2021 M.E.S.S. SALMON ENUMERATION PROGRAM

FISHERIES AND OCEANS CANADA AREA 12: Musgamagw Dzawad<u>a</u>'enu<u>x</u>w territories, broughton archipelago



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ACKNOWLEDGMENTS



Photo: Stream technicians Emily and Ben look out over the falls pool from the river bank during an enumeration survey of the Ahta River. (April Bencze, 2021)

Data is collected through the annual M.E.S.S.S. Salmon Enumeration Program in conjunction with Fisheries and Oceans Canada (D.F.O.). The Area 12 Salmon Enumeration Contract maintains important historical records while informing local stream restoration initiatives and monitoring stream health. The collective efforts of many contributed to the success of the 2021 field season. All data was collected on the unceded territories of the Musgamagw Dzawad<u>a</u>'enu<u>x</u>w Nations, specifically on the lands of the Kwikwasut'inu<u>x</u>w Haxwa'mis First Nation, Gwawaenuk Tribe, and Dzawad<u>a</u>'enu<u>x</u>w First Nation. Each salmon enumeration survey is carried out with care and respect for the people, land, and water of this place.

The 2021 season marks M.E.S.S.S.'s 36th year of working towards the health and longevity of salmon populations and their habitat in this region. The ongoing dedication of the M.E.S.S.S. board members again played a critical role in supporting the stream technicians to meet the program objectives during the 2021 season. Thanks especially to Chris and Hannah Bennett for coordinating the Salmon Enumeration Program, and to the board members for their contributions. Private donations provided through Billy Proctor's Museum, as well as other generous donations from individuals, allowed M.E.S.S.S. to continue to survey an additional 10 streams. With the crew based in Echo Bay, it is a privilege to have Billy Proctor and Yvonne Maximchuk (long-time M.E.S.S.S. board members and Echo Bay residents) nearby and willing to share their knowledge.

Thank you to Fisheries and Oceans Canada, specifically Andrew Pereboom, Matthew Clarke, and Kiana Matwichuk for continuing to conduct and support salmon enumeration initiatives in Area 12. The opportunity to maintain the quality and consistency of enumeration data for this region over the past 13 years is greatly appreciated.

Thanks especially to Emily Grubb, M.E.S.S.S. stream technician for 2021, who brought her extensive knowledge, skill, and expertise to the team to conduct this work safely and with great care. Thanks to Ben Paulsen, fill-in stream technician for 2021, for completing surveys during gaps that arose during the field season. With gratitude to Jo Gagnon, former Lead Stream Technician, for her support which was helpful to maintain the consistency and accuracy of the data collected. Thanks to all who generously volunteered their time and skill this season (See Page 56, Section 6.0. *Field Team and Volunteers*).

EXECUTIVE SUMMARY

The Mainland Enhancement of Salmonid Species Society (M.E.S.S.S.)'s Salmon Enumeration Program exists to provide long-term salmon escapement data for Fisheries and Oceans Canada Pacific Fisheries Management Area 12 (Broughton Archipelago/Musgamagw Dzawada'enuxw Territories) and to inform salmon conservation policy and local streamkeeping initiatives. M.E.S.S.S. has conducted the annual Salmon Enumeration Program each fall to fulfil these primary objectives since 2009. In 2021, M.E.S.S.S. was contracted by Fisheries and Oceans to survey the following 8 streams: Ahta River, Embley River, Carriden Creek, Wahkana Creek, Viner River, Scott Cove Creek, Shoal Harbour Creek, and Maple Cove Creek. In addition, M.E.S.S.S. funded the enumeration of an additional 10 streams in Area 12, mostly located on Gilford Island (See Pages 6-7, Section 1.0. *Stream Survey Outline*).

A total of 105 formal surveys for 18 streams were completed from July 27th to November 12th, 2021. Escapement data for returning pink, chum, coho, sockeye, and kokanee (minihump) was obtained via foot and snorkel surveys either instream or from stream banks. Streams were enumerated every statistical week; every 7-14 days (with some exceptions given flooding conditions). Fisheries and Oceans contracted 8 formal surveys of the 8 systems listed above, while the remaining 10 systems, funded by M.E.S.S.S., were surveyed between 2-5 times on a timely basis; strategically based on population returns. The goal of surveys for all M.E.S.S.S. systems was to establish salmon presence or absence under the same protocol as Fisheries and Oceans surveys, and to provide consistent escapement estimates for these streams.

Pink Enumeration Summary

The overall 2021 pink return in Area 12 for the odd-year population was low. Historically, the odd-year population return is substantially less than even-year pink returns. The Ahta River was the only watershed with a significant pink return of the streams surveyed in 2021, with a peak estimated count of 511 pink salmon. This is a slight increase from the 2017 and 2019 odd-year pink returns, but historically remains low. The Viner River (peak estimated count of 8 pink), Shoal Harbour Creek (peak estimated count of 0 pink), Embley River (peak estimated count of 6 pink) populations were very low in 2021 when compared to previous years. Notably the Viner River odd-year population has seen a sharp decline since 2017. (See Page 9, Subsection 3.1. *Pink/Minihump Peak Counts by Stream 2009-2021*).

Loose Lake Kokanee (Minihump) Enumeration Summary

The tributaries of Loose Lake and Townie Lake are home to a land-locked population of kokanee which are locally known as minihumps. This population remains stable with slight increases in recent years. Minihump Creek, which connects Loose Lake with Townie Lake, has the most abundant population with a 2021 peak estimated count of 1,720 minihump. This is the highest peak return (1,964 peak estimated count) since 2013. Historic numbers of minihump have reached a peak estimate of 3,522 (2009) in this stream however. In 2021, minihump were observed in smaller numbers in the following streams: Connector Creek (peak estimated count of 28), Chris Bennett Creek (peak estimated count of 2), and John Lewis Creek (peak estimated count of 3). (See Page 9, Subsection 3.1. *Pink/Minihump Peak Counts by Stream 2009-2021*). For more information about this unique population of kokanee thriving on Gilford Island, see Page 71, Subsection 8.4. *Bartlett, M.C. (2017). Minihumps*.

Chum Enumeration Summary

The overall 2021 chum return in Area 12 saw a slight increase from historic lows in the previous few years. The main chum systems surveyed were Viner River (peak estimated count of 440 chum), Shoal Harbour Creek (peak estimated count of 176 chum), and Ahta River (peak estimated count of 122 chum). Embley River and Wahkana Creek also saw small chum returns (peak estimated count of 8 chum, each). Compared to historic numbers since 2009, Ahta River and Viner River chum returns were each among the

lowest 4 years of peak counts, whereas the Shoal Harbour Creek chum return was among the highest 5 years of peak counts. (See Page 10, Subsection 3.2. *Chum Peak Counts by Stream 2009-2021*).

Sockeye Enumeration Summary

The sockeye population in the streams surveyed remains low with a slight increase in 2021 returns. The majority of the streams surveyed are not home to sockeye populations. Only 3 streams of the survey roster have notable sockeye observations: Ahta River, Embley River, and Viner River. No sockeye were observed in Embley River in 2021 (last observation was in 2014). However, 7 sockeye were observed and estimated in the Ahta River, and 13 sockeye were observed in Viner River for 2021 (the most recorded since 2009). Several jack sockeye were a part of the return to Viner River. (See Page 10, Subsection 3.2. *Sockeye Peak Counts by Stream 2009-2021*).

Coho Enumeration Summary

In 2021, the coho population varied by stream but ultimately saw an increase in the overall population, though numbers remain low historically. The Scott Cove Creek and Loose Lake watershed includes the following streams and their respective 2021 peak estimated counts: Scott Cove Creek (218 coho) and its tributaries Minihump Creek (8 coho), Connector Creek (2 coho), Chris Bennett Creek (21 coho), Loose Lake Creek (3 coho), John Lewis Creek (9 coho). The Shoal Harbour Creek and Bridie Lake watershed includes the following streams and their respective 2021 peak estimated counts: Shoal Harbour Creek (13 coho) and its tributaries Mount Worthington Creek (0 coho) and Billy Proctor Creek (48 coho). The coho return to Billy Proctor Creek of 48 coho (peak estimated) is notably the highest on record since enumeration began in 2009, and serves as a good example of why surveying the tributaries (where coho often spawn) can provide a more accurate assessment of a given coho population than surveying the main stream of a watershed. Additionally, the 4 peak estimated coho returning to Simoom Sound Creek is notable as coho have only been observed in this stream in one other year (2015) during enumeration surveys. Coho also returned to Viner River, Carriden Creek, and Embley River in low numbers. (See Page 11, Subsection 3.4. Coho Peak Counts by Stream). The coho population in Ahta River (86 peak estimated coho) is significant in 2021 not for its abundance, but for the high efficiency obtained via the snorkel survey that was conducted, and revealed coho that otherwise would not have been observed during foot surveys. Given the unreliability of visual surveys for coho, it is worth restating that these estimates serve as relative abundance estimates and not true abundance. The dark tannin water and elusive nature of coho makes visual estimation surveys less reliable than other species. However, current methodology offers an observed and estimated amount that takes into account factors which make coho difficult to count. This season, the stream technicians took a critical look at coho enumeration methodology and formed several watershed-specific recommendations that would increase surveyor efficiency and estimation accuracy for enumeration in future years. (See Page 51, Section 5.1. Enumeration Survey Review).

Additional Survey Observations Summary

Consistent with previous years Salmon Enumeration Programs, M.E.S.S.S. conducted a 20-minute observation survey in each estuary (See Page 8, Section 2.0. *Enumeration Methodology*). The jumper count for salmon during surveys was moderate-low this season, with (peak) jumping activity in the following streams as follows: Scott Cove Creek (37 coho jumpers), Shoal Harbour Creek (22 chum jumpers), Viner River (32 chum jumpers), Ahta River (13 pink jumpers), and Wahkana Creek (9 unidentified jumpers). (See Page 71, Subsection 8.8. *M.E.S.S.S. Enumeration Database 2009-2021*)

Tides and precipitation play an important role when it comes to the overall timing of salmon spawning cycles. Unlike the 2020 enumeration surveys which began with generally moderate water levels, and had frequent floods in many streams throughout the season, 2021 generally saw gradually increasing bankfulls and relatively few flooding events. While water levels were initially very low (10-35%) they increased

with the first rains of the season in September. Flooding and extreme weather hindered survey efforts in Carriden Creek and Embley River on 2 occasions, limiting the survey number to 6 of 8 completed surveys. Otherwise, surveys were able to be timed around flooding events to still be completed safely for all other streams. All surveys were timed with the tides to allow access into shallow estuaries or lagoons.

Wildlife was monitored both in-stream and during estuary surveys to gain a better sense of mortality rates caused by predation, as well as to roughly gauge the health of a watershed by the presence and behavior of apex predators and other wildlife. The majority of morts (dead fish) were predated upon with minimal fish fragments remaining (ie. a gill plate or blood stain). Black bear sign was a common observation in most watersheds. Grizzly bear activity was observed in Ahta River, Viner River, Gilford Creek, and Shoal Harbour Creek this year. Grizzly bear encounters on Gilford Island increased in 2021. Between the 2019 and 2021 field seasons, there have been 4 black bear carcasses found near Viner River, with signs pointing to predation from the resident grizzly bear of this watershed. Given that 2019 and 2020 were two of the lowest recorded years of the last decade for chum returning to Viner River, predators seeking alternative food sources makes sense. Notably less sightings of Pacific White-sided Dolphins were recorded around Tribune Channel and Bond Sound in 2021 compared to previous years. Cougar sign was observed in Maple Cove Creek and Embley River. A Northern goshawk (species at risk) was observed in Wahkana Creek (sighting is in the process of being reported.)

DNA samples of chum and coho were collected via fin clips for the Fisheries and Oceans Canada database. In total, 9 fin clips were collected from coho in Shoal Harbour Creek and Scott Cove Creek tributaries on Gilford Island. 1 chum fin clip was collected from Shoal Harbour Creek on Gilford Island.

Overall, low returns of pink, chum, and coho salmon were observed throughout Area 12 with some increases for pink, chum, coho, and sockeye compared to the extreme low returns of the past couple of years. The Loose Lake kokanee (minihump) population remains stable and increasing. Modifications to survey methods for coho enumeration may support an increase in surveyor efficiency and estimate accuracy. (See Page 51, Subsection 5.1. *Enumeration Survey Review*). There are several initiatives that could benefit salmon populations and those relying on them in Area 12. These centre around habitat restoration, in-stream restoration (specifically the removal of obstacles to migration to allow for earlier upstream access and shelter from predators), and the creation and implementation of watershed-specific salmon conservation community guidelines (See Page 51, Section 5.0. *Recommendations*).



Photo: Stream technician Jo finishes an enumeration survey of Viner River and walks back through the estuary. (April Bencze, 2018)

1.0 OVERVIEW & LOCATION

1.1 SEASON OVERVIEW

Stream Technicians: April Bencze, Emily Grubb, and Ben Paulsen *Total Surveys*: 105

2021 DFO STREAMS

- Formal surveys: 62
- 8 streams surveyed on a rotational basis (every 7-14 days)
 - Ahta River (x10 surveys) (Mainland)
 - Embley River (x6 surveys) (Mainland)
 - Carriden Creek (x6 surveys) (Mainland)
 - Wahkana Creek (x8 surveys) (Gilford Island)
 - Viner River (x8 surveys) (Gilford Island)
 - Scott Cove Creek (x8 surveys) (Gilford Island)
 - Shoal Harbour Creek (x8 surveys) (Gilford Island)
 - Maple Cove Creek (x8 surveys) (Gilford Island)

2021 MESSS STREAMS

- Formal surveys: 43
- 10 streams/tributaries enumerated on a rotational basis (timed strategically)
 - Scott Cove Creek/Loose Lake Tributaries (Gilford Island)
 - Minihump Creek (x4 surveys)
 - Connector Creek (x4 surveys)
 - Chris Bennett Creek (x4 surveys)
 - Loose Lake Creek (x4 surveys)
 - John Lewis Creek (x4 surveys)
 - Shoal Harbour Creek/Bridie Lake Tributaries (Gilford Island)
 - Mount Worthington Creek (x2 surveys)
 - Billy Proctor Creek (x3 surveys)
 - Gilford Creek (x8 surveys) (Gilford Island)
 - Simoom Sound Creek (x5 surveys) (Mainland)
 - Sir Edmund Bay Creek (x5 surveys) (Broughton Island)

Note: The number of surveys per year fluctuates each season. To compare previous years with 2021, see Page 57, Table 7.1a. *Number of Surveys Per Year*.

1.2 SURVEY LOCATIONS



Map 1.0. Broughton Archipelago/Musgamagw Dzawada'enuxw Territories/D.F.O. Area 12 Enumeration area map (Google Earth, North up)





<u>Maps 2.0 and 3.0.</u> Survey sites in West (left) & East (right) Broughton respectively.

2.0 ENUMERATION METHODOLOGY

Comprehension of the following definitions of key terms and methodologies used in enumeration surveys is required to interpret the data presented in this report.

Estuary Survey: A 20-minute estuary observation period was carried out during which any jumping salmon, wildlife, weather, and any notable observations were recorded. The objective of estuary surveys was to monitor salmon jumping activity, estuary predation activity, fish schooling, holding patterns, in-stream migration timing, as well as general wildlife activity and weather conditions.

Rotational Surveys: M.E.S.S.S. streams: 10 streams were surveyed between 2-5 times throughout the season on a timely basis, based strategically on respective population returns. D.F.O. streams: 8 streams were surveyed 8 times throughout the season on a rotational basis (every 7-14 days).

Stream Measurements - A Hanna Multiparameter was used to measure the stream acidity (pH), dissolved oxygen (%DO), and water temperature. Air temperature, bankfull, weather, rainfall, water clarity, light levels, fish visibility, etc. were also recorded for each stream.

Coho Surveys - Coho surveys are conducted by watching for jumpers at the base of select waterfalls for a period of 20-minutes. Jumpers are recorded and included in the enumeration totals. This method supports enumeration efforts in streams such as Scott Cove Creek, in which coho surveys serve as the primary enumeration method due to low visibility in the main stream.

% Surveyor Efficiency - The estimated percentage of fish observation accuracy based on factors such as visibility, water clarity/turbidity, light levels, cover for fish, water levels (bankfull), and other factors which restrict the surveyor from observing the entire population.

% Population Surveyed - The estimated percentage of the population observed for the stream. Example: if the whole stream is surveyed, the % Population would be 100%, but if only partially surveyed due to limited access or other factors, the percentage would be less than 100%.

Relative Abundance Estimate: Peak Counts and the enumeration estimates in this report should be considered relative abundance estimates and not true abundance estimates. (Examples of true abundance estimates would be estimates produced through fence counts, or intensive mark recapture programs). Relative abundance counts are useful tools to compare trends over time but do not provide a total count of the true number of spawners returning to a river each year.

Peak Counts: The highest sum of fish (per species) counted during a single survey for the enumeration season. Peak Counts provide a conservative relative abundance estimate and are used in this report to compare trends for population returns over time. Peak Counts are the primary salmon enumeration estimate method utilized in this report.

Observed (O) **Count:** Live fish seen and recorded by the stream technicians. This number does not include morts, jacks, or any estimated inflations (% population, % efficiency) to the population total.

Estimated (E) Count: An estimated count for each stream calculated by the stream technicians. This number includes morts (dead fish), jacks (precocial males), and also accounts for the percentage of the population surveyed (% population) as well as the percentage of efficiency determined by the stream technicians (% efficiency). Estimated counts are obtained by using this formula:

 $0 \quad \frac{(Adults \ Estimated + Jacks + Dead) \ (X)}{\% \ Population \ Surveyor \ (0.XX)} / \ \% \ surveyor \ efficiency \ (0.XX)$

3.0 PEAK STREAM COUNTS BY SPECIES 2009 - 2021

3.1 PINK/MINIHUMP PEAK COUNTS BY STREAM 2009-2021

STREAM	T Y		PINK/MINIHUMP													
	P E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		
	0			2,197	8,047	13,466	48,943	5,549	546	354	3,129	289	307	484		
Ahta	E	-	-	2,587	10,242	16,474	51,861	6,897	608	412	3,687	363	392	511		
	0		409		3,408	67	109,283	0	1,425	2	78	0	122	3		
Embley	Е	-	1,024	-	6,533	267	152,182	0	1,789	3	124	0	174	6		
a	0	1	67	0	0	0	1,610	0	12	0	0	0	0	0		
Carriden	Е	1	88	0	0	0	4,339	0	20	0	0	0	0	0		
Wahkana	0	8	16	7	10	8	442	2	8	0	0	0	0	0		
	Е	15	18	20	19	15	618	10	12	0	1	0	0	0		
Viner	0	1,114	124	53	1,354	685	1,438	145	21	48	0	6	5	5		
viner	Е	1,450	344	1,132	3,360	1,046	1,898	194	27	75	0	8	6	8		
6 <i>4</i> 6	0	25	2	0	2	0	185	0	0	0	0	0	0	0		
Scott Cove	E	50	2	0	7	0	298	0	0	0	0	0	0	0		
Minihumn	0	2,289	831	878	33	1,236	319	676	491	1,263	1,202	98	835	1,290		
wiininump	E	3,522	877	1,171	776	1,964	798	966	655	1,590	1,503	490	1,045	1,720		
Connector	0	_	_	_	_	26	_	38	21	8	17	40	0	7		
Connector	E					35		59	22	12	21	57	0	28		
C Bennett	0		2	0	0	0	0	0	0	0	1	0	0			
Ci Dellitett	E	0	10	0	0	0	0	0	0	0	2	0	0	2		
Loose	0		0	0	0	0		0	0	0	0	0	0	0		
	E	0	0	0	U	0	0	0	0	0	5	0	1	0		
J. Lewis	0		0	0		0	0	0	0	8 11) 7		1	2		
	E	159	6	16	100	61	267	1		1	1	0	5	0		
Shoal H.	O E	1 38 199	28	25	267	109	515	8	6	1 1	1 3	0	5 6	0		
	0	0	20	1	0	0	30	0		0	2	0	1	0		
Maple	Е	0	35	7	47	0	58	0	-	0	4	0	2	1		
	0	5	12	0	91	2	40	0		0	0	0	0	0		
Gilford	Е	5	26	1	129	50	57	0	-	0	0	0	0	0		
<i>a</i> . ~	0	121	4	0			230	70	0	0	0	0	0	0		
Simoom S.	E	142	4	0	-	-	300	94	0	0	0	0	0	0		
C' . E 1	0	6	1				12	0	0		0	0	0	0		
Sir Ed.	E	6	2	-	-	-	36	0	0	-	0	0	0	0		

Table 3.1. Comparison of Peak Observed (O) & Estimated (E) counts for pink salmon and minihump kokanee in streams enumerated from 2009-2021. Minihump Creek Kokanee (MH) were grouped with pinks in this table solely in the interest of column space. White: odd-year pink population. Light grey: even-year pink population. Yellow with red font: minihump population.

-: Stream not inspected. Billy Proctor Creek and Mount Worthington Creek are not pink systems and were not listed in this table.

	T Y		СНИМ													
STREAM	P E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021		
Ahto	0	_	_	88	388	258	80	800	287	390	239	210	14	115		
Anta	Ε			96	686	402	102	1,539	674	577	328	253	19	122		
	0		0		11	8	12	42	26	18	1	8	1	4		
Embley	Е	-	0	-	30	80	29	151	34	27	13	13	1	8		
	0	3	1	0	0	0	6	10	3	2	18	8	0	5		
Wahkana	Е	6	1	0	0	1	16	14	4	3	25	10	1	8		
	0	2,201	27	1,424	2,500	1,936	351	5,098	1,625	638	1,609	132	38	334		
Viner	Ē	2,269	81	2,560	6,066	3,656	535	22,263	7,608	993	2,332	176	55	440		
	0	10	0	0	1	0	151	1	28	11	1	0	0	0		
Scott Cove	Е	20	0	0	3	0	910	2	38	15	2	0	0	0		
	0	116	1	94	38	152	20	1	174	1	42	6	2	68		
Shoal H.	Е	142	2	269	63	301	86	236	352	27	63	35	3	176		
	0	0	1	0	0	0	0	0		0	0	0	0	0		
Maple	Е	0	8	0	0	0	0	0	-	0	0	0	0	0		
	0	1	1	0	0	2	0	0		0	0	0	0	0		
Gilford	Е	1	2	0	0	5	0	0	-	0	0	0	0	0		
	0	0	0	0			0	19	0	0	0	0	0	0		
Simoom S.	Ē	0	0	0	-	-	0	29	0	0	6	0	0	0		
	0	0	0				0	0	0		0	0	0	0		
Sir Ed.	Ē	0	0	-	-	-	0	0	0	-	0	0	0	0		

3.2 CHUM PEAK COUNTS BY STREAM 2009-2021

Table 3.2. Comparison of Peak Observed (O) & Estimated (E) counts for chum salmon in streams enumerated from 2009-2021. -: Stream not inspected. The following streams are not chum systems and were not included in this table: Carriden Creek, Minihump Creek, Connector Creek, Chris Bennett Creek, Loose Creek, John Lewis Creek, Mount Worthington Creek, and Billy Proctor Creek.

3.3 SOCKEYE PEAK COUNTS BY STREAM 2009-2021

	T Y	SOCKEYE												
STREAM	P E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	0			5	3	12	4	5	4	2	3	2	1	7
Ahta	Ē	-	-	6	4	13	5	6	4	2	3	2	2	7
	0	0	0	0	0	1	2	0	0	0	0	0	0	0
Embley	E	0	0	0	0	1	4	0	0	0	0	0	0	0
	0	0	0	0	2	2	3	0	0	0	0	0	0	4
Viner	E	0	0	0	2	3	4	0	0	0	0	0	0	13

Table 3.3. Comparison of Peak Observed (O) & Estimated (E) counts for sockeye salmon in streams enumerated from 2009-2021. -: Stream not inspected. Of the streams surveyed and listed in this report, none are considered to have a significant sockeye population. However, the Ahta River has a consistent but very minimal return of sockeye, and stray sockeye are sometimes observed in Embley River and Viner River as illustrated in the above table.

	T Y	СОНО												
STREAM	P E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	0			400	849	959	156	1,752	57	200	35	11	8	81
Anta	E	-	-	1,115	1,067	3,941	322	1,959	76	250	44	22	13	86
Embloy	0	_	75	_	53	16	3	0	3	6	0	3	3	2
Lindley	E		256	-	250	362	600	0	33	14	0	8	7	4
Carriden	0	0	2	0	0		6	0	0	0			0	0
	E	0	1/	0	0	0	/0	0	0	0		1	0	1
Wahkana	0	3 10	2	0	0		13 59		0	0			0	0
	E	10	ð	1	1	12	20	1	1	0			1	0
Viner	0	29	18	12	1		3 151	1 10	1 25	2 14			1	2 10
	E	100	102	15	22	240	151	50	25 52	14 62	4	5	1 6	27
Scott Cove		122	95 346	33	55 610	240	40 274	50 671	33 375	02 231	168	3 87	0 67	27
	Ľ	189	340	106	2	1,137	274	0/1	0	231	100	02	07	210
Minihump		1	2 30	0	- 3 - 16	0	33	1	0	0	0	0	1	2 8
	0					0		1	0	5	4	1	0	0
Connector	Ē	-	-	-	-	0	-	4	0	8	8	3	0	2
	0	0	9	2	3	0	0	3	1	3	0	2	1	9
C. Bennett	Ē	0	26	4	16	0	0	6	6	6	0	3	1	21
	0	14	0	0	1	0	0	4	3	1	1	0	0	0
Loose	E	21	0	0	33	0	1	13	16	3	2	0	0	3
	0	10	0	0		0	0	0	0	1	0	1	0	5
J. Lewis	E	17	0	0	-	0	0	0	0	2	0	1	0	9
	0	11	9	1	4	10	1	0	2	0	0	0	2	7
Shoal H.	Е	29	64	70	45	44	100	0	16	0	0	0	4	13
M4 Wenth	0			0				0	0	0	0	0	0	0
Mit worth.	E	-	-	0	-	-	-	0	0	0	0	0	0	0
D. Ducaton	0	_	_	8	13	_	_	1	0	0	0	0	0	30
b. Proctor	E		_	27	39	_	_	1	0	0	2	0	3	48
Manla	0	0	0	0	0	0	0	0	_	0	0	0	1	0
wiapie	E	1	0	0	0	0	0	0	_	0	0	0	1	0
Gilford	0	15	0	2	25	1	1	0	-	0	2		0	0
	E	0	10	00	846	51	50	1			51		0	2
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3.4 COHO PEAK COUNTS BY STREAM 2009-2021

Table 3.4. Comparison of Peak Observed (O) & Estimated (E) counts for coho salmon in streams enumerated from 2009-2021. -: Stream not inspected.

4.1 AHTA RIVER

Kwikwasut'inuxw Haxwa'mis Territory (50°52'13.60"; 126°10'12.49"W); Watershed Code (WC): 90060400

Watershed Information

Ahta River is a non-glacial watershed that drains into Bond Sound to the south through the Ahta Valley. The river has a total length of 12.2 km and opens into a lake. Ahta River has an estimated 4800m² of suitable spawning gravel. There is a steep set of falls at the 1.2 km mark which are believed to be a barrier to salmon passage for all species.

Stream Segments

- AHR01: 470m Best surveyed at a low-mid tide for accessibility. Gravel substrate dominates.
- **AHR02:** 400m Majority gravel substrate. This segment is where the majority of pink spawning activity takes place. There is a significant log jam that spans the river at the beginning of this segment but allows ample fish passage and cover.
- AHR03: 400m Beginning after the big bend pool, consists of boulders that extend to the bottom of the falls. Falls pools are included in this segment. There are 2 deep pools beneath the falls that provide holding habitat for salmon. Coho are predominantly observed in these 2 pools, as well as pink, chum, and sockeye early in the season. The water clarity in the first pool approaching the falls is adequate early in the season but becomes very poor mid-to-late season with increased water level and turbidity. Poor visibility at the falls impact the efficiency of coho estimates.
- **AHR04:** *500m* This segment was added as a standard part of the enumeration survey in 2021 after stream bed changes from flooding in 2020 made this channel deeper and more viable for salmon to migrate up, hold within, and utilize for spawning. It is best surveyed at a low-mid tide for accessibility purposes. Beginning at the big bend pool at the end of AHR02, this segment is known as the 'side channel' and branches off to the north, leading back to the estuary.

Survey Notes

- Surveyed a total of 10 times between July 27th and November 10th, 2021 every 8 to 16 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.
- 2 volunteer preliminary surveys were conducted in late July and early August to more accurately document when pink salmon enter this watershed. The first preliminary surveys for 2020-2021 showed pink were already in the river by the end of July. (See Page 58, Table 7.21b. *Ahta River 2021: Enumeration by Rotation*) Given this, the first survey for the Ahta River could be timed around July 21st in order to pinpoint when pink initially enter the river each year for both the even- and odd-year pink populations. (See Page 51, Subsection 5.1. *Enumeration Survey Review*)

Efficiency, Visibility, Bankfull & Temperature

- The visibility ranged from mid-high throughout the 2021 season, remaining fairly consistent especially when compared to 2020's numerous flooding events.
- Surveyor efficiency varied more significantly (10-95%) due to a few factors. A single snorkel survey was conducted raising the efficiency to 95%; a significant increase from foot surveys. Due to stream bed changes from flooding in 2020, the main holding pools became deeper and wider in several places, reducing visibility to almost nil (despite lower bankfull and good water clarity).
- Bankfull ranged from 20-70% during the 10 surveys.
- Water temperature ranged from a low of 5.6°C to a high of 14.3°C, primarily decreasing throughout the season. This is very similar to 2020's temperature range of 5.8°C to 14.5°C.

Wildlife Observations

- Grizzly bear encounters were an infrequent occurrence especially compared to previous years enumeration. However, grizzly bear tracks and scat remain abundant especially during peak salmon spawning activity. Deer tracks, eagles, dippers, and hawks were all commonly observed.
- Notably less Pacific white-sided dolphins were observed during the 2021 season, and no large pods were observed in the estuary as was the case for the previous few years.



<u>Graph 4.1a.</u> Peak estimated counts for the Ahta River from 2011-2021 for pink, chum, coho, and sockeye salmon. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 58, Table 7.21a. *Ahta River 2009-2021 Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.1(b)</u>. Rotational estimated counts for the Ahta River between July 27th and November 10th 2021 for pink, chum, coho, and sockeye. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 58, Table 7.21b. *Ahta River* 2021 Enumeration by Rotation for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species AHTA RIVER PEAK ESTIMATED COUNTS 2021:

PINK: 511 CHUM: 122 COHO: 86 SOCKEYE: 7

2021 AHTA RIVER PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* Rotation #3 (September 7th) pink peaked at 484 observed, 511 estimated.
- *First Observed*: Preliminary I (July 27th) (5 observed, 14 estimated)
- *Last observed (live)*: Rotation #6 (October 13th) (2 observed and 4 estimated). (See Page 58, Section 7.2. *Stream Enumeration Data, Table 7.21b. Ahta River 2021*)
- *Population status:* It is historically consistent for the odd-year pink population to be less abundant than the even-year population. Since 2015, both the even-and-odd year populations have been in decline. However, the 2021 peak return of 511 estimated pink shows a slight increase in population compared to the previous odd-year population peak count in 2019 of 363 estimated pink. Overall, both the odd-year and even-year pink populations of the Ahta River are low when compared with 2011-2015 counts. (See Page 13, Graph 4.1a. *Ahta River*)

2021 AHTA RIVER CHUM SALMON

- *Peak Estimated Count:* Rotation #3 Survey (September 7th) chum peaked at 115 observed, 122 estimated.
- *First Observed*: Rotation #1 (August 20th) (1 observed, 2 estimated)
- *Last observed (live)*: Rotation #6 (October 13th) (12 observed and 59 estimated). (See Page 58, Section 7.2. *Stream Enumeration Data, Table 7.21b. Ahta River 2021*)
- *Population status:* Since 2011, chum populations in the Ahta River remain low. The populations vary as 3-, 4-, and 5-year olds return to spawn and so long-term consistent data is especially important for this species. The 2021 peak return of 122 estimated chum is on the lower end of chum numbers in the past 11 years of data, with only 2020 (19 estimated chum) and 2011 (96 estimated chum) counts lower than 2021. (See Page 13, Graph 4.1a. *Ahta River*)

2021 AHTA RIVER COHO SALMON

- *Peak Estimated Count:* Rotation #3 Survey (September 7th) coho peaked at 81 observed, 86 estimated.
- *First Observed*: Preliminary II (August 6th) (4 observed, 8 estimated)
- *Last observed (live)*: Rotation #8 (November 10th) (2 observed and 7 estimated) (See Page 58, Section 7.2. *Stream Enumeration Data, Table 7.21b. Ahta River 2021*).
- *Population status:* Coho numbers have been very low since 2018 in the Ahta River. 2021's peak estimate of 86 coho was gathered during a snorkel survey as opposed to previous years' foot surveys. Efficiency for coho estimates is higher due to gaining access to underwater viewing of undercut banks and deep pools where coho typically hide. In 2021, coho populations ultimately remain low when compared to estimates prior to 2016. (See Page 13, Graph 4.1a. *Ahta River*)

2021 AHTA RIVER SOCKEYE SALMON

- *Peak Estimated Count:* Rotation #3 Survey (September 7th) sockeye numbers peaked at 7 observed, 7 estimated (this was a snorkel survey).
- *First Observed*: Preliminary II (August 6th) (2 observed, 4 estimated)
- *Last observed (live)*: Rotation #3 (September 7th) (7 observed and 7 estimated). (See Page 58, Section 7.2. *Stream Enumeration Data, Table 7.21b. Ahta River 2021*)
- *Population status:* There is consistently a very small return of sockeye to this river. (See Page 13, Graph 4.1a. *Ahta River*)

4.2 EMBLEY RIVER

Gwawaenuk Territory (50°56.984'N; 126°52.819"W); WC: 900730600

Watershed Information

Embley River is a non-glacial watershed that drains out of Huaskin Lake (a large lake of 441.7 ha/km). From the estuary to Huaskin Lake the river measures 4.8 km. This river is a Fisheries and Oceans Canada indicator stream for pink salmon in Area 12. The fish ladder was built by D.F.O. in 1962 as part of an enhancement project.

Stream Segments

- **EMB01:** *100m* Covers the length of the fish ladder and the waterfall/cascades river mouth that parallels the fish ladder. This segment ends at the top of the ladder. Visibility is limited within the fish ladder itself, lowering efficiency for this first segment.
- EMB02: 880m Ranges from the top of the fish ladder to the log that serves as a bridge to cross the river before the old landslide site. Glides, which are characterised by non-turbulent flow similar to that of a shallow canal, are the dominant flow type of Segment 2. Fine substrate and eelgrass, as well as other still water vegetation characterise this segment. There is a large beaver dam that blocks flow at lower water levels and is submerged during flooding conditions and therefore, not a barrier to fish passage.
- **EMB03:** *1200m* This segment is similar to Segment 2 regarding fines and sand substrate and glides making up the majority of the segment. Spawning gravel is found in the last 200m of Segment 3.
- **EMB04:** 200m Segment 4 is a U-shaped tributary at the bottom of the cascades, accessed from the left bank.
- **EMB05:** *600m* The cascade section that follows is Segment 5 which has a moderate-high gradient that is passable by pink, chum, and coho. The visibility along this segment becomes null after water levels rise.
- **EMB06**: *1200m* Above the cascades is Segment 6, the primary spawning location for pink along the stretch of gravel that transitions into a riffle section with increasing boulder/cobble substrate.

Survey Notes

- Surveyed a total of 6 times between August 17th and October 30th, 2021 every 10 to 16 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.
- 2 surveys were not possible to conduct due to flooding conditions.
- 2021 is the odd-year pink population (which historically sees a very small pink return each year.)

Efficiency, Visibility, Bankfull & Temperature

- The large size of Huaskin Lake moderates water levels of the river and the increase in bankfull percentage is generally gradual.
- Visibility decreased from high to low during the 2021 season as water levels increased into the fall.
- Bankfull ranged from 20-105% during the 6 surveys. Flooding conditions limited survey efforts in the latter half of the season.
- Surveyor efficiency varied (5-50%) but remained low throughout the season due to a few factors: wide river, limited surveying access (bank walk), plenty of cover, log jams and deep pools.
- Water temperature ranged from a low of 5.6°C to a high of 20.4°C, decreasing throughout the season. This differs from 2020's temperature range of 12.9°C to 21.0°C.

Wildlife Observations

- Beaver activity (active dam spanning river and altering flow), black bear activity, grizzly bear sign, deer tracks. Overall a lower abundance of bear sign compared to previous years.
- High cougar activity (4 fresh scratches and scat on trail) during the last survey.



<u>Graph 4.2a.</u> Peak estimated counts for Embley River from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 59, Table 7.22a. *Embley River 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.2b.</u> Rotational estimated counts for Embley River between August 17th to October 30th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 59, Table 7.22b. *Embley River 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species EMBLEY RIVER PEAK ESTIMATED COUNTS 2021:

PINK: 6 CHUM: 8 COHO: 4

2021 EMBLEY RIVER PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count/First Observed/Last Observed:* Rotation #3 (September 13th) pink peaked at 3 observed, 6 estimated. This was the only survey for 2021 that observed pink. (See Page 59, Section 7.2. *Stream Enumeration Data, Table 7.22b. Embley River 2021*)
- *Population status:* It is historically consistent in Area 12 for the odd-year pink population to be significantly less abundant than the even-year population. Since 2015, the odd-year population has not exceeded more than 6 peak estimated pink, however, in 2013, 267 peak estimated pink were observed. Overall, both the odd-year and even-year pink populations of Embley River are low and in decline from 2013 and 2014, respectively. (See Page 16, Graph 4.2a. *Embley River*)

2021 EMBLEY RIVER CHUM SALMON

- *Peak Estimated Count:* Rotation #4 (September 23rd) chum peaked at 4 observed, 8 estimated.
- *First Observed*: Rotation #3 (September 13th) (3 observed, 6 estimated)
- *Last observed (live)*: Rotation #4 (September 23th) (4 observed and 8 estimated). 2 chum morts were observed during Rotation #6 (October 30th) (See Page 59, Section 7.2. *Stream Enumeration Data, Table 7.22b. Embley River 2021*)
- *Population status:* Since 2010, chum populations in the Embley River remain low (under 200 peak estimated counts). The last 6 years are especially low, not exceeding a peak count of 34 and as low as 1. The populations vary as 3-, 4-, and 5-year olds return to spawn; long-term consistent data is especially important for this species. (See Page 16, Graph 4.2a. *Embley River*)

2021 EMBLEY RIVER COHO SALMON

- *Peak Estimated Count:* Rotation #2 (August 27th) coho peaked at 2 observed, 4 estimated.
- *First Observed*: Rotation 1 (August 17th) (1 observed, 3 estimated)
- *Last observed (live)*: Rotation #4 (September 23rd) (1 observed, 4 estimated) (See Page 59, Section 7.2. *Stream Enumeration Data, Table 7.22b. Embley River 2021*)
- *Population status:* The peak estimated coho counts have been low (less than 40) since 2015 in Embley River. Prior to 2015 coho returns were much greater (more than 200). 2021's peak estimate of 4 coho is low, though efficiency for coho estimates is very low in this river due to factors such as limited viewing, large system, deep glides, and lots of cover. (See Page 16, Graph 4.2a. *Embley River*)

2021 EMBLEY RIVER SOCKEYE SALMON

• *Population status*: Sockeye salmon have not been observed in Embley River since 2014. (See Page 16, Graph 4.2a. *Embley River*)

4.3 CARRIDEN CREEK

Gwawaenuk Territory (50°54'40.66"N; 126°54'33.45"W); WC: 900735

Watershed Information

Carriden Creek drains Rosemary Lake and the surrounding watershed, flowing east into Carriden Bay and Grappler Sound. Railway logging took place from 1930-1936 in this watershed. Beaver activity remains near the landslide and below the lake.

Stream Segments

- **CAR01:** *500m* Segment 1 spans from the estuary to 500m upstream. The first 450m of the creek is characterized by a high grade, steep banks, a relatively high flow rate and a substrate composed mostly of boulders.
- CAR02: 900m Segment 2 stretches until the top of the landslide. Past the landslide the stream is characterized by a lower grade, decreased flow rate and a substrate composed primarily of fines and cobbles with an open forest until it reaches the lake.
- CAR03: Segment 3 reaches from the top of the landslide to Rosemary Lake.
- CAR04: Segment 4 is the small tributary below Rosemary Lake.

Survey Notes

- Surveyed a total of 6 times between August 17th and October 30th, 2021 every 10 to 16 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.
- 2 surveys were not possible to conduct due to flooding conditions and weather restricting travel.

Efficiency, Visibility, Bankfull & Temperature

- The visibility ranged from high-low throughout the 2021 season, decreasing as water levels increased with rainfall, and flooding restricted surveys.
- Surveyor efficiency varied significantly (5-90%) during the 6 surveys, decreasing as high water levels restricted visibility.
- Bankfull ranged from 15-95% during the 6 surveys.
- Water temperature ranged from a low of 9.3°C to a high of 15.1°C. This differs from 2020's temperature range of 10.9°C to 19.0°C, with cooler temperatures for the higher range.

Wildlife Observations

• Black bear activity was recorded during most surveys in Carriden Creek, as well as fresh beaver activity above the landslide and below Rosemary Lake.



<u>Graph 4.3a.</u> Peak estimated counts for Carriden Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 59-60, Table 7.23a. *Carriden Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.3b.</u> Rotational estimated counts for Carriden Creek between August 17th to October 30th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 60, Table 7.23b. *Carriden Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species CARRIDEN CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 0 COHO: 1

2021 CARRIDEN CREEK PINK SALMON (ODD-YEAR POPULATION)

- Pink salmon were not observed in Carriden Creek during the 6 surveys in 2021. (See Page 60, Section 7.2. *Stream Enumeration Data, Table 7.23b. Carriden Creek 2021*)
- *Population status:* Historically, pink salmon have spawned in this stream. With the exception of 2014, returns in recent years have been negligible, with no pink observed since 2016 (peak estimate of 20 pink). (See Page 18, Graph 4.3a. *Carriden Creek)*

2021 CARRIDEN CREEK CHUM SALMON

- Chum salmon were not observed in Carriden Creek during the 6 surveys in 2021. (See Page 60, Section 7.2. *Stream Enumeration Data, Table 7.23b. Carriden Creek 2021*)
- *Population status:* Since 2009, there has been no evidence of a chum population in Carriden Creek. (See Page 18, Graph 4.3a. *Carriden Creek)*

2021 CARRIDEN CREEK COHO SALMON

- *Peak Estimated Count, First Observed, and Last Observed (live):* No live coho were observed during the 6 surveys of Carriden Creek in 2021. However 1 mort (presumed to be a coho based on size of the fresh salmon spine observed in-stream, but no positive ID) was observed during Rotation #4 (September 23rd). This means coho numbers peaked at 0 observed, 1 estimated. (See Page 60, Section 7.2. *Stream Enumeration Data, Table 7.23b. Carriden Creek 2021*)
- *Population status:* Coho have been observed in Carriden Creek during 3 years since 2009. These occurred in 2010 (peak estimate of 17 coho), 2014 (peak estimate of 70 coho), and the 1 mort observed in 2021 (See Page 18, Graph 4.3a. *Carriden Creek*). The coho population of Carriden Creek is difficult to enumerate (low efficiency) due to the nature of coho moving instream and migrating to Rosemary Lake very quickly. Schools of coho have been observed holding in the estuary in previous years but these numbers are not recorded in the official surveys. (See Page 71, Section 8.0. *References, 8.8. M.E.S.S.S. Enumeration Database*). A strategic update to the survey is recommended to improve efficiency for coho estimates in this stream, which may include fry trapping for coho in the spring. (See Page 51, Section 5.1. *Enumeration Survey Review, 5.1b. Carriden Creek*). Overall, the coho population of Carriden Creek remains low.

4.4 WAHKANA CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50º48'58.69"N; 126º18'0.54"W); WC: 90555750054200)

Watershed Information

Wahkana Creek flows into Wahkana Bay on northeastern Gilford Island. It drains Wahkana Lake as well as the rest of the watershed (an area of approximately 3m²). Gravel substrate this season was covered with brown algae likely due to lack of fish activity and lower flow before the rain arrived.

Stream Segments

- WAH01: 740m Spawning activity for pink and chum have only been observed in Segment 1. Low gradient, large woody debris (LWD) throughout, series of long, deep, and dark pools plus undercut banks where fish shelter. The stream has very little elevation change over the first 800m.
- WAH02: 760m Segment 2 extends to Wahkana Lake. There is a large landslide at the end of Segment 1, followed by a swampy area spanning ~150m. The habitat transitions into low gradient cascades consisting of boulder/cobble substrate. Segment 2 is both shallow and narrow (offering few opportunities for cover). Coho tend to migrate upstream quickly to shelter in the lake.
- WAH03: 335m Tributary #1 extends from the main stream to a falls that appears impassable.

Survey Notes

• Surveyed a total of 8 times between August 20th and November 10th, 2021 every 8 to 16 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.

Efficiency, Visibility, Bankfull & Temperature

- The visibility ranged from mid-low throughout the 2021 season, remaining consistently moderate throughout most of the season. Despite clear water in the narrow stream, the amount of undercut banks, deep pools, and woody debris as cover hinders visibility significantly.
- Surveyor efficiency remained fairly stable (60-85%) due to the narrow stream and clear water which allowed for thorough inspection despite plenty of cover and deep holding pools.
- Bankfull ranged from 25-80% during the 8 surveys.
- Water temperature ranged from a low of 6.8°C to a high of 14.4°C, primarily decreasing throughout the season. This is consistent with 2020's temperature range 6.4°C to a high of 15.0°C.

Wildlife Observations

- A black bear was observed (Rotation #3) and scat was commonly observed near the stream.
- A Northern goshawk was observed and positively identified by Ben Paulsen during Rotation #7.
- Multiple beaver dams are active and restricting flow near the lake.



<u>Graph 4.4a.</u> Peak estimated counts for Wahkana Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 60, Table 7.24a. *Wahkana Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.4b.</u> Rotational estimated counts for Wahkana Creek between August 20th to November 10th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 60-61, Table 7.24b. *Wahkana Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

WAHKANA CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 8 COHO: 0

2021 WAHKANA CREEK PINK SALMON (ODD-YEAR POPULATION)

- Pink salmon were not observed in Wahkana Creek during the 8 surveys in 2021. (See Page 60-61, Section 7.2. *Stream Enumeration Data, Table 7.24b. Wahkana Creek 2021*)
- *Population status:* Since 2009, less than 25 (peak estimated count) of pink salmon have been observed for each year with the exception of 2014 (618 peak estimated pink). No pink have been observed in Wahkana Creek since 2018. (See Page 20-21, Graph 4.4a. *Wahkana Creek*)

2021 WAHKANA CREEK CHUM SALMON

- *Peak Estimated Count & Last Observed (live):* Rotation #6 (October 13th) chum peaked at 5 observed, 8 estimated and were last seen live.
- *First Observed:* Rotation #5 (October 4th) chum count of 1 observed, 2 estimated. (See Page 60-61, Section 7.2. *Stream Enumeration Data, Table 7.24b. Wahkana Creek 2021*)
- *Population status:* Since 2009, the chum population in Wahkana Creek has remained very low (below 30 peak estimated chum). (See Page 20-21, Graph 4.4a. *Wahkana Creek)*

2021 WAHKANA CREEK COHO SALMON

- Coho salmon were not observed in Wahkana Creek during the 8 surveys in 2021. (See Page 60-61, Section 7.2. *Stream Enumeration Data, Table 7.24b. Wahkana Creek 2021*)
- *Population status:* Since 2009, less than 15 (peak estimated count) coho have been observed for each year, with the exception of 2014 which saw a peak estimated count of 58 coho return. None have been observed in Wahkana Creek since 2019. (See Page 20-21, Graph 4.4a. *Wahkana Creek*)
- A strategic update to the survey segments is recommended to improve efficiency for coho estimations in this stream, which may include fry trapping for coho in the spring. If possible, surveying the upper and lake tributaries of Wahkana Creek may increase coho estimation efficiency. (See Page 51, Section 5.1. *Enumeration Survey Review, 5.1c. Wahkana Creek*).

4.5 VINER RIVER

Kwikwasut'inuxw Haxwa'mis Territory (50º47.259'N; 126º22.033'W); WC: 9055750039800

Watershed Information

Viner River drains a watershed with an area of approximately 25 km². The Viner watershed is a floodplain that drains out of Viner Lake. The river supports 9.0 km of fish habitat in the mainstream and tributary reaches. These have previously been accessible to coho, pink, chum, sockeye, and steelhead, as well as cutthroat and rainbow trout.

Stream Segments

- **VIN01:** *1000m* This segment is primarily gravel substrate with spawning gravel throughout, starting from the river mouth. The end point is marked by the first significant log jam with severe clay bank erosion.
- **VIN02:** *1000m* This segment extends to the riverbend at the bottom of the cascades. The majority is viable spawning gravel. Recent erosion, large woody debris are abundant throughout.
- **VIN03:** *1500m* This segment is characterized by a long reach of cascades with high flow and low visibility. There is spawning gravel nearer to the 3km mark where the Scott Cove M/L road intersects with the river at an old bridge site. Here the stream splits into several tributaries composed of spawning gravel and holding pools.

Survey Notes

- Surveyed a total of 8 times between August 18th and November 7th, 2021 every 10 to 14 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.
- There were 40 jumpers total observed during estuary counts throughout the 2021 season.

Efficiency, Visibility, Bankfull & Temperature

- The visibility ranged from mid-high (0.5-3.0 M) throughout the 2021 season, remaining fairly consistent especially when compared to 2020's numerous flooding events.
- Surveyor efficiency remained stable (between 70-90%) for pink, chum, and sockeye salmon. Efficiency was lower for coho salmon (between 20-50%).
- Bankfull ranged from 20-70% during the 8 surveys.
- Water temperature ranged from a low of 7.4°C to a high of 13.2°C, decreasing throughout the season. This temperature range is higher when compared to 2020's temperature range of 5.6°C to a high of 12.2°C.

Wildlife Observations

- Grizzly bear and black bear tracks were abundant throughout the season in the Viner watershed
- Stream technicians had 1 encounter with a grizzly bear in 2021, during Rotation #6 (October 14th)
- Significant amount of waterfowl activity in the estuary, as well as eagles and dippers upstream.



<u>Graph 4.5a</u> Peak estimated counts for Viner River from 2009-2021 for pink, chum, coho, and sockeye. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 61, Table 7.25a. *Viner River 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.5h</u>, Rotational *estimated counts* for Viner River between August 19th to November 7th, 2021 for pink, chum, coho, and sockeye. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 61, Table 7.25b. *Viner River 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

VINER RIVER PEAK ESTIMATED COUNTS 2021:

PINK: 8 CHUM: 440 COHO: 10 SOCKEYE: 13

2021 VINER RIVER PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count & Last observed:* Rotation #5 (October 5th) the pink count peaked at 5 observed, 8 estimated.
- *First Observed*: Rotation #3 (September 12th) (3 observed, 4 estimated) (See Page 61, Section 7.2. *Stream Enumeration Data, Table 7.25b. Viner River 2021*)
- *Population status:* Since 2016, both the even-and-odd year pink populations have been in sharp decline with peak estimated numbers less than 100. Overall, the status of the pink populations of Viner River is of significant concern given the negligible numbers returning to spawn from 2018-2021 (0-8 peak estimated pink salmon counts in the past 4 years). Pink salmon returns in Viner River were significantly more abundant prior to 2015. (See Page 23, Graph 4.5a. *Viner River*)

2021 VINER RIVER CHUM SALMON

- Peak Estimated Count: Rotation #5 (October 5th) chum peaked at 334 observed, 440 estimated.
- *First Observed*: Rotation #2 (August 29th) (2 observed, 3 estimated)

- *Last observed (live)*: Rotation #8 (November 7th) (2 observed, 13 estimated) (See Page 61, Section 7.2. *Stream Enumeration Data, Table 7.25b. Viner River 2021*)
- Population status: Chum numbers have been concerningly low (less than 200 peak estimated count) in the past 2 years (2019-2020) with an increase in numbers for 2021 (440 peak estimated count). However, given the large carrying capacity and recent historic runs of Viner River, (eg. 22,263 peak estimated return for chum in 2015) the 2021 chum salmon population estimate for Viner River remains a cause for concern. (See Page 23, Graph 4.5a. Viner River)

2021 VINER RIVER COHO SALMON

- *Peak Estimated Count & Last observed (live):* Rotation #6 (October 14th) the coho count peaked at 2 observed, 10 estimated.
- *First Observed*: Rotation #5 (October 5th) (1 observed, 2 estimated) (See Page 61, Section 7.2. *Stream Enumeration Data, Table 7.25b. Viner River 2021*)
- *Population status:* Coho estimates are more challenging than other species given the lower efficiency involved in coho enumeration. Since 2009, peak coho estimates have remained under 200. The last 5 years (2017-2021) peak estimates have remained under 15. These lower numbers are of concern. Since very few coho are observed spawning, altering the survey method for coho could increase efficiency. (See Page 23, Graph 4.5a. *Viner River*)

2021 VINER RIVER SOCKEYE SALMON

- *Peak Estimated Count:* Rotation #5 (October 5th) the sockeye count peaked at 4 observed, 13 estimated.
- *First Observed*: Rotation #1 (August 19th) (1 mort observed)
- *Last observed (live)*: Rotation #6 (October 14th) (2 observed and 4 estimated) (See Page 61, Section 7.2. *Stream Enumeration Data, Table 7.25b. Viner River 2021*)
- *Population status:* Since 2009 the sockeye population in Viner River has remained negligible. No sockeye were observed in the past 6 years (2015-2020). 2021's peak estimated count for sockeye (13 estimated) was the highest since 2009. (See Page 23, Graph 4.5a. *Viner River*)

4.6 SCOTT COVE CREEK & LOOSE LAKE WATERSHED TRIBUTARIES



Map 4.0. Scott Cove Creek & Loose Lake watershed and the tributaries M.E.S.S.S. surveys for coho during October and November. The coho system extends from Loose Lake into Townie Lake, Carson Lake, Echo Lake, and more.

4.61 SCOTT COVE CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°45'59.17"N; 126°27'29.96"W); WC: 90555750022700

Watershed Information

Scott Cove Creek is a coho system on the west side of Gilford Island. A small coho hatchery was located here and run by M.E.S.S.S. (ceasing enhancement activities in 2007). Coho tend to migrate directly to Loose Lake and spawn in the lake's tributaries later in the season. Coho travel up into several smaller lakes and their tributaries from Loose Lake as well, making Scott Cove Creek the gateway to an expansive coho spawning network of lakes and tributaries.

Stream Segments

- SC01: *350m* Segment 1 spans from the estuary, beyond the bridge crossing the creek mouth and the first set of waterfalls to the old upper Hatchery Dam at 350m. A 20-minute coho survey is conducted at the lower falls (150m).
- SC02: *100m* Segment 2 is accessed at 1.5km up Scott Cove M/L and opens into a pool and falls known as the upper falls. A second 20-minute coho survey is carried out here to count jumping coho at the falls.

Survey Notes

- Surveyed a total of 8 times between August 21st and November 7th, 2021 every 7 to 14 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.
- Coho estimates for this creek primarily reflect jumper counts made during two 20-minute surveys at the bottom of both the lower and upper falls. Unfortunately, jumping frequency can be misleading since numbers fail to adjust for fish that may jump multiple times.

Efficiency, Visibility, Bankfull & Temperature

• The visibility remained low throughout the 2021 season due to Scott Cove Creek's high flow and many waterfalls that reduce the in-stream visibility to null. Estimates rely on 20-minute coho surveys at the falls to enumerate this population migrating upstream due to this low visibility.

- Surveyor efficiency remained stable (50%) due to the low visibility in this creek.
- Bankfull ranged from 30-100% during the 8 surveys, increasing with rainfall events.
- Water temperature ranged from a low of 9.1°C to a high of 16.3°C, decreasing throughout the season. This is cooler than 2020's temperature range of 9.7°C to 18.0°C.

Wildlife Observations

• It is typical for black bears and eagles to take advantage of coho migrating toward the pool below the lower falls (SC01); a black bear was encountered instream as well as eagles.



<u>Graph 4.61a.</u> Peak estimated counts for Scott Cove Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 62, Table 7.26a. *Scott Cove Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



Graph 4.61b. Rotational estimated counts for Scott Cove Creek between August 21st to November 7th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 62, Table 7.26b. *Scott Cove Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

SCOTT COVE CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 0 COHO: 218

2021 SCOTT COVE CREEK PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* No pink were observed during the 8 surveys of 2021. (See Page 62, Section 7.2. *Stream Enumeration Data, Table 7.26b. Scott Cove Creek 2021*)
- *Population status:* Pink salmon have not been observed in Scott Cove Creek since 2014. This stream is typically not a pink system. (See Page 26, Graph 4.61a. *Scott Cove Creek)*

2021 SCOTT COVE CREEK CHUM SALMON

- *Peak Estimated Count:* No chum were observed during the 8 surveys of 2021. (See Page 62, Section 7.2. *Stream Enumeration Data, Table 7.26b. Scott Cove Creek 2021*)
- *Population status:* Chum salmon have not been observed in Scott Cove Creek since 2018. Only a small population of chum returned to Scott Cove Creek prior to 2018 (less than 40 annual peak estimated count for chum since 2009). (See Page 26, Graph 4.61a. *Scott Cove Creek)*

2021 SCOTT COVE CREEK COHO SALMON

- *Peak Estimated Count:* Rotation #3 (September 12th) the coho count peaked at 27 observed, 218 estimated.
- *First Observed*: Rotation #2 (August 31st) (1 observed, 9 estimated)
- *Last observed (live)*: Rotation #5 (October 2nd) (4 observed, 37 estimated) with 1 mort observed during Rotation #6 (October 16th). (See Page 62, Section 7.2. *Stream Enumeration Data, Table 7.26b. Scott Cove Creek 2021*)
- *Population status:* The coho population in Scott Cove Creek was higher than previous years but overall remains low considering historic numbers. (See Page 26, Graph 4.61a. *Scott Cove Creek)*

4.62 MINIHUMP CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°45.207'N; 126°25.669'W); WC: 9055575003370020

Watershed Information

Minihump Creek flows from Townie Lake into Loose Lake, which drains into Scott Cove on Gilford Island. It is accessed at 4.0 km along the Scott Cove M/L logging road. Industrial impacts on the stream have been extensive. Gravel sites exist within the mid reach of the stream, offering some spawning opportunities for coho. Fines are the dominant substrate throughout the stream, (preferred substrate for spawning minihump). Large woody debris is abundant in the stream. A forest approximately 30 years in age is established.

Stream Segments

- **MH01:** *800m* Beginning at Loose Lake, the end point of the minihump survey area is the tail pool at the bottom of the cascade section at 800m (Segment 1). A trail is utilized for a bank survey along the west side of the stream to not disturb the delicate minihump redds dug in fine substrate.
- **MH02**: *200m* Segment 2 from the cascades to Townie Lake is typically not surveyed as it's not the preferred habitat of spawning minihump or coho.

Survey Notes

• Surveyed a total of 4 times between October 8th and November 11th, 2021 every 10 to 13 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.

Efficiency, Visibility, Bankfull & Temperature

- The visibility remained low-mid throughout the 2021 season due to Minihump Creek's dark water, deep pools and abundance of cover that reduces in-stream visibility.
- Surveyor efficiency remained low-mid (25-75%) due to the low visibility in this creek and as well as the thick, young forest that blocks light and shades the stream. Timing this survey during clear skies and close to midday increases efficiency by using the light to better enumerate minihumps.
- Bankfull ranged from 40-85% during the 4 surveys, increasing with rainfall events.
- Water temperature ranged from a low of 8.3°C to a high of 12.3°C, decreasing throughout the season. This is cooler than 2020's temperature range of 10.3°C to 16.1°C.

Wildlife Observations

• The majority of predation (for minihumps) seemed to occur from mergansers, great blue herons, and kingfishers routinely observed during surveys.



<u>Graph 4.62a</u>. Peak estimated counts for Minihump Creek from 2009-2021 for minihump, pink, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 62-63, Table 7.26c. *Minihump Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.62b</u>. Rotational estimated counts for Minihump Creek between October 8th to November 11th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 63, Table 7.26d. *Minihump Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species **MINIHUMP CREEK PEAK ESTIMATED COUNTS 2021:** MINIHUMP: 1,720 PINK: 0 COHO: 8

2021 MINIHUMP CREEK KOKANEE (MINIHUMP)

- *Peak Estimated Count & Last Observed (live):* Rotation #3 (November 1st) the minihump count peaked at 1,290 observed, 1,720 estimated. though it is suspected minihumps remained in-stream for Rotation #4 (November 11th) but were not observed due to very low efficiency.
- *First Observed*: Rotation #1 (October 8th) (763 observed, 1,272 estimated) (See Page 62-63, Section 7.2. *Stream Enumeration Data, Table 7.26d. Minihump Creek 2021*)
- *Population status:* The freshwater kokanee (minihump) population of Minihump Creek remains stable and appears to be increasing over time. Low efficiency is a factor for accurately enumerating this population in a stream that is easily flooded and visibility is commonly a

challenge. Numerous surveys are conducted to accurately determine returns in this stream and findings have been positive (stable population) despite the significant impact on this stream from industrial activity. (See Page 28, Graph 4.62a. *Minihump Creek*)

2021 MINIHUMP CREEK PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* No pink were observed during the 4 surveys of 2021. (See Page 62-63, Section 7.2. *Stream Enumeration Data, Table 7.26d. Minihump Creek 2021*)
- *Population status:* Pink salmon have not been observed in Minihump Creek since 2009. This stream is not a pink system. (See Page 28, Graph 4.62a. *Minihump Creek)*

2021 MINIHUMP CREEK COHO SALMON

- *Peak Estimated Count & Last observed:* Rotation #4 (November 11th) coho peaked at 2 observed, 8 estimated.
- *First Observed*: Rotation #2 (October 19th) (1 jack observed) (See Page 62-63, Section 7.2. *Stream Enumeration Data, Table 7.26d. Minihump Creek 2021*)
- *Population status:* The coho population in Minihump Creek was higher than previous years but overall remains low considering historic numbers. (See Page 28, Graph 4.62a. *Minihump Creek)*

4.63 CONNECTOR CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°44.473'N; 126°25.823'W); WC: n/a

Watershed Information

Connector Creek is located approximately 5.5 km along the Connector M/L. The system has excellent gravel from 200-450m upstream from the bridge. Spawning gravel was added near the bridge at 4 locations in 2014, and twice again in 2017 and 2018, upstream from the bridge. Coho tend to spawn in this section while minihumps prefer the downstream section closer to Townie Lake (finer substrate).

Stream Segments

- **CC01:** *450m* Segment 1 begins at the deactivated logging bridge that crosses the downstream portion of the creek and ends at Townie Lake, where Connector Creek flows into the lake. This segment is where minihump activity occurs as well as coho holding. The substrate is mostly fines.
- **CC02:** *800m* Segment 2 is accessed from 5.5 km along the Connector M/L logging road. The stream is followed for 400m on each side of the road. Spawning gravel suited for coho is located here and coho are often observed spawning in this stretch late season. This segment is becoming increasingly silted out and suffers from severe impacts from logging activity.

Survey Notes

• Surveyed a total of 4 times between October 7th and November 12th, 2021 every 9 to 15 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.

Efficiency, Visibility, Bankfull & Temperature

- The visibility remained low-mid throughout the 2021 season due to Connector Creek's dark water, deep pools and over-abundance of large woody debris that reduces in-stream visibility. This stream tends to flood easily, and visibility can quickly become null following rainfall.
- Surveyor efficiency remained low-mid (25-75%) due to the low visibility in this creek.
- Bankfull ranged from 50-85% during the 4 surveys, increasing with rainfall events.
- Water temperature ranged from a low of 7.5°C to a high of 9.0°C, decreasing throughout the season. This is more stable than 2020's temperature range of 6.5°C to a high of 12.9°C likely due to less flooding events than the previous year.

Wildlife Observations

• Eagle predation was observed late in the season, and coho fry were observed in-stream.



<u>Graph 4.63a.</u> Peak estimated counts for Connector Creek from 2009-2021 for minihump, pink, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 63, Table 7.26e. *Connector Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.63b.</u> Rotational estimated counts for Connector Creek between October 7th to November 12th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season See Page 63-64, Table 7.26f. *Connector Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

CONNECTOR CREEK PEAK ESTIMATED COUNTS 2021:

MINIHUMP: 28 PINK: 0 COHO: 2

2021 CONNECTOR CREEK KOKANEE (MINIHUMP)

- *Peak Estimated Count:* Rotation #2 (October 18th) minihump peaked at 7 observed, 28 estimated.
- *First Observed*: Rotation #1 (October 7th) (2 observed, 4 estimated)
- *Last observed (live)*: Rotation #4 (November 12th) (1 observed, 3 estimated) (See Page 63-64, Section 7.2. *Stream Enumeration Data, Table 7.26f. Connector Creek 2021*)
- *Population status:* The freshwater kokanee (minihump) population of Connector Creek remains low but relatively stable since enumeration efforts began in 2013. Low efficiency is a factor for accurately enumerating this population in a stream that is easily flooded and visibility is commonly a challenge. (See Page 30, Graph 4.63a. *Connector Creek)*

2021 CONNECTOR CREEK COHO SALMON

- *Peak Estimated Count, First Observed, and Last Observed (live):* Rotation #4 (November 12th) the coho count peaked at 2 morts observed in the downstream section near Townie Lake. (See Page 63-64, Section 7.2. *Stream Enumeration Data, Table 7.26f. Connector Creek 2021*)
- Population status: The coho population remains low. (See Page 30, Graph 4.63a. Connector Creek)

4.64 CHRIS BENNETT CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°44.901'N; 126°22.746'W); WC: 9055575003370040

Watershed Information

Chris Bennett Creek drains surface runoff from the surrounding watershed before flowing north into Loose Lake. Located 7.5 km along the Scott Cove M/L. There is plenty of sand and spawning gravel, as well as fines. Gravel was added near the bridge and culvert in 2014.

Stream Segments

- **CB01:** *700m* Segment 1 runs parallel to Scott Cove M/L and at times is less than 1m from the logging road; a cause for concern given the road has collapsed into this stream in the past causing significant unresolved siltation issues. The average width, depth, gradient, and flow rate of Segment 1 are low. Accessed at the spur road bridge, where spawning gravel for coho exists and is commonly utilized, this segment extends 300m upstream and 400m downstream to the culvert crossing the logging road.
- **CB02:** 800m Segment 2 is accessed from 7.5 km along Scott Cove M/L logging road where the culvert directs the stream beneath the logging road. This Segment offers excellent coho habitat with cover and spawning gravel. A slide from the logging road that parallels the stream has caused siltation issues that make upstream migration possible only during flooding events. This segment ends at Loose Lake.

Survey Notes

• Surveyed a total of 4 times between October 8th and November 11th, 2021 every 10 to 13 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.

Efficiency, Visibility, Bankfull & Temperature

- The visibility remained mid-high throughout the 2021 season due to Chris Bennett Creek's narrow breadth and clear water.
- Surveyor efficiency remained low-mid (50-75%) due to the undercut banks.
- Bankfull ranged from 40-55% during the 4 surveys, remaining stable.
- Water temperature ranged from a low of 7.0°C to a high of 9.6°C, primarily decreasing throughout the season. This is more stable than 2020's temperature range of 6.5°C to a high of 12.6°C likely due to less flooding events than the previous year.

Wildlife Observations

• Eagle predation was observed late in the season, and coho fry were frequently observed in-stream.



<u>Graph 4.64a</u>. Peak estimated counts for Chris Bennett Creek from 2009-2021 for minihump, pink, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 64, Table 7.26g. *Chris Bennett Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.64b</u>. Rotational estimated counts for Chris Bennett Creek between October 8th to November 11th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 64, Table 7.26h. *Chris Bennett Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

CHRIS BENNETT CREEK PEAK ESTIMATED COUNTS 2021: MINIHUMP: 2 PINK: 0 COHO: 21

2021 CHRIS BENNETT CREEK KOKANEE (MINIHUMP)

- *Peak Estimated Count, First Observed, and Last Observed:* Rotation #3 (November 1st) the minihump count peaked at 1 observed, 2 estimated. (See Page 64, Section 7.2. *Stream Enumeration Data, Table 7.26h. Chris Bennett Creek 2021*)
- *Population status:* The freshwater kokanee (minihump) population of Chris Bennett Creek are infrequently observed, only seen 3 years of the last 13 and in low numbers. (See Page 32, Graph 4.64a. *Chris Bennett Creek*)

2021 CHRIS BENNETT CREEK COHO SALMON

• *Peak Estimated Count & Last Observed:* Rotation #4 (November 11th) the coho count peaked at 9 observed and 21 estimated.

- *First Observed:* Rotation #1 (November 12th) the coho count peaked at 1 jack observed. (See Page 64, Section 7.2. *Stream Enumeration Data, Table 7.26h. Chris Bennett Creek 2021*)
- *Population status:* The coho return of Chris Bennett Creek in 2021 (peak estimated count of 21 coho) was the second highest recorded peak estimate since 2009 (2010 saw a peak estimated count of 26 coho). This is a positive increase in the coho population for 2021 after many years of low returns. (See Page 32, Graph 4.64a. *Chris Bennett Creek*)

4.65 LOOSE LAKE CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°44.937'N; 126°22.099'W); WC: 9055575003370070

Watershed Information

Loose Lake Creek is fed by runoff from the surrounding watershed. It flows northwest into Loose Lake. It is accessed from 9.0 km along Scott Cove M/L. Large overflow channels, in addition to debris and log jams, indicate heavy flooding which is common during high precipitation events. Gravel and boulders dominate this stream.

Stream Segments

- LL01: *500m* Segment 1 has a low grade, deep pools, and a wide bank width. The main branch of the creek is surveyed from Loose Lake, travelling upstream back to the bridge (Segment 1 end) to form a loop. An over-abundance of large woody debris clogs the system. Large gravel and boulders dominate this part of the stream.
- LL02: 200m Segment 2 is accessed via the logging road from an established trail located 150m beyond the bridge. This trail leads to a shallow tributary, followed to reach the lake headwater The creek splits into 2 branches near the lake, where coho are often spotted.

Survey Notes

• Surveyed a total of 4 times between October 8th and November 11th, 2021 every 10 to 13 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.

Efficiency, Visibility, Bankfull & Temperature

- The visibility remained low throughout the 2021 season due to Loose Lake Creek's wide breadth and deep water, with plenty of cover and undercut banks for coho to seek cover beneath.
- Surveyor efficiency remained low-mid (20-75%) due to the over-abundance of woody debris and cover for coho to remain hidden beneath.
- Bankfull ranged from 50-70% during the 4 surveys, remaining fairly stable but high, limiting visibility in the many deep pools.
- Water temperature ranged from a low of 6.6° C to a high of 9.2° C, primarily decreasing throughout the season. This is cooler and more stable than 2020's temperature range of 6.2° C to 13.0° C.

Wildlife Observations

• Eagle predation on coho was observed late in the season.



<u>Graph 4.65a.</u> Peak estimated counts for Loose Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 64-65, Table 7.26i. *Loose Lake Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.65b.</u> Rotational estimated counts for Loose Lake Creek between October 8th to November 11th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season See Page 65, Table 7.26j. *Loose Lake Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

LOOSE LAKE CREEK PEAK ESTIMATED COUNTS 2021:

MINIHUMP: 0 PINK: 0 COHO: 3

2021 LOOSE LAKE CREEK COHO SALMON

- *Peak Estimated Count, First & Last Observed:* Rotation #4 (November 11th) coho peaked at 3 morts observed. (See Page 65, Section 7.2. *Stream Enumeration Data, Table 7.26j. Loose Lake Creek 2021*)
- *Population status:* The coho return in Loose Lake Creek in 2021 (peak estimated count of 3 coho) was low overall but greater than recent years. These numbers are influenced by the low efficiency for this stream. (See Page 34, Graph 4.65a. *Loose Lake Creek)*

4.66 JOHN LEWIS CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°45.849'N; 126°20.871'W); WC: 9055575003370070

Watershed Information

John Lewis Creek drains snowmelt and surface runoff from the surrounding watershed. It empties into the east end of Loose Lake. Flooding conditions are required for coho to move further up than roughly 50m above the lake due to woody debris and steep falls blocking migration at low water.

Stream Segments

• **JL01:** *455m* Segment 1 spans from the bridge to Loose Lake. The bridge is accessed at 11.5 km up Scott Cove M/L. The majority of gravel is close to the lake, however sand and boulders dominate from the bridge downstream to 300m.

Survey Notes

- Surveyed a total of 4 times between October 8th and November 11th, 2021 every 10 to 13 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.
- The bridge was replaced in 2020; material debris was observed downstream of the bridge during surveys and remains littering the creek in 2021. A volunteer clean up is recommended for 2022. (See Page 51, Section 5.3. *Obstacles to Migration, 5.3i. Scott Cove Creek & Tributaries*).

Efficiency, Visibility, Bankfull & Temperature

- The visibility ranged from mid-high throughout the 2021 season due to John Lewis Creek's narrow width and shallow, very clear water.
- Surveyor efficiency remained mid-high and stable (70-80%) due to the high visibility in this narrow, shallow, and clear stream and ease of in-stream access at moderate water levels.
- Bankfull ranged from 35-65% during the 4 surveys, remaining fairly stable and low, allowing ample visibility and in-stream access. This also isolated coho observations to lower in the stream, near the lake (flooding conditions are necessary for coho to migrate up this stream).
- Water temperature ranged from a low of 6.7°C to a high of 8.5°C, primarily decreasing throughout the season. This is more stable than 2020's temperature range of 6.1°C to 12.8°C likely due to the severe and frequent flooding that occured in 2020.

Wildlife Observations

- Eagle and bear predation on coho was observed late in the season.
- A red tailed hawk was sighted in 2021 (this species was seen in previous years at this location).



<u>Graph 4.66a.</u> Peak estimated counts for John Lewis Creek from 2009-2021 for minihump, pink, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 65, Table 7.26k. *John Lewis Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.


<u>Graph 4.66b</u>. Rotational estimated counts for John Lewis Creek between October 8th to November 11th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 65-66, Table 7.26l. *John Lewis Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

JOHN LEWIS CREEK PEAK ESTIMATED COUNTS 2021:

MINIHUMP: 3 PINK: 0 COHO: 9

2021 JOHN LEWIS CREEK KOKANEE (MINIHUMP)

- *Peak Estimated Count, First/Last Observed:* Rotation #3 (November 1st) minihump peaked at 2 observed, 3 estimated. (See Page 66, Section 7.2. *Stream Enumeration Data, Table 7.26l. John Lewis Creek 2021*)
- *Population status:* The freshwater kokanee (minihump) population of John Lewis Creek remains low but still in existence since initial observations in 2017. (See Graph 4.66a. *John Lewis Creek*)

2021 JOHN LEWIS CREEK COHO SALMON

- *Peak Estimated Count & Last Observed (live):* Rotation #4 (November 11th) the coho count peaked at 5 observed, 9 estimated.
- *First Observed:* Rotation #3 (November 1st) the initial coho count peaked at 2 observed, 4 estimated. (See Page 65-66, Section 7.2. *Stream Enumeration Data, Table 7.261. John Lewis Creek 2021*)
- *Population status:* The coho population in John Lewis Creek saw a spike in 2021 with a count of 9 peak estimated coho. Since the last spike in 2009 (17 peak estimated coho) the coho population has remained low in this stream. (See Graph 4.66a. *John Lewis Creek*)

4.7 SHOAL HARBOUR CREEK & BRIDIE LAKE TRIBUTARIES



Map 5.0. Shoal Harbour Creek & Bridie Lake Tributaries on Gilford Island.

4.71 SHOAL HARBOUR CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50º43.953'N; 126º29.472'W); WC: 90555700276

Watershed Information

Shoal Harbour Creek drains Bridie Lake west into Shoal Harbour on Gilford Island. A logging road (inactive this spawning season) parallels the stream, crossing above the surveyed area at 1600m.

Stream Segments

- **SH01:** *600m* Segment 1 has a wide and stable channel width with a low gradient and moderate flow. The system offers a mix of pools and riffles. There are 2 significant log jams which block fish migration at low-moderate water levels. This segment ends at the windfall area near a clearcut where the creek bends sharply.
- SH02: *1100m* In Segment 2 the watershed begins to level further, with areas above 1000m being primarily marshlands. The riparian area is open and allows easy travel with some woody debris but very little undergrowth. The stream splits off into the Mount Worthington Spur and continues as the mainstem into Bridie Lake. The logging road crosses the stream in 2 places each with a bridge. The survey area ends at these bridges.

Survey Notes

• Surveyed a total of 8 times between August 21st and November 12th, 2021 every 10 to 15 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.

Efficiency, Visibility, Bankfull & Temperature

• The visibility remained moderate throughout the 2021 season due to Shoal Harbour Creek's width, cover, and deep pools providing ample hiding for fish.

- Surveyor efficiency varied from mid-high (50-90%) due to the variable bankfull and moderate visibility in this stream.
- Bankfull ranged from 20-85% during the 8 surveys, fluctuating with rainfall events, allowing variable visibility and in-stream access.
- Water temperature ranged from a low of 7.5° C to a high of 13.7° C, primarily decreasing throughout the season. This is cooler than 2020's temperature range of 6.8° C to 16.3° C.

Wildlife Observations

- A grizzly bear was encountered in-stream during Rotation #4 and their sign was observed during the remainder of the surveys.
- SHOAL HARBOUR CREEK Peak Estimated Counts by Year 2009-2021 550 -PINK CHUM ESTIMATED TOTAL СОНО 100 -1²⁷ n Λ YEAR
- Abundance of eagle, dipper, and black bear activity.

<u>Graph 4.71a</u>. Peak estimated counts for Shoal Harbour Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 66, Table 7.27a. *Shoal Harbour Creek 2009-2021: Peak Enumeration by Year* for both peak observed and estimated counts and respective survey dates.



<u>Graph 4.71b.</u> Rotational estimated counts for Shoal Harbour Creek between August 21st to November 12th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 66, Table 7.27b. *Shoal Harbour Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species SHOAL HARBOUR CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 176 COHO: 13

2021 SHOAL HARBOUR CREEK PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* No pink were observed during the 8 surveys of 2021. (See Page 66, Section 7.2. *Stream Enumeration Data, Table 7.27b. Shoal Harbour Creek 2021*)
- *Population status:* Pink salmon have not been observed in numbers above 10 (peak estimated) since 2014 and prior when the population was more abundant and stable. The odd-year pink population in Shoal Harbour Creek has been non-existent to extremely low since 2013. (See Page 38, Graph 4.71a. *Shoal Harbour Creek)*

2021 SHOAL HARBOUR CREEK CHUM SALMON

- *Peak Estimated Count:* Rotation #5 (October 7th) chum peaked at 68 observed, 176 estimated.
- *First Observed*: Rotation #3 (September 12th) (58 observed, 84 estimated)
- *Last observed (live)*: Rotation #7 (November 2nd) (1 observed, 1 estimated) (See Page 66, Section 7.2. *Stream Enumeration Data, Table 7.27b. Shoal Harbour Creek 2021*)
- *Population status:* Chum numbers from 2017-2020 remained very low, with a significant increase in return in 2021. The 2016 chum return was higher still, and the 2021 return could be a reflection of the higher numbers of 2016, as a 5-year chum salmon return. However, this increase could also be a reflection of high survival rates of other chum populations as well. Prior to 2017 the chum population was generally higher and more stable than it has been in the past 4 years. In-stream restoration opportunities could greatly support the chum population in this stream. (See Page 38, Graph 4.71a. *Shoal Harbour Creek*)

2021 SHOAL HARBOUR CREEK COHO SALMON

- *Peak Estimated Count, First Observed:* Rotation #4 (September 24th) coho peaked at 7 observed, 13 estimated.
- *Last Observed:* Rotation #7 (November 2nd) coho peaked at 1 observed, 2 estimated. (See Page 66, Section 7.2. *Stream Enumeration Data, Table 7.27b. Shoal Harbour Creek 2021*)
- *Population status:* Data suggests the coho population appears to have declined sharply since 2014 with a small increase in 2021. (See Page 38, Graph 4.71a. *Shoal Harbour Creek*) However this could be indicative of the possibility that coho are favouring habitat above Bridie Lake, rather than below in Shoal Harbour Creek. For example, Billy Proctor Creek, a tributary of this stream located above Bridie Lake, saw a fair population of coho later in the season, which provides an important assessment of surveyor efficiency and survey method for coho in this system given the number of coho observed migrating up through Shoal Harbour Creek vs. the number observed spawning in the tributary later in the season. (See Page 42, Graph 4.73b. *Billy Proctor Creek*)

4.72 MOUNT WORTHINGTON CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°43.704'N; 126°27.358'W); WC: n/a

Watershed Information

This stream is a tributary of Shoal Harbour Creek which splits into 2 branches; the mainstem carries on to Bridie Lake, while the spur is known as Mount Worthington Creek and ends at an unnamed lake along the Connector Road. Gravel was added below the upper bridge in 2017 to support coho spawning activity.

Stream Segments

- **MW01:** *1150m* Segment 1 has a high gradient, dominated by a boulder substrate/cascades with several small waterfalls. Starting at 1.5 km on Shoal M/L to the Connector M/L culvert.
- **MW02:** *450m* Segment 2 begins at the upper bridge and ends at the lake. The habitat turns into swampy marshlands 250m upstream, providing rearing habitat, but no known spawning habitat.

Survey Notes

- Surveyed a total of 2 times between November 2nd and November 12th, 2021 every 10 days timed for maximum efficiency given rainfall conditions that heavily influence visibility.
- In 2020, a slide into the stream from the logging road occurred and has not yet been assessed.

Efficiency, Visibility, Bankfull & Temperature

- The visibility remained moderate throughout the 2021 season due to Mount Worthington Creek's narrow width yet long length (the whole population was not surveyed due to time constraints).
- Surveyor efficiency varied from mid-high (50-85%) due to the moderate visibility and percentage of population surveyed during the 2 rotations (30-50% population surveyed).
- Bankfull ranged from 40-50% during the 2 surveys, remaining stable.
- Water temperature ranged from a low of 6.8°C to a high of 7.2°C, decreasing throughout the season. This is similar to 2020's temperature range of 6.0°C to 6.5°C.

Wildlife Observations

• No wildlife was observed in this stream during the 2 surveys.



<u>Graph 4.72a</u>. Peak estimated counts for Mount Worthington Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 66-67, Table 7.27c. *Mount Worthington Creek 2009-2021: Peak Enumeration by Year* for both peak observed & estimated counts and respective survey dates.

Enumeration Summary by Species

MOUNT WORTHINGTON CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 0 COHO: 0

MOUNT WORTHINGTON CREEK COHO SALMON

- *Peak Estimated Count:* No coho were observed during the 2 surveys of 2021. (See Page 67, Section 7.2. *Stream Enumeration Data, Table 7.27d. Mount Worthington Creek 2021*)
- *Population status:* Coho have not been observed in Mount Worthington Creek during the years M.E.S.S.S. has conducted surveys. (See Graph 4.72a. *Mount Worthington Creek*) An adjustment to survey method as well as fry trapping for coho in the spring is recommended to better estimate this population and understand how this tributary is utilised by coho. (See Page 51, Section 5.1. *Enumeration Survey Review, 5.1e. Shoal Harbour Creek & Tributaries*).

4.73 BILLY PROCTOR CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°42.963'N; 126°27.110'W); WC: n/a

Watershed Information

Billy Proctor Creek flows into Bridie Lake, which then drains into Shoal Harbour Creek. It is accessed from Shoal M/L road located off the left spur where Shoal M/L road transitions into Maple M/L. The system is exposed and is both shallow and narrow, with a few deep pools and undercut banks. It is also prone to flooding, and braids quite extensively through the forest. Plenty of spawning gravel exists. The young forest surrounding the stream is very thick, blocking sunlight, and could benefit from thinning.

Stream Segments

- **BP01:** *800m* Segment 1 begins at the old bridge crossing. Billy Proctor Creek is surveyed by walking downstream along the upper cascade section to Segment 2 where the stream branches into several channels. Plenty of spawning gravel and cover exists.
- **BP02**: *200m* Segment 2 begins where the stream begins to braid through the forest, with far less gravel and moving into swampier area as it approaches Bridie Lake (segment end).

Survey Notes

- Surveyed a total of 3 times between October 26th and November 12th, 2021 every 4 to 13 days timed for maximum efficiency given coho spawn timing.
- Survey changes are recommended (See Page 51, Section 5.1. *Enumeration Survey Review, 5.1e. Shoal Harbour Creek & Tributaries*).
- This stream requires a clean up as it is littered by debris from an old logging camp.

Efficiency, Visibility, Bankfull & Temperature

- Visibility remained moderate throughout the 2021 season due to Billy Proctor Creek's narrow width yet abundance of cover (undercut banks).
- Surveyor efficiency varied from mid-high (50-75%) due to the moderate visibility and cover for coho to disappear beneath (undercut banks and pools).
- Bankfull ranged from 70-90% during the 3 surveys.
- Water temperature ranged from a low of 7.3°C to a high of 9.3°C, decreasing throughout the season. This is similar (though warmer) compared to 2020's temperature range of 6.8°C to 7.5°C.

Wildlife Observations

• Signs of bear and eagle predation observed during the 3 surveys.



<u>Graph 4.73a</u> Peak estimated counts for Billy Proctor Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 67, Table 7.27e. *Billy Proctor Creek 2009-2021: Peak Enumeration by Year* for both peak observed & estimated counts and respective survey dates.



<u>Graph 4.73b</u>. Rotational estimated counts for Billy Proctor Creek between October 26th to November 12th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 67-68, Table 7.27f. *Billy Proctor Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

BILLY PROCTOR CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 0 COHO: 48

2021 BILLY PROCTOR CREEK COHO SALMON

- *Peak Estimated Count & Last Observed (live):* Rotation #3 (November 12th) coho peaked at 30 observed, 48 estimated.
- *First Observed:* Rotation #1 (October 26th) coho peaked at 1 jack observed. (See Page 67-68, Section 7.2. *Stream Enumeration Data, Table 7.27f. Billy Proctor Creek 2021*)
- *Population status:* The coho population increased in 2021, recording the highest count documented since 2011, when M.E.S.S.S. enumeration surveys began in this stream. 2021's return of 48 peak estimated coho more similarly reflects the 2011-2012 population returns compared to the very minimal numbers recorded in the 6 years prior to 2021. The coho observed in Billy Proctor Creek arrived via Shoal Harbour Creek, where this abundance of coho was not observed entering the stream. (peak estimated count of 13 in Shoal Harbour Creek vs. 48 in its tributary). This speaks to the lower surveyor efficiency of earlier season coho counts in the mainstem vs. enumeration of coho during their spawn in upper tributaries (in this case the tributary above the lake). (See Page 41-42, Graph 4.73a. *Billy Proctor Creek*)

4.8 MAPLE COVE CREEK

Kwikwasut'inuxw Haxwa'mis Territory (51°44'144"N; 126°27'589"W); WC: 905557500828

Watershed Information

Maple Cove Creek is located 9.0 km from Shoal Harbour and can be accessed by turning onto Maple M/L at 3km off Shoal M/L. This watershed is in an area of heavy logging activity that has resulted in excessive blowdowns within the stream. It is a medium sized creek with good flow, a relatively stable channel and a mix of substrate that provides good rearing habitat as well as spawning opportunities. The abundance of LWD provides cover for fish, though acts as barriers at low-moderate water levels.

Stream Segments

- MC01: 400m Boulder and clay substrate dominates the lower reach of this stream, transitioning from cascades into deeper pools and woody debris with some spawning gravel.
- MC02: *800m* Segment 2 is composed of gravel, boulders, and deeper pools as well as sections of fines and cascades. A log jam restricts migration access at low-mid water levels.
- MC03: 600m Segment 3 is surveyed for coho later in the season and ends at a large pool.
- MC04: 100m Segment 4 is surveyed for presence/absence of coho just up and downstream of the bridge, accessed from a side road on Maple M/L at 5.5km.

Survey Notes

- Surveyed a total of 8 times between August 18th and November 8th, 2021 every 9 to 18 days timed for maximum efficiency given rainfall events and factors that might impact surveyor efficiency.
- Survey method changes are recommended for 2022; fry trapping and coho surveys. (See Page 51, Section 5.1. *Enumeration Survey Review, 5.1f. Maple Cove Creek*).

Efficiency, Visibility, Bankfull & Temperature

- Visibility remained moderate-high throughout the 2021 season due to Maple Cove Creek's narrow width yet abundance of cover (woody debris and undercut banks).
- Surveyor efficiency varied from low-high (10-95%) due to the variable visibility and bankfull, as well as an abundance of cover for coho to disappear beneath (undercut banks and pools).
- Bankfull ranged from 15-100% during the 8 surveys (highly variable) given rainfall events.
- Water temperature ranged from a low of 6.9°C to a high of 13.9°C, decreasing throughout the season. This is similar (though cooler on the high end) to 2020's temperature range of 6.0°C to 15.0°C.

Wildlife Observations

- Frequent sightings of great blue herons upstream and at the creek mouth.
- Black bear tracks, cougar tracks, deer tracks, mink, and eagles all observed.



<u>Graph 4.8a.</u> Peak estimated counts for Maple Cove Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 68, Table 7.28a. *Maple Cove Creek 2009-2021: Peak Enumeration by Year* for both peak observed & estimated counts and respective survey dates.



<u>Graph 4.8b.</u> Rotational estimated counts for Maple Cove Creek between August 18th to November 8th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 68, Table 7.28b. *Maple Cove Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

MAPLE COVE CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 1 CHUM: 0 COHO: 0

2021 MAPLE COVE CREEK PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* 1 mort was observed during the 8 surveys of 2021, during Rotation #5 Survey (October 7th) (See Page 68, Section 7.2. *Stream Enumeration Data, Table 7.28b. Maple Cove Creek 2021*)
- *Population status:* The odd-year pink population in Maple Cove Creek has not surpassed a handful of fish (4 peak estimated) since 2009, and 2021 was no exception. The even-year pink population has not had a significant return since 2014 (58 peak estimated pink). Overall, both populations are extremely low. (See Graph 4.8a. *Maple Cove Creek)*

2021 MAPLE COVE CREEK COHO SALMON

- *Peak Estimated Count, First & Last Observed:* No coho were observed during the 8 surveys in 2021. (See Page 68, Section 7.2. *Stream Enumeration Data, Table 7.28b. Maple Cove Creek 2021*)
- *Population status:* Only 2 years have seen 1 peak estimated coho return since 2009. This is a long system where the entire population is not surveyed. Changes to the survey are recommended. (See Page 51, Subsection 5.1 Enumeration Survey Review, 5.1f. *Maple Cove Creek*)

4.9 GILFORD CREEK

Kwikwasut'inuxw Haxwa'mis Territory (51°64'245"N; 126°57'282"W); WC: 90555750078200

Watershed Information

Several lakes and surface runoff feed Gilford Creek, which flows southwest into Gilford Bay and Knight Inlet. This is a comparatively large system; with approximately 10km of accessible stream length and a watershed of 62km². There are 25 lakes in this watershed. It is characterised by a wide, deep channel capable of supporting large volumes of water during flooding events and seasonal highs. The gradient is high over the first 300m and lessens after with little improvement in visibility. Both the upper and lower segments are dominated by boulders, with some cobble throughout.

Stream Segments

- **GIL01:** *350m* Segment 1 begins from the estuary, extending to 350m upstream to the first falls in one wide cascades reach characterised by large boulders and a few deep pools throughout. A 20-minute coho observation survey is conducted at the falls to enumerate jumping coho at the top of the cascades section where this stream bottlenecks.
- **GIL02:** *1229m* Segment 2 begins at the first bridge up from the estuary (above and below the bridge is surveyed). Below the bridge is a very large log jam that has become built up with a significant build up of sediment.
- **GIL03**: *1080m* Segment 3 is surveyed during the coho spawning window later in the season. It is composed of a long reach of large gravel, with some pools, dark tannin water, and high flow.
- **GIL04**: *1040m* Segment 4 begins at the confluence of Gilford Creek and Coyote Lake Tributary, to 200m above the Coyote Creek bridge.
- **GIL05:** Segment 5 begins at the confluence and stretches up to Fraser Lake.

Survey Notes

- Surveyed a total of 8 times between August 18th and November 8th, 2021 every 9 to 18 days timed for maximum efficiency given rainfall events and factors that might impact surveyor efficiency.
- Survey method changes are recommended for 2022; fry trapping and coho surveys. (See Page 51, Section 5.1. *Enumeration Survey Review, 5.1g. Gilford Creek*).

Efficiency, Visibility, Bankfull & Temperature

- Visibility remained mid-low throughout the 2021 season due to Gilford Creek's width, high whitewater flow that restricts viewing, long length, and deep, dark pools.
- Surveyor efficiency varied from low-high (25-90%) due to the variable visibility and bankfull, as well as an abundance of cover for coho to hide beneath (undercut banks and pools).
- Bankfull ranged from 20-85% during the 8 surveys (highly variable) given rainfall events.
- Water temperature ranged from a low of 8.0°C to a high of 15.8°C, decreasing throughout the season. This is similar (though cooler on the high end) to 2020's range of 7.5°C to 17.5°C.

Wildlife Observations

- Multiple black bears were encountered in-stream (GIL01).
- A grizzly bear was encountered on the road paralleling Gilford Creek (GIL02 near the bridge).



<u>Graph 4.9a.</u> Peak estimated counts for Gilford Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 68-69, Table 7.29a. *Gilford Creek 2009-2021: Peak Enumeration by Year* for both peak observed & estimated counts and respective survey dates.



<u>Graph 4.9b.</u> Rotational estimated counts for Gilford Creek between August 18th to November 8th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 69, Table 7.29b. *Gilford Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

GILFORD CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 0 COHO: 0

2021 GILFORD CREEK PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* No pink were observed in Gilford Creek during the 8 surveys in 2021. (See Page 69, Section 7.2. *Stream Enumeration Data, Table 7.29b. Gilford Creek 2021*)
- Population status: Pink have not been observed since 2014. (See Graph 4.9a. Gilford Creek)

2021 GILFORD CREEK CHUM SALMON

- *Peak Estimated Count:* No chum were observed in Gilford Creek during the 8 surveys in 2021. (See Page 69, Section 7.2. *Stream Enumeration Data, Table 7.29b. Gilford Creek 2021*)
- Population status: Chum salmon have not been observed since 2013. (See Graph 4.9a. Gilford Creek)

2021 GILFORD CREEK COHO SALMON

- *Peak Estimated Count:* No coho were observed in Gilford Creek during the 8 surveys in 2021. (See Page 69, Section 7.2. *Stream Enumeration Data, Table 7.29b. Gilford Creek 2021*)
- *Population status:* Coho have not been observed in Gilford Creek since 2018. The population has remained below 100 peak estimated coho since 2009 with the exception of a spike in 2012 (846 peak estimated coho) (See Graph 4.9a. *Gilford Creek*). Overall, the coho population appears to be very low and remains difficult to accurately enumerate given the low efficiency in this stream.

4.10 SIMOOM SOUND CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°45'10"N; 126°29'35"W); WC: 9006544

Watershed Information

Simoom Sound Creek drains an unnamed lake and several small tributaries before flowing southwest into Simoom Sound, entering at the northeastern elbow. This is a small system with a low to moderate gradient, a steep falls, with a shallow channel and good flow. The valley sides are steep in places, and a large slide is visible on the right. This has pushed rock and woody debris into the creek, producing a side channel at 200m. The log jam below spawning gravel is an obstruction to migration through the early season.

Stream Segments

- **SS01:** *450m* Segment 1 begins from the estuary, extending to 500m upstream to the steep falls that mark the end of the segment and is the furthest point of the survey area. Boulders, gravel, cascades and pools make up this rocky creek, and there is a pool below the falls that coho hide in.
- **SS02:** *350m* Segment 2 consists of the side channel and is surveyed as a return loop from the falls that mark the end point of Segment 1.

Survey Notes

• Surveyed a total of 5 times between August 19th to October 4th, 2021 every 8 to 15 days timed for maximum efficiency given rainfall events and factors that might impact surveyor efficiency.

Efficiency, Visibility, Bankfull & Temperature

- Visibility remained mid-high throughout the 2021 season due to Simoom Sound Creek's narrow width, clear water, and accessibility.
- Surveyor efficiency remained high (75-95%) due to the ample visibility and stable water levels, despite the woody debris and undercut banks that serve as cover for coho throughout the creek.
- Bankfull ranged from 35-65% during the 5 surveys (stable, moderate).
- Water temperature ranged from a low of 10.0°C to a high of 13.4°C, primarily decreasing throughout the season. This is notably cooler than 2020's range of 13.4°C to 15.5°C.

Wildlife Observations

- Black bear scat commonly found near the stream. One black bear encountered during a survey.
- One osprey was observed at the estuary.



<u>Graph 4.10a.</u> Peak estimated counts for Simoom Sound Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 69-70, Table 7.210a. *Simoom Sound Creek 2009-2021: Peak Enumeration by Year* for both peak observed & estimated counts and respective survey dates.



<u>Graph 4.10b</u>. Rotational estimated counts for Simoom Sound Creek between August 19th to October 4th, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 70, Table 7.210b. *Simoom Sound Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

SIMOOM SOUND CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 0 COHO: 4

2021 SIMOOM SOUND CREEK PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* No pink were observed during the 5 surveys in 2021. (See Page 70, Section 7.2. *Stream Enumeration Data, Table 7.210b. Simoom Sound Creek 2021*)
- *Population status:* Pink have not been observed in Simoom Sound Creek since 2015. (See Page 47, Graph 4.10a. *Simoom Sound Creek*)

2021 SIMOOM SOUND CREEK CHUM SALMON

- *Peak Estimated Count:* No chum were observed during the 5 surveys in 2021. (See Page 70, Section 7.2. *Stream Enumeration Data, Table 7.210b. Simoom Sound Creek 2021*)
- *Population status:* Chum salmon have not been observed in Simoom Sound Creek since 2018 and have not been observed as a stable population since M.E.S.S.S. enumeration began. (See Page 47, Graph 4.10a. *Simoom Sound Creek)*

2021 SIMOOM SOUND CREEK COHO SALMON

- *Peak Estimated Count & First Observed:* Rotation #4 (September 26th) the peak and initial coho count peaked at 2 observed, 4 estimated.
- *Last Observed (live):* Rotation #5 (October 4th) the last coho count peaked at 2 observed, 4 estimated (same fish in the falls pool 2 adult coho and 1 jack observed). (See Page 70, Section 7.2. *Stream Enumeration Data, Table 7.210b. Simoom Sound Creek 2021*)
- *Population status:* Coho have not been observed in Simoom Sound Creek since 2015. (See Page 47, Graph 4.10a. *Simoom Sound Creek*). It is recommended to set fry traps extensively above and below the falls to determine whether coho can make it beyond the steep falls. (See Page 51, Section 5.1. *Enumeration Survey Review, 5.1h. Simoom Sound Creek*).

4.11 SIR EDMUND BAY CREEK

Kwikwasut'inuxw Haxwa'mis Territory (50°50.105'N; 126°37.325'W) WC: n/a

Watershed Information

Sir Edmund Bay Creek flows east into the west end of Sir Edmund Bay. Historic runs of pink (60-100) and chum (40-80) show a small, but not insignificant population. This is a small, slow flowing stream with tannin water. It was damaged by logging in the 1940's. This stream requires high water levels for salmon to migrate upstream past obstacles.

Stream Segments

• **SE01:** *500m* Segment 1 stretches from the estuary to 500m upstream and is the extent of survey efforts this season due to low water levels restricting access any further upstream. This is a narrow, slow flowing stream with tannin water.

Survey Notes

• Surveyed a total of 5 times between August 19th to October 3rd, 2021 every 8 to 13 days timed for maximum efficiency given rainfall events and factors that might impact surveyor efficiency.

Efficiency, Visibility, Bankfull & Temperature

- Visibility remained high throughout the 2021 season due to Sir Edmund Bay Creek's narrow width, clear water, and accessibility.
- Surveyor efficiency remained high and stable (90-95%) due to the ample visibility and stable water levels. This is a very small, accessible stream to survey.
- Bankfull ranged from 10-50% during the 5 surveys (very low to moderate). Water levels did not allow fish migration until later in the season when bankfull increased.
- Water temperature ranged from a low of 11.3°C to a high of 14.9°C, primarily decreasing throughout the season. This is similar to 2020's range of a low of 12.1°C to a high of 13.9°C.

Wildlife Observations

• Black bear tracks were commonly seen in this stream, and a black bear was observed at the creek mouth during a survey. Deer tracks, herons, and other common wildlife were observed.



<u>Graph 4.11a.</u> Peak estimated counts for Sir Edmund Bay Creek from 2009-2021 for pink, chum, and coho. This graph illustrates the total estimated number of each species from the single survey with the highest species count of the season. See Page 70, Table 7.211a. *Sir Edmund Bay Creek 2009-2021: Peak Enumeration by Year* for both peak observed & estimated counts and respective survey dates.



<u>Graph 4.11b.</u> Rotational estimated counts for Sir Edmund Bay Creek between August 19th to October 3rd, 2021 for pink, chum, and coho. This graph illustrates the estimated total species counts of each rotational survey. This visualises the in-stream migration, residence time, peak spawn, and post-spawn trajectories occurring over the duration of the enumeration season. See Page 70, Table 7.211b. *Sir Edmund Bay Creek 2021: Enumeration by Rotation* for both observed and estimated counts and respective survey dates.

Enumeration Summary by Species

SIR EDMUND BAY CREEK PEAK ESTIMATED COUNTS 2021:

PINK: 0 CHUM: 0 COHO: 0

2021 SIR EDMUND BAY CREEK PINK SALMON (ODD-YEAR POPULATION)

- *Peak Estimated Count:* No pink were observed during the 5 surveys in 2021. (See Page 70, Section 7.2. *Stream Enumeration Data, Table 7.211b. Sir Edmund Bay Creek 2021*)
- *Population status:* Pink have not been observed in Sir Edmund Bay Creek since 2014. (See Page 49, Graph 4.11a. *Sir Edmund Bay Creek)*

5.0 RECOMMENDATIONS

5.1 ENUMERATION SURVEY REVIEW

5.1a. <u>AHTA RIVER</u>

- Conduct the initial preliminary survey ~ July 21st to better pinpoint when the odd- and even-year pink populations initially enter the river.
- Extend the survey dates to mid-late November to cover the coho spawn. This could be achieved by spacing out the rotations to stretch later into November. Currently, the survey timing ends just shy of when the coho are moving back down the river to spawn.
- Conduct 2 snorkel surveys per season (within the first half of September and November respectively) to raise the efficiency for all species, especially for coho. This river has changed in the past few years and as a consequence has lowered the efficiency for foot surveys throughout the season due to the majority of fish holding in deep pools with very low visibility. Snorkel surveys would raise the efficiency and help to remedy this issue.
- Survey the tributary that flows from AHR02 to AHR04 as it has changed in the past few seasons to become viable for fish activity. Consider adding this in as a new segment for the Ahta River survey if time allows and habitat looks viable for fish.

5.1b. CARRIDEN CREEK

- Assess tributaries near and above Rosemary Lake for coho spawning habitat, including fry trapping in spring to determine coho range and rearing habitat.
- Alter survey method to focus on coho spawning habitat in upper tributaries (identified via assessments) in the latter half of the season.

5.1c. WAHKANA CREEK

- Fry trapping in spring to determine coho range and rearing habitat.
- Survey upper tributaries and determine accessibility of above the lake tributaries where coho likely spawn.
- Survey later in the season to monitor coho spawning.
- Target upper tributaries later in the season, if accessible.

5.1d. <u>VINER RIVER</u>

• Extend the survey range to the upper tributaries/closer to Viner Lake on the last rotation (#8) in November to increase coho enumeration efficiency. Identifying late season coho spawning habitat and pinpointing timing would raise coho enumeration efficiency.

5.1e. SHOAL HARBOUR CREEK & TRIBUTARIES

- Mount Worthington Creek: Reassess survey area via fry trapping and visual assessment of coho spawning habitat. Fry trapping between the upper bridge lake to determine if coho that may have been missed during spawner enumeration are utilising this tributary.
- Billy Proctor Creek: Assess to possibly extend the survey area further upstream, and increase the number of surveys to 4 per season, to the end of November if possible.

5.1f. MAPLE COVE CREEK

• Fry trap for pink, chum, and coho in this stream to determine fish presence/absence.

5.1g. <u>GILFORD CREEK</u>

- Assess Coyote Lake and Fraser Lake Tributaries and create better access to survey coho spawning habitat, including fry trapping in spring to determine range and rearing habitat.
- Extend/alter survey area to better target spawning coho in the latter half of the season.

5.1h. SIMOOM SOUND CREEK

- Add or adjust surveys to extend later in the season to target for coho spawning activity.
- Fry trap thoroughly above the waterfall that currently marks the survey end point to determine coho presence/absence.

5.1i. <u>SIR EDMUND BAY CREEK</u>

• Fry trap in this stream for pink, chum, and coho to determine fish presence/absence.

5.2 TRAIL MAINTENANCE



Photo: Emily, April, and Siobhan after a day of trail maintenance in August. (April Bencze, 2021)

Trail maintenance was completed in 2021 by a crew of 4 for 9 days which is the minimum recommended time in order to maintain the network of trails that allows enumeration surveys to be completed safely and efficiently. Enumeration efforts benefit from focused pre-season trail maintenance on all survey streams to varying degrees. It is recommended to implement 2 weeks (minimum) of trail maintenance into the M.E.S.S.S. Salmon Enumeration Program, possibly taking place from late July to mid-August. Benefits of clear trails to conduct enumeration surveys range from risk reduction (both wildlife conflict and personal injury risk), limiting the impact of in-stream walking during salmon spawning periods (less disturbance to fish and redds especially in narrow streams), higher surveyor efficiency, to ease of stream access. It is not recommended to combine trail maintenance with surveys due to time constraints and split focus. Some minor trail clearing during surveys is necessary, but should not be a focus. While all systems surveyed would benefit from annual trail maintenance, the following systems require more substantial work, and are recommended to be prioritised in these efforts:

- 1. **Embley River:** Entire trail needs annual maintenance and 2022 will require at least 1-2 days with focused chainsaw work.
- 2. Wahkana Creek: Annual maintenance required. Extension to the lake. Chainsaw work.
- 3. Chris Bennett Creek: Clear trail for ~300m upstream and downstream of the bridge.
- 4. Loose Creek: Needs clearing and chainsaw work.
- 5. John Lewis Creek: Needs clearing and chainsaw work.
- 6. Viner River: Annual maintenance. Chainsaw work.
- 7. Maple Cove Creek: Annual maintenance required (chainsaw). Extend to the bridge.

- 8. Minihump Creek: Annual maintenance and clearing to Loose Lake.
- 9. Connector Creek: Access points to the stream need clearing, bank trail needs clearing.
- 10. Sir Edmund Bay Creek: Needs clearing and extension.
- 11. Carriden Creek: Annual maintenance required.
- 12. Scott Cove Creek: Annual maintenance required. Chainsaw work.
- 13. Ahta River: Trail section paralleling cascades along the right bank (looking upstream) needs to be cleared to link up with the established trail so that this section of the river can be accessed during high water levels.
- 14. Shoal Harbour Creek: Annual maintenance. Chainsaw work.
- 15. Mt. Worthington Creek: No established trail exists; needs clearing.
- 16. Billy Proctor Creek: No established trail exists; needs clearing.
- 17. Gilford Creek: Annual maintenance.
- 18. Simoom Sound Creek: Annual maintenance and minor chainsaw work.

5.3 **OBSTACLES TO MIGRATION**

5.3a. <u>EMBLEY RIVER</u>

No fish access at river mouth, only fish passage via fish ladder at low water level (~20% bankfull). There is a beaver dam in EMB02 that is obstructing fish passage with roughly a 3.5-4ft drop in water level from upstream of the dam to the downstream side at low water. During flooding conditions the beaver dam is submerged. The dam is causing changes to the river upstream - widening the river, low flow, lake-like vegetation growth. Beaver dam would benefit from assessment for restoration activity.

5.3b. WAHKANA CREEK

Log jam in WAH01 appears to be fully restricting upstream migration at low water level. Additionally an expansive log jam beginning at approximately 800m (primarily composed of cut logs from past forestry operations) is clogging the stream and would benefit from restoration assessment.

5.3c. <u>VINER RIVER</u>

A notable and concerning amount of new bank erosion was recorded in VIN01 and VIN02 (900-2000m) in 2021. New large woody debris has fallen into the river and added to several already substantial log jams (notably the log jam at approximately 1900m). Viner River would benefit from assessment and restoration. However, fish are able to still migrate past all obstacles at moderate water levels as of 2021.

5.3d. SHOAL HARBOUR CREEK & TRIBUTARIES

Blow down into the stream from the windfall zone/clearcut at approximately 700m is causing extensive in-stream barriers and damage. Two log jams located at 700m and 850m respectively along Segment 2 of Shoal Harbour Creek are creating a major barrier to fish passage at low-moderate water levels. Collapsed sand banks from previous flooding and an accumulation of small woody debris has increased the severity of the blockages. Heavy sediment loading. Predation (bear, eagle) occurs at the first log jam (500m) while the fish hold below the log jam waiting until water levels increase to a passable level later in the season. In order to regulate water flow and facilitate earlier upstream migration to spawning gravel sites, assessment and restoration of these log jams is recommended. Chainsaw work will likely be required to clear larger logs and so should be timed and permitted appropriately. As well, on the Mount Worthington tributary of Shoal Harbour Creek, a large slide from the road fell in-stream along with ~20-30 trees. This should be surveyed and documented, as well as recommendations made

for any remedial action. Billy Proctor Creek is littered with old industrial materials and could benefit from a garbage clean up initiative.

5.3e. MAPLE COVE CREEK

A significant blow down/slide of 10-20 trees fell across the mouth of Maple Cove Creek before the 2019 enumeration season. Though this does not cause a complete restriction to migration, it is recommended to assess and restore this before it restricts stream access as it builds into a larger log jam. Clearing this blockage will require significant chainsaw work and therefore permitting, and likely multiple days of work by a crew. A log jam at the survey mid-point also acts as a complete barrier to migration at lower water levels in this stream and is situated before a section of spawning gravel. There is significant sediment build up on the upstream side of this obstacle to migration. Restoration of this log jam would benefit fish populations in this stream.

5.3f. GILFORD CREEK

The log jam below the Gilford Creek Bridge is growing in size with a significant and concerning build up of sediment on the upstream side of the log jam. Flow is extremely restricted by this jam and fish passage at low water is very unlikely but remains unknown. In the stream's tributaries, blow downs stemming from the nearby clear cut continue to build upon existing log jams.

5.3g. SIMOOM SOUND CREEK

Several small-moderate log jams in this narrow stream have become clogged with woody debris, impassable at low water levels. Clearing these log jams to allow earlier season upstream salmon migration is recommended. Fry trapping above the falls at the current survey end point (500m) is recommended to determine if coho are able to migrate beyond the falls during flooding events.

5.3h. CARRIDEN CREEK

Several small log jams have become clogged with small woody debris in Carriden Creek, making the creek impassable at low-average water levels. Clearing these log jams to allow earlier season fish migration upstream is recommended. This stream is narrow and a little effort would make a big difference for early-season (low water) migration access.

5.3i. SCOTT COVE CREEK & TRIBUTARIES

Scott Cove Creek had large metal debris clogging a log jam at the old hatchery dam site that had to be removed by hand in 2021. More debris exists and a clean up of industrial remains at this stream is recommended. A slide from north stream bank (2020) caused a significant amount of large woody debris to clog the stream below the lower falls; building upon the pre-existing log jam. 2 large log jams exist in the lower reach of this stream.

John Lewis Creek, Loose Creek, Chris Bennett Creek, Minihump Creek, and Connector Creek could all use work to clear upstream migration access for spawning coho, though these systems are less of a priority than other streams because coho are able to navigate these obstacles during flooding events which occur later in the season. A lot of the blockages in these streams are cut logs from past forestry operations that have caused extensive damage to these tributaries and should be assessed for restoration. Notably the section downstream of the road slide in Chris Bennett Creek has a large build up of sediment that completely blocks the stream at low water. A silt screen placed to prevent this currently lays mid-stream full of silt at the road slide site.

5.3j. <u>SIR EDMUND BAY CREEK</u>

Sir Edmund Bay Creek could benefit from clearing blockages of small woody debris and small log jams, as upstream migration access was blocked this year until late September. This is a narrow stream and would require minimal effort to make a large difference in earlier-season migration access.

5.4 UPDATES TO EQUIPMENT

- Charts: New paper charts for navigation are required for the 2021 season. The chart numbers needed are: 3546, 3547, and 3515. Watertight chart cases or lamination is necessary to avoid damage to charts stored in the open work boat.
- Hanna Multiparameter 9829 & Accessories: This device did not function correctly during the 2021 season and requires a new pH sensor. Due to the issues with this unit over the past several years, it is recommended to look at replacing this with a more reliable, more easily packed, unit.
- M.E.S.S.S. Boat: The boat (16' *Surfer*) was painted top and bottom as a volunteer effort by April Bencze, as well as patched (fibreglass) thanks to Billy Proctor, before the 2021 season. The boat had engine issues during the 2021 season and Billy Proctor generously donated the use of his boat for the majority of the season. The engine requires troubleshooting and repair before the 2022 season. To further prep the boat for the 2022 season, in the spring it will require new bottom paint, engine oil, leg oil, oil and fuel filter as per annual maintenance. Upgrades to the tool/safety kit for the boat need to be assembled, and stored on the boat at all times for field repairs.
- Handheld VHF Radio (Waterproof): New handheld radio is required as the old one no longer works due to excessive water damage.

5.5 COMMUNICATION & OUTREACH

Community engagement is an important part of salmon conservation. An updated website to make available the enumeration findings and data from 2009 - 2021 and ongoing would be beneficial to the community and the public. Communicating M.E.S.S.S./D.F.O. data sets in an accessible manner, local salmon and stream history, as well as initiatives to improve salmon habitat in Area 12 would be an effective way to fundraise for, and bolster salmon conservation efforts on a larger scale. Additionally, with salmon stocks low and in decline, conservative management recommendations for the specific management area could make a difference for increasing the number of spawners making it upstream. This could come in a form as simple as a list of community sport fishing guidelines recommended by M.E.S.S.S. and supported by Fisheries and Oceans Canada.

6.0 FIELD TEAM AND VOLUNTEERS



April Bencze M.E.S.S.S. Lead Stream Technician

2021 was April's 4th season as a stream technician for M.E.S.S.S. They live near Echo Bay/Kwaxwalawadi on Gilford Island, Kwikwasut'inuxw Haxwa'mis First Nation Territory. April is passionate about being a part of, and of service to, the interconnected watersheds, salmon, and communities of the coast. Some of their previous work includes bear research, writing, filmmaking, underwater photography (focus on salmon), and scuba/rebreather diving.

Emily Grubb *M.E.S.S.S. Stream Technician*

2021 was Emily's 1st season as a stream technician for M.E.S.S.S. and 5th season conducting salmon enumeration surveys. Living in Sointula ('Namgis First Nation Territory), Emily is very excited to be participating in local salmon conservation initiatives, and the opportunity to share and learn from following the spawning salmons' return to their freshwater habitat. Emily has been fortunate to assess, monitor, and restore wild salmon habitat on the west coast and northern Vancouver Island since 2013.



Thank you to Ben Paulsen, M.E.S.S.S.'s fill-in stream technician for 2021, for completing surveys during gaps that arose during the field season.

A total of 134 volunteer hours were logged during the 2021 Salmon Enumeration Program. Volunteers who supported the success of the 2021 field season include: April Bencze, Billy Proctor, Emily Grubb, Ben Paulsen, Robin Bennett, Steven Smith, and Brady Stjerneberg.

A huge thank-you to M.E.S.S.S.'s core and extended field team for making this enumeration season possible. With a number of local, experienced, and skilled people on the field team, M.E.S.S.S. was able to carry out each survey safely and with accuracy, despite limitations in welcoming additional volunteers due to COVID-19 restrictions.

7.0 APPENDICES

7.1 NUMBER OF SURVEYS PER YEAR

STREAM	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Ahta	0	0	6	6	8	8	7	8	8	8	8	10	10
Embley	0	1	0	7	6	8	7	7	8	7	8	7	6
Carriden	4	4	4	1	1	5	1	1	1	3	6	7	6
Wahkana	4	5	6	3	1	7	3	3	5	5	8	8	8
Viner	5	6	7	5	7	8	8	8	8	8	8	8	8
Scott Cove	6	7	0	7	6	7	8	8	8	8	8	8	8
Minihump	4	4	3	3	2	4	4	4	6	5	4	3	4
Connector	0	0	0	0	2	0	4	3	4	5	3	4	4
C. Bennett	3	4	3	3	2	2	4	3	4	5	3	4	4
Loose	3	4	1	0	2	2	4	3	4	5	3	4	4
J. Lewis	1	4	1	0	2	2	4	3	3	5	3	4	4
Shoal H.	5	6	9	6	7	9	6	7	7	7	8	8	8
Mt Worth.	0	0	1	0	1	0	3	1	3	3	2	2	2
B. Proctor	0	0	1	1	1	0	3	1	4	3	2	2	3
Maple	5	4	5	0	3	4	3	0	3	3	3	8	8
Gilford	6	5	6	5	7	7	1	0	2	4	6	6	8
Simoom S.	5	5	6	0	0	5	3	2	3	3	4	5	5
Sir Ed.	4	4	3	0	0	3	1	2	0	2	3	2	5

Table 7.1a. The number of annual rotational surveys for each stream from 2009-2021. For example: The Ahta River was surveyed 10 times in 2021. The comparison of the number of annual surveys per year is a variable that can influence the final enumeration estimate; the number and timing of surveys is important to consider as more surveys can result in improved accuracy of peak estimated counts, though other variables need to be considered along with these data.

7.2 STREAM ENUMERATION DATA

7.21 AHTA RIVER

a) AHTA RIVER 2009-2021: PEAK ENUMERATION BY YEAR

								SOCKEY
YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО	DATE	Е
2009	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2011	30.09.11	2,197/ 2,587	12.09.11	88/ 96	12.09.11	400/1,115	12.09.11	5/6
2012	19.09.12	8,047/ 10,242	19.09.12	388/ 686	18.08.12	849/ 1,067	18.08.12	3/4
2013	18.09.13	13,466/ 16,474	18.09.13	258/ 402	18.09.13	959/ 3,941	03.09.13	12/13
2014	03.09.14	48,943/ 51,861	21.08.14	80/ 102	21.08.14	156/ 322	03.09.14	4/5
2015	21.09.15	5,786/ 6,897	13.09.15	800/1,539	21.08.15	1,752/ 1,959	05.09.15	5/6
2016	18.08.16	546/ 608	18.08.16	287/ 674	18.08.16	57/ 76	18.08.16	4/4
2017	22.09.17	354/ 412	22.09.17	390/ 577	25.08.17	200/ 250	04.09.17	2/ 2
2018	18.09.18	3,129/ 3,687	18.09.18	239/ 328	02.10.18	35/44	13.10.18	3/3
2019	03.09.19	289/ 363	28.09.19	210/ 253	15.09.19	11/22	11.10.19	2/ 2
2020	17.09.20	307/ 392	10.09.20	14/ 19	10.09.20	8/13	31.07.20	1/2
2021	07.09.21	484/511	07.09.21	115/122	07.09.21	81/ 86	07.09.21	7/ 7

Table 7.21a. Comparison of peak observed/estimated counts for pink, chum, coho, and sockeye recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.1a, (See Page 13, Section 4.1. *Ahta River*) providing the observed counts and dates of each peak survey for comparison.

b) AHTA RIVER 2021: ENUMERATION BY ROTATION

SURVEY #	DATE	PINK	CHUM	СОНО	SOCKEYE
Prelim I	27.07.21	5/14	0/0	0/0	0/0
Prelim II	06.08.21	9/24	0/0	4/8	2/4
Ahta 1	20.08.21	316/ 397	1/2	4/8	2/4
Ahta 2	30.08.21	198/ 373	23/ 43	6/9	0/0
Ahta 3	07.09.21	484/ 511	115/ 122	81/ 86	7/ 7
Ahta 4	19.09.21	46/210	27/110	0/0	0/0
Ahta 5	04.10.21	57/ 221	27/132	1/2	0/0
Ahta 6	13.10.21	2/4	12/ 59	0/0	0/0
Ahta 7	29.10.21	0/0	0/0	0/0	0/0
Ahta 8	10.11.21	0/0	0/2	2/7	0/0

Table 7.21b. Observed/Estimated (#/#) counts for Ahta River surveyed between July 27th - November 10th 2021 via rotational surveys. This table expands on Graph 4.1b. (See Page 13, Section 4.1. *Ahta River*) providing the observed counts and dates of each survey.

7.22 EMBLEY RIVER

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	n/a	n/a	n/a	n/a	n/a	n/a
2010	11.09.10	409/1,024	-	0/0	11.09.10	75/ 256
2011	n/a	n/a	n/a	n/a	n/a	n/a
2012	22.08.12	3,408/ 6,533	20.09.12	11/ 30	20.09.12	53/ 250
2013	12.09.13	67/ 267	12.09.13	8/80	12.09.13	16/ 362
2014	7.09.14	109,283/152,182	01.10.14	12/ 29	01.10.14	3/600
2015	-	0/0	25.09.15	42/151	-	0/0
2016	04.10.16	1,425/ 1,789	04.10.16	26/ 34	24.09.16	3/ 33
2017	15.09.17	2/3	24.09.17	18/ 27	15.09.17	6/14
2018	15.09.18	78/124	28.09.18	1/13	-	0/0
2019	-	0/0	07.09.19	8/13	29.09.19	3/8
2020	27.08.20	122/174	27.08.19	1/1	27.08.20	3/7
2021	13.09.21	3/6	23.09.21	4/8	27.08.21	2/4

EMBLEY RIVER 2009-2021: PEAK ENUMERATION BY YEAR

Table 7.22a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.2a, (See Page 16, Section 4.2. *Embley River*) providing the observed counts and dates of each peak survey for comparison.

EMBLEY RIVER 2021: ENUMERATION BY ROTATION

SURVEY #	DATE	PINK	CHUM	СОНО
Embley 1	17.08.21	0/0	0/0	1/3
Embley 2	27.08.21	0/0	0/0	2/4
Embley 3	13.09.21	3/6	3/6	0/0
Embley 4	23.09.21	0/0	4/8	1/4
Embley 5	03.10.21	0/0	0/0	0/0
Embley 6	30.10.21	0/6	0/2	0/0

Table 7.22b. Observed/Estimated (#/#) counts for Embley River surveyed between August 17th - October 30th 2021 via rotational surveys. This table expands on Graph 4.2b. (See Page 16, Section 4.2. *Embley River*) providing the observed counts and dates of each survey.

7.23 CARRIDEN CREEK

CARRIDEN CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	29.09.09	1/1	-	0/0	-	0/0
2010	29.10.10	67/ 88	-	0/0	16.10.10	2/17
2011	-	0/0	-	0/0	-	0/0
2012	-	0/0	-	0/0	-	0/0
2013	-	0/0	-	0/0	-	0/0
2014	22.10.14	1,610/ 4,339	-	0/0	08.10.14	6/ 70
2015	-	0/0	-	0/0	-	0/0
2016	21.09.16	12/20	_	0/0	-	0/0

2017	-	0/0	-	0/0	-	0/0
2018	-	0/0	-	0/0	-	0/0
2019	-	0/0	-	0/0	-	0/0
2020	-	0/0	-	0/0	-	0/0
2021	-	0/0	-	0/0	23.09.21	0/1

Table 7.23a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.3a, (See Page 18, Section 4.3. *Carriden Creek)* providing the observed counts and dates of each peak survey for comparison.

CARRIDEN CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	PINK	CHUM	СОНО
Carriden 1	17.08.21	0/0	0/0	0/0
Carriden 2	27.08.21	0/0	0/0	0/0
Carriden 3	13.09.21	0/0	0/0	0/0
Carriden 4	23.09.21	0/0	0/0	0/1
Carriden 5	03.10.21	0/0	0/0	0/0
Carriden 6	30.10.21	0/0	0/0	0/0

<u>Table 7.23b</u>. Observed/Estimated (#/#) counts for Carriden Creek surveyed between August 17^{th} - October 30^{th} 2021 via rotational surveys. This table expands on Graph 4.3b. (See Page 19, Section 4.3. *Carriden Creek*) providing the observed counts and dates of each survey.

7.24 WAHKANA CREEK

WAHKANA CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	19.09.09	8/15	19.09.09	3/6	19.09.09	3/10
2010	13.09.10	16/ 18	29.10.10	1/1	29.10.10	2/8
2011	27.09.11	7/20	-	0/ 0	-	0/1
2012	24.09.12	10/ 19	-	0/ 0	-	0/0
2013	12.10.13	8/15	12.10.13	0/1	12.10.13	4/12
2014	27.09.14	442/618	23.10.14	6/16	09.09.14	13/ 58
2015	13.09.15	2/10	20.09.15	10/14	-	0/0
2016	22.09.16	8/12	03.10.16	3/4	-	0/0
2017	-	0/0	24.09.17	2/3	-	0/0
2018	-	0/1	02.10.18	18/ 25	-	0/1
2019	-	0/0	28.09.19	8/10	15.09.19	1/2
2020	-	0/0	20.10.20	0/1	-	0/0
2021	-	0/0	13.10.21	5/8	-	0/0

<u>Table 7.24a</u>. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.4a, (See Page 20-21, Section 4.4. *Wahkana Creek*) providing the observed counts and dates of each peak survey for comparison.

WAHKANA CREEK 2021: ENUMERATION BY ROTATION

SURVEY #	DATE	PINK	CHUM	СОНО
Wahkana 1	20.08.21	0/0	0/0	0/0
Wahkana 2	30.08.21	0/0	0/0	0/0

Wahkana 3	07.09.21	0/0	0/0	0/0
Wahkana 4	19.09.21	0/0	0/0	0/0
Wahkana 5	04.10.21	0/0	1/2	0/0
Wahkana 6	13.10.21	0/0	5/8	0/0
Wahkana 7	29.10.21	0/0	0/3	0/0
Wahkana 8	10.11.21	0/0	0/2	0/0

Table 7.24b. Observed/Estimated (#/#) counts for Carriden Creek surveyed between August 20th - November 10th 2021 via rotational surveys. This table expands on Graph 4.4b. (See Page 21, Section 4.4. *Wahkana Creek*) providing the observed counts and dates of each survey.

7.25 VINER RIVER

VINER RIVER 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО	DATE	SOCKEYE
2009	23.09.09	1,114/ 1,450	23.09.09	2,201/2,269	20.10.09	29/64	-	0/0
2010	17.09.10	124/ 344	17.09.10	27/81	04.10.10	18/ 102	-	0/0
2011	05.10.11	53/1 ,132	05.10.11	1,424/ 2,560	08.09.11	2/13	-	0/0
2012	14.09.12	1,354/ 3,360	17.10.12	2,500/6,066	14.09.12	1/1	14.09.12	2/ 2
2013	11.09.13	685/ 1,046	24.09.13	1,936/ 3,656	11.09.13	8/ 30	24.09.13	2/3
2014	04.09.14	1,438/ 1,898	14.09.14	351/ 535	04.09.14	3/151	17.09.14	3/4
2015	19.08.15	145/ 194	23.09.15	5,098/22,263	10.09.15	1/ 106	-	0/0
2016	29.08.16	21/ 27	22.09.16	1,625/7,608	06.10.16	1/ 25	-	0/0
2017	14.09.17	48/75	23.09.17	638/ 993	03.10.17	2/14	-	0/0
2018	-	0/0	06.10.18	1,609/2,332	25.09.18	1/4	-	0/0
2019	25.09.19	6/8	25.09.19	132/ 176	25.09.19	1/2	-	0/0
2020	16.08.20	5/6	22.09.20	38/55	28.08.20	1/1	-	0/0
2021	05.10.21	5/8	05.10.21	334/440	14.10.21	2/10	05.10.21	4/13

Table 7.25a. Comparison of peak observed/estimated counts for pink, chum, coho, and sockeye recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.5a, (See Page 23, Section 4.5. *Viner River)* providing the observed counts and dates of each peak survey for comparison.

VINER RIVER 2021: ENUMERATION BY ROTATION

SURVEY #	DATE	PINK	CHUM	СОНО	SOCKEYE
Viner 1	19.08.21	0/0	0/0	0/0	0/1
Viner 2	29.08.21	0/0	2/3	0/0	0/0
Viner 3	12.09.21	3/4	40/57	0/0	0/0
Viner 4	22.09.21	2/3	91/ 131	0/0	1/1
Viner 5	05.10.21	5/8	334/ 440	1/2	4/13
Viner 6	14.10.21	0/0	53/102	2/10	2/4
Viner 7	25.10.21	0/0	3/18	0/0	0/0
Viner 8	07.11.21	0/0	2/13	0/0	0/0

Table 7.25b. Observed/Estimated (#/#) counts for Viner River surveyed between August 19th - November 7th 2021 via rotational surveys. This table expands on Graph 4.5b. (See Page 23, Section 4.5. *Viner River*) providing the observed counts and dates of each survey.

7.26 SCOTT COVE CREEK & LOOSE LAKE WATERSHED TRIBUTARIES

7.26a SCOTT COVE CREEK

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО		
2009	20.09.09	25/ 50	20.09.09	10/20	06.09.09	122/189		
2010	22.08.10	2/ 2	-	0/0	21.09.10	93/ 346		
2011	-	0/0	-	0/0	15.09.11	33/106		
2012	04.10.12	2/7	04.10.12	1/3	19.08.12	33/619		
2013	-	0/0	-	0/0	12.10.13	240/1,137		
2014	08.09.14	185/ 298	03.10.14	151/ 910	08.09.14	40/274		
2015	-	0/0	17.10.15	1/2	22.09.15	50/671		
2016	-	0/0	11.09.16	28/ 38	20.09.16	53/ 325		
2017	-	0/0	06.10.17	11/15	25.09.17	62/ 231		
2018	-	0/0	-	1/2	01.09.18	10/ 168		
2019	-	0/0	-	0/0	08.10.19	5/82		
2020	-	0/0	-	0/0	16.09.20	6/67		
2021	-	0/0	-	0/0	12.09.21	27/218		

SCOTT COVE CREEK 2009-2021: PEAK ENUMERATION BY YEAR

Table 7.26a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.5a, (See Page 26, Section 4.61. *Scott Cove Creek*) providing the observed counts and dates of each peak survey for comparison.

SCOTT COVE CREEK 2021: ENUMERATION BY ROTATION

SURVEY #	DATE	PINK	CHUM	СОНО
Scott 1	21.08.21	0/0	0/0	0/0
Scott 2	31.08.21	0/0	0/0	1/9
Scott 3	12.09.21	0/0	0/0	27/ 218
Scott 4	25.09.21	0/0	0/0	3/24
Scott 5	02.10.21	0/0	0/0	4/37
Scott 6	16.10.21	0/0	0/0	0/1
Scott 7	25.10.21	0/0	0/0	0/0
Scott 8	07.11.21	0/0	0/0	0/0

Table 7.26b. Observed/Estimated (#/#) counts for Scott Cove Creek surveyed between August 21st - November 7th 2021 via rotational surveys. This table expands on Graph 4.61b. (See Page 26, Section 4.61. *Scott Cove Creek*) providing the observed counts and dates of each survey.

7.26b MINIHUMP CREEK

MINIHUMP CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	MINIHUMP	DATE	PINK	DATE	СОНО
2009	21.10.09	2,289/ 3,522	24.09.09	3/4	21.10.09	1/1
2010	17.10.10	831/ 877	-	0/0	01.11.10	2/30
2011	18.10.11	878/ 1,171	-	0/0	-	0/0
2012	21.10.12	33/776	-	0/0	05.11.12	3/16
2013	27.10.13	1,236/ 1,964	-	0/0	-	0/0

2014	19.10.14	319/ 798	-	0/0	11.10.14	3/ 33
2015	27.10.15	676/ 966	-	0/0	06.11.15	0/1
2016	16.10.16	491/ 655	-	0/0	-	0/0
2017	11.11.17	1,263/ 1,590	-	0/0	-	0/0
2018	22.10.18	1,202/1,503	-	0/0	-	0/0
2019	09.10.19	98/ 490	-	0/0	-	0/0
2020	07.10.20	835/ 1,045	-	0/0	-	0/1
2021	01.11.21	1,290/1,720	-	0/0	11.11.21	2/8

Table 7.26c. Comparison of peak observed/estimated counts for minihump, pink, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.62a, (See Page 28, Section 4.62. *Minihump Creek*) providing the observed counts and dates of each peak survey for comparison.

MINIHUMP CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	MINIHUMP	PINK	СОНО
Minihump 1	08.10.21	763/ 1,272	0/0	0/0
Minihump 2	19.10.21	572/ 1,271	0/0	0/1
Minihump 3	01.11.21	1,290/ 1,720	0/0	0/0
Minihump 4	11.11.21	0/0	0/0	2/8

Table 7.26d. Observed/Estimated (#/#) counts for Viner River surveyed between October 8th - November 11th 2021 via rotational surveys. This table expands on Graph 4.61b. (See Page 28, Section 4.62. *Minihump Creek*) providing the observed counts and dates of each survey.

7.26c CONNECTOR CREEK

CONNECTOR CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	MINIHUMP	DATE	PINK	DATE	СОНО
2009	n/a	n/a	n/a	n/a	n/a	n/a
2010	n/a	n/a	n/a	n/a	n/a	n/a
2011	n/a	n/a	n/a	n/a	n/a	n/a
2012	n/a	n/a	n/a	n/a	n/a	n/a
2013	28.10.13	26/ 35	-	0/0	-	0/0
2014	n/a	n/a	n/a	n/a	n/a	n/a
2015	22.10.15	38/ 59	-	0/0	15.11.15	1/4
2016	24.10.16	21/ 22	-	0/0	-	0/0
2017	23.10.17	8/12	-	0/0	02.11.17	5/ 8
2018	16.10.18	17/ 21	-	0/0	16.11.18	4/8
2019	03.11.19	40/57	-	0/0	22.10.19	1/3
2020	-	0/0	_	0/0	_	0/0
2021	18.10.21	7/28	_	0/0	12.11.21	0/2

Table 7.26e. Comparison of peak observed/estimated counts for minihump, pink, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.63a, (See Page 30, Section 4.63. *Connector Creek*) providing the observed counts and dates of each peak survey for comparison.

CONNECTOR CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	MINIHUMP	PINK	СОНО
Connector 1	07.10.21	2/4	0/0	0/0
Connector 2	18.10.21	7/ 28	0/0	0/0

Connector 3	02.11.21	19/ 25	0/0	0/0
Connector 4	12.11.21	1/3	0/0	0/2

Table 7.26f. Observed/Estimated (#/#) counts for Connector Creek surveyed between October 7th - November 12th 2021 via rotational surveys. This table expands on Graph 4.63b. (See Page 31, Section 4.63. *Connector Creek*) providing the observed counts and dates of each survey.

7.26d CHRIS BENNETT CREEK

CHRIS BENNETT CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	MINIHUMP	DATE	PINK	DATE	СОНО
2009	-	0/0	-	0/0	-	0/0
2010	01.11.10	2/10	-	0/0	01.11.10	9/ 26
2011	-	0/0	-	0/0	02.11.11	2/4
2012	-	0/0	-	0/0	05.11.12	3/16
2013	-	0/0	-	0/0	-	0/0
2014	-	0/0	-	0/0	-	0/0
2015	-	0/0	-	0/0	15.11.15	3/6
2016	-	0/0	-	0/0	07.11.16	1/6
2017	-	0/0	-	0/0	14.11.17	3/6
2018	09.11.18	1/2	-	0/0	-	0/0
2019	-	0/0	-	0/0	05.11.20	2/3
2020	_	0/0	_	0/0	12.11.20	1/1
2021	01.11.21	1/2	-	0/0	11.11.21	9/21

Table 7.26g. Comparison of peak observed/estimated counts for minihump, pink, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.64a, (See Page 32, Section 4.64. *Chris Bennett Creek*) providing the observed counts and dates of each peak survey for comparison.

CHRIS BENNETT CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	MINIHUMP	PINK	СОНО
C Bennett 1	08.10.21	0/0	0/0	0/1
C Bennett 2	19.10.21	0/0	0/0	0/1
C Bennett 3	01.11.21	1/2	0/0	1/2
C Bennett 4	11.11.21	0/0	0/0	9/21

Table 7.26h. Observed/Estimated (#/#) counts for Chris Bennett Creek surveyed between October 8th - November 11th 2021 via rotational surveys. This table expands on Graph 4.64b. (See Page 33, Section 4.64. *Chris Bennett Creek*) providing the observed counts and dates of each survey.

7.26f LOOSE LAKE CREEK

LOOSE LAKE CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	MINIHUMP	DATE	PINK	DATE	СОНО
2009	-	0/0	-	0/0	06.11.09	14/ 21
2010	-	0/0	-	0/0	-	0/0
2011	-	0/0	-	0/0	-	0/0
2012	-	0/0	-	0/0	21.10.12	1/33
2013	-	0/0	-	0/0	-	0/0
2014	-	0/0	-	0/0	-	0/1

2015	-	0/0	-	0/0	22.10.15	4/13
2016	-	0/0	-	0/0	07.11.16	3/16
2017	-	0/0	-	0/0	14.11.17	1/3
2018	-	0/0	-	0/0	16.11.18	1/2
2019	-	0/0	-	0/0	-	0/0
2020	-	0/0	-	0/0	-	0/0
2021	-	0/0	-	0/0	11.11.21	0/3

Table 7.26i. Comparison of peak observed/estimated counts for minihump, pink, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.65a, (See Page 34, Section 4.65. *Loose Lake Creek*) providing the observed counts and dates of each peak survey for comparison.

LOOSE LAKE CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	MINIHUMP	PINK	СОНО
Loose 1	08.10.20	0/0	0/0	0/0
Loose 2	19.10.20	0/0	0/0	0/0
Loose 3	27.10.20	0/0	0/0	0/0
Loose 4	12.11.20	0/0	0/0	0/3

Table 7.26j. Observed/Estimated (#/#) counts for Loose Lake Creek surveyed between October 8th - November 12th 2021 via rotational surveys. This table expands on Graph 4.64b. (See Page 34, Section 4.65. *Loose Lake Creek*) providing the observed counts and dates of each survey.

7.26e JOHN LEWIS CREEK

JOHN LEWIS CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	MINIHUMP	DATE	PINK	DATE	СОНО
2009	-	0/0	-	0/0	08.11.09	10/17
2010	-	0/0	-	0/0	-	0/0
2011	-	0/0	-	0/0	-	0/0
2012	n/a	n/a	n/a	n/a	n/a	n/a
2013	-	0/0	-	0/0	-	0/0
2014	-	0/0	-	0/0	-	0/0
2015	-	0/0	-	0/0	-	0/0
2016	-	0/0	-	0/0	-	0/0
2017	06.11.17	8/11	-	0/0	14.11.17	1/2
2018	17.10.18	5/ 7	-	0/0	-	0/0
2019	-	0/0	-	0/0	05.11.19	1/1
2020	08.10.20	1/1	-	0/0	-	0/0
2021	01.11.21	2/3	-	0/0	11.11.21	5/9

Table 7.26k_Comparison of peak observed/estimated counts for minihump, pink, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.66a, (See Page 36, Section 4.66. John Lewis Creek) providing the observed counts and dates of each peak survey for comparison.

STREAM	DATE	MINIHUMP	PINK	СОНО				
John Lewis 1	08.10.21	0/0	0/0	0/0				
John Lewis 2	19.10.21	0/0	0/0	0/0				
John Lewis 3	01.11.21	2/3	0/0	2/4				

IOHN LEWIS CREEK 2021: ENUMERATION BY ROTATION

John Lewis 4 11.11.21 0/0 0/0	5/ 9
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Table 7.261. Observed/Estimated (#/#) counts for John Lewis Creek surveyed between October 08st - November 11th 2021 via rotational surveys. This table expands on Graph 4.66b. (See Page 36, Section 4.66. *John Lewis Creek*) providing the observed counts and dates of each survey.

7.27 SHOAL HARBOUR CREEK & BRIDIE LAKE TRIBUTARIES

7.27a SHOAL HARBOUR CREEK

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	21.09.09	158/ 199	21.09.09	116/ 142	10.11.09	11/29
2010	18.09.10	6/28	05.10.10	1/2	09.11.10	9/64
2011	19.09.11	16/25	29.09.11	94/ 269	22.09.11	1/ 70
2012	09.12.12	199/ 267	20.10.12	38/ 63	20.10.12	4/45
2013	27.09.13	61/ 109	09.10.13	152/ 301	27.09.13	10/44
2014	05.10.14	367/ 515	13.09.14	20/86	-	1/ 100
2015	20.08.15	4/8	11.09.15	1/ 236	-	0/0
2016	11.09.16	4/6	02.10.16	174/ 352	11.09.16	2/16
2017	25.09.17	1/1	25.09.17	1/27	-	0/0
2018	12.09.18	1/3	23.09.18	42/ 63	-	0/0
2019	-	0/0	26.09.19	6/35	-	0/0
2020	17.08.20	5/6	06.09.20	2/3	16.09.20	2/4
2021	-	0/0	07.10.21	68/ 176	02.11.21	7/13

SHOAL HARBOUR CREEK 2009-2021: PEAK ENUMERATION BY YEAR

Table 7.27a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.71a, (See Page 38, Section 4.71. *Shoal Harbour Creek*) providing the observed counts and dates of each peak survey for comparison.

SHOAL HARBOUR CREEK 2021: ENUMERATION BY ROTATION

SURVEY #	DATE	PINK	CHUM	СОНО
Shoal 1	21.08.21	0/0	0/0	0/0
Shoal 2	31.08.21	0/0	0/0	0/0
Shoal 3	12.09.21	0/0	58/ 84	0/0
Shoal 4	24.09.21	0/0	92/ 128	0/0
Shoal 5	07.10.21	0/0	68/ 176	0/0
Shoal 6	18.10.21	0/0	0/42	0/0
Shoal 7	02.11.21	0/0	1/1	7/13
Shoal 8	12.11.21	0/0	0/3	0/0

Table 7.27b. Observed/Estimated (#/#) counts for Shoal Harbour Creek surveyed between August 21st - November 12th 2021 via rotational surveys. This table expands on Graph 4.71b. (See Page 38, Section 4.71. *Shoal Harbour Creek*) providing the observed counts and dates of each survey.

7.27b MOUNT WORTHINGTON CREEK

MOUNT WORTHINGTON CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	n/a	n/a	n/a	n/a	n/a	n/a
2010	n/a	n/a	n/a	n/a	n/a	n/a

2011	-	0/0	-	0/0	-	0/0
2012	n/a	n/a	n/a	n/a	n/a	n/a
2013	n/a	n/a	n/a	n/a	n/a	n/a
2014	n/a	n/a	n/a	n/a	n/a	n/a
2015	-	0/0	-	0/0	-	0/0
2016	-	0/0	-	0/0	-	0/0
2017	-	0/0	-	0/0	-	0/0
2018	-	0/0	-	0/0	-	0/0
2019	-	0/0	-	0/0	-	0/0
2020	-	0/0	-	0/0	-	0/0
2021	-	0/0	-	0/0	-	0/0

Table 7.27c. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.72a, (See Page 40, Section 4.72. *Mount Worthington Creek*) providing the observed counts and dates of each peak survey for comparison.

MOUNT WORTHINGTON CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	PINK	CHUM	СОНО
Mt Worth 1	02.11.21	0/0	0/0	0/0
Mt Worth 2	12.11.21	0/0	0/0	0/0

<u>Table 7.27d</u>. Observed/Estimated (#/#) counts for Mount Worthington Creek surveyed between November 2^{nd} - November 12^{th} 2021 via rotational surveys.

7.27c BILLY PROCTOR CREEK

BILLY PROCTOR CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	n/a	n/a	n/a	n/a	n/a	n/a
2010	n/a	n/a	n/a	n/a	n/a	n/a
2011	-	0/0	-	0/0	11.11.11	8/27
2012	-	0/0	-	0/0	05.11.12	13/ 39
2013	n/a	n/a	n/a	n/a	n/a	n/a
2014	n/a	n/a	n/a	n/a	n/a	n/a
2015	-	0/0	-	0/0	09.11.15	1/1
2016	-	0/0	-	0/0	-	0/0
2017	-	0/0	-	0/0	-	0/0
2018	-	0/0	-	0/0	10.11.18	0/2
2019	-	0/0	-	0/0	-	0/0
2020	-	0/0	-	0/0	26.10.20	0/3
2021	-	0/0	-	0/0	12.11.21	30/48

Table 7.27e. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.73a, (See Page 41, Section 4.73. *Billy Proctor Creek*) providing the observed counts and dates of each peak survey for comparison.

BILLY PROCTOR CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	PINK	CHUM	СОНО
B Proctor 1	26.10.21	0/0	0/0	0/1

B Proctor 2	08.11.21	0/0	0/0	31/ 45
B Proctor 3	12.11.21	0/0	0/0	30/ 48

Table 7.27f. Observed/Estimated (#/#) counts for Billy Proctor Creek surveyed between October 26th - November 12th 2021 via rotational surveys. This table expands on Graph 4.73b. (See Page 42, Section 4.73. *Billy Proctor Creek*) providing the observed counts and dates of each survey.

7.28 MAPLE COVE CREEK

MAPLE COVE CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	-	0/0	-	0/0	11.09.09	0/1
2010	27.09.10	20/35	27.09.10	1/8	-	0/0
2011	19.09.11	1/7	-	0/0	-	0/0
2012	11.09.12	0/47	-	0/0	-	0/0
2013	-	0/0	31.10.13	0/0	-	0/0
2014	22.09.14	30/58	-	0/0	-	0/0
2015	-	0/0	-	0/0	-	0/0
2016	n/a	n/a	n/a	n/a	n/a	n/a
2017	-	0/0	-	0/0	-	0/0
2018	14.09.18	2/4	-	0/0	-	0/0
2019	-	0/0	-	0/0	-	0/0
2020	08.09.20	1/2	-	0/0	26.10.20	1/1
2021	07.10.21	0/1	-	0/0	-	0/0

Table 7.28a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.8a, (See Page 44, Section 4.8. *Maple Cove Creek*) providing the observed counts and dates of each peak survey for comparison.

MAPLE COVE CREEK 2021: ENUMERATION BY ROTATION

SURVEY #	DATE	PINK	CHUM	СОНО
Maple 1	18.08.21	0/0	0/0	0/0
Maple 2	28.08.21	0/0	0/0	0/0
Maple 3	14.09.21	0/0	0/0	0/0
Maple 4	25.09.21	0/0	0/0	0/0
Maple 5	07.10.21	0/0	0/0	0/0
Maple 6	16.10.21	0/0	0/0	0/0
Maple 7	26.10.21	0/0	0/0	0/0
Maple 8	08.11.21	0/0	0/0	0/0

Table 7.28b. Observed/Estimated (#/#) counts for Maple Cove Creek surveyed between August 18th - November 8th 2021 via rotational surveys. This table expands on Graph 4.8b. (See Page 44, Section 4.8. *Maple Cove Creek*) providing the observed counts and dates of each survey.

7.29 GILFORD CREEK

GILFORD CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	27.09.09	5/ 5	16.10.09	1/1	11.09.09	15/ 68
2010	27.09.10	12/ 26	27.09.10	1/2	27.09.09	0/10

2011	-	0/1	-	0/0	04.10.11	2/68
2012	11.09.12	91/ 129	-	0/0	-	25/ 846
2013	02.10.13	2/50	31.10.13	2/5	11.09.13	1/51
2014	22.09.14	40/57	-	0/0	04.10.14	1/50
2015	-	0/0	-	0/0	-	0/0
2016	n/a	n/a	n/a	n/a	n/a	n/a
2017	-	0/0	-	0/0	07.10.17	0/1
2018	-	0/0	-	0/0	14.09.18	2/51
2019	-	0/0	-	0/0	-	0/0
2020	-	0/0	-	0/0	-	0/0
2021	-	0/0	-	0/0	-	0/0

Table 7.29a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.9a, (See Page 46, Section 4.9. *Gilford Creek*) providing the observed counts and dates of each peak survey for comparison.

STREAM	DATE	PINK	CHUM	СОНО	SOCKEYE		
Gilford 1	18.08.21	0/0	0/0	0/0	0/0		
Gilford 2	28.08.21	0/0	0/0	0/0	0/0		
Gilford 3	14.09.21	0/0	0/0	0/0	0/0		
Gilford 4	25.09.21	0/0	0/0	0/0	0/0		
Gilford 5	02.10.21	0/0	0/0	0/0	0/0		
Gilford 6	16.10.21	0/0	0/0	0/0	0/0		
Gilford 7	26.10.21	0/0	0/0	0/0	0/0		
Gilford 8	08.11.21	0/0	0/0	0/0	0/0		

GILFORD CREEK 2021: ENUMERATION BY ROTATION

Table 7.29b. Observed/Estimated (#/#) counts for Maple Cove Creek surveyed between August 18th - November 8th 2021 via rotational surveys. This table expands on Graph 4.9b. (See Page 46, Section 4.9. *Gilford Creek*) providing the observed counts and dates of each survey.

7.210 SIMOOM SOUND CREEK

SIMOOM SOUND CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	15.09.09	121/ 142	-	0/0	-	0/0
2010	23.09.10	4/4	-	0/0	-	0/0
2011	-	0/0	-	0/0	-	0/0
2012	n/a	n/a	n/a	n/a	n/a	n/a
2013	n/a	n/a	n/a	n/a	n/a	n/a
2014	05.10.14	230/ 300	-	0/0	-	0/0
2015	09.09.15	70/ 94	22.09.15	19/ 29	09.09.15	1/2
2016	-	0/0	-	0/0	-	0/0
2017	-	0/0	-	0/0	-	0/0
2018	-	0/0	29.09.18	0/6	-	0/0
2019	_	0/0	-	0/0	-	0/0
2020	-	0/0	-	0/0	-	0/0

2021 - 0/0 - 0/0 26.09.21 2/4

Table 7.210a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.10a, (See Page 47, Section 4.10. *Simoom Sound Creek*) providing the observed counts and dates of each peak survey for comparison.

STREAM	DATE	PINK	CHUM	СОНО
Simoom 1	19.08.21	0/0	0/0	0/0
Simoom 2	29.08.21	0/0	0/0	0/0
Simoom 3	11.09.21	0/0	0/0	0/0
Simoom 4	26.09.21	0/0	0/0	2/4
Simoom 5	04.10.21	0/0	0/0	2/4

SIMOOM SOUND CREEK 2021: ENUMERATION BY ROTATION

Table 7.210b. Observed/Estimated (#/#) counts for Simoom Sound Creek surveyed between August 19th - October 4th 2021 via rotational surveys. This table expands on Graph 4.10b. (See Page 48, Section 4.10. *Simoom Sound Creek*) providing the observed counts and dates of each survey.

7.211 SIR EDMUND BAY CREEK

SIR EDMUND BAY CREEK 2009-2021: PEAK ENUMERATION BY YEAR

YEAR	DATE	PINK	DATE	CHUM	DATE	СОНО
2009	29.09.09	6/6	-	0/0	-	0/0
2010	30.09.10	1/2	-	0/0	-	0/0
2011	n/a	n/a	n/a	n/a	n/a	n/a
2012	n/a	n/a	n/a	n/a	n/a	n/a
2013	n/a	n/a	n/a	n/a	n/a	n/a
2014	08.10.14	12/ 36	-	0/0	-	0/0
2015	-	0/0	-	0/0	-	0/0
2016	-	0/0	-	0/0	-	0/0
2017	n/a	n/a	n/a	n/a	n/a	n/a
2018	-	0/0	-	0/0	-	0/0
2019	-	0/0	-	0/0	-	0/0
2020	-	0/0	-	0/0	-	0/0
2021	-	0/0	-	0/0	-	0/0

Table 7.211a. Comparison of peak observed/estimated counts for pink, chum, and coho recorded from 2009-2021. n/a: stream not inspected; -: no fish observed. This table expands on Graph 4.11a, (See Page 49, Section 4.11. *Sir Edmund Bay Creek*) providing the observed counts and dates of each peak survey for comparison.

SIR EDMUND BAY CREEK 2021: ENUMERATION BY ROTATION

STREAM	DATE	PINK	CHUM	СОНО
Sir Ed 1	19.08.21	0/0	0/0	0/0
Sir Ed 2	29.08.21	0/0	0/0	0/0
Sir Ed 3	11.09.21	0/0	0/0	0/0
Sir Ed 4	23.09.21	0/0	0/0	0/0
Sir Ed 5	03.10.21	0/0	0/0	0/0

<u>Table 7.211b</u>. Observed/**Estimated** (#/#) counts for Sir Edmund Bay Creek surveyed between August 19th - October 3rd 2021 via rotational surveys. This table expands on Graph 4.11b. (See Page 50, Section 4.11. *Sir Edmund Bay Creek*) providing the observed counts and dates of each survey.

8.0 REFERENCES

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