24		713	1	6		5		1008	25
03-Oct-15*	1140		1165		88		35		78	31
04-Oct-15			1328		18		13		576	115
22-Oct-15	82		706	9	1		511	25	1	6
24-Nov-15	0		0		0		0		0	

\*Survey of Upper San Juan from the upper bridge to the Harris Confluence

**Comments:** The majority of the surveys in 2015 covered only the Lower San Juan from the Harris confluence to Fairy Lake

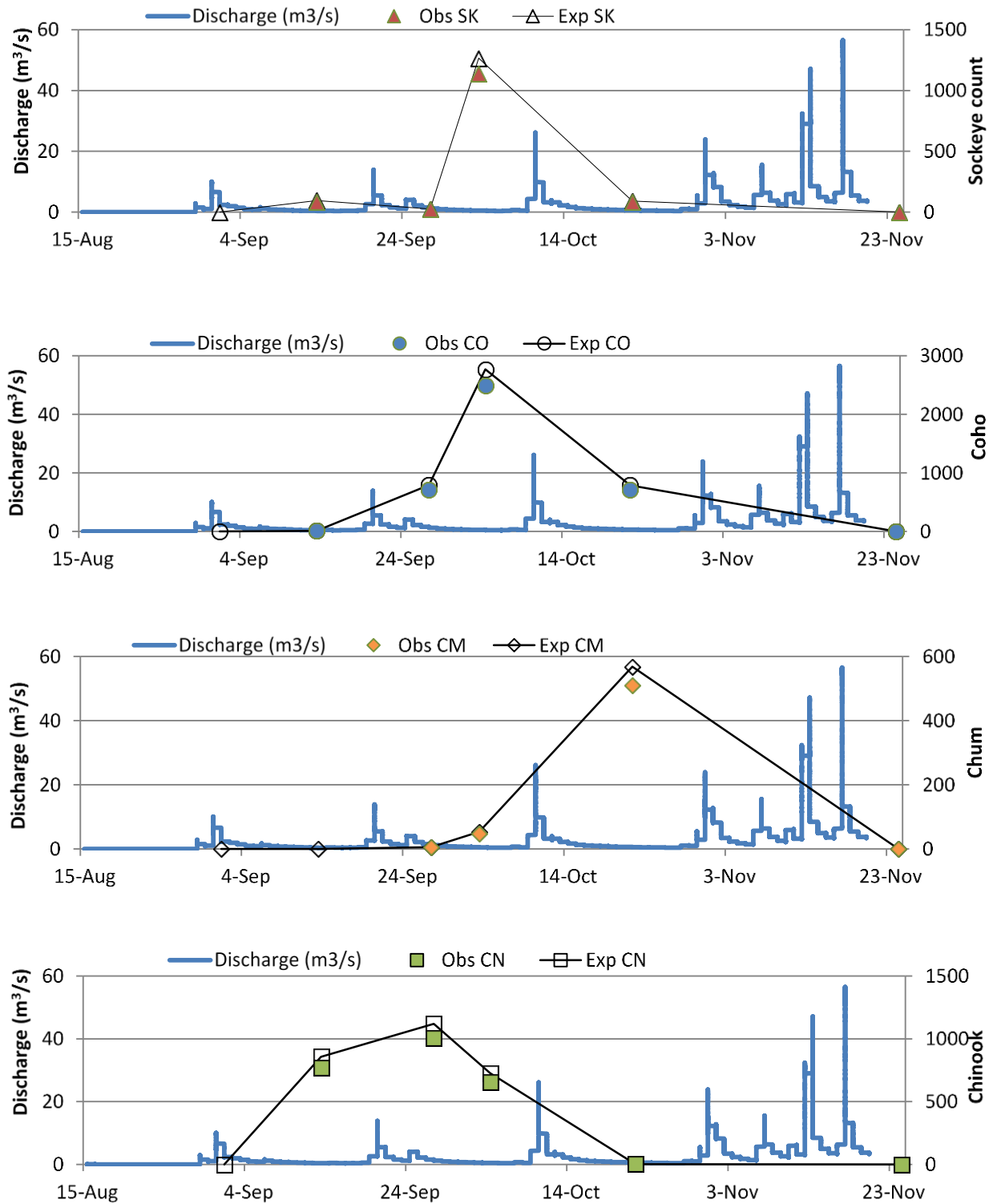


Figure 2-1. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the Environment Canada hydrometric station Harris Creek near Lake Cowichan (08ha070).

Table 2-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye				
Coho				
Pink				
Chum				
Chinook	15 (10-20)	01-Sep-15	24-Nov-15	Applied the low end of the historical range for Chinook on the WCVI; limited tagging in 2012 indicated a relatively low SL.

Table 2-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
13-Sep-15	excellent	Water level normal, water clear (5m)
27-Sep-15	excellent	Water level normal, water slightly turbid (4m)
03-Oct-15	excellent	Water level below normal, water clear (4m)
04-Oct-15	excellent	Water level below normal, water clear (4.5m)
22-Oct-15	excellent	Water level below normal, water clear (4m)
24-Nov-15	good	Water level normal, water slightly turbid (3.5m)

Table 2-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	1,267	Expanded PL+D	2
Coho	2,770	Expanded PL+D	3
Pink	191	Expanded PL+D	3
Chum	593	Expanded PL+D	3, reasonable timing but may have missed the peak by a week
Chinook	2,061 (1,546-3,092)	AUC	2

### Escapement Commentary:

#### Sockeye Return:

There was an unusually large number of Sockeye relative to observations the last 40 years.

## 2.3. Spawner Distribution

### Run Timing:

Table 2-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho							
Pink					Mid Sept		
Chum					Late Oct		
Chinook					Mid Sept	Early Oct	Late Oct

Comments: Spawning not observed for Sockeye and Coho. Peak spawn for Chum also not observed.

### Spatial distribution

No information available on the survey sections used for spawning.

## 2.4. Environmental Conditions

No information provided.

## 2.5. Update to Stream Survey Protocols

### Current Assessment Method:

Fence from early September to mid-October (Thanksgiving) to collect brood and count all species through the fence. Snorkel surveys of San Juan and major tributaries following fence removal.

### Deviations from current assessment protocols:

Fence not installed due to high water event in late Aug, early Sept when the fence would normally have been installed.

Assessment method shifted in-season to swims of the lower San Juan with one upper swim paired with a lower during peak CN.

### Access and Safety Updates:

No change to access or safety concerns.

## 2.6. Enhancement

### Brood Removal:

Chinook: 68 males, 68 females taken for brood, 270,000 eggs collected became 220,000 eyed eggs

### Planned Release Numbers and Strategy:

Unknown

## 2.7. Other Enhancement/Restoration Activities

Unknown

## 2.8. Biosamples

95 samples collected to monitor the hatchery contribution to the return as well as supporting research regarding the interaction of hatcheries and wild fish.

Sex ratio of the brood collection was 63% males and 37% females.

Age ratios were 0% 2<sub>1</sub>, 27.85% 3<sub>1</sub>s, 40.51% 4<sub>1</sub>s, 31.65% 5<sub>1</sub>s, and 0% 6<sub>1</sub>s

Fecundity estimate was 3970 eggs per female.

## 2.9. Concerns and Comments

None identified.

### 3. JORDAN RIVER

#### 3.1. Stream Summary

The Jordan River is almost 30 km long and flows southwest into the Juan de Fuca Strait. The system was dammed in 1911 in order to supply power to local communities. The Elliott Reservoir is located about 8 km upstream from the mouth, the Diversion Dam is located about 10 km upstream from the mouth, and the Bear Creek Reservoir is located about 3 km upstream of the Diversion Dam on the Bear Creek Tributary.

The stream within 1 km of the mouth is accessible to anadromous salmon. The road to Port Renfrew (highway 14) crosses the river at the mouth and just upstream from the bridge is a dry land log sort. The lower end of the survey area is adjacent to the log sort. The survey extends about 850 km upstream from the log sort to the Rock-face Pool which is the top end of the survey area. The survey area includes several run and riffle sections and pools. The Tailrace Pool marks the location of a BC Hydro tailrace which joins the Jordan on river right about 300 m below the Rock-face Pool. There are several small tributaries that flow into the survey area, including two that flow from a mine portal and slag debris.

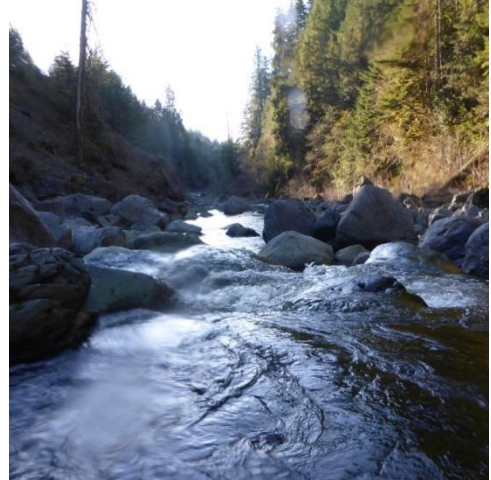


Figure 3-2. Looking downstream to the run riffle section below the Rockface Pool (right). Photo credit: H. Jones, Nov. 21, 2015.

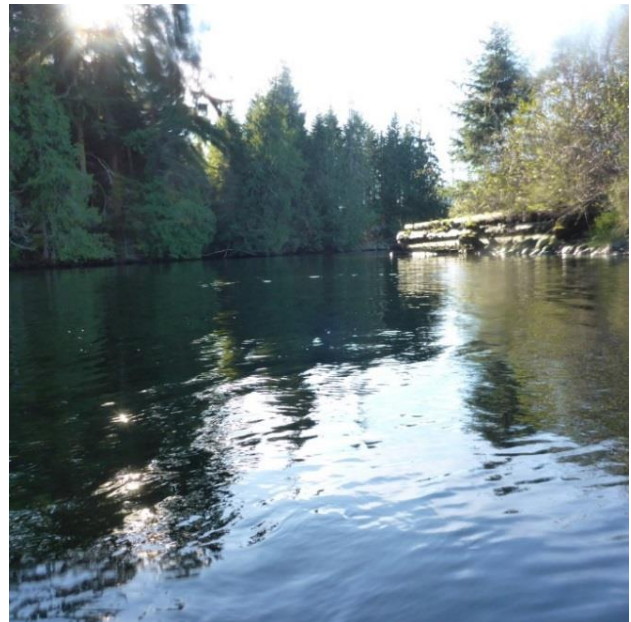


Figure 3-1. The BC Hydro tailrace (left) and the lower survey area looking downstream to the Queesto dryland sort and a second downstream tidal riffle. Photo credit: H. Jones, Nov. 21, 2015.

### 3.2. Escapement Estimates

Survey Crew: Pacheedaht First Nation (Helen Jones, Jeff Jones; comments by H. Jones)  
Stock Assessment Biologist: Diana McHugh

Table 3-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
21-Nov-15			3							

One snorkel survey was conducted on the morning of Saturday November 21, 2015. Three small adult Coho were observed in a run holding close to substrate.

### 3.3. Environmental Conditions

The weather and river conditions were excellent. Flows were normal with a water level of 0.405 m recorded at the downstream gauge. In the non-tidal section the fish visibility was high, with the horizontal and vertical visibility each estimated to be about 2 meters. The high tide and halocline reduced the visibility down to less than 1 m horizontally and vertically in the pool area below the first riffle downstream of the generating station. Overall the visibility of the habitat sections was augmented by the bright sunshine which illuminated the entire survey area.

### 3.4. Survey Protocols

Stream walk/snorkel of about 850 m from Rock-face Pool to the dryland sort riffle.

The BC Hydro generator was shut down for maintenance repairs at the time of the survey so the escapement survey encompassed the entire survey area (approx. 850m) from the upstream Rock-face pool downstream past the tailrace to the second tidal riffle located adjacent to Queesto's dryland sort.

### 3.5. Enhancement/Restoration Activities

None identified.

### 3.6. Concerns and Comments

- No juveniles or evidence of digging or redds observed
- Lots of run off of partial tributary
- Gauge was bent upwards and was straightened to take the gauge measurement.
- During the survey, gravel recruitment was observed at the upstream area of the pool just below the inflows and also in the tailout of the pool on the river right
- Flow was higher than in November 2014



## 4. RENFREW CREEK (GRANITE)

### 4.1. Stream Summary

Renfrew Creek, located on the north side of the San Juan Valley, is a major tributary of the San Juan River. The mainstem is almost 16 km in length and the confluence is located about 6 km upstream from the San Juan River estuary. About 250 m upstream from the confluence, Renfrew Creek flows through Fairy Lake.

### 4.2. Escapement Estimates

Survey Crew: Pacheedaht First Nation (Helen Jones, Jeff Jones)

Stock Assessment Biologist: Diana McHugh

Table 4-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
6-Nov-15	45		510	2			21	4	10	

### 4.3. Escapement Comments

SK: 50 PL+D, Data Quality Level 3

CO: 569 PL+D, Data Quality Level 3

CM: 27 PL+D, Data Quality Level 3

CN: 11 PL+D, Data Quality Level 3

Spawning observed for CN only.

### 4.4. Environmental Conditions

Water level below normal, high fish visibility

### 4.5. Survey Protocols

Snorkel survey from quarry to outflow

### 4.6. Enhancement/Restoration Activities

None identified

### 4.7. Concerns and Comments

Abundance of all species was low, especially CO and CN. Chum had not begun to spawn.

## 5. GORDON RIVER

### 5.1. Stream Summary

The Gordon River flows south where it joins with the North Arm of the San Juan River then flows through the estuary into Port San Juan. The mainstem is almost 50 km in length and drains a watershed of about 300 km<sup>2</sup>. The stream is fed by many small tributaries from the surrounding mountains.

The lower 5 km of the Gordon has a low gradient (< 2%) and is a depositional alluvial area with wide cobble/gravel bars, rock and side channels. Upstream the gradient increases (< 5%) and the step pool channels are largely confined in bedrock canyons. The upper Gordon River is characterised by boulder/cobble beds with periodic bedrock outcrops.

The Gordon River experiences high peak flows generated from heavy annual precipitation (estimated to be 3600mm) and transported by moderate to steep slopes that have been disturbed by a total watershed harvest of 72%. After precipitation events, fine sediments are transported into the river thereby significantly reducing visibility from 10 m to 1 m or less. Due to difficult river access the maximum surveyable snorkel length is 8 km above the tidal area. The only potential barrier to salmonid movement within the surveyable area in low water events in late summer.

### 5.2. Escapement Estimates

Survey Crew: Pacheedaht First Nation (Helen Jones, Jeff Jones)

Stock Assessment Biologist: Diana McHugh

Table 5-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
23-Nov-15	8		60	3						

### 5.3. Escapement Comments

SK: Adults present, 100% spawning at the time of survey

CO: Adults present. Spawning starting at time of the survey

CM: None Observed

CN: None Observed

### 5.4. Environmental Conditions

Visibility good, flow was as expected

### 5.5. Survey Protocols

Snorkel/Stream walk 8000 metres from Gordon Bridge to tidal pool

## 6. LENS CREEK

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### 6.1. Stream Summary

Lens Creek, located on the north side of the San Juan Valley and to the west of Renfrew Creek, is a major tributary of the San Juan River. The mainstem is about 34 km in length and the confluence is located about 13 km upstream from the San Juan River estuary. The stream is fed mainly by many small tributaries from the surrounding mountains.

### 6.2. Escapement Estimates

Survey Crew: Pacheedaht First Nation (Helen Jones, Jeff Jones)

Stock Assessment Biologist: Diana McHugh

*Table 6-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
17-Oct-15	56		371	1					17	1

### 6.3. Escapement Comments

SK: 62, PL+D, Data Quality Level 3

CO: 413, PL+D, Data Quality Level 3, spawning not observed

CM: None Observed

CN: 20, PL+D, Data Quality Level 3, spawning ending.

### 6.4. Environmental Conditions

Water level normal, visibility high

### 6.5. Survey Protocols

Snorkel survey 6000 metres from Lower Lens to San Juan

## 7. HARRIS CREEK

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### 7.1. Stream Summary

Harris Creek, located on the north side of the San Juan Valley and to the west of Lens Creek, is a major tributary of the San Juan River. The mainstem is about 32 km in length and the confluence is located about 11 km upstream from the San Juan River estuary. The stream is fed mainly by many small tributaries from the surrounding mountains.

### 7.2. Escapement Estimates

Survey Crew: Pacheedaht First Nation (Helen Jones, Jeff Jones)

Stock Assessment Biologist: Diana McHugh

*Table 7-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
16-Oct-15	679		1,094	1	2		22		4	2

### 7.3. Escapement comments

SK: 754, PL+D, Data Quality Level 3, Spawning starting

CO: 1217, PL+D, Data Quality Level 3

CM: 24, PL+D, Data Quality Level 3

CN: Adults present, spawning ending

### 7.4. Environmental Conditions

Water level normal, visibility high

### 7.5. Survey Protocols

Snorkel survey 7000 metres from Lower Harris Creek to San Juan

*STREAMS IN AREAS 21/22*

## 8. AREA 21/22 SUMMARY OF OBSERVATIONS IN 2015

Area 21 includes streams between Pachena Point and Carmanah Point on the west coast of Vancouver Island. Area 22, located inland of Area 21, includes streams draining into Nitinat Lake. There are 4 streams in Area 21 with records of spawning salmon in the DFO database, and 14 in Area 22. Most streams are surveyed using the snorkel method described in the DFO snorkel survey manual. Occasionally systems are also surveyed by stream or bank walk. The Nitinat River Chinook population is enhanced by the Nitinat River Hatchery which has been in operation since 1980.

In 2015, only the Cheewaht and Nitinat Rivers were surveyed in Areas 21 and 22 (Figure 8-1). A fence was operated by Ditidaht and the NTC to count Sockeye into Hobiton Lake from May 7 to July 16 when migrating fish had tailed off and were no longer showing in the river mouth below the fence.

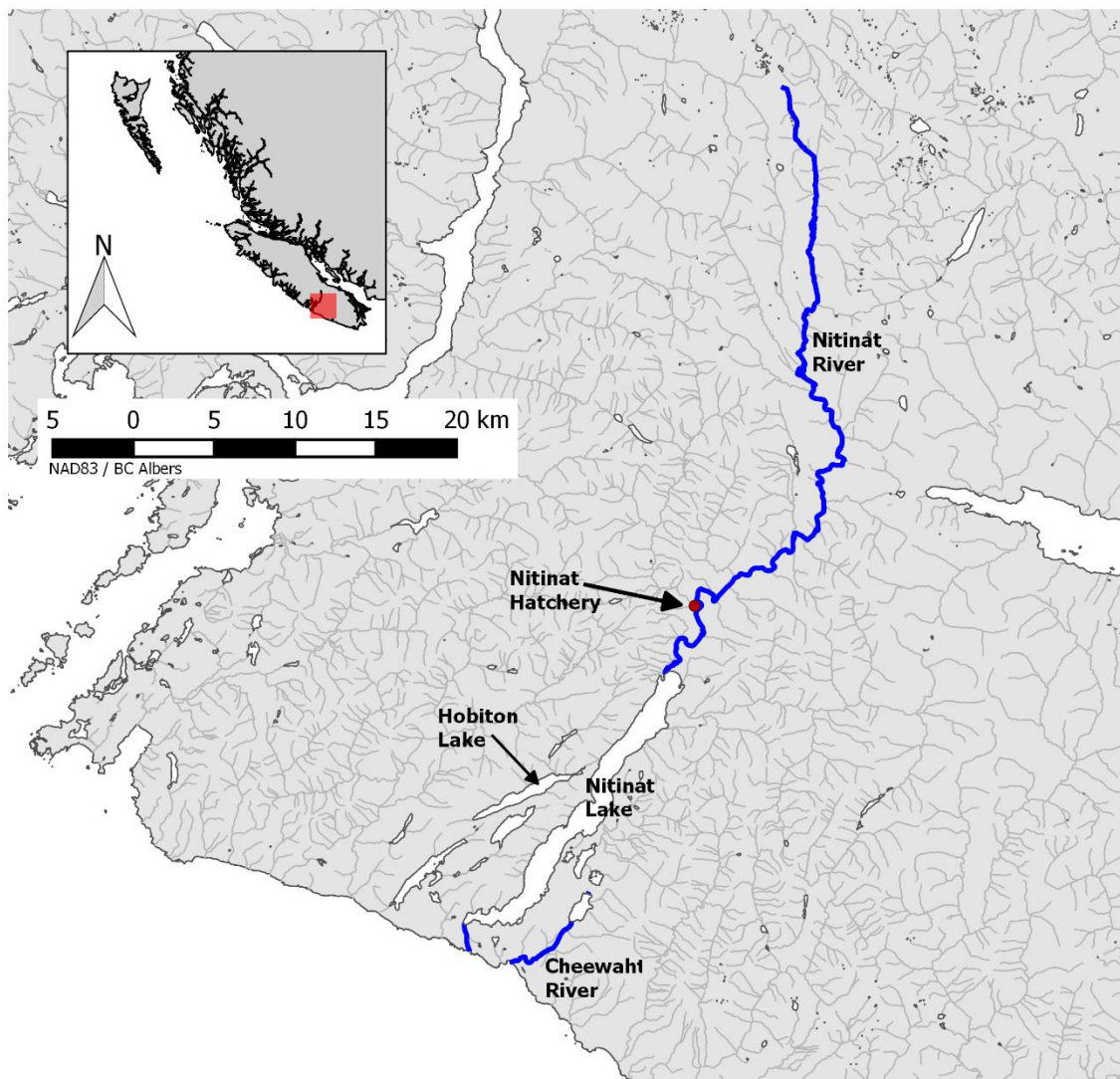


Figure 8-1. Streams surveyed in Areas 21 and 22 in 2015 (highlighted blue).

The 2015 survey results from Areas 21 to 23 were reviewed at a post-season escapement review workshop held at the Tebo St. DFO office in Port Alberni on February 1, 2016. Workshops participants (Table 8-1) reviewed and discussed the individual survey results and escapement estimates. This discussion is captured in the commentary below. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the stream summaries was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

*Table 8-1. Participants at the Area 21-23 escapement review workshop in Port Alberni on February 1, 2016.*

<b>Participant</b>	<b>Affiliation</b>
Stephanie King	Sea This Consulting
Diana McHugh	DFO
Andrew Campbell	Escapement Contractor
Gary Dagley	DFO,Nitinat Hatchery
Miranda Devisser	Escapement Contractor
Jeff Till	DFO
Dave Hurwitz	Thorton Creek Enhancement Society
Sabrina Crowley	Nuu-chah-nulth Tribal Council
Steve Emmonds	DFO,Robertson Creek Hatchery
Rob Brouwer	DFO,Nitinat Hatchery
Erica Blake	CA
Monty Horton	Uchucklesaht First Nation, Director of Lands, Environmental & Natural Resource
Ryan Abbott	MC Wright

## 9. NITINAT RIVER

### 9.1. Stream Summary

The Nitinat River flows into the northeast end of Nitinat Lake before flowing into the Pacific Ocean. Nitinat Lake is over 20 km long. Upstream from the lake, the Nitinat River mainstem is over 50 km long but there is a barrier to fish about 18 km upstream from the lake. The survey area is the 17.5 km above the Nitinat Lake (Figure 9-1). Chum, Chinook and Coho spawn in the system in large numbers. The Nitinat Hatchery is a major enhancement facility located about 6 km upstream of the lake.

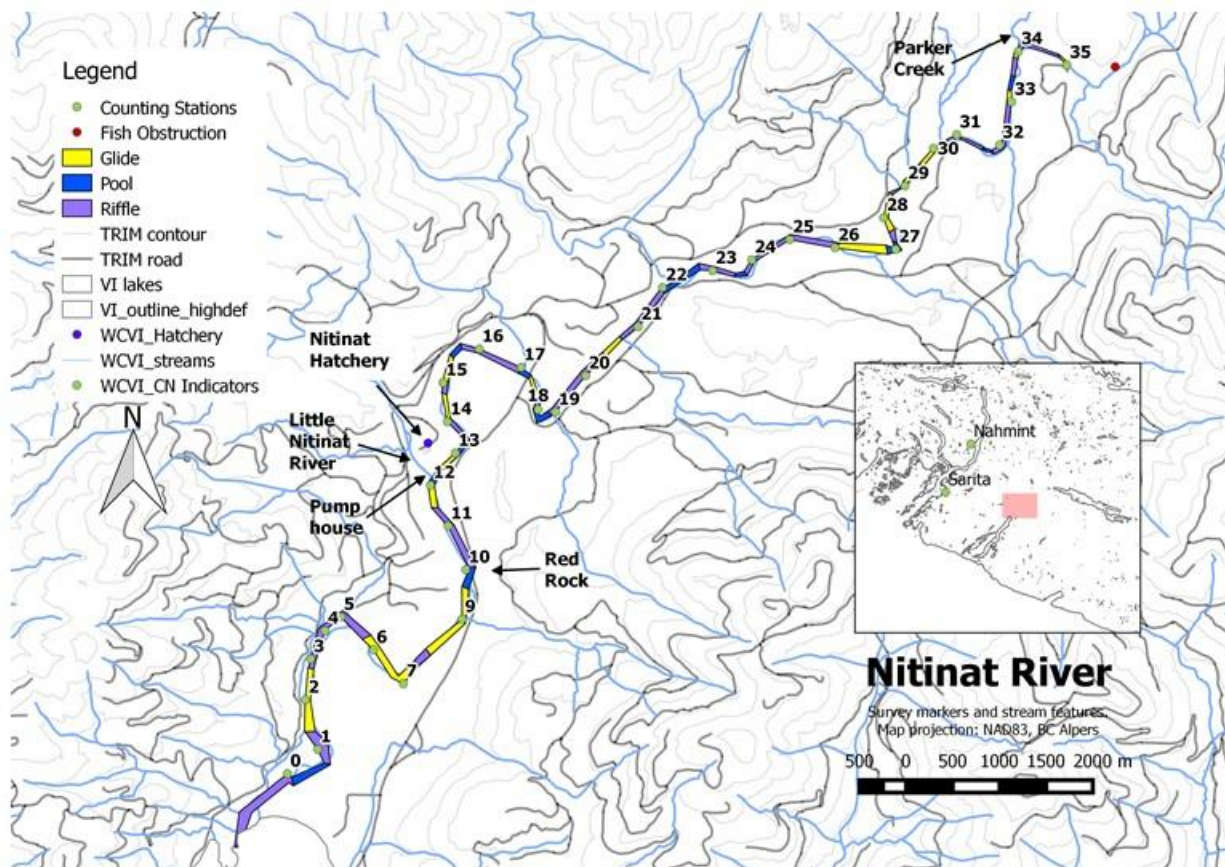


Figure 9-1. Nitinat River (above Nitinat Lake) habitat units and survey markers. Map inset show locations of other systems that are regularly surveyed in the area. Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and/or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.



## 9.2. Survey Results and Escapement Estimate

Survey Crew: Keta Biological, Nitinat Hatchery staff

Stock Assessment Biologist: D. McHugh

The Nitinat River was surveyed 8 times in 2015, using a combination of swims and helicopter surveys. Aerial surveys are good for assessing large numbers of fish over a wide area. Snorkel surveys are needed to nail down the species composition, particularly for the less numerous species. Four full snorkel surveys of Nitinat were planned to provide a rough estimate of Chum and Chinook for management purposes. Aerial surveys are conducted by hatchery staff opportunistically during the Chinook and Chum returns, but they are dependent on helicopter availability.

### Individual Survey Data:

Table 9-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
17-Sep-15	1356	1	272		49	4	329		7986	
27-Sep-15*	1000						5000		10000	
05-Oct-15**	743		158				1611	62	3390	223
06-Oct-15***	65		80		5		6402	941	3546	438
14-Oct-15*							90600			
21-Oct-15***	16		366				31073	22386	317	34
22-Oct-15**	950	7	626		1		1755	4139	126	11
05-Nov-15	267	14	651	1			589	1957		

Comments: \*Aerial Survey

\*\*Upper Nitinat survey: Parker Creek to mid-point

\*\*\*Lower Nitinat survey: mid-point to lake

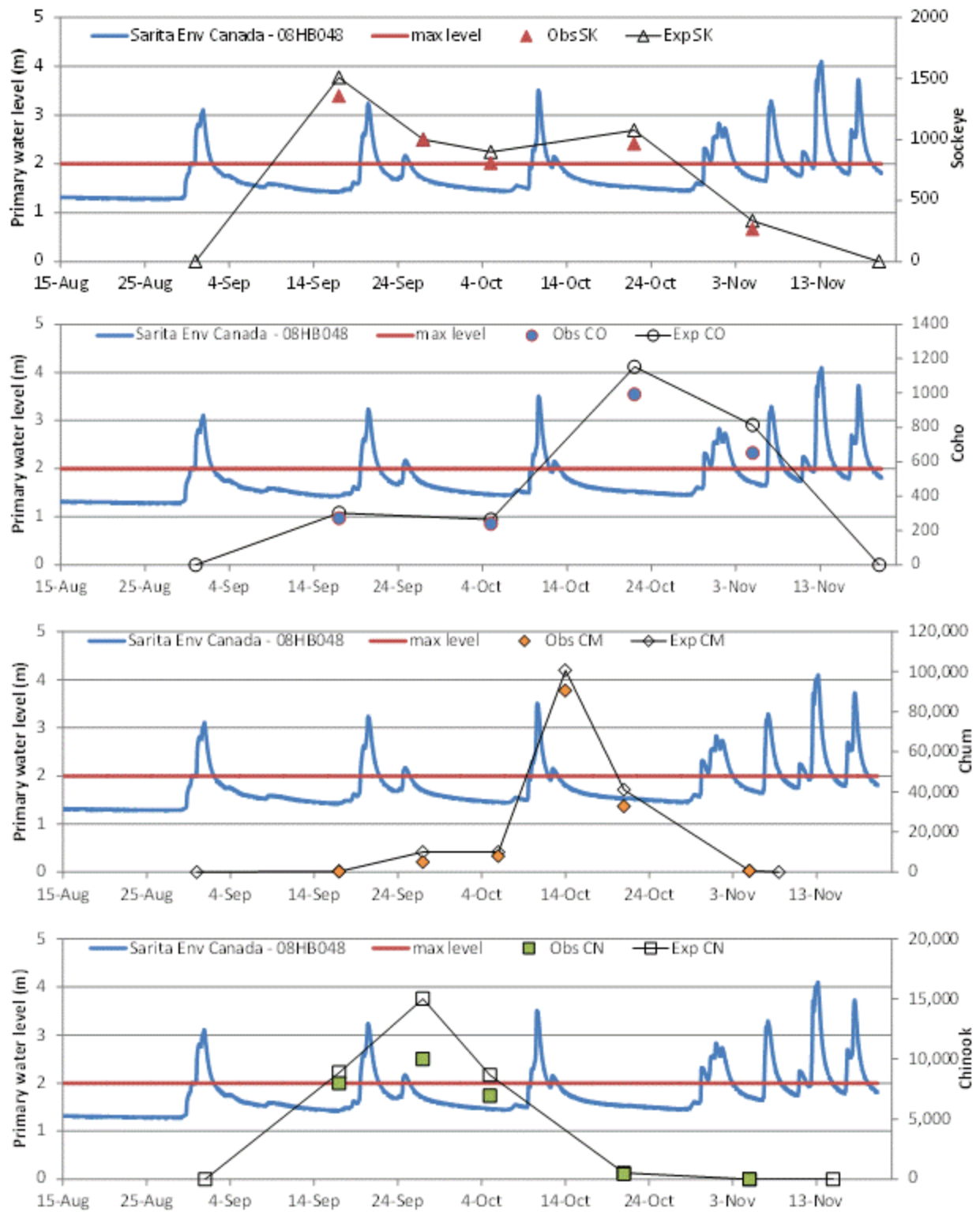


Figure 9-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 9-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	Aug 31	Nov 15	
Coho	30 (25-35)	Aug 31	Nov 15	
Pink	20 (15-25)	Aug 31	Nov 15	
Chum	7 (7-15)	Aug 31	Nov 15	Short survey life based on large numbers of carcasses washed downstream between surveys
Chinook	15 (15-25)	Aug 31	Nov 15	Short survey life based on large numbers of carcasses washed downstream between surveys
General comments: First freshet Aug 31, last zero standard date				

Table 9-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
17-Sep-15	excellent	Water level below normal, water clear (10.5 m)
27-Sep-15*		Self-reported estimate of 50% for Chum applied, survey not included in other species estimates
05-Oct-15**	excellent	Water level below normal, water clear (5-11m)
06-Oct-15***	excellent	Water level below normal, water slightly turbid (5.5m)
14-Oct-15*		Self-reported OE of 90% for Chum, survey not included in other species estimate
21-Oct-15***	good	Water level below normal, water clear (8.5m)
22-Oct-15**	excellent	Water level below normal, water clear (11.5m)
05-Nov-15	good	Water level above normal, water clear (10m)

\*Aerial Survey

\*\*Upper Nitinat survey: Parker Creek to mid-point

\*\*\*Lower Nitinat survey: mid-point to lake

Table 9-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	2,228 (1,910-2,674)	AUC	2
Coho	1,342 (1,150-1,610)	AUC	2
Pink	65	Peak Live + Dead	3
Chum	198,781 (92,765-198,781)	AUC	2
Chinook	20,464 (12,278-20,464)	AUC	2

## Escapement Commentary:

### *Sockeye Return:*

Much higher than the 12 year average (~60). Seemed to be two pulses of fish, possibly water related. Usually see about 100 river Sockeye with 50% of the peak usually by June 15. Observations from 2015 are over 10 times the average. Surveyors suggest that they were probably strays from Hobiton that couldn't get up Hobiton due to low water levels. (DNA collected, length, scales). 500-1000 seen holding in pools in Lower Nitinat in June (groundwater). Usually see 35-50.

### *Coho Return:*

Less than half the 12 year average (~5,500). Coho usually come in with Chinook and keep coming in, poor return, few caught in the lake (1100 swim-ins to hatchery, so 2-3k wild likely in the river).

### *Pink Return:*

Many more than on average; typically less than 10 are reported.

### *Chum Return:*

Above the 12 year average (~150,000). River was really warm, quite a bit of mortality, including silver females, Chum wandered into the Caycuse (first observed full spawn in Caycuse), lake was warm and full of dead fish (also wandered to Hobiton) looking for cool water.

Most tributaries were full of Chum. Helicopter recommended survey method. (Other systems less CM, Sarita down, most of Clayoquot down, particularly little systems)

### *Chinook Return:*

Roughly twice the 12 year average (~10,500). Guides and pilot also report 2 to 3 times the average.

## 9.3. Spawner Distribution

### Run Timing:

Table 9-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Sept	Early Oct	Late Oct
Coho					Early Nov		
Pink							
Chum					Late Sept	Early Oct	Early Nov
Chinook					Late Sept	Early Oct	Early Nov

Comments: Coho peak spawning was not observed

## Spatial Distribution:

Table 9-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Parker Creek-bridge
Coho	
Pink	
Chum	Entire river
Chinook	Entire river

## 9.4. Environmental Conditions

### Weather Summary:

River was warmer than normal, optimal freshet timing this year. River didn't cool off until mid-Oct (from 12 to 9.5 °C). Flow was very low for Mid-Oct, so dead didn't flush out. Nitinat hatchery may have river temp gauge.

### Physical Characteristics Update:

Normal, some changes to log jams.

## 9.5. Update to Stream Survey Protocols

### Current Assessment Method:

Swim 34-0 (Parker Creek to mouth), two crews or two days, split at bridge (17). Aerial survey for peak CM and peak CN when available.

Spot check at falls, pools above 34 not normally included in survey section, difficult access, unsafe to survey

### Deviations from current assessment protocols:

Sept 17: two crews, first surveyed from Parker Creek (Marker 34) to upper bridge (Marker 17), second surveyed from upper bridge to the lake

Oct 5: Parker Creek to Pump House Pool (Marker 12)

Oct 6: Pump House to Sturgeon Pool (Marker 0)

Oct 21: upper bridge to Sturgeon Pool

Oct 22: Parker Creek to upper bridge

Nov 5: Parker Creek to upper bridge, swam bridge to Red Rock (Marker 10) first, then Parker to Bridge in all on Nov 5. The crew didn't swim all the way down to Sturgeon Pool because pick-up was not available.

None were done with an accompanying boat (standard method).

### Access and safety updates:

None reported

## 9.6. Enhancement

### **Brood Removal:**

71,537 Chum. All hatchery removals were from marker 12 (hatchery pool).

### **Planned Release Numbers and Strategy:**

Chinook: 4 million Sub-yearling Smolt

Chum: 30 million Fed Fry

Coho: 100,000 Fed Fry/100,000 Yearling Smolt

### **Other Activities:**

Hatchery being re-built, 12 new 20 foot round tanks, replacing all the worn out equipment. New pumps and generators.

## 9.7. Biosamples

Chinook Assessment Objectives:

1. Currently, these fish are all thermally marked differentially between production and semi-natural rearing regimes. They have been thermally marked since 1992.
2. Returns from semi-natural rearing strategies brood year have been compared with returns from a production rearing strategy since 2004 brood year, using thermal marking.
3. DNA, otolith and scales samples are being taken from 200 fish for a straying study.
4. DNA is being collected from 100 jacks returning from 2013 PBT.

Chum sampled (normal samples 200 scales and otoliths, +100 river mouth, +100 Hobiton), to assess hatchery contribution.

Coho sampled (otoliths, DNA, lengths, no scales) for assessing hatchery component.

## 9.8. Concerns and Comments

Aerial survey is best for assessing large numbers.

Survey markers all need to be replaced.

Stand up paddle boards for counts?

About 1/3 of the CM brood was lost due to pre-spawn mortality (targeted 30 million eggs and collected enough fish, ended up with 20 million eggs).

Fish seemed to be poor quality (weak, small, skinny then stressed).

## 10. CHEEWAHT RIVER

### 10.1. Stream Summary

The Cheewaht River flows southwest into the Pacific Ocean, to the south of Nitinat Lake. The River drains Cheewaht Lake which is located about 5 km upstream from the mouth. There are records of Sockeye, Coho and Chum salmon in the Cheewaht River. Sockeye are also found in the lake.

### 10.2. Escapement Estimates

Survey Crew: Ditidaht First Nation (Perry Edgar)  
Stock Assessment Biologist: Diana McHugh

Table 10-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
27-Nov-15		8								

### 10.3. Escapement Comments

SK: Adults present, based on relative number of carcasses a low return.

### 10.4. Environmental Conditions

### 10.5. Survey Protocols

Stream walk, all of S1 and S2 up to the falls, S3 was not surveyed (S1, S2 and S3 are tributaries). MC Wright has those maps.

### 10.6. Enhancement/Restoration Activities

None noted.

### 10.7. Concerns and Comments

Noticed sedimentation build-up in pools particularly in the lower sections. Should add measuring of pool depth to survey protocol, based on MC Wright data and locations.

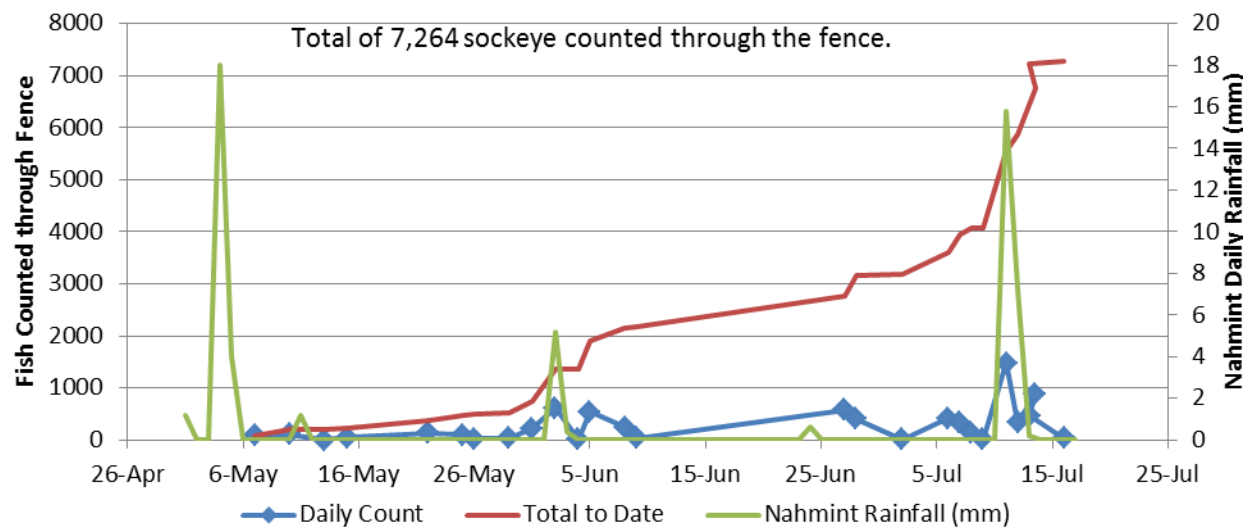
## 11. HOBITON CREEK

### 11.1. Stream Summary

Hobiton Creek drains Hobiton Lake into Nitinat Lake. There are records of Sockeye, Coho and Chum salmon in the Creek.

### 11.2. Escapement Estimates

Survey Crew: Ditidaht First Nation (Perry Edgar)  
Stock Assessment Biologist: Jim Lane (NTC)



### 11.3. Escapement Comments

SK: Adults present, based on relative number of carcasses a low return. Likely missed some fish which moved through during the early May rain event prior to fence installation.

### 11.4. Environmental Conditions

Extremely low water levels through the spring and summer.

### 11.5. Survey Protocols

Fence using mechanical counters installed by Ditidaht Fisheries Department with the assistance of NTC.



*STREAMS IN AREA 23*

## 12. AREA 23 SUMMARY OF OBSERVATIONS IN 2015

Over 60 streams and major tributaries have records of spawning salmon in Area 23. The Somass/Stamp River system is an intensive indicator stock and assessed through a coast-wide mark-recovery program and the data are not described in this report. Besides the Somass/Stamp stock, the priority for escapement enumeration are the Chinook indicator stocks in the Sarita and Nahmint. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most surveys are conducted using the snorkel method described in the DFO snorkel survey manual. Occasionally, systems are also surveyed by stream or bank walks. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups. The wild Coho indicator is Carnation Creek, which is enumerated at a fence operated by the Province of B.C.

Robertson Creek Hatchery is a major enhancement facility on the Somass system and has been enhancing the Chinook population since the 1970s. The Sarita River has been enhanced by the Nitinat River Hatchery since the mid-1980s, and Thornton Creek and Toquaht River have been enhanced by the Thornton Creek Enhancement Society also since the 1980s.

In 2015, 8 streams were surveyed in Area 23 (not including the Somass/Stamp). The two indicator stocks as well as Clemens Creek and Toquaht River were surveyed frequently enough to allow a reliable application of the Area Under the Curve (AUC) estimation method for most species. China Creek, Franklin River, Maggie River and Macktush Creek were also surveyed, but each only twice resulting in a low quality minimum estimate of escapement.

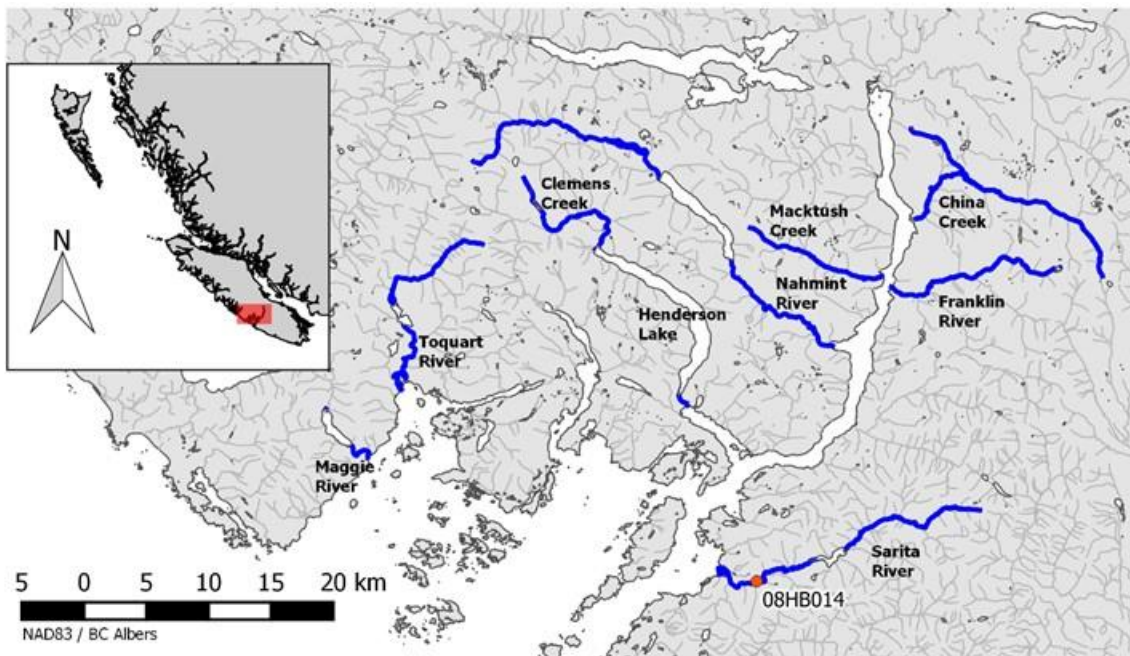


Figure 12-1. Streams in Area 23 that were surveyed in 2015 (highlighted blue). The Environment Canada Hydromet station on the Sarita (08HB014) is a good indicator of flow in most systems.

The 2015 survey results from Area 23 were reviewed at a post-season escapement review workshop held at the Tebo St. DFO office in Port Alberni on February 1, 2016 (along with areas 21 and 22). Workshop participants (Table 8-1) reviewed and discussed the individual survey results and escapement estimates. This discussion is captured in the commentary below. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the stream summaries was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

## 13. SARITA RIVER

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### 13.1. Stream Summary

The Sarita River flows southwest and northwest into Numukamis Bay, East of Tzartus Island in the Barkley (Sound) Land District. The lower river is fed by Sarita Lake, located about 9 km upstream from the estuary, but only the lower 8 km is accessible to salmon because of a series of falls that are impassible to fish (Figure 13-1). The 6 km below the falls is the survey area and has been divided into 12 – 500 m long sections that are used for salmon enumeration (Figure 13-2).



*Figure 13-1. Sarita falls near survey marker 12. Photo taken by surveyor Andrew Campbell on Oct. 20, 2015.*

The marker farthest downstream is markers 0 and is located just above the tidal area in the river. The South Sarita is the main tributary that joins the Sarita about 2.5 km upstream from marker, between survey markers 4 and 5. The South Sarita does not usually connect to the Sarita until October and may be used occasionally by spawning salmon. Surveyors spot check the South Sarita from the bridge but do not survey the tributary.

There is abundant gravel and several deep pools on the Sarita. The Corner Pool between survey markers 3 and 4 is estimated to be 6 to 8 m in depth and the deepest in the survey area. Other pools include one at Blenheim Bridge and another below the falls at marker 12. There is a trestle above marker 9 and a cable car above marker 2. Around survey marker 11 the habitat is complex and the channel splits in several spots. Near marker 2 there is a big log jam and between markers 2 and 0 there are gravel banks that have experienced considerable erosion in the past several years.

Sarita is a lake moderated system, unregulated by a dam and is prone to flashy flows where the water level can come up by 6 metres overnight. High water is retained for longer because of the lake and after heavy rain the river takes a couple of days to clear, often several days longer than the Nahmint. After the first rains in the fall the system stays tea-coloured for the rest of the year. The pools, which Chinook use for holding, often have higher turbidity. Compared to the mainstem, the South Sarita stays relatively clear. The river temperature can be relatively warm early in the spawning season and cause fish stress. The South Sarita is always a cooler then the mainstem.

There are often bears, eagles and other birds observed on the river during spawning season. Seals are often seen in the estuary and occasionally in the system all the way to Blenheim Bridge (between markers 6-5).

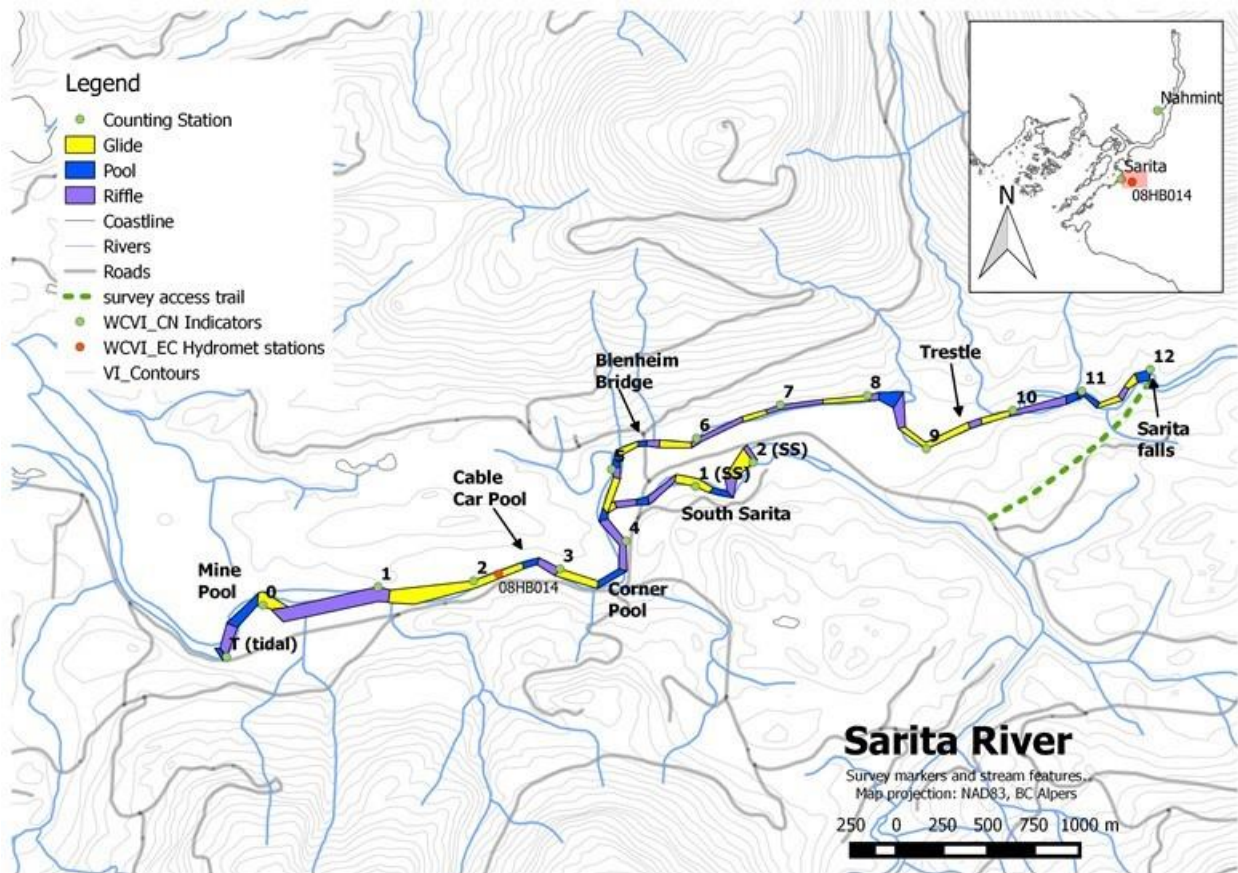


Figure 13-2. Sarita River habitat units and survey markers. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. The orange marker shows the location of the Environment Canada hydromet station at Sarita (08HB014).

## 13.2. Survey Results and Escapement Estimate

Survey Crew: Keta Biological (A. Campbell)

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

Table 13-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
14-Sep-15	20		333		42		97		1287	
23-Sep-15	37		15				25	11	132	1
01-Oct-15	47		95				742	5	1515	12
15-Oct-15	16		26	2			1528	116	227	3
20-Oct-15	73		123				4773	1455	49	12
26-Oct-15	35	11	352				1759	3862	2	2
03-Nov-15	1	1	35				274	70	1	

**Comments:** All snorkel surveys



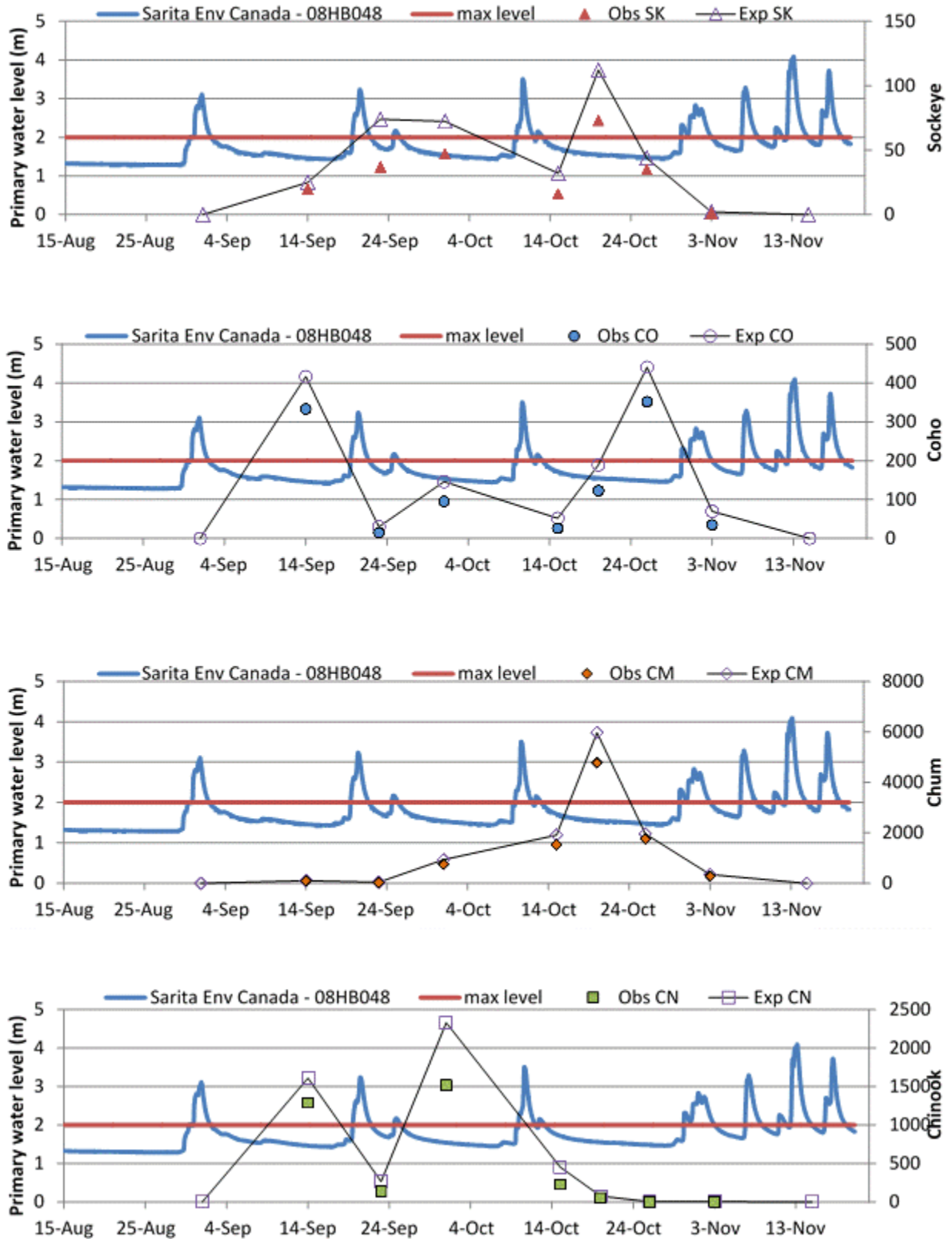


Figure 13-3. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 13-2. Survey life and rational for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	25 (20-30)	Sept 1	Nov 4	
Coho	25 (20-30)	Sept 1	Nov 15	
Pink				
Chum	12.5 (10-15)	Sept 1	Nov 15	Lower range applied due to observed pattern, SL < 12.5 results in estimate < raw peak count
Chinook	20 (15-25)	Sept 1	Nov 15	

Table 13-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
14-Sep-15	good	Water level normal (0.452m), clear (7-9m), poor visibility in pools
23-Sep-15	poor	Water level normal (0.698m), but muddy due to recent rain (3-4.5m), poor visibility in pools
01-Oct-15	fair	Water level normal (0.530m), but slightly turbid (6-8m), poor visibility in pools
15-Oct-15	poor	Water level normal (0.68m), but muddy due to recent rain (4-7m), aggressive bears reduced coverage, and survey ended at Marker 1 due to equipment failure
20-Oct-15	fair	Water level normal (0.540m), but slightly turbid (5.5m), poor visibility in pools
26-Oct-15	good	Water level below normal (0.469m), but slightly turbid (8-8.5m)
03-Nov-15	poor	Water level above normal (1.97m), visibility 6-10m

Table 13-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	117 (98-147)	AUC	3
Coho	470 (392-588)	AUC	3
Pink	52	Exp PL+D	3
Chum	6,378 (5,315-7,972)	AUC	2
Chinook	2,517 (2,014-3,356)	AUC	2

## Escapement Commentary:

### *Sockeye Return:*

Less than the 12 year average (~292), check the time series for anomalies

### *Coho Return:*

~37% of 12 year average, which would be consistent with other areas (Nitinat)

### *Pink Return:*

### *Chum Return:*

~50% of the 12 year average

### *Chinook Return:*

~twice the 12 year average, a good spawn this year, but 75% were males so few female spawners.

## 13.3. Spawner Distribution

### Run Timing:

Table 13-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Sept	Late Oct	Early Nov
Coho					Late Oct		
Pink							
Chum					Late Sept	Mid Oct	Late Oct
Chinook					Late Sept	Mid Oct	Late Oct

**Comments:** Surveys ended before peak Coho spawning occurred. All species were present in the stream when surveys started

### Spatial Distribution:

Table 13-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	12-7,6-5, 2-1
Coho	9-8, 2-1
Pink	
Chum	12-0
Chinook	12-10, 9-8,7-3
Steelhead	

**Comments:** Peak spawning of Coho was not observed.

## 13.4. Environmental Conditions

### Weather Summary:

Weather mostly good, only one survey in early October had to be postponed due to weather. However, visibility in Sarita is severely reduced once rains begin.



### Physical Characteristics Update:

Logging in upper reaches (10-7) has come very close to the river bank and erosion has increased. Right to the river.

## 13.5. Update to Stream Survey Protocols

### Current Assessment Method:

Survey begins at Sarita Falls (marker 12) and ends at marker zero (just above the mine pool). Vertical visibility and temperature were taken at the falls pool. Horizontal vis is recorded at the run between 11-10, and at Blenheim Bridge. Discharge is recorded by Environment Canada and available online

([https://wateroffice.ec.gc.ca/report/report\\_e.html?type=realTime&stn=08HB014](https://wateroffice.ec.gc.ca/report/report_e.html?type=realTime&stn=08HB014))

### Deviations from current assessment protocols:

In previous years surveys were split between half-surveys (6-0) and full surveys (12-0). All surveys this year were full surveys

### Access Updates:

Two trucks required. One truck parked at the mine pool gate, and one at the Sarita Falls trailhead. To access the falls, follow the flagging tape and rope down to the river. This is the same as in previous years.

### Safety Update:

Much of the large woody debris in the lower sections of the stream was washed out during the heavy storms in late 2014-early 2015. There was also increased bear activity and an increase in aggressive behaviour this year.

## 13.6. Enhancement

### Brood Removal:

Table 13-7. 2015 Sarita Chinook brood removals by date.

Date	1 st SET			Deposit to holding		
	Male	Female	Jack	Male	Female	Jack
Sept. 15	50	9	0	13	50	3
Sept. 16	197	38	9	70	35	10
Sept. 22	13	2	2	30	8	5
Sept. 23	53	7	0	21	19	7
Oct. 8	80	4	0	0	14	0
1st set Totals	393	60	11			
Sex Ratios	86.75%	13.25%				

Sex Ratio is Adults only & from 1st set information only. GVD

**Planned Release Numbers and Strategy:**

Chinook: 500,000 Subyearling Smolt

**Other Activities:**

None reported.

**13.7. Biosamples**

All brood fully biosampled.

**13.8. Concerns and Comments**

- Increased logging activity near the river over the last year. Some of it coming very close to the river bank.
- Bear activity was noticeably increased and bears were more aggressive than in previous years. We speculate that this was due to drought conditions in the summer making food scarcer. Bear spray should be brought on all surveys.
- Poachers were active in the area. Two black bears were found with gall bladders removed were found in late October. Conservation officers were notified.
- Trail maintenance is recommended as parts of the trail to marker 12 are overgrown or poorly flagged.



*Figure 13-4. The Sarita River at survey marker 5 looking upstream. Photo taken by surveyor Andrew Campbell on Oct. 20, 2015.*

## 14. NAHMINT RIVER

### 14.1. Stream Summary

The Nahmint River flows southeast into Nahmint Bay in Alberni Inlet. The lower Nahmint drains out of Nahmint Lake which is located 11.7 km upstream from the estuary. There is a steep canyon about 3.5 km upstream from the mouth (between markers 7 and 8), which was historically thought to be an obstruction to migration, but salmon are occasionally observed above the canyon. The mainstem below the canyon has been divided into 6 – 500 m sections for salmon enumeration. Historically, the survey started in the upper reaches above the canyon and ended at marker 0 in the tidal area. In recent years the survey starts just above marker 7 and ends marker 1 which is the upper extent of the salt water (Figure 14-1).

The stream has two small tributaries; one is an unnamed tributary just upstream of survey marker 1, and the other is Canyon Creek just below survey marker 7. Both tributaries are considered suitable fish habitat, but have no record of fish observations. The river habitat is characterized by several deep, wide pools, riffles and several fast flowing rapids. There tends to be a lot of clay in the system. Stream features include the Beaver Pond between markers 2 and 3, the side channel at marker 3, and the canyon pool between markers 6 and 7 (Figure 14-2).

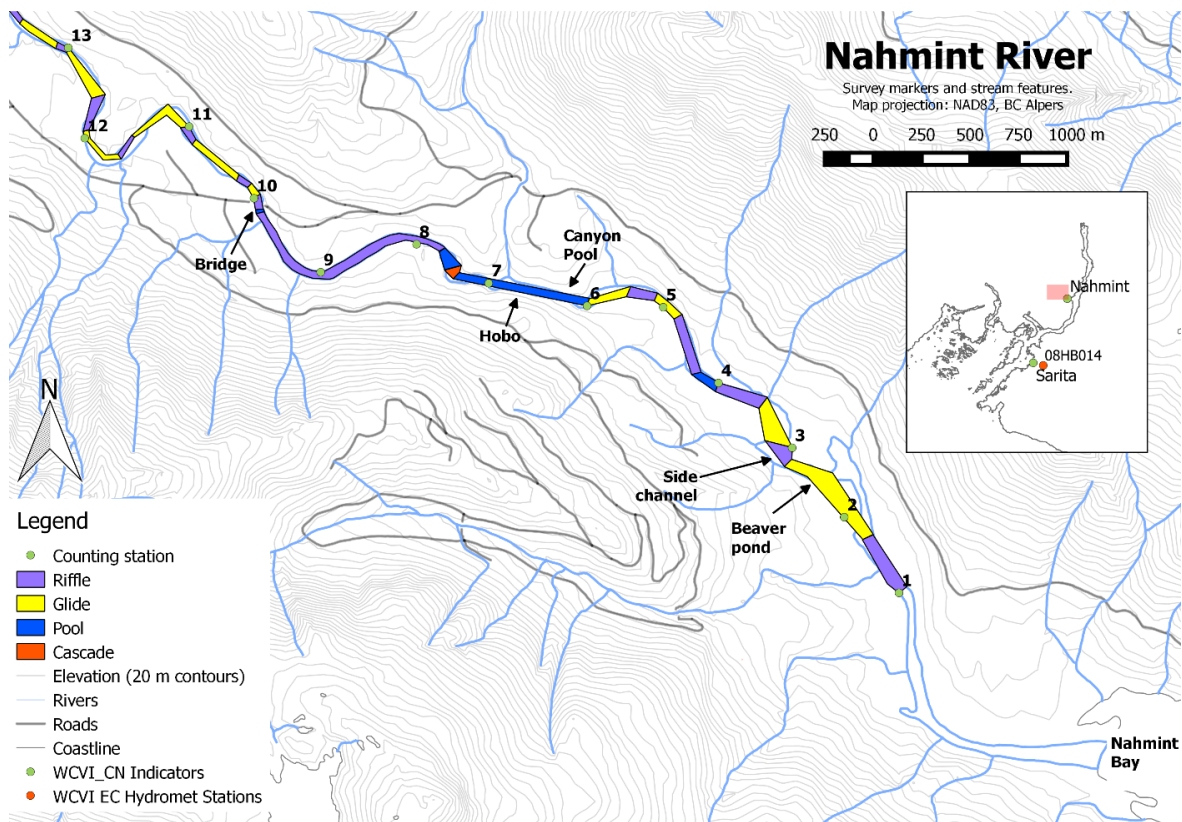


Figure 14-1. Nahmint River habitat units and counting stations. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. The Beaver Pond largely filled in with silt and gravel as of 2014. Map inset shows the location of the nearby Sarita River as well as the location of the Environment Canada hydromet station at Sarita (08HB014).



Similar to the Sarita River, Nahmint is a lake moderated system, unregulated by dam, and is prone to flashy flows where the water level can come up by 6 metres overnight. High water is retained for longer because of the lake and after heavy rain the river takes a couple of days to clear. The time to clear has increased in recent years due to higher sediment loads from logging. The stream clears more quickly than the Sarita.



Figure 14-2. Photo of the Nahmint River looking downstream from the Canyon Pool at marker 7. Photo taken by Andrew Campbell in October 2015.

Many species are found in the area during spawning periods (i.e. bears, eagles, seagulls and seals). Seals are often observed in high numbers in the estuary and in the lower reaches of the river during surveys.

## 14.2. Survey Results and Escapement Estimate

Survey Crew: Keta Biological (A. Campbell, C. Mack)

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

Table 14-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
04-Sep-15	558	1	39				2		104	
10-Sep-15*	809	10	69				34		160	
18-Sep-15	584		51		2		405		266	7
24-Sep-15	602		136				565		267	
02-Oct-15	665	2	68		3		1490	10	290	3
16-Oct-15	1112		47				3981	50	45	
24-Oct-15	1432	5	182				3867	3262	8	
30-Oct-15	320	3	24	1			310	1928	3	

**Comments:** All snorkel surveys.

\*This survey was conducted all the way to Nahmint Bay, approximately 1km downstream of normal exit point. Tidal influence begins ~400 metres downstream of normal exit

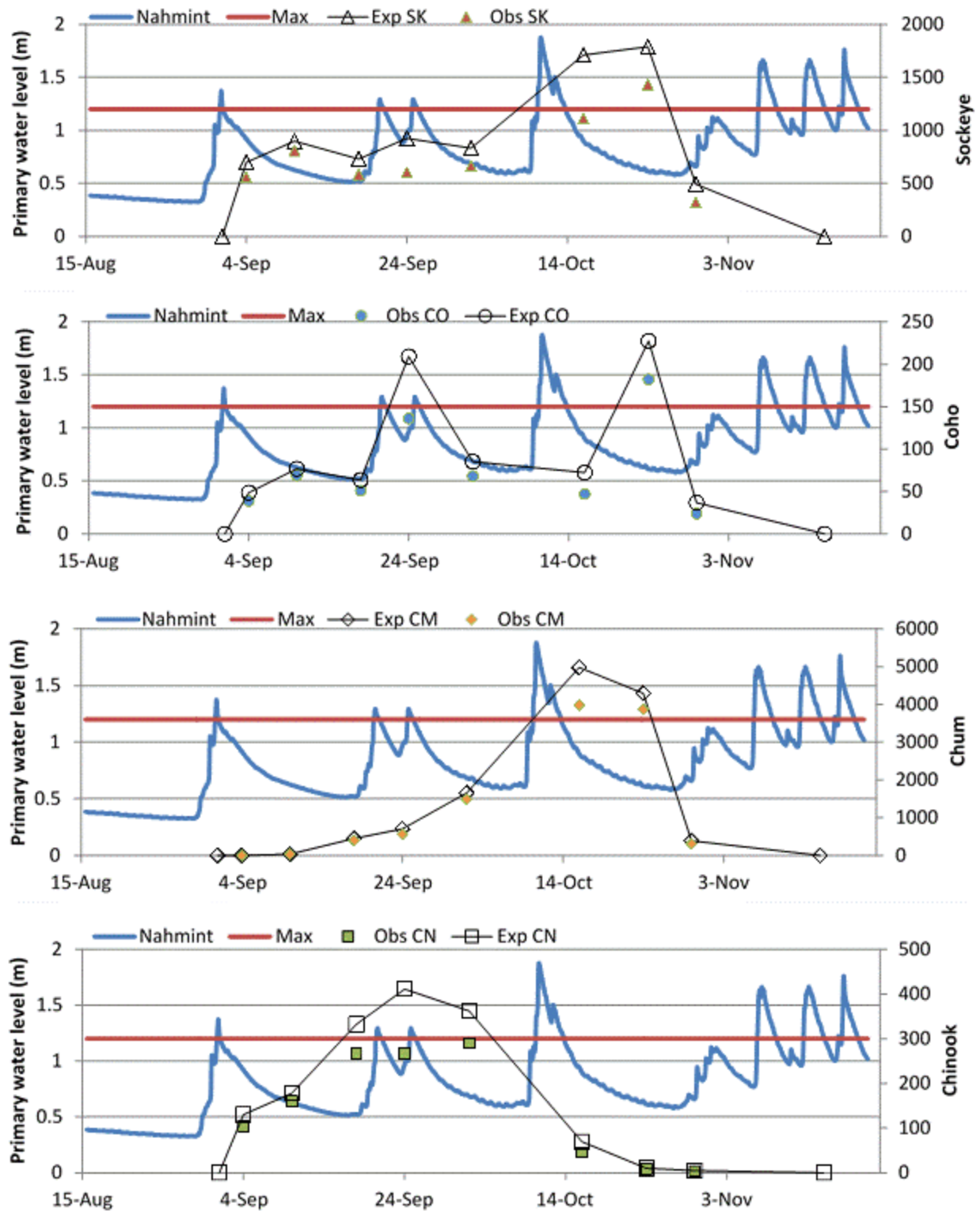


Figure 14-3. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from DFO Hobo monitoring station on Nahmint. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 14-2. Survey life and rational for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	Sep 1	Nov 15	Standard values, sufficient water for normal timing
Coho	25 (20-30)	Sep 1	Nov 15	Standard values, sufficient water for normal timing
Pink				
Chum	15 (10-20)	Sep 1	Nov 15	Standard values, sufficient water for normal timing
Chinook	25 (15-25)	Sep 1	Nov 15	Longer SL recommended due to relatively early entry due to Aug 31 freshet, and lack of observed spawning until fairly late in the season

Table 14-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
04-Sep-15	good	Water level above normal (0.910m), water clear (9 m)
10-Sep-15	excellent	Water level below normal (0.620m), water clear (11m)
18-Sep-15	good	Water level below normal (0.532m), water clear (11.5m), rain, bears interfered with full access to some pools
24-Sep-15	fair	Flood conditions (1.01m), water slightly turbid (8.5m), % habitat
02-Oct-15	good	Water level normal (0.690m), water clear (9.5m)
16-Oct-15	fair	Water level above normal (0.868m), water slightly turbid (8m)
24-Oct-15	good	Water level below normal (0.613m), water slightly turbid (8m)
30-Oct-15	fair	Water level above normal (0.876m), water tea coloured (6.5m)

Table 14-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	2,231 (1,912-2,677)	Area Under the Curve	2
Coho	256 (213-320)	Area Under the Curve	2
Pink	Adults Present		2
Chum	7,710 (5,783-11,566)	Area Under the Curve	2
Chinook	476 (476-793)	Area Under the Curve	2

## Escapement Commentary:

### *Sockeye Return:*

High relative to the 12 year average (~750).

### *Coho Return:*

Low relative to the 12 year average (~420).

### *Pink Return:*

A few adults observed, consistent with previous years.

### *Chum Return:*

Low relative to the 12 year average (~18,500), but increased from 2013 and 2014.

### *Chinook Return:*

Close to the 12 year average (~350), improved over the past three years.

## 14.3. Spawner Distribution

### Run Timing:

Table 14-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Sept	Early Oct	
Coho					Mid Oct		
Pink							
Chum					Late Sept	Early Oct	Late Oct
Chinook					Early Sept	Early Oct	Late Oct

**Comments:** Coho peak spawn not observed. Influx of Sockeye in mid-late October extended the peak spawn, end of spawning not observed.

### Spatial Distribution:

Table 14-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	7-2
Coho	
Pink	
Chum	7-2
Chinook	7-2
Steelhead	

**Comments:** Spawners observed in all sections, Coho spawning does not begin until after surveys end

#### 14.4. Environmental Conditions

**Weather Summary:**

Ideal weather conditions for most of the survey season.

**Physical Characteristics Update:**

Much of the debris jam above the beaver pool has washed away since 2014, creating a large drop off at the entrance to the pool. A lot of the silt that has been collecting in the beaver pool has been removed; there were much better conditions than in previous years. A large tree fell into the river above the beaver pool in October.

#### 14.5. Update to Stream Survey Protocols

**Current Assessment Method:**

Two trucks are required. One parked at the entrance and one at the exit. At the entrance follow the trail down to the canyon pool to start the survey. Exit at marker 2 and follow the trail back to the road.

**Deviations from current assessment protocols:**

One survey was carried out to Nahmint Bay. It was decided that this would not be necessary for remaining surveys as tidal influence starts soon after typical exit, and there is some confusion about the numbering of the stream markers that needs to be resolved.

**Access Updates:**

No change reported.

**Safety Update:**

High bear activity this year. New tree in river above the beaver pool, not a safety issue as the water moves slowly in this section.

#### 14.6. Enhancement

**Brood Removal:**

Spawned 19 females and 19 males, however overall 29% of brood captured were strays from other rivers (Thornton Creek, Toquart, Conuma, Robertson, other). The total usable went down from 45 females to 19 females.

Nahmint is cooler in summer and warmer in winter than nearby rivers, so Chinook may be attracted to cooler water. Nahmint tags strayed to Nitinat and Sarita. Also caught an unclipped S1 from Omega.

**Planned Release Numbers and Strategy:**

CN: 165,000 subyearling smolts to the river and 60,000 seapen to the estuary

**Other Activities:**

Nothing reported.



#### 14.7. Biosamples

Late surge of Sockeye in mid-October, we tried sampling to determine origin but were only able to find 4 morts.

#### 14.8. Concerns and Comments

Late surge of Sockeye in mid-October, unclear if they were strays or if they were just late. Lots of bear activity on Nahmint this year, with an increase in aggressive behaviour. We speculate this may be due to drought conditions making food scarcer in the summer.

Waiting for DNA results required holding fish, which resulted in egg losses. One female, and fecundity was down to 4000 vs 4400 avg.

Sockeye in September (first couple swims) had fungus (a white cap), fish disappeared by mid-October (no spawning observed in that period so they likely died pre-spawn).

## 15. CLEMENS CREEK

### 15.1. Stream Summary

Clemens Creek flows southwest into the top end of Henderson Lake. The mainstem is over 12 km long. It is primarily a Sockeye and Coho system but Chum and Chinook are also present. Survey length is 4.7 km. Extensive surveys of the accessible length in previous years found that the majority of fish utilized the area surveyed with a few utilizing a couple of pools a kilometer above the survey section. Spot checks of those pools are conducted occasionally, particularly early in the season.

### 15.2. Survey Results and Escapement Estimate

Survey Crew: M.C. Wright and Associates Ltd. (M. deVisser, I. Wright, R. Abbott)

Stock Assessment Biologist: D. McHugh

#### Individual Survey Data:

Table 15-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
29-Jul-15	1									
26-Aug-15	0									
04-Sep-15	175		17						1	
11-Sep-15	274		373						1	
21-Sep-15	497		457				5		1	
28-Sep-15	763		1326		2		43		2	
05-Oct-15	427		864		2		27		30	
13-Oct-15	402	1	779				30		12	
20-Oct-15	476	1	796				51		64	
27-Oct-15	517	7	657		1		14	1	32	2
03-Nov-15	223	4	595				10	3	10	
09-Nov-15	71	2	497	3			2		2	1
19-Nov-15	3		171	1						

Comments: All snorkel surveys; additional visit July 23 was a spot check of the bridge pool and bottom end by DFO staff, saw no sign of fish. Additional counts made at a fence (described below).

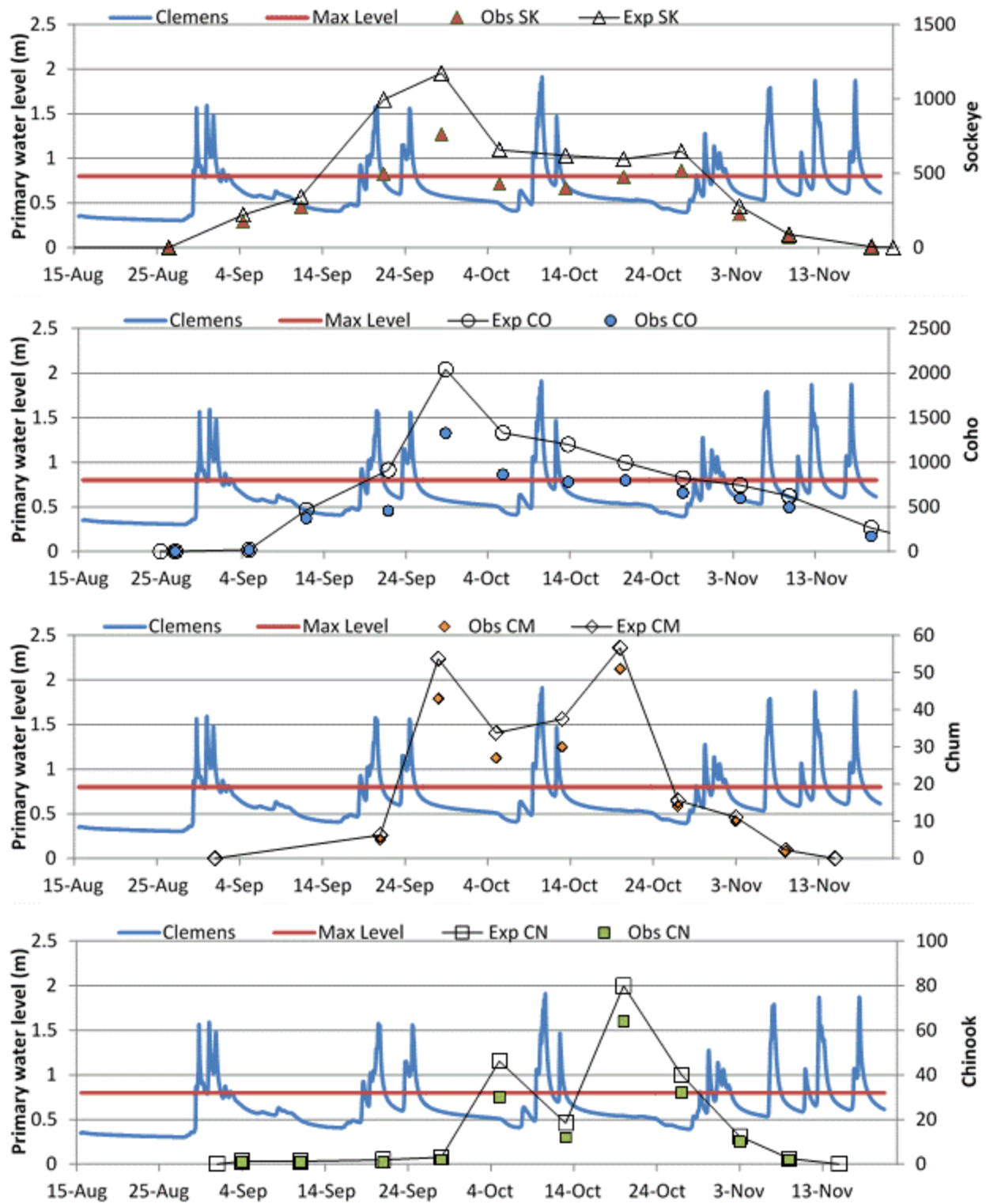


Figure 15-1. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 15-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	14.5 (11-18)	Aug 26	Dec 1	Survey Life based on the historical relationship between the raw survey counts and escapement estimate.
Coho	30 (25-35)	Aug 26	Dec 1	
Pink				
Chum	15 (10-20)	Sept 11	Nov 19	First zero observed
Chinook	17.5 (10-25)	Sept 1	Nov 19	

Table 15-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
29-Jul-15	excellent	Water level extremely low (0.36m), water clear
26-Aug-15	excellent	Water level extremely low (0.345m), water clear (16 m)
04-Sep-15	good	Water level normal (0.657m), water clear (>20 m)
11-Sep-15	good	Water level below normal (0.510 M), water clear (>20m)
21-Sep-15	poor	Water level above normal (0.780m), water slightly turbid (5-10m)
28-Sep-15	fair	Water level normal (0.615m), water clear (12.5m)
05-Oct-15	fair	Water level below normal (0.520m), water clear (>20m)
13-Oct-15	fair	Water level above normal (0.735m), water clear
20-Oct-15	good	Water level normal (0.573m), water clear (>20m)
27-Oct-15	good	Water level below normal (0.430m), water clear (>20m)
03-Nov-15	good	Water level below normal (0.641m), water clear (20m)
09-Nov-15	good	Water level normal (0.660m), water clear (16.5m)
19-Nov-15	fair	Water level normal (0.702m), slightly turbid (17m)

Table 15-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	1,966 (1,584-2,592)	Area Under the Curve	2
Coho	2,908 (2,342-3,833)		2
Pink	Adults Present		
Chum	103 (77-155)		2
Chinook	81 (57-141)		2

## Additional Data

A fence was installed by Uchucklesaht with assistance from NTC and Maa-nulth in the Henderson River from June 29 to August 29. Four mechanical flappers installed to count fish as they move through. The counters should be calibrated frequently to ensure the flappers are accurately counting fish through as well as verifying species composition. Unfortunately no fish were observed passing through the counters, so no calibration was possible in 2015, greatly increasing the uncertainty associated with the count

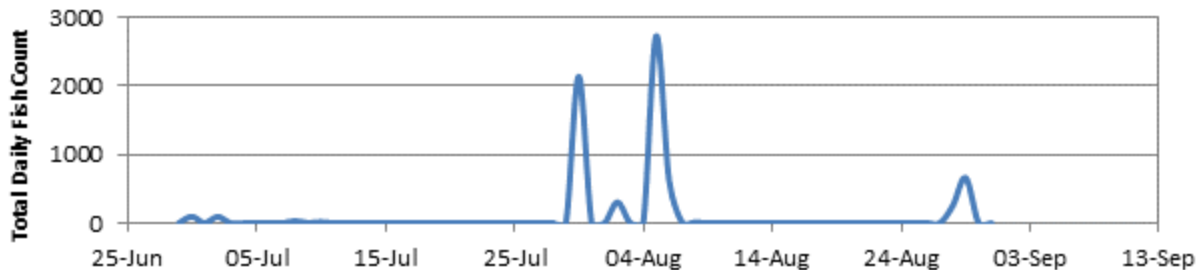


Figure 15-2. Counts from the mechanical flappers on the fence on the Henderson River in 2015. Some portion of the count is coho. 7,175 total counted through if the late August peak is assumed to be coho, the count is 6,262.

## Escapement Commentary:

### *Sockeye Return:*

Sockeye returns were much lower this year than forecast. Virtually no beach spawners were observed, and no fish were observed schooling in the lake (this system typically sees a small population of beach spawners and consistently sees schools of 500 to 2,000 fish holding in the lake prior to river entry). The lack of holding fish in the lake may be attributable to warmer than average lake temperatures, particularly from arrival to peak run times, causing new recruits to hold in deeper water and beyond the visible limits of snorkel surveyors.

Only one ROV survey in Late Aug due to none observed by swimmers in-season.

### *Coho Return:*

A strong Coho return was noted this year. Unsure how the population estimate compares to the forecasted amount. New recruits were observed up until the final swim survey on November 19.

### *Pink Return:*

Pinks are typically not observed in this system; however, the 2015 season saw a handful of Pink salmon during the early to mid-survey season.

### *Chum Return:*

Chum returns appeared to be average or slightly less than average.

### *Chinook Return:*

Near average Chinook returns were noted in Clemens Creek this year, with Chinook present throughout the majority of the survey season.

### 15.3. Spawner Distribution

#### Run Timing:

Table 15-5. The run timing for the survey year by species. N.O. stands for none observed.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye	N/A	N/A	N/A	Sept. 4*	Oct. 13	Oct. 27	Nov. 9
Coho	N/A	N/A	N/A	Sept. 4	Oct. 27	N.O.	Unknown
Pink	N/A	N/A	N/A	Sept. 28		N.O.	
Chum	N/A	N/A	N/A	Sept. 21		N.O.	
Chinook	N/A	N/A	N/A	Sept. 11		N.O.	

**Sockeye:** A small body of fish typically moves into the system prior to the first survey. These fish were not observed this year. Peak spawn timing consistent with previous years.

**Coho:** No significant active Coho spawning was observed during this year's survey.

#### Spatial Distribution:

Table 15-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Sockeye were primarily concentrated in the middle of the survey area this year (i.e. between counting stations 3 and 7), unlike previous years, where a significant body of fish has always been observed lower down in the system (i.e. between the lake and counting station 2). Spawning was concentrated in the pool tail-outs of the major pools in counting sections 3-4 and 6-7, and occasionally in 5-6. Unlike previous years, no spawning was observed between counting stations 7 and 9. Only limited beach spawning was observed this year, primarily later in the run (i.e. not until early November).
Coho	Coho were distributed evenly throughout the survey area, with the majority of holding occurring in major pools in counting sections 3-4, 5-6, 6-7, and at the bridge. No active Coho spawning was observed. Possible that major spawning grounds are upstream of the survey section.
Pink	
Chum	Chum were distributed primarily between counting stations 3 and 5. In previous years, a significant component of the population was observed at the bottom end of the system (i.e. between counting stations 0 and 5). No fish observed lower in the system this year.
Chinook	Chinook typically distributed within the middle of the survey section, i.e. between counting stations 3 and 7. The most significant numbers were observed holding in the pool below the bridge and the major pools in counting sections 3-4, 4-5, and 5-6.

## 15.4. Environmental Conditions

### **Weather Summary:**

Weather conditions throughout 2015 were a combination of intense storms followed by dry spells. No sustained periods of rain occurred; therefore, the system experienced a series of high discharges over a short period of time followed by periods of decay and normal water levels. Significantly less overall rainfall occurred in 2015 in comparison to 2014. In 2014, the Clemens Creek hydrometric station recorded 2,608mm of rain between September and November whereas in 2015, only 1,407mm of rain was recorded.

Despite some rainfall in August (contrary to the last few years where the first significant rainfall did not occur until late September or early October), water levels in both the river and lake remained extremely low. This may be attributable to the drought experienced during the spring and summer of 2015 and subsequent low groundwater tables.

Early in the Summer, due to concern with the low water levels Creek walked to look for stranded fry, but water was deep enough to provide access from the lake up to (~2km upstream, July-Jim Lane and Monty Horton). No stranded fry observed. Jim noted more gravel build up than usual.

### **Physical Characteristics Update:**

No major changes observed from last year. However, active logging in the upper watershed commenced this fall, which may or may not impact erosion and water clarity next year.

The side channel near 5-3 is getting quite a bit more water (left bank), ~35-40%, debris jam at the point where it diverges, may become the main channel. Large cutblock there at the side channel, decent setback is present.

Around marker 10, a cutblock with a narrow set back is being eroded, may be good to monitor.

## 15.5. Update to Stream Survey Protocols

### **Current Assessment Method:**

The standard survey area this year was from counting station 9-2 all the way to the hatchery, including the lake shoreline from the mouth of Clemens Creek to the hatchery. This survey takes between 4 to 6 hours depending on flows and number of fish present. Environmental measurements are collected at the bridge (visibility and temperature) and in the lake near the hatchery (temperature).

### **Deviations from current assessment protocols:**

No deviations from last year's assessment protocols occurred

### **Access Updates:**

The river was accessed from the road near counting station 9-0, which entailed a short (approximately 50m) bushwhack down to the river. Access has not changed from previous years.

Note that active hauling was occurring this year, so swimmers had to ensure vehicles were parked far enough off the road to allow off-road logging trucks to pass. There is a new gate on Clemens mainline, just past the Bridge where the HOBO is, will need the key.

**Safety Update:**

No significant changes – the log jams in counting sections 5-6 and 8-9 continue to be hazardous during higher flows.

## 15.6. Enhancement

**Brood Removal:**

None, however 187 Sockeye, 19 Chinook, 46 Coho and one Pink were taken by the Uchucklesaht fishery in Henderson River and in the Inlet just outside Henderson.

**Planned Release Numbers and Strategy:**

N/A

## 15.7. Biosamples

Three Sockeye were biosampled this year. Sample 1 was collected between counting stations 6 and 7 on October 20, sampled for POH, otoliths, and DNA. Results pending. Samples 2 and 3 were collected between counting stations 7 and 8 on October 27, sampled for POH, otoliths, and DNA. Results pending.

20 food fish SK were also sampled.

One Chinook was biosampled this year. Sample 1 was collected between counting stations 5 and 6 on November 9, sampled for POH, otoliths, and DNA. Results pending.

## 15.8. Concerns and Comments

Very few black bears were observed this year, which is extremely abnormal for this system. Bears were often not observed during a survey.

Based on mechanical counters in a fence installed in Henderson River, an estimated 6,700 Sockeye entered Henderson Lake from June 29 to Aug 30. Some portion may have been Coho, particularly later in the season. Warm lake temperatures may have resulted in Sockeye spawning in the lake below the depth observable by swimmers.

River temp (Henderson River) was high ( ranged 18.5 (July 26) to 21 degrees Aug 16 and 19<sup>th</sup>), Aug 27<sup>th</sup> 20 degrees.

Logging again, dewatering at Elbow Creek again, small (~2 liters) diesel spill reported mid-Jan 2016. May want to do an ROV survey again next year.

Fish were seen jumping in Snug Basin, a small basin in Uchucklesaht Inlet adjacent to the entrance to Henderson River, where they are not usually seen.



## 16. TOQUAHT RIVER

### 16.1. Stream Summary

The Toquaht River flows south into Toquaht Bay on the northwest edge of Barkley Sound. The mainstem is about 10 km up to Toquaht Lake. The main tributary is the Little Toquaht River which enters the Toquaht about 500 m upstream from the mouth. The Little Toquaht River drains Little Toquaht Lake which is located about 3 km upstream from the confluence. The Toquaht has a moderate gradient and about 4 km upstream from the mouth is a set of cascades which are impassible to Chinook and Chum. The Thornton Creek Hatchery has been enhancing the Toquaht and other streams in the area since the late 1970s.

### 16.2. Survey Results and Escapement Estimate

Survey Crew: TCES (Ray Bisaro, Dave Hurwitz)

Stock Assessment Biologist: Diana McHugh

#### Individual Survey Data:

*Table 16-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
14-Sept-15	397	1	700	13	60		36		269	
1-Oct-15	252	1	95	1			1168	44	87	1
24-Oct-15	262	15	40				2119	2448	207	7
5-Nov-15			342						3	1

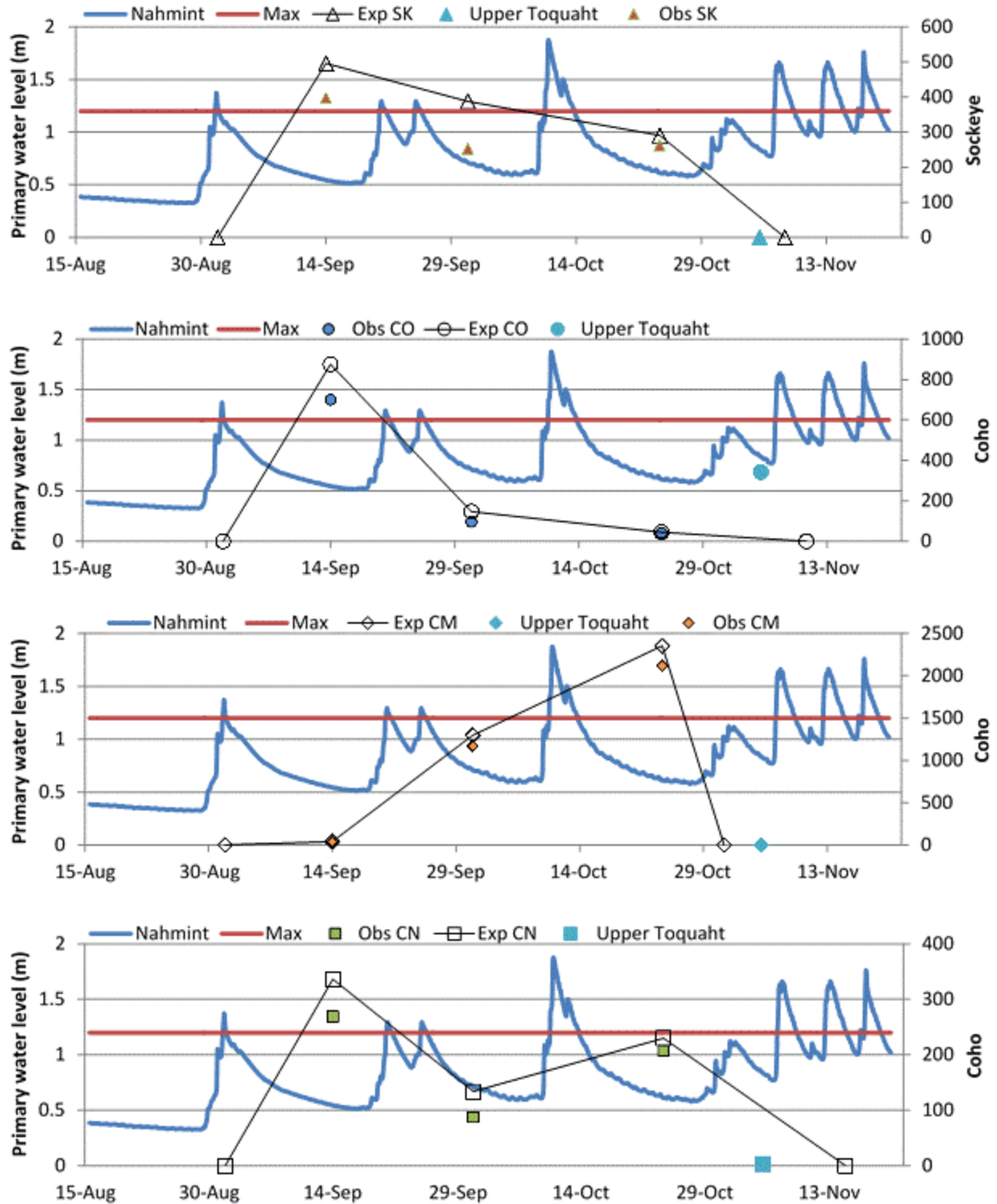


Figure 16-1. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 16-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	N/A			
Coho	N/A			
Pink	N/A			
Chum	N/A			
Chinook	N/A			

Table 16-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
14-Sep-15	good	Ideal conditions for the lake fed system, water level below normal, water tea coloured (6 m)
01-Oct-15	fair (good for CM)	River up & murky despite gauge reading, water level above normal, water tea coloured (3m)
24-Oct-15	excellent	Water level below normal, water clear (5m)
05-Nov-15	excellent	Water level below normal, water clear (8m)

Table 16-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	497	PL+D	3
Coho	888	PL+D	2
Pink	67	PL+D	3
Chum	4802	PL+D	2
Chinook	336	PL+D	3

## Escapement Commentary:

*Sockeye Return:*

*Coho Return:*

Fungus in Sept, first swim. Which is early

*Pink Return:*

*Chum Return:*

A good peak count, was ~1/2 of a normal year, used to seek 10k dead stacked up. More fish (~6500) in the Little Toquaht. There is a little cascade ~Marker 4 that acts as a bit of a barrier

*Chinook Return:*

A couple CN spawning in upper river, a good sign. Usually stacked up in a couple places, this year well spread out.

### 16.3. Spawner Distribution

#### Run Timing:

Table 16-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Oct		
Coho							
Pink							
Chum					Mid Oct	Late Oct	Early Nov
Chinook					Mid Oct	Late Oct	Early Nov

Comments: Has a summer run of Coho, due to the lake.

#### Spatial Distribution:

Table 16-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	13-12, 4-3
Coho	
Pink	
Chum	4-0
Chinook	Right at the outlet of the Lake, 14-8, 7-4
Steelhead	

### 16.4. Environmental Conditions

None provided.

### 16.5. Update to Stream Survey Protocols

#### Current Assessment Method:

Snorkel survey from marker 15-0, ~7500m

### 16.6. Enhancement

#### Brood Removal:

Only one full day of brood (10 female CN, 16 males: ~35,000 eggs)

### 16.7. Biosamples

All brood fully sampled.

### 16.8. Concerns and Comments

Lots of Fungus on Coho in October, didn't see many fish in November, so think fungus killed them

~90% males

Upper Toquaht River has been logged again starting in the last two years, major trib ~3k above the lake. The timber licence may have just been acquired by Toquaht FN. So we should try to add measuring the depths of some of the pools.

Needs survey markers

Long time surveyor R. Bisaro retired after the 2015 field season, will need a second experienced surveyor (D. Palfrey if available) but will work on finding another swimmer.

## 17. MAGGIE RIVER

### 17.1. Escapement Estimates

Survey Crew: Toquaht First Nation (Carlos Mack)

Stock Assessment Biologist: Diana McHugh

Table 17-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
19-Sep-15			86							
26-Sep-15			150							
03-Oct-15			203							
10-Oct-15			320							
17-Oct-15			480							
24-Oct-15			40							

**Comments:** Good survey conditions during all surveys.

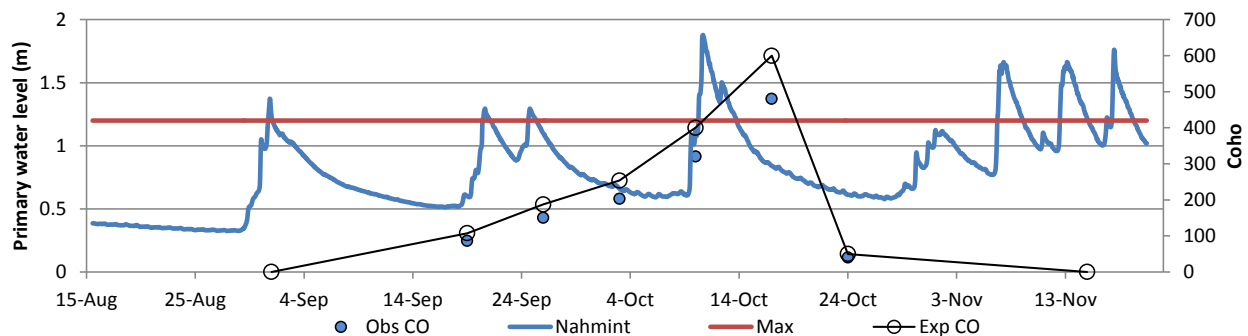


Figure 17-1. Raw counts (solid marker) and expanded counts (open marker) for Coho. The water level/discharge is from DFO Hobo monitoring station on Nahmint. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

### 17.2. Escapement comments

CO: 608, Area Under the Curve, fish still silver during Oct 10<sup>th</sup> survey

CM: None Observed

### 17.3. Environmental Conditions

Water was tea-coloured

### 17.4. Survey Protocols

Snorkel survey of 1.22 km from the fish ladder to the estuary.

### 17.5. Concerns and Comments

Bears at the fish ladder and on the trail.

## 18. CHINA CREEK

### 18.1. Stream Summary

China Creek flows southwest into Alberni Inlet. The mainstem is about 24 km long and is fed by the many tributaries and several small lakes including Bainbridge, Lizard Lake and Duck Lake. The system is dammed and the supplies water to the city of Port Alberni. The China Creek Marina and Campground is located at the mouth. The Creek was historically a Coho stream with occasional observations of Pick and Chinook.

### 18.2. Escapement Estimates

Survey Crew: Tseshah First Nation (Frank Cartlidge, Darwin Webber)  
Stock Assessment Biologist: Diana McHugh

Table 18-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
05-Oct-15										
15-Oct-15										

Comments: Water level below normal Oct 5, and normal Oct 15. Water clarity was poor (0-1m) during both surveys.

### 18.3. Escapement Comments

No fish observed during a Chum-targeted bankwalk of China Creek (720m section from the falls to the estuary), but there were 60 Coho estimated below China Creek logging road bridge further upstream on Oct 5. On Oct. 15 Chum were holding outside creek along the beach.

### 18.4. Environmental Conditions

### 18.5. Survey Protocols

~700 metre bank walk from falls to estuary.

### 18.6. Enhancement/Restoration Activities

### 18.7. Concerns and Comments

## 19. FRANKLIN RIVER

### 19.1. Escapement Estimates

Survey Crew: Tseshaht First Nation (Frank Cartlidge, Darwin Webber)  
Stock Assessment Biologist: Diana McHugh

Table 19-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
05-Oct-15	175		145	5			1			
13-Oct-15			2				30			

**Comments:** Bank walks conducted on 2015-10-05 & 2015-10-13. Poor survey coverage, method and conditions during surveys.

### 19.2. Escapement Comments

SK: 175, Sockeye do not normally spawn in this river but Somass Sockeye turned up everywhere this year, even the Puntledge River and Fraser test fishery. The "Unexpanded PL+D" was selected as the escapement estimate.

CO: 150, Poor survey coverage, method and conditions during surveys, so the "Unexpanded PL+D" was selected as the escapement estimate.

CM: 30, Poor survey coverage, method and conditions during surveys, so the "Unexpanded PL+D" was selected as the escapement estimate.

CN: None Observed

### 19.3. Environmental Conditions

Water clarity 1-3 metres for both surveys.

### 19.4. Survey Protocols

500m bank walk, from bridge to estuary

### 19.5. Enhancement/Restoration Activities

None reported

### 19.6. Concerns and Comments

None reported



## 20. MACTUSH CREEK

### 20.1. Escapement Estimates

Survey Crew: Tseshah First Nation (Frank Cartlidge, Darwin Webber)  
Stock Assessment Biologist: Diana McHugh

Table 20-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
06-Oct-15	0		0				0			

**Comments:** Bank walks conducted. Poor survey coverage, method and conditions during surveys.

### 20.2. Escapement Comments

No salmon observed in the Creek due to low water levels, fish were seen holding outside the creek and around the corner along the beach.

### 20.3. Environmental Conditions

Water clarity 0-1 metres, water levels extremely low.

### 20.4. Survey Protocols

500 m bank walk

### 20.5. Enhancement/Restoration Activities

None reported

### 20.6. Concerns and Comments

None reported

*STREAMS IN AREA 24*

## 21. AREA 24 SUMMARY OF OBSERVATIONS IN 2015

There are almost 60 streams and major tributaries that have records of spawning salmon in Area 24. The priority for escapement enumeration are the Chinook indicator stocks in the Bedwell River, Tranquil Creek and Megin River. There is no Coho indicator in Area 24. The Moyeha River was historically a Chinook indicator but was dropped due to logistical difficulties. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most surveys are conducted using the snorkel method described in the DFO snorkel survey manual. Occasionally, systems are also surveyed by stream or bank walks. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups.

Enhancement in Area 24 has been primarily done by the Tofino Salmon Enhancement Society, Thornton Creek Enhancement Society, and Kennedy Lake Hatchery operated by Tla-o-qui-aht. The Kennedy River has been enhanced in most years since the mid-1980s, Tranquil Creek since the early 1990s, Cypre River since the late 1990s and Bedwell River since 2008. Enhancement efforts have focused primarily on Chinook.

In 2015, 20 streams were surveyed in Area 24 (Figure 21-1). Bedwell, Tranquil, Megin, Cypre were surveyed frequently enough to allow a reliable application of the Area Under the Curve (AUC) estimation method for most species. Additional streams were surveyed once or twice in order to obtain a minimum estimate of escapement ideally during the peak.

The 2015 survey results from Area 24 were reviewed at a post-season escapement review workshop held at the Tofino Botanical Gardens in Tofino on February 2, 2016. Workshop participants (Table 21-1) reviewed and discussed the individual survey results and escapement estimates. This discussion is captured in the commentary below. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the stream summaries was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

*Table 21-1. Participants at the Area 24 escapement review workshop in Tofino on February 2, 2016.*

Participant	Affiliation
Stephanie King	Sea This Consulting (organizer)
Diana McHugh	DFO (organizer)
Doug Palfrey	Tofino Enhancement Society
Dave Hurwitz	Thornton Creek Enhancement Society
Erica Blake	DFO, Community advisor
Denise Koshowski	DFO - fishery officer
Dan Smith	DFO - fishery officer
Pat Vek	Escapement contractor

Observations that were consistent across most of the surveys in the area are as follows:

- Extremely hot and dry conditions through the spring and summer resulted in low water in most systems through the summer until August. After the first major rain event in late August, flows were normal to the end of the year.

- In most systems, surveyors reported a higher proportion of Coho jacks than normal.
- There was a very high Sockeye return to most systems.
- In most systems, Coho were small and of poor quality. Coho were normal in the Megin.
- After years of poor returns, Pinks appear to be building in some systems.

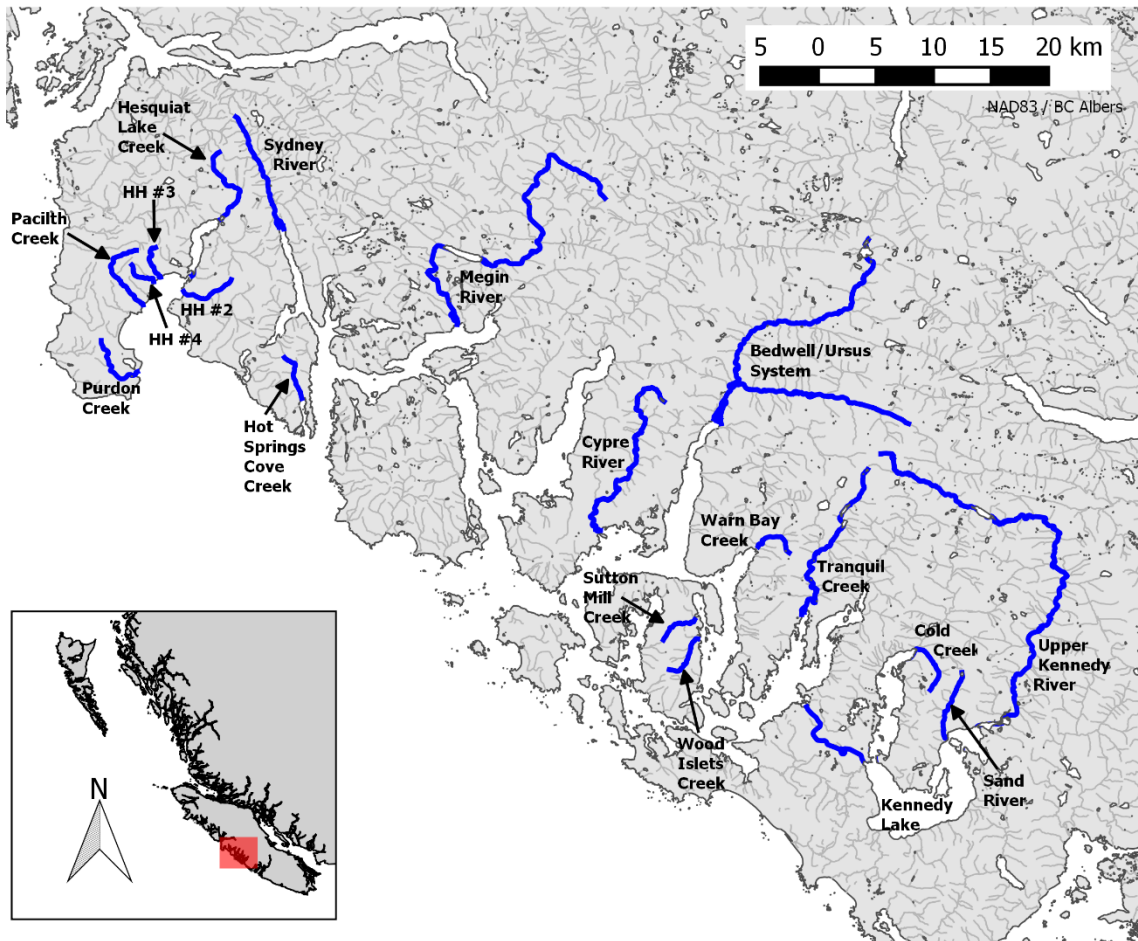


Figure 21-1. Streams in Area 24 that were surveyed in 2015 (highlighted blue).

## 22. BEDWELL RIVER/URSUS CREEK

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### 22.1. Stream Summary

The Bedwell River and Ursus Creek make up the Bedwell System, which flows southwest into the Bedwell Sound. The area is remote with the exception of the Clayoquot Wilderness Resort which operates at the mouth of the River. The Bedwell River is fed by glacier snowmelt from many steep tributaries and by Bedwell Lake located almost 30 km upstream from the mouth.

The lower 6 km of the Bedwell River has been divided into 12-500 m survey sections for salmon enumeration (Figure 22-1). At the top of the survey section on the Bedwell River there is a canyon that is impassible to fish. The largest tributary to the Bedwell is Ursus Creek which historically entered the Bedwell River at survey marker 5. In 2013/14 and 2014/15, there were major changes in the stream channel around the confluence with the Ursus. The location of marker 6 on Figure 22-1 is now dry river bed. The lower 3 km, markers 0 to 6, is the area usually surveyed on the Ursus.

The system is dynamic, with few or no log jams and no beaver dams. The mainstem channels are generally shallow and wide, and erosion is a problem. Most large woody debris gets washed out. On a high tide, salt water reaches marker 1. There are several deep pools on the Bedwell between markers 2 and 3, 9 and 10 and below the canyon (marker 12) on the Bedwell. The pool between markers 4 and 5 has been filling-in in recent years. On Ursus Creek, there are several pools between markers 3 and 6.

The system is described as 'great indicator stream' with generally clear water and pools that have excellent visibility. After heavy rainfall the system will become murky and take up to three days to clear. The water clarity and retainment characteristics are similar to nearby systems Cypre, Tranquil and Moyeha. Typical flow for the Bedwell system is  $1.8 \text{ m}^3/\text{s}$ , compared to 0.4 for Tranquil and 0.8 for Megin. The Bedwell is considered a relatively cool system, with temperatures slightly cooler than Tranquil. The Environment Canada Water Survey Station at Tofino Creek (08HB086) has a long record of discharge measurements and can be used as an indicator for discharge at Bedwell. DFO installed a hydrometric station on the Bedwell in 2015 at marker 8. Seals are occasionally seen in the estuary but also not considered to be a problem.

Historical spawner survey reports note considerable silt and erosion. The upper reaches of the Ursus, above marker 13, are unlogged, relatively flat, but have experienced a lot of change since the early 2000s.

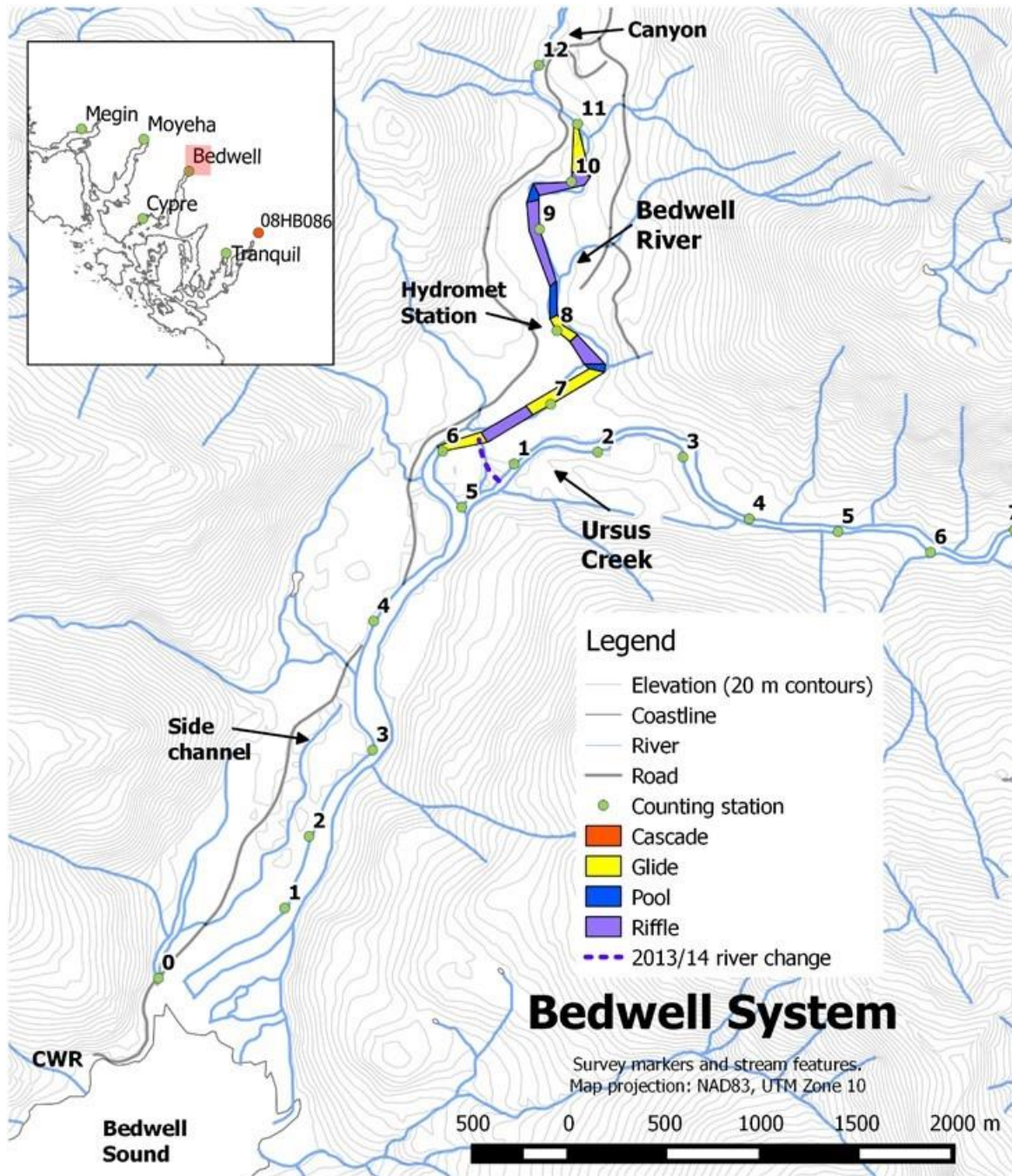


Figure 22-1. The Bedwell/Ursus system habitat units and counting stations. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydromet station at Tofino Creek (08HB086). Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The 2013/14 river change (purple dashed line) shows the approximate location of the Ursus channel as of 2014. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

## 22.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

Table 22-1.Unexpanded live and dead counts by species for each survey on **Bedwell River**

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
12-Sep-15	245		147		8		11		49	
28-Sep-15	163	1	228		4		308		298	
05-Oct-15	169		163				301	2	367	
18-Oct-15	183		302				755		144	5
28-Oct-15	146	7	376	1			1464	524	50	3
05-Nov-15	61	10	280				809	356	3	1
20-Nov-15	1		247							
28-Nov-15			201							

Table 22-2.Unexpanded live and dead counts by species for each survey on **Ursus Creek**

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
12-Sep-15	516	2	90		19	1	5		6	
28-Sep-15	343	1	163		6		20		44	
05-Oct-15	348	21	108		3		25		65	
18-Oct-15	329	3	174				86	2	135	2
28-Oct-15	301	17	195				33	31	38	10
05-Nov-15	143	46	123	1			10	11	14	5
20-Nov-15	67	1	76						1	
28-Nov-15	21	20	68	2			1			



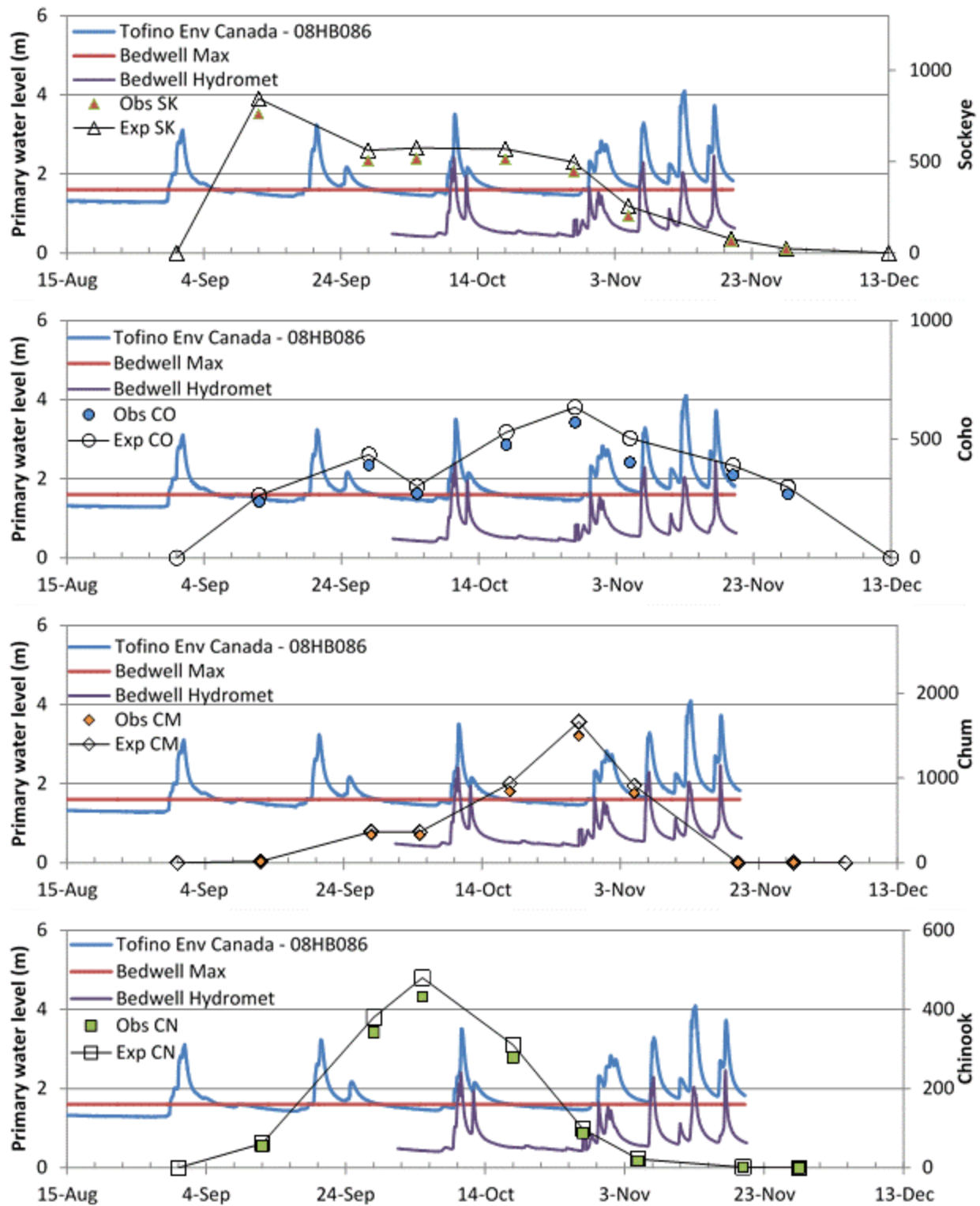


Figure 22-2. Combined Bedwell/Ursus raw counts (open marker) and expanded counts (solid marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.



Table 22-3. Survey life and range applied for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Bedwell River				
Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	31-Aug-15	21-Nov-15	
Coho	35 (30-40)	31-Aug-15	15-Dec-15	
Pink				
Chum	15 (10-20)	31-Aug-15	20-Nov-15	
Chinook	20 (15-25)	31-Aug-15	20-Nov-15	
Ursus Creek				
Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	31-Aug-15	01-Dec-15	
Coho	35(30-40)	31-Aug-15	15-Dec-15	
Pink				
Chum	15 (10-20)	01-Sep-15	01-Dec-15	
Chinook	20 (15-25)	31-Aug-15	28-Nov-15	

Table 22-4. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
12-Sep-15	Excellent	Water level normal, water clear (10m)
28-Sep-15	Excellent	Water level normal, water clear (9m)
05-Oct-15	Excellent	Water level below normal, water clear (10m)
18-Oct-15	Excellent	Water level normal, water clear (10m)
28-Oct-15	Excellent	Water level normal (0.45m), water clear (10m)
05-Nov-15	Excellent	Water level above normal (0.560m), water clear (8m)
20-Nov-15	Excellent	Water level below normal (0.445), water clear (9m)
28-Nov-15	Excellent	Water level below normal (0.63), water clear (9m)

Table 22-5. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate (Bedwell)	Annual escapement estimate (Ursus)	Annual escapement estimate (Bedwell+Ursus)	Analytical method	Data quality level
Sockeye	386 (331-463)	884 (758-1061)	1270 (1089-1524)	AUC	3
Coho	703 (615-820)	358 (313-418)	1061 (928-1238)	AUC	2
Pink	9	22	31	PL+D	3
Chum	2,356 (1,767-3,533)	139 (104-208)	2495 (1871-3741)	AUC	2
Chinook	551 (441-735)	185 (148-246)	736 (589-981)	AUC	2

### Escapement Commentary:

#### Sockeye Return:

Higher than normal, early run (they are observed distributed in the river in Aug, not sure when they come in).

#### Coho Return:

Near average Coho return, a lot of jacks this year, consistent with neighboring systems. Coho were small and ratty (2-3 pounders), didn't seem to feed well. Quality poor.

#### Pink Return:

A few, started seeing them about five years ago. Spawn marker 2 and 1 on river right, just above tidal influence. A few in the Ursus as well.

#### Chum Return:

Close to average, normal sized, run came in a bit later.

#### Chinook Return:

Higher than the twelve year average, but still low overall.

## 22.3. Spawner Distribution

### Run Timing:

Table 22-6. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Early Sept	Late Oct	Early Nov
Coho					Mid Nov	3rd week to end of Nov	End of Dec
Pink						Mid-late sept	
Chum					Mid Oct	Late Oct	Late Oct
Chinook					Mid Oct	Late Oct	Late Oct

**Comments:** Peak spawning of Coho not observed. Spawn timings were similar in Bedwell and Ursus

## Spatial Distribution:

Table 22-7. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Bedwell: 12-11, 5-3, Side channel Ursus: 6-1
Coho	Bedwell: 12-9, 5-4, at marker 3 Ursus: 2-1, and probably as far as marker 27, but only observed up to the cascades at Marker 6
Pink	Bedwell: 2-1 just above the tidal influence
Chum	Bedwell: 5-3, about half were in the side channel between markers 4 and 3 on river right (~1km above tidal) Ursus: mostly 4-0
Chinook	Bedwell: 12-11, 10-8, 3-2 Ursus: 0-6
Steelhead	

**Comments:** Chinook usually just spawn below marker 5, this year a large number were seen spawning above marker 5, roughly half of the Chum spawned in the side channel

## 22.4. Environmental Conditions

### Weather Summary:

Late Aug storm brought fish in early, otherwise it was a normal year

### Physical Characteristics Update:

Another major change in the river in winter 2014/15 where the river blew through just above Marker 6 down to 5 (Confluence). The former confluence has been filled in and near marker 6 on the Bedwell, the river is no longer near the marker. In spring 2015, the river continued to straighten and is now a straight shot from 250m above Marker 6 to the confluence.

## 22.5. Update to Stream Survey Protocols

### Current Assessment Method:

Snorkel surveys, two crews. Bedwell: 12 to 0, Ursus: 100m above 6 to 0 (Cascades to confluence). Side channel included in Bedwell section. No deviations from protocols.

### Access Updates:

None, boat to Bedwell, then vehicle to top of Bedwell. Drive and 3 km walk up to top of Ursus. Swim down to boat. Boat back to Tofino.

### Safety Update:

None. Cell phones don't work, need sat phone, the Outpost monitors Channel 10 on VHF

## 22.6. Enhancement

### Brood Removal:

Chinook: 10 females removed, 12 males used but not removed

### Planned Release Numbers and Strategy:

37,000: maybe a 15g seapen smolt release or a 6g river release of smolts

**Other Activities:**

Side channel working well for Chum, small numbers of Coho (up to 20) use it as well. Upwelling side channel. Lots of Coho fry use the side channel as well.

**22.7. Biosamples**

37 full Chinook biosamples. High tagged jack return. Recovered 21 ad-clipped heads, majority females.

**22.8. Concerns and Comments**

New management at the Outpost. Ursus survey up to 6 does not cover all of the Coho spawning area which extends up to Marker 27. Would require a helicopter up to 24 then walk up to 27, then float plane pickup. Markers will need to be installed at new coordinates where the river has formed a new channel.

## 23. MEGIN RIVER

### 23.1. Stream Summary

The lower Megin River flows out of the western end of Megin Lake and southward into Shelter Inlet in Clayoquot Sound (Figure 23-1). The system is remote and access is only available via boat or plane. Fog is often a problem for accessing the system. The Megin is located in Strathcona Provincial Park and near the mouth is the Megin River Ecological Reserved which was established in 1981. The area is unlogged with pristine habitat in the park. As of the early 2000s there have been no survey markers on this system. Survey sections are estimated using habitat and reference to survey markers is based on historical positions of 19 survey markers each about 500 m apart.

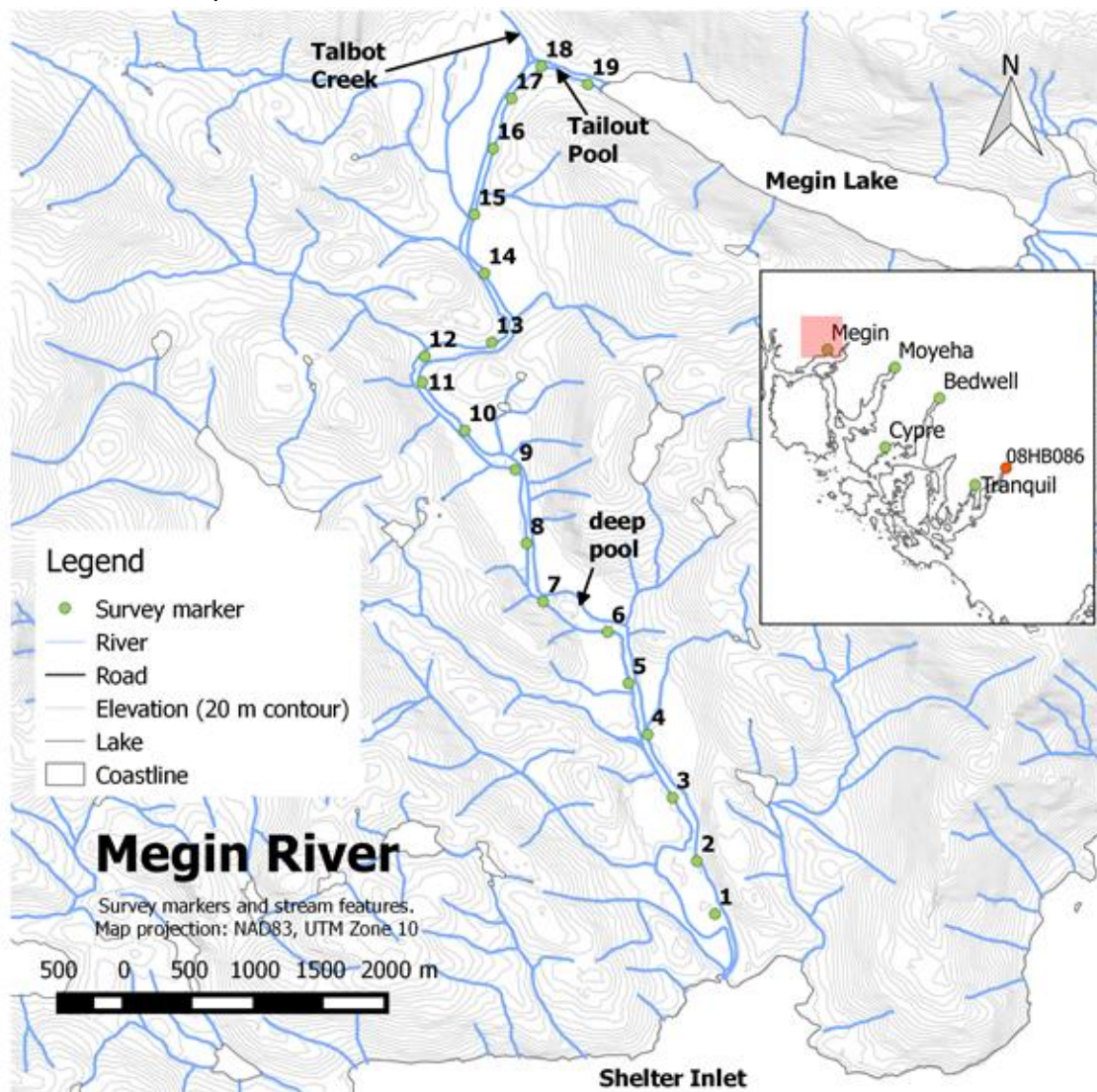


Figure 23-1. The approximate location of Megin River counting stations. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Reference to survey markers are based on historical positions and should be updated if new markers are installed. Map inset shows locations of other well-sampled systems in the area and also the location of the Environment Canada monitoring station at Tofino Creek (08HB086).

The lower Megin River is fed by Megin Lake, located about 9.5 km upstream from the mouth, as well as many small tributaries. The largest tributary is Talbot Creek which joins the lower Megin about 9 km upstream from the mouth (near marker 18). Megin Lake is fed by the upper Megin River and many small tributaries. The lower Megin has water clarity and retainment characteristics that are quite different from other streams in Area 24. The system has heavy suspended silt after rains and can take up to 6 days to clear. Some pools never clear. The Upper Megin, above the lake, is clearer and takes less time to clear after rain.

The Megin River is described as a slow system with many areas of little or no water movement. Typical flow for the Megin is 0.8 m<sup>3</sup>/s compared to 1.8 m<sup>3</sup>/s for the Bedwell River and 0.4 m<sup>3</sup>/s for Tranquil Creek. The lower Megin has a low gradient (<2%) and mostly consists of wide cobble/gravel bars. There are several deep pools, including the Tailout Pool (marker 18), a deep pool near marker 7 (~10 m depth), and another pool near marker 3. The habitat is generally described as stable. However, in 2014, erosion was noted near marker 1.

## 23.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

Table 23-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
07-Sep-15	4		134		2		5	1	10	1
17-Sep-15	23		202	1	29		86	1	33	1
30-Sep-15			25		2		113		30	4
07-Oct-15			36	1			378	4	1	7
23-Oct-15			2				161	40	1	5

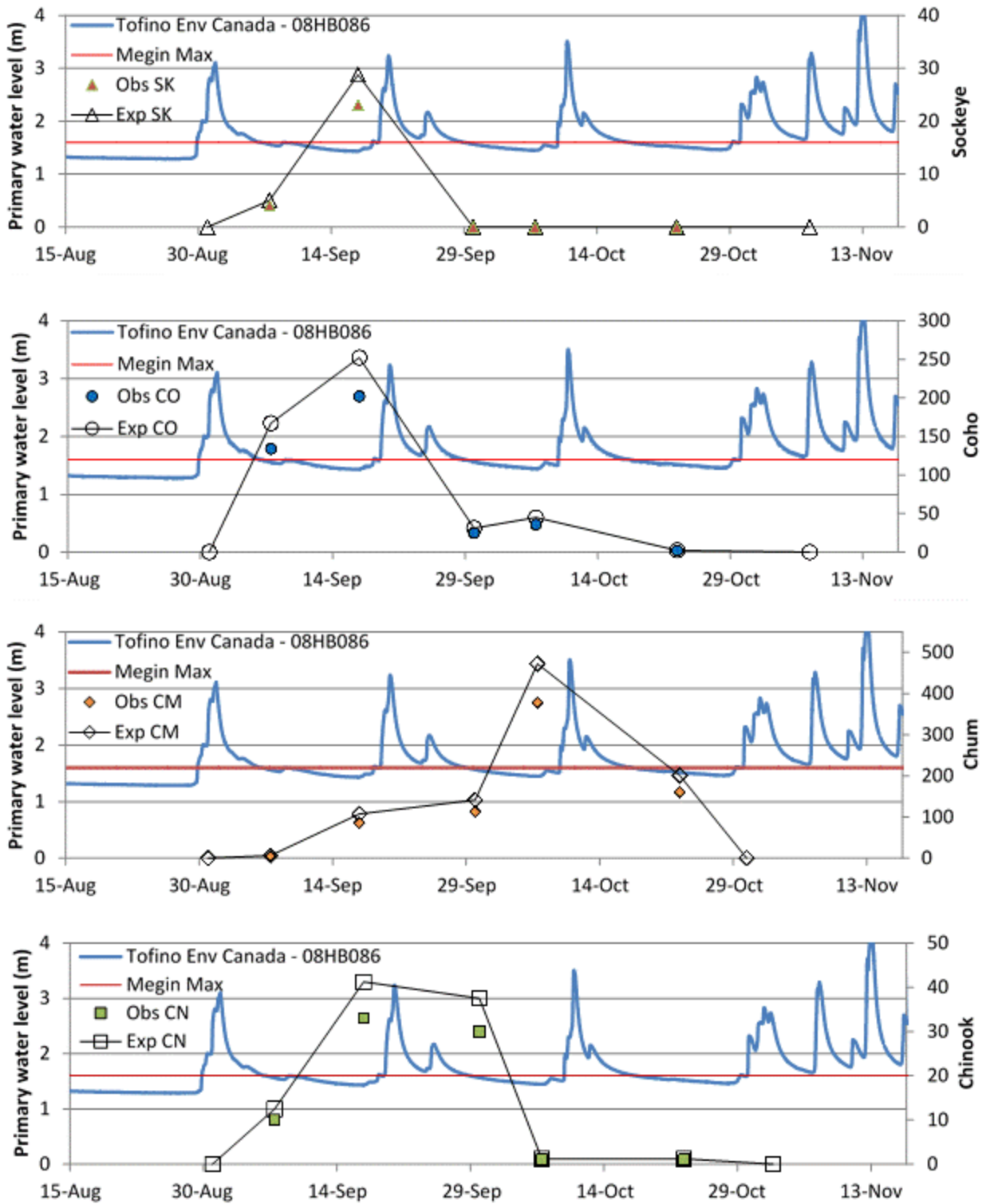


Figure 23-2. Raw counts (open marker) and expanded counts (solid marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 23-2. Survey life and range applied for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye				
Coho	20 (15-25)	8/31/2015	15-Nov-15	Shorter SL due to CO passing through the std survey section and Upper Megin not being surveyed, also observed pattern
Pink				
Chum	15 (10-20)	8/31/2015	30-Oct-15	
Chinook	20 (15-25)	8/31/2015	02-Nov-15	

Table 23-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
07-Sep-15	good	Water level normal, water clear (8m)
17-Sep-15	good	Water level below normal, tea coloured (5m)
30-Sep-15	good	Water level normal, water tea coloured (6m)
07-Oct-15	Good, (might be excellent for spawning fish)	Water level normal, water tea coloured (5m)
23-Oct-15	good	Water level normal, water tea coloured (6m)

Table 23-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	29	PL+D	3, didn't cover upper Megin
Coho	260 (208-347)	AUC	3
Pink	36	PL+D	3
Chum	619 (464-929)	AUC	2
Chinook	49 (39-66)	AUC	2

### Escapement Commentary:

#### Sockeye Return:

Unknown because surveyors were unable to complete an Upper Megin survey in Mid-Nov

#### Coho Return:

Relatively low, but uncertain, all spawning occurs above the section surveyed. Coho quality was normal

#### Pink Return:

A bit more than average



**Chum Return:**

Roughly average, some fishing in the lower river

**Chinook Return:**

Average, but still low

### 23.3. Spawner Distribution

**Run Timing:**

*Table 23-5. The run timing for the survey year by species.*

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho							
Pink							
Chum					Late Sept	Late Oct	
Chinook					Early Sept	Late Sept	Early Oct

**Comments:** All species present during first survey. Coho and Sockeye spawning were not observed

**Spatial Distribution:**

*Table 23-6. The survey sections used by spawners per species.*

Species	Survey Section(s) used for spawning
Sockeye	
Coho	
Pink	
Chum	10-2, very small numbers- mostly in 2-3 in a few spots
Chinook	19-18, 13-12, 9-6
Steelhead	

### 23.4. Environmental Conditions

**Weather Summary:**

Fog and stormy weather interfered with access, which requires a float plane drop-off and pickup.

**Physical Characteristics Update:**

None

### 23.5. Update to Stream Survey Protocols

**Current Assessment Method:**

Snorkel swim from 19 to 0 (Lake to Mouth), float plane drop off and pickup.

**Deviations from current assessment protocols:**

None.

**Access Updates:**

None.

**Safety Update:**

None, use radio channel 16 and 68 for Ahousaht (71a for Ahousaht Search and Rescue).

23.6. Enhancement

**Brood Removal:**

None.

**Planned Release Numbers and Strategy:**

None.

**Other Activities:**

None.

23.7. Biosamples

16 CN biosampled

23.8. Concerns and Comments

Fishing in the river mouth.

## 24. TRANQUIL CREEK

### 24.1. Stream Summary

Tranquil Creek flows south into the head of Tranquil Inlet in Clayoquot Sound. Tranquil is a small, clear system fed mainly by run-off and small surrounding streams. The lower 3.5 km of the system have been divided into seven 500 m sections for salmon enumeration (Figure 24-1). There are falls located about 3.5 km upstream which are considered impassable to fish. The system has several deep (~6 m), clear pools including pool just below the falls, a small pool just below marker 6, the Mossy Rock Pool below marker 5, the Road Pool between markers 3 and 2, and Dougie's Pool at marker 2.

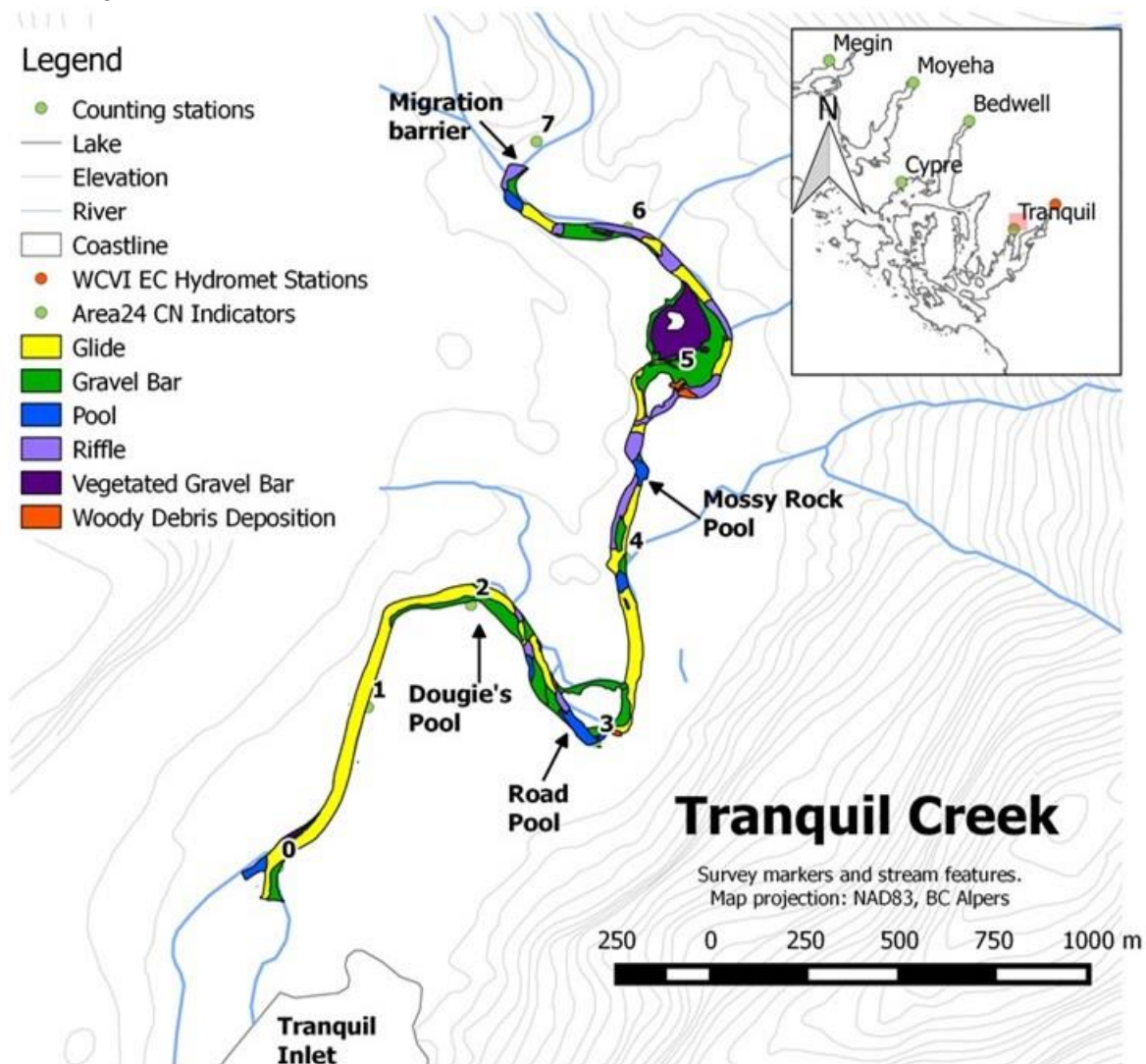


Figure 24-1. Tranquil Creek survey marker locations. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydromet station at Tofino Creek (08HB086). Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

The system is generally clear with good visibility except after heavy rainfall when it becomes murky and takes up to three days to clear. The water clarity and retention characteristics are similar to Cypre, Bedwell and Moyeha. Typical flow for the Tranquil Creek is 0.4 m<sup>3</sup>/s, compared to 1.8 for Bedwell, and 0.8 for Megin. Tranquil is warmer than Bedwell, but temperature is never an issue for spawning salmon or surveys. The closest station where discharge is monitored is at Tofino Creek (Environment Canada Water Survey Station 08HB086) or on the Bedwell River since 2015.

Surveyors report frequent erosion events including large slides in 2006 and 2009 which degraded water quality for several weeks during the fall. In late-2011, there was a major flow event which cut a new channel between markers 3 and 2. The event deposited sand downstream to marker 2 and partially filled in Dougie's Pool. Ongoing erosion is reported above marker 3 where the system is eating away at alders on the bank. There is a small alder log-jam below marker 3. Most of area around the stream has been logged, although near survey maker 6 there are a few very old cedars.

Salmon enhancement started on the Tranquil in 1990 by Tofino Creek Enhancement Society and the Thornton Creek Hatchery. Chinook and Coho Salmon continue to be enhanced.

## 24.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

*Table 24-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
06-Sep-15	1679		24		4		480		15	
18-Sep-15	1896	2	29		5		1223	3	22	
29-Sep-15	1542		178		1		2733		80	
08-Oct-15	1800	1	107		2		2525	104	96	
22-Oct-15	1778		463				1401	523	118	7
03-Nov-15	1250		392				160	15	27	

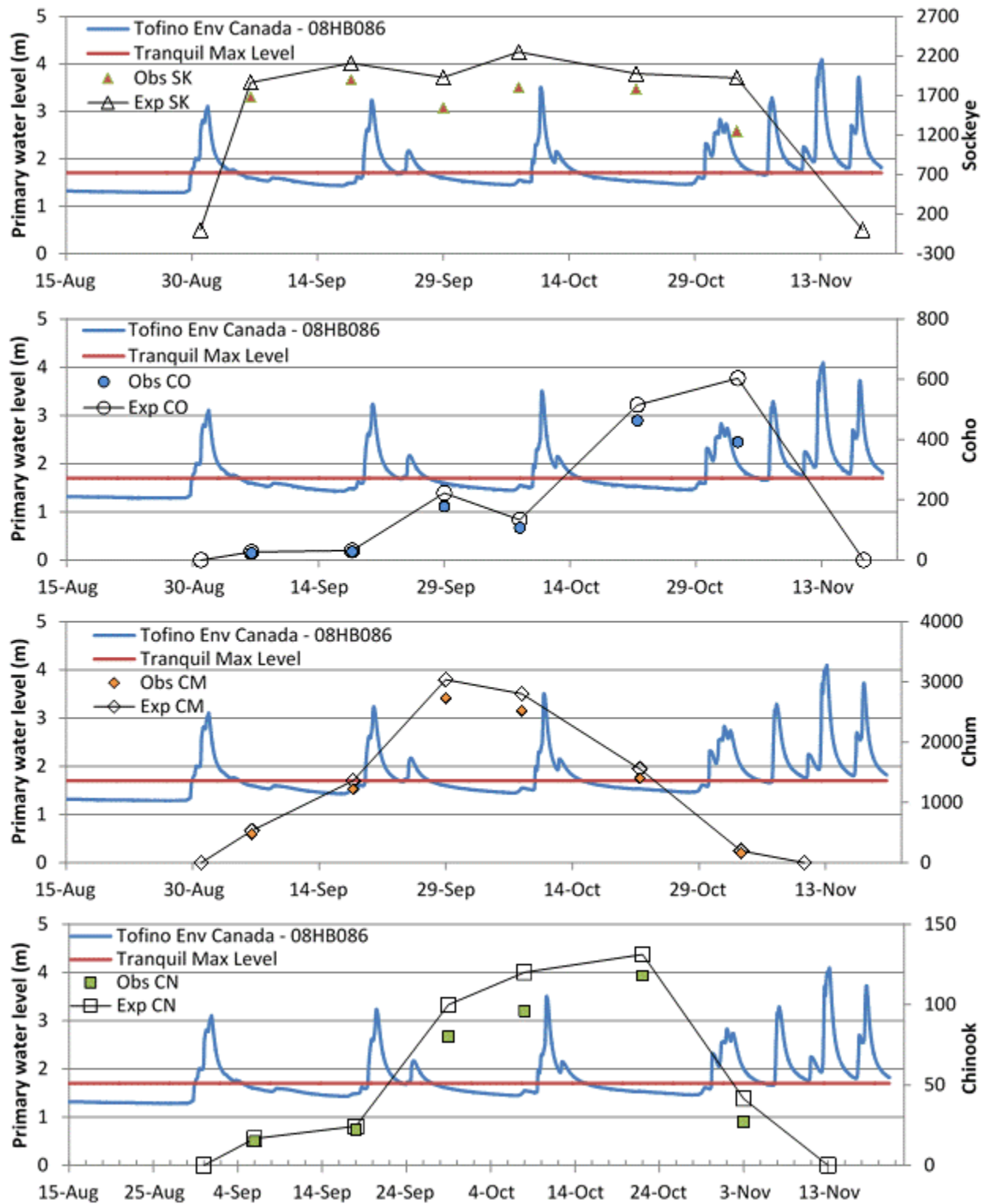


Figure 24-2. Raw counts (open marker) and expanded counts (solid marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 24-2. Survey life and range applied for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye				
Coho	30 (25-35)	01-Sep-15	20-Nov-15	
Pink				
Chum	25 (20-30)	01-Sep-15	15-Nov-15	Chum entered a bit early and held prior to spawning,
Chinook	25 (20-30)	31-Aug-15	13-Nov-15	Chinook came in early due to Late August freshet, few additional fish came in after the initial push.

Table 24-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
06-Sep-15	Excellent	Water level normal (0.665m), water clear
18-Sep-15	Excellent	Water level normal (0.72m), water clear (10m)
29-Sep-15	Good	Water level below normal (0.65m), water below normal (10m)
08-Oct-15	Good	Water level above normal (0.69m), water clear (8m)
22-Oct-15	Excellent	Water level below normal (0.65m), water clear (9m)
03-Nov-15	Fair	Water level above normal (0.73m), water clear (8m)

Table 24-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	2,251	PL+D	3
Coho	660 (566-792)	AUC	2
Pink	6	PL+D	3
Chum	4495 (3746-5618)	AUC	2
Chinook	199 (166-249)	AUC	2

## Escapement Commentary:

### *Sockeye Return:*

Many more observed than usual. Sockeye held for a long time before spawning.

### *Coho Return:*

Near average Coho numbers (neighboring systems saw poor Coho numbers). A mix of normal fish and small, underfed fish.

### *Pink Return:*

A few observed, as usual.

### *Chum Return:*

Low relative to average, but the highest Chum return in Clayoquot in 2015. High predation by bears, up to 7 bears observed feeding. Chum seemed a bit smaller than average (fewer large fish).

### *Chinook Return:*

At least 80% males based on trying to collect brood. None were removed due to the low number of females.

## 24.3. Spawner Distribution

### Run Timing:

Table 24-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Oct	Late Oct	Early Nov
Coho							
Pink							
Chum					Mid Sept	End Oct	Early Nov
Chinook					Mid Oct	Mid Oct	End Oct

**Comments:** All species present during first survey. Coho spawning did not start until after last survey.

### Spatial Distribution:

Table 24-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	7-6, 5-0
Coho	
Pink	
Chum	7-0
Chinook	7-4, 3-2
Steelhead	

#### 24.4. Environmental Conditions

**Weather Summary:**

Periodic rain, good conditions for surveys and fish

**Physical Characteristics Update:**

More erosion just above marker 3, going into the alders. Marker 3 will need to be moved.

#### 24.5. Update to Stream Survey Protocols

**Current Assessment Method:**

Snorkel swim from 7-0.

**Deviations from current assessment protocols:**

None.

**Access Updates:**

Boat then drive to top, bridge over a tributary is impassible. Could be made passable, BC Timber Sales may be headed in to repair a culvert blocking passage of tributary into Tranquil at Marker 5. Will be done this summer.

Dock also needs repair.

**Safety Update:**

Cell works at dock, channel 10 to Creative Salmon, bridge could be hazardous, channel 16 also works.

#### 24.6. Enhancement

**Brood Removal:**

None, too few females. Went in twice to try to get brood.

**Planned Release Numbers and Strategy:**

None

**Other Enhancement/Restoration Activities**

Bridge and culvert repair planned for summer 2016 on tributary on river left above marker 5.

#### 24.7. Biosamples

**Description of Biosamples including reason for sample and sample description:**

7 CN biosampled. Some SK DNA

#### 24.8. Concerns and Comments

Culvert at the top needs maintenance. Dock needs repair.



## 25. CYPRE RIVER

### 25.1. Stream Summary

The Cypre River flows south into Cypress Bay, west of Bedwell Sound in Clayoquot Sound. The Cypre River is a clean, clear fast flowing system fed by many small tributaries from the surrounding mountains. The mainstem length is about 21 km and there are many small tributaries.

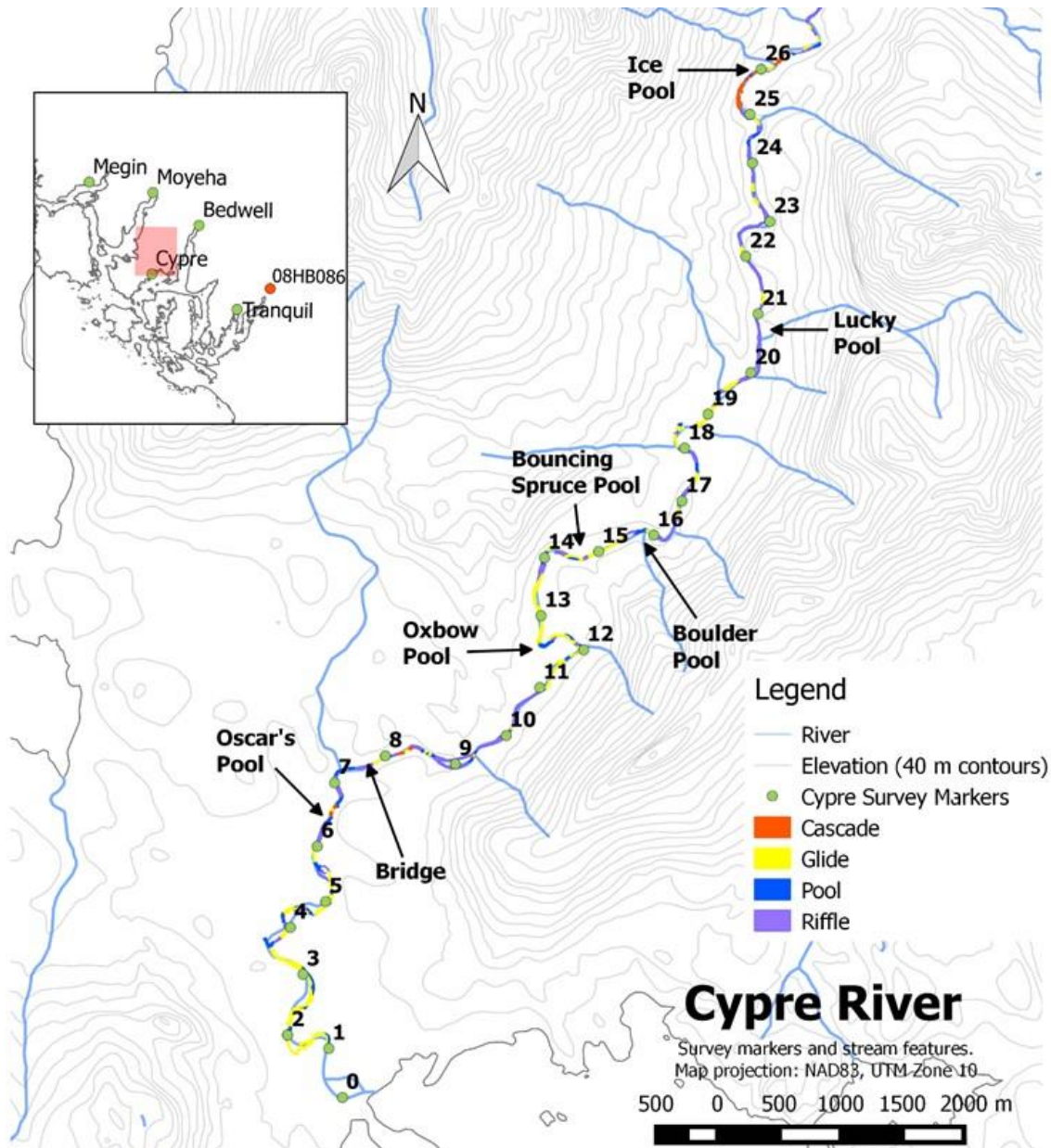


Figure 25-1. Cypre River counting stations and habitat units. Map inset shows locations of other systems that are regularly surveyed in Area 24 as well as the location of the Environment Canada hydromet station at Tofino Creek (08HB086). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. The positions of survey markers 15 to 26 are approximate.

Compared to other streams in the area, Cypre flow is moderate; slightly less than the Moyeha and more than Tranquil. The system has a large floodplain and the lower 4 km has a low gradient (i.e. below marker 8). About 8 km upstream from the mouth (i.e. above marker 16) the stream becomes steeper, has two sets of cascades, more boulders and not as much spawning habitat. There is a canyon between survey markers 8 and 9 which is swimmable under most conditions. There are falls about 13 km upstream from the mouth (marker 26). The closest station where discharge is monitored is at Tofino Creek (Environment Canada Water Survey Station 08HB086). Low water can be a problem for fish entering the system. In 2012, fish were unable to access the system prior to late September because of low water level (the Tofino gauge was below 0.1 m at the time).

The lower 13 km of the system is considered suitable spawning habitat and has been divided into 26 - 500 m sections for salmon enumeration (Figure 25-1). There are many deep pools on the system including Oscar's Pool (between markers 6 to 7; Named for Oscar Hanson who was one of the early surveyors), the Oxbow Pool (above marker 12), Bouncing Spruce Pool (100 m below marker 15) and the Boulder Pool (above marker 15), Lucky Pool (between markers 20 and 21), and Ice Pool (near marker 25). There is a cave in the Ice Pool. There were three side channels made in the late-90s: at survey marker 12, in the tidal area between markers 0 and 1 and near marker 20.

The historical survey reports tell of frequent erosion, silting and landslides. Spawner survey reports also frequently note significant amounts of mobile large woody debris causing large areas of scouring in the spawning riffles. The watershed consists of steep terrain and old growth forests. It was subject to extensive damage from poor logging practices in the 1970s and 80s. Logging mostly stopped in the 1980s and since then the Cypre habitat has returned to a stable state with excellent fish habitat with spawning stocks that have rebuilt.

## 25.2. Survey Results and Escapement Estimate

Survey Crew: TCES (D. Palfrey)

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

Table 25-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
16-Sep-15	93		22		5		3		1088	
01-Oct-15	102		148		2		95		1962	
14-Oct-15	35		64				959	2	1006	8
24-Oct-15	57	2	298				517	99	524	123
21-Nov-15			400	1			1		1	

**Comments:** Oct 24 and Nov 21 covered Upper and Lower Cypre (top to tidal)

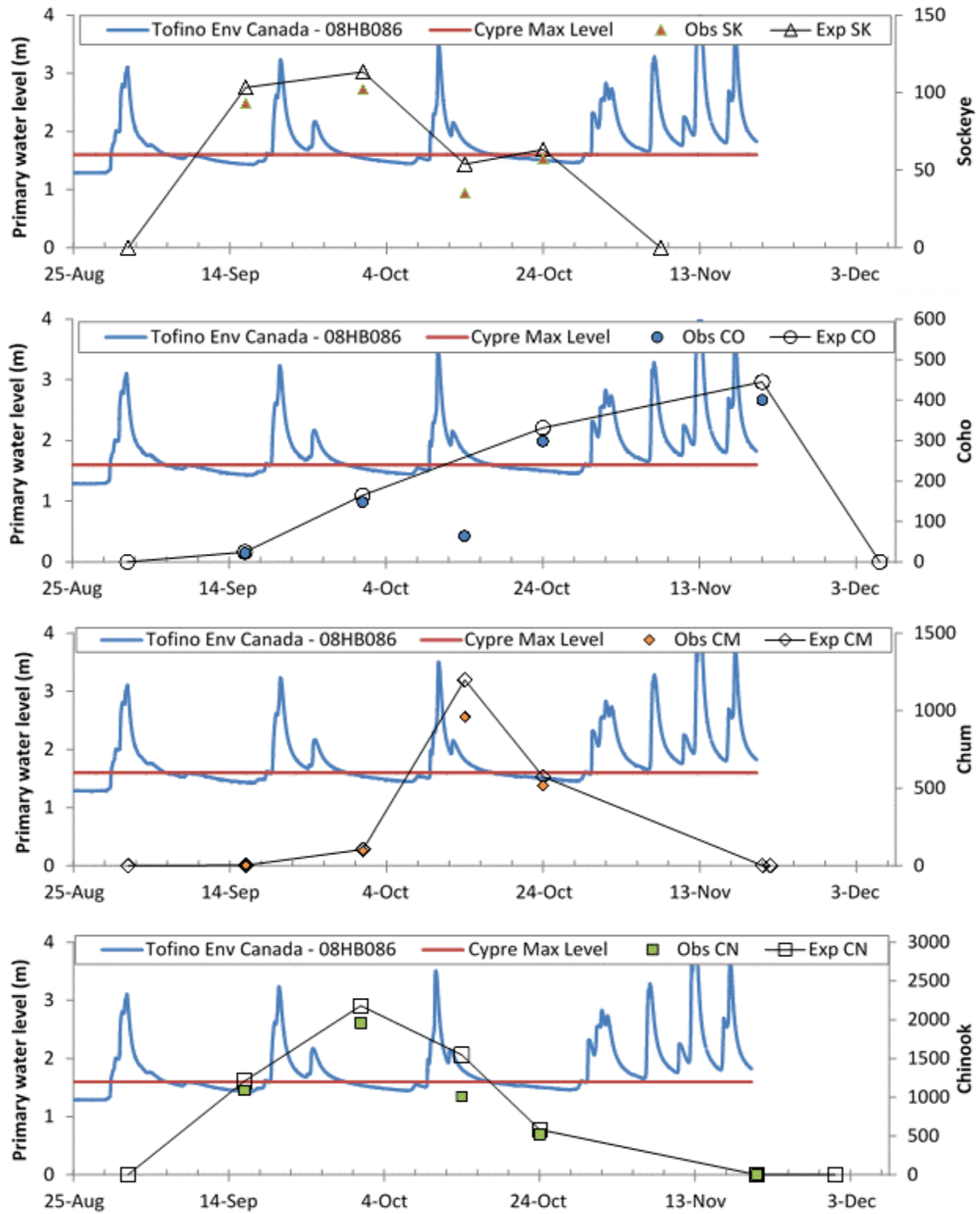


Figure 25-2. Raw counts (open marker) and expanded counts (solid marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns.

Table 25-2. Survey life and range applied for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	9/1/2015	15-Nov-15	
Coho				
Pink				
Chum	15 (10-20)	9/10/2015	25-Nov-15	
Chinook	30 (20-30)	9/1/2015	25-Nov-15	

Table 25-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
16-Sep-15	excellent	Water level normal, water clear (10m)
01-Oct-15	excellent	Water level below normal, water clear (5-10m)
14-Oct-15	fair	Water level above normal, water clear (8m)
24-Oct-15	excellent	Water level below normal, water clear (8m)
21-Nov-15	excellent	Water level below normal (1.04m), water clear (10m)

Table 25-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	159 (136-191)	AUC	2
Coho	445	PL+D, may have missed the peak	2
Pink	6	PL+D	3
Chum	1,749 (1,312-2,623)	AUC	2
Chinook	2,584 (2,584-3,877)	AUC; they held longer than normal, a lot of green fish were observed in Mid-Oct	2

### Escapement Commentary:

#### Sockeye Return:

Many more than average

#### Coho Return:

Less than half of a normal return (really low). Fish condition were relatively good compared to other systems, high jack numbers (roughly half jacks).

#### Pink Return:

A few as usual

**Chum Return:**

Near average return, 6-12 observed above the steep section (super Chum) Markers 9-8. Few Chum normally get that high.

**Chinook Return:**

A high proportion of Chinook were still green in Mid-October during brood collection. Above normal return, was also good in 2014. A few had net marks (less than a dozen).

## 25.3. Spawner Distribution

**Run Timing:**

*Table 25-5. The run timing for the survey year by species.*

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho					Mid-Nov		
Pink							
Chum						Late Oct	
Chinook						Late Oct	

**Comments:** Spawning not observed for SK and CO

**Spatial Distribution:**

*Table 25-6. The survey sections used by spawners per species.*

Species	Survey Section(s) used for spawning
Sockeye	
Coho	Top to Marker 5
Pink	
Chum	5-1
Chinook	16-15, 14-10, 7-3
Steelhead	

## 25.4. Environmental Conditions

**Physical Characteristics Update:**

Large root wad (20' by 20') was tied off with 2" rope just below the bridge between 6 and 5 Dec 2015. There's a lot of filling in above the oxbow in section 12-13 (closer to 13).

## 25.5. Update to Stream Survey Protocols

**Current Assessment Method:**

Snorkel from Ice Pool (26) to mouth, markers only in from 15 to 0.

**Deviations from current assessment protocols:**

Early in the season, only covered the lower half no Chinook observed above.

**Access Updates:**

Slide impaired access by surveyors, was repaired.

**Safety Update:**

None.

25.6. Enhancement

**Brood Removal:**

37 female CN removed, males used and released mid Oct to third week Oct. No CO collected.

**Planned Release Numbers and Strategy:**

96k smolt, seapen 12g/river release 5-6g

**Other Activities:**

Culvert being pulled which is blocking fish passage into a tributary ~2/3 up the river.

25.7. Biosamples

**Description of Biosamples including reason for sample and sample description:**

58 CN biosampled.

25.8. Concerns and Comments

Slide blocked access to upper 2/3 of the river and a culvert needs to be cleared. BCTS was supposed to do the work, but it has been delayed to next year. D. Palfrey surveyed the river above the slide, and the river is clear above but road is blocked. Local group is looking into clearing the road themselves rather than waiting for BCTS.

A net fishery occurred Aug 29 and 30, at the mouth. Hook and line fishing observed Sept 1. Sept 7 additional netting took 80 Chinook

## 26. COLD CREEK

### 26.1. Stream Summary

Cold Creek flows northwest into the head of Clayoquot Arm in Kennedy Lake. The mainstem is about 5 km long and the creek enters Kennedy Lake near the mouth of the Clayoquot River. The lower section has a flat gradient but the stream becomes steeper above about 300 m. The water clarity is good except after rains. Flow is flashy. The watershed was logged and no reforestation took place. Alders line the creek. The lower 50 m is braided and frequently changes course.

### 26.2. Escapement Estimates

Survey Crew: TCES (Doug Palfrey)

Stock Assessment Biologist: Diana McHugh

Table 26-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
04-Nov-15			6							

Comments:

### 26.3. Escapement Comments

Coho: Adults and jacks present. Coho at peak spawning and was roughly a third of what was expected.

### 26.4. Environmental Conditions

Water level below normal and clear. High fish visibility

### 26.5. Survey Protocols

200m stream walk. One survey in conjunction with Sockeye beach spawner survey.

### 26.6. Enhancement/Restoration Activities

### 26.7. Concerns and Comments

Poor past logging practices had a severe impact on salmon stocks here.

## 27. SUTTON MILL CREEK (NORTH AND SOUTH)

### 27.1. Stream Summary

Sutton Mill Creek flows west-northwest into Mosquito Harbour on Meares Island in Clayoquot Sound. The mainstem is almost 4 km long.

### 27.2. Escapement Estimates

Survey Crew: TCES (Doug Palfrey)

Stock Assessment Biologist: Diana McHugh

*Table 27-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
(S)25-Oct-15							18	19		
(N)25-Oct-15							2	1		

### 27.3. Escapement Comments

Chum: 39 Expanded Peak Live + Dead (level 3); peak spawning underway, observed numbers are only a fraction of the previous returns in Sutton Mill South, were up to 1,000 in 2005.

Coho: None Observed

### 27.4. Environmental Conditions

Water level normal, fish visibility high

### 27.5. Survey Protocols

Sutton Mill Creek North is a 100 metre stream walk, Sutton Mill Creek South is a 250m stream walk.

### 27.6. Enhancement/Restoration Activities

### 27.7. Concerns and Comments

Very poor return, normally see 1-2 seals in the bay/estuary predation is an issue. A log allows seals to easily catch Chum attempting to enter Sutton Mill South, removal would likely improve escapement.



## 28. KENNEDY LAKE

### 28.1. Stream Summary

Kennedy Lake flows into the Lower Kennedy River in a westerly direction. The area of the lake is 6542 ha and the perimeter is 133.5 km.

### 28.2. Escapement Estimates

Survey Crew: TCES (D. Palfrey, D. Hurwitz, R. Bisaro, E. Blake, D. Redpath)  
Stock Assessment Biologist: Diana McHugh

Table 28-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
04-Nov-15	1,720	25	27				2			
04-Nov-15 (Clayoquot Arm)	2,316	31								

### 28.3. Escapement Comments

Kennedy Lake: Sockeye spawning throughout. Coho present.  
Clayoquot Arm: Sockeye spawning throughout.

### 28.4. Environmental Conditions

Water level below normal, fish visibility high

### 28.5. Survey Protocols

Kennedy Lake: 6000 metre boat survey  
Clayoquot Arm: 9800 metre boat survey

### 28.6. Enhancement/Restoration Activities

None

### 28.7. Concerns and Comments

In addition to the TCES surveys, a peak of 960 Sockeye were seen Oct 20<sup>th</sup> in the Lower Kennedy by the Kennedy Hatchery staff during their regular boat surveys (no SIL completed). Hatchery staff noted an 8:1 ratio of males to females when conducting Chinook broodstock capture in the Lower River. Hatchery staff also noted 40 Chinook/200 Coho in Angora Creek and 40 Chinook/100 Coho in the mouth of Staghorn (Kennedy Lake tributaries) in early October during spot checks by boat.

## 29. UPPER KENNEDY RIVER

### 29.1. Stream Summary

Upper Kennedy River flows into Kennedy Lake from the northwest.

### 29.2. Escapement Estimates

Survey Crew: TCES (D. Palfrey, and D. Hurwitz)

Stock Assessment Biologist: Diana McHugh

*Table 29-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
11-Sep-15	1,299	2	9				1			
15-Nov-15	3	16	143	1						

### 29.3. Escapement Comments

SK: Adults Present for both surveys. Spawning starting during 9/23 survey, and pre-peak spawn for 11/23 survey, lowest observed in 30 years

CO: Adults present. Spawning was over by the 11/23 survey

CM: 1 Adult seen during first survey

### 29.4. Environmental Conditions

Water level normal, fish visibility high for both surveys

### 29.5. Survey Protocols

Snorkel survey, ~8 km from where Marion Main intersects the river down to the Lake.

### 29.6. Enhancement/Restoration Activities

Coho: 15 females and 18 males removed, matrix spawned, BKD screened, 37,317 eggs, fed fry release prior to June 21, will be clipped. Some eggs returned to the river, all were Parental Based Tagged. Work done by TCES.

### 29.7. Concerns and Comments

Clipped Coho may be picked up in mark only fishery in 3 years.

## 30. SAND RIVER

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### 30.1. Stream Summary

The Sand River flows south into Kennedy Lake. The mainstem is almost 6 km long.

### 30.2. Escapement Estimates

Survey Crew: TCES (Doug Palfrey)

Stock Assessment Biologist: Diana McHugh

*Table 30-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
4-Nov-15			6						1	

### 30.3. Escapement Comments

SK: None Observed

CO: Adults Present, pre-spawn at time of survey

CM: None Observed

CN: Adults present, spawning over at time of survey

### 30.4. Environmental Conditions

Water level below normal, fish visibility high.

### 30.5. Survey Protocols

200 metre stream walk

### 30.6. Enhancement/Restoration Activities

### 30.7. Concerns and Comments

A disturbed system that has changed since they removed a bridge ten years ago. Didn't see any Sockeye, anticipated seeing some around the mouth. Steep and big boulders.

## 31. WOOD ISLETS CREEK (FUNDY CREEK)

### 31.1. Stream Summary

Woods Islets Creek flows into Mosquito Harbour on the east coast of Meares Island in Clayoquot Sound. Fundy Creek includes Woods Islet Creek north and south. It is a shallow, short system with a survey length of only about 100 m. There is no gradient near the mouth, but above about 50 m the gradient increases and there are more boulders. The water has a slight tannin colour. The watershed is mostly pristine, old growth forest. The system is primarily a Chum stream.

### 31.2. Escapement Estimates

Survey Crew: TCES (Doug Palfrey)

Stock Assessment Biologist: Diana McHugh

Table 31-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
25-Oct-15 (N)							3	1		
25-Oct-15 (S)										
Nov 9, 2015 (N)										
Nov 9, 2015 (S)										

### 31.3. Escapement Comments

CO: None Observed

CM: Adults present, peak spawning underway

### 31.4. Environmental Conditions

Water level normal, fish visibility high.

### 31.5. Survey Protocols

100 metre stream walk

### 31.6. Enhancement/Restoration Activities

Wood Islets South has a log blocking access to Chum migration, log jam behind it has heavy layers of rock and gravel, so Chum trying to enter are easy targets for seals. Log may be removed this summer

### 31.7. Concerns and Comments

Very poor return in north creek. Runs are deteriorating. Wood Islets South also surveyed but none observed.

## 32. LORRY CREEK

### 32.1. Stream Summary

Stream flows into Browning Passage between Meares Island and Esowista Peninsula, just SE of Tofino, Clayoquot Land District.

### 32.2. Escapement Estimates

Survey Crew: TCES (Doug Palfrey)

Stock Assessment Biologist: Diana McHugh

Table 32-1. Unexpanded live and dead adult counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
8-Nov-15										
14-Nov-15										
18-Nov-15										

**Comments:** Stream walk

### 32.3. Escapement Comments

1 Coho jack observed, very poor return

### 32.4. Environmental Conditions

Water level normal, fish visibility high.

### 32.5. Survey Protocols

300 metre stream walked three times

### 32.6. Enhancement/Restoration Activities

None

### 32.7. Concerns and Comments

Only 1 jack observed, no redds observed either.

## 33. WARN BAY CREEK

### 33.1. Stream Summary

Warn Bay Creek flows into Warn Bay at the north end of Fortune Channel in Clayoquot Sound. The mainstem length is 4500 m. The lower 1000 m consists of a low gradient with pebble and rock substrate.

### 33.2. Escapement Estimates

Survey Crew: TCES (Doug Palfrey)

Stock Assessment Biologist: Diana McHugh

*Table 33-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
25-Oct-15	6		30	1			220	174	51	
10-Nov-15	2		57				7	6	6	1

### 33.3. Escapement Comments

SK: Adults present. Spawning ending during last survey

CO: 63, Expanded Peak Live + Dead. Spawning not observed

CM: 418, Expanded Peak Live + Dead, Peak spawning underway at time of first survey, used to see 2-3k, doesn't get fished

CN: 57, Expanded Peak Live + Dead, spawning had started at time of first survey and ended ant time of last survey

### 33.4. Environmental Conditions

Water level normal, fish visibility high for both surveys.

### 33.5. Survey Protocols

500 metre snorkel survey

### 33.6. Enhancement/Restoration Activities

None

### 33.7. Concerns and Comments

Unusually high #'s of CN. Usually 10-20 Chinook. Only 1 female spawned out due to low water. 11 ad-clipped adult CN observed. One full biosample collected.

## 34. HESQUIAT HARBOR #2 CREEKS (AYYII-SAQH)

### 34.1. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)

Stock Assessment Biologist: Diana McHugh

*Table 34-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
02-Nov-15							3	12		
03-Nov-15							6	4		

### 34.2. Escapement Comments

Chum: Adults present

Coho: None observed

### 34.3. Environmental Conditions

Water level normal, fish countability 'fair'

### 34.4. Survey Protocols

Stream walk ~1000m

### 34.5. Enhancement/Restoration Activities

### 34.6. Concerns and Comments

## 35. HESQUIAT HARBOR #3 CREEKS (YAAKSIS)

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### 35.1. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)

Stock Assessment Biologist: Diana McHugh

*Table 35-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
03-Nov-15										
09-Nov-15										

### 35.2. Escapement Comments

No adults present. Juvenile Coho were observed.

### 35.3. Environmental Conditions

Water level normal

### 35.4. Survey Protocols

Stream walk, ~600m

### 35.5. Enhancement/Restoration Activities

### 35.6. Concerns and Comments



## 36. HESQUIAT HARBOR #4 CREEKS (MA-API)

### 36.1. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)

Stock Assessment Biologist: Diana McHugh

Table 36-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
14-Oct-15							15			

### 36.2. Escapement Comments

CM: 19, Expanded Peak Live+Dead

### 36.3. Environmental Conditions

Water level normal, fish countability 'fair';

### 36.4. Survey Protocols

Stream walk, ~600m

### 36.5. Enhancement/Restoration Activities

### 36.6. Concerns and Comments

## 37. HESQUIAT LAKE CREEK (TSA-YA)

### 37.1. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)  
Stock Assessment Biologist: Diana McHugh

*Table 37-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
20-Oct-15							735	40		
03-Nov-15							728	64		
13-Nov-15							125	140		

Comments: Bankwalks, conditions during final survey were poor.

### 37.2. Escapement Comments

CM: Adults present, 974, Expanded Peak Live + Dead

### 37.3. Environmental Conditions

Water level above normal for both all surveys. Fish countability recorded as fair to poor.

### 37.4. Survey Protocols

Stream walk, ~300m

### 37.5. Enhancement/Restoration Activities

### 37.6. Concerns and Comments

## 38. HOT SPRINGS COVE CREEK (AHTUUPQH)

### 38.1. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)

Stock Assessment Biologist: Diana McHugh

*Table 38-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
15-Oct-15			1				6			

### 38.2. Escapement Comments

CO: Adults and fry present

CM: Adults present

### 38.3. Environmental Conditions

Water level normal.

### 38.4. Survey Protocols

Stream walk

### 38.5. Enhancement/Restoration Activities

### 38.6. Concerns and Comments

## 39. PACILTH CREEK

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### 39.1. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)

Stock Assessment Biologist: Diana McHugh

*Table 39-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
14-Oct-15							2			

### 39.2. Escapement Comments

CO: fry present

CM: Adults present

### 39.3. Environmental Conditions

Water level normal.

### 39.4. Survey Protocols

Stream walk, ~600metres

### 39.5. Enhancement/Restoration Activities

### 39.6. Concerns and Comments

## 40. PURDON STREAM

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### 40.1. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)

Stock Assessment Biologist: Diana McHugh

*Table 40-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
9-Nov-15			6	1						

### 40.2. Escapement Comments

CO: Adults present

CM: None observed

### 40.3. Environmental Conditions

Turbid water, poor visibility (6")

### 40.4. Survey Protocols

Stream walk, ~200metres

### 40.5. Enhancement/Restoration Activities

### 40.6. Concerns and Comments

## 41. SYDNEY RIVER

### 41.1. Stream Summary

The Sydney River flows south into the head of Sydney Inlet in northwestern Clayoquot Sound. The mainstem is about 10 km long and fed by many small tributaries and Irvine Lake. Sydney Inlet and the lower Sydney River are located within the Sydney Inlet Provincial Park which was established in 1995. The watershed has old growth forest and there are often log jams in the lower river.

### 41.2. Escapement Estimates

Survey Crew: Hesquiat Fisheries Department (Rufus Charleson)  
Stock Assessment Biologist: Diana McHugh

Table 41-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
15-Sept-15					275					
10-Nov-15								3		

**Comments:** Poor survey coverage and conditions, only two surveys spread out (one in Sept and the other in Nov.). The survey conditions in Sept were fair; however, there was zero fish count ability in the November survey. Pinks were observed in September, due to the survey method and conditions, the "Unexpanded PL+D" was selected for the escapement estimate.

### 41.3. Escapement Comments

PK: 275, Peak Live + Dead

CM: Adults present

### 41.4. Environmental Conditions

Water level normal

### 41.5. Survey Protocols

Stream walk, ~3500metres

### 41.6. Enhancement/Restoration Activities

### 41.7. Concerns and Comments

*STREAMS IN AREA 25*

## 42. AREA 25 SUMMARY OF OBSERVATIONS IN 2015

There almost 60 streams and major tributaries in Area 25 with records of spawning salmon. The priority for escapement enumeration are the Chinook indicator stocks Burman River, Leiner River and Tahsis River. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most systems are surveyed using the snorkel method described in the DFO snorkel survey manual. Occasionally systems are also surveyed by stream or bank walks.

In 2015, 9 systems were surveyed in Area 25 (Figure 42-1). The three indicators as well as Zeballos and Conuma were surveyed frequently enough to allow a reliable application of the Area Under the Curve (AUC) estimation method for most species. Other systems were surveyed less frequently with the intent of making a less reliable, minimum estimate of escapement, usually based on the expanded Peak Live + Dead count. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups.

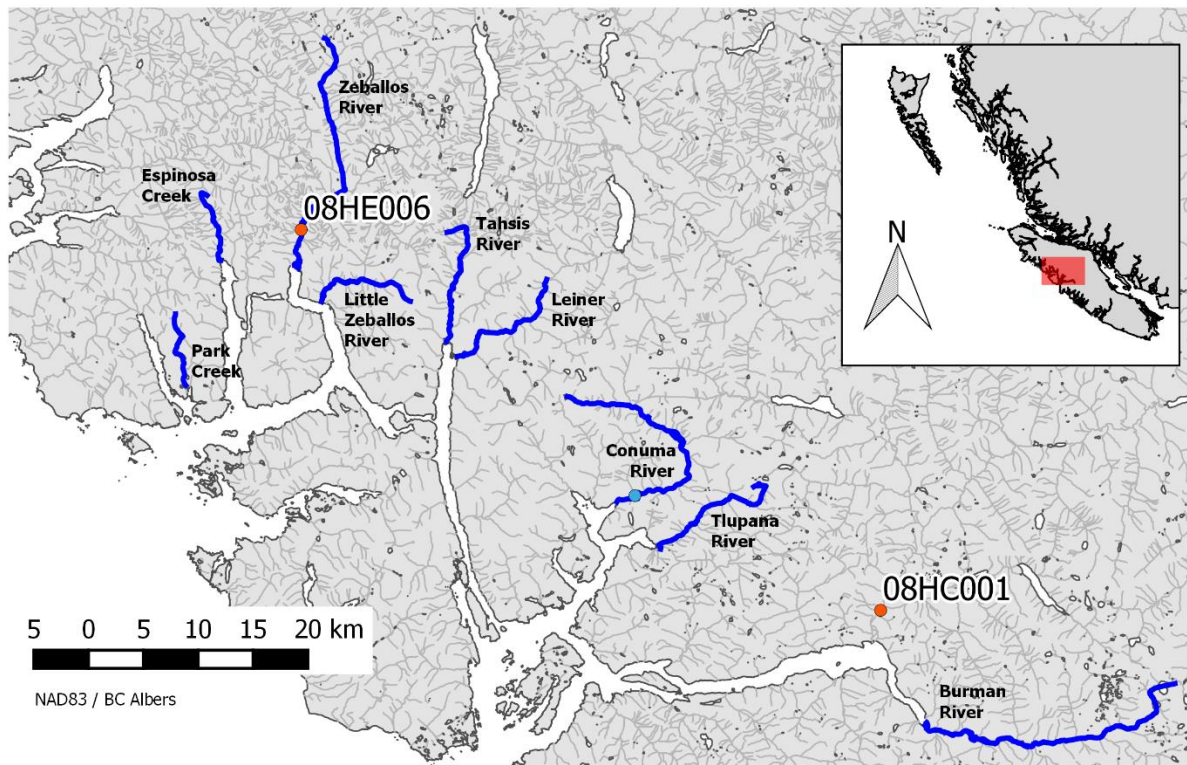


Figure 42-1. Streams in Area 25 that were surveyed in 2015. Environment Canada hydrometric stations on the Gold River (08HC001) and Zeballos River (08HE006) indicate flow on nearby ungauged systems. The blue circle marks the location of the major enhancement facility at Conuma.

The Conuma Hatchery enhances Chinook populations in the Burman River, Conuma River and Gold River. Prior to 2015, the Conuma Hatchery also enhanced Sucwoa, Tlupana, and Canton Chinook, but they stopped because biosamples results showed the majority of fish returning to those systems were from the Conuma Hatchery release. The Tahsis Enhancement Society enhances populations in the Tahsis and Leiner Rivers.



The 2015 survey results from Area 25 were reviewed at a post-season escapement review workshop held at the Maritime Heritage Museum in Campbell River on February 17, 2016. Workshops participants (Table 42-1) reviewed and discussed the individual survey results and escapement estimates. This discussion is captured in the commentary below. Participants also discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the stream summaries was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

*Table 42-1. Participants at the Area 25 escapement review workshop in Campbell River on February 17, 2016.*

<b>Participant</b>	<b>Affiliation</b>
Stephanie King	Sea This Consulting (organizer)
Diana McHugh	DFO (organizer)
Roger Dunlop	Nuu-chah-nulth Tribal Council/Nootka Sound Watershed Society
Chris Erickson	Conuma Hatchery
James Craig	BCCF (via teleconference)
Eamon Miyagi	DFO
Shawn Hay	Escapement Contractor
Kadin Snook	Fisheries Coordinator, Mowachaht/Muchalaht First Nations

Several observations that were common to multiple systems in Area 25 included:

- Very dry conditions in spring and summer then normal flows for September through November. Surveyors note that the low flows may have caused problems for fish that entered early.
- A high number of Coho jacks, i.e. > 30% of the fish observed in some systems
- Fewer than normal Chinook jacks

## 43. TAHSIS RIVER

### 43.1. Stream Summary

The Tahsis River flows south into the head of Tahsis Inlet and is fed by many small tributaries and headwaters in the mountains. McKelvie Creek is the largest tributary which joins Tahsis about one kilometre from the mouth. The Environment Canada hydrometric station at Zeballos (08HE006) is a good indicator of flow on the Tahsis.

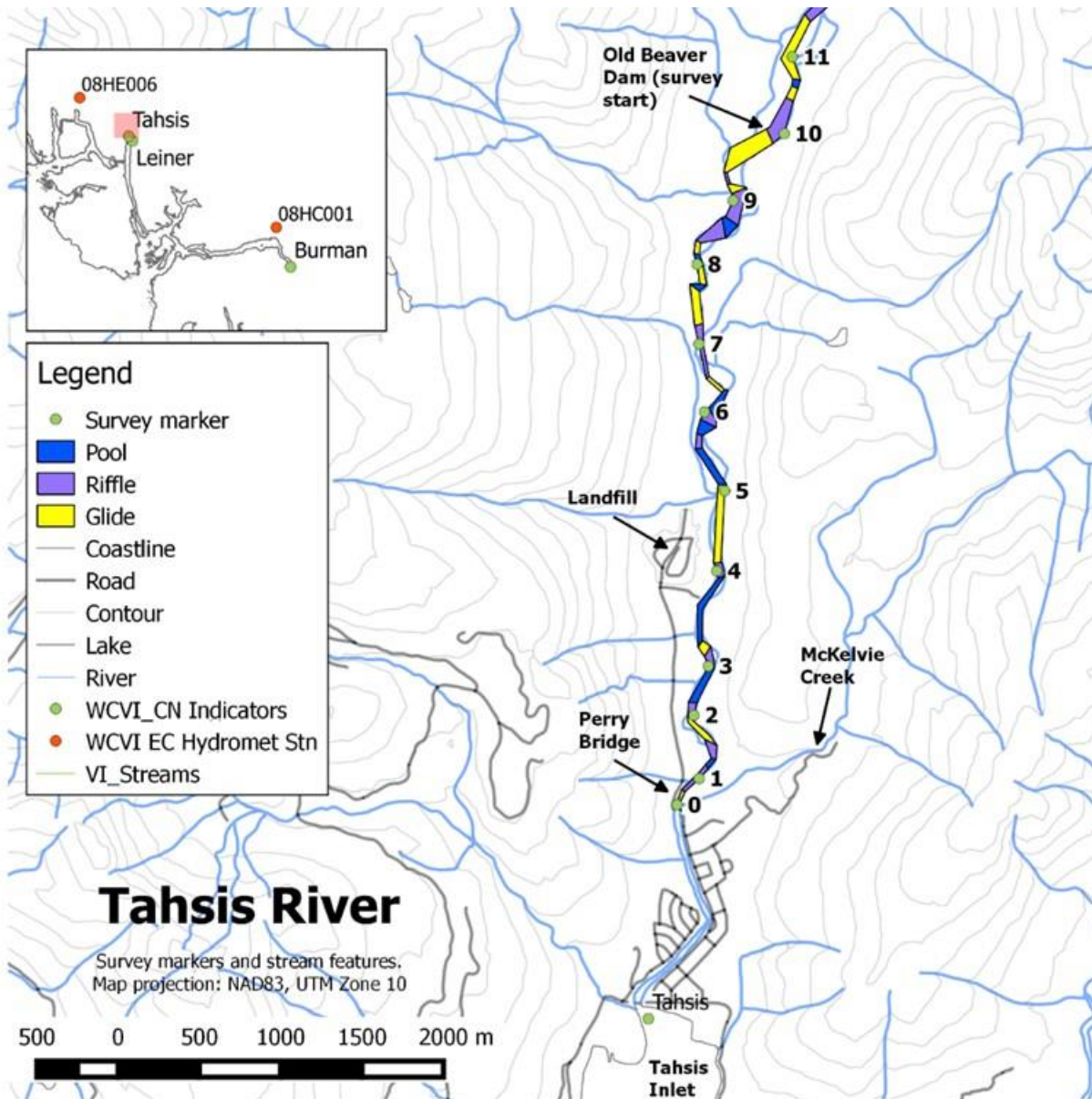


Figure 43-1. Tahsis River, habitat units and survey markers. Map inset show locations of other systems that are regularly surveyed in the area as well as the location of the nearby Environment Canada hydrometric station on the Gold River (08HC001). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

Compared to the nearby Leiner River, the Tahsis is a slightly smaller system and clears more quickly than the Leiner after rain events. Water clarity in the Tahsis is exceptional. Turbidity increases after rain events but typically returns to normal after 48 hours. When the Gold River below Ucona station (08HC001) discharge is less than 130 m<sup>3</sup>/s, the Tahsis is typically swimmable, but surveyors check with locals regarding the Tahsis water level. When the rain stopped is also relevant, as visibility can be reduced by suspended particulates in the water.

The survey area is 5 km in length and has been divided into 10 survey sections, each about 500 m apart. Marker 0 is located at the Perry Bridge at the north end of the town of Tahsis, and about 1.3 km upstream from the mouth. The survey section is primarily a low gradient (<1%) single channel comprised of repeating units of riffle/pool habitat. There are several areas that are heavily braided (sections 10/9 and 7/6) where the active channel can change year to year. While the survey sections represent most of the spawning grounds, local experts note that Chinook, Coho, Chum and Sockeye spawn outside of the area surveyed, including in McKelvie Creek and above the marker 10.

During extreme low flow periods in the late summer and early fall the river flow goes sub surface in the upper survey sections (i.e. usually above marker 9, above 8 in 2012). Didymosphenia (*Didymosphenia geminata*) has been observed throughout the survey area Tahsis in recent years. The Tahsis Salmon Enhancement Society in Tahsis has been actively carrying out salmon enhancement activities in the Leiner and Tahsis rivers since 1984.

## 43.2. Survey results and escapement estimate

Survey Crew: Al Eden and Assoc. (S. Hay, A. Eden, P. Lough, M. Lough)  
Stock Assessment Biologist: Diana McHugh

In 2015, the Tahsis River was snorkelled 7 times between September 5 and November 5 with an average survey frequency of 10 days (Table 43-1). There were 4 short duration rain events over the fall survey period (144 mm from Aug. 29 to Sep. 2; 226 mm from Sep. 19 to 25; 92 mm from Oct. 7 to 11; 134 mm from Oct. 29 to Nov. 1). The rainfall intervals (every 2-3 weeks) and moderate rain volumes allowed Tahsis flows to drop quickly after the weather cleared providing crews the opportunity to safely conduct the surveys. This enabled swimmers to closely track migrating salmon through to spawning. For this reason the Tahsis data should be considered reliable.

### Individual Survey Data:

Table 43-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
05-Sep-15	104		107		1		5		110	
12-Sep-15	150		37		2		7		138	
27-Sep-15	166		341		4		787		230	
04-Oct-15	205		405		1		985		69	6
15-Oct-15	109		361				3,943	2	26	
25-Oct-15	101		528				10,086	2,441	2	
05-Nov-15	71	3	399	1			456	445	1	

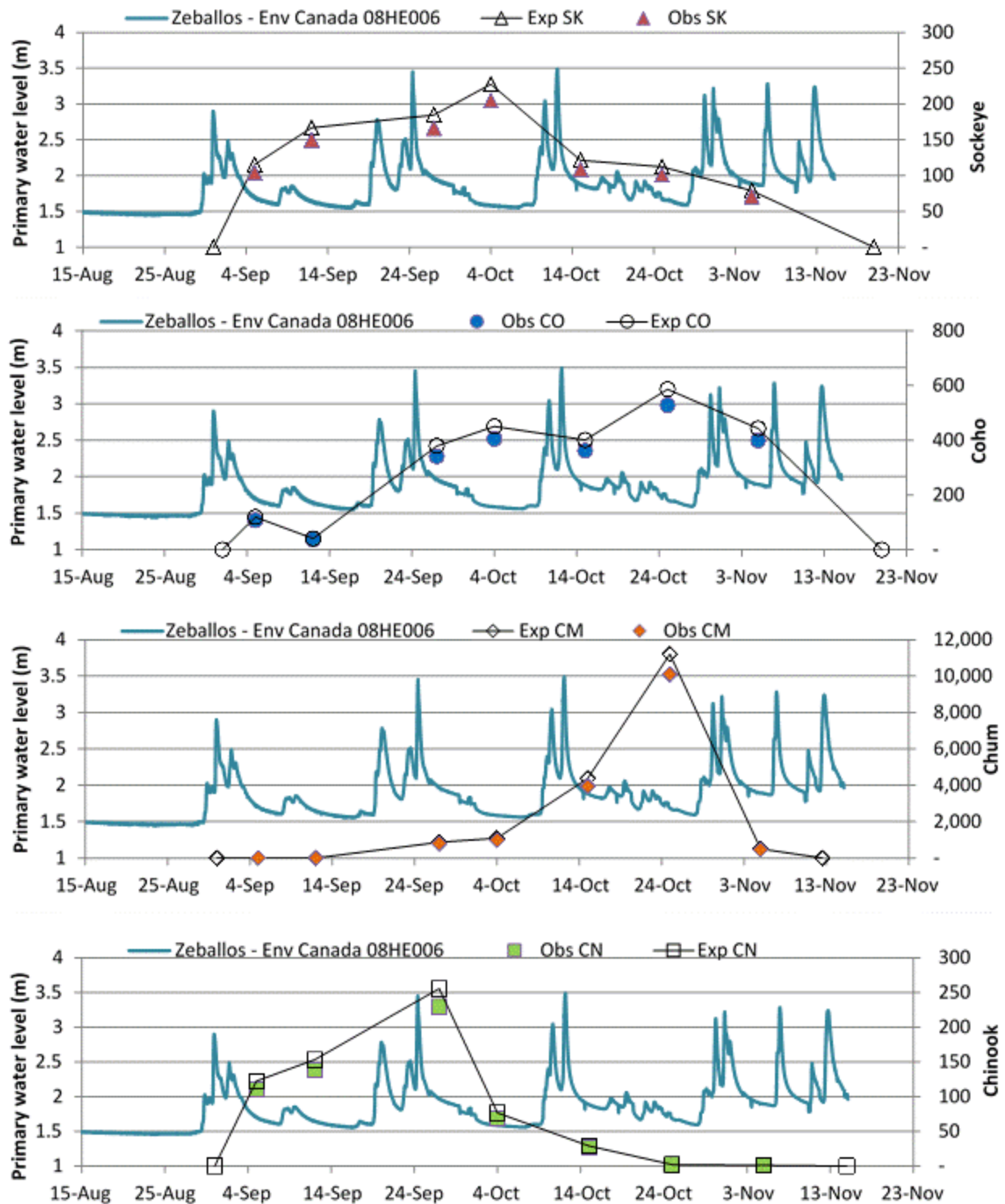


Figure 43-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station.

Table 43-2. Survey life and rational for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	Sep 1	Nov 15	
Coho	30 (25-35)	Sep 1	Nov 15	
Pink	NA			
Chum	14 (10-18)	Sep 1	Nov 15	
Chinook	20 (15-25)	Sep 1	Nov 15	

Table 43-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
05-Sep-15	Excellent	Water level normal (0.39m), water clear
12-Sep-15	Excellent	Water level normal, water clear.
27-Sep-15	Excellent	Water level normal (0.49m), water clear
04-Oct-15	Excellent	Water level normal (0.21m), water clear
15-Oct-15	Excellent	Water level normal (0.41m), water clear
25-Oct-15	Excellent	Water level normal (0.42m), water clear
05-Nov-15	Excellent	Water level normal (0.39m), water clear

Table 43-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	334 (286-401)	Expanded Area under the Curve	2
Coho	848 (727-1,017)	Expanded Area under the Curve	2
Pink	5	Expanded Area under the Curve	3
Chum	13,465 (10,473-18,851)	Expanded Area under the Curve	2
Chinook	310 (248-413)	Expanded Area under the Curve	2

## Escapement Commentary:

### Sockeye Return:

In all 7 surveys we saw no indication that fresh run, bright Sockeye were entering the river after September (indicating longer residence time). In 2015, the peak count of 205 Sockeye was made on October 4. The next survey on October 15 noted almost a 50% reduction in the count. This sudden decline was probably due to a poor count rather than fewer adults. The less numerous Sockeye were difficult identify among the several thousand Chum salmon that had recently moved into the river.

The date of the peak count in 2015 is consistent with 4 of the last 5 years of swim data, occurring around the first week of October. (The timing in 2012 was 3 weeks earlier due to drought in late-Sept.)

*Coho Return:*

In 2015, a few Coho entered the Tahsis on the late August flow spike but the main push did not occur until late September. This is consistent with migration patterns observed in 4 of the last 5 years. (This timing in 2012 was later due to extreme drought conditions.) The peak count was Oct. 25 and was comprised of 30% new, bright fish mixed in with dusky or semi bright fish. The peak count in 2015 was similar to 2012 and 2013 but about half of the peak in 2011 and 2014.

The Coho jack count was unusually high in 2015. We estimated about 63% of the adult count was comprised of jacks. In other words the peak count of Coho for 2015 was 520 adults plus 327 jacks. This compares to 13% jacks in 2013 and 9% jacks in 2014. The high number of jacks may be due in part to the 27,000 hatchery Coho fry (2014 brood) released prematurely during early spring 2015 because of a disease outbreak at the Tahsis Community Hatchery. The unusually small size of many of these jacks (15-20 cm), suggest these fish may be survivors from this release.

*Pink Return:*

On September 25, 2015, 4 Pink adults were observed but these were all dark males that appeared to be kelts. The only females observed were single sightings on September 5 and 12. The numbers are consistent with low returns observed since the 1990s.

*Chum Return:*

There was a strong Chum return to the Tahsis in 2015. The run started slowly with only a handful of Chum in the river by mid-September but with the heavy rains of September 19-25, the number spiked to 787. Chum numbers continued to build slowly until mid-October rains and ideal flow conditions resulted in a fourfold increase in the live count, reaching a season high of 4274 live adults on October 25. This number exceeded by 25% the next most numerous count of 3114 fish in 2014. The date of the peak live count for Chum is almost identical to the day with the previous 4 years of survey data.

The distribution of Chum salmon in 2015 was similar to other years with the highest concentrations holding and spawning in the lower half of the index section. This year's strong return coupled with ideal migration flows saw a larger proportion of the run reaching the upper river. On October 25 there were over 700 Chum or 16% of the peak count upstream of Marker 6.

Marker 0 at the Perry Bridge represents the demarcation zone between fresh and saltwater. The 1400m of river channel downstream of this point is intertidal. Adults holding in this zone are not included in the stock assessment tally; the conventional wisdom being that they will eventually move upstream into the index section and be counted later. Around the beginning of October local residents reported that there were large numbers of Chum holding and spawning in this intertidal area. On October 25 during a low tide, the swim crew examined a short section of the intertidal zone following completion of the normal index section. In the 300m of riffle/run habitat below the Perry Bridge, 5800 live Chum and 1600 carcasses were counted. Shore observations of the remaining intertidal areas showed that these rough densities continued for a further 400m. The majority of these adults were paired and spawning and not likely to move upstream into the index site and therefore will not figure into the escapement totals for this year.

If the intertidal population were combined with the live plus dead from the index section, the total would likely be in the 15,000 fish range. This number would represent at least a 3-fold increase

over counts reported during the last 5 years. This year's unusually large return is still considerably below the 26,000 and 32,000 recorded in 2004 and 1998 respectively.

#### *Chinook Return:*

Tahsis Chinook capitalized on the August 29 flow spike and entered the river early. On September 5, 110 bright Chinook were observed holding in several large groups in the lower river. As discharge slowly dropped over the next week upstream migration slowed with only a few dozen new immigrants observed by September 12. The majority of the run moved into the river with the Sept 19-25 rain event, with the peak count made on Sept. 27. Compared with the last 5 years of data, this year's peak count is second only to the 470 adults recorded in 2013 but far short of the 1270 Chinook counted in 1999.

The 2015, the Chinook jack count in the Tahsis was a relatively high 37%, considerably higher than the 14% recorded in 2014.

### 43.3. Spawner Distribution

#### **Run Timing:**

*Table 43-5. The run timing for the survey year by species. 'Obs.' refers to snorkel survey date when species or activity was encountered. 'Prob.' refers to probability of occurrence using expert opinion*

Species	Arrival in Stream		Date of Spawning					
			Start		Peak		End	
	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.
Sockeye	05-Sep	May-Jun	25-Oct	25-Oct	05-Nov	01-Nov	No data	10-Nov
Coho	05-Sep	29-Aug	No data	06-Nov	No data	15-Nov	No data	10-Dec
Pink	05-Sep	29-Aug	12-Sep	08-Sep	No data	15-Sep	No data	21-Sep
Chum	05-Sep	29-Aug	15-Oct	10-Oct	25-Oct	25-Oct	05-Nov	10-Nov
Chinook	05-Sep	29-Aug	12-Sep	12-Sep	27-Sep	30-Sep	04-Oct	07-Oct

#### **Spatial distribution:**

*Table 43-6. The survey sections used by spawners per species in order of importance for Tahsis River, 2015.*

Species	Survey Section(s) used for spawning
Sockeye	Marker 10/9 - Beaver pond pool d/s to Marker 9; Marker 8/7 - mid section run; Marker 5/4 - riffle site below long glide; Marker 4/3 - perimeter site of long glide; Marker 7/6 - 100m long glide ending at Marker 6.
Coho	Not observed in 2015 but in other years observed primarily u/s of Marker 4.
Pink	Marker 5 to Marker 0 - shallow riffle habitat primarily
Chum	Marker 6 to Marker 0 - riffle and run habitat; Marker 0 d/s 600m - intertidal zone at low tide; Marker 10/9 - beaver pond pool d/s to Marker 9
Chinook	Marker 8/7 - mid section run; Marker 7 to Marker 6 - primarily run habitat; Marker 10/9 - beaver pond pool d/s to Marker 9; Marker 5/4 - riffle site below long glide

## **Spawning Distribution Commentary:**

### *Sockeye Spawning:*

Sockeye spawning on the Tahsis normally occurs throughout the index section but the preferred area is consistently upstream of Marker 5 with the heaviest concentrations between Marker 10 and Marker 7. The location of Sockeye spawning in 2015 was generally consistent with previous years, except that extreme low water prevented migration past mid-way between markers 7 and 8 early in the season. Even after the channel re-watered in September, these fish did not move to better habitat upstream as expected, but rather chose to stay in this general area until spawning.

The timing of Sockeye spawning in 2015 followed the same general pattern as previous years. The first observation of fish pairing up and spawning was October 25; with peak spawning probably occurring around November 1 to coincide with a large rain event during late October; high water late in the season is a major factor in driving peak spawning activity. Similar observations have been recorded on the Leiner as well. The end of spawning is unknown but it is likely that the few remaining unspawned fish observed on November 5 spawned during the heavy rains and high water of November 6 - 10.

### *Coho Spawning:*

Coho spawn throughout the drainage. Key spawning areas are upstream of Marker 4 but preferred sites are between Marker 6 and Marker 10 in pool tailouts and edge habitat below log debris. It is unknown what proportion of the Coho run migrate and spawn upstream of the index section but it is probably substantial.

During the last 2 surveys of the 2015 season, we saw no indication that pairing and spawning had begun. Many of the Coho were very dark on the November 5 survey with some showing evidence of fungus. It is likely that spawning started during or following the heavy rains of November 6-10 and likely ended early to mid-December.

### *Pink Spawning:*

In 2015, Pink salmon were observed holding and spawning downstream of Marker 5. The only spawning activity actually witnessed this year was a pair on a redd below Marker 4 on September 12. All other observations after this date were males that looked to be kelts or partial kelts.

It seems reasonable that Tahsis Pink salmon enter and spawn early in September with a few males that hold through the month waiting to spawn with the odd late entry female. It is also possible that a few pairs spawned during the August 29 to September 1 flow pulse, died and were washed from the system prior to the first survey on September 5.

It is unclear why so few Pink salmon return to the Tahsis River, as spawning habitat is not limiting for this species. The lower 2 km has abundant gravel bars and numerous low gradient riffles and runs to accommodate several thousand individuals yet few adults are observed annually.

### *Chum Spawning:*

Chum spawn throughout the index section. In most years, spawning activity takes place in the lower 2 km (Marker 4 – Marker 0). This year was no different with 72% of the peak count



spawning downstream of Marker 4 but with the strong return and ideal flow conditions, about 16% of the run spawned upstream of Marker 6.

The spawning cycle in 2015 was consistent with previous years. The first observation of Chum spawning was on October 15 but the actual start was likely 5 days earlier during a flow pulse brought on by 92 mm of rain. Spawning activity increased rapidly over the next 10 days reaching a peak on October 25. This peak likely continued through the next high water event in late October before declining thereafter. On November 5 the final survey, the count had dropped sharply to 466 adults with about 50% still unspawned. These remaining adults probably finished spawning the following week during the Nov 6-10 high water.

In 2015, we saw an unusually high number of Chum salmon holding and spawning in the 1400m of intertidal river channel downstream of the Perry Bridge. Most of these fish were paired up and distributed across the channel actively digging redds. To confirm these fish were actually depositing eggs in the gravel, one redd was gently excavated and live eggs observed.

#### *Chinook Spawning:*

To a large extent, Tahsis Chinook hold and spawn in the same areas every year. Exceptions to this pattern can occur during an exceptionally wet or exceptionally dry September. In wet years a larger proportion of adults will move to upstream holding areas and eventually spawn above Marker 6 whereas in a dry September the reverse is true. In September 2015, an average rainfall month, all Chinook spawning occurred upstream of Marker 3 (Km 2.5) with 40% above Marker 6 (Km 3).

Spawning began on or about September 12. Most adults were still holding in the deeper pools and runs but a few pairs were observed on redds. We counted 6 fresh redds between Marker 3 and Marker 4 and estimated about 3% of the 138 adults were paired and spawning of this date.

On September 27 about 50% of the 230 adults were paired and spawning. Spawning activity likely accelerated during the high water of September 19-25 eventually peaking around September 30. This is supported by the October 4 survey results that showed a 60% drop in the live count, an increase in the number of kelts and the presence of numerous redds.

Chinook spawning probably ended around October 7. It seems likely that the remaining unspawned fish took advantage of the high flows that occurred October 7 – 11 to complete the cycle. This is confirmed by the October 15 swim results that showed that all of the 26 Chinook observed were kelts.

## 43.4. Environmental Conditions

### **Weather Summary:**

The weather in Nootka Sound in 2015 was characterized by an extremely dry spring and summer followed by a typical west coast fall consisting of short duration rain events interspersed with longer periods of cool, dry weather. There were 4 rain events recorded in Nootka Sound during the salmon migration period. The timing and precipitation amounts are as follows (Conuma Hatchery rainfall records): Aug 29 – Sep 2 (144 mm); Sep 19 – 25 (226 mm); Oct 7 – 11 (92 mm); Oct 29 – Nov 1 (134 mm).

### **Physical Characteristics Update:**

The Tahsis watershed was heavily logged starting in the 1950s. Regrowth is mostly Red Alder and willow with conifer species starting to appear in localized areas away from the stream bank. Although there hasn't been any active logging for 30 years, the stream channel remains unstable. The active channel still migrates across the valley bottom from time to time in response to flood events. During late summer and early fall, sections of the wetted channel often flow subsurface leaving large sections of the channel dry.

As in the past 3 years, in 2015 dewatering occurred between markers 8 and 10, but occurred in mid to late summer, eventually re-watering with the August 29 rain event. The length of this year's dewatering interval is unknown since it occurred before the fall surveys began but local residents hiking up the river observed that the area above Marker 8 was bone dry. After the channel re-watered in late August, it remained wetted throughout the fall survey period.

In 2015 we documented 2 areas within the 5 km index section where the active channel has changed from 2014 observations:

1. Km 4.5 (adjacent to Marker 9 sign). The left bank fork (right bank fork drains the beaver dam pool at Marker 10 sign) has a new active channel that has punched through some debris and mid channel elevated gravel bars to join the main channel about 40m downstream of the original left fork confluence.
2. Km 3 (50m d/s of Marker 6 sign). Old channel crossed diagonally from left bank to right bank bisecting a large elevated bar. The new channel no longer flows diagonally but stays to the left bank; at low flows the old right bank channel remains partially wetted but with little discernable flow; it still functions during high water.

A new logjam formed during the September 19, 2015 high water. The jam crosses the entire channel at right angles near Km 1 (Marker 2 sign). Foot access around the left bank edge of the jam is the best route for swimmers to bypass this debris. The jam is comprised of variable sized alders with roots attached and some larger conifer dead wood. The jam is not well anchored and will likely blow out this winter.

Active bank erosion is taking place between Marker 2 and Marker 1. River flow has cut into a steep-sided, forested bank along a wide outside bend midway between the two marker signs. The bank substrate is mainly fines and coarse gravel providing a soft surface for erosion. Along the top of the bank are large second growth conifers, which are currently slumping into the channel.

Holding pools continue to be filling in with gravel. The most noticeable in 2015 is the mossy 2-rock pool about 100 m upstream of the Marker 6 sign. The pool was large (~450 m<sup>2</sup>) and deep (3-4m) when observed a decade ago. It was not uncommon to see 400-600 adults holding in this area in the past. This year we noted that the pool has lost about 60% of its depth due to gravel infilling. The pool is still a key holding area but now fish only hold in the upstream end of the pool where some depth remains.

## 43.5. Update to Stream Survey Protocols

### **Current assessment method:**

Two swimmers snorkel survey from Marker 10 down to Marker 0.

### **Deviations from current assessment protocols:**

Methods consistent with previous years.

### **Access Updates:**

Access to Marker 10 remains the same as described in the stream narrative. Crews basically walk the 5 km from the Perry Bridge at Marker 0 to Marker 10 at the top of the index section. The hike usually takes about 75 minutes but can take longer at higher flows since the crew must walk up the channel for most of the route.

### **Safety Update:**

There are several safety issues facing swimmers on the Tahsis R. Two concern in-stream hazards and one that is wildlife related:

1. During a major mid-September storm this year a new, full channel logjam formed at Marker 2 (See Physical Characteristics Section for details). At low flows, this debris jam is not a hazard but at moderate to high flows, swimmers drifting toward this debris would be unable to swim around the jam or stand up and walk out of the channel due to the depth and water velocity. Since most surveys are conducted at low to moderate flows, the risk of entanglement in this logjam is minor.
2. There are 2 new strainers (log with branches submerged cross channel) that have high entanglement potential at moderate to high flows. These logs are located between Marker 2 and Marker 1. At low flows the stream velocity and depth upstream of the strainers are such that the log is clearly visible and easily avoided. Conversely at moderate flows the log lays a few cm below the water surface and is easy to miss.
3. There is the potential for bear conflicts when water levels are low and salmon are in the riffles spawning. There were no issues with bears in 2015 but in 2012 and 2013 there were several and all occurred between Marker 10 and Marker 9. This 500m, right bank channel connects the beaver dam pool (Marker 10) to the confluence with the left bank channel at Marker 9. In 2012 and 2013 there were several run-ins with belligerent bruins that were in the channel feeding on spawners. On two occasions the bears refused to move out of the channel and we had to start the survey at that point. Bear spray is required equipment.

## 43.6. Enhancement

### **Brood Removal:**

53 Chinook removed for brood by the Tahsis Enhancement Society produced 51,000 eggs.

### **Planned Release Numbers and Strategy:**

See Dave Davies (Community Advisor) or Bill Dwulit (Tahsis Community Hatchery) for details.

### **Other enhancement and restoration activities:**

During the summer 2015, volunteers from the Tahsis Enhancement Society obtained funding to excavate the pool below the Perry Bridge (at the confluence with McKelvie). In years past, Chinook and Chum commonly used the pool as a short term holding spot until fall rains provided suitable flows to move up river. The pool had filled in during the last decade and was used regularly by only Chum salmon. The close proximity of the pool to the road and hatchery had provided a reliable brood capture spot for Chinook but with the infilling this was no longer possible.

Swim crew observations during the 2015 season showed that Chinook did not use the newly dug pool as expected although it was moderately successful in attracting Chum salmon. The success of the project will likely be short lived. Examination of the pool following the October rains showed substantial infilling.

### **43.7. Biosamples**

53 Chinook biosampled

### **43.8. Concerns and Comments**

1. Currently the Marker 2 sign is missing and should be replaced. About 6 of the remaining signs are difficult to see from the channel due to surrounding vegetation growth. These sites should be slashed out or relocated to a more visible spot.
2. The staff gauge at Marker 0 (Perry Bridge) should be rehabilitated (currently bent) so water level readings can be taken after each swim.
3. Suggest flow metering be done at transect installed in 2012 to facilitate development of a rule curve for discharge. Metering to be done after each swim survey.
4. Suggest transect site and staff gauge be surveyed in using a permanent benchmark to ensure continuity between years in the event of flood damage.
5. Schedule a late August survey to obtain valid zero count.

## 44. CONUMA RIVER

### 44.1. Stream Summary

The Conuma River flows into Moutcha Bay at the head of Tlupana Inlet in Nootka Sound. The Conuma Hatchery, located about 2.5 km upstream from the mouth, has been in operation since the 1980s. The hatchery currently rears Chinook, Chum and Coho. There has been extensive industrial forestry and road building in the watershed. The system is extremely flashy and is swimmable within a few hours of the end of major rain events, but can take some time to clear. It has good visibility, though not quite as good as Tahsis. Flow is more than Tahsis but less than the Burman. The hatchery can collect brood from the river at water levels less than or equal to 9.2m on the Conuma staff gauge, but survey quality begins to decline when the Conuma staff gauge is greater than 0.6m.

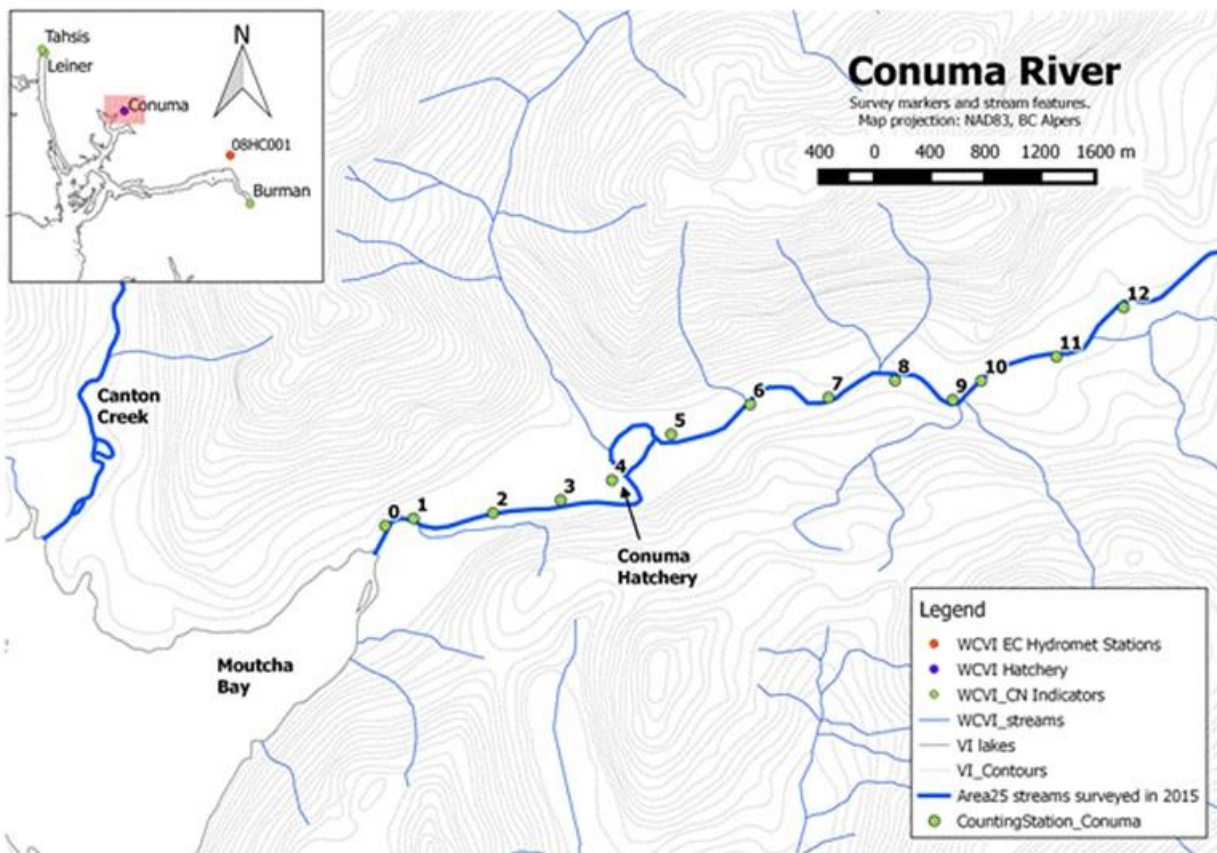


Figure 44-1. Conuma River counting stations. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.

## 44.2. Survey results and escapement estimate

Survey Crew: Al Eden and Associates (Al Eden, Shawn Hay, Mike Lough)  
Stock Assessment Biologist: Diana McHugh

In 2015, the Conuma River was snorkelled 6 times between September 4 and November 6 with an average survey frequency of 11 days (Table 44-1). There were 4 short duration rain events over the fall survey period. These well-spaced rain events and moderate rain volumes meant that water levels dropped quickly and the river swimmable within 2-3 days. This enabled crews to closely track Chinook and Chum migration through to spawning. For this reason the Conuma data in 2015 should be considered reliable. Identification and enumeration of less abundant species was problematic because of the high concentrations of Chinook (same as in 2013).

### Individual Survey Data:

Table 44-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
04-Sep-15*	8		251		1		44		17353	
13-Sep-15	43		603		2		864		35405	314
28-Sep-15	52		1611				6533	3	13721	3289
17-Oct-15**	9		566	2			872	156	55	
26-Oct-15	25		454				133	229	16	2
06-Nov-15***	11		358				4	2		1

\*Surveyed Mrkr 8-0, 2% of Chinook in section 12-8 in subsequent survey;

\*\*Surveyed Mrkr 10-0, estimated 13% of Coho and 22% of Chinook in missed section based on adjacent surveys,

\*\*\*Surveyed 12-2

**Comments:** There were 4 short duration rain events over the fall survey period (144 mm from Aug. 29 to Sep. 2; 226 mm from Sep. 19 to 25; 92 mm from Oct. 7 to 11; 134 mm from Oct. 29 to Nov. 1).

Hatchery staff (Mike Austin Sept 17<sup>th</sup>) confirmed that while they were not able to complete a boat survey, they are comfortable with an estimate of between 30k and 40k Chinook in the river based on their spot checks and brood removal activities (collecting all their brood from an accessible pool just above the hatchery). Although swim conditions like visibility and discharge were optimum during the surveys, these large accumulations ultimately limit the ability of snorkelers to count adults effectively.

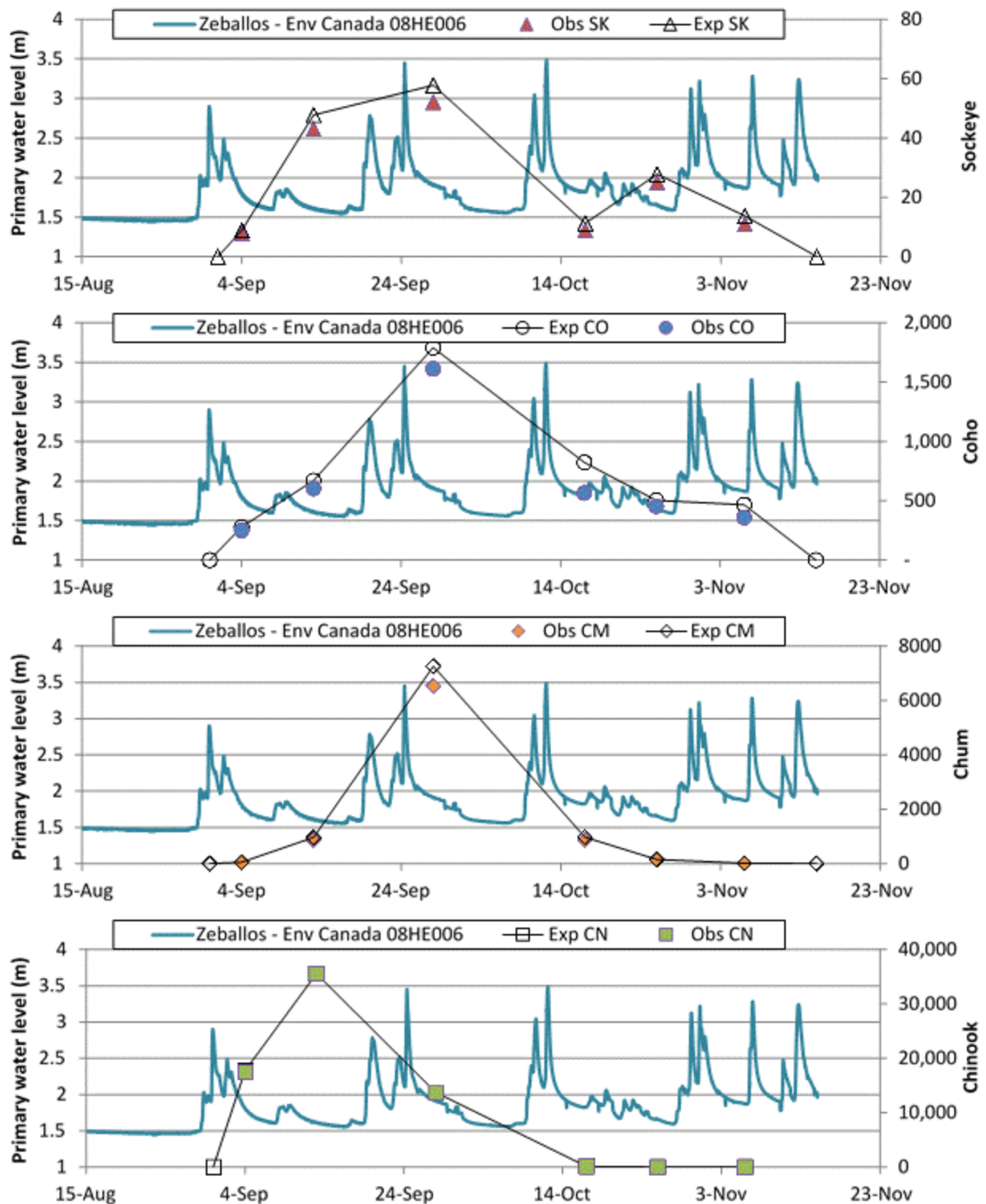


Figure 44-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station.

Table 44-2. Survey life and rational for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	Sept 1	Nov 21	
Coho	30 (25-35)	Sept 1	Nov 15	
Pink				
Chum	15 (10-20)	Sept 1	Nov 13	
Chinook	20 (15-25)	Sept 1	Nov 15	

Table 44-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
04-Sep-15	Excellent	Water level normal, water clear
13-Sep-15	Excellent*	Water level normal, water clear
28-Sep-15	Excellent*	Water level normal, water clear
17-Oct-15	Good*	Water level normal, water level mostly clear
26-Oct-15	Excellent	Water level normal, water clear
06-Nov-15	Good	Water level normal, water clear to marker 3, after marker 3 water was slightly turbid

**Comments:** No secchi readings were taken, \*extremely large counts of Chinook were not expanded for the estimate

Table 44-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	74 (64-89)	AUC	2
Coho	2,039(1,748-2,447)	AUC	2
Pink	Adults Present		2
Chum	10,020 (7,515-15,030)	AUC	2
Chinook	38,178 (30,542-50,904)	AUC	2

## Escapement Commentary:

### Sockeye Return:

In 2015, the peak count of 52 Sockeye was made on September 28 but this number is clearly an underestimate due to identification issues posed by large numbers of Chinook and Chum. Conuma Sockeye migrate throughout the 6 kilometers of the index section. The largest groups consistently hold in deep pool and run habitat upstream of Marker 2. In 2015, all Sockeye observations were between Marker 3 and Marker 9.

### Coho Return:

In 2015, 251 early Coho migrants entered the Conuma on the late August flow spike but the main surge did not occur until a high water on September 19 provided optimum migration



conditions. The peak count of Coho this year was 1611 fish on September 28. This count is about average compared to peak tallies recorded since 2011. This is within a week to 10 days of migration patterns observed in 4 of the last 5 years. This differs from 2012, an extremely dry fall, when the main run was delayed until late October due to low water conditions. Coho migration can extend into December so these estimates should be considered conservative.

During the last 5 surveys in 2015, Coho were consistently a mix of fresh, bright fish mixed in with dusky or semi bright fish; this ratio shifting to predominantly dark fish as the season progressed. This observation when compared to the 50% drop in Coho counts after September 28 suggests that a larger proportion of the run may be moving upstream out of the counting section into the deep pool habitat of the lower canyon.

The Coho jack count in 2015 is about 17% of the adult count. In other words the peak count of Coho for 2015 was 1611 adults plus 275 jacks.

*Pink Return:*

Low count consistent with recent years.

*Chum Return:*

There was a relatively modest Chum return to the Conuma in 2015. The timing of river entry was early this year due to the late August rainstorm that raised water levels for a 4-day period. A few dozen early Chum entered the river during this flow spike, with numbers steadily building over the next 3 weeks. It was not until a second high water after mid-month before the main body of the run entered the river, eventually reaching a peak count of 6533 fish on September 28.

The date of the Chum peak live count this year is about a week to 10 days earlier than previous years however it should be noted that comparative data in recent years is limited during this period.

Chum salmon migrate throughout the index section. The distribution of Chum salmon in 2015 was similar to other years with the largest proportion of the run holding and spawning downstream of Marker 4 (hatchery). This is to be expected since Chum returns are primarily derived from hatchery production. During the peak count on September 28, 4800 adults or 74% of the total count were holding in the lower 2 kilometers of the river. The ideal migration flows this year saw an increase in relative numbers in the upper river with 6% or 415 adults migrating upstream of Marker 7.

*Chinook Return:*

Chinook adults migrate throughout the 6-km index section. The majority of adults remain downstream of Marker 12, however an unconfirmed, albeit small number, likely move beyond the upper marker and hold in the deep pools of the lower canyon until spawning.

Conuma Chinook, like other Nootka area Chinook streams in 2015, entered their natal stream early this season, taking advantage of the 4 days of high water in late August. On September 4, the first survey of the season, 17,353 bright Chinook were counted holding in large groups downstream of Marker 7. One week later, even as discharge was steadily dropping, the count doubled to 35,405 fish. Compared with the previous 5 years of data, this year's peak count on September 13 is second only to the 37,814 adults recorded in 2013.

The distribution of Chinook in the Conuma is similar to Chum, with a large percentage of the run homing in to areas adjacent to the hatchery. About 90% of the peak count was observed downstream of Marker 6 (Km 3) with close to half (16445) below Marker 4 (hatchery).

The 2015, the Chinook jack count in the Conuma was a relatively low 4%. This should be considered an underestimate due to the difficulty in identifying jacks among the extremely large, often milling groups of adult Chinook.

### 44.3. Spawner Distribution

#### Run Timing:

Table 44-5. The run timing for the survey year by species. 'Obs.' refers to snorkel survey date when species or activity was encountered. 'Prob.' refers to probability of occurrence using expert opinion

Species	Arrival in Stream		Date of Spawning					
			Start		Peak		End	
	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.
Sockeye	04-Sep	No data	26-Oct	24-Oct	26-Oct	29-Oct	06-Nov	07-Nov
Coho	04-Sep	29-Aug	26-Oct	29-Oct	No data	10-Nov	No data	01-Dec
Pink	04-Sep	29-Aug	No data	29-Aug	13-Sep	11-Sep	No data	19-Sep
Chum	04-Sep	29-Aug	13-Sep	13-Sep	28-Sep	07-Oct	26-Oct	29-Oct
Chinook	04-Sep	29-Aug	13-Sep	11-Sep	28-Sep	20-Sep	17-Oct	07-Oct

#### Spatial distribution:

Table 44-6. The survey sections used by spawners per species in order of importance for Conuma River, 2015

Species	Survey Section(s) used for spawning
Sockeye	Marker 7 to Marker 4 – hydro run to Leagh Cr confluence; Marker 4/3 – boat launch run to Bill's run; Marker 12 to Marker 8 – riffle and run habitat
Coho	Marker 12 to Marker 6 – riffles and perimeter sites in runs; Marker 6/5 to Marker 3 – tail out of hydro pool at road corner to tail out of Bill's run.
Pink	Marker 5 to Marker 1 – mainly shallow riffle habitat
Chum	Marker 5 to Marker 0 – pool tail outs, all riffle and run habitat; Marker 8 to Marker 6/5 – riffles and perimeter sites in runs; Marker 12 to Marker 11/10 - riffles and perimeter sites in runs.
Chinook	Marker 5 to Marker 0 – pool tail outs, all riffle and run habitat; Marker 8 to Marker 6/5 – riffles and perimeter sites in runs; Marker 12 to Marker 11/10 - riffles and perimeter sites in runs.

#### Spawning Distribution Commentary:

##### Sockeye Spawning:

The timing and location of Sockeye spawning in 2015 is consistent with previous years. This season most spawning occurred between Marker 7 and Marker 4 but a few pairs were observed spawning in other areas. The first indication that spawning was underway was during the October 26 survey but likely began a few days earlier. Peak spawning was judged to take place between October 26 and November 1 when 4 days of high water provided optimum spawning

conditions. By the November 6 survey, spawning was complete as confirmed by a declining adult count and a few kelts.

*Coho Spawning:*

Coho spawn throughout the 6.5 kilometers of accessible habitat. Key spawning areas are upstream of Marker 6 but some late entry Coho prefer to spawn in the lower river, usually in the 1000m upstream of the hatchery. It is unknown what proportion of the Coho run migrate and spawn upstream of the index section in the pool tailouts of the lower canyon.

During the October 26, 2015 survey, we saw the first indication that pairing and spawning had begun. An estimated 10% of the count was spawning as of that date. On November 6, the last survey of the season, the spawning percentage was still around the 10% mark but many of the Coho were very dark and looked to be quite gravid. Although no conclusive data is available it is probable that peak spawning occurred during the November 7-15 high water and ended late November or early December.

*Pink Spawning:*

In 2015, the few Pink salmon observed were holding and presumably spawning downstream of Marker 5. No active spawning was observed but a few kelt males were counted near fresh redds on September 13. It is likely that the large numbers of Chinook and Chum salmon spawning in the lower Conuma would have a detrimental effect on the shallow spawning, less numerous species like Pink salmon. In most years, every square meter of gravel substrate in the lower 3 kilometers of the Conuma is excavated numerous times by successive waves of larger salmon such that the survival of Pink salmon eggs would be a long shot at best.

*Chum Spawning*

Chum spawn throughout the index section. In most years, spawning activity takes place in the lower 3 km (Marker 6 – Marker 0). This year was no different with 86% of the peak count spawning downstream of Marker 6.

The spawning cycle in 2015 was consistent with previous years. The first observation of Chum spawning was on September 13 when a few dozen pairs were holding in the riffle tailouts but not yet actively excavating. Spawning activity increased rapidly over the next 10 days reaching a peak on September 28, but probably continued through to the October 7 high water before declining thereafter. By October 26 the adult count had dropped sharply to 132 mostly kelt adults, indicating that spawning was essentially over. The remaining dozen or so unspawned adults likely finished spawning during the late October high water.

*Chinook Spawning:*

Chinook spawn throughout the accessible reach of the Conuma. The distribution of spawners in 2015 was no exception. Due to the influence of hatchery water to returning Chinook, about 70% of the run spawns within 1500 m above and below Marker 4.

The first observation of spawning Chinook was September 13 but the dozens of redds, 314 carcasses and the occasional kelt female indicated that spawning likely started a few days earlier. An estimated 10% of the 35K Chinook were actively spawning on this date. Peak spawning probably occurred around September 20 to coincide with a large rain event. This was confirmed by the September 25 count, which was about 60% lower than the peak count on September 13. By October 17 the Chinook count had dropped to a few dozen kelts suggesting the end of spawning probably occurred 10 days earlier during the high water of October 7.

Chinook and Chum redd dewatering is a serious concern on the lower Conuma (see concerns section below).

#### 44.4. Environmental Conditions

##### **Weather Summary:**

The weather in the Nootka Sound area in 2015 was characterized by an extremely dry spring and summer followed by a typical west coast fall consisting of short duration rain events interspersed with longer periods of cool, dry weather. There were 4 rain events recorded in Nootka Sound during the salmon migration period (Conuma Hatchery rainfall records). The timing and precipitation amounts are as follows: Aug 29 – Sep 2 (144 mm); Sep 19 – 24 (226 mm); Oct 7 – 11 (92 mm); Oct 29 – Nov 1 (134 mm).

##### **Physical Characteristics Update:**

The river upstream of Marker 7 is relatively stable with little evidence of recent bank slumping or active erosion. Below this point the channel becomes progressively wider with large, elevated gravel bars becoming more prevalent in the lower river. At Km 3.1, on the right bank just upstream of Marker 6 (the S-bend) the river is actively side cutting into the roadbed.

#### 44.5. Update to Stream Survey Protocols

##### **Current assessment method:**

The index section is 6 kilometers long and is broken up into 12 - 500m marks. Most of the anadromous species hold and spawn downstream of Marker 12 but an unknown number of Coho, Chinook and steelhead move beyond this point into the deep pools and runs of the canyon. The canyon is roughly 1500m in length (Conuma bridge to Marker 12) with numerous cascades and waterfalls throughout; reportedly about 500m of the canyon is accessible to migrants.

Standard swim methodology is to spot a vehicle on the hatchery access road near Marker 0, just upstream of the brood capture pool at tidewater. Drive a second vehicle or get dropped off at the unnamed creek where it crosses Head Bay Road. This creek crosses the Head Bay Road about 1.6-road km west of the Conuma Bridge. Swim crews hike east along the unnamed creek for 300m to Marker 12, beside a large pool at the canyon entrance.

Depending on flows, visibility and fish numbers, the survey generally takes about 6-7 hours including rest breaks to complete.

##### **Deviations from current assessment protocols:**

Methods consistent with previous years except:

- Oct 17, Surveyed Marker 10 to tidewater;
- Nov 6 Marker 12 to 2.

##### **Access Updates:**

Access is unchanged from previous year surveys.

### Safety Update:

There are no safety issues outside the normal in-stream hazards present on the Conuma River.

## 44.6. Enhancement

### Brood Removal:

734 Chum brood removed from Canton Creek by hatchery to supplement shortage of Chum brood from Conuma (suspected that Canton Chum are Conuma strays). Estimate 3300 natural Chum spawners in Canton.

42 Chinook brood removed from Gold River by hatchery. Did not meet target due to difficult conditions. Estimate 850 natural Chinook spawners in Gold River.

Table 44-7. Planned release numbers and strategy from Conuma River Hatchery Assessment Plan (SEP).

Stock	Adults		Juveniles						
	Egg Target	Esc. Target	Release Target	Release Stage	Release Site	# Marked / Tagged			D / S
						Ad CWT	Ad Clip	Thermal	
Conuma R. Chinook	3,200,000	17,000	2,700,000	Seapen	Conuma Est			2,700,000	
Gold R. Chinook	575,000	7,500	150,000 / 350,000	Seapen / Subyearling Smolt	Gold R/ Muchalat Lk			500,000	
Canton R. Chum	Use Conuma R. stock	15,000	500,000	Fed Fry	Canton River			500,000	
Conuma R. Chum	3,600,000	55,000	1,500,000 / 500,000	Seapen / Fed Fry	Conuma River / Est			2,000,000	
Conuma R. Coho	300,000	6,000	150,000 / 50,000	Seapen / Fed Fry	Conuma River / Est		Smolts only		

### Other enhancement and restoration activities:

Currently none

## 44.7. Biosamples

300 Conuma Chinook biosampled

## 44.8. Concerns and Comments

1. Missing or misplaced markers: Markers 1, 2 and 3 below the hatchery have been missing for several years. There are two Marker 9 signs separated by 200m. Apparently we need to determine which we want to use and get rid of the other one. Marker signs 5 and 7 are also missing, fallen down or no longer visible. Suggest next season that the crew locate all marker signs with GPS coordinates to ensure new signs can be replaced in a timely manner.

2. Counting large groups of fish: Enumerating groups that are several thousand strong is a difficult task for snorkel surveyors. This year for example, a large group of Chinook in the hydro run (Marker 7/6) was 50 m long, 4 m wide and 2 m deep with the fish bunched together in such a tight group that a swimmer drifting alongside was unable see through the first layer. In this situation it is difficult to come up with a fish estimate with any degree of confidence. Discussions between Conuma hatchery staff and the stock assessment crew on how to best reduce the error in estimating fish numbers in these large groups are ongoing.
3. Dewatered redds: Chinook and Chum redd dewatering is a serious concern on the lower Conuma. Observations over the last few years have confirmed that hundreds of redds are dewatered downstream of Marker 4. The areas most affected are along the right bank between Marker 4 and Marker 3 and on the left bank between Marker 3 and Marker 1. These two areas contain large elevated gravel bars that on average rise about 1.5 to 2 meters above the normal low water level. When high water occurs during the peak of the spawning period, adults spawn where water velocities and depths are optimum. Many of these premium areas are on top of the elevated bars, extending to the high water line at the stream bank. In 2012, an extremely dry fall when the first major rain storm occurred mid-October, Chum salmon were the most affected. In 2015, when several heavy rain events occurred during mid-September and early October, Chinook salmon took the biggest hit. This was confirmed with our field observations during the October 17, 2015 survey. In a 200m section adjacent to the hatchery (Marker 4) we counted 50 dewatered redds and a further 25 redds that had been excavated by bears to get at the rotting Chinook eggs. Clearly nothing can be done to rectify the elevated bar issue since logging in the Conuma headwaters and the ensuing downstream movement of gravel and fines will continue for the foreseeable future.

## 45. LEINER RIVER

### 45.1. Stream Summary

The Leiner River flows southwest into the end of Tahsis Inlet in Nootka Sound. The system is fed by small tributaries including the Perry River which enters about 2 km upstream from the mouth (between markers 3 and 4). Spawning salmon are generally found in the lower 2 km of the Leiner which has been divided into 4 survey sections, each 500 m in length (Sockeye and Coho are also found further upstream). The surveys start at survey marker 4 where a bridge crosses the river.

The survey area has a low gradient (<1%) is mainly comprised of riffles, glides and several deep pools. The stream channel is quite stable with the only evidence of bank erosion along the right bank (north bank) below marker 1 bordering Pete's Farm. The deepest pool is about 4 to 5 m and located near the campground near marker 3, however it has been filling in in recent years.

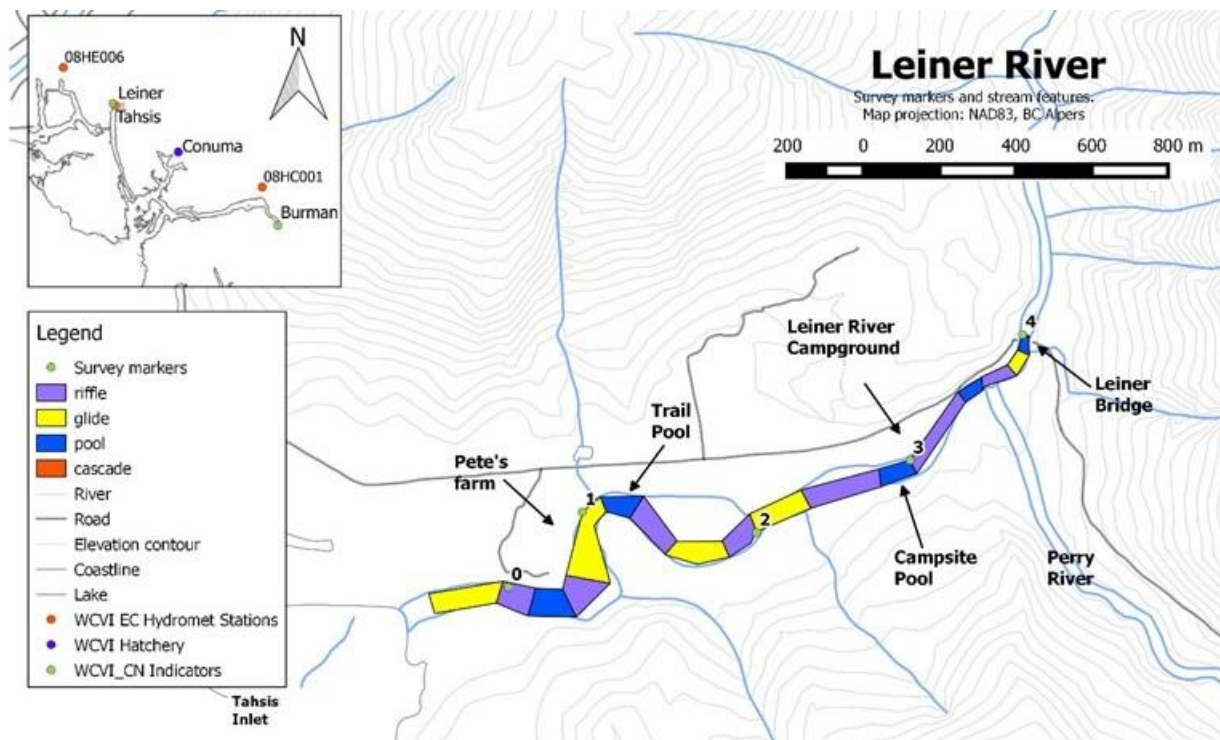


Figure 45-1. Leiner River habitat units and survey markers. Map inset show locations of other systems that are regularly surveyed in the area as well as the location of the nearby Environment Canada hydromet stations Gold River Below Ucona River (08HC001) and Zeballos River at Zeballos (08HE006). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

Water clarity in the Leiner is excellent. The river becomes slightly turbid during and after rain events and crews report good visibility 2 to 3 days after a major rain event. Compared to nearby Tahsis River, the Leiner is a slightly larger system and usually takes about a day longer to return to normal after rain events. Unlike the Tahsis River, water level for fish entry is not

usually a problem on the Leiner. Even during very low water fish can get in on high tides and hold in pools. The Tahsis Salmon Enhancement Society in Tahsis has been actively carrying out salmon enhancement activities in the Leiner and Tahsis rivers since 1984.

## 45.2. Survey results and escapement estimate

Survey Crew: Al Eden and Associates (Al Eden, Shawn Hay, Mike Lough)

Stock Assessment Biologist: D. McHugh

Low flows and good visibility are essential conditions for collecting reliable escapement data. It is equally important to conduct surveys immediately after rain events because rising water levels in the fall are important migration and spawning cues for salmonids.

In 2015, the Leiner River was snorkelled 7 times between September 6 and November 4 with an average survey frequency of 10 days (

Table 45-1). There were 4 short duration rain events over the fall survey period. The rainfall intervals (every 2-3 weeks) and moderate rain volumes allowed Leiner flows to drop quickly after the weather cleared providing crews the opportunity to safely conduct the surveys. This enabled swimmers to closely track migrating salmon through to spawning. For this reason the Leiner data should be considered reliable.

### Individual Survey Data:

*Table 45-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
06-Sep-15	120		249				10		530	
11-Sep-15	144		223		5		61		620	
29-Sep-15	137		293		2		1334		278	44
05-Oct-15	173		413		1		1406	10	113	43
16-Oct-15	107		259				1505	220	17	1
24-Oct-15	124	1	237				1252	623	10	1
04-Nov-15	65		490	1			152	240	1	



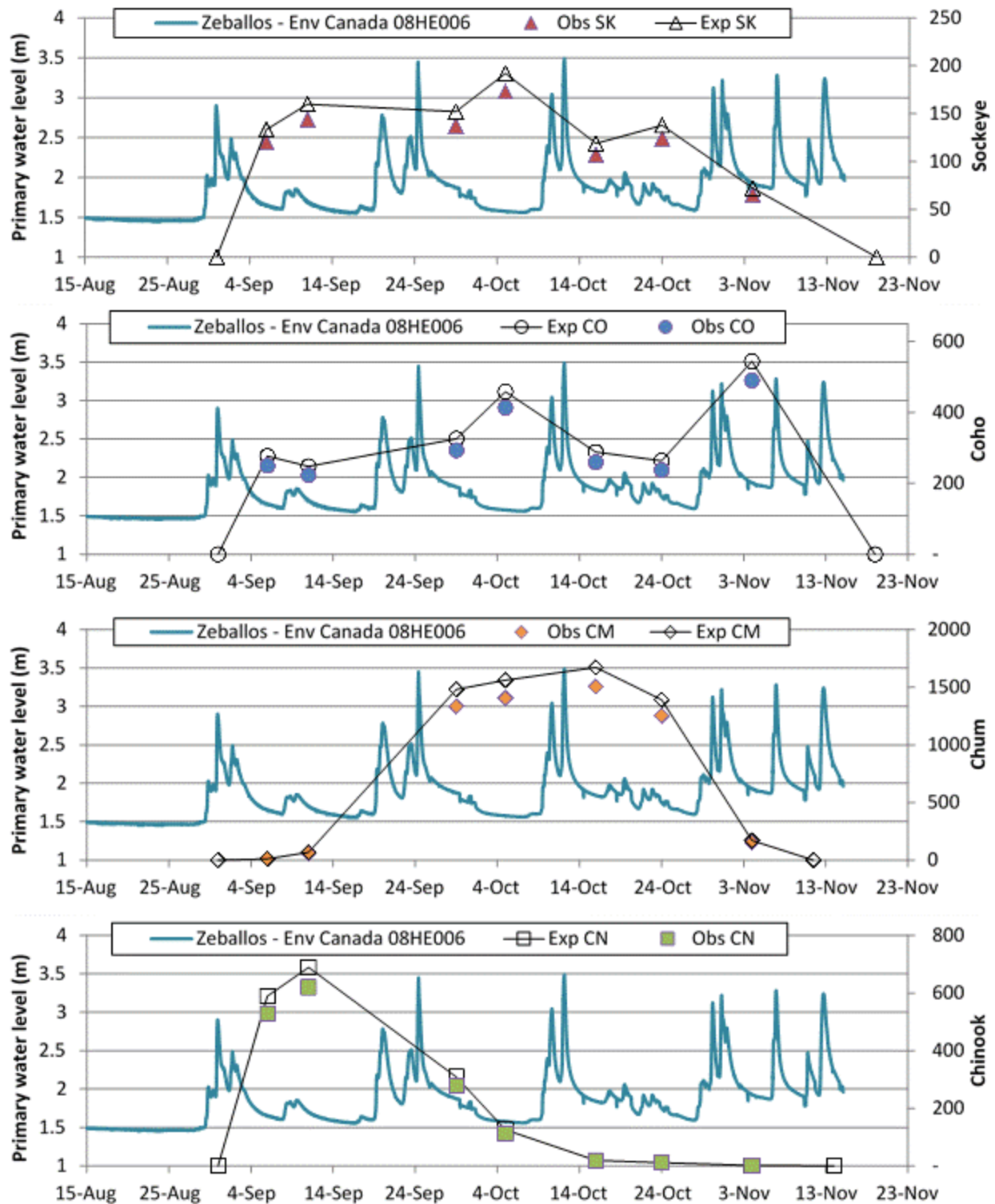


Figure 45-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station.

Table 45-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	Sept 1	Nov 15	
Coho	30 (25-35)	Sept 1	Nov 19	
Pink				
Chum	15 (10-20)	Sept 1	Nov 11	
Chinook	20 (15-25)	Sept 1	Nov 5	

Table 45-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
06-Sep-15	excellent	Water level normal, water clear
11-Sep-15	excellent	Water level normal, water clear (10m+)
29-Sep-15	excellent	Water level normal, water clear
05-Oct-15	excellent	Water level dropping due to low overnight temperatures, excellent visibility
16-Oct-15	excellent	Water level normal, water clear
24-Oct-15	excellent	Water level normal, water clear
04-Nov-15	excellent	Water level normal, water clear

Table 45-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	311 (267-374)	AUC	3
Coho	812 (696-974)	AUC	3
Pink	6	PL+D	2
Chum	4,168 (3,126-6,252)	AUC	2
Chinook	797 (637-1,062)	AUC	2

## Escapement Commentary:

### Sockeye Return:

In 2015, the peak count of 173 Sockeye was made on October 5, but it is likely that all these fish were present earlier but missed due to the focus on Chinook counts. Early in the season, Sockeye can be confused with small female Chum or just lost amongst the large groups of Chinook, Coho and Chum. In all 7 surveys we saw no indication that fresh run, bright Sockeye were entering the river after September.

### Coho Return:

In 2015, Coho entered the Leiner about 2 weeks earlier than in previous years due to a late August rain event, which provided good migration flows at a time when flows are normally very low. Fresh fish moved steadily into the lower river through September reaching a mid-run peak

of 413 fish on October 5. Subsequent swims (Oct 16, Oct 24) showed a drop in the count because many of these earlier fish took advantage of mid-season flow pulses (Sep 19, Oct 7) to move into canyon habitat upstream of Marker 4 and out of the survey area. To better assess the strength of the Coho run the index section was extended 1500m to Marker 7 for the final survey on Nov 5 when a high of 490 adults were counted.

The drop in the Coho count during the mid-October surveys may also be due to some adults moving from the lower Leiner into the Perry system. Tahsis sports fishermen report that there is a late summer Coho run in the Perry but little information on the life history of this stock is available.

The 2015 peak count of 490 Coho is the second lowest estimate recorded over the last 5 years (213 – 1115). It should be noted that the October 15, 2013 low count of 213 adults did not include the upper 1500 meters of canyon habitat and is likely an undercount.

The jack Coho return in 2015 was relatively strong at about 30%. This compares to 32% jacks in 2013 and 6% jacks in 2014.

#### *Pink Return:*

There is a remnant population of Pink salmon in the Leiner River. On Sep 11, 2015, a peak count of 5 fish was recorded but all were post spawning males guarding redds. The run is clearly larger than the swim counts indicate and suggests that migration and spawning is taking place prior to the start of surveys in early September.

The low count of Pink salmon this year is consistent with peak counts recorded since 2011.

#### *Chum Return:*

The first observation of bright Chum salmon in the Leiner was September 6, however these adults probably entered the Leiner a week earlier during a flow pulse resulting from late August heavy rains. This contrasts with previous year's surveys when the first observation of Chum salmon occurred 2 weeks later, around mid-September.

The first major influx of Chum migrants was observed on September 29 when 1334 adults were counted. These fish likely entered the Leiner during the second rain event of September 19 -25 when 226 mm of rain spiked flows. Chum numbers continued to build over the next 2 weeks reaching a peak live count of 1505 adults on October 16.

This year's peak live count occurred mid-October; this is consistent with peak counts recorded during previous year surveys (2011-2014).

#### *Chinook Return:*

After a record dry summer, five days of heavy starting on Aug. 29 provided optimum migration flows such that on September 6, 530 bright Chinook were counted; or 85% of the peak live count of September 11. This run timing is typical when there is a late-Aug or early-Sep rain event (2000, 2002, 2003, 2004, 2008, 2009 and 2013). Otherwise, the peak does not usually occur until after the third week in September.

The peak Chinook live count for 2015 is the highest number recorded over the last decade and second highest since 1995. The highest live count was recorded in 2002 when 864 Chinook adults were observed.

About 9% of the Chinook counted in 2015 were jacks. This compares to the 11% and 13% recorded in 2013 and 2014 respectively.

### 45.3. Spawner Distribution

#### Run Timing:

Table 45-5. The run timing for the survey year by species. 'Obs.' refers to snorkel survey date when species or activity was encountered. 'Prob.' refers to probability of occurrence using expert opinion

Species	Arrival in Stream		Date of Spawning					
			Start		Peak		End	
	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.	Obs.	Prob.
Sockeye	06-Sep	May-Jun	04-Nov	29-Oct	04-Nov	29-Oct	No data	15-Nov
Coho	06-Sep	29-Aug	04-Nov	29-Oct	No data	15-Nov	No data	01-Dec
Pink	06-Sep	29-Aug	11-Sep	06-Sep	11-Sep	11-Sep	29-Sep	29-Sep
Chum	06-Sep	29-Aug	05-Oct	05-Oct	16-Oct	20-Oct	04-Nov	04-Nov
Chinook	06-Sep	29-Aug	11-Sep	11-Sep	29-Sep	22-Sep	05-Oct	07-Oct

#### Spatial distribution:

Table 45-6. The survey sections used by spawners per species in order of importance for Leiner River, 2015.

Species	Survey Section(s) used for spawning
Sockeye	Marker 4/3 - in bridge pool tailout along left bank; Marker 1/0 - Pete's Farm glide, along left bank, often observed spawning amongst spawning Chum. Marker 2/1 - left bank under riparian vegetation just d/s Marker 2 sign.
Coho	Marker 7 to Marker 5/4 - canyon pool tailouts; Marker 4/3 - in bridge pool tailout and Perry/Leiner confluence run; Marker 2/1 - tailout of the Trail Pool; Marker 1/0 - Luke's Hole and Pete's Farm.
Pink	Marker 1/0 - Luke's Hole and Pete's Farm; Marker 2/1 - tailout of the Trail Pool.
Chum	Marker 1/0 - Luke's Hole and Pete's Farm; Marker 2/1 - tailout of the Trail Pool; Marker 4/3 - in bridge pool tailout and Perry/Leiner confluence run.
Chinook	Marker 2/1 - tailout of the Trail Pool; Marker 1/0 - Luke's Hole and Pete's Farm; Marker 4/3 - in bridge pool tailout and Perry/Leiner confluence run.

#### Spawning Distribution Commentary:

##### Sockeye Spawning:

The location of Sockeye spawning in 2015 is consistent with previous years. Peak spawning occurred earlier this year and was likely due to the 134 mm of rain that fell over 4 days beginning October 29. This was confirmed by the November 4 survey that identified fresh redds, kelts and a sharp decline in the adult count.

*Coho Spawning:*

On November 5, the last survey of the 2015 season, most of the Coho adults observed were holding in large groups in the deep pools of the Leiner canyon. Spawning was just starting, as there were a few pairs observed digging redds as well as 4-5 males guarding recently completed redds. Several redds were in shallow, low velocity habitat suggesting they were laid down when flows were higher. For this reason the start of spawning probably occurred during the high water pulse on October 29.

Information on peak spawning was not collected this year but the dark colouration and gravid condition of Coho observed on Nov 5 suggest that it occurred after the 200+ mm of rain that fell between November 6 and 15 when high water provided optimum spawning conditions.

*Pink Spawning:*

Pink salmon were finished spawning by the first survey on September 6. The presence of post spawning males guarding redds suggests that spawning was recent; it is likely that the entire cycle of Pink migration and spawning occurred between August 29 and September 5 when flows were high.

*Chum Spawning:*

In 2015, Chum entered the Leiner about a week earlier than expected but the timing of the spawning cycle (start, peak and end) appears to be consistent with previous years.

Chum salmon spawn in the same general areas every year. About 95% of the run spawn in the low velocity runs and riffles downstream of Marker 2 (km 1) where gravel is abundant. As with other salmonids, spawning is associated with high water events. Such was the case this year when 92 mm of rain fell in mid-October; this provided ideal flow conditions for peak spawning the following week.

*Chinook Spawning:*

Leiner Chinook hold and spawn in the same general areas every year. About 95% of the run spawns downstream of Marker 4 with the preferred sites in the 1000 m above tidewater. In some years a few Chinook manage to transit the steep cascade above Marker 4 to spawn in the Leiner canyon. Although these sightings are infrequent there were 3 Chinook male kelts (1 adult and 2 jacks) counted upstream of Marker 4 in 2015.

By September 11 spawning was underway. Although most of the adults were still holding in large groups, several pairs were actively spawning. We counted 16 fresh redds downstream of Marker 2 and 1 female kelt. We estimated about 3% of the 620 adults were spawning as of this date.

The date of peak spawning was projected to be September 22 to coincide with a high water event between September 19 and 25. This is confirmed by the September 29 survey when the Chinook counted dropped 50%, the presence of numerous redds and large groups of kelts showing wounds, fungus and skinny body condition.

The end of Chinook spawning was thought to be around October 7. This is based on the October 5 survey when 80% of the 113 adults observed were spawning. It seems likely that these fish took advantage of the high flows that occurred October 7 – 11 to complete the cycle.

#### 45.4. Environmental Conditions

##### **Weather Summary:**

The weather in the Nootka Sound area in 2015 was characterized by an extremely dry spring and summer followed by a typical west coast fall consisting of short duration rain events interspersed with longer periods of cool, dry weather. There were 4 rain events recorded in Nootka Sound during the salmon migration period. The timing and precipitation amounts are as follows (Conuma Hatchery rainfall records): Aug 29 – Sep 2 (144 mm); Sep 19 – 25 (226 mm); Oct 7 – 11 (92 mm); Oct 29 – Nov 1 (134 mm).

##### **Physical Characteristics Update:**

The lower 3.5 km (index site) of the Leiner River appears relatively stable; we saw no evidence of recent large scale bank slumping or erosion. It should be noted however that the right bank along Pete's Farm (Km 0.2) has been slowly eroding for the last 15 years and could be problematic in the event of a large flood. In 2003, Pete Chote of Pete's Farm fame reportedly said that he had lost about 2 acres of his farm due to river erosion over that last 2 decades.

#### 45.5. Update to Stream Survey Protocols

##### **Current assessment method:**

Chinook, Chum, Pink and Sockeye surveys focus on the lower 2 kilometers since these stocks mainly hold and spawn downstream of Marker 4 (bridge). Most Coho stocks migrate upstream of Marker 4 to 1500 meters of preferred spawning habitat in the stable pools and runs of the Leiner canyon. For Coho peak counts, the survey index section is expanded to include this upper habitat. In 2015 the peak count occurred on November 4 where 90% of the 490 fish counted were upstream of Marker 4

##### **Deviations from current assessment protocols:**

Method consistent with previous years.

##### **Access Updates:**

A local volunteer group has built a new walking trail to the Leiner River canyon. The trailhead sign is attached to a tree near the east side of the Head Bay Road bridge (Marker 4) and runs up the left bank (east side), eventually connecting to the old trail built by Eden and Associates in 2011. The 2011 trail extended from the (now gated) logging road west of the river, traversed east through a timber stand and crossed the Leiner River about 700 m above the Head Bay Road bridge (see Leiner River stream narrative). The new trail, called the Leiner River Boulder Patch Trail, provides a safer and more direct route for crews to access Marker 7 (Km 3.5) in the canyon.

##### **Safety Update:**

There are no safety issues outside the normal in-stream hazards present on the Leiner River. The new Boulder Patch Trail has provided an easier and safer hike into Marker 7 and has shortened the trip to 45 minutes.

## 45.6. Enhancement

### **Brood Removal:**

103 brood removed, produced 157,000 eggs. Note: 98 Chinook brood stock were captured from the Leiner on September 11, a few hours before the swim survey was conducted. The peak count of 620 adults on September 11 does not include the brood fish removed.

### **Other enhancement and restoration activities:**

Currently none.

## 45.7. Biosamples

126 Chinook were biosampled.

## 45.8. Concerns and Comments

1. Marker signs 3, 4, 5, 6 and 7 are missing and should be replaced next season.
2. The staff gauge at Marker 4 (Head Bay road bridge) should be replaced so water level readings can be taken after each swim.
3. Suggest transect site and staff gauge be surveyed in using a permanent benchmark to ensure continuity between years in the event of flood damage.
4. Suggest flow metering be done at transect installed in 2012 to facilitate development of a rule curve for discharge. Metering to be done after each swim survey.

Schedule a late August survey to obtain valid zero count.

With the new trail, we may want to start surveys at 7 rather than at the bridge, would add ~2 hours to the survey.

Starting to log in the Upper Leiner.

## 46. ZEBALLOS RIVER

### 46.1. Stream Summary

The Zeballos River flow south into the north end of Zeballos Inlet in Nootka Sound. The lower river runs through the town of Zeballos. It is a large river system that drains a large area. The mainstem is over 26 km long, but there are cascades at 1.3 km up from the mouth which are a barrier to salmon. The river below the cascades have been divided into three 500 m survey sections (Figure 46-1). Most of the watershed has been logged and the system is flashy. The canyon pool moderates flow in the lower river, however after strong rain events the system is usually too dangerous to swim.

The water colour is clear but gets very silty after a rain events. Observing conditions can be a problem on the Zeballos because of steep canyons creating low light levels. It is best to survey the system mid-day when the sun is highest. Visibility and species identification can be a problem in the pools.

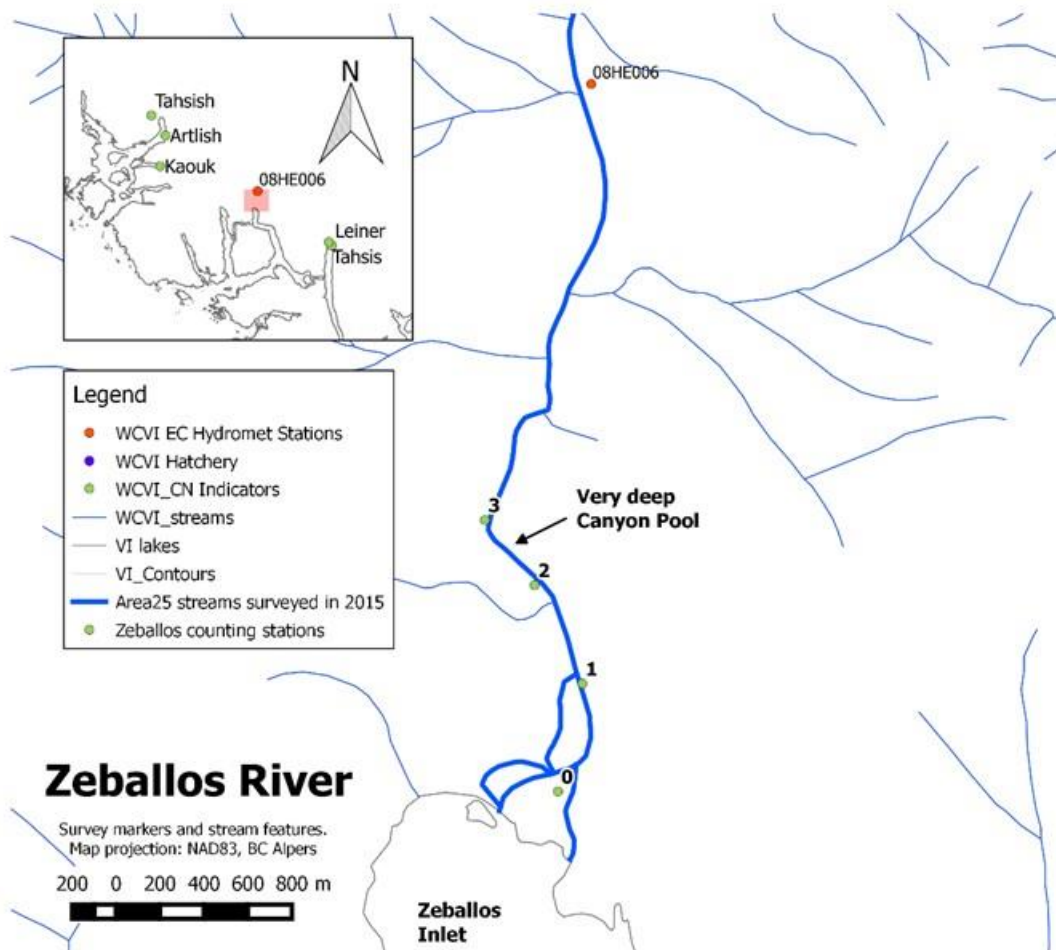


Figure 46-1. Zeballos River survey markers. Map inset show locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station on the Zeballos River at Zeballos (08HE006). Rivers and coastline are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.



There is an engineered overflow channel in the floodplain below the canyon that relieves floodwaters and acts as a spawning channel. Substrate is mostly cobble and gravel. Chum tend to spawn in the lower glides and upper tidal area. Chinook, Coho and Sockeye tend to spawn in the tail-out of the canyon pool. There is a bridge between markers 0 and 1.

There is a hatchery in Zeballos that is run as a collaboration between Ehattesaht and the Zeballos Elementary and Secondary School with a focus on Chum. Contacts are Elmar Nabb, Lyle Billy, Dave Ewart, Stacey Larson.

## 46.2. Survey results and escapement estimate

Survey Crew: DFO (E. Miyagi, P. Vek), BCCF (J. Atkinson, M. Friesen)

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

*Table 46-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
17-Sep-15	256		105		11		299		165	
21-Sep-15	300									
15-Oct-15	86		91				9200	106	75	15
26-Oct-15	259		427				5440	2983	235	5

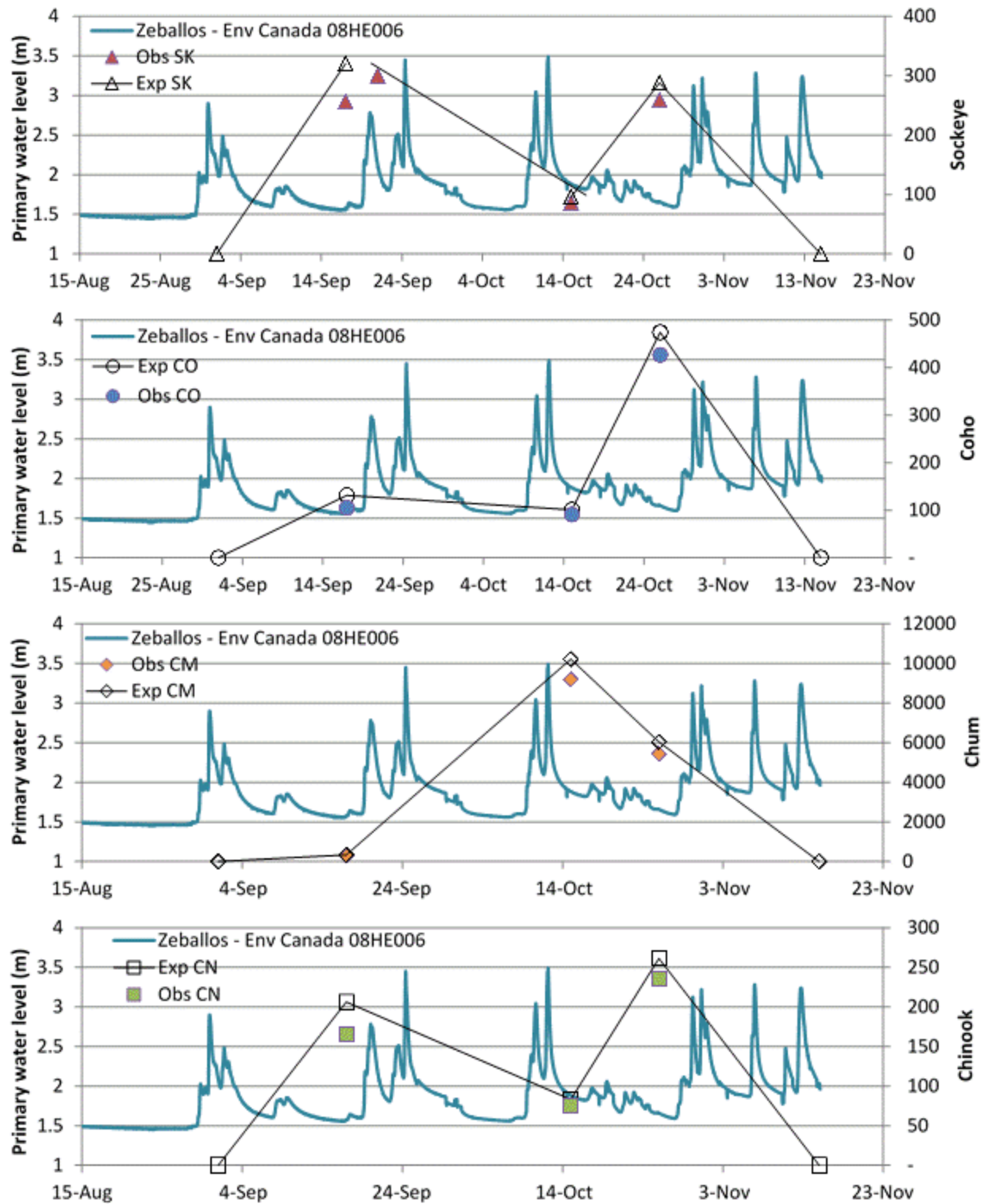


Figure 46-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station.

Table 46-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	N/A			
Coho	N/A			
Pink	N/A			
Chum	N/A			
Chinook	N/A			

Table 46-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
17-Sep-15	good	Water below normal (1.63m), water clear
21-Sep-15	poor	Water level above normal, poor visibility
15-Oct-15	excellent	Water level normal (1.83m), water slightly turbid (10m), less confident than Oct 26 (first swim for that crew on that system), raw count is conservative)
26-Oct-15	excellent	Water level below normal (1.63m), water clear (20m)

Table 46-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	320	PL+D	3
Coho	474	PL+D	3
Pink	Adults Present		3, too late for Pink peak observation
Chum	10,328	PL+D	2
Chinook	266	PL+D	2

### Escapement Commentary:

None provided

### 46.3. Spawner Distribution

#### Run Timing:

Table 46-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							Late Oct
Coho							
Pink							
Chum					Mid Sept	Mid Oct	Late Oct
Chinook							Mid Oct

**Comments:** Peak spawning not observed for Chinook, Coho or Sockeye.

#### Spatial distribution:

Table 46-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	3-2
Coho	
Pink	
Chum	3-0
Chinook	3-1
Steelhead	

### 46.4. Environmental Conditions

#### Weather Summary:

The weather in the Nootka Sound area in 2015 was characterized by an extremely dry spring and summer followed by a typical west coast fall consisting of short duration rain events interspersed with longer periods of cool, dry weather. There were 4 rain events recorded in Nootka Sound during the salmon migration period. The timing and precipitation amounts are as follows (Conuma Hatchery rainfall records): Aug 29 – Sep 2 (144 mm); Sep 19 – 25 (226 mm); Oct 7 – 11 (92 mm); Oct 29 – Nov 1 (134 mm).

#### Physical Characteristics Update:

None provided

### 46.5. Update to Stream Survey Protocols

#### Current assessment method:

Snorkel survey from canyon pool to tide-water

**Deviations from current assessment protocols:**

None

**46.6. Enhancement**

**Brood Removal:**

A few Chum broodstock (18) removed to Zeballos Hatchery.

**Planned Release Numbers and Strategy:**

**Other enhancement and restoration activities:**

Road raised and off-channel habitat built above the falls, so not accessible to salmon.

**46.7. Biosamples**

**46.8. Concerns and Comments**

Old fishing gear (mostly abandoned nets) are piled up in the willows above the bridge and a beach seine is in the canyon tail out pool on the right bank. Health and safety issue. Lots of bears as well.

Mainline road has been graded during rain, which puts a lot of silt into the river. They are not supposed to grade during rain, so incidents should be reported (BCTS) as contractor may not be aware of condition or is not adhering to conditions.

## 47. BURMAN RIVER

### 47.1. Stream Summary

The Burman River flows west into Matchlee Bay in Muchalat Inlet in Nootka Sound. Most of the watershed, including the headwaters, is located in Strathcona Provincial Park to the east which means there has been less logging activity. The system is 25 km in length and fed mainly by many small tributaries and snow melt. Popsicle Creek, located about 9 km from the mouth, is the largest tributary. The majority of spawning occurs in the lower 8 km of the system which has been divided into 500 m sections for salmon enumeration (Figure 47-1).

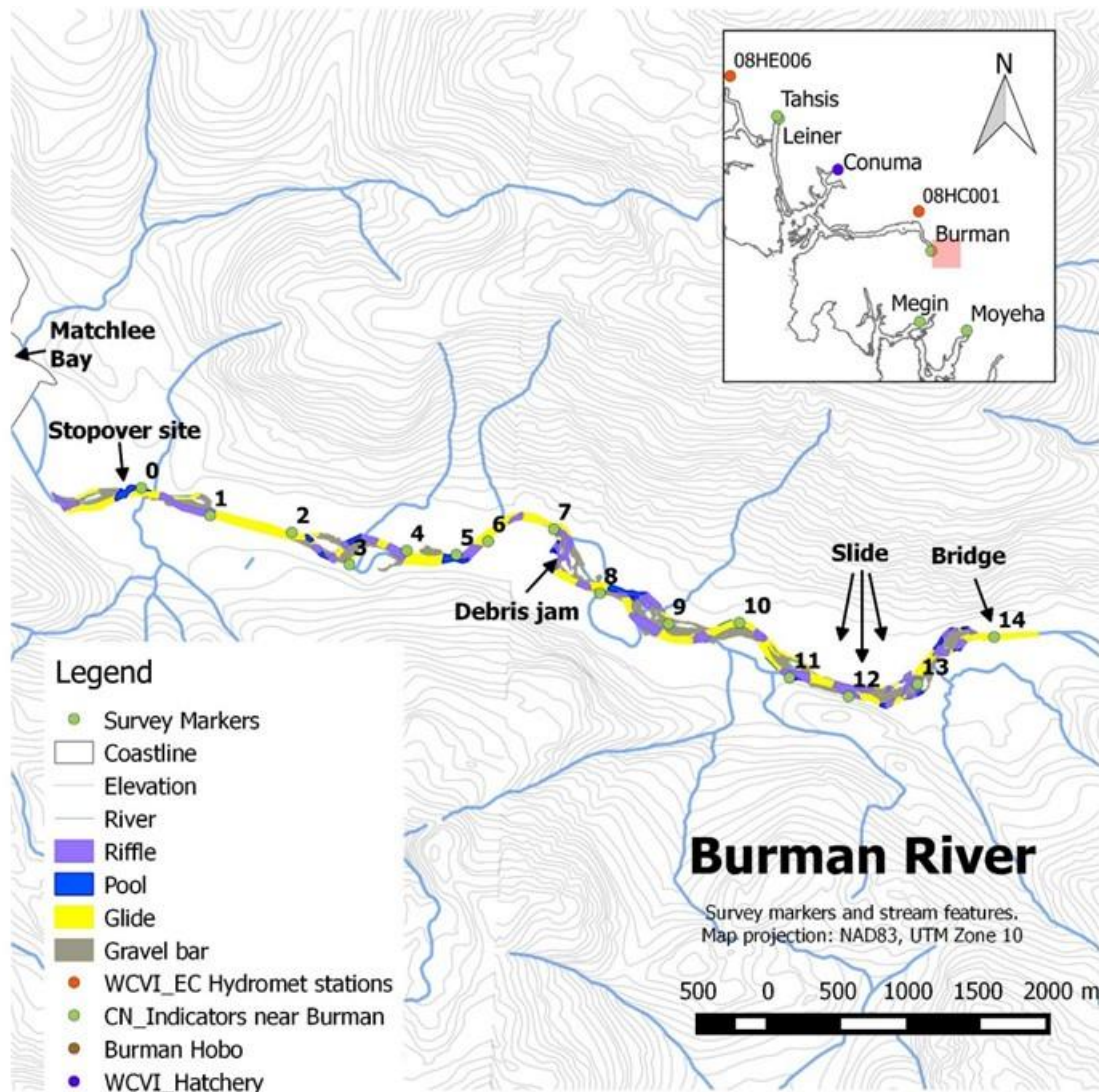


Figure 47-1. Burman River, habitat units and survey markers. Roads, rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. Map inset shows locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet station on the Gold River (08HC001).

In the upper survey sections, there are many runs, pools and short riffles. In the lower river there are longer riffles and glides with lots of gravel and excellent spawning habitat. The substrate consists of mainly mixed gravels and bedrock. The system is relatively stable, although in recent years erosion has been observed in upper survey sections.

The system has numerous pools and there large slide between markers 10 and 13 that entered the river years ago. Most fish spawn below the slide but observations are made above as well. There is a bridge at marker 14 which is also the location of the Hobo water monitoring station and the start of the survey. A unique feature of the Burman River is the stopover pool below marker 0 where fish hold for several days before moving to the spawning grounds. The pool is tidal and not part of the standard survey sections.

The Burman is generally described as a clear system. It rises quickly after rain events, but returns to normal levels within several days. During high water the system turns an opaque green color from high suspended sediment loads. The system accumulates algae on the rocks over the summer which is washed out with the first major rain event. The worst clarity is usually after this first rain event and for the rest of the fall and winter the system is generally clear.

In recent years there have been several restoration activities and tagging studies. DFO installed a hydrometric station with a HOBO data logger on the Burman River at survey marker 15 in August 2014. The system has been enhanced by the Conuma Hatchery since the 1980s.

## 47.2. Survey results and escapement estimate

Survey Crew: NTC/Muchalaht-Mowachat First Nation (R. Dunlop, G. Mark, K. Snook, J. Jack, D. Savey)

Stock Assessment Biologist: D.McHugh

### Individual Survey Data:

Table 47-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
28-Aug-2015*	0	0	0	0	0	0	0	0	200	0
04-Sep-2015	0	0	0	0	0	0	41	0	450	0
07-Sep-2015	576	0	175	0	0	0	984	0	924	0
10-Sep-2015	40	0	1	0	0	0	101	0	558	0
14-Sep-2015	617	0	146	0	12	0	489	0	1490	0
17-Sep-2015	294	0	45	0	0	0	325	0	1343	0
19-Sep-2015	19	0	19	0	0	0	53	0	714	12
21-Sep-2015	32	0	48	0	0	0	51	0	560	1
28-Sep-2015	861	0	327	0	11	0	960	0	3795	0
01-Oct-2015	187	0	57	0	0	0	1001	0	1060	0
05-Oct-2015	624	1	209	0	9	0	1071	0	1260	0
07-Oct-2015	341	0	99	0	10	0	1281	0	1712	0
13-Oct-2015	60	1	182	0	0	0	531	0	175	2
16-Oct-2015	105	0	241	0	0	0	2315	0	568	0
19-Oct-2015	262	7	829	0	0	0	2215	0	1062	2
21-Oct-2015	140	0	295	0	0	0	1529	0	650	0
26-Oct-2015	744	6	652	0	0	0	1190	0	158	15
28-Oct-2015	151	0	245	0	0	0	612	0	334	0
03-Nov-2015	146	0	687	0	0	0	105	0	55	0
09-Nov-2015	13	0	273	0	0	0	2	0	11	0

**Comments:** \*Bank walk by R. Dunlop, no fish in the survey area but 200 Chinook observed holding just below Marker 0.



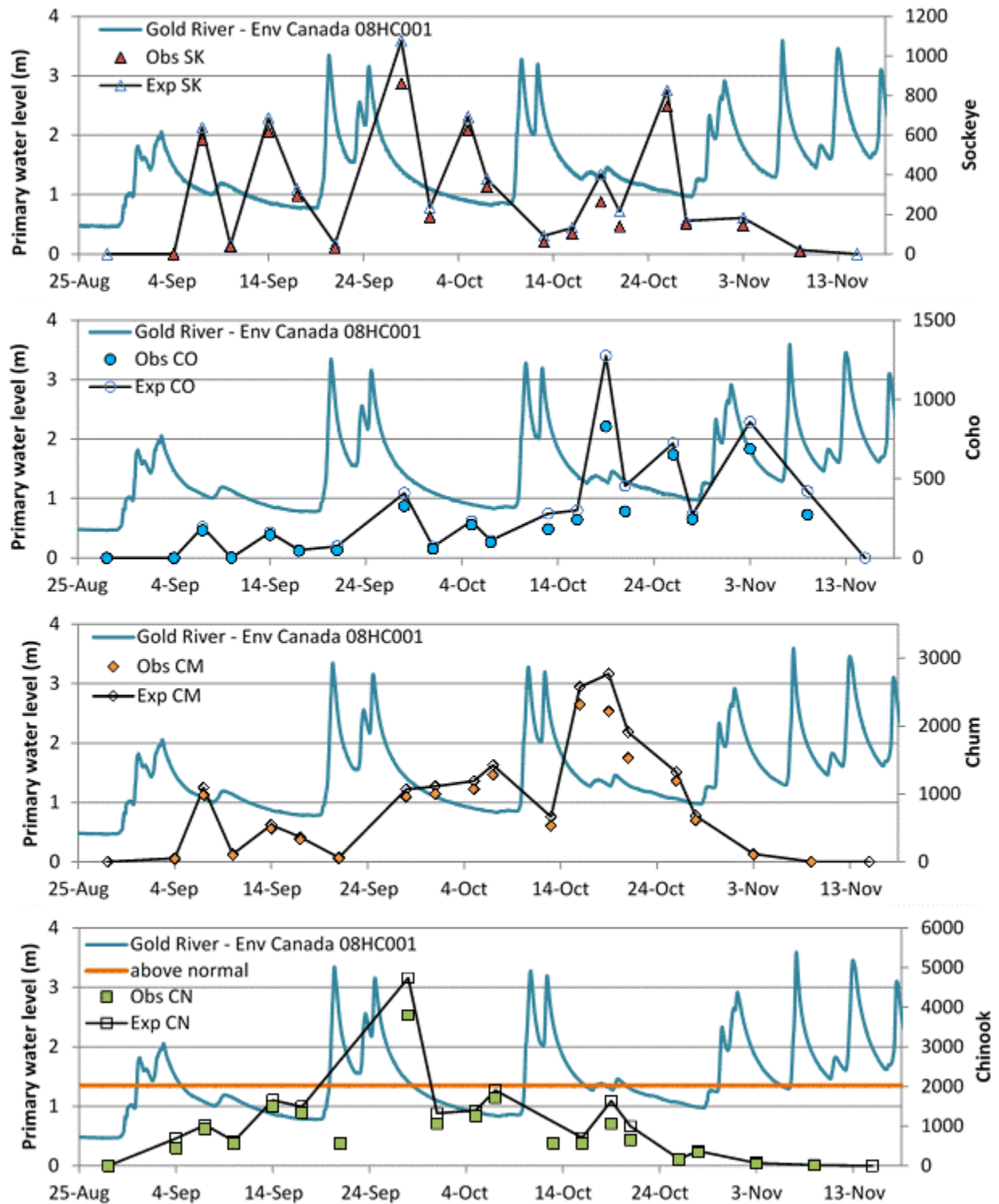


Figure 47-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station.

Table 47-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	25 (20-30)	Sept 1	Nov 15	
Coho	25 (20-30)	Sept 1	Dec 15	
Pink	NA			
Chum	15 (10-20)	Sept 1	Nov 15	
Chinook	15 (10-20)	Sept 1	Nov 15	

General comments: Based on the tagging work, the Chinook SL may be an over estimate.

Table 47-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
28-Aug-2015	excellent	water extremely low, water clear (>5m)
04-Sep-2015	fair	water above normal (1.387m), water clear
07-Sep-2015	excellent	water below normal (1.035m), water clear (>5m)
10-Sep-2015	excellent	water below normal(1.1m), water clear (>10m)
14-Sep-2015	excellent	water below normal(0.853m), water clear (>5m)
17-Sep-2015	excellent	water below normal (0.785m), water clear (>5m)
19-Sep-2015	N/A	water normal (0.943m), water tea (3-5m), spot check from hatchery staff during broodstock removal via beach seine
21-Sep-2015	fair	water above normal (2.025m) and slightly turbid
28-Sep-2015	good	water normal (1.35m), water slightly turbid (<5m)
01-Oct-2015	good	water normal, water clear
05-Oct-2015	excellent	water below normal, water clear (10m)
07-Oct-2015	excellent	water below normal (0.70m), water clear (13m)
13-Oct-2015	fair	water above normal (1.3m), water slightly turbid (6m)
16-Oct-2015	good	water normal (1.336m), water clear (13m)
19-Oct-2015	fair	water below normal (1.358m), water clear (13m)
21-Oct-2015	fair	water above normal (1.261m), water clear (13m)
26-Oct-2015	excellent	water below normal (1.048m), water clear (13m)
28-Oct-2015	excellent	water below normal (0.977m), water clear (15m)
03-Nov-2015	good	water normal (1.694m), water tea
09-Nov-2015	fair	water above normal (1.701m), water tea (13m)

Table 47-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	1,189 (991-1,486)	Expanded Area Under the Curve	3
Coho	1,334 (1,112-1,668)	Expanded Area Under the Curve	2
Pink	14	Expanded Peak Live + Dead	3
Chum	4,839 (3,630-7,259)	Expanded Area Under the Curve	2
Chinook	6,035 (4,527-9,053)	Expanded Area Under the Curve	2

### Escapement Commentary:

#### Coho Return:

Coho pass through the survey area, peak abundance fairly late, though this is typical of the run.

## 47.3. Spawner Distribution

### Run Timing:

Table 47-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Mid Sept	Late Sept	Early Oct
Coho						Late Oct	
Pink							
Chum					Mid Sept	Mid Oct	Late Oct
Chinook					Mid Sept	Late Sept	Early Oct

### Spatial distribution:

Table 47-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	also use side channel habitat
Coho	
Pink	
Chum	Markers 7 down to 0, favoring 7-6 and 3-2, also use side channel habitat
Chinook	Throughout from 13 down, preferring everywhere other than 10-9, also use side channel habitat between markers 5-6 (logjam)
Steelhead	

**Comments:** % Spawning not recorded by section, all species start at section 2, in previous years Chum mostly 6 down and Chinook throughout,

#### 47.4. Environmental Conditions

##### **Weather Summary:**

The weather in the Nootka Sound area in 2015 was characterized by an extremely dry spring and summer followed by a typical west coast fall consisting of short duration rain events interspersed with longer periods of cool, dry weather. There were 4 rain events recorded in Nootka Sound during the salmon migration period. The timing and precipitation amounts are as follows (Conuma Hatchery rainfall records): Aug 29 – Sep 2 (144 mm); Sep 19 – 25 (226 mm); Oct 7 – 11 (92 mm); Oct 29 – Nov 1 (134 mm).

##### **Physical Characteristics Update:**

Some significant erosion Section 4-3 which allowed a major deadfall to enter the river and split the channel. May have entered the estuary during winter storms.

Bank has eroded ~20m in section 14-13 (top/slide pool), headed for a boulder landslide.

Pool at the side channel, gravel bar has moved 20m downriver.

#### 47.5. Update to Stream Survey Protocols

##### **Current assessment method:**

Two swimmers from marker 14 to 0 starting at the beginning of September every 7-10 days through October for a total of 6-8 surveys.

##### **Deviations from current assessment protocols:**

As in 2009-2014, a Mark-Recapture project was conducted by the NTC to estimate the Chinook abundance. So quite a few additional surveys occurred to support that estimation method, which requires recaptures of tagged fish, well in excess of the number (5-8) typically used to estimate the escapement based on the AUC method typically used.

##### **Access Updates:**

Permanent dock has been installed, but portable bridges in the lower river may be removed. When accessing you should inform the MMFN fisheries manager.

##### **Safety Update:**

The BCTS are still planning to fly out a large amount of timber, so we need to avoid their flight path. Road is likely to be blocked by windfall, some quite large, bring two chainsaws and winch.

#### 47.6. Enhancement

##### **Brood Removal:**

257 Chinook removed by Conuma Hatchery

##### **Planned Release Numbers and Strategy:**

Chinook: 350,000 net pen release to estuary, 6g target

#### 47.7. Biosamples

All brood sampled as well as deadpitch (130 otoliths, 5-600 scales).

#### 47.8. Concerns and Comments

Sea lions seen three times in the tagging pool, 1 to 2 plus one harbour seal.

## 48. ESPINOSA CREEK

### 48.1. Steam Summary

Espinosa Creek flows south into the head of Espinosa Inlet with the Nuchatlaht First Nation village of Oclucje located at the mouth. The mainstem is about 8 km long, but only the lower 1.1 km is surveyed because of falls which are a barrier to migration. The water colour is generally clear and the riparian is mature forest. The survey starts at a pool at the base of falls. All salmon species may be found throughout the system with Chum more abundant in the lower system.

### 48.2. Escapement estimates

Survey Crew: DFO (E. Miyagi, P. Vek)  
Stock Assessment Biologist: D. McHugh

Table 48-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
18-Sep-2015	25	0	3	0	22	0	33	0	5	0

**Comments:** Excellent survey conditions but poor survey coverage.

### 48.3. Escapement comments:

SK: 28 Expanded Peak Live + Dead, Level 3  
PK: 24 Expanded Peak Live + Dead, Level 3  
CO: Adults Present  
CM: Adults Present  
CN: 6 Expanded Peak Live + Dead, Level 3

Chum was the primary survey target. Survey was conducted before the peak of the Chum run, but based on the SK, PK, and CN observations in adjacent systems, a significant portion of the SK, PK, and CN run should have been present.

### 48.4. Environmental Conditions

Conditions were normal with high visibility.

### 48.5. Survey protocols

Stream walk/Snorkel: Survey site is at the end of Espinosa Inlet. There is road access via the Zeballos to Fair Harbour road or there is a dock near the end of the inlet if accessing the site by boat. Access to the site is located in the village of Oclucje of the Nuchatlaht First Nation. It is advised that surveyors contact the First Nation ahead of time to inform the Nuchatlaht of your visit. If mooring at the dock, you will need to walk with your gear on, along the road until you reach the village (~1000m). From the village, walk along the bottom road that follows the shoreline and continue on until you reach a treatment plant (sea can). The creek is on the left and there is a worn path that runs along the creek. When the path strays from the creek bank, you have to walk in the stream until you reach the waterfall barrier. The survey starts at the waterfall.

## 49. LITTLE ZEBALLOS RIVER

### 49.1. Stream Summary

The Little Zeballos River flows west then south into Zeballos Inlet. The mainstem length is over 11 km but only the lower 3 km are surveyed. The Little Zeballos River watershed has been heavily logged and the stream is a flashy with much gravel movement and changes in stream channel morphology and braiding annually. It tends to be ephemeral especially during summer months. Its surveyed length is mostly low gradient ~2% with mostly cobble and gravel substrate. Water colour is described as 'gin clear' but will be silty during high water events. Riparian is a young forest. Much of the spawning activity takes place in side channels. There are large gravel fans and little deep pool habitat in the mid reaches of stream.

### 49.2. Escapement estimates

Survey Crew: BCCF (J. Atkinson, M. Friesen), DFO (E. Miyagi, P. Vek)  
Stock Assessment Biologist: D. McHugh

Table 49-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
17-Sep-2015	6	0	28	0	2	0	14	0	9	0
26-Oct-2015	10	0	98	0	0	0	2339	1238	8	0

### 49.3. Escapement comments:

SK: 11, Expanded Peak Live + Dead

PK: Adults Present

CN: 10, Expanded Peak Live + Dead

CO: 109, Expanded Peak Live + Dead

CM: 3,837; Expanded Peak Live + Dead. Chum count missed the adult peak so focused on getting a good count of carcasses. All Level 3 estimates.

### 49.4. Environmental Conditions

Conditions for both surveys were normal. Low flow conditions with high visibility.

### 49.5. Survey protocols

The survey is conducted by bank walk and sticking head in pools. The site is accessed by boat. Boat is anchored off shore and a skiff used to get to shore. There is an overgrown old road that can be followed along the stream banks. When the road turns away from the river you must walk upstream and along banks until you reach the confluence of Friend Creek. The survey is started at Friend Creek. There are no markers on the system and surveyors count by habitat unit.

### 49.6. Concerns and comments

Access trail is heavily overgrown and could use maintenance. Stream markers would be beneficial if this stream is to be surveyed more.

## 50. PARK RIVER

### 50.1. Stream Summary

The Park River flows south into Queen Cove on the east side of the inlet, Port Eliza. The mainstem length is 8.5 km and the lower 2.5 km is surveyed. Park River is lake buffered. It is stable and maintains a fairly consistent flow. High quality spawning gravel is available throughout most of its length but there are few holding pools. The gradient is 2% or less throughout. Much of the watershed has been logged in recent years, but there is a generous buffer of old growth conifers along the creek. The water colour is like tea and surveyors comment it is hard to see in the pools.

### 50.2. Escapement estimates

Survey Crew: BCCF (J. Atkinson, M. Friesen), DFO (E. Miyagi, P. Vek)  
Stock Assessment Biologist: D. McHugh

Table 50-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
18-Sep-2015	0	0	7	0	0	0	12	0	0	0
27-Oct-2015	0	0	134	0	0	0	440	2794	0	0

**Comments:** Stream was surveyed before and after the peak Chum spawn.

### 50.3. Escapement comments:

SK: None Observed  
CM: 3,344; Expanded PL+D  
CO: 206, Expanded PL+D  
CN: None Observed

All estimates are Level 3; by Oct 27 bears seemed satiated with few partially eaten carcasses, indicating a large number of Chum had come and gone.

### 50.4. Environmental Conditions

Water levels were low and visibility was medium at best (heavy tannins in water).

### 50.5. Survey protocols

The survey is mostly a stream walk. There is quite a bit of very large woody debris and bears.

Park is accessed by boat. Boat can be moored at a private dock in Queens Cove and a skiff used to get close to the river confluence. Depending on the tides and river conditions, access may be difficult. If conditions allow you should be able to reach the lake and start the survey from there. There are no trails aside from a few game trails that can be followed some of the way. To get all the way to the lake, you will have to walk in stream. Conditions navigating in stream can be dangerous. There is a lot of LWD and blow down trees. There was signs of heavy bear presence although none were seen. Park River is secluded with very confined



survey conditions. Surveyors must be prepared for all situations. Stream markers are present (some missing) but can be easily missed.

## 50.6. Enhancement/restoration activities

## 50.7. Concerns and comments

Park and Espinosa surveys can be completed in the same day. Active logging in the area.



*Figure 50-1. Typical large woody debris (LWD) and pool on Park Creek. Photo taken on Sept. 18, 2015 by the survey crew.*

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## 51. TLUPANA RIVER

### 51.1. Stream summary

The Tlupana River flows southwest into Nesook Bay, on the northeast side Tlupana Inlet in Nootka Sound. The mainstem is 15 km long and the lower 5 km are surveyed for salmon enumeration. The system is stable with old growth in the watershed. There has not been as much logging as other watersheds and the system is relatively slow to respond to rain events.

### 51.2. Escapement estimates

Survey Crew: Conuma Hatchery

Stock Assessment Biologist: D. McHugh

*Table 51-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
9-Sep-2015	1	0	4	0	0	0	210	0	18	0
15-Oct-2015	15	0	24	0	0	0	315	250	2	500

**Comments:** Conuma River Hatchery staff conducted a survey using a boat and beach seine in the lower pool on 2015-09-25; visited the river 5 times between 2015-09-30 and 2015-10-09 to do Chum broodstock removal and did a bank/walk survey on 2015-10-15. Poor survey coverage in 2015.

### 51.3. Escapement comments:

SK: 19, Expanded PL+D

PK: None Observed

CN: 502, Expanded PL+D

CO: 30, Expanded PL+D

CM: 600, Expanded PL+D

Surveys missed the peak Chum and Chinook. Chinook were relatively high based on the number of mortalities observed. Probably 3-4,000 based on expert opinion of hatchery staff. Only a low portion of carcasses are typically retained.

### 51.4. Environmental Conditions

Sep 9 survey had high water with poor visibility. Oct 15 survey had low water with high visibility.

### 51.5. Survey protocols

Sep 9 survey was a boat survey and beach seine in lower pool to assess brood, conditions were not ideal. Oct 15 survey was a bank/stream walk with ideal conditions and visibility.

### 51.6. Enhancement/restoration activities

Chum: 543 Chum brood removed by Conuma Hatchery (Sep 30-Oct 9)

## 52. OKTWANCH RIVER

### 52.1. Stream summary

The Oktwanch River flows southwest into the Gold River. The lower 3.5 km are surveyed for salmon enumeration.

### 52.2. Escapement estimates

Survey Crew: Muchalaht-Mowachat First Nation Fisheries (G. Mark, K. Snook, J. Jack)

Stock Assessment Biologist: D. McHugh

*Table 52-1. Unexpanded live and dead counts by species for each survey.*

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
17-Oct-2015	160	0	110	0	0	0	1	0	52	0

### 52.3. Escapement comments:

SK: 200, Expanded PL+D  
CO: 137, Expanded PL+D  
PK: None Observed  
CM: Adults Present  
CN: 65, Expanded PL+D

Surveys missed the peak Chum and Chinook, target species was Sockeye.

### 52.4. Environmental Conditions

Oct 17 survey had above normal water with tea coloured water.

### 52.5. Survey protocols

Oct 17 survey was a snorkel swim with moderate conditions and visibility.

### 52.6. Enhancement/restoration activities

None.

*STREAMS IN AREA 26*

## 53. AREA 26 SUMMARY OF OBSERVATIONS IN 2015

Over 25 streams in Area 26 have records of spawning salmon. The priority for escapement enumeration are the Chinook indicator stocks in Kaouk River, Artlish River and Tahsish River. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most systems are surveyed using the snorkel method described in the DFO snorkel survey manual. Occasionally systems are also surveyed by stream or bank walks.

In 2015, 14 systems were surveyed in Area 26 (Figure 53-1). The three indicators as well as Malksope were surveyed frequently enough to allow a reliable application of the Area Under the Curve (AUC) estimation method for most species. Other systems were surveyed less frequently with the intent of making a less reliable, minimum estimate of escapement, usually based on the expanded Peak Live + Dead count. Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups. There are no hatchery activities on systems in Area 26.

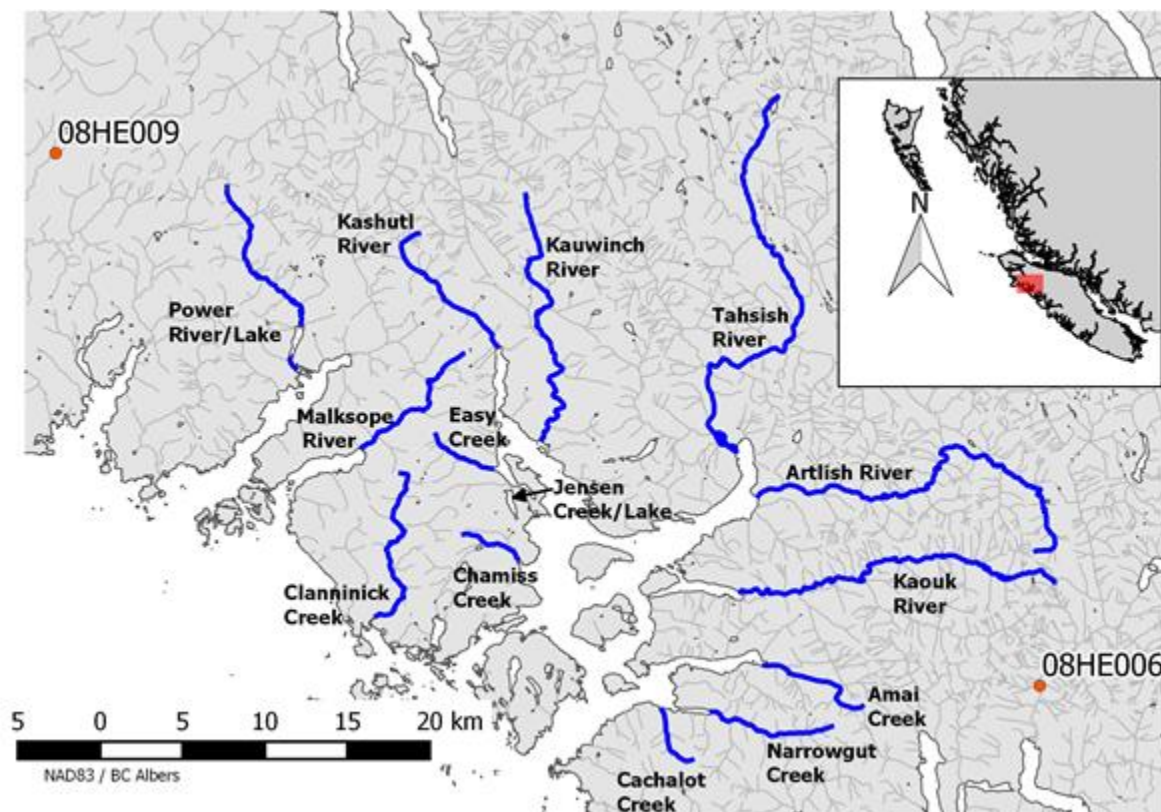


Figure 53-1. Streams in Area 26 that were surveyed in 2015. Environment Canada Hydromet stations on the Zeballos River (08HE006) and Klaskish River Near Klaskino Inlet (08HE006) indicate flow on nearby ungauged systems. A DFO hydromet station was installed in Kaouk in Sept. 2014.

The 2015 survey results from Area 26 were reviewed at a post-season escapement review workshop held at the Maritime Heritage Museum in Campbell River on February 18, 2016. Workshops participants (Table 53-1) reviewed and discussed the individual survey results and escapement estimates. This discussion is captured in the commentary below. Participants also

discussed quality of the observations and classified the estimates according to how they can be used for management purposes. Most of the commentary in the stream summaries was derived from the stream narratives which have been completed by numerous surveyors over the past 20 years.

*Table 53-1. Participants at the Area 26 escapement review workshop in Campbell River on February 18, 2016.*

<b>Participant</b>	<b>Affiliation</b>
Stephanie King	Sea This Consulting (organizer)
Diana McHugh	DFO, Stock Assessment (organizer)
Ron Frank	Maa-nulth Contact
Frank Dragon	Ka:'yu:'k't'h'/ Che:k'tles7et'h (Kyuquot/Checlesah First Nation)
Shane Johnson	Escapement Contractor, LGL
Tony Hansen	Ka:'yu:'k't'h'/ Che:k'tles7et'h (Kyuquot/Checlesah First Nation) Fisheries Manager

Several observations that were common for systems in Area 26 included:

- Very dry conditions in spring and summer
- Normal conditions in September through November with regular moderate rain events meant that survey conditions were generally good and there was good coverage through the season
- Coho were generally small and there were a high percentage of Coho Jacks
- Chinook return was average compared to last year
- Chum return was okay in larger Chum systems but seems to be declining in smaller systems
- Sockeye return was higher than in recent years
- Several systems had the first observations of Pinks in recent years

Workshop participants discussed the on-going conservation concerns for Chinook populations in Kyuquot Sound due to low numbers observed. There was also an interest in collecting Sockeye biosamples (DNA).

## 54. KAOUK RIVER

### 54.1. Stream Summary

The Kaouk River flows west into the head of Fair Harbour in Kyuquot Sound. There are campground and a marina to the south of the estuary. The system is over 20 km in length and is fed by many small tributaries and surrounding mountains. The largest tributary is Rowland Creek which enters the Kaouk about 7.5 km upstream (Marker 15, Figure 54-1). Spawner surveys cover 8.5 km in the lower river, in 17 - 500 m survey sections. The survey starts just above the bridge at marker 17. The upper survey sections are primarily pool and riffle habitats with gravels and cobble as the most common substrates as well as some boulders. In the lower portion, the habitat has all meso-habitat features, but is primarily composed of riffle and glide habitats. The substrate is mostly composed of cobbles and boulders. There is suitable rearing and spawning habitat throughout the survey area.

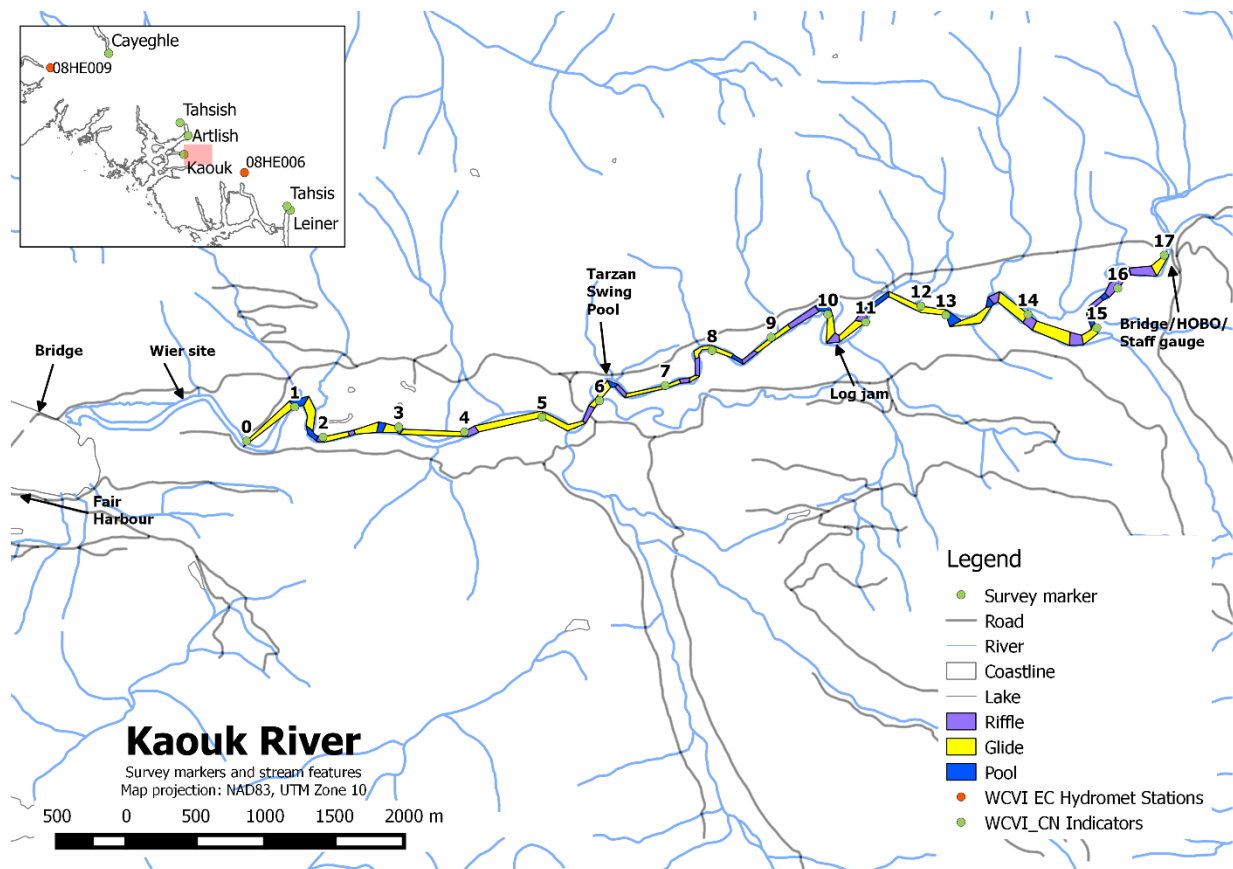


Figure 54-1. Kaouk River counting stations and habitat units. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.



There are several deep pools including those at marker 6, markers 10 and between markers 11 and 12. Historically, there was also a bridge below markers 6. The abutments still remain and the bridge was replaced by hydro lines which now cross the system. A counting fence was installed in 2009. The fence was washed out, but the weir footings still remain.

There is a lot of wood and debris in the system. In recent years erosion has been noted in many locations of the system, especially around markers 16 and 17, and pools have been filling in. The sections downstream of marker 6 have a lower gradient and tend to be more stable.

The Kaouk discharge is described as flashy; the water can increase by more than 2 meters in a day. Surveyors comment that the water clarity is good, but that compared to the nearby Artlish River the Kaouk is generally more turbid and also takes longer to clear. As with many other systems on the west coast of Vancouver Island, the water clarity deteriorates quickly with increasing flow after rain events. In 2014, DFO installed a hydrometric station at survey marker 17 on the Kaouk. The Environment Canada monitoring station on the Zeballos River (08HE006), about 20 km to the east-southeast of the mouth, is also a good indicator of flow on the Kaouk.

There is a relatively large seal population in the estuary and locals are concerned about the impact on returning Chinook. The seal population is largest when the salmon are holding in the estuary prior to the first large rain event.

Logging has been absent from the watershed for ~8 years. The steep mountains have obvious signs of both conventional and helicopter logging activities. The upper Kaouk watershed has been extensively logged in the recent past.

## 54.2. Survey Results and Escapement Estimate

Survey Crew: NWISEA, KCFN/LGL

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

Table 54-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
08-Sep-15	66		311	1	1		10		147	
17-Sep-15	69		420		9		105		202	
26-Sep-15	56		658				1469	1	208	
02-Oct-15	60		1050	1			1612	3	110	1
08-Oct-15	44		1665	1	1		1825	9	50	2
16-Oct-15	48		2160		0		5933	56	18	5
27-Oct-15	39		1581	2			4395	2110	6	
03-Nov-15	23		847	1			1179	293	1	
09-Nov-15	13		853	1			207	121	1	
14-Dec-15*			482	14				1		

**Comments:** \* Dec 14 survey covered Markers 22-0 to look at what proportion of the Coho were spawning above the standard Chinook-focused survey section (~1/3).



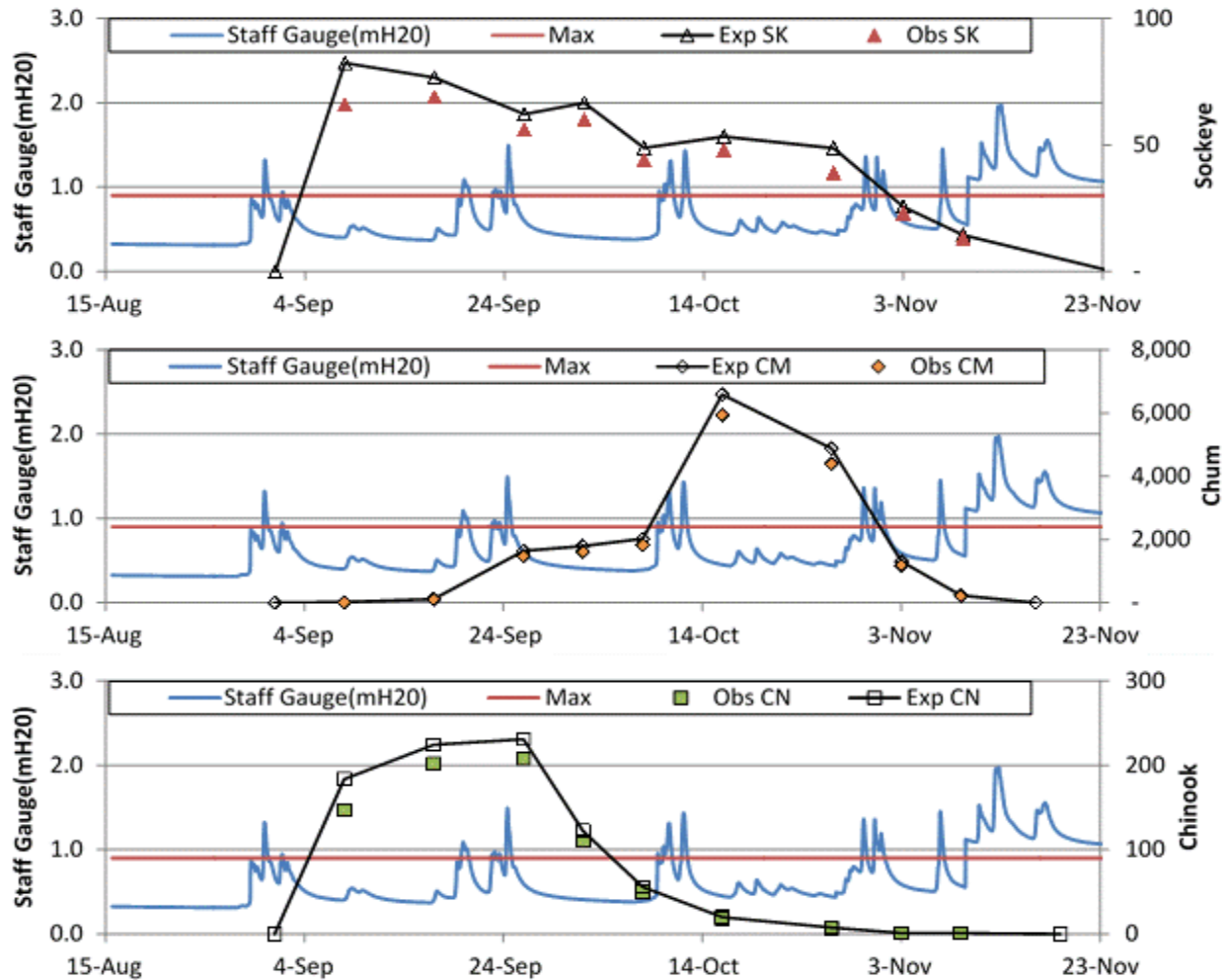


Figure 54-2. Raw counts (closed marker) and expanded counts (open marker) for Sockeye, Chum and Chinook (Coho is shown below). The water level/discharge is from the DFO hydrometric staff gauge on the Kaouk. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns. Note: The staff gauge reading starting Nov 9<sup>th</sup> is roughly 1m higher than the true reading due to the sensor being knocked over by a high water event.

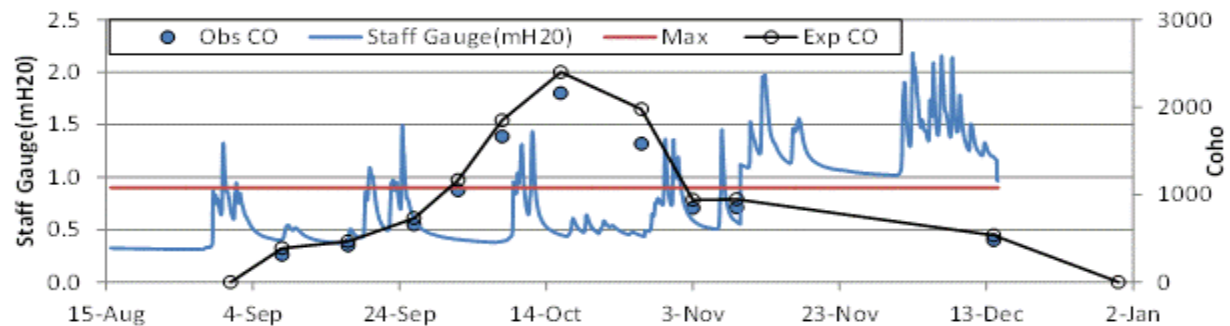


Figure 54-3. Raw counts (closed marker) and expanded counts (open marker) for Coho (note difference in date range). The water level/discharge is from the Hobo hydrometric staff gauge on the Kaouk. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns. Note: The staff gauge reading starting Nov 9<sup>th</sup> is roughly 1m higher than the true reading due to the sensor being knocked over by a high water event.

Table 54-2. Survey life and rational for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	30 (25-35)	Sep 1	Nov 15	
Coho	35(30-40)	Sep 1	Dec 31	
Pink	NA			
Chum	15 (10-20)	Sep 1	Nov 15	
Chinook	20 (15-25)	Sep 1	Dec 15	

Table 54-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
08-Sep-15	good	Water level normal (0.51m, 2.76cms), and slightly turbid (8.8-10.5m)
17-Sep-15	excellent	Water level below normal (0.5m, 2.38cms), and slightly turbid (6-7m)
26-Sep-15	excellent	Water level low to moderate (0.55m), and slightly turbid (11-13m)
02-Oct-15	excellent	Water level below normal (0.418m), and clear (14-15m)
08-Oct-15	excellent	Water extremely low (0.404m) and clear (14m)
16-Oct-15	excellent	Water level below normal (0.45m, 2.11cms) and clear (14m)
27-Oct-15	good	Water level normal (0.442m, 0.96cms) and clear (14-15.5m), % habitat observed roughly 85%
03-Nov-15	excellent	Water level normal (0.516m, 2.54cms) and slightly turbid (11-12m)
09-Nov-15	excellent	Water level normal (0.5m), and clear (11-13m)
14-Dec-15	excellent	Water level normal (0.547m) and clear (13m)

Table 54-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	120 (103-144)	Expanded Area Under the Curve	2
Coho	3,223 (2,820-3,760)	Expanded Area Under the Curve	2
Pink	9	Expanded Peak Live + Dead	3
Chum	10,274 (7,705-15,410)	Expanded Area Under the Curve	2
Chinook	331 (265-441)	Expanded Area Under the Curve	2

## Escapement Commentary:

### *Sockeye Return:*

Increase from last year.

### *Coho Return:*

In 2015, there were a large % of jacks and the adult Coho Salmon were smaller than in the past years. On Dec 14, a late season snorkel survey was conducted that included section marker 22, the falls down to section marker 0, completed by two swim crews. Section 23-17 are not part of the usual survey section, but was included to see what proportion of the Coho population may leave the survey area (roughly 1/3).

### *Chum Return:*

Moderate return relative to the twelve year average

### *Chinook Return:*

Moderate return relative to the twelve year average. Extensive work was done to collect Chinook biological samples from dead Chinook for baseline samples and for a Chinook run-reconstruction project being conducted. 29 Chinook samples were collected, 3 of which were 'jacks', and one sample no otoliths were collected. Sections 14-13 and 5-4 were locations where Chinook seemed to hold, spawn and die. A majority of the dead pitch samples were collected from these two spots.

## 54.3. Spawner Distribution

### Run Timing:

Table 54-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Aug	Mid Oct	Early Nov
Coho					Mid Sept	Late Oct	Early Dec
Pink					Late Aug	Mid Oct	Early Nov
Chum					Late Sept	Mid Oct	Early Nov
Chinook					Late Aug	Mid Oct	Early Nov

### Spatial Distribution:

Table 54-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Marker #14 to 5
Coho	Marker #22 to 2, the extended survey in Dec observed a third of the Coho spawning above Marker #17
Pink	Unknown
Chum	Marker #16 to 0, well distributed due to relatively high returns
Chinook	Marker #15 to 3, but mostly hold in pool at Marker 14 and spawning in glide just up stream, between 6 and 5 is also a good spawning location

**Comments:** This is typical of this watershed.

## 54.4. Environmental Conditions

### **Weather Summary:**

As there were eight surveys the weather conditions varied. The weather was primarily sunny and dry. There were several high water events during late summer and fall. Overall, conditions were relatively normal compared to previous years during Sept to Nov period. Weather was particularly hot and dry through the spring and summer.

### **Physical Characteristics Update:**

Water clarity was clear; bank erosion in several locations (i.e., Marker 14 and 11) throughout the reach; high bedload movement (i.e., extensive gravel bars). A log jam spanning the channel, located in reach 11 was still present in Nov but was blown out in Dec (Figure 54-4). There has been some in-filling above the logjam, and the pool used to be larger. River avulsed from mainstem ~300m upstream of marker 2. It joins a side channel and mainstem now has ~30-40% of the flow, side channel rejoins main channel ~100m downstream.

## 54.5. Update to Stream Survey Protocols

### **Current Assessment Method:**

The 8.5 km snorkel survey is conducted by two or more surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately four hours from the start of the survey and back. Water temperature, discharge, staff gauge height and horizontal visibility were measured during the surveys.

In previous years, NWISEA would conduct six or seven snorkel surveys on the Kaouk River, with LGL and KCFN only conducting one or two surveys. The KCFN/LGL surveys would occur near the end of the escapement curve with a focus on Coho and Chum. In 2015, LGL and KCFN conducted eight surveys on the Kaouk River and NWISEA conducted 2 surveys.

### **Deviations from current assessment protocols:**

On December 14, 2015, the upper portion (Marker 22 to 17) of Kaouk River was surveyed, to determine the abundance of adult Coho Salmon and habitat quality. A crew of two surveyed from marker 22-10 and another crew surveyed from marker 10-0.

### **Access Updates:**

Access is via the Fair Harbour main logging road by vehicle. The bridge over the Kaouk River at the 10 km marker is the survey start access point, and also where the HOBO site is located. Access to river section 14-13 can easily be accessed by following the creek at 9km marker on Fair Harbour Main down to the river. The Fair Harbour main follows the river and at several point the river is visible and accessible from the main road. The mid-point of the survey, just above river marker 6, also known as the swimming pool or Tarzan swing pool is probably one of the easiest and best known access points. This is located at approximately 5.5 km on the Fair Harbour Mainline. Below river marker 6, there is little access to the river. Access to the end of survey point, marker 0, is via an old road off the Fair Harbour Mainline at approximate 2.5 km.

There are some ribbons at the road entrance, but the road is still easy to miss. There is also good access to the river at the old counting fence site. There is a big yellow gate with a short road that ends at a high bank overlooking the river. There is a trail down to the river, but is becoming overgrown as the trail and site is not being used.

The Kaouk River was accessed by boat from the Kyuquot Village (approximately a 45 minute run) and then by road. A driver dropped off the swim crew at the start point of the survey (Fair Harbour mainline bridge) and then picked them up at a spur road near marker 0 (50°4'0.54"N; 127°4'58.60"W)

#### **Safety Update:**

There was a high abundance of bears in the area. During one survey, 9 bears in five km (Marker 10-0) were observed. There was also a high abundance of LWD throughout the survey. River channel is changing course continuously, so swimmers need to be aware of the LWD build ups and changes in river course.

### **54.6. Enhancement**

No known hatchery, enhancement or restoration activities.

### **54.7. Biosamples**

A total of 29 Chinook samples were collected (3 of which were jacks, 1 sample had no otoliths). Various methods were used to collect samples. A long pole with a hook on the end was used to retrieve carcasses from a couple of deep pools. A small tangle net was also used in section 14-13 and 5-4 where there were a high number of post spawn Chinook holding. Other Chinook samples were collected by snorkel crews that came across dead Chinook during snorkel surveys.

On October 7, 2015, one Chinook biosample was taken in reach 5-4. On October 8, 2015, two Chinook biosamples were taken in reach 11-10 and 5-4. On October 8, 2015, five Chinook biosamples were taken in reach 14-13 and one in reach 4-3. Three of the Chinook were post spawned and alive; the other three were morts. The biosample information included: Date, River Segment, Fork Length (mm), POH Length (mm), Adipose clip (Y/N), Scales, Otoliths, DNA, Sex (M/F), Egg Retention and Carcass Condition. Once the samples and information were gathered the caudal fin was then cut off. The information was then forwarded to DFO staff.

Samples were collected as part of a West Coast Vancouver Island Chinook run reconstruction project being conducted by DFO Stock Assessment. These samples will also be used to build the Chinook DNA baseline for the Kaouk River.

### **54.8. Concerns and Comments**

The stream avulsion near marker 2 has reduced flow to the historic channel for ~100m, which encompasses a couple of important holding pools. A plan to maintain flows was recommended. The Kaouk River is a flashy system that has high bedload and LWD movement. This has led to periodic increases to sediment input into the river.

In the months of September and October, there is significant fishing pressure on the river by recreational anglers and by guide outfitters. It is all catch and release targeting Coho, and likely has little impact.

There is an interest in getting Sockeye biosamples (DNA).

Extend survey area in 2016 to include more of the upstream habitat not normally surveyed.



*Figure 54-4. Upper photo: Looking downstream at a log jam in reach #11 of the Kaouk River. Lower photo: . Looking downstream at the Kaouk River, from the Fair Harbour mainline bridge (photo credits: Shane Johnson, November 16, 2012).*

## 55. ARTLISH RIVER

### 55.1. Stream Summary

The Artlish River flows west into Tahsish Inlet in Kyuquot Sound. The Artlish River is a typical west coast Vancouver Island stream fed by many small, unnamed tributaries from the surrounding mountains. The mainstem length is over 25 km. The watershed consists of steep terrain except for the lower 8 km which has a relatively low gradient. There is a barrier to salmon migration at 15 km upstream from the mouth.

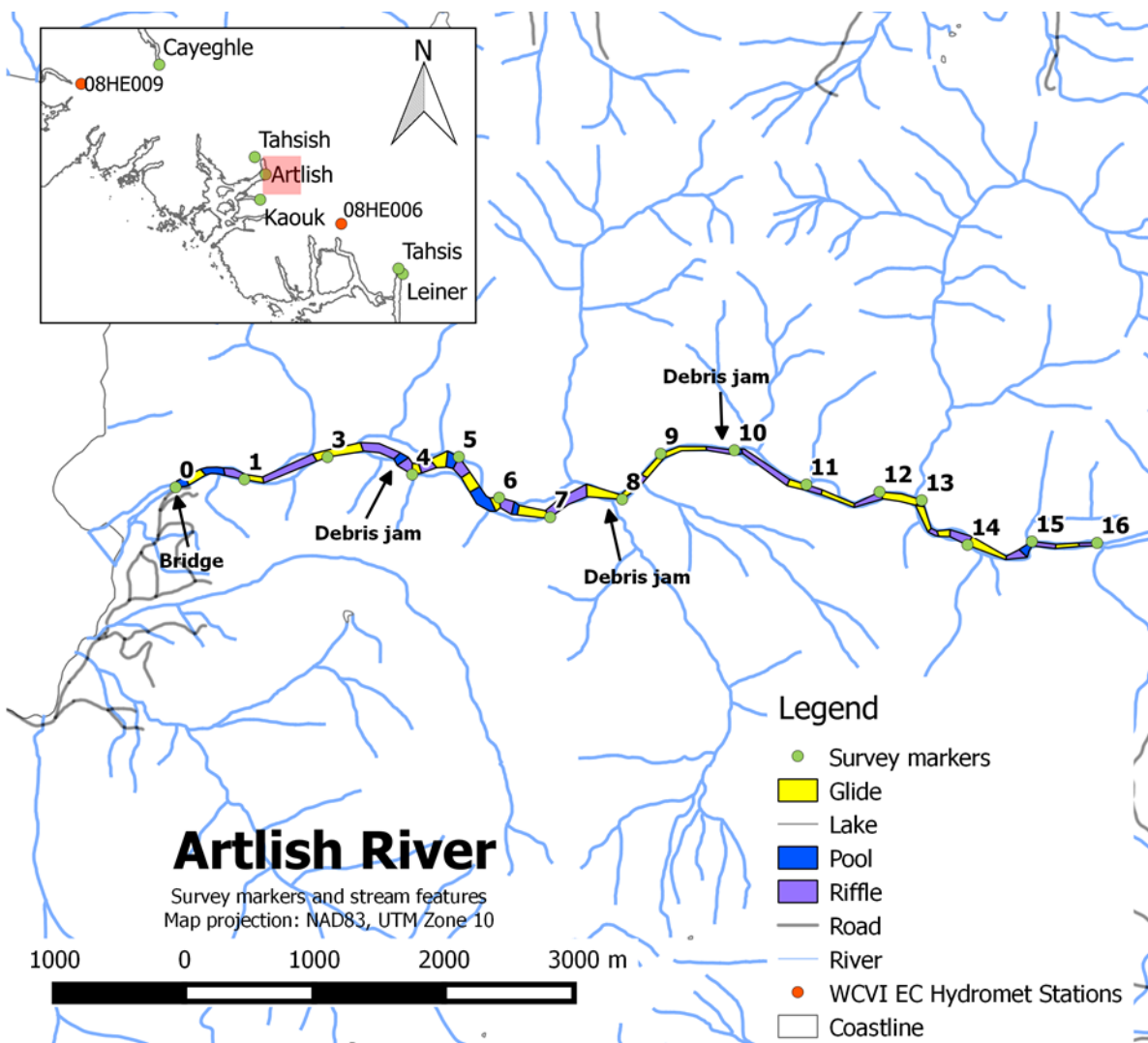


Figure 55-1. Artlish River counting stations and habitat units. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The logging road running the length of the system is not shown. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. Debris jam locations are approximate and as reported in 2014.

This lower 8 km has been divided into 16 - 500 m sections for conducting escapement surveys (Figure 55-1). The upper survey sections include all meso-habitat features, but are primarily composed of pool and riffle habitats. There are several avulsions as well. All substrate types are present in the upper sections, but most common are gravel and cobble with some boulders. In the lower survey sections, the habitat includes all meso-habitat features, but is primarily composed of riffle and glide habitats. The substrate is gravel and cobble. In recent years, surveyors have reported an overall increase in gravel in the system. There is both rearing and spawning habitat throughout the 8 km survey area.

Large woody debris jams are common on the Artlish and divert flow in some sections. In 2014, major debris jams were located below marker 10, below marker 8 and between markers 3 and 4. There is a constant influx of new wood into system and frequent movement of jams. Pools below marker 15 and above 10 are about 3 to 4 m in depth and are considered good holding pools. However, there have been observations of pools filling in in recent years.

Flow on the nearby Kaouk River is a good indicator for conditions on the Artlish River. With the influx of gravel into the system, local experts suggest that more of the river flow has become subsurface in recent years.

Water clarity in the Artlish is usually excellent except after heavy precipitation. Surveyors often measure horizontal visibility with a Secchi disc at over 12 m. Water clarity decreases with rain events and the system takes 3 to 5 days return to normal conditions. Surveyors generally note high observer efficiency on the Artlish due to its excellent water clarity and a channel with low complexity.

The river banks have become increasingly unstable in recent years with heavy erosion in some sections. In 2012, a landslide between markers 5 and 6 deposited some large boulders in the system. Poor road maintenance has led to periodic increases to sediment input into the river. Surveyors reported large amount of bedload movement in 2014 and 2015.

## 55.2. Survey Results and Escapement Estimate

Survey Crew: NWISEA/KCFN-LGL

Stock Assessment Biologist: D. McHugh

### Individual Survey Data:

Table 55-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
03-Sep-15	3		46						15	
10-Sep-15	3		310		4		34		771	
18-Sep-15	21		383		6		19	1	782	
02-Oct-15	4		740				1510	2	196	16
07-Oct-15			560				808	15	127	6
14-Oct-15	0		723	1			3565	15	36	
21-Oct-15	9		843		1		5850	348	10	
27-Oct-15	4		852	4			1573	2068		2
28-Oct-15	2		822				3237	3351	2	
05-Nov-15			569	3			259	163	3	

**Comments:** Oct 27 survey conducted by KCFN-LGL with a focus on Chum and Coho Salmon



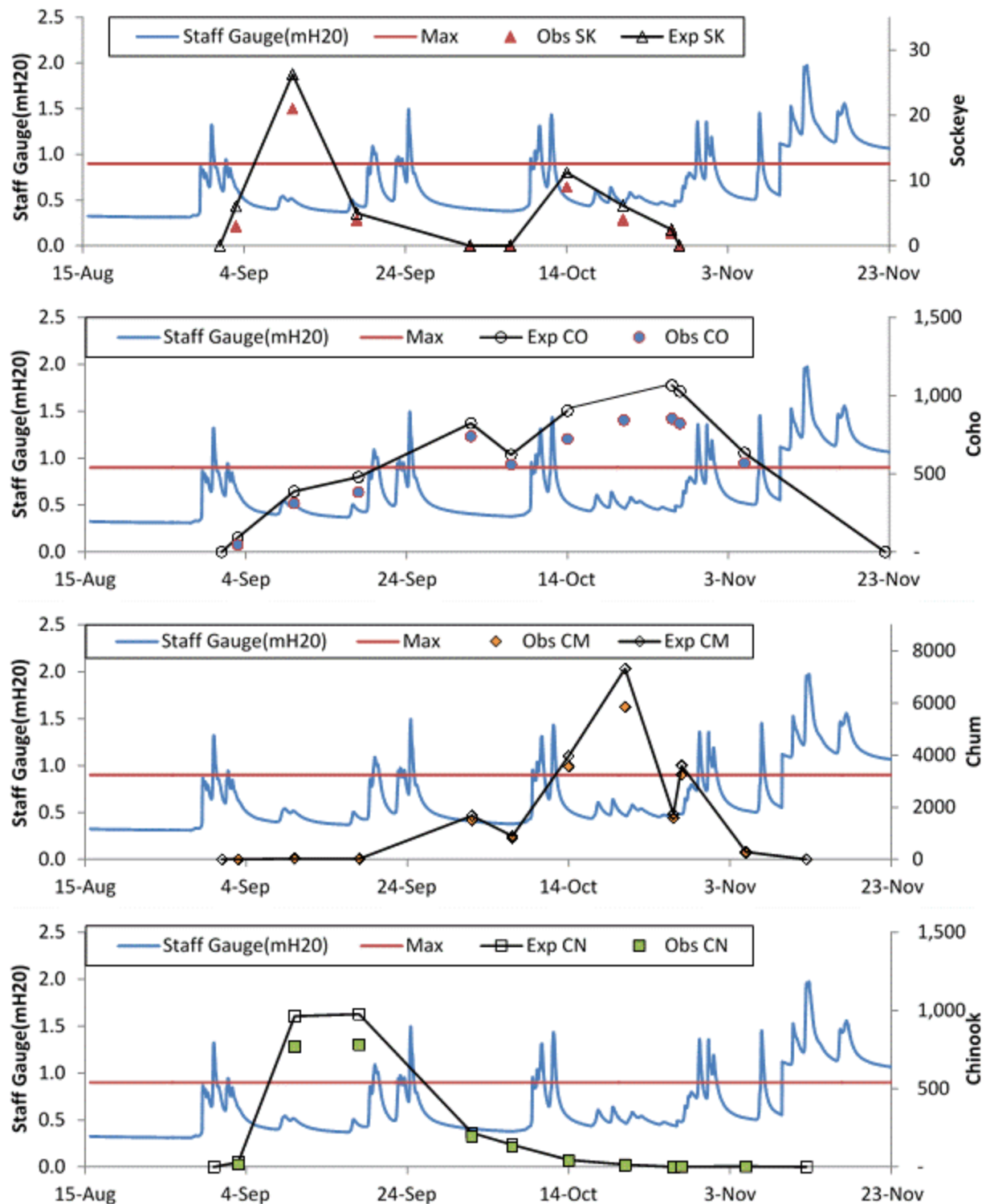


Figure 55-2. Raw counts (closed marker) and expanded counts (open marker) for each species. The water level measurement is from the DFO hydrometric station on the Kaouk. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns. The two surveys in late Oct were conducted by two separate crews. Note: The staff gauge reading starting Nov 9<sup>th</sup> is roughly 1m higher than the true reading due to the sensor being knocked over by a high water event.

Table 55-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	NA			
Coho	35 (30-40)	Sept 1	Dec 1	
Pink	NA			
Chum	15 (10-20)	Sept 1	Nov 15	
Chinook	20 (15-25)	Sept 1	Nov 15	

Table 55-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
03-Sep-15	Poor, partial	Only the upper section (16-9) was accessible due to road construction, water level above normal (0.8 m; 14.2 cms)
10-Sep-15	Good	Normal water level (0.49m; 3.8 cms), excellent visibility (>15m)
18-Sep-15	Good	Normal water level (0.45m), excellent visibility (>15m)
02-Oct-15	Excellent	Normal water level (0.36m; 1.9 cms), excellent visibility (>15m)
07-Oct-15	Excellent	Below normal water level (0.29m; 1.0 cms), excellent visibility (>15m)
14-Oct-15	Good	Normal water level (0.62m; 5.8 cms), excellent visibility (>15m)
21-Oct-15	Fair	Above normal water level (0.6m; 6.6 cms), excellent visibility (>15m), but steady rain during survey affected visibility slightly
27-Oct-15	Good	Normal water level (0.5m, 3.5 cms), excellent visibility (13m)
28-Oct-15	Good	Normal water level (0.5m, 3.5 cms), excellent visibility (22.5m), 12mm of rain that morning may have brought in additional Chum.
05-Nov-15	Excellent	Below normal water level (0.5m, 4.3 cms), excellent visibility (>15m)

Table 55-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	23	Expanded Peak Live + Dead	Level 3
Coho	1,486 (1,300-1,733)	Expanded Area Under the Curve	Level 2
Pink	6	Expanded Peak Live + Dead	Level 3
Chum	8,133 (6,100-12,199)	Expanded Area Under the Curve	Level 2
Chinook	1,113 (891-1,485)	Expanded Area Under the Curve	Level 2

### Escapement Commentary:

#### *Sockeye Return:*

Roughly twice the 12yr average.

#### *Coho Return:*

Close to the 12yr average. In 2015, there were a large % of jacks and the adult Coho Salmon were smaller than in the past years.

#### *Chum Return:*

Roughly twice the 12yr average.

#### *Chinook Return:*

Roughly 5 times the 12yr average.

## 55.3. Spawner Distribution

### Run Timing:

Table 55-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho					Early Oct.	Late Oct.	Early Dec.
Pink							
Chum					Late Sep.	Mid Oct.	Early Nov.
Chinook							

### Spatial Distribution:

Table 55-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Marker #9 to 7
Coho	Marker #16 to 3
Pink	Unknown
Chum	Marker #12 to 1
Chinook	Unknown
Steelhead	Unknown

## 55.4. Environmental Conditions

### Weather Summary:

Conditions were relatively normal compared to previous years from Sept to Dec, spring and summer were extremely hot and dry.

### Physical Characteristics Update:

Water clarity was clear; bank erosion in several locations (i.e., Marker 14 and 10) throughout the reach; high bedload movement (i.e., extensive gravel bars). There was some recent road work due to landslides and culvert washouts.

## 55.5. Update to Stream Survey Protocols

### **Current Assessment Method:**

A 8.0 km snorkel survey is conducted by two or three surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately four hours from the start of the survey to the estuary. Water temperature and horizontal visibility were measured during the survey. The staff gauge is located between markers 9 and 10.

### **Deviations from current assessment protocols:**

None reported.

### **Access Updates:**

Access to the Artlish River from highway 19 is via the Zeballos Main, Atluck Main and then the Artlish Main. River access is to the survey start point at marker 16 is via an old deactivated road that is flagged. The mid river access/check in point is between river markers 10-9. Staff gauge and discharge site are located at the mid river point. The survey exit point is at the Artlish mainline bridge down at the estuary. Exit the river on river right, there is a long rope to aid climbing the steep bank up to the bridge deck.

Access to the Artlish River involved, traveling on a gravel road for ~50 km along the Artlish Mainline Road. The survey crew was dropped off at an old spur road, near marker #16. The crew used the spur road to access the river on right bank. The driver waited between marker #9 and 10 for the crew to swim past and then met them at the mainline bridge, near the estuary. In 2013, there was active logging in the area, which improved road conditions

### **Safety Update:**

Many bears on system. In a previous year, surveyors were charged by bull elk.

## 55.6. Enhancement

No known hatchery, enhancement or restoration activities.

## 55.7. Biosamples

A total of 38 Chinook samples were collected, including 1 jack Chinook, and one partial sample. The samples were collected from dead, or near dead Chinook. Some were from dead carcasses, others were from Chinook caught by hand, that were post spawn and near dead. Dedicated bio-sampling days were spent collecting samples.

On October 27, 2015, two Chinook biosamples were taken. One was taken in reach 14-13 and the other in reach 13-12. Both Chinook Salmon were dead when the samples were taken. The biosample information included: Date, River Segment, Fork Length (mm), POH Length (mm), Adipose clip (Y/N), Scales, Otoliths, DNA, Sex (M/F), Egg Retention and Carcass Condition. Once the samples and information were gathered the caudal fin was then cut off. The information was then forwarded to DFO staff. Chinook biosamples were also collected Oct 2, 4, and 7 by A. Pereboom and NVERSEA (36 samples)

Samples were collected as part of a West Coast Vancouver Island Chinook run reconstruction project being conducted by DFO Stock Assessment. These samples will also be used to build the Chinook DNA baseline for the Kaouk River.

### 55.8. Concerns and Comments

Road repairs and culvert replacement occurred throughout the fall of 2015 on the Artlish Mainline. This prevented some swims from occurring, or delayed the swim date. The road upgrades are also a sign that logging activities in the watershed are likely to resume in the near future.

Poor road maintenance has led to periodic increases to sediment input into the river. In reach #11 there has been a landslide, resulting in some large boulders entering the system. At this point, it poses little threat to salmonids, but it should be noted in future surveys. There are several areas of bank erosion including reach 14 and 11 (Photo #1 and 2).

We may want to get an extended survey (up to the caves ~ Marker 30) during the peak of Chinook to evaluate how many may be spawning above the survey section.

There is an interest in getting Sockeye biosamples (DNA).



*Figure 55-3. Upper photo: Looking downstream in reach 14-13, at an eroding bank in Artlish River. (Photo credits: Shane Johnson, November 25, 2013).*



*Figure 55-4. Looking downstream in reach 11-10, at an eroding bank in Artlish River (photo credit: Shane Johnson, November 25, 2013).*

## 56. MALKSOPE RIVER

### 56.1. Stream Summary

Flows southwest into head of Malksope Inlet, to the northwest of Kyuquot Sound. The mainstem length is 10 km and the lower 5.6 km is surveyed in eleven 500 m sections (Figure 56-1). The survey starts at marker 11 which is also at the lower end of a canyon which is a barrier to anadromous fish (Figure 56-2). Historically, the survey started about 150 m downstream from the current starting point.

The upper survey area is characterized by pool and riffle habitats with some runs and glides. All substrate types are present but cobble, boulder and bedrock predominate upstream of marker 7. There is a second canyon from above marker 8 to below marker 8.

In the lower portion the habitat consists primarily of riffles, there are several glides, pools and runs. Below marker 8 there is abundant rearing and spawning habitats for all species. The vast majority of Chum spawn below marker 8. Malksope is predominately a Chum and Coho salmon stream with some Chinook and Sockeye salmon. A significant tributary enters from river left about 200 m below marker 3. The system is used as a Coho indicator stream.

There is a lot of wood in the river and high bedload movement. The watershed has been extensively logged and is currently ongoing. There have been several Coho tagging studies in recent years.

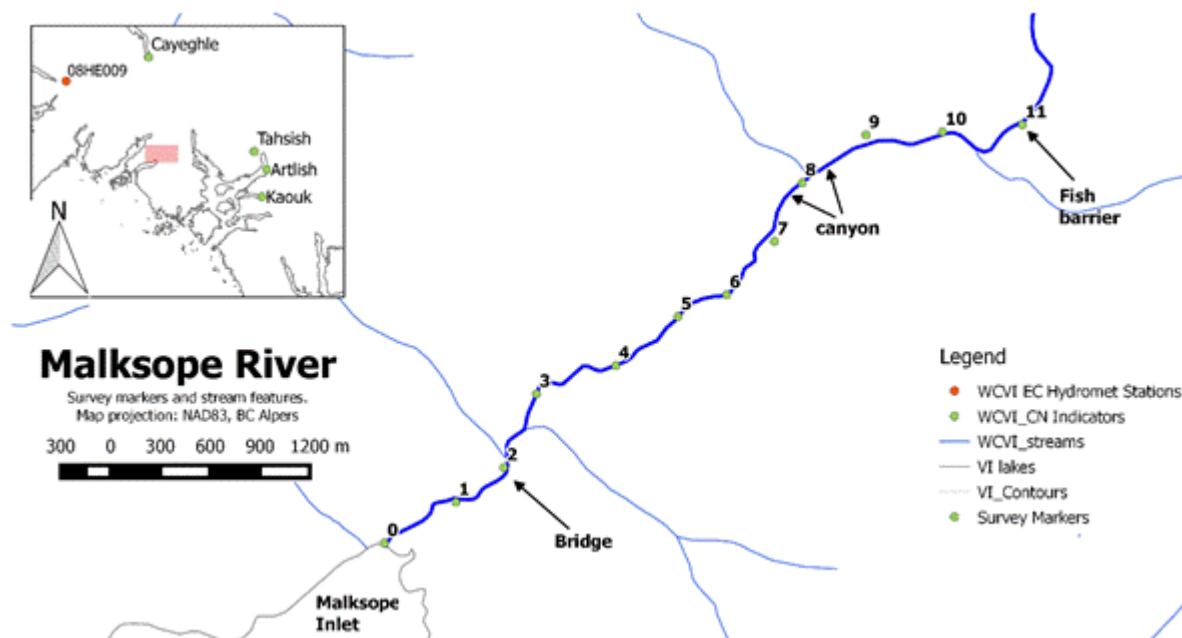


Figure 56-1. Malksope River survey markers. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia.





Figure 56-2. Looking upstream at the Malksope River anadromous barrier at marker 11 (photo credit: Shane Johnson, November 11, 2014).

## 56.2. Survey Results and Escapement Estimate

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)

Stock Assessment Biologist: D. McHugh

Individual Survey Data:

Table 56-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
16-Sep-2015	1	0	321	0	3	0	69	0	11	0
28-Sep-2015	3	0	685	0	4	0	727	0	4	0
3-Oct-2015	4	0	717	0	1	0	1126	0	9	0
14-Oct-2015	3	0	1062	0	0	0	2542	14	3	0
27-Oct-2015	7	0	1110	1	1	0	1236	443	1	1
4-Nov-2015	2	0	841	0	0	0	143	39	0	0
10-Nov-2015	2	0	651	3	0	0	3	7	0	0
23-Nov-2015	0	0	546	3	0	0	0	2	0	0
15-Dec-2015	0	0	209	13	0	0	0	0	0	0



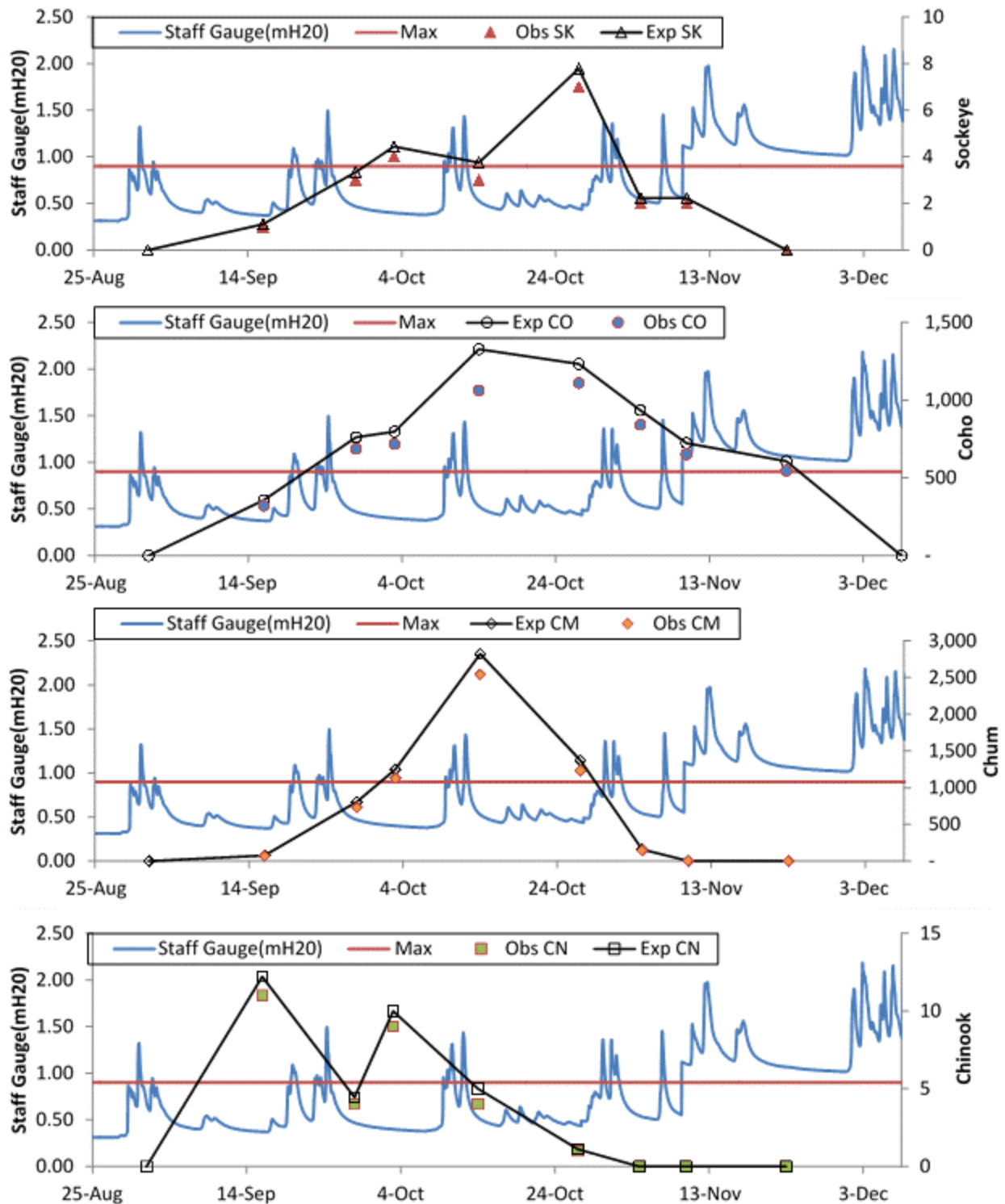


Figure 56-3. Raw counts (closed marker) and expanded counts (open marker) for each species. The water level measurement is from the DFO hydrometric station on the Kaouk. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns. Note: The Kaouk staff gauge reading starting Nov 9<sup>th</sup> is roughly 1 m higher than the true reading due to the sensor being knocked over by a high water event.

Table 56-2. Survey life and rational for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	20 (15-25)	Sep 1	Nov 23	
Coho	35 (30-40)	Sep 1	Dec 31	Based on Coho tagged Sept 29 and Oct 15
Pink	NA			
Chum	15 (10-20)	Sep 1	Nov 15	
Chinook	20 (15-25)	Sep 1	Nov 4	
<b>General comments:</b> Tags have been applied to Coho in-river with capture via beach seine 2011 to 2015 to estimate Survey Life. Estimates have ranged from 23 to 36 days, except for groups tagged late in October.				

Table 56-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
16-Sep-15	Excellent	Water level extremely low (0.88m) and clear (16m)
28-Sep-15	Excellent	Water level normal (0.978m) and clear (14m)
03-Oct-15	Excellent	Water level below normal (0.898m) and clear (14m)
14-Oct-15	Good	Water level above normal (1.08m, 15cms) and clear (14-15m)
27-Oct-15	Excellent	Water level below normal (0.952m, 8cms) and clear (15m)
04-Nov-15	Excellent	Water level normal (0.950m, 9.2cms) and clear (14m)
10-Nov-15	Excellent	Water level normal (0.998m) and clear (14m)
23-Nov-15	Excellent	Water level normal (0.956m) and clear (15m)
15-Dec-15	Excellent	Water level normal (1.05m) and clear (14m)

Table 56-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	10 (8-10)	Expanded Area Under the Curve	2
Coho	1,883 (1,647-2,196)	Area Under the Curve-unexpanded tags used for SL estimate	2
Pink	4	Expanded Peak Live + Dead	2
Chum	4,490 (3,368-6,735)	Expanded Area Under the Curve	2
Chinook	17 (14-23)	Expanded Area Under the Curve	2

### 56.3. Escapement Commentary:

#### *Sockeye Return:*

There was a higher abundance of Sockeye in 2015 (5) then in 2014 (1).

#### *Coho Return:*

There was a lower abundance of Coho in 2015 (peak count 1110) then in 2014 (1501). In 2015, there were a large % of jacks and the adult Coho Salmon were smaller than in the past years.

#### *Pink Return:*

There was a higher abundance of Pink in 2015 (4) then in 2014 (0). This was the first time Pink Salmon were observed by Shane Johnson (LGL) since starting in Area 26 in 2012.

#### *Chum Return:*

There was a lower abundance of Chum in 2015 (peak count 3007) then in 2014 (5559).

#### *Chinook Return:*

There was a higher abundance of Chinook in 2015 (11) then in 2014 (6).

### 56.4. Spawner Distribution

#### Run Timing:

Table 56-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Aug.	Mid Oct.	Early Nov.
Coho					Mid Sep.	Late Oct.	Early Dec.
Pink					Late Aug.	Mid Oct.	Early Nov.
Chum					Late Sep.	Mid Oct.	Early Nov.
Chinook					Late Aug.	Mid Oct.	Early Nov.

#### Spatial Distribution:

Table 56-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Marker #7 to 5
Coho	Marker #11 to 2
Pink	Marker #5 to 3
Chum	Marker #7 to 0
Chinook	Marker #11 to 10
Steelhead	Unknown

**Comments:** This is typical of this watershed

## 56.5. Environmental Conditions

### **Weather Summary:**

As there were nine surveys, the weather conditions varied. The weather was primarily sunny and dry. There were several high water events during late summer and fall. Overall, conditions were relatively normal compared to previous years.

### **Physical Characteristics Update:**

Water clarity was clear; bank erosion in several locations (i.e., Marker 10 and 7) throughout the survey reach; and high bedload movement (i.e., extensive gravel bars), particularly at river km 2.5 (avulsed from 4 to 3) occurred in 2014.

## 56.6. Update to Stream Survey Protocols

### **Current Assessment Method:**

A 5.5 km snorkel survey is conducted by two or more surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately four hours from the start of the survey to the end. Water temperature, discharge, staff gauge height and horizontal visibility were measured during the surveys.

### **Deviations from current assessment protocols:**

None reported

### **Access Updates:**

The Malksope River was accessed by road from Kyuquot Village (approximately 50 minutes). In 2015, a driver dropped off the swim crew at the upper access trail (50° 9'40.33"N; 127°21'55.75"W), upstream of marker 11. The crew would then hike through the forest on left bank, along a flagged trail and end up ~10 m upstream of the anadromous barrier (Photo 1). The crew would then swim down the margins of the river and climb down the falls on the right bank side and start the survey at the base of the falls. Upon completing the survey, the crew walked upstream from marker 0 to marker 1, and get picked up on the Malksope Mainline road. Historically, the survey has been divided into two portions, with one crew surveying the upper portion of the reach (markers 11 to 6) and the other crew surveying the lower portion of the reach (markers 6 to 0). If time is an issue, it is recommended to divide the survey into two portions.

### **Safety Update:**

A small full-spanning logjam was present Sept 16, 150m downstream of Marker 4. During high flows the canyon upstream of the anadromous barrier (marker 11) and the canyon in marker 9-8 may become unpassable to swimmers. There is a takeout point ~10 m upstream of the lower canyon, on left bank (50°9'32.73"N, 127°22'59.45"W). The upper canyon can be avoided by hiking further downstream in the forest. There has been a high abundance of bears in the lower reaches (marker 3 to 0) and several surveys have had to be stopped near marker 1 because of this reason.

## 56.7. Enhancement

No hatchery activities.

### **Other Activities:**

To determine Coho Salmon survey life, fish were tagged during two tagging events. Survey life will be estimated through a “tag-depletion” curve, based on subsequent observations of tagged fish by survey crews.

There have been several habitat restoration projects on the Malksope River in the past. These include riparian releases, LWD, and back-channel formation.

## 56.8. Biosamples

Two tagging events occurred (Sep 29, Oct 15). Fork Length and sex were recorded. Scale samples were also taken. A total of 81 fish were tagged.

## 56.9. Concerns and Comments

Intensive forestry activities has taken place of both sides of Malksope River and could be the reason for increased water transport, resulting in bedload movement. In reach 5-4, there is high bedload movement and instability. This would be an ideal location for gravel bar enhancement and riparian releases.

There is an interest in getting Sockeye biosamples (DNA).

There were extensive habitat rehabilitation works in the mid-1990s, but the main channel has not stabilised.



*Figure 56-4. Looking upstream at the Malksope River from the bridge in Marker 2 (photo credit: Shane Johnson, October 3, 2015).*

## 57. TAHSISH RIVER

### 57.1. Stream Summary

The Tahsish River flows south into head of Tahsish Inlet, in Kyuquot Sound. The lower river is located in the Tahsish-Kwois Provincial Park. The mainstem is 29 km long, but the most suitable spawning habitat and area surveyed is found in the lower 6 km. The Tahsish River is fed by many small tributaries, snow pack and several small lakes. About 6 km upstream from the estuary there is a canyon where the stream's gradient becomes very steep. It is considered a barrier to fish under most conditions. Historically, the lower 6 km was divided into 12 survey sections, each about 500 m apart, but there have been no survey markers on the system in recent years and marker locations are approximate (Figure 57-1).

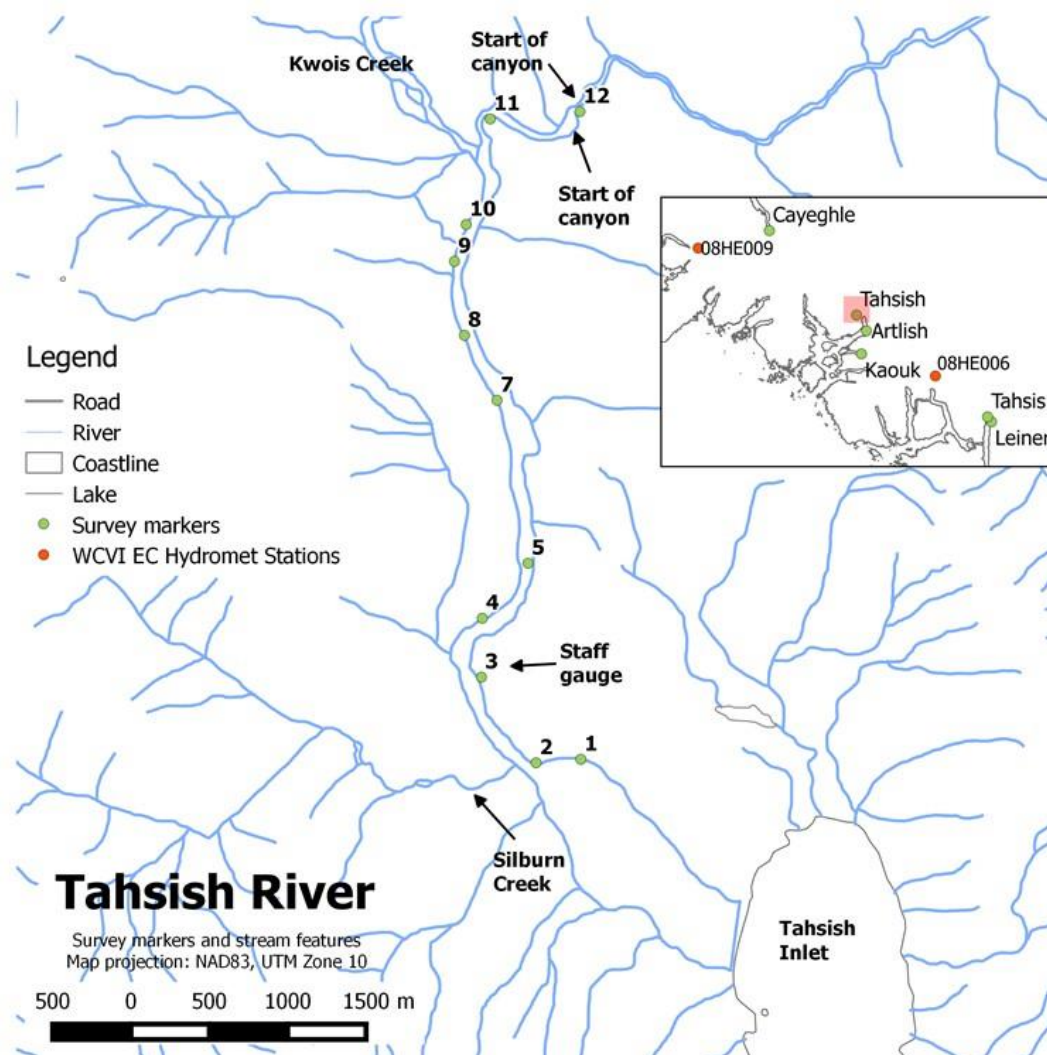


Figure 57-1. Tahsish River counting stations. Map inset shows the locations of other systems that are regularly surveyed in the area as well as the location of the Environment Canada hydromet stations on the Zeballos River near Zeballos (08HE006) and on the Klaskish River near Klaskino Inlet (08HE009). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. Survey markers are approximate and based on historical locations.

Kwois Creek is the largest tributary and enters the Tahsish between markers 10 and 11. Another tributary, Silburn Creek, enters Tahsish about 1 km up from the mouth. There have been observations of Coho in both tributaries. Most of the survey area has a low gradient with a variety of meso-habitats throughout. In the upper survey sections, the habitat is primarily pools and glides and there are a range of substrate types including bedrock at the top of the survey area. The lower survey sections are primarily riffle and glide habitats and the substrate mostly gravel and cobble. Between markers 0 and 1 the stream splits into two channels. There is both rearing and spawning habitat throughout the 6 km survey area.

There is a large pool at the base of the canyon, above survey marker 12, and deep enough that surveyors cannot see the bottom on swim surveys. The Tahsish has moderate water clarity, particularly in comparison to nearby systems such as Kaouk and Artlish. The discharge is comparatively higher, and water clarity is made worse by ongoing forestry in the area above the canyon. Kwois Creek generally has high tannins and has been reported to contribute considerable gravel to the system in recent years.

## 57.2. Survey Results and Escapement Estimate

Survey Crew: NVERSEA, KCFN, LGL

Stock Assessment Biologist: D. McHugh

## 57.3. Individual Survey Data:

Table 57-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
9-Sep-2015	12	0	328	0	2	0	6	0	184	0
11-Sep-2015	17	0	608	0	4	0	63	0	307	0
18-Sep-2015	7	0	557	0	5	0	53	2	440	0
28-Sep-2015	30	0	594	0	2	0	1599	5	319	1
5-Oct-2015	58	0	632	0	0	0	972	8	218	2
16-Oct-2015	36	0	1335	1	0	0	4076	49	49	3
23-Oct-2015	0	0	590	2	0	0	1218	76	7	0
5-Nov-2015	5	0	642	2	0	0	195	420	3	0

**Comments:** Nov 5 survey conducted by KCFN and LGL with a focus on Chum and Coho Salmon



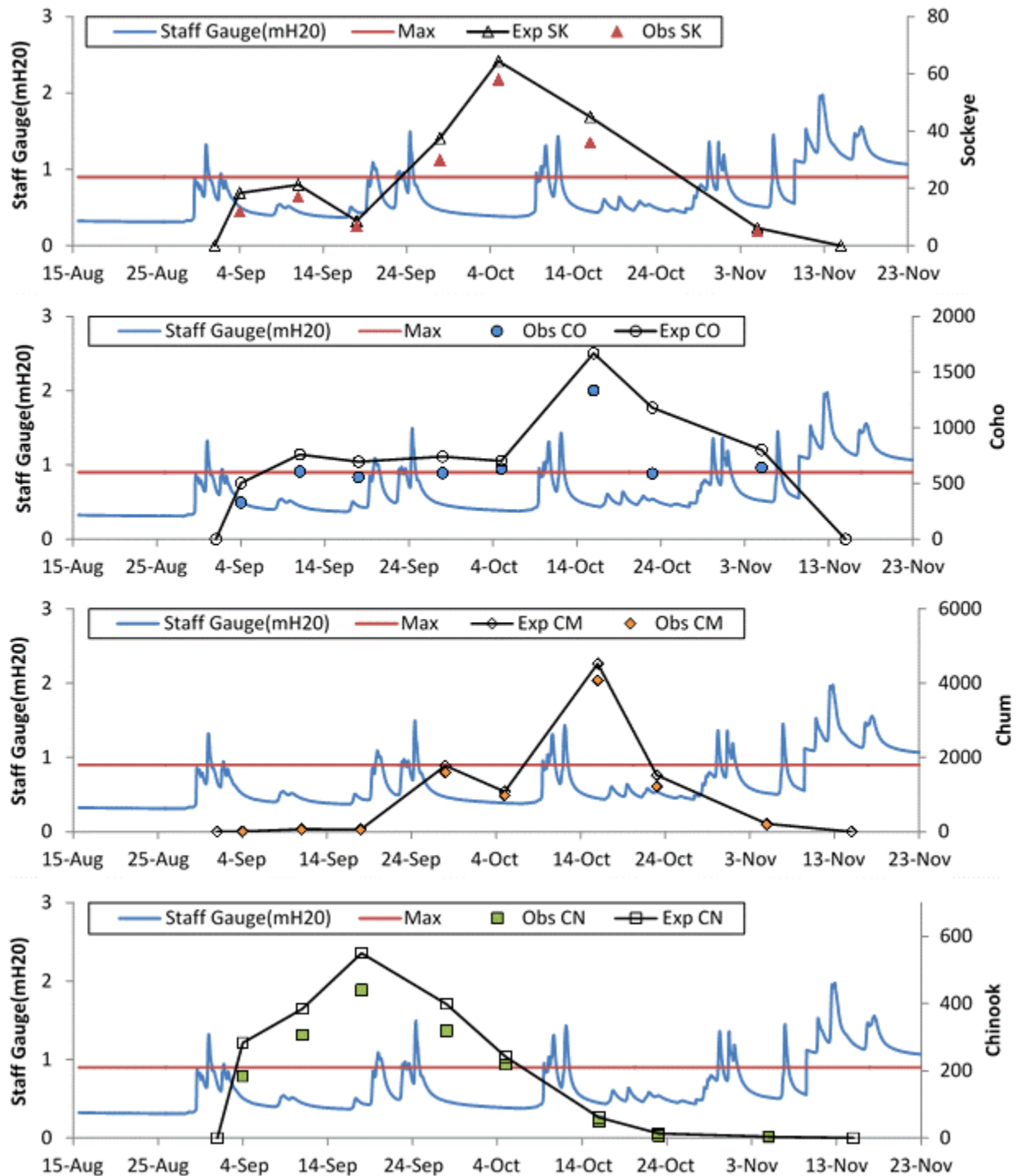


Figure 57-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the DFO hydrometric staff gauge on the Kaouk. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns. Note: The staff gauge reading starting Nov 9th is roughly 1m higher than the true reading due to the sensor being knocked over by a high water event.



Table 57-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye	25 (20-30)	1-Sep-15	15-Nov-15	Rough range based on spawning observed starting in Aug,
Coho	30 (25-35)	1-Sep-15	15-Nov-15	Standard range for WCVI Coho, water levels in early fall were sufficient for entry
Pink	NA			
Chum	15 (10-20)	1-Sep-15	15-Nov-15	Standard range for WCVI Chum, water levels in early fall were sufficient for entry
Chinook	20 (15-25)	1-Sep-15	15-Nov-15	Standard range for WCVI Chinook, water levels in early fall were sufficient for entry

Table 57-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
4-Sep-2015	Fair	Water level above normal (0.55m) and slightly turbid (7.5-15m)
11-Sep-2015	Good	Water level normal (0.43m) and clear (15+m)
18-Sep-2015	Good	Water level normal (0.38m) and tea coloured (13-13.5m)
28-Sep-2015	Good	Water level normal (0.55m) and clear (12.5-15m)
5-Oct-2015	Excellent	Water level below normal (0.46m) and tea coloured (15+m)
16-Oct-2015	Good	Water level normal (0.42m) and tea coloured (9.5-10m)
23-Oct-2015	Poor	Water level above normal (0.8m) and rising, tea coloured (7.5-7m)
5-Nov-2015	Good	Water level normal (0.46m) and slightly turbid (9-11m)

Table 57-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye	111 (92-138)	Expanded Area Under the Curve	2
Coho	2,081 (1,784-2,498)	Expanded Area Under the Curve	2
Pink	6	Expanded Peak Live + Dead	3
Chum	5,622 (4,216-8,433)	Expanded Area Under the Curve	2
Chinook	768 (614-1,024)	Expanded Area Under the Curve	2

## Escapement Commentary:

### Coho Return:

In 2015, there were a large % of jacks and the adult Coho Salmon were smaller than in past years.

**Chinook Return:**

Good number of Chinook in 2015. Marker 8-7 appeared to hold good numbers of spawning Chinook.

## 57.4. Spawner Distribution

### Run Timing:

Table 57-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye					Late Aug.	Mid Oct.	Early Nov.
Coho				Late Aug.	Mid Sep.	Late Oct.	Early Dec.
Pink					Late Aug.	Mid Oct.	Early Nov.
Chum				Mid Sep.	Late Sep.	Mid Oct.	Early Nov.
Chinook					Late Aug.	Mid Oct.	Early Nov.

### Spatial Distribution:

Table 57-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Marker 11 to unknown
Coho	Marker 12 to 4
Pink	Unknown
Chum	Marker 10 to 0
Chinook	Marker 11 to unknown
Steelhead	Unknown

**Comments:** NWISEA conducts six or seven snorkel surveys on the Tahsish River, with LGL and KCFN only conducting one survey. This survey would occur near the end of the escapement curve with a focus on Coho and Chum. Further comment on spawning distribution should be made by the NWISEA surveyors.

## 57.5. Environmental Conditions

### Weather Summary:

The weather was sunny and river flows were low and clear. Conditions were relatively normal compared to previous years. During the spring and summer conditions were hot and dry.

### Physical Characteristics Update:

Water clarity was clear; bank erosion in several locations throughout the reach; high bedload movement (i.e., extensive gravel bars).

## 57.6. Update to Stream Survey Protocols

### **Current Assessment Method:**

A 6.0 km snorkel survey is conducted by two or more surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel from Marker 12 to 3. At marker 3 they are picked up by helicopter and from 3 to 0 the system is surveyed from the air. It takes approximately four hours from the start of the survey to the end. Water temperature, staff gauge height and horizontal visibility were measured during the surveys

### **Deviations from current assessment protocols:**

A three-person KCFN survey crew was picked up at Fair Harbour and dropped off at marker 12 and surveyed to the estuary (marker 0), where they were picked up by boat.

### **Access Updates:**

The Tahsish River was accessed by helicopter (West Coast Helicopters).

### **Safety Update:**

Lots of LWD build ups in certain locations. Swimmers need to be alert of oncoming obstacles. Bears prevalent.

## 57.7. Enhancement

No known hatchery, enhancement or restoration activities.

## 57.8. Biosamples

42 Chinook samples collected, 5 jacks and 2 partial samples. Swim survey crews sampled Chinook if carcasses found during survey. Dedicated sampling occurred 5 times targeting Chinook bio-sampling. Some samples were from dead Chinook, others were from near dead spawned out Chinook caught by hand.

The biosample information included: Date, River Segment, Fork Length (mm), POH Length (mm), Adipose clip (Y/N), Scales, Otoliths, DNA, Sex (M/F), Egg Retention and Carcass Condition.

Samples were collected as part of a West Coast Vancouver Island Chinook run reconstruction project being conducted by DFO Stock Assessment. These samples will also be used to build the Chinook DNA baseline for the Tahsish River.

## 57.9. Concerns and Comments

The crew observed a LWD in the channel that had recently been cut by a power saw (Figure 57-3). This was done to access the river by boat. This is concerning, as cutting the LWD may affect its stability and possible damage spawning grounds if it moves. There are no numbered triangular markers on the Tahsish River and they should be re-established to indicate reach breaks.

Sample crews noted a large number of fish predators at the mouth of the river, and on occasion noted seals up past marker 3 in-river.

Fish guiding is ongoing on the Tahsish River each fall targeting Coho salmon. Some wood has been cut in river to allow jetboat access up the river. The amount of cutting is minimal, and not likely to any effect on river course or erosion.

There is a need to set up an official staff gauge, or water level measurement tool on this system. Previous attempts were intertidal. There is a staff gauge near swim marker 4, but the river has shifted and only a portion of the river runs past the staff gauge location. It may be worth the time, effort and money to helicopter in on the first 2016 snorkel survey to get this set up. There may be a slight increase in cost to have the helicopter pick up the person installing the staff gauge at the end of the swim. I believe there is a good spot in the canyon (#12) pool. Review of some video will provide a better idea of what to expect.



*Figure 57-3. Looking downstream at LWD root wad at marker 3 that had recently been cut to access the Tahsish River by boat (photo credit: Shane Johnson, November 5, 2015)*

## 58. POWER (HISNIT) RIVER/LAKE

### 58.1. Stream Summary

The Power (Hisnit) River flows into Ououkinsh Inlet to the northwest of Kyuquot Sound. Power Lake is located just over one kilometer up from the mouth. The Power River is a flashy system that has high bedload and LWD movement. Power Lake is usually turbid after the first rain event of the season. The outlet to the lake is in a canyon and is dark.

### 58.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)  
Stock Assessment Biologist: D. McHugh

Table 58-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
22-Nov-2015	1	2	8	0	0	0	0	0	0	0

### 58.3. Escapement Comments

Sockeye Return: There was a lower abundance of Sockeye in 2015 (1) then in 2014 (21). The survey was completed November 22, 2015 past peak escapement.

Coho Return: There was a lower abundance of Coho in 2015 (8) then in 2014 (108). The survey was completed November 22, 2015 past peak escapement.

Pink Return: No Pink Salmon were observed.

Chum Return: No Chum Salmon were observed, as expected given the survey timing.

Chinook Return: No Chinook Salmon were observed, as expected given the survey timing.

### 58.4. Environmental Conditions

The weather was sunny and river flows were low. Water visibility in the Power Lake was poor, but great in Power River. Conditions were relatively normal compared to previous years. Water clarity was clear in the river, but turbid in the lake; high LWD and bedload movement (i.e., extensive gravel bars) and avulsions throughout the survey reach.

### 58.5. Survey Protocols

A 2.5 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately 5 hours from the estuary to start of the survey and back. Water temperature horizontal and vertical visibility were measured during the survey. Power River/Lake was accessed by boat from Kyuquot Village (approximately a 1 hour run). The crew anchored the boat at the mouth and hiked a skiff up Power River to the Power Lake outlet. They then used the skiff to access Power River upstream of Power Lake. The crew hiked 2 km upstream from the river mouth along the river margins, where they started the survey. Once the crew got back to the lake, they surveyed the

confluences of three tributaries. They surveyed ~200 m along the margins of the tributaries. Due to recent rain events, Power Lake was turbid and the crew was unable to survey the lake effectively, as visibility was poor (horizontal vis = 5 m). Power River, downstream of the lake is extremely slippery and surveyors should take caution when accessing the lake.

#### 58.6. Enhancement/Restoration Activities

No known hatchery, enhancement or restoration activities.

#### 58.7. Concerns and Comments

The Power River is a flashy system that has high bedload and LWD movement. This has led to periodic increases to sediment input into the river.

To determine salmon escapement to Power River, further enumeration studies (i.e., earlier surveys; hydroacoustic or DIDSON studies; ect.) should be considered.



*Figure 58-1. Looking downstream at the Power River, Power Lake confluence (Photo taken by Shane Johnson, November 22, 2015).*



## 59. AMAI CREEK

### 59.1. Stream Summary

Flows W. into head of Amai Inlet in the southeast portion of Kyuquot Sound. The mainstem is about 7.5 km but only the lower 2.2 km are surveyed. In the upper surveyed reaches, the habitat is characterized by steep boulder cascades with some large and small plunge pools. The substrate consists of mostly gravel and cobble, with some boulders. There is a limited amount of rearing and spawning habitat. In the lower portion of the survey, the habitat consists of shallow riffles with several avulsions. There is some rearing and spawning habitat for salmonids. This is a predominately a Chum salmon stream, with some Coho and possibly Chinook salmon.

### 59.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox), LGL (Shane Johnson)  
Stock Assessment Biologist: D. McHugh

Table 59-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
17-Oct-15	0	0	109	0	0	0	829	98	0	0

### 59.3. Escapement Comments

Sockeye Return: No Sockeye Salmon were observed.

Coho Return: 121, Expanded PL+D; There was a lower abundance of Coho in 2015 than in 2014 (297). The survey was completed October 17, 2015 near peak escapement.

Pink Return: No Pink Salmon were observed.

Chum Return: 1,019; Expanded PL+D. There was a higher abundance of Chum in 2015 than in 2014 (632). The survey was completed October 17, 2015 near peak escapement. The crew observed wolf tracks, scat and predatory morts in the lower reaches. Due to the low flows and several avulsions, this system is subject to a high abundance of predatory morts. Level 2 PL+D due to timing.

Chinook Return: No Chinook Salmon were observed.

### 59.4. Environmental Conditions

There was a medium amount of rain during the survey. Water levels were slightly elevated, due to recent rain in the area. The discharge was ~5 m<sup>3</sup>/s and horizontal visibility was 13 m. Conditions were relatively normal compared to previous years. Water clarity was clear; small amount of bank erosion; high bedload movement (i.e., extensive gravel bars); several avulsions throughout the survey reach. No recent land use.

### 59.5. Survey Protocols

Amai Creek was accessed by boat from Kyuquot Village (approximately a 45 minute run). The crew anchored the boat at the mouth and used a skiff to get to shore. The crew walked approximately 2.2 km upstream to the start of the survey. Bears and wolves in the area.

### 59.6. Enhancement/Restoration Activities

No brood removal or planned release. Restoration/enhancement activities unknown.

### 59.7. Concerns and Comments

Intensive forestry activities has taken place of both sides of Amai Creek and could be the reason for increased water transport, resulting in bedload movement. An investigation into bank stabilization and riparian protection is recommended.



*Figure 59-1. Looking downstream at log jam in Amai Creek (Photo credit: Shane Johnson, October 17, 2015).*



## 60. CACHALOT CREEK

### 60.1. Stream Summary

Cachalot Creek flows north into the entrance Cachalot Inlet in Kyuquot Sound. The stream is just over 4 km long, but only the lower 1.1 km is surveyed. In the upper portion of the survey area, the habitat is characterized by steep boulder cascades with several small plunge pools. The substrate is mostly boulders and cobble and the flow is confined by bedrock banks. There is a limited amount of rearing and spawning habitat. In the lower portion, the habitat consists of shallow riffles with several avulsions, and substrate that is mostly gravel and cobble. There is some rearing and spawning habitat. This is a predominately a Chum salmon stream, with some Coho and possibly Chinook salmon.

### 60.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox), LGL (Shane Johnson)

Stock Assessment Biologist: D. McHugh

Table 60-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
17-Oct-2015	0	0	17	0	0	0	47	159	0	0

### 60.3. Escapement Comments

Sockeye Return: No Sockeye Salmon were observed.

Coho Return: 19, Expanded PL+D; There was a lower abundance of Coho in 2015 than in 2014 (66). The survey was completed October 17, 2015 during peak escapement.

Pink Return: No Pink Salmon were observed.

Chum Return: 211, Expanded PL+D; There was a lower abundance of Chum in 2015 then in 2014 (274). The survey was completed October 17, 2015 near peak escapement. Due to the low flows and several avulsions, this system is subject to a high abundance of predatory morts in the lower reaches.

Chinook Return: No Chinook Salmon were observed.

There was a high abundance of wind fallen trees instream, from the 2014/15 winter storms. A log jam located ~20 m downstream of the mainline bridge may be a barrier to fish passage (Photo 1). No fish were observed upstream of the log jam, as in years past.

### 60.4. Environmental Conditions

There was a light amount of rain during the survey. Water levels were slightly elevated due to recent rain in the area. The discharge was ~2.0 m<sup>3</sup>/s and horizontal visibility was 8 m. Conditions were relatively normal compared to previous years. Water clarity was clear; several

avulsions throughout the lower reaches; and high bedload movement (i.e., extensive gravel bars).

### 60.5. Survey Protocols

A 1.4 km snorkel survey was conducted by two surveyors, swimming downstream parallel to each other, looking for adult salmon in the centre of the channel. It takes approximately three hours from the estuary to the start of the survey and back. Water temperature and horizontal visibility were measured during the survey. The boat was moored at an old log sort (50°0'4.05"N; 127°10'15.97"W). The crew walked 1.2 km up the logging road and followed a left-bank spur road for an additional 300 m, where it crossed the creek. The crew then entered the creek and followed the channel approximately 250 m upstream to the start of the survey. Cachalot Creek has a steep gradient with lots of wood spanning the entire channel. Therefore, this should be deemed a highly hazardous survey and surveyors should take extreme caution when maneuvering through the channel.

### 60.6. Enhancement/Restoration Activities

No known hatchery, enhancement or restoration activities.

### 60.7. Concerns and Comments

The recent log jam located ~20 m downstream of the mainline bridge, should be monitored and if deemed necessary removed. Intensive forestry activities has taken place on both sides of Cachalot Creek and could be the reason for increased water transport, resulting in bedload movement. An investigation into bank stabilization and riparian protection is recommended.

A lot of predation in the lower river (bears).



*Figure 60-1. Looking downstream at log jam in Cachalot Creek May be a barrier to fish passage (250m downstream of the start of the survey, 1.2 km up from mouth) (Photo credit: Shane Johnson, October 17, 2015).*

## 61. CHAMISS CREEK

### 61.1. Stream Summary

Chamiss Creek is 4 km long with the lower 2 km surveyed for salmon enumeration. The system has a low gradient in the survey section and the water is generally clear.

### 61.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson, Ian Beverage)

Stock Assessment Biologist: D. McHugh

Table 61-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
29-Oct-2015	0	0	84	0	0	0	764	2483	0	0

### 61.3. Escapement Comments

Sockeye Return: No Sockeye Salmon were observed.

Coho Return: 93, Expanded PL+D; There was a higher abundance of Coho in 2015 than in 2014 (54). The survey was completed October 29, 2015 near peak escapement.

Pink Return: No Pink Salmon were observed.

Chum Return: 3,332; Expanded PL+D: There was a lower abundance of Chum in 2015 than in 2014 (4180). The survey was completed October 29, 2015 past peak escapement. Due to the low flows, this system is subject to a high abundance of predatory marts. During the survey, the crew counted a high abundance of Chum marts (2483). Level 3

Chinook Return: No Chinook Salmon were observed.

### 61.4. Environmental Conditions

There was a medium amount of rain during the survey. Water levels were slightly elevated due to recent rain in the area. The discharge was ~3.0 m<sup>3</sup>/s and horizontal visibility was 8 m. Conditions were relatively normal compared to previous years. Water clarity was clear; historical forestry in the area; avulsions throughout the survey reach; and high bedload movement (i.e., extensive gravel bars).

### 61.5. Survey Protocols

A 2.0 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately 3 hours from the start of the survey to the estuary. Water temperature and horizontal visibility were measured during the survey. The crew accessed Chamiss Creek by road (Chamiss Main); a 40-minute drive from Kyuquot Village. The road parallels the creek both upstream (left bank) and downstream (right bank) of the mainline bridge, resulting in easy access. To access the top of

the survey, a crew of two was dropped off on the road, near the start of the survey. The other crew members parked the truck on the Chamiss Mainline road, approximately 0.42 km upstream of the mainline bridge. They then hiked ~20 m upstream from the bridge, to marker 2. At the lower end of the survey, the crew walked through the forest to the road on the right bank side and got pick-up by the upper crew.

#### 61.6. Enhancement/Restoration Activities

Large woody debris placement near marker one.

#### 61.7. Concerns and Comments

Due to low flows there are a high abundance of predatory morts.



*Figure 61-1. Looking downstream at Chamiss Creek in reach #4 (Photo credit: Shane Johnson, October 23, 2013)*

## 62. CLANNINICK CREEK

### 62.1. Stream Summary

Clanninick Creek flows southwest into Clanninick Cove on the northeast edge of Kyuquot Sound. The mainstem is over 12 km long, with only the lower 2 km surveyed. The uppermost survey section (markers 3 to 4) are characterized by bedrock pools and cascades with some riffles. At the top of the survey area is a canyon which is a barrier to fish. The substrate consists of all types, but primarily bedrock and boulders that confine the river. Above marker 3 there is limited spawning habitat but some holding and rearing habitats. Below the canyon between markers 3 and 4 the river widens to a shallow riffle which is excellent Chum spawning habitat. In the lower part of the survey there is a second canyon (above marker 1) and also habitat with pools and cascades with some riffles and runs. The substrate is mostly composed of bedrock and boulders with some gravel and cobble. This is a predominately a Chum salmon stream, with some Coho and Chinook salmon. The Clanninick watershed has been heavily logged and is thought to have resulted in more extreme flows and higher bedload movement.

### 62.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox), LGL (Shane Johnson)  
Stock Assessment Biologist: D. McHugh

Table 62-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
24-Nov-2015	0	0	196	1	0	0	0	0	0	0

### 62.3. Escapement Comments

Sockeye Return: No Sockeye Salmon were observed.

Coho Return: 230, Expanded PL+D; There was a lower abundance of Coho in 2015 than in 2014 (667). The survey was completed November 24, 2015 past peak escapement.

Pink Return: No Pink Salmon were observed.

Chum Return: None Observed; There was a lower abundance of Chum in 2015 (0) than in 2014 (25). The survey was completed November 24, 2015 past peak escapement.

Chinook Return: No Chinook Salmon were observed.

### 62.4. Environmental Conditions

The weather was sunny and clear. Water levels were low and clear, as there was no recent rain in the area. The discharge was ~2.0 m<sup>3</sup>/s and horizontal visibility was 15 m. Conditions were relatively normal compared to previous years. Water clarity was clear and the substrates were relatively stable, due to the two canyons.



### 62.5. Survey Protocols

A 2.0 km snorkel survey was conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It took approximately 3 hours from the estuary to the start of the survey and back. Water temperature and horizontal visibility were measured during the survey. To access the Clanninick Creek, surveyors were dropped off by boat at the mouth and took a skiff upstream to the base of the lower canyon (50°2'48.96"N; 127°24'24.30"W). The crew then walked/swam upstream in the channel, until the anadromous falls (50°3'0.30"N; 127°23'29.43"W). Under high flows, the canyons become impassable by surveyors.

### 62.6. Enhancement/Restoration Activities

No known hatchery, enhancement or restoration activities.

### 62.7. Concerns and Comments

None reported.



*Figure 62-1. Looking upstream at anadromous falls in Clanninick Creek-Anadromous barrier (November 24, 2015).*

## 63. EASY CREEK

### 63.1. Stream Summary

Easy Creek flows into Easy Inlet on the west side of Kashutl Inlet in Kyuquot Sound. The mainstem is about 4.5 km and the lower 2.5 km are surveyed. The upper survey reaches are characterized by shallow riffles, some small pools and several avulsions. The substrate consists of gravel and cobbles, with some boulders. There are primarily holding/rearing habitats with some spawning habitat. The lower portion consists of shallow riffles with several avulsions. There are some rearing and spawning habitats for salmonids. This is predominately a Chum salmon stream, with some Coho salmon also present.

### 63.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson, Ian Beverage)  
Stock Assessment Biologist: D. McHugh

Table 63-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
29-Oct-2015	0	0	267	0	0	0	382	303	2	0

### 63.3. Escapement Comments

Sockeye Return: No Sockeye Salmon were observed.

Coho Return: 297, Expanded PL+D; There was a similar abundance of Coho in 2015 than in 2014 (283). The survey was completed October 29, 2015 near peak escapement.

Pink Return: No Pink Salmon were observed.

Chum Return: 727, Expanded PL+D; There was a lower abundance of Chum in 2015 than in 2014 (1094). The survey was completed October 29, 2015 past peak escapement. Due to the low flows this system is subject to a high abundance of predatory morts.

Chinook Return: Adults Present, survey was too late in the season to represent a peak CN abundance.

For the small size of the system, there were a decent number of fish.

### 63.4. Environmental Conditions

There was a medium amount of rain during the survey. Water levels were slightly elevated due to recent rain in the area. The discharge was ~3.0 m<sup>3</sup>/s and horizontal visibility was 8 m. Conditions were relatively normal compared to previous years. Water clarity was clear; historical forestry in the area; avulsions throughout the survey reach; and high bedload movement (i.e., extensive gravel bars).

### 63.5. Survey Protocols

A snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately 4 hours from the start of the survey to the estuary. Water temperature and horizontal visibility were measured during the survey. The crew accessed the creek by road (Chamiss Main); a drive of approximately 40 minutes from Kyuquot Village. The road parallels the creek both upstream (left bank) and downstream (right bank) of the mainline bridge, facilitating easy access. The crew accessed the start of the survey (~100 m upstream of marker 8), by dropping two crew members off at a left-bank tributary, where they walked downstream to the Easy Creek confluence. At the lower end of the survey, the crew parked the truck near the mainline bridge, at marker 4 and surveyed to marker 0. The upper crew then picked up the lower crew on the mainline road.

### 63.6. Enhancement/Restoration Activities

Several habitat restoration projects have taken place in the Easy Creek watershed, including (but limited to) large woody debris placement and riparian release.

### 63.7. Concerns and Comments

Due to low flows there are a high abundance of predatory morts.



*Figure 63-1. Looking upstream at the anadromous falls (left) and downstream from the falls (right) in Easy Creek (photo credits: Shane Johnson, October 29, 2015).*



## 64. JANSEN CREEK/LAKE

### 64.1. Stream Summary

Jansen Creek flows into Easy Inlet in the northern part of Kyuquot Sound. The creek drains Jansen Lake which is about 200 m upstream from the estuary. The lake and creek both have good clarity unless there is logging in the watershed.

### 64.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)  
Stock Assessment Biologist: D. McHugh

Table 64-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
30-Sep-2015	0	0	1	0	0	0	0	0	0	0
6-Nov-2015	0	0	65	0	0	0	0	0	0	0

### 64.3. Escapement Comments

Sockeye Return: No Sockeye Salmon were observed.

Coho Return: 65, PL+D; There was a lower abundance of Coho in 2015 than in 2014 (386). The survey was completed Nov 6, 2015 during peak escapement.

Pink Return: No Pink Salmon were observed.

Chum Return: No Chum Salmon were observed.

Chinook Return: No Chinook Salmon were observed.

### 64.4. Environmental Conditions

There was a medium amount of rain during the survey. Water levels were slightly elevated due to recent rain in the area. The discharge was ~1.0 m<sup>3</sup>/s and horizontal visibility was 8 m in Jensen Creek. The visibility in Jensen Lake was poor and both the horizontal and vertical visibility was measured to be 5 m. Conditions were relatively normal compared to previous years. Water clarity in Jensen Creek was clear, but turbid in Jensen Lake; historical forestry in the area; avulsions throughout the survey reach; high bedload movement in Jensen Creek (i.e., extensive gravel bars); and large log jam at the outlet of the lake was still present. There is no holding habitat and limited spawning habitat in Jensen Creek above the lake.

### 64.5. Survey Protocols

A 1.5 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately 3 hours from the start of the survey to the lake outlet. Water temperature and horizontal and vertical visibility were measured during the survey. Jensen Creek/Lake was accessed by driving of

approximately 30 minutes from Kyuquot Village along the Chamiss mainline road. The truck was parked at the mainline road bridge and then the crew hiked upstream and downstream in Jensen Creek. The crew walked upstream ~200 m, where they observed an impassable log jam (Photo 1). The crew then hiked downstream to Jensen Lake, where they surveyed near the inlet, along the margins for ~500 m in east to west direction. The crew then used kayaks to paddle across the lake to the outlet and surveyed along the margins for ~500 m in an east to west direction. The log jam at the outlet of the lake is hazardous to maneuver around.

#### 64.6. Enhancement/Restoration Activities

A large log jam exists at the outlet of the lake and some debris were removed at some point. A Sockeye smolt study has occurred in years past. There is a fish ladder at the outlet of the lake to the Inlet.

#### 64.7. Concerns and Comments

A feasibility study to remove woody debris (Photo 2) at the Jensen Lake outlet should be completed and potential restoration (i.e., spawning gravel placement) measures be evaluated.

To determine salmon escapement to Jensen Lake, further enumeration studies (i.e., hydroacoustic or DIDSON studies) should be considered.

Coho number declined drastically from last year. The log jam at the lake outlet and logging debris on the bottom may be affecting the success of lake spawners.



*Figure 64-1. Looking downstream at wood accumulation, near the Jensen Lake outlet. The red arrow indicates the outlet location (Photo credit: Shane Johnson, September 30, 2015).*

## 65. KASHUTL RIVER

### 65.1. Stream Summary

Kashutl River flows south into head of Kashutl Inlet in northern Kyuquot Sound. The mainstem is 10.5 km and only the lower 2.2 km are surveyed. The upper survey reaches are characterized by deep canyon pools and steep riffles (Figure 65-1). The substrate consisted of boulders with some cobbles and gravel, and primarily holding/rearing habitats with some spawning habitats. The lower portion consists of shallow riffles with several avulsions, and some rearing and spawning habitats for salmonids. This is predominately a Chum and Coho salmon stream, with some Chinook salmon.



Figure 65-1. Looking upstream at anadromous falls in Kashutl River at 2.2km, no fish observed from here down past another set of falls ~50m downstream, which may be the anadromous barrier (Photo credit: Shane Johnson, November 19, 2014).

### 65.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)

Stock Assessment Biologist: D. McHugh

Table 65-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
27-Sep-2015	4	0	72	0	1	0	303	0	2	0
19-Nov-2015	0	0	58	3	0	0	0	15	0	0

**Comments:** Surveys occurred before and after the peak for both CO and CM.

### 65.3. Escapement Comments

Sockeye Return: Adults Present; There was a higher abundance of Sockeye in 2015 (4) than in 2014 (0).

Coho Return: 80, Expanded PL+D; There was a lower abundance of Coho in 2015 than in 2014 (105). The survey was completed September 27, 2015, prior to peak escapement.

Pink Return: Adults Present; One Pink was observed during the survey. This was the first Pink observed in Kashutl River, since starting the surveys in 2012.

Chum Return: 337, Expanded PL+D; There was a higher abundance of Chum in 2015 than in 2014 (4). The survey was completed September 27, 2015, prior to peak escapement. In 2014, the survey was conducted on November 19, 2014, which past peak escapement.

Chinook Return: Adults Present; In total, 2 Chinook were observed during the September 27, 2015. This is the earliest date the crew has surveyed the Kashutl River.

### 65.4. Environmental Conditions

During both surveys the weather was clear. Water levels were low and the crew was able to reach the anadromous falls during both surveys (Figure 65-1). Conditions were relatively normal compared to previous years. Water clarity was clear; small amount of bank erosion; and high bedload movement (i.e., extensive gravel bars).

### 65.5. Survey Protocols

A 2.2 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately three hours from the estuary to the start of the survey and back. Water temperature and horizontal visibility were measured during the survey. The crew traveled to the Kashutl River from Kyuquot Village by boat (40-50 minutes). Due to the high tide the crew was able to use the skiff to get to marker 1. The crew tied the skiff to shore, near the logging road bridge. The logging road was followed across the bridge before turning right (upstream) at the "T" in the road. Approximately 250 m from the turn off, the crew turned right onto an overgrown logging road (50°11'58.99"N; 127°18'59.26"W). This road was followed for ~550 m to the right bank of the Kashutl River. The crew then hiked upstream along the margins of the river to the anadromous barrier located ~200 m upstream of marker 4. The anadromous barrier is a ~6 m high falls.

### 65.6. Enhancement/Restoration Activities

Nothing reported

### 65.7. Concerns and Comments

Intensive forestry activities has taken place of both sides of Kashutl River and could be the reason for increased water transport, resulting in bedload movement. In reach 4, there is some bank erosion and an investigation into bank stabilization and riparian protection is recommended.

## 66. KAUWINCH RIVER

### 66.1. Stream Summary

Kauwinch River flows south into the east side of Kashutl Inlet in Kyuquot Sound. The mainstem is almost 16 km long and the lower 6.5 is generally surveyed. The upper survey reaches are characterized by bedrock pool, riffles and glides, with all substrate types, but primarily of gravel and cobbles. There is a canyon in the upper survey area that should only be surveyed under low flow conditions. The lower portion consists of glides, pools, riffles and runs. There are several rearing and spawning habitats present. This is predominately a Chum and Coho salmon stream with some Chinook salmon.

### 66.2. Escapement Estimates

Survey Crew: KCFN (Keith Cox, Tyler Hanson), LGL (Shane Johnson)  
Stock Assessment Biologist: D. McHugh

Table 66-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
18-Sep-2015	57	0	314	0	12	0	98	0	311	1
1-Oct-2015	41	0	518	1	0	0	421	0	29	10
20-Nov-2015	0	0	60	3	0	0	4	26	0	0

**Comments:** The Oct 1 survey decline is partially explained by having to avoid bears fishing in the holding pools, so number observed is an underestimate.

### 66.3. Escapement Comments

Sockeye Return: 63, Level 3 Expanded PL+D; There was a higher abundance of Sockeye Salmon in 2015 than in 2014 (0).

Coho Return: 577 Level 3 Expanded PL+D; There was a lower abundance of Coho in 2015 (518) than in 2014 (865). The survey was completed October 1, 2015, prior to peak escapement. The survey on October 5, 2014, was from marker 7 to 0.

Pink Return: Adults Present; There was a higher abundance of Pink Salmon in 2015 (12) than in 2014 (0). Level 3

Chum Return: 468 Level 3 Expanded PL+D; There was a lower abundance of Chum in 2015 than in 2014 (1690). The survey was completed October 1, 2015, prior to peak escapement.

Chinook Return: 347 Level 2 Expanded PL+D; In total, 312 adult Chinook were observed during the September 18, 2015 survey. This was the earliest date the crew has surveyed the Kauwinch River. Bigger Chinook in general than in 2014.

#### 66.4. Environmental Conditions

During one survey, the weather was clear and during the other there was a medium amount of rain. The river conditions were low and clear during each survey. Conditions were relatively normal compared to previous years. Water clarity was clear; small amount of bank erosion; and high bedload movement (i.e., extensive gravel bars). A log jam spanning the channel, located in reach 1 was still present and does not impede fish passage (Figure 66-1).

#### 66.5. Survey Protocols

A 6.5 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately five hours from the estuary to the start of the survey and back. Water temperature and horizontal visibility were measured during the survey. The crew traveled to Kauwinch River, from Kyuquot Village by boat (40-50 minutes). Due to the high tide, the crew was able to use the skiff to get to marker 1. The crew tied the skiff to shore and started hiking upstream along the margins. The crew hiked out to the logging road on left bank and followed the road up to a left bank tributary. The crew then followed the tributary to the mainstem, where they started the survey. Snorkel marker 13-0, Sept 18 only accessed up to marker 8 due to an engine issue with the skiff, the crew had to walk an additional km, and it would have been dark before they got back if they had hiked up to 13. There were a high abundance of bears in the lower river (marker 3 to 1). The section of the Kauwinch River between markers 13 and 7 can be problematic as the river veers away from the road, and two canyons exist downstream of marker 13. During high flows the canyons become unpassable.

#### 66.6. Enhancement/Restoration Activities

Nothing reported

#### 66.7. Concerns and Comments

On October 1, 2015, four Chinook biosamples were taken from reach 12-11; 8-7; and two from 7-6. The biosample information included: Date, River Segment, Fork Length (mm), POH Length (mm), Adipose clip (Y/N), Scales, Otoliths, DNA, Sex (M/F), Egg Retention and Carcass Condition. Once the samples and information were gathered the caudal fin was then cut off. The information was then forwarded to DFO staff. Intensive forestry activities has taken place of both sides of Kauwinch River and could be the reason for increased water transport, resulting in bedload movement. The log jam in reach 1, should continue to be monitored to ensure fish passage is possible. If transportation can be arranged, the crew should survey the Kauwinch River in two sections: from marker 23 (or above) to marker 13; and from marker 13 to marker 0.

Chinook are a conservation concern. DNA sample SK.





*Figure 66-1. Looking downstream at a log jam in reach #1 of the Kauwinch River (Photo credit: Shane Johnson, October 21, 2013).*

## 67. NARROWGUT CREEK

### 67.1. Stream Summary

Narrowgut Creek flows west into Cachalot Inlet in Kyuquot Sound. The mainstream is about 16 km and the lower 2 km are surveyed for salmon enumeration. The upper survey reaches are characterized by steep boulder cascades with some large and small plunge pools. The substrate consisted of mostly gravel and cobble, with some boulders. There is a limited amount of rearing or spawning habitat. The lower survey reaches consist of shallow riffles with several avulsions. There is some rearing and spawning habitat for salmonids in this section. This is a predominately a Chum salmon stream, with some Coho and possibly Chinook salmon.

### 67.2. Escapement Estimates

Survey Crew: KCFN (Tyler Hanson), LGL (Shane Johnson)  
Stock Assessment Biologist: D. McHugh

Table 67-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
21-Nov-2015	1	0	269	0	0	0	7	45	0	0

### 67.3. Escapement Comments

Sockeye Return: Adults Present; The survey was conducted on November 21, 2015, which is past peak escapement.

Coho Return: 299, Expanded PL+D; There was a higher abundance of Coho in 2015 than in 2014 (240).

Pink Return: No Pink Salmon were observed.

Chum Return: Adults Present; There was a lower abundance of Chum observed in 2015 (52) than in 2014 (518) however the timing was too late for a peak Chum count in both years (2014 survey occurred Nov 12)

Chinook Return: No Chinook Salmon were observed.

### 67.4. Environmental Conditions

The weather was sunny and creek flows were low and clear. Conditions were relatively normal compared to previous years. Water clarity was clear; small amount of bank erosion; high bedload movement (i.e., extensive gravel bars); several avulsions throughout the survey reach. No recent land use.

### 67.5. Survey Protocols

A 2.1 km snorkel survey is conducted by two surveyors, swimming downstream parallel to each other looking for adult salmon in the centre of the channel. It takes approximately three hours



from the estuary to the start of the survey and back. Water temperature and horizontal visibility were measured during the survey. The Narrowgut Creek was accessed by boat from Kyuquot Village (approximately a ½ hour run) and infrastructure from a shellfish aquaculture dock was used for moorage. A skiff was then used for transportation to the mouth of the creek. The crew hiked 2.1 km upstream, along the margins to the start of the survey.

#### 67.6. Enhancement/Restoration Activities

Nothing reported

#### 67.7. Concerns and Comments

Intensive forestry activities has taken place of both sides of Narrowgut Creek and could be the reason for increased water transport, resulting in bedload movement. An investigation into bank stabilization and riparian protection is recommended.



*Figure 67-1. Looking downstream at wood accumulation (left) downstream of Marker 2 and upstream at a right bank side channel in Narrowgut Creek (Photo Credits: Shane Johnson, November 21, 2015).*

*STREAMS IN AREA 27*

## 68. AREA 27 SUMMARY OF OBSERVATIONS IN 2015

Over 60 streams and major tributaries in Area 27 have records of spawning salmon. The priority for escapement enumeration are the Chinook indicator stocks in Marble River and the Colonial/Cayeghle System. Additional systems are surveyed when funding allows and typically less frequently than the indicator systems. Most systems are surveyed using the snorkel method described in the DFO snorkel survey manual. Occasionally systems are also surveyed by stream or bank walks.

In 2015, only the two indicator systems were surveyed in Area 27 (Figure 68-1). Surveys are typically conducted by DFO contractors, First Nations and local enhancement groups. The NWISEA (North Vancouver Island Salmon Enhancement Association) and the Friends of the Marble River Society operate the Marble River Hatchery to enhance Marble River Chinook. Benson River, Colonial/Cayeghle Creek and Goodspeed River have also been enhanced occasionally by various hatcheries in the past 20 years.

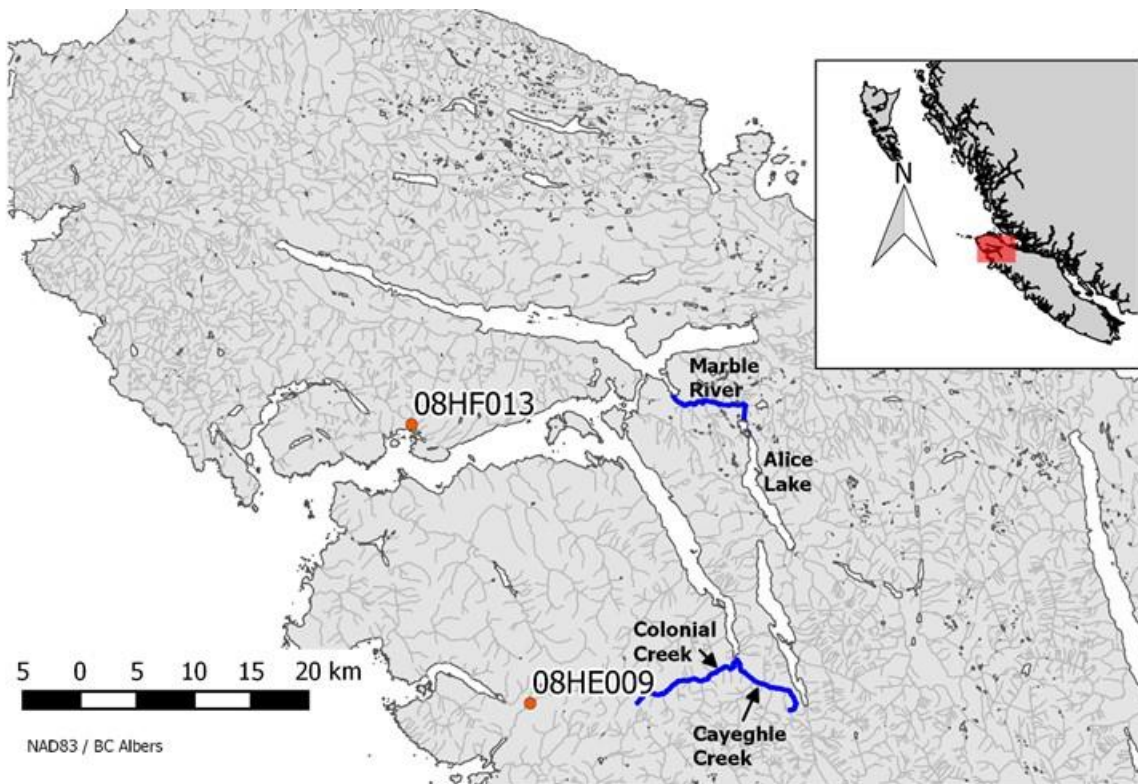
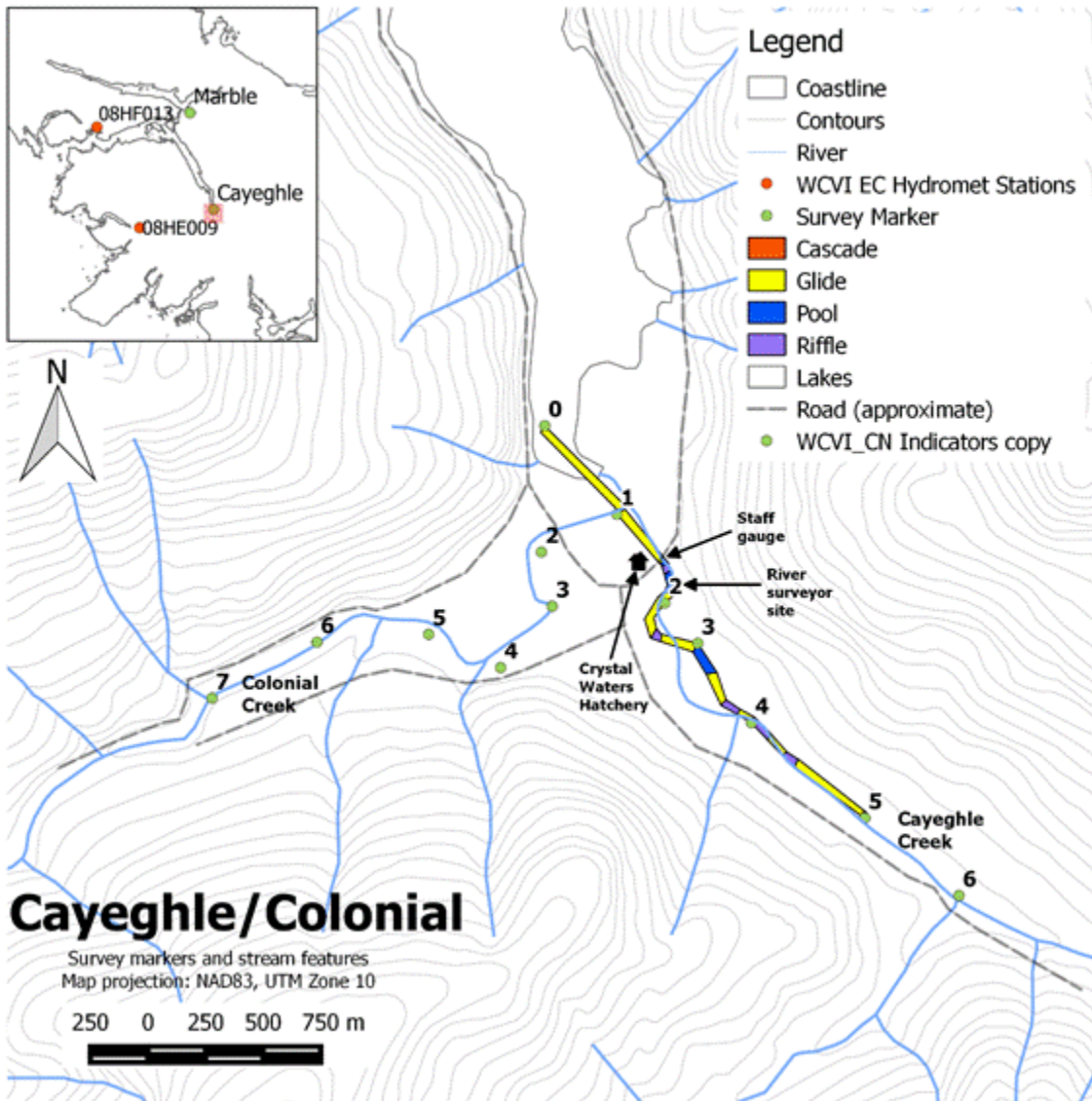


Figure 68-1. Streams in Area 27 that were surveyed in 2015. Environment Canada Hydromet stations on the Zeballos River (08HE006) and Klaskish River Near Klaskino Inlet (08HE006) indicate flow on nearby ungauged systems.

## 69. COLONIAL CREEK/CAYEGHLE CREEK

### 69.1. Stream Summary

The Cayeghle Creek flows northwest into the head of Neroutsos Inlet in Quatsino Sound. The Cayeghle system is fed by the many small tributaries from the surrounding mountains. The largest tributary, Colonial Creek, enters the Cayeghle about 500 m upstream from the estuary. Both creeks are surveyed for salmon enumeration.



The

Figure 69-1. Creek counting stations and habitat units. Map inset shows the location the Marble River, another regularly surveyed system in the area, as well as the location of the Environment Canada hydromet stations on the Klaskish River near Klaskino Inlet (08HE009) and Simpson Creek near Koprino Harbour (08HF013). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The logging road running the length of the system is not shown. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd. Debris jam locations are approximate and as described in 2014.

Cayeghle mainstem is over 8 km long and the lower 3 km is considered the most suitable spawning habitat, with 6 survey sections, each 500 m in length (Figure 69-1). The lower 3 km of Colonial Creek has also been divided into 6 survey sections for salmon enumeration. Another major tributary besides Colonial Creek is Utluh Creek which enters Cayeghle Creek at about marker 6.

Cayeghle Creek has a low gradient for most of the survey area. Above marker 6 the stream becomes narrower and slightly steeper at the lower end of a canyon. The canyon contains pools and chutes there have been observations of Coho and Chinook. The substrate in the system is mainly a mix of bedrock, gravel and cobble. There are large pools at markers 4 and 3 is used for holding. The left bank (looking downstream) between markers 3 and 2 has been heavily eroded in recent years.

The Colonial surveys start at marker 7 and end at marker 1 which is the confluence with Cayeghle Creek. The gradient on Colonial Creek is also low for most of the survey section and the substrate consists of mainly gravel, cobble and some bedrock. The Cayeghle system usually has excellent visibility except at high water.

Bears and other wildlife are common on the system. Seals have been observed up to survey marker 2 on Cayeghle. The watershed has been heavily logged and activities are ongoing. Logging roads cover a large part of the watershed and cross the stream and tributaries several times. Between markers 2 and 1 on Cayeghle Creek are the now inactive buildings from the Crystal Waters Atlantic Salmon Hatchery. There is a pulp mill in Port Alice that has been in operation since the 1950s.

## 69.2. Survey Results and Escapement Estimate

Survey Crew: NWISEA (Erin Wright)

Stock Assessment Biologist: Diana McHugh

In 2015, the Colonial/Cayeghle system was snorkel surveyed 8 times between early September and early November. All surveys had excellent conditions with the exception of Oct. 8 when flood waters created poor visibility. Generally good survey conditions and coverage through the season, as well as an experienced survey crew resulted in reliable escapement estimates for Coho, Chum and Chinook.



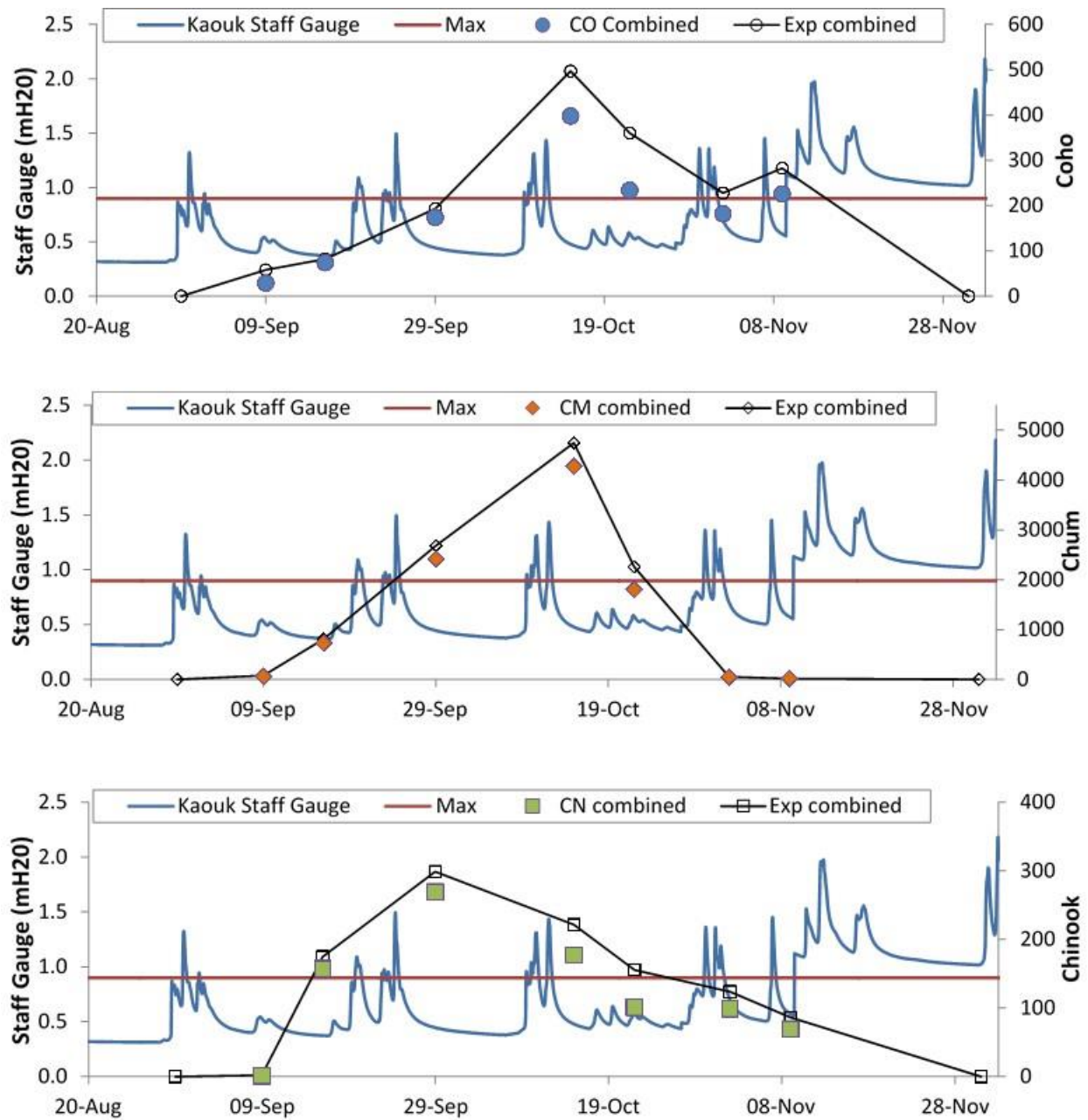


Figure 69-2. Raw counts (solid marker) and expanded counts (open marker) for each species combined for Colonial and Cayeghle Creeks. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns. Note: The staff gauge reading starting Nov 9<sup>th</sup> is roughly 1m higher than the true reading due to the sensor being knocked over by a high water event. The survey on Oct. 8 was conducted in very poor conditions and is not shown here.

## Individual Survey Data:

Table 69-1. Unexpanded live and dead counts by species for each survey on **Colonial Creek**.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
09-Sep-15			7				35		1	
16-Sep-15	1		28		3		406		105	
29-Sep-15			50				1111	9	174	
08-Oct-15			1				225		2	
15-Oct-15			83				1661	91	85	
22-Oct-15			78				573	98	79	
02-Nov-15			51				42	6	62	
09-Nov-15			65				14	3	54	1

Table 69-2. Unexpanded live and dead counts by species for each survey on **Cayeghle Creek**.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
09-Sep-15			22				27			
16-Sep-15	1		46		16		325	17	52	
29-Sep-15	1		124		2		1304	7	95	
15-Oct-15	1		315		1		2612	81	92	
22-Oct-15	1		156				1232	222	22	1
2-Nov-15	0		131				5	15	37	
09-Nov-15			161	3			4		15	

Table 69-3. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye				
Coho	30 (28-45)	1-Sep-15	15-Dec-15	Historic range for Cayeghle Coho, water levels in early fall were sufficient for entry.
Pink				
Chum	15 (12-17)	1-Sep-15	15-Nov-15	Historic range for Cayeghle Chum, water levels in early fall were sufficient for entry.
Chinook	20 (17-38)	01-Sep-15	15-Nov-15	Historic range for Cayeghle Chinook, water levels in early fall were sufficient for entry.

Table 69-4. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:  
For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%  
For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
09-Sep-15	poor	Water level above normal (0.42m), water tea/slightly turbid (4.5-6m)
16-Sep-15	excellent	Water level normal (0.1m), Water clear (>15m)
29-Sep-15	excellent	Water level normal (0.19m), water clear (>15m)
08-Oct-15	very poor	Flood conditions, water muddy (1-3m)
15-Oct-15	good	Water level normal (0.36m), water level clear (15m)
22-Oct-15	fair	Water level normal (0.36m), water turbid (4-6m)
02-Nov-15	good	Water level normal (0.23m), water clear-tea (5-8m)
09-Nov-15	good	Water level normal (0.25m), water clear 13-15m)

Table 69-5. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate (Colonial)	Annual escapement estimate (Cayeghle)	Annual escapement estimate (Colonial/Cayeghle)	Analytical method	Data quality level
Sockeye	Adults Present	Adults Present	Adults Present		
Coho	194 (128-206)	511 (394*-543)	705 (522-749)	AUC	2
Pink	3	17	20	PL+D	
Chum	3,395 (2,996-4,244)	4,813 (4,247-6,016)	8208 (7,243-10,260)	AUC	2
Chinook	372 (196-437)	214 (112-251)	586 (308-689)	AUC	2

\*Historic high SL produces estimate lower than peak, so minimum is expanded peak count.

### Escapement Commentary:

Sockeye: Sockeye not usually seen, but they were noted in 2015

Coho: Lots of jack Coho observed

Pink: More Pinks than usual seen in early surveys

Chinook: Higher than average Chinook return in 2015

## 69.3. Spawner Distribution

### Run Timing:

Table 69-6. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho					Early Nov		
Pink							
Chum					Early Sept	Late Sept	Mid Oct
Chinook					Mid Sept	Early Oct	Early Nov



## Spatial Distribution:

Table 69-7. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	
Coho	Cay: 6-2, Col:5-2
Pink	
Chum	Cay: 5-0, Col: 6-0
Chinook	Cay: 5-3, Col: 6-0
Steelhead	

**Comments:** Section marker 6 is in a canyonous spot, and is difficult for fish passage, although fish (notably Coho) have been noted upstream of this point.

## 69.4. Environmental Conditions

### Weather Summary:

Weather patterns were normal for the fall season. Typically, water levels rise and fall very fast. Colonial seemed to be flashier than normal, and much more turbid at high flows than normal. Discussions amongst surveyors suggested it may have been due to the recent and ongoing logging upstream from the survey area.

### Physical Characteristics Update:

Colonial Creek had one large change in river course. Near marker 3, the river now cuts through the trees and re-joins river channel below. Approximately 300 m of old stream bed is now left de-watered. There was also a high volume of sediment/bed load movement. This is typical, but appeared to be higher than other years.

## 69.5. Update to Stream Survey Protocols

### Current Assessment Method:

The Cayeghle System is surveyed by a snorkel crew of two people every 7 to 10 days through the spawning season. On Cayeghle Creek, markers 6 to 0 are surveyed over a 3 km length. On Colonial Creek markers 6-0 are also surveyed over a 3 km length. Each system takes approximately 1.5 hours to survey. A staff gauge is located on the Cayeghle system, just upstream of the Marine Drive main bridge. Discharge measurements are collected at the pool tail out just upstream of the bridge. There are orange flagging ribbons on either side of the river to identify the discharge measurement location.

### Safety Update:

There were some changes in river channel location. Colonial now cuts through treed area and cut off section of river around marker 3.

## 69.6. Enhancement

These systems have had obvious habitat improvement structures built. Some are still in place, others are far from the current stream channel. The Cayeghle side had considerable rip rap

dumped in at section marker 3 a few years ago to prevent further bank scouring and stabilization of the bank.

## 69.7. Biosamples

### **Description of Biosamples including reason for sample and sample description:**

23 Chinook biosamples were collected from the Colonial Creek side. Only 1 sample was collected from Cayeghle side. Nearly all of the samples collected were in section 5-4 on the Colonial Creek side.

Samples were either found dead by the swim crew, caught live by hand (post spawn), or captured in tangle net or with a spear gun.

Samples were collected as part of a West Coast Vancouver Island Chinook run reconstruction project being conducted by DFO Stock Assessment. These samples will also be used to build the Chinook DNA baseline for the Colonial Creek. The biosample information included: Date, River Segment, Fork Length (mm), POH Length (mm), Adipose clip (Y/N), Scales, Otoliths, DNA, Sex (M/F), Egg Retention and Carcass Condition.

## 69.8. Concerns and Comments

- Seals are common and the surveyors identified many carcasses identified as “seals kills”
- Scouring, turbid water, flashy, high bed load movements
- Heavy logging activity
- Fishing activity and poaching are considered to be moderate or low

## 70. MARBLE RIVER

### 70.1. Stream Summary

The Marble River flows north through Victoria and Alice Lake, then west into Varney Bay, south of Rupert Inlet. The mainstem length is about 15 km long, but only 5 km in the lower system are surveyed for salmon enumeration. The majority of the Marble River is located within the Marble River Provincial Park. The Marble River Hatchery and Marble River Campsite located at Alice Lake outlet. Logging operations are active in the watershed.

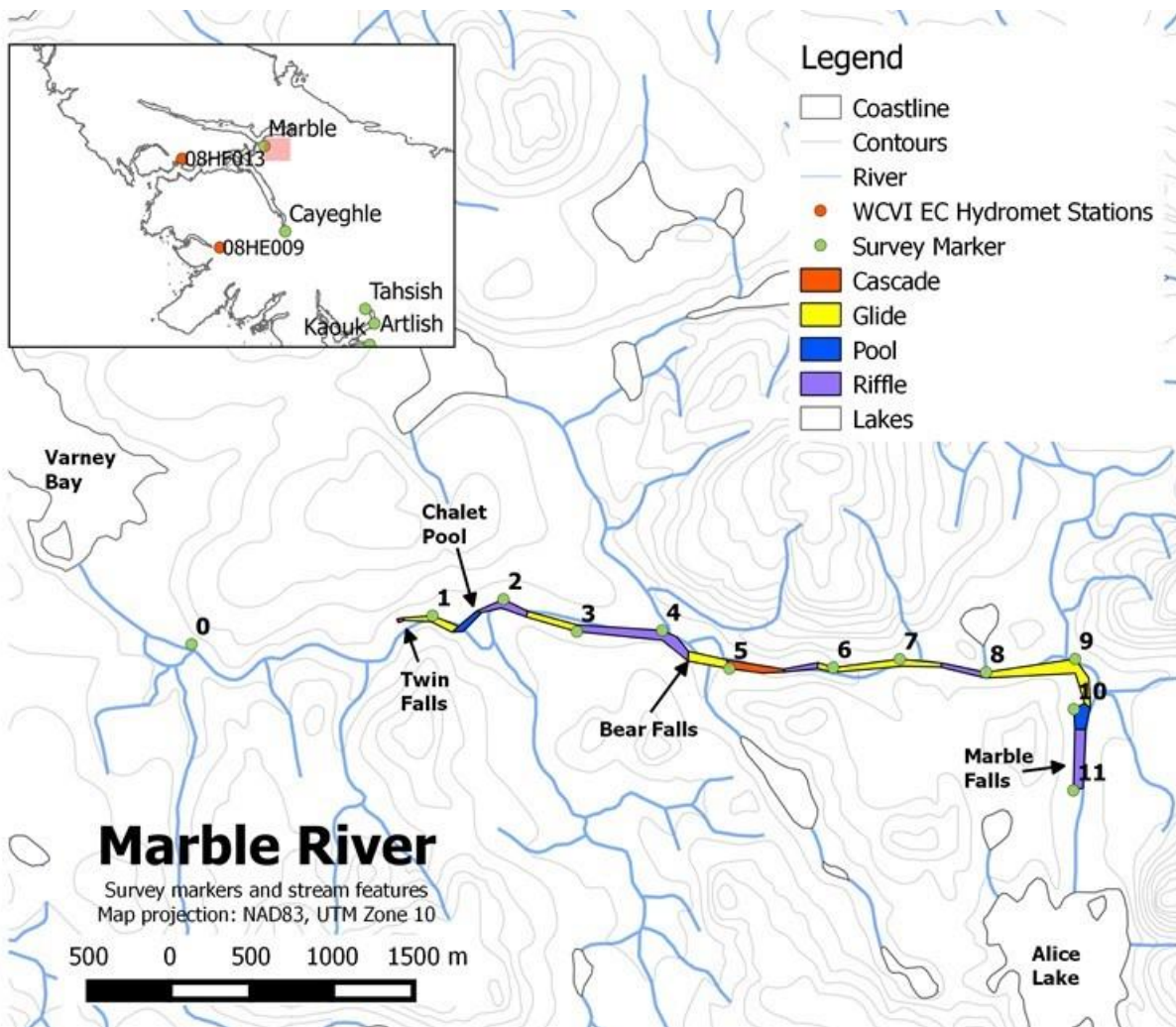


Figure 70-1. Marble River counting stations and habitat units. Map inset shows the location the Marble River, another regularly surveyed system in the area, as well as the location of the Environment Canada hydromet stations on the Klaskish River near Klaskino Inlet (08HE009) and Simpson Creek near Koprino Harbour (08HF013). Rivers, coastline and elevations are based on the Terrain Resource Information Management (TRIM) digital base maps of British Columbia. The logging road running the length of the system is not shown. Habitat data were mapped in the field and / or digitized from recent high resolution orthophotographs by M.C. Wright and Associates Ltd.

## 70.2. Survey Results and Escapement Estimate

Survey Crew: NVERSEA (E. Wright)

Stock Assessment Biologist: Diana McHugh

The Marble River was surveyed 5 times between early September and late November. Heavy rains resulting in high flows in late September and again in mid-October prevented crews from entering the system. Reduced survey coverage and poor survey conditions result in less reliable escapement estimates for Marble River Chinook and Coho.

### Individual Survey Data:

Table 70-1. Unexpanded live and dead counts by species for each survey.

Date	SK		CO		PK		CM		CN	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
02-Sep-15			256						108	
15-Sep-15			376	1					1134	
21-Sep-15			191	2					1222	
09-Oct-15	0		99						2907	
30-Nov-15									250	150

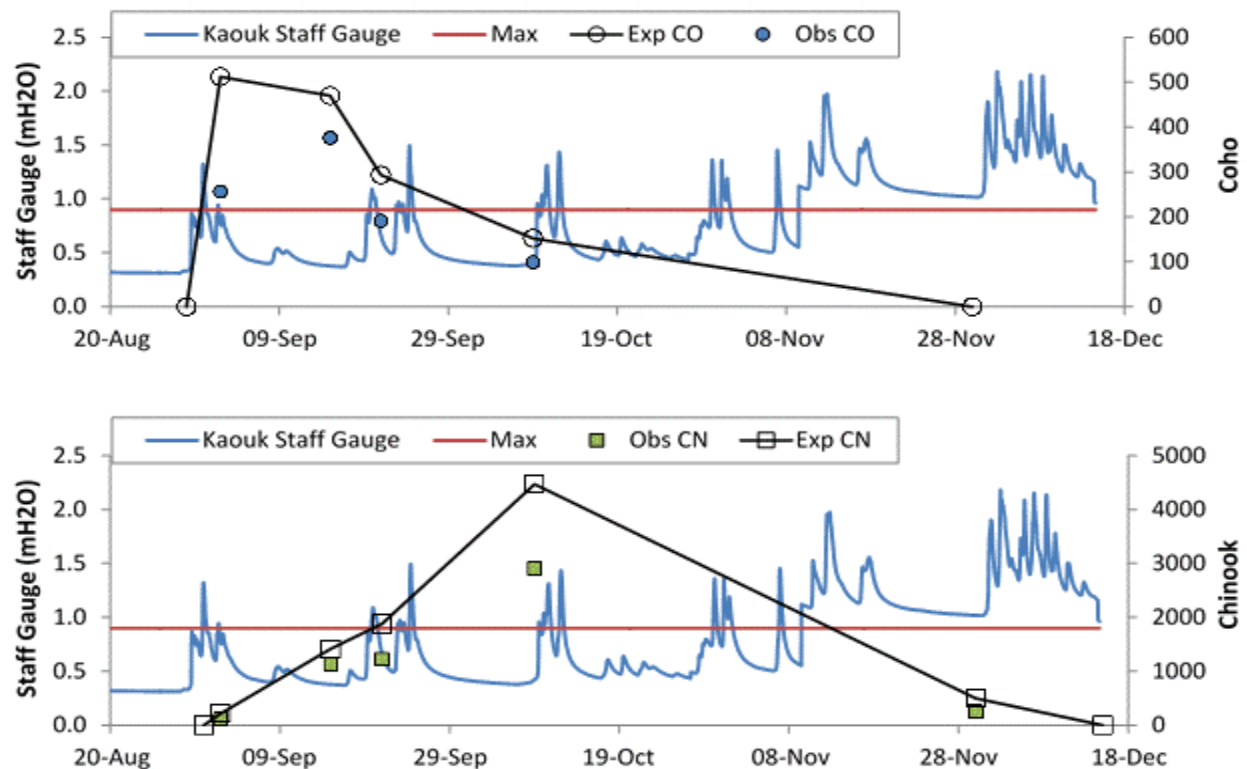


Figure 70-2. Raw counts (solid marker) and expanded counts (open marker) for each species. The water level/discharge is from the nearest or most representative hydrometric station. The red line is the water level above which surveys should no longer be conducted because of safety or observer efficiency concerns. Note: The staff gauge reading starting Nov 9<sup>th</sup> is roughly 1m higher than the true reading due to the sensor being knocked over by a high water event.

Table 70-2. Survey life and rationale for each species. Also includes the first and last zero used for the annual estimate if AUC was the estimate method used.

Species	Survey Life	First Zero	Last Zero	Comments
Sockeye				
Coho	35 (30-40)	28-Aug-15	15-Dec-15	Historic range for Marble Chinook, water levels in early fall were sufficient for entry.
Pink				
Chum				
Chinook	35 (30-40)	28-Aug-15	15-Dec-15	Historic range for Marble Chinook, water levels in early fall were sufficient for entry.
Comments: It is highly likely (year dependant) that some Chinook and many Coho leave the survey area and move into Alice Lake. Radio tagging could not confirm Chinook migration past survey area. Chinook have been observed by snorkel crews in both Link and Benson Rivers. SL applied are consistent with historical values to allow between year comparisons.				

Table 70-3. Observer efficiency rationale. Observer Efficiency is based on environmental measurements from the individual surveys. The observer efficiency expansion is based on the following categories:

For SK, CO, PK, CN - Excellent = 90%; Good = 80%, Fair = 65%, Poor = 50%

For CM - Excellent = 90%; Good = 90%, Fair = 80%, Poor = 80%

Date	OE category	Comments
02-Sep-15	poor	Water level above normal (0.45m), water slightly turbid/tea coloured (5-13m)
15-Sep-15	good	Water level normal (0.37m), water slightly turbid (8.5-9m)
21-Sep-15	fair	Water level above normal (0.43m), water level slightly turbid (8.5)
09-Oct-15	fair	Water level above normal (0.34m), water slightly turbid (8m)
30-Nov-15	poor	Water level below normal, water turbid. No measurements taken, the focus was on biosampling not on snorkel survey

Note: water level recorded at segment 11-10 used for this table

Table 70-4. Escapement Estimates using the OE and SL parameters described above. A range is given in brackets if there was an upper and lower SL provided and if the analytical method used was AUC. The data quality level refers to how data can be used for management purposes. Level 1 data are high quality estimates, level 2 data are mixed or medium quality estimates and should be used with caution, and level 3 data are low quality estimates and are of limited use for management purposes.

Species	Annual escapement estimate	Analytical method	Data quality level
Sockeye			
Coho	399 (349-466)	AUC	3
Pink			
Chum			
Chinook	6,516 (5,701-7,601)	AUC	2

### Escapement Commentary:

**Sockeye Return:** Sockeye not typically observed.

**Coho Return:** Coho return appeared average. It is unclear what proportion of the Coho population migrates beyond the survey area.

**Chinook Return:** Early, strong, well distributed. Large size based on visual observations.

### 70.3. Spawner Distribution

#### Run Timing:

Table 70-5. The run timing for the survey year by species.

Species	Estuary			Arrival in Stream	Dates of Spawning		
	Arrival	Peak	End		Start	Peak	End
Sockeye							
Coho				July/August			
Pink							
Chum					Late Sept		
Chinook	July	August	Sept/Oct	Sept/Oct	late Sept	Oct	December

**Comments:** Peak or end spawn not observed for either species.

#### Spatial Distribution:

Table 70-6. The survey sections used by spawners per species.

Species	Survey Section(s) used for spawning
Sockeye	Sockeye not typically observed.
Coho	Coho observed throughout all survey areas. Visual observations of large numbers of Coho leaving the top of survey area and into Alice Lake.
Pink	Few Pinks are observed, if seen they tend to be observed below Bear Falls (marker 4)
Chum	Few Chum are observed. If seen, they tend to be observed below Bear Falls (marker 4)
Chinook	Well distributed. Spawning observed throughout the whole survey area, with higher abundances below Bear Falls (marker 4). Heavy Chinook spawning populations also noted throughout other sections of the river, but the campground area (marker 10-8) is also noted for heavy amounts of Chinook spawning. Chinook do leave the survey area and enter Alice Lake. It is unclear what proportion of the run emigrates past the top end of the survey area.
Steelhead	Few fish are noted. Marker 3-2 is where swim crews tend to note small groups of steelhead almost every year. Fish are regularly observed in the tail out of the section marker 11 pool, and downstream past the campground to section marker 8. Steelhead are more prevalently observed in the Link River system.

### 70.4. Environmental Conditions

#### Weather Summary:

Water levels are usually low and relatively clear throughout most of September. 2015 saw late August and early September rains which brought the Chinook in early. Extensive rains on Sept 22 prevented swims from occurring again until Oct 10. The small window on Oct 10 did not last long as the rains hit again immediately after that and the river levels spiked for the remainder of the snorkel survey season.

#### Physical Characteristics Update:

Water clarity was moderate at best in 2015. Heavy amounts of flocculent were suspended in the water making visibility poor. The main Chalet Pool is still big, wide and deep, but the tail out

is starting to fill up with gravel. Section 2-1 appears to have lost some stability as there appears to be some change in river bottom structure and flow patterns.

## 70.5. Update to Stream Survey Protocols

### **Current Assessment Method:**

Snorkel surveys are planned for every 7 to 10 days beginning in early September, as flows allow. Survey begins at marker 11 (below rapids at the highway bridge) and ends at marker 1 (just above Twin Falls). Historically surveyors continued swimming downstream past twin falls and through the lower canyon where they would be picked up by boat (tide dependant). In 2012, a trail was blazed out allowing surveyors to hike out from the lower Marble and get picked up via truck off the Varney 510 logging road.

Environmental measurements are collected in various spots on the Marble. Horizontal measurements are usually conducted at the starting point at marker 11, and again at the Chalet Pool in section 2-1. There are 3 staff gauges set up on the Marble. One is on the highway bridge piling which can be observed from river right bank. A second staff gauge is anchored to the rocks at the “get in” point at marker 11. The third staff gauge is in the Chalet pool in section 2-1 on river right bank just behind the inside corner of the pool.

There is a mid-river canyon section that does not get surveyed. Survey crews swim downstream to the anglers access pool (marker 6), then get out on river left bank and hike up to the Marble trail that follows the river. The canyon bi-pass is about 800 meters down the trail before the swim crew cuts down the river bank back down to the river below the canyon (just above marker 5). Bear Falls are at the bottom of section 5-4. Surveyors need to get out above the falls and hike around and drop back in below the falls. Going through the fish way or over the falls would be catastrophic.

The survey takes about 5 hours to complete, plus the hike out from Chalet Pool which is an additional half hour.

### **Deviations from current assessment protocols:**

Snorkel survey methods have been the same as previous years. In 2012, snorkel crews used the hike out trail on a more regular basis as swims did not have to be coordinated with high tides for boat pick-ups, this prevented any estimate for the lower river (marker 1-0) count.

### **Access Updates:**

Access to the “get in” point at marker 11 is still the same (little trail from camp ground road down along the cement release race way).

The lower river trail is difficult to find, but it exits the river from the clay bank just below the “mini chalet” pool on river right. There is flagging tape there to mark the trail head. Vehicle access is via the Varney main logging road, then left on the V500, and a quick right on the V510. This takes you up to a new cut block where the truck parks and waits for the swim crew to emerge from trail.

**Safety Update:**

No safety updates, just be aware of mid river canyon (marker 6-5), Bear Falls (marker 5-4) and possibly Twin Falls which is below the survey area (marker 1-0). A “no swim” cut off point is established at 0.6 m on the hatchery staff gauge in the intake well.

## 70.6. Enhancement

**Brood Removal:**

None this year. Authorized for 225 pairs of Chinook, but Chinook did not hold where they could be taken for broodstock while water levels and fish condition were acceptable.

**Planned Release Numbers and Strategy:**

1M egg target.

**Other Activities:**

None recently.

## 70.7. Biosamples

**Description of Biosamples including reason for sample and sample description:**

Two biosampling events were conducted in 2015. Once on Nov. 30, and again on Dec. 3. A total of 50 Chinook samples were taken from river section 2-1. Most samples were from dead Chinook with white gills, but a few were found dead with red gills, and a few were caught live post spawn and sampled.

Samples were collected as part of a West Coast Vancouver Island Chinook run reconstruction project being conducted by DFO Stock Assessment. These samples will also be used to build the Chinook DNA baseline for the Colonial Creek. The biosample information included: Date, River Segment, Fork Length (mm), POH Length (mm), Adipose clip (Y/N), Scales, Otoliths, DNA, Sex (M/F), Egg Retention and Carcass Condition.

## 70.8. Concerns and Comments

Nothing noted.



*WCVI IN-SEASON ESCAPEMENT BULLETINS*

# WCVI ESCAPEMENT BULLETIN - OCTOBER 1, 2015

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## WCVI Salmon Escapement Bulletin Chinook, Coho and Chum Extensive Indicator Program In-season Update, October 1, 2015

### IN-SEASON OBSERVATIONS:

River levels were extremely low through most of the summer, but a major rain event in late-August, over 250mm of rain from Aug 28 to Sept 3, caused high water levels in many index systems, bringing Chinook and coho into many systems and briefly delaying the first swims in some index systems.

Peak escapement of chinook to WCVI rivers is typically about the first week of October.

Peak escapement of chum to WCVI rivers is typically mid to late October.

Peak escapement of coho to WCVI rivers is typically late October to early November.

Peak escapement of sockeye to Clemens Creek is typically mid to late October.

**Port Renfrew (Area 20):** The San Juan fence has not been installed due to the high water levels. San Juan Enhancement society Chinook brood stock will be taken by a combination of seine and tangle net near the old fence site. Swim surveys of the lower San Juan will be conducted periodically through September and October to assess salmon escapement. Two swims have been completed to date; Chinook escapement is at least 60% of the 12 year average.

**Nitinat (Area 22):** Four swims are planned in Nitinat starting in mid-September. One survey in mid-September observed an unusually high number of sockeye, Chinook were already 75% of the 12 year average, and surveys in the coming week should provide more information regarding chum and coho returns.

**Barkley Sound/Alberni Inlet (Area 23):** Surveys have been completed on schedule in Area 23, the number of sockeye observed in Toquart is unusually high, but is close to the 12 year average in Nahmint. Chinook are at 77% of the 12 year average as of last week in Nahmint, and are just above the 12 year average in Sarita. Toquart was last surveyed in mid-September, but another survey is scheduled soon.

**Clayoquot Sound (Area 24):** Some surveys in the last two weeks have been delayed due to high water events, but should be completed this week. Based on the first round of swims in early to mid-September, sockeye are unusually prevalent in Clayoquot systems where they are usually only seen in small numbers. Chinook are above the 12 year average in Cypre, and based on preliminary information from a swim this week, Bedwell Chinook have returned at least twice the 12 year average.

**Nootka Sound/Esperanza Inlet (Area 25):** Surveys of Tahsis, Leiner, Burman, and Conuma have occurred generally as scheduled, but the most recent information from Zeballos, Little Zeballos, Espinosa and Park is from mid-September. Sockeye numbers are not unusually high in Nootka; Burman, Leiner, and Conuma Chinook are above the 12 year average and Tahsis is

at 65% of the 12 year average. The Conuma seems to have peaked as the survey this week observed roughly 17,000 – a decline from mid-Sept.

**Kyuquot Sound (Area 26):** Chinook observations are above the 12 year average in Tahsish, about 2/3 of the average in Kaouk, and well above average in Artlish.

**Quatsino Sound (Area 27):** Chinook observations are close to half of the 12 year average for both Marble and Cayeghle.

## **ESCAPEMENT MONITORING FRAMEWORK:**

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

**Intensive indicator stocks** describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

**Extensive indicator stocks** provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

**Other Escapement Information:** Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

**Data Quality:** The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the

same weight in fisheries management decisions.<sup>1</sup> The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

## **IN-SEASON RESULTS:**

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

**For more information Contact:**  
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**WCVI Salmon Extensive Assessment Program Biologist**  
**Telephone (250) 756-7006, Fax (250) 756-7162**  
**E-mail: [Diana.McHugh@dfo-mpo.gc.ca](mailto:Diana.McHugh@dfo-mpo.gc.ca)**

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<sup>1</sup> The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak live plus dead counts to date for 2015 WCVI salmon survey populations.



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## Stock Assessment Division, South Coast Salmon

For more information contact:

WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 63

### 2015 Preliminary Escapement Observations

#### Summary Note:

Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat and Stamp numbers current as of Sept 26. Carnation as of Sept 22.

#### Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	-	5	-	-	-	-	CO
23	SPROAT RIVER	Fence	11	2,198	303,665	NA	NA	NA	CN/SK
23	STAMP RIVER	Fence	34,145	12,853	390,191	21	662	32	CN/SK

#### Level 2 WCVI Indicator Streams

#### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	1	7,986	272	1,347	329	19	53	CN
23	CLEMENS CREEK	7	2	1,326	763	43	1	2	SK
23	NAHMINT RIVER	4	272	136	817	565	-	2	CN
23	SARITA RIVER	3	1,525	333	47	747	-	42	CN
24	BEDWELL RIVER	2	350	237	761	20	1	27	CN
24	MEGIN RIVER	1	10	129	4	5	-	2	CN
24	TRANQUIL CREEK	1	15	24	1,680	602	1	4	CN
25	BURMAN RIVER	8	3,799	267	617	1,001	1	12	CN
25	CONUMA RIVER	3	35,719	1,611	52	6,536	9	3	CN
25	LEINER RIVER	3	620	293	144	1,334	1	5	CN
25	LITTLE ZEBALLOS RIVER	1	9	28	6	14	-	2	CM
25	PARK RIVER	1	-	7	-	12	-	-	CM
25	TAHSIS RIVER	3	230	360	166	787	3	4	CN
25	ZEBALLOS RIVER	2	165	105	300	299	1	11	CM
26	ARTLISH RIVER	3	782	383	21	34	-	6	CN
26	KAOUK RIVER	3	206	658	69	1,468	1	9	CN
26	TAHSISH RIVER	4	440	608	30	1,599	2	5	CN
26	MALKSOPE RIVER	1	11	321	1	69	-	3	CO
27	CAYEGHLE SYSTEM	3	269	174	1	2,431	1	19	CN
27	MARBLE RIVER	3	1,222	377	-	-	1	-	CN

#### Level 3 Streams

#### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	2	1,049	714	85	5	144	172	CN
23	TOQUART RIVER	1	269	700	397	35	14	60	CN
24	CYPRE RIVER	1	1,088	21	93	3	-	5	CN
25	ESPINOSA CREEK	1	5	3	25	33	4	22	CM
26	KAUWINCH RIVER	1	312	314	57	98	-	12	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,400	1,800	8,200	7,100	1,200	900
22	NITINAT RIVER	7,700	10,700	5,200	5,500	130,000	147,000
23	CLEMENS CREEK	200	100	2,100	2,000	110	120
23	NAHMINT RIVER	300	400	500	400	11,900	18,500
23	SARITA RIVER	1,000	1,500	1,100	700	11,600	10,200
24	BEDWELL RIVER	240	150	1,400	1,200	3,500	3,500
24	MEGIN RIVER	50	50	1,700	1,200	1,900	2,100
24	TRANQUIL CREEK	320	520	1,000	800	9,800	9,700
25	BURMAN RIVER	3,400	1,900	1,400	1,400	5,000	4,700
25	CONUMA RIVER	23,400	21,300	2,200	2,700	6,800	10,900
25	INNER BASIN CREEK (Black C)	NA	NA	NA	NA	3,500	5,000
25	LEINER RIVER	410	390	1,010	830	1,900	4,000
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,700	3,700
25	PARK RIVER	NA	NA	NA	NA	4,900	4,600
25	TAHSIS RIVER	280	360	1,700	1,400	3,200	5,900
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	3,700	5,800
26	ARTLISH RIVER	170	220	1,800	1,400	4,400	4,700
26	KAOUK RIVER	230	320	2,500	2,200	9,500	8,800
26	MALKSOPE	NA	NA	2,400	2,300	11,800	10,800
26	TAHSISH RIVER	350	300	3,100	2,700	5,400	5,300
27	CAYEGHLE SYSTEM	290	430	840	850	12,200	10,300
27	MARBLE RIVER	2,600	2,700	1,700	2,100	NA	NA

# WCVI ESCAPEMENT BULLETIN - OCTOBER 9, 2015

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## WCVI Salmon Escapement Bulletin Chinook, Coho and Chum Extensive Indicator Program In-season Update, October 9, 2015

### IN-SEASON OBSERVATIONS:

River levels were extremely low through most of the summer, but a major rain event in late-August, over 250mm of rain from Aug 28 to Sept 3, caused high water levels in many index systems, bringing Chinook and coho into many systems and briefly delaying the first swims in some index systems.

Peak escapement of chinook to WCVI rivers is typically about the first week of October.

Peak escapement of chum to WCVI rivers is typically mid to late October.

Peak escapement of coho to WCVI rivers is typically late October to early November.

Peak escapement of sockeye to Clemens Creek is typically mid to late October.

**Port Renfrew (Area 20):** The San Juan fence has not been installed due to the high water levels. Swim surveys of the lower San Juan will be conducted periodically through September and October to assess salmon escapement. Three swims have been completed to date with the latest including the Upper San Juan as well; as of Oct 5 Chinook escapement is at least 60% of the 12 year average and has started to decline, chum in only at 5%, and coho is at least 36% of the 12 year average

**Nitinat (Area 22):** Four swims are planned in Nitinat starting in mid-September. A second swim occurred Oct 5-6, Chinook have begun to decline in-river (currently at 75% of the 12 year average), chum have increased in-river (currently at 5% of the 12 year average), and coho have remained steady (5% of the 12 year average).

**Barkley Sound/Alberni Inlet (Area 23):** Surveys have been completed on schedule in Area 23. Chinook are at 80% of the 12 year average as of last week in Nahmint, are just above the 12 year average in Sarita, and are at 61% of the 12 year average in Toquart. At Carnation, 45 adult coho and 150 coho jacks were observed passing through the fence and just downstream.

**Clayoquot Sound (Area 24):** Surveys were completed last week. Chinook are at roughly twice the 12 year average in Cypre and Bedwell, at 74% of the 12 year average in the Megin, but only 17% of the 12 year average in Tranquil. Chum are at 28% of the 12 year average in Tranquil, but less than 10% of the 12 year average in Bedwell, Cypre, and Megin. Coho are between 11% and 32% of the 12 year average in Tranquil, Bedwell, Cypre, and Megin.

**Nootka Sound/Esperanza Inlet (Area 25):** Surveys of Tahsis, Leiner, and Burman have occurred generally as scheduled, but the most recent information from Zeballos, Little Zeballos, Espinosa and Park is from mid-September, and Conuma was last surveyed the first week of October. Chinook are between 150% and 200% of the 12 year average in Burman, Leiner, and

Conuma, Tahsis is at 65% of the 12 year average, and Chinook numbers have begun to decline.

**Kyuquot Sound (Area 26):** Chinook observations are above the 12 year average in Tahsish, about 2/3 of the average in Kaouk, well above average in Artlish and have started to decline.

**Quatsino Sound (Area 27):** Chinook observations are close to half of the 12 year average for Cayeghle and Marble Chinook are just above the 12 year average based on today's survey.

## **ESCAPEMENT MONITORING FRAMEWORK:**

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

**Intensive indicator stocks** describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

**Extensive indicator stocks** provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

**Other Escapement Information:** Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

**Data Quality:** The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the



same weight in fisheries management decisions.<sup>2</sup> The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

## **IN-SEASON RESULTS:**

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

**For more information Contact:**  
**Diana McHugh,**  
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**E-mail: [Diana.McHugh@dfo-mpo.gc.ca](mailto:Diana.McHugh@dfo-mpo.gc.ca)**

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<sup>2</sup> The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak live plus dead counts to date for 2015 WCVI salmon survey populations.



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## Stock Assessment Division, South Coast Salmon

For more information contact:

WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 83

### 2015 Preliminary Escapement Observations

#### Summary Note:

Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat and Sproat numbers current as of Sept 26, Stamp as of Oct 4, Carnation as of Oct 5, an additional 28 Coho and 3 Chinook were observed below the Carnation fence.

### Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	1	17	-	1	-	-	CO
23	SPROAT RIVER	Fence	11	2,198	303,665	NA	NA	NA	CN/SK
23	STAMP RIVER	Fence	44,969	11,604	409,383	25	680	28	CN/SK

### Level 2 WCVI Indicator Streams

### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	2	7,986	272	1,347	8,578	22	53	CN
23	CLEMENS CREEK	8	31	1,326	763	43	1	2	SK
23	NAHMINT RIVER	5	281	136	817	1,500	-	3	CN
23	SARITA RIVER	3	1,525	333	47	747	-	42	CN
24	BEDWELL RIVER	2	342	391	761	328	1	27	CN
24	MEGIN RIVER	3	34	202	23	113	-	29	CN
24	TRANQUIL CREEK	3	90	178	1,834	2,733	1	5	CN
25	BURMAN RIVER	9	3,799	267	629	1,452	1	12	CN
25	CONUMA RIVER	3	35,719	1,611	52	6,536	9	3	CN
25	LEINER RIVER	4	620	413	173	1,409	1	5	CN
25	LITTLE ZEBALLOS RIVER	1	9	28	6	14	-	2	CM
25	PARK RIVER	1	-	7	-	12	-	-	CM
25	TAHSIS RIVER	4	230	405	205	985	4	4	CN
25	ZEBALLOS RIVER	2	165	105	300	299	1	11	CM
26	ARTLISH RIVER	4	782	740	21	1,512	2	6	CN
26	KAOUK RIVER	4	206	1,050	69	1,615	1	9	CN
26	TAHSISH RIVER	4	440	608	30	1,599	2	5	CN
26	MALKSOPE RIVER	2	11	717	5	1,192	-	4	CO
27	CAYEGHLE SYSTEM	3	269	174	1	2,431	1	19	CN
27	MARBLE RIVER	4	2,907	377	-	-	1	-	CN

### Level 3 Streams

### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	3	1,049	2,571	1,140	48	144	172	CN
23	TOQUART RIVER	2	269	700	397	1,055	14	60	CN
24	CYPRE RIVER	2	1,962	147	103	95	-	5	CN
25	ESPINOSA CREEK	1	5	3	25	33	4	22	CM
26	JANSEN CREEK	1	-	1	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	2	72	4	303	-	1	CM
26	KAUWINCH RIVER	2	312	518	57	421	-	12	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,400	1,800	8,200	7,100	1,200	900
22	NITINAT RIVER	7,700	10,700	5,200	5,500	130,000	147,000
23	CLEMENS CREEK	200	100	2,100	2,000	110	120
23	NAHMINT RIVER	300	400	500	400	11,900	18,500
23	SARITA RIVER	1,000	1,500	1,100	700	11,600	10,200
24	BEDWELL RIVER	240	150	1,400	1,200	3,500	3,500
24	MEGIN RIVER	50	50	1,700	1,200	1,900	2,100
24	TRANQUIL CREEK	320	520	1,000	800	9,800	9,700
25	BURMAN RIVER	3,400	1,900	1,400	1,400	5,000	4,700
25	CONUMA RIVER	23,400	21,300	2,200	2,700	6,800	10,900
25	INNER BASIN CREEK (Black C)	NA	NA	NA	NA	3,500	5,000
25	LEINER RIVER	410	390	1,010	830	1,900	4,000
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,700	3,700
25	PARK RIVER	NA	NA	NA	NA	4,900	4,600
25	TAHSIS RIVER	280	360	1,700	1,400	3,200	5,900
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	3,700	5,800
26	ARTLISH RIVER	170	220	1,800	1,400	4,400	4,700
26	KAOUK RIVER	230	320	2,500	2,200	9,500	8,800
26	MALKSOPE	NA	NA	2,400	2,300	11,800	10,800
26	TAHSISH RIVER	350	300	3,100	2,700	5,400	5,300
27	CAYEGHLE SYSTEM	290	430	840	850	12,200	10,300
27	MARBLE RIVER	2,600	2,700	1,700	2,100	NA	NA

# WCVI ESCAPEMENT BULLETIN - OCTOBER 15, 2015

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## WCVI Salmon Escapement Bulletin Chinook, Coho and Chum Extensive Indicator Program In-season Update, October 15, 2015

### IN-SEASON OBSERVATIONS:

Survey conditions in the past week have been good following a storm that came through Thanksgiving weekend.

Peak escapement of chinook to WCVI rivers is typically about the first week of October.

Peak escapement of chum to WCVI rivers is typically mid to late October.

Peak escapement of coho to WCVI rivers is typically late October to early November.

Peak escapement of sockeye to Clemens Creek is typically mid to late October.

**Port Renfrew (Area 20):** The San Juan fence has not been installed due to the high water levels. Swim surveys of the lower San Juan will be conducted periodically through September and October to assess salmon escapement. Three swims have been completed to date with the latest including the Upper San Juan as well; as of Oct 5 Chinook escapement is at least 60% of the 12 year average and has started to decline, chum in only at 5%, and coho is at least 36% of the 12 year average

**Nitinat (Area 22):** Four swims are planned in Nitinat starting in mid-September. A second swim occurred Oct 5-6, Chinook had begun to decline in-river (currently at 75% of the 12 year average) and coho remained steady (5% of the 12 year average). An aerial survey Oct 14 by an experienced pilot and hatchery staff observed a substantial increase in chum numbers, with fish well-distributed in the river (currently at 68% of the 12 year average).

**Barkley Sound/Alberni Inlet (Area 23):** Surveys of Clemens, Sarita, China and Franklin have been completed this week and Nahmint is being surveyed today, the last Nahmint and Toquaht surveys were the first week of October. Chinook are just above the 12 year average in Sarita and now declining. Chum in the Sarita are at 16% of the 12 year average, but the 500m closest to the estuary wasn't covered due to an equipment failure, so it is an underestimate.

**Clayoquot Sound (Area 24):** Surveys were completed last week, but did not include Cypre. Chinook are over twice the 12 year average in Cypre and Bedwell, at 74% of the 12 year average in the Megin and starting to decline, but only 18% of the 12 year average in Tranquil. Chum are at 28% of the 12 year average in Tranquil, 17% of the 12 year average in the Megin, but less than 10% of the 12 year average in Bedwell and Cypre. Coho are between 11% and 32% of the 12 year average in Tranquil, Bedwell, Cypre, and Megin.

**Nootka Sound/Esperanza Inlet (Area 25):** Surveys of Tahsis, Leiner, Zeballos and Burman this week are available. Conuma will be surveyed Oct 17<sup>th</sup>. Chinook are between 150% and 200% of the 12 year average in Burman, Leiner, and Conuma, Tahsis is at 65% of the 12 year average, and Chinook numbers have begun to decline. Chum are at 31% of the 12 year average in Burman, 168% of the 12 year average in the Zeballos, 38% of the 12 year average in

Leiner, 60% of the 12 year average in Conuma, and 67% of the 12 year average in Tahsis. Coho are at 19% of the 12 year average in Burman, 29% of the 12 year average in the Zeballos, 50% of the 12 year average in Leiner, 59% of the 12 year average in Conuma, and 28% of the 12 year average in Tahsis.

**Kyuquot Sound (Area 26):** Surveys of the Kaouk and Tahsish are available from last week and Artlish this week. Chinook observations are above the 12 year average in Tahsish, about 2/3 of the average in Kaouk, and well above average in Artlish. Chinook are spawning and numbers have started to decline. Chum are at 21% of the 12 year average in Kaouk, 76% of the 12 year average in Artlish, and 30% of the 12 year average in Tahsish. Chum are spawning, but coho haven't yet started. Coho are at 76% of the 12 year average in Kaouk, 53% of the 12 year average in Artlish, and 24% of the 12 year average in Tahsish.

**Quatsino Sound (Area 27):** Marble Chinook are just above the 12 year average and coho are 18% of the 12 year average based on an Oct 14<sup>th</sup> survey. The Cayeghle System was surveyed this week, Chinook peaked at 63% of the 12 year average have started to decline, chum are 43% of the 12 year average and spawning, and coho are 47% of the 12 year average but not yet spawning.

## ESCAPEMENT MONITORING FRAMEWORK:

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

**Intensive indicator stocks** describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

**Extensive indicator stocks** provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

**Other Escapement Information:** Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management

decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

**Data Quality:** The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.<sup>3</sup> The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

## **IN-SEASON RESULTS:**

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

**For more information Contact:**  
**Diana McHugh,**  
**WCVI Salmon Extensive Assessment Program Biologist**  
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**E-mail: [Diana.McHugh@dfo-mpo.gc.ca](mailto:Diana.McHugh@dfo-mpo.gc.ca)**

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<sup>3</sup> The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak live plus dead counts to date for 2015 WCVI salmon survey populations.



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## Stock Assessment Division, South Coast Salmon

For more information contact:

WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 105

### 2015 Preliminary Escapement Observations

#### Summary Note:

Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat and Stamp numbers current as of Oct 13, Carnation as of Oct 5, an additional 28 Coho and 3 Chinook were observed below the Carnation fence.

### Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	1	17	-	1	-	-	CO
23	SPROAT RIVER	Fence	84	2,640	311,868	NA	NA	NA	CN/SK
23	STAMP RIVER	Fence	51,778	12,557	411,660	27	707	31	CN/SK

### Level 2 WCVI Indicator Streams

### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	3	7,986	272	1,347	100,000	22	53	CN
23	CLEMENS CREEK	9	31	1,326	763	43	1	2	SK
23	NAHMINT RIVER	5	281	136	817	1,500	-	3	CN
23	SARITA RIVER	4	1,525	333	47	1,644	-	42	CN
24	BEDWELL RIVER	3	432	391	761	328	4	27	CN
24	MEGIN RIVER	4	34	202	23	361	-	29	CN
24	TRANQUIL CREEK	4	96	178	1,834	2,733	1	5	CN
25	BURMAN RIVER	10	3,799	267	629	1,452	1	12	CN
25	CONUMA RIVER	3	35,719	1,611	52	6,536	9	3	CN
25	LEINER RIVER	5	620	413	173	1,505	1	5	CN
25	LITTLE ZEBALLOS RIVER	1	9	28	6	14	-	2	CM
25	PARK RIVER	1	-	7	-	12	-	-	CM
25	TAHSIS RIVER	5	230	405	205	3,943	4	4	CN
25	ZEBALLOS RIVER	3	165	105	300	9,306	1	11	CM
26	ARTLISH RIVER	6	782	740	21	3,580	2	6	CN
26	KAOUK RIVER	5	206	1,666	69	1,834	2	9	CN
26	TAHSISH RIVER	5	440	632	58	1,599	2	5	CN
26	MALKSOPE RIVER	2	11	717	5	1,192	-	4	CO
27	CAYEGHLE SYSTEM	5	269	398	1	4,444	1	19	CN
27	MARBLE RIVER	4	2,907	377	-	-	8	-	CN

Table 1 continued. Raw Peak live plus dead counts to date for 2015 WCVI salmon survey populations.

Level 3 Streams		2015 Peak Live + Dead Count to Date							
Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	3	1,049	2,571	1,140	48	144	172	CN
23	CHINA CREEK	2	-	-	-	-	-	-	CM
23	FRANKLIN RIVER	2	-	150	175	30	-	-	CM
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	8	5	142	120	-	-	CM
23	TOQUAHT RIVER	2	269	700	397	1,055	14	60	CN
24	CYPRE RIVER	2	1,962	147	103	95	-	5	CN
25	ESPINOSA CREEK	1	5	3	25	33	4	22	CM
26	JANSEN CREEK	1	-	1	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	2	72	4	303	-	1	CM
26	KAUWINCH RIVER	2	312	518	57	421	-	12	CM



Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,400	1,800	8,200	7,100	1,200	900
22	NITINAT RIVER	7,700	10,700	5,200	5,500	130,000	147,000
23	CLEMENS CREEK	200	100	2,100	2,000	110	120
23	NAHMINT RIVER	300	400	500	400	11,900	18,500
23	SARITA RIVER	1,000	1,500	1,100	700	11,600	10,200
24	BEDWELL RIVER	240	150	1,400	1,200	3,500	3,500
24	MEGIN RIVER	50	50	1,700	1,200	1,900	2,100
24	TRANQUIL CREEK	320	520	1,000	800	9,800	9,700
25	BURMAN RIVER	3,400	1,900	1,400	1,400	5,000	4,700
25	CONUMA RIVER	23,400	21,300	2,200	2,700	6,800	10,900
25	INNER BASIN CREEK (Black C)	NA	NA	NA	NA	3,500	5,000
25	LEINER RIVER	410	390	1,010	830	1,900	4,000
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,700	3,700
25	PARK RIVER	NA	NA	NA	NA	4,900	4,600
25	TAHSIS RIVER	280	360	1,700	1,400	3,200	5,900
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	3,700	5,800
26	ARTLISH RIVER	170	220	1,800	1,400	4,400	4,700
26	KAOUK RIVER	230	320	2,500	2,200	9,500	8,800
26	MALKSOPE	NA	NA	2,400	2,300	11,800	10,800
26	TAHSISH RIVER	350	300	3,100	2,700	5,400	5,300
27	CAYEGHLE SYSTEM	290	430	840	850	12,200	10,300
27	MARBLE RIVER	2,600	2,700	1,700	2,100	NA	NA

# WCVI ESCAPEMENT BULLETIN - OCTOBER 22, 2015

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## WCVI Salmon Escapement Bulletin Chinook, Coho and Chum Extensive Indicator Program In-season Update, October 22, 2015

### IN-SEASON OBSERVATIONS:

Survey conditions in the past week have been good following a storm that came through Thanksgiving weekend.

Peak escapement of chinook to WCVI rivers is typically about the first week of October.

Peak escapement of chum to WCVI rivers is typically mid to late October.

Peak escapement of coho to WCVI rivers is typically late October to early November.

Peak escapement of sockeye to Clemens Creek is typically mid to late October.

**Port Renfrew (Area 20):** Three swims of the San Juan have been completed to date with the latest including the Upper San Juan as well; as of Oct 5 Chinook escapement is at least 60% of the 12 year average and has started to decline, chum in only at 5%, and coho is at least 36% of the 12 year average. Harris and Lens swims occurred last week, and two additional swims of the Lower San Juan are planned in the next couple of weeks.

**Nitinat (Area 22):** Four swims are planned in Nitinat starting in mid-September. A second swim occurred Oct 5-6, Chinook had begun to decline in-river (currently at 75% of the 12 year average) and coho remained steady (5% of the 12 year average). An aerial survey Oct 14 by an experienced pilot and hatchery staff observed a substantial increase in chum numbers, with fish well-distributed in the river (currently at 68% of the 12 year average).

**Barkley Sound/Alberni Inlet (Area 23):** Surveys of Clemens and Sarita have been completed this week and Nahmint is being surveyed today so the last available Nahmint survey was last week. In Sarita, Chinook are just above the 12 year average and now declining, Chum are at 61% of the 12 year average and Coho are at 49%. In Nahmint, Chinook are at least 80% of the 12 year average, Chum are at 22%, Coho are at 33%, and Sockeye are at 148% of the 12 year average.

**Clayoquot Sound (Area 24):** The most recent surveys available were completed in the second week of October and did not include Cypre. Chinook are over twice the 12 year average in Cypre and Bedwell, at 74% of the 12 year average in the Megin and starting to decline, but only 18% of the 12 year average in Tranquil. Chum are at 28% of the 12 year average in Tranquil, 17% of the 12 year average in the Megin, but less than 10% of the 12 year average in Bedwell and Cypre. Coho are between 11% and 32% of the 12 year average in Tranquil, Bedwell, Cypre, and Megin.

**Nootka Sound/Esperanza Inlet (Area 25):** Surveys of Tahsis, Leiner, Zeballos and Conuma last week are available. Burman was last surveyed Oct 21<sup>st</sup>. Chinook are between 150% and 200% of the 12 year average in Burman, Leiner, and Conuma, Tahsis is at 65% of the 12 year

average, and Chinook numbers have begun to decline. Chum are at 47% of the 12 year average in Burman, 168% of the 12 year average in the Zeballos, 38% of the 12 year average in Leiner, 60% of the 12 year average in Conuma, and 67% of the 12 year average in Tahsis. Coho are at 59% of the 12 year average in Burman, 29% of the 12 year average in the Zeballos, 50% of the 12 year average in Leiner, 59% of the 12 year average in Conuma, and 28% of the 12 year average in Tahsis.

**Kyuquot Sound (Area 26):** Surveys of the Kaouk, Artlish, Tahsish and Malksope are available from last week. Chinook observations are above the 12 year average in Tahsish, about 2/3 of the average in Kaouk, and well above average in Artlish. Chinook are nearly finished spawning and numbers have declined. Chum are at 67% of the 12 year average in Kaouk, 76% of the 12 year average in Artlish, and 77% of the 12 year average in Tahsish. Coho are at 98% of the 12 year average in Kaouk, 53% of the 12 year average in Artlish, and 50% of the 12 year average in Tahsish.

**Quatsino Sound (Area 27):** Marble Chinook are just above the 12 year average and coho are 18% of the 12 year average based on an Oct 9<sup>th</sup> survey. The Cayeghle System was surveyed Oct 15<sup>th</sup>, Chinook peaked at 63% of the 12 year average have started to decline, chum are 43% of the 12 year average and spawning, and coho are 47% of the 12 year average but not yet spawning.

## **ESCAPEMENT MONITORING FRAMEWORK:**

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

**Intensive indicator stocks** describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

**Extensive indicator stocks** provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

**Other Escapement Information:** Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

**Data Quality:** The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.<sup>4</sup> The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

## **IN-SEASON RESULTS:**

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

### **For more information Contact:**

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<sup>4</sup> The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

Table 1. Raw Peak live plus dead counts to date for 2015 WCVI salmon survey populations.



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## Stock Assessment Division, South Coast Salmon

For more information contact:

WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 118

### 2015 Preliminary Escapement Observations

#### Summary Note:

Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat and Stamp numbers current as of Oct 20, Carnation as of Oct 21; an additional 25 Coho, 2 Chinook, and 20 Chum were observed below the Carnation fence.

### Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	2	36	-	1	-	-	CO
23	SPROAT RIVER	Fence	145	2,828	311,472	NA	NA	NA	CN/SK
23	STAMP RIVER	Fence	52,253	12,673	413,358	30	712	30	CN/SK

### Level 2 WCVI Indicator Streams

### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	3	7,986	272	1,347	100,000	22	53	CN
23	CLEMENS CREEK	10	64	1,326	763	51	1	2	SK
23	NAHMINT RIVER	6	281	136	1,112	4,031	-	3	CN
23	SARITA RIVER	5	1,525	333	73	6,233	-	42	CN
24	BEDWELL RIVER	3	432	391	761	328	4	27	CN
24	MEGIN RIVER	4	34	202	23	361	-	29	CN
24	TRANQUIL CREEK	4	96	178	1,834	2,733	1	5	CN
25	BURMAN RIVER	12	3,799	829	629	2,215	1	12	CN
25	CONUMA RIVER	4	35,719	1,611	52	6,536	9	3	CN
25	LEINER RIVER	5	620	413	173	1,505	1	5	CN
25	LITTLE ZEBALLOS RIVER	1	9	28	6	14	-	2	CM
25	PARK RIVER	1	-	7	-	12	-	-	CM
25	TAHSIS RIVER	5	230	405	205	3,943	4	4	CN
25	ZEBALLOS RIVER	3	165	105	300	9,306	1	11	CM
26	ARTLISH RIVER	6	782	740	21	3,580	2	6	CN
26	KAOUK RIVER	6	206	2,160	69	5,889	2	9	CN
26	TAHSISH RIVER	6	440	1,336	58	4,125	2	5	CN
26	MALKSOPE RIVER	3	11	1,062	5	3,007	-	4	CO
27	CAYEGHLE SYSTEM	5	269	398	1	4,444	1	19	CN
27	MARBLE RIVER	4	2,907	377	-	-	8	-	CN

Table 1 continued. Raw Peak live plus dead counts to date for 2015 WCVI salmon survey populations.

Level 3 Streams		2015 Peak Live + Dead Count to Date							
Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	3	1,049	2,571	1,140	48	144	172	CN
20	HARRIS CREEK	1	6	962	664	22	11	3	CO
20	LENS CREEK	1	18	371	56	-	-	-	CO
23	CHINA CREEK	2	-	-	-	-	-	-	CM
23	FRANKLIN RIVER	2	-	150	175	30	-	-	CM
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	8	5	142	120	-	-	CM
23	TOQUAHT RIVER	2	269	700	397	1,055	14	60	CN
24	CYPRE RIVER	2	1,962	147	103	95	-	5	CN
25	ESPINOSA CREEK	1	5	3	25	33	4	22	CM
26	AMAI CREEK	1	-	109	-	927	-	-	CM
26	CACHALOT CREEK	1	-	17	-	206	-	-	CM
26	JANSEN CREEK	1	-	1	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	2	72	4	303	-	1	CM
26	KAUWINCH RIVER	2	312	518	57	421	-	12	CM

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,400	1,800	8,200	7,100	1,200	900
22	NITINAT RIVER	7,700	10,700	5,200	5,500	130,000	147,000
23	CLEMENS CREEK	200	100	2,100	2,000	110	120
23	NAHMINT RIVER	300	400	500	400	11,900	18,500
23	SARITA RIVER	1,000	1,500	1,100	700	11,600	10,200
24	BEDWELL RIVER	240	150	1,400	1,200	3,500	3,500
24	MEGIN RIVER	50	50	1,700	1,200	1,900	2,100
24	TRANQUIL CREEK	320	520	1,000	800	9,800	9,700
25	BURMAN RIVER	3,400	1,900	1,400	1,400	5,000	4,700
25	CONUMA RIVER	23,400	21,300	2,200	2,700	6,800	10,900
25	INNER BASIN CREEK (Black C)	NA	NA	NA	NA	3,500	5,000
25	LEINER RIVER	410	390	1,010	830	1,900	4,000
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,700	3,700
25	PARK RIVER	NA	NA	NA	NA	4,900	4,600
25	TAHSIS RIVER	280	360	1,700	1,400	3,200	5,900
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	3,700	5,800
26	ARTLISH RIVER	170	220	1,800	1,400	4,400	4,700
26	KAOUK RIVER	230	320	2,500	2,200	9,500	8,800
26	MALKSOPE	NA	NA	2,400	2,300	11,800	10,800
26	TAHSISH RIVER	350	300	3,100	2,700	5,400	5,300
27	CAYEGHLE SYSTEM	290	430	840	850	12,200	10,300
27	MARBLE RIVER	2,600	2,700	1,700	2,100	NA	NA

# WCVI ESCAPEMENT BULLETIN - OCTOBER 29, 2015

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## WCVI Salmon Escapement Bulletin Chinook, Coho and Chum Extensive Indicator Program In-season Update, October 29, 2015

### IN-SEASON OBSERVATIONS:

Water levels have been fairly low in the past week due to lower temperatures and relatively minor amounts of rain since mid-October. Overall, Chinook have finished spawning in most rivers, Chum are in the midst of spawning with roughly half of those observed being post-spawn mortalities, Coho are either holding steady or increasing with few signs of spawning.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

**Port Renfrew (Area 20):** Four swims of the San Juan have been completed to date; as of Oct 22, Chinook escapement is at least 60% of the 12 year average, Chum is at 63%, and Coho is at least 36% of the 12 year average. Harris and Lens swims occurred mid-October, and one additional swim of the Lower San Juan is planned in the next couple of weeks. The Harris and Lens Coho counts were 40-50% of the 12 year average.

**Nitinat (Area 22):** Three in-river surveys and one aerial survey of Nitinat have been completed to date, with an additional in-river survey planned for the first week of Nov. Chinook escapement is at least 75% of the 12 year average, Chum is at 68%, and Coho is at least 18% of the 12 year average.

**Barkley Sound/Alberni Inlet (Area 23):** Surveys of Clemens, Sarita and Nahmint have been completed roughly on schedule since late August and surveys should continue into early-November. In Clemens, Chinook escapement is at least 53% of the 12 year average, Chum is at 43%, Coho is at least 65% of the 12 year average, but the highest Sockeye count for a single survey is only 5% of the 12 year average. Sockeye in Clemens have not yet started to spawn, but very few new Sockeye were observed in the most recent swim. In Sarita, Chinook escapement is at least 102% of the 12 year average, Chum is at 61%, and Coho is at least 52% of the 12 year average. In Nahmint, Chinook escapement is at least 80% of the 12 year average, Chum is at 39%, Coho is at least 44% of the 12 year average, and Sockeye is at 191% of the 12 year average.

**Clayoquot Sound (Area 24):** Surveys of Bedwell, Megin, and Tranquil were briefly interrupted in mid-September and mid-October due to high water events, but have resumed as of last week. In Bedwell, Chinook escapement is at least 287% of the 12 year average, Chum is at 24%, Coho is at least 40% of the 12 year average, and Sockeye is at 224% of the 12 year average. In Megin, Chinook escapement is at least 74% of the 12 year average, Chum is at 17%, and Coho



is at least 17% of the 12 year average. In Tranquil, Chinook escapement is at least 24% of the 12 year average, Chum is at 28%, Coho is at least 57% of the 12 year average, and Sockeye is nearly 30 times the 12 year average (1834 vs. 67).

**Nootka Sound/Esperanza Inlet (Area 25):** Surveys of Tahsis, Leiner, Burman and Conuma have occurred roughly as scheduled. In Tahsis, Chinook escapement is at least 65% of the 12 year average, Chum is at 72%, and Coho is at least 38% of the 12 year average. In Leiner, Chinook escapement is at least 159% of the 12 year average, Chum is at 38%, and Coho is at least 50% of the 12 year average. In Burman, Chinook escapement is at least 200% of the 12 year average, Chum is at 47%, and Coho is at least 59% of the 12 year average. In Conuma, Chinook escapement is at least 168% of the 12 year average, Chum is at 60%, and Coho is at least 59% of the 12 year average.

**Kyuquot Sound (Area 26):** Surveys of the Kaouk, Artlish, and Tahsish have occurred roughly on schedule, but Malksope surveys have been delayed with the most recent available survey from mid-October. In Kaouk, Chinook escapement is at least 64% of the 12 year average, Chum is at 74%, and Coho is at least 98% of the 12 year average. In Artlish, Chinook escapement is at least 351% of the 12 year average, Chum is at 132%, and Coho is at least 53% of the 12 year average. In Tahsish, Chinook escapement is at least 147% of the 12 year average, Chum is at 77%, and Coho is at least 50% of the 12 year average. In Malksope, Chinook escapement is at least 57% of the 12 year average, Chum is at 28%, and Coho is at least 46% of the 12 year average.

**Quatsino Sound (Area 27):** Surveys of the Marble have been delayed by high water with the most recent survey in early October. Cayeghle swims have occurred roughly as scheduled; however visibility following rain in the Cayeghle has been particularly poor this year. Recent logging activity and eroding clay river banks may be contributing factors. In Marble, Chinook escapement is at least 108% of the 12 year average and Coho is at least 18% of the 12 year average. In Cayeghle, Chinook escapement is at least 63% of the 12 year average, Chum is at 43%, and Coho is at least 47% of the 12 year average.

## **ESCAPEMENT MONITORING FRAMEWORK:**

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

**Intensive indicator stocks** describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

**Extensive indicator stocks** provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to

establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

**Other Escapement Information:** Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

**Data Quality:** The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.<sup>5</sup> The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

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<sup>5</sup> The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

**IN-SEASON RESULTS:**

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

**For more information Contact:**  
**Diana McHugh,**  
**WCVI Salmon Extensive Assessment Program Biologist**  
**Telephone (250) 756-7006, Fax (250) 756-7162**  
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Table 7. Raw Peak live plus dead counts to date for 2015 WCVI salmon survey populations.



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## Stock Assessment Division, South Coast Salmon

For more information contact:

WCVI: Diana McHugh (250) 756-7006

Total no. surveys: 141

### 2015 Preliminary Escapement Observations

#### Summary Note:

Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat and Stamp numbers current as of Oct 27, Carnation as of Oct 29; the counts include 2 Chum that were observed below the Carnation fence, but do not include 203 Coho jacks that have moved through the fence.

#### Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	4	56	-	24	-	-	CO
23	SPROAT RIVER	Fence	193	2,852	311,689	NA	NA	NA	CN/SK
23	STAMP RIVER	Fence	53,138	12,891	413,802	37	717	30	CN/SK

#### Level 2 WCVI Indicator Streams

#### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	4	7,986	991	1,347	100,000	22	53	CN
23	CLEMENS CREEK	11	64	1,326	763	51	1	2	SK
23	NAHMINT RIVER	7	281	182	1,437	7,129	1	3	CN
23	SARITA RIVER	6	1,525	352	73	6,233	2	42	CN
24	BEDWELL RIVER	4	432	476	761	845	4	27	CN
24	MEGIN RIVER	5	34	202	23	361	-	29	CN
24	TRANQUIL CREEK	5	125	463	1,834	2,733	1	5	CN
25	BURMAN RIVER	13	3,799	829	744	2,215	1	12	CN
25	CONUMA RIVER	5	35,719	1,611	52	6,536	9	3	CN
25	LEINER RIVER	6	620	413	173	1,505	1	5	CN
25	LITTLE ZEBALLOS RIVER	2	9	98	16	3,577	5	2	CM
25	PARK RIVER	2	-	134	-	3,234	-	-	CM
25	TAHSIS RIVER	6	230	540	205	4,274	4	4	CN
25	ZEBALLOS RIVER	4	240	427	300	9,306	9	11	CM
26	ARTLISH RIVER	7	782	740	21	6,198	2	6	CN
26	KAOUK RIVER	7	206	2,160	69	6,505	2	9	CN
26	TAHSISH RIVER	7	440	1,336	58	4,125	2	5	CN
26	MALKSOPE RIVER	3	11	1,062	5	3,007	-	4	CO
27	CAYEGHLE SYSTEM	6	269	398	1	4,444	1	19	CN
27	MARBLE RIVER	4	2,907	377	-	-	8	-	CN

**Level 3 Streams**
**2015 Peak Live + Dead Count to Date**

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	4	1,049	2,571	1,140	571	144	172	CN
20	HARRIS CREEK	1	6	962	664	22	11	3	CO
20	LENS CREEK	1	18	371	56	-	-	-	CO
23	CHINA CREEK	2	-	-	-	-	-	-	CM
23	FRANKLIN RIVER	2	-	150	175	30	-	-	CM
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	8	5	142	120	-	-	CM
23	TOQUAHT RIVER	3	272	700	397	4,181	14	60	CN
24	CYPRE RIVER	4	1,962	298	103	975	-	5	CN
24	WARN BAY CREEK	1	51	30	6	392	-	-	CM
25	ESPINOSA CREEK	1	5	3	25	33	4	22	CM
26	AMAI CREEK	1	-	109	-	927	-	-	CM
26	CACHALOT CREEK	1	-	17	-	206	-	-	CM
26	JANSEN CREEK	1	-	1	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	2	72	4	303	-	1	CM
26	KAUWINCH RIVER	2	312	518	57	421	-	12	CM

Table 8. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,400	1,800	8,200	7,100	1,200	900
22	NITINAT RIVER	7,700	10,700	5,200	5,500	130,000	147,000
23	CLEMENS CREEK	200	100	2,100	2,000	110	120
23	NAHMINT RIVER	300	400	500	400	11,900	18,500
23	SARITA RIVER	1,000	1,500	1,100	700	11,600	10,200
24	BEDWELL RIVER	240	150	1,400	1,200	3,500	3,500
24	MEGIN RIVER	50	50	1,700	1,200	1,900	2,100
24	TRANQUIL CREEK	320	520	1,000	800	9,800	9,700
25	BURMAN RIVER	3,400	1,900	1,400	1,400	5,000	4,700
25	CONUMA RIVER	23,400	21,300	2,200	2,700	6,800	10,900
25	INNER BASIN CREEK (Black C)	NA	NA	NA	NA	3,500	5,000
25	LEINER RIVER	410	390	1,010	830	1,900	4,000
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,700	3,700
25	PARK RIVER	NA	NA	NA	NA	4,900	4,600
25	TAHSIS RIVER	280	360	1,700	1,400	3,200	5,900
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	3,700	5,800
26	ARTLISH RIVER	170	220	1,800	1,400	4,400	4,700
26	KAOUK RIVER	230	320	2,500	2,200	9,500	8,800
26	MALKSOPE	NA	NA	2,400	2,300	11,800	10,800
26	TAHSISH RIVER	350	300	3,100	2,700	5,400	5,300
27	CAYEGHLE SYSTEM	290	430	840	850	12,200	10,300
27	MARBLE RIVER	2,600	2,700	1,700	2,100	NA	NA

# WCVI ESCAPEMENT BULLETIN – NOVEMBER 13, 2015

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## WCVI Salmon Escapement Bulletin Chinook, Coho and Chum Extensive Indicator Program In-season Update, November 13, 2015

### IN-SEASON OBSERVATIONS:

Overall, Chinook have finished spawning in most rivers, Chum are in the late stages of spawning with over half of those observed being post-spawn mortalities, Coho are beginning to spawn, as are Sockeye. Surveys have concluded for the season in most index systems, though coho-directed surveys will continue as weather allows in Malksope.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

**Port Renfrew (Area 20):** Four swims of the San Juan have been completed, Chinook escapement is at least 58% of the 12 year average, Chum is at 63%, and Coho is at least 36% of the 12 year average. Harris and Lens swims occurred mid-October, and Renfrew was surveyed the first week of November. The Harris, Lens, and Renfrew Coho counts were roughly 40-50% of the 12 year average.

**Nitinat (Area 22):** Four in-river surveys and one aerial survey of Nitinat have been completed to date. Chinook escapement is at least 75% of the 12 year average, Chum is at 68%, and Coho is at least 18% of the 12 year average.

**Barkley Sound/Alberni Inlet (Area 23):** Surveys of Clemens, Sarita and Nahmint were completed roughly on schedule since late August and have now concluded, except in Clemens, where surveys have been extended. In Clemens, Chinook escapement is at least 53% of the 12 year average, Chum is at 43%, Coho is at least 65% of the 12 year average. In Sarita, Chinook escapement is at least 102% of the 12 year average, Chum is at 61%, and Coho is at least 52% of the 12 year average. In Nahmint, Chinook escapement is at least 80% of the 12 year average, Chum is at 39%, Coho is at least 44% of the 12 year average, and Sockeye is at 191% of the 12 year average. The counters at Stamp were removed Nov 6<sup>th</sup> due to high water, and the Sproat counters were removed Nov 11<sup>th</sup> due to high water.

**Clayoquot Sound (Area 24):** Surveys of Bedwell, Megin, and Tranquil were briefly interrupted in mid-September and mid-October due to high water events. In Bedwell, Chinook escapement is at least 287% of the 12 year average, Chum is at 58%, and Coho is at least 47% of the 12 year average. In Megin, Chinook escapement is at least 74% of the 12 year average, Chum is at 17%, and Coho is at least 17% of the 12 year average. In Tranquil, Chinook escapement is at least 24% of the 12 year average, Chum is at 28%, and Coho is at least 57% of the 12 year average.

**Nootka Sound/Esperanza Inlet (Area 25):** Surveys of Tahsis, Leiner, Burman and Conuma have occurred roughly as scheduled. In Tahsis, Chinook escapement is at least 65% of the 12 year average, Chum is at 72%, and Coho is at least 38% of the 12 year average. In Leiner, Chinook escapement is at least 159% of the 12 year average, Chum is at 38%, and Coho is at least 59% of the 12 year average. In Burman, Chinook escapement is at least 200% of the 12 year average, Chum is at 47%, and Coho is at least 59% of the 12 year average. In Conuma, Chinook escapement is at least 168% of the 12 year average, Chum is at 60%, and Coho is at least 59% of the 12 year average.

**Kyuquot Sound (Area 26):** Surveys of the Kaouk, Artlish, Tahsish, and Malksope have occurred roughly on schedule. In Kaouk, Chinook escapement is at least 64% of the 12 year average, Chum is at 74%, and Coho is at least 98% of the 12 year average. In Artlish, Chinook escapement is at least 351% of the 12 year average, Chum is at 132%, and Coho is at least 61% of the 12 year average. In Tahsish, Chinook escapement is at least 147% of the 12 year average, Chum is at 77%, and Coho is at least 50% of the 12 year average. In Malksope, Chinook escapement is at least 57% of the 12 year average, Chum is at 28%, and Coho is at least 48% of the 12 year average.

**Quatsino Sound (Area 27):** Surveys of the Marble were delayed by high water with the most recent survey in early October. Cayeghle swims have occurred roughly as scheduled; however visibility following rain in the Cayeghle has been particularly poor this year. Recent logging activity and eroding clay river banks may be contributing factors. In Marble, Chinook escapement is at least 108% of the 12 year average and Coho is at least 18% of the 12 year average. In Cayeghle, Chinook escapement is at least 63% of the 12 year average, Chum is at 43%, and Coho is at least 47% of the 12 year average.

## **ESCAPEMENT MONITORING FRAMEWORK:**

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

**Intensive indicator stocks** describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek, also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

**Extensive indicator stocks** provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble



Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

**Other Escapement Information:** Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

**Data Quality:** The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.<sup>6</sup> The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

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<sup>6</sup> The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.

**IN-SEASON RESULTS:**

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations.

Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

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Table 1. Raw Peak Live plus Dead counts to date for 2015 WCVI salmon survey populations.



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## Stock Assessment Division, South Coast Salmon

For more information contact:

Total no. surveys: 171

WCVI: Diana McHugh (250) 756-7006

### 2015 Preliminary Escapement Observations

#### Summary Note:

Raw Peak Live Plus Dead Counts (i.e. maximum number of fish counted for any one survey). Sproat numbers current as of Nov 9th, Stamp numbers as of Nov 4, Carnation as of Nov 12; the counts include 2 Chum that were observed below the Carnation fence, but do not include 205 Coho jacks that have moved through the fence.

#### Level 1 Streams

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
23	CARNATION CREEK	Fence	4	59	1	24	-	-	CO
23	SPROAT RIVER	Fence	234	2,886	312,294	NA	NA	NA	CN/SK
23	STAMP RIVER	Fence	53,241	13,110	415,660	49	733	30	CN/SK

#### Level 2 WCVI Indicator Streams

#### 2015 Peak Live + Dead Count to Date

Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
22	NITINAT RIVER	5	7,986	991	1,347	100,000	22	53	CN
23	CLEMENS CREEK	13	64	1,326	763	51	1	2	SK
23	NAHMINT RIVER	8	281	182	1,437	7,129	1	3	CN
23	SARITA RIVER	7	1,525	352	73	6,233	2	42	CN
24	BEDWELL RIVER	6	432	561	761	2,002	4	27	CN
24	MEGIN RIVER	5	34	202	23	361	-	29	CN
24	TRANQUIL CREEK	6	125	463	1,834	2,733	1	5	CN
25	BURMAN RIVER	16	3,799	829	744	2,215	35	12	CN
25	CONUMA RIVER	6	35,719	1,611	52	6,536	9	3	CN
25	LEINER RIVER	7	620	491	173	1,505	4	5	CN
25	LITTLE ZEBALLOS RIVER	2	9	98	16	3,577	5	2	CM
25	PARK RIVER	2	-	134	-	3,234	-	-	CM
25	TAHSIS RIVER	7	230	540	205	4,274	4	4	CN
25	ZEBALLOS RIVER	4	240	427	300	9,306	9	11	CM
26	ARTLISH RIVER	9	782	855	21	6,198	2	6	CN
26	KAOUK RIVER	9	206	2,160	69	6,505	2	9	CN
26	TAHSISH RIVER	8	440	1,336	58	4,125	2	5	CN
26	MALKSOPE RIVER	6	11	1,111	7	3,007	-	4	CO
27	CAYEGHLE SYSTEM	8	269	398	1	4,444	1	19	CN
27	MARBLE RIVER	4	2,907	377	-	-	8	-	CN

Table 1 continue. Raw Peak Live plus Dead counts to date for 2015 WCVI salmon survey populations.

Level 3 Streams		2015 Peak Live + Dead Count to Date							
Area	System	Number of Surveys	CN Adults	CO Adults	SK Adults	CM Adults	ST Adults	PK Adults	Primary Species
20	SAN JUAN RIVER	4	1,049	2,571	1,140	571	144	172	CN
20	HARRIS CREEK	1	6	962	664	22	11	3	CO
20	LENS CREEK	1	18	371	56	-	-	-	CO
20	RENFREW CREEK	1	10	512	45	24	-	-	CO
23	CHINA CREEK	2	-	-	-	-	-	-	CM
23	FRANKLIN RIVER	2	-	150	175	30	-	-	CM
23	MACKTUSH CREEK	1	-	-	-	-	-	-	CM
23	SOMASS RIVER (Lower)	1	8	5	142	120	-	-	CM
23	TOQUAHT RIVER	4	272	700	397	4,181	14	60	CN
24	CYPRE RIVER	4	1,962	298	103	975	-	5	CN
24	WARN BAY CREEK	2	51	57	6	392	-	-	CM
25	ESPINOSA CREEK	1	5	3	25	33	4	22	CM
26	AMAI CREEK	1	-	109	-	927	-	-	CM
26	CACHALOT CREEK	1	-	17	-	206	-	-	CM
26	CHAMISS CREEK	1	2	84	-	3,247	-	-	CM
26	EASY CREEK	1	2	267	-	685	-	-	CM
26	JANSEN CREEK	2	-	65	-	-	-	-	SK/CO
26	KASHUTL RIVER	1	2	72	4	303	-	1	CM
26	KAUWINCH RIVER	2	312	518	57	421	-	12	CM

Table 9. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,400	1,800	8,200	7,100	1,200	900
22	NITINAT RIVER	7,700	10,700	5,200	5,500	130,000	147,000
23	CLEMENS CREEK	200	100	2,100	2,000	110	120
23	NAHMINT RIVER	300	400	500	400	11,900	18,500
23	SARITA RIVER	1,000	1,500	1,100	700	11,600	10,200
24	BEDWELL RIVER	240	150	1,400	1,200	3,500	3,500
24	MEGIN RIVER	50	50	1,700	1,200	1,900	2,100
24	TRANQUIL CREEK	320	520	1,000	800	9,800	9,700
25	BURMAN RIVER	3,400	1,900	1,400	1,400	5,000	4,700
25	CONUMA RIVER	23,400	21,300	2,200	2,700	6,800	10,900
25	INNER BASIN CREEK (Black C)	NA	NA	NA	NA	3,500	5,000
25	LEINER RIVER	410	390	1,010	830	1,900	4,000
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,700	3,700
25	PARK RIVER	NA	NA	NA	NA	4,900	4,600
25	TAHSIS RIVER	280	360	1,700	1,400	3,200	5,900
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	3,700	5,800
26	ARTLISH RIVER	170	220	1,800	1,400	4,400	4,700
26	KAOUK RIVER	230	320	2,500	2,200	9,500	8,800
26	MALKSOPE	NA	NA	2,400	2,300	11,800	10,800
26	TAHSISH RIVER	350	300	3,100	2,700	5,400	5,300
27	CAYEGHLE SYSTEM	290	430	840	850	12,200	10,300
27	MARBLE RIVER	2,600	2,700	1,700	2,100	NA	NA

# WCVI ESCAPEMENT BULLETIN – 2015 POST SEASON

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## WCVI Salmon Escapement Bulletin Chinook, Coho and Chum Extensive Indicator Program 2015 Post Season

### POST-SEASON OBSERVATIONS:

Moderate rain events starting in late August and recurring periodically through the fall made for near-ideal survey conditions in most systems. An unusually large number of sockeye were seen in systems from San Juan to Clayoquot, likely related to the large return of Somass Sockeye.

Peak escapement of Chinook to WCVI rivers is typically about the first week of October.

Peak escapement of Chum to WCVI rivers is typically mid to late October.

Peak escapement of Coho to WCVI rivers is typically late October to early November.

Peak escapement of Sockeye to Clemens Creek is typically mid to late October.

**Port Renfrew (Area 20):** In 2015, the San Juan fence was not installed, but based on the peak count relative to the historical peak counts, Coho were roughly one half of the 12 year average, Chum were slightly above the 12 year average, and Chinook were near average.

**Nitinat (Area 22):** The Nitinat River was surveyed 8 times in 2015, using a combination of swims and helicopter surveys. Aerial surveys are good for assessing large numbers of fish over a wide area. Snorkel surveys are needed to nail down the species composition, particularly for the less numerous species. Survey coverage was fairly good, so estimates should be considered reliable. Chinook escapement was almost twice the 12 year average, Chum escapement was above the 12 year average, Coho was less than half of the 12 year average, and Sockeye were well above the 12 year average.

**Barkley Sound/Alberni Inlet (Area 23):** Surveys of Clemens, Sarita and Nahmint were completed roughly on schedule, under decent conditions, so estimates should be considered reliable. In Clemens, Sockeye were less than a quarter of the 12 year average, Coho and Chum were equal to the 12 year average, and Chinook escapement was about half of the 12 year average. In Sarita, Sockeye were slightly below the 12 year average, Coho and Chum were about half of the 12 year average, and Chinook escapement was almost twice the 12 year average. In Nahmint, Sockeye were three times the 12 year average, Coho and Chum were about half of the 12 year average, and Chinook escapement was slightly above the 12 year average.

**Clayoquot Sound (Area 24):** Surveys of Bedwell, Megin, and Tranquil were briefly interrupted in mid-September and mid-October due to high water events, so peak Chum counts, particularly in Megin, may be biased low. Also, the Upper Megin survey did not occur so the Sockeye estimate is not comparable to previous years. In Bedwell, Sockeye were well above the 12 year average, Coho and Chum were roughly three quarters of the 12 year average, and Chinook

escapement was almost twice the 12 year average. In Megin, Coho were relatively low, Chum were roughly a third of the 12 year average, and Chinook escapement was roughly average but still low. In Tranquil, Sockeye were well above the 12 year average, Coho and Chum were roughly three quarters of the 12 year average, and Chinook escapement was less than half of 12 year average and brood was not collected because the sex ratio was 80% males.

**Nootka Sound/Esperanza Inlet (Area 25):** Surveys of Tahsis, Leiner, Burman and Conuma occurred roughly on schedule, under decent conditions, so estimates should be considered reliable. In Tahsis, Sockeye and Coho were about two thirds of the 12 year average, Chum were more than twice the 12 year average, and Chinook escapement was slightly above the 12 year average. In Leiner, Sockeye were roughly half of the 12 year average, Coho and Chum were equal to the 12 year average, and Chinook escapement was about twice of the 12 year average. In Burman, Sockeye were almost twice the 12 year average, Coho and Chum were equal to the 12 year average, and Chinook escapement was roughly three times the 12 year average. In Conuma, Sockeye were less than a quarter of the 12 year average, Coho were equal to the 12 year average, and both Chum and Chinook escapements were above of the 12 year average.

**Kyuquot Sound (Area 26):** Surveys of the Kaouk, Artlish, Tahsish, and Malksope occurred roughly on schedule, under decent conditions, so estimates should be considered reliable. In Kaouk, Sockeye were twice the 12 year average, Coho were above the 12 year average and Chum and Chinook escapement were slightly above the 12 year average. In Artlish, Sockeye were above the 12 year average, Coho were roughly three quarters of the 12 year average, Chum were above the 12 year average, and Chinook escapement was about three times the 12 year average. In Tahsish, Sockeye and Coho were about two thirds of the 12 year average, Chum were slightly below to the 12 year average, and Chinook escapement was above the 12 year average. In Malksope, Coho were roughly 80% of the 12 year average and Chum were about half of the 12 year average.

**Quatsino Sound (Area 27):** Some surveys of Marble were cancelled by high water with the final full survey in early October and a spot check in late November to collect biosamples, so estimates are uncertain. However, based on the available surveys and the spawning distribution, Marble Coho numbers were fairly average and Chinook numbers were strong with heavy spawning observed throughout the survey area. Cayeghle swims occurred roughly as scheduled; however visibility following rain in the Cayeghle has been particularly poor this year. Recent logging activity and eroding clay river banks may be contributing factors. In Cayeghle, Coho were nearly 90% of the 12 year average, Chum were roughly two thirds of the 12 year average, and Chinook were nearly twice the 12 year average.

## **ESCAPEMENT MONITORING FRAMEWORK:**

For WCVI salmon and most other BC management units, a system of 'intensive' and 'extensive' indicator stocks are used to assess stock status and fishery impacts and provide recommendations for harvest management.

**Intensive indicator stocks** describe the distribution, exploitation and survival rate patterns for populations within a management unit that have a similar life history and marine distribution. This information is collected through the coast-wide Mark-Recovery Program (MRP). Select stocks are tagged with coded-wire-tags as juveniles and through recoveries of these tags in fisheries and escapement survival and exploitation rates are estimated.

Robertson Creek Hatchery located in DFO Statistical Area 23 (Barkley Sound/Alberni Inlet) is the CWT hatchery indicator stock for WCVI chinook and coho populations. Carnation Creek,

also located in Area 23, is the CWT wild indicator stock for WCVI coho. There is no CWT indicator program from chum salmon.

**Extensive indicator stocks** provide information about the variability of status of populations across the management unit. The specific goals of the program are utilize consistent escapement survey methodologies; estimate total escapement by river using analytical techniques such as the area-under-the-curve (AUC) method for observation expansion; to establish a time series of escapement information and habitat capacity for use in establishing escapement goals; and to estimate hatchery contribution to rivers.

The following populations are used as extensive indicator stocks for WCVI salmon:

Chinook: Nitinat, Nahmint, Sarita, Bedwell/Ursus, Megin, Tranquil, Burman, Conuma, Leiner, Tahsis, Artlish, Kaouk, Tahsish, Colonial/Cayeghle, Marble

Coho: Malksope

Chum: Most of the Chinook indicators with the addition of Little Zeballos, Zeballos, Inner Basin Creek (Black Cr.), Park, and Tsowwin

**Other Escapement Information:** Escapement information for non-indicator stocks may be provided through other programs. Depending on the frequency of surveys and types of methods employed, the resulting information may be of limited utility to inform management decisions. However, the observations provide a useful gauge of spawner distribution in rivers across the WCVI area and this information is used to monitor biodiversity.

**Data Quality:** The WCVI escapement monitoring program results in escapement estimates of variable quality. While all the information is useful, not all estimates should be accorded the same weight in fisheries management decisions.<sup>7</sup> The following guidelines were used to rank the escapement information presented in this bulletin:

**Level 1 (High Quality) Estimates.** Level 1 escapement estimates are subject to quality control and peer review. Estimates of abundance are reliable and include an estimate of uncertainty. For most years in the WCVI area, Level 1 estimates are limited to those generated through the “intensive” indicator stocks programs.

**Level 2 (Medium or Mixed Quality) Estimates.** These estimates have some inherent shortcomings with regard to scientific quality (e.g. greater uncertainty, potential biases, etc.); however they are still useful for informing fishery management decisions. For WCVI spawning populations, Level 2 escapement estimates have typically been generated through periodic visual counts of spawners using the snorkel survey method and expanding for observer error and survey life with the area-under-the-curve procedure.

**Level 3 (Low Quality) Estimates.** These estimates substantially fail to meet standards of scientific quality and therefore are of limited utility for informing fishery management decisions. However, the information is still used to monitor biodiversity within the WCVI management area. Level 3 escapement information may include observations gathered from partial or infrequent surveys or using methods subject to higher observation error (e.g. bank walks).

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<sup>7</sup> The ranking scheme here weighs heavily on the Research and Science Information Standard for New Zealand Fisheries (NZ Ministry of Fisheries, 2011). When ranking the quality of scientific information, information is evaluated according to how well it meets the following scientific principles: methodology has been subject to peer review, data are relevant to management decision, integrity, objectivity, and reliability (i.e. repeatability) of estimate.



This bulletin updates in-season assessment results of Level 1 to 3 escapement surveys for WCVI chinook, coho and chum populations. Note: during the survey escapement information may also be collected for other species.

#### **IN-SEASON RESULTS:**

Table 1 displays the raw peak spawner counts to date of WCVI salmon survey populations. Table 2 displays the 5 and 12 year average estimated escapement for WCVI extensive indicator systems.

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Table 1. Escapement estimates for 2015 WCVI salmon survey populations.

Total no. surveys: 211

### 2015 Escapement Estimates

#### Summary Note:

PL+D: Peak Live Plus Dead Counts (I.e. maximum number of fish counted for any one survey)

AUC: Area Under the Curve (trapezoidal approximation) EO: Expert Opinion ST and PK estimates are all PL+D AP:

Adults Present

#### Level 1 Streams

Area	System	Estimate Type	CN Adults	Estimate Type	CO Adults	Estimate Type	SK Adults	Estimate Type	CM Adults	ST Adults	PK Adults
23	CARNATION CREEK	Fence	4	Fence	60	-	-	Fence	22	-	-

#### Level 2 WCVI Indicator Streams

#### 2015 Escapement Estimate

Area	System	Chinook		Coho		Sockeye		Chum		ST Adults	PK Adults
		Estimate Type	CN Adults	Estimate Type	CO Adults	Estimate Type	SK Adults	Estimate Type	CM Adults		
20	SAN JUAN RIVER	AUC	2,061	PL+D	2,770	PL+D	1,267	PL+D	593	144	191
22	NITINAT RIVER	AUC	20,464	AUC	1,342	-	2,069	AUC	198,781	-	-
23	CLEMENS CREEK	AUC	64	AUC	2,059	AUC	2,109	AUC	120	-	-
23	NAHMINT RIVER	AUC	447	AUC	213	AUC	2,243	AUC	7,710	-	-
23	SARITA RIVER	AUC	2,557	AUC	402	AUC	99	AUC	6,309	-	-
23	TOQUAHT RIVER	AUC	335	AUC	888	AUC	600	AUC	4,802	-	-
24	BEDWELL RIVER	AUC	736	AUC	1,061	AUC	1,270	AUC	2,495	-	31
24	CYPRE RIVER	AUC	3,721	AUC	614	-	164	AUC	1,750	-	-
24	MEGIN RIVER	AUC	49	AUC	221	-	29	AUC	619	-	-
24	TRANQUIL CREEK	AUC	199	AUC	640	PL+D	2,251	AUC	6,302	-	6
25	BURMAN RIVER	AUC	6,035	AUC	1,334	AUC	1,189	AUC	4,839	-	14
25	CANTON CREEK	-	-	-	-	-	-	EO	2,650	-	-
25	CONUMA RIVER	AUC	38,178	AUC	2,039	AUC	74	AUC	10,020	-	AP
25	LEINER RIVER	AUC	797	AUC	812	AUC	311	AUC	4,168	-	6
25	TAHSIS RIVER	AUC	310	AUC	848	AUC	334	AUC	13,465	-	5
25	TLUPANA RIVER	PL+D	502	PL+D	30	PL+D	19	PL+D	600	-	NO
26	ARTLISH RIVER	AUC	1,113	AUC	1,486	PL+D	23	AUC	8,133	-	6
26	KAOUK RIVER	AUC	331	AUC	3,223	AUC	120	AUC	10,274	-	9
26	TAHSISH RIVER	AUC	768	AUC	2,081	AUC	111	AUC	5,622	-	6
26	MALKSOPE RIVER	AUC	17	AUC	1,883	AUC	10	AUC	4,490	-	4
27	MARBLE RIVER	AUC	6,515	AUC	399	-	-	-	-	-	-

Table 1 continued. Escapement estimates for 2015 WCVI salmon survey populations.

Level 3 Streams				2015 Escapement Estimate							
Area	System	Estimate Type	CN Adults	Estimate Type	CO Adults	Estimate Type	SK Adults	Estimate Type	CM Adults	ST Adults	PK Adults
20	HARRIS CREEK	-	AP	-	962	-	-	-	-	-	-
20	LENS CREEK	-	AP	-	371	-	-	-	-	-	-
20	RENFREW CREEK	PL+D	11	PL+D	569	PL+D	50	PL+D	27	-	-
23	CHINA CREEK	P/A	NO	-	-	-	-	-	-	-	-
23	FRANKLIN RIVER	P/A	NO	-	-	-	-	-	-	-	-
23	MACKTUSH CREEK	P/A	NO	-	-	-	-	-	-	-	-
23	MAGGIE RIVER	P/A	NO	-	-	-	-	-	-	-	-
24	HESQUIAT HARBOUR #2 CREEKS (Ayyi Saqh)	-	-	-	NO	-	-	-	AP	-	-
24	HESQUIAT HARBOUR #3 CREEKS (Ya-ksis)	-	-	-	NO	-	-	-	NO	-	-
24	HESQUIAT HARBOUR #4 CREEKS (Ma-api)	-	-	-	NO	-	-	PL+D	19	-	-
24	HESQUIAT LAKE CREEK (Tsa-ya)	-	-	-	NO	-	-	PL+D	974	-	-
24	KENNEDY RIVER (UPPER)	P/A	AP	PL+D	148	PL+D	1,445	P/A	AP	-	-
24	SYDNEY RIVER	P/A	NO	-	-	-	-	-	AP	-	275
24	WARN BAY CREEK	P/A	AP	-	-	-	-	-	-	-	-
25	ESPINOSA CREEK	PL+D	6	-	AP	PL+D	28	-	AP	-	24
25	GOLD RIVER	EO	850	-	-	-	-	-	-	-	-
25	LITTLE ZEBALLOS RIVER	PL+D	10	PL+D	109	PL+D	11	PL+D	3,837	-	AP
25	OKTWANCH RIVER	PL+D	65	PL+D	137	PL+D	200	-	AP	-	-
25	PARK RIVER	-	NO	PL+D	206	-	NO	PL+D	3,344	-	AP
25	ZEBALLOS RIVER	PL+D	266	PL+D	474	PL+D	328	PL+D	10,328	-	AP
26	AMAI CREEK	P/A	NO	PL+D	121	-	NO	PL+D	1,019	-	NO
26	CACHALOT CREEK	-	NO	PL+D	19	-	NO	PL+D	211	-	NO
26	CHAMISS CREEK	-	NO	PL+D	93	-	NO	PL+D	3,332	-	NO
26	CLANNINICK CREEK	P/A	NO	PL+D	230	-	NO	-	NO	-	NO
26	EASY CREEK	P/A	AP	PL+D	297	-	NO	PL+D	727	-	NO
26	JANSEN CREEK	-	NO	PL+D	65	-	NO	-	NO	-	NO
26	KASHUTL RIVER	P/A	AP	PL+D	80	P/A	AP	PL+D	337	-	AP
26	KAUWINCH RIVER	PL+D	347	PL+D	577	PL+D	63	PL+D	468	-	AP
26	NARROWGUT CREEK	-	NO	PL+D	299	P/A	AP	P/A	AP	-	NO
27	CAYEGHLE SYSTEM	AUC	586	AUC	705	-	AP	AUC	8,208	-	20

Table 2. Average escapement (last 5 and 12 years) for Level 2 WCVI Indicator Systems; for Chum Indicator Systems, only chum averages are presented as chum-directed surveys cover chinook and coho distributions and timing poorly.

Area	System	Average Escapement Estimates					
		CN Adults		CO Adults		CM Adults	
		5yr avg	12yr avg	5yr avg	12yr avg	5yr avg	12yr avg
20	SAN JUAN RIVER	1,400	1,800	8,200	7,100	1,200	900
22	NITINAT RIVER	7,700	10,700	5,200	5,500	130,000	147,000
23	CLEMENS CREEK	200	100	2,100	2,000	110	120
23	NAHMINT RIVER	300	400	500	400	11,900	18,500
23	SARITA RIVER	1,000	1,500	1,100	700	11,600	10,200
24	BEDWELL RIVER	240	150	1,400	1,200	3,500	3,500
24	MEGIN RIVER	50	50	1,700	1,200	1,900	2,100
24	TRANQUIL CREEK	320	520	1,000	800	9,800	9,700
25	BURMAN RIVER	3,400	1,900	1,400	1,400	5,000	4,700
25	CONUMA RIVER	23,400	21,300	2,200	2,700	6,800	10,900
25	INNER BASIN CREEK (Black C)	NA	NA	NA	NA	3,500	5,000
25	LEINER RIVER	410	390	1,010	830	1,900	4,000
25	LITTLE ZEBALLOS RIVER	NA	NA	NA	NA	4,700	3,700
25	PARK RIVER	NA	NA	NA	NA	4,900	4,600
25	TAHSIS RIVER	280	360	1,700	1,400	3,200	5,900
25	TSOWWIN RIVER	NA	NA	NA	NA	1,600	4,700
25	ZEBALLOS RIVER	NA	NA	NA	NA	3,700	5,800
26	ARTLISH RIVER	170	220	1,800	1,400	4,400	4,700
26	KAOUK RIVER	230	320	2,500	2,200	9,500	8,800
26	MALKSOPE	NA	NA	2,400	2,300	11,800	10,800
26	TAHSISH RIVER	350	300	3,100	2,700	5,400	5,300
27	CAYEGHLE SYSTEM	290	430	840	850	12,200	10,300
27	MARBLE RIVER	2,600	2,700	1,700	2,100	NA	NA