Technical Report No. 17-13

Gartina Falls Hydroelectric Facility Biotic Monitoring, 2016–2017

by

Nicole M. Legere

December 2017

Alaska Department of Fish and Game **Division of Habitat**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in reports by the Divisions of Habitat, Sport Fish, and Commercial Fisheries. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figures or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
no data	ND
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

TECHNICAL REPORT NO. 17-13

GARTINA FALLS HYDROELECTRIC FACILITY BIOTIC MONITORING, 2016–2017

By

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December 2017

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Cover: Dolly Varden char captured in Gartina Falls Hydroelectric Facility bypass reach.

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ACKNOWLEDGEMENTS

The Inside Passage Electric Cooperative (IPEC) fully funded this project. Operations Manager Brandon Shaw, Head Plant Operator Don Bolton, Relief Operator David Fagan and former Plant Operator Brandin Hill provided logistical support. Mr. Shaw reviewed the draft report, and Mr. Bolton assisted with sampling. Division of Habitat Operations Manager Dr. Al Ott and Southeast Regional Supervisor Jackie Timothy reviewed and edited the report.

Thank you all for your contribution.

EXECUTIVE SUMMARY

In August 2015, the Inside Passage Electric Cooperative (IPEC) completed construction of a 425 kW run-of-river hydroelectric facility that has been producing renewable electricity for the City of Hoonah (Figure 1). IPEC contracted with the Alaska Department of Fish and Game (ADF&G) Division of Habitat to complete the Gartina Falls Hydroelectric Facility biotic monitoring required by the Federal Energy Regulatory Commission (FERC) license, Article 410 (IPEC 2014b). The monitoring was deemed necessary to evaluate the effectiveness of the 10 ft^3/s minimum flow requirement to maintain aquatic habitat and stream connectivity in the project bypass reach downstream of Gartina Falls.

The monitoring program included setting minnow traps in the pool at the base of Gartina Falls once a month during August, September and November, and conducting weekly visual surveys of spawning adult salmon in the bypass reach downstream of the falls from mid-July through November for two years. In the event we did not identify adverse impacts, then monitoring would cease.

In 2016 and 2017, we captured juvenile coho salmon *Oncorhynchus kisutch,* Dolly Varden char *Salvelinus malma,* rainbow trout *O. mykiss,* and sculpin *Cottus* sp. in the bypass reach. We captured more fish in 2016 than were captured during 2010 pre-construction or our 2017 sampling.

In 2016 and 2017, IPEC's Head Plant Operator, Don Bolton, conducted weekly visual surveys of adult salmon in the bypass reach July through November. In 2016, he observed coho salmon in the bypass reach. In 2017, he observed chum *O. keta*, pink *O. gorbuscha,* and coho salmon in the bypass reach. We never observed adult salmon in the tailrace.

Based on our monitoring, we have determined the 24 m long, 30 cm diameter minimum flow pipe conveying 10 ft^3/s of discharge to the base of Gartina Falls is unnecessary to maintain aquatic habitat and stream connectivity in the short bypass reach downstream of Gartina Falls, as a small tributary located below the dam and above the falls provides sufficient water to the bypass reach throughout the year.

We recommend discontinuing monitoring and decommissioning the minimum flow pipe.

INTRODUCTION

In 2010 and 2011, IPEC contracted with HDR Alaska Inc. to conduct baseline aquatic studies in Gartina Creek from the airport to 488 m above Gartina Falls in support of their application for the Gartina Falls Hydroelectric Project (IPEC 2012). After review and licensing, FERC required IPEC to file a biotic monitoring plan for commission approval. In 2013, IPEC proposed a biotic monitoring program that documented juvenile and adult salmonids in the bypass reach and consulted with the ADF&G Division of Sport Fish, the National Marine Fisheries Service, and the US Fish and Wildlife Service. IPEC received no substantive agency comments on the proposal and in 2014, FERC adopted IPEC's proposed biotic monitoring program into Article 410 (IPEC 2014b). In 2015, IPEC contracted with the ADF&G Division of Habitat to complete the Gartina Falls Hydroelectric Facility biotic monitoring program and biologists scheduled fieldwork for 2016 and 2017.

PURPOSE

The purpose of the ADF&G investigation and technical report is to provide results for IPEC's Article 406 Operation Compliance Monitoring Report (IPEC 2014a) and to recommend, based on the data, whether additional monitoring is warranted per Article 410 (IPEC 2014b).

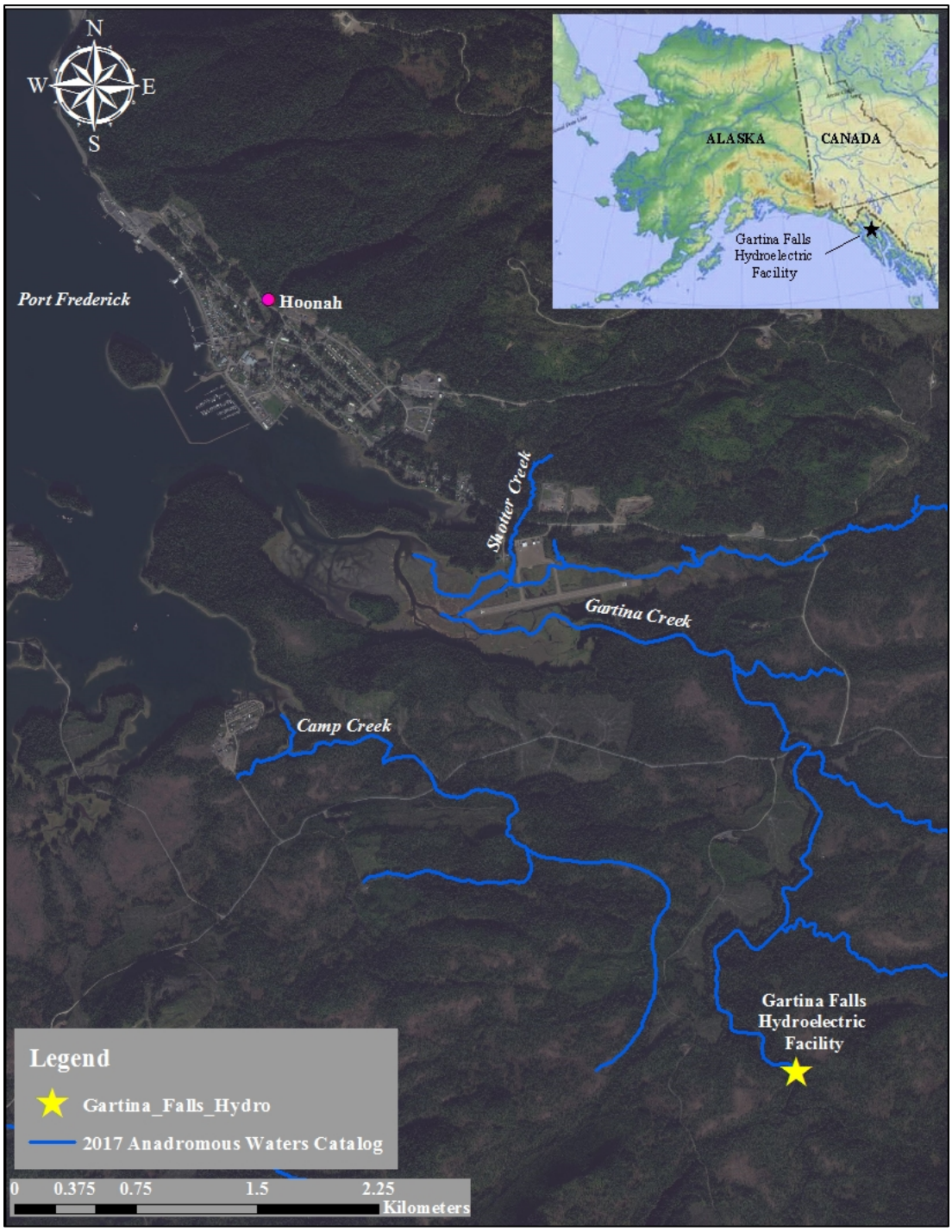

Figure 1.–Gartina Falls Hydroelectric Facility area map.

AQUATIC STUDIES

We completed monitoring in the 24 m bypass reach downstream of Gartina Falls:

- Setting minnow traps in the pool at the base of the falls once a month during July[a], August, September/October[b], and November; and
- Visually surveying for spawning adult salmon in the bypass reach downstream of the falls and the tailrace from mid-July through November.

To the extent possible, we compared data from pre- and post- development.[c]

STUDY AREA

The Gartina Falls Hydroelectric Facility is located on Gartina Creek about 3.5 air km southeast of the Hoonah Airport (Table 1).[d] A diversion dam, intake chamber, and sluice and radial gates, are located 38 m upstream of the 17 m Gartina Falls, and a powerhouse is located 24 m downstream of the falls (Figures 2, 3). The bypass reach is a plunge pool at the base of the falls about 24 m long by 9 m wide by 2 m deep. The substrate in the pool is gravel.

The Gartina Falls drainage area is about 27 km^2 (IPEC 2012) and the main channel measures about 5.5 km from the project area to the mouth in Port Frederick. A small tributary located below the dam and above the falls provides water to the bypass reach throughout the year (Figures 4–6).[e]

The lower 5.5 km of Gartina Creek (Stream No. 114-31-10090) provides habitat for chum, pink, and coho salmon, and Dolly Varden char (Litchfield and Blossom 2017). In addition, ADF&G documented rainbow trout and sculpin in the bypass reach during this study and HDR documented Dolly Varden char upstream of the falls (IPEC 2012).

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[a] July sampling was not required by Article 410, but while we were in Hoonah for another project, we set minnow traps in the bypass reach.

[b] In September 2017, we were unable to travel to Hoonah due to other field obligations earlier in the month and poor flying conditions later in the month. Instead, we went in early October.

[c] HDR collected data from the bridge upstream to the barrier falls, which is about 2,236 m. The ADF&G Division of Sportfish Statewide FERC Hydropower Coordinator agreed only 24 m should be sampled after construction. Therefore, we will make comparisons where they make sense acknowledging the difference.

[d] 58.07029 N, 135.38318 W; WGS84 datum.

[e] On November 22, 2017, we were at the site during a week of below 0 temperatures and the tributary was frozen.

Figure 2.–Spillway, intake chamber, and sluice and radial gates.

Figure 3.–Looking down the penstock at the powerhouse and bypass reach.

Figure 4.–Tributary flowing into bypass reach during low water, August 23, 2017.

Figure 5.–Hydroelectric facility operating at full capacity and overtopping the dam with tributary in far left, November 9, 2017.

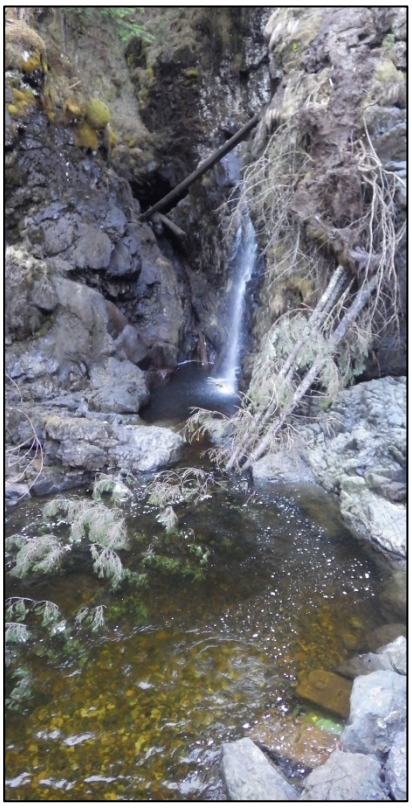

Figure 6.–Tributary flowing into bypass reach during winter, February 1, 2016.

METHODS

JUVENILE SALMONID USE

We set six two-piece 6.35 mm galvanized steel minnow traps following methods described in Magnus et al. (2006). We baited the traps with disinfected salmon eggs contained in a punctured plastic bag and placed them in the pool at the base of the falls for about four hours. We counted and identified fish to species. Given the number of fish per trap and the limited time we had to catch our flights during the shorter fall days, we measured and recorded the fork length of the smallest and largest fish of each salmonid species from each minnow trap. We present and compare the 2010 pre-construction minnow trap data from the pool at the base of Gartina Falls (Site G01) [f] to the 2016 and 2017 minnow trap data in a table, and fish composition in figures.

ADULT PACIFIC SALMON USE

We provided IPEC's Head Plant Operator, Don Bolton, a handheld thermometer, polarized sunglasses, and data sheets. We trained Mr. Bolton to record water and air temperatures, weekly count and identify adult Pacific salmon, and take photographs at four established photo points in the 24 m bypass stream reach. Mr. Bolton sent us a weekly email of the data and photos. When we were in Hoonah to set minnow traps, we took photos and conducted the weekly spawning survey instead of Mr. Bolton. We present the data in a table, and the photo points in Appendix A.

[f] Fisheries Biologist Erin Cunningham provided the 2010 fish capture data spreadsheet to ADF&G Habitat Biologist Johnny Zutz.

RESULTS

JUVENILE SALMONID USE

In 2016 and 2017, we captured juvenile coho salmon, Dolly Varden char, rainbow trout, and sculpin with minnow traps in the bypass reach (Figures 7, 8). We captured more fish in 2016 and 2017 than in 2010[g] and we captured more juvenile coho salmon than any other species during all trapping events (Table 1; Figures 9–11).

Figure 7.–Coho salmon captured in minnow trap.

Figure 8.–Rainbow trout captured in minnow trap.

Table 1.–Minnow trap results from pool/bypass reach at base of Gartina Falls pre-and post-construction.

2010 Pre-Construction (24 hr soak)				2016 Post-Construction (4 hour soak)				2017 Post-Construction (4 hour soak)			
Date	Species	Total	FL range (mm)	Date	Species	Total	FL range (mm)	Date	Species	Total	FL range (mm)
8/3/10	CO	3	78–83	7/25/16	CO	78	45–110	8/23/17	CO	12	60-125
	DV	4	77–102		DV	54	60–160		DV	8	110-140
	RT	0	ND		RT	9	85–140		RT	0	ND
	SC	1	80		SC	88	ND		SC	6	ND
9/15/10	CO	22	75–112	8/26/16	CO	74	45–110	10/5/17	CO	26	60-110
	DV	8	96–164		DV	31	90–150		DV	13	80-165
	RT	2	86–143		RT	5	90–135		RT	9	70-150
	SC	0	ND		SC	5	ND		SC	27	ND
11/8/10	CO	0	ND	9/28/16	CO	32	55–115	11/22/17	CO	0	ND
	DV	0	ND		DV	21	100–190		DV	0	ND
	RT	0	ND		RT	21	75–150		RT	0	ND
	SC	0	ND		SC	5	ND		SC	0	ND
				11/9/16	CO	36	65–120				
					DV	11	100–160				
					RT	14	90–120				
					SC	40	ND				

Note: CO = coho salmon, DV = Dolly Varden char, RT = rainbow trout, SC = sculpin

[g] We do not know how many minnow traps HDR set in the pool during each trapping event.

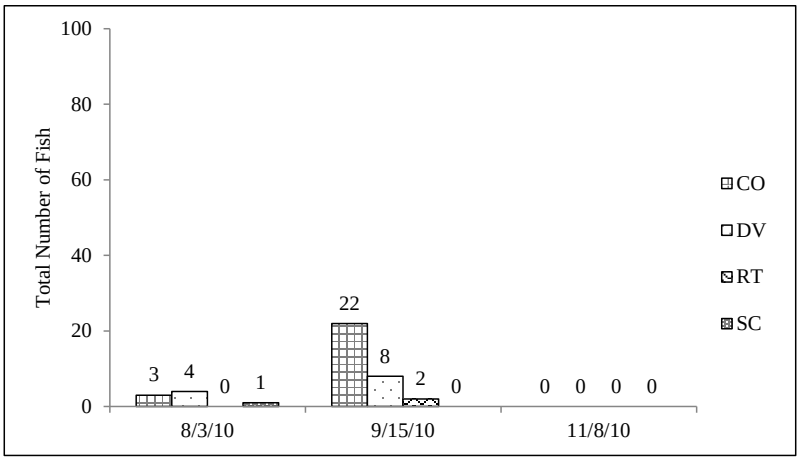

Figure 9.– 2010 fish captures in the Gartina Falls bypass reach pre- construction.

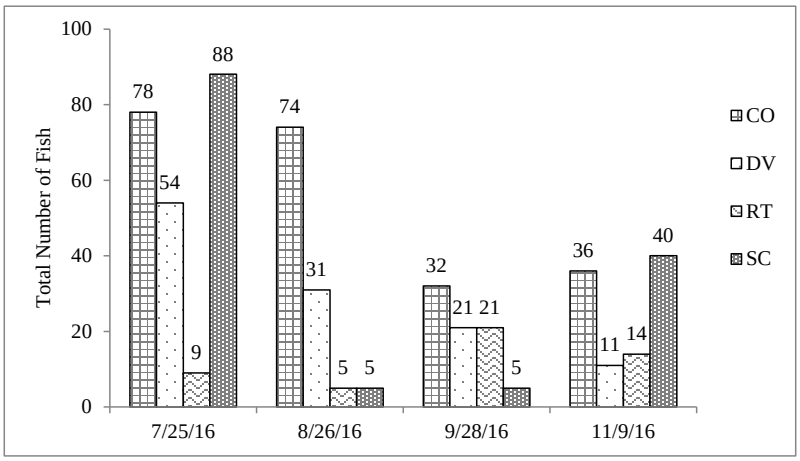

Figure 10.–2016 fish captures in the Gartina Falls bypass reach post-construction.

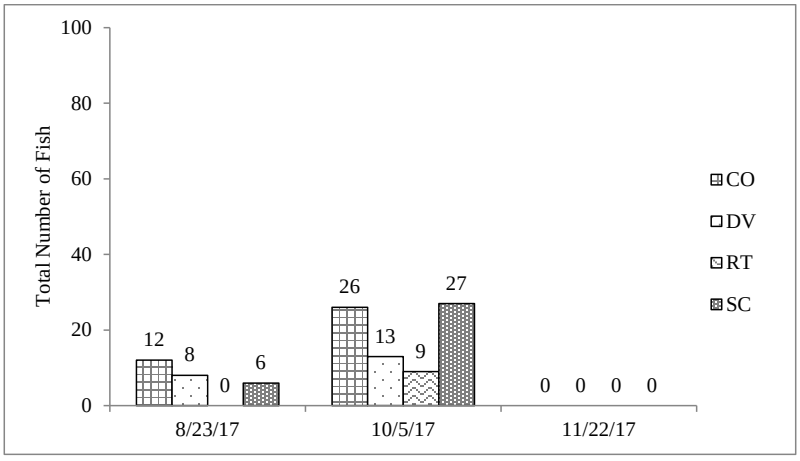

Figure 11.–2017 fish captures in the Gartina Falls bypass reach post-construction.

ADULT PACIFIC SALMON USE

In 2016, Mr. Bolton and I counted 17 live adult coho salmon in the bypass reach during 19 weekly surveys. We did not count any other adult salmon species during that time (Figure 12; Table 2). Mr. Bolton reported observing a few chum salmon in the bypass reach on days he was not conducting his weekly survey, but never observed pink salmon (D.W. Bolton, Head Plant Operator, IPEC, Hoonah, personal communication).

In 2017, Mr. Bolton and I counted 11 live and one carcass adult chum salmon, and 17 live adult coho salmon in the bypass reach during 20 weekly surveys. We did not count any other adult salmon species during that time (Table 3).

During both years, we counted more coho salmon than were reported in 2010 and 2011 Reach 3 baseline surveys (IPEC 2012).[h] In 2010, no chum and pink salmon were observed in Reach 3. In July through September 2011, more chum and pink salmon were observed in Reach 3 than we observed in the bypass reach.

Neither Mr. Bolton nor I observed adult salmon in the tailrace during our surveys (D.W. Bolton, Head Plant Operator, IPEC, Hoonah, personal communication).

During both years water levels were similar during all our visits except in November. In 2016, water levels were higher due to rain, and though the hydro was operating at full capacity, Gartina Creek was still overtopping the dam (Figure 13). In November 2017, air temperatures were colder and the bypass reach was partially covered in ice. Though the tributary was frozen, the bypass reach continued to hold water, and would have even without the minimum flow pipe (Figure 14).

Figure 12.–Coho salmon in the bypass reach.

[h] The 2010/2011 Reach 3 was considerably longer than our 24 m sampling reach approved in Article 410 by the agencies. The 2010/2011 Reach 3 was 659 m, starting at the base of the falls.

Table 2.–2016 adult salmon count survey data.

Date	Air temp (°C)	Water temp (°C)	Weather	Water clarity	# of chum salmon		# of pink salmon		# of coho salmon	
					Live	Carcasses	Live	Carcasses	Live	Carcasses
7/25/16	20.0	12.0	clear	good	0	0	0	0	0	0
8/4/16	18.0	10.0	sunny, warm	good	0	0	0	0	0	0
8/11/16	19.0	11.0	cloudy	fair	0	0	0	0	0	0
8/19/16	17.0	11.0	cloudy	fair	0	0	0	0	0	0
8/26/16	ND	ND	overcast	good	0	0	0	0	0	0
9/2/16	24.0	10.0	clear, sunny,	good	0	0	0	0	0	0
9/8/16	20.0	10.0	mostly cloudy	fair-poor	0	0	0	0	0	0
9/16/16	15.0	9.0	cloudy	poor	0	0	0	0	0	0
9/23/16	16.0	7.0	cloudy, rain showers	poor	0	0	0	0	0	0
9/28/16	10.0	8.0	overcast, sprinkles	good	0	0	0	0	0	0
10/7/16	18.0	4.0	sunny, clear	good	0	0	0	0	0	0
10/13/16	11.0	3.0	clear, sunny,	good	0	0	0	0	0	0
10/20/16	13.0	5.0	cloudy	fair	0	0	0	0	0	0
10/27/16	11.0	3.0	cloudy	good	0	0	0	0	4	0
11/2/16	13.0	3.0	mostly cloudy	good	0	0	0	0	12	0
11/9/16	8.0	6.0	cloudy, light mist	fair	0	0	0	0	1	0
11/16/16	1.0	3.0	clear, cool	fair	0	0	0	0	0	0
11/23/16	11.0	0.0	cloudy, snow showers	good	0	0	0	0	0	0
11/30/16	2.0	2.0	cloudy	poor	0	0	0	0	0	0
				Total	0	0	0	0	17	0

Table 3.–2017 adult salmon count survey data.

Date	Air temp (°C)	Water temp (°C)	Weather	Water clarity	# of chum salmon		# of pink salmon		# of coho salmon	
					Live	Carcasses	Live	Carcasses	Live	Carcasses
7/13/17	17.0	10.0	cloudy, rain showers	poor	0	0	0	0	0	0
7/21/17	19.0	9.0	cloudy	good	0	0	0	0	0	0
7/27/17	17.0	10.0	cloudy, rain showers	poor	5	0	0	0	0	0
8/3/17	17.0	10.0	cloudy, rain showers	good	4	0	0	0	0	0
8/10/17	24.0	10.0	clear, sunny	good	2	0	1	0	0	0
8/17/17	14.0	10.0	cloudy, rain showers	poor	0	0	0	0	0	0
8/23/17	10.5	9.5	overcast	fair	0	1	0	0	0	0
9/1/17	14.0	9.0	cloudy	poor	0	0	0	0	0	0
9/8/17	16.0	9.5	cloudy, rain, wind	poor	0	0	0	0	0	0
9/14/17	16.0	8.0	cloudy	good	0	0	0	0	0	0
9/21/17	12.0	7.0	cloudy	good	0	0	0	0	0	0
9/28/17	14.0	8.5	cloudy	poor	0	0	0	0	0	0
10/5/17	9.0	7.5	cloudy	good	0	0	0	0	0	0
10/12/17	12.0	4.0	clear, sunny	good	0	0	0	0	5	0
10/20/17	12.0	4.5	cloudy, rain	fair	0	0	0	0	4	0
10/25/17	8.0	3.0	cloudy	good	0	0	0	0	5	0
11/2/17	5.0	2.0	clear, sunny	good	0	0	0	0	5	0
11/8/17	9.0	1.0	clear,cool	good	0	0	0	0	7	0
11/14/17	0.0	1.0	clear, sunny, cool	good with ice cover	0	0	0	0	0	0
11/22/17	0.0	1.0	cool, overcast	good with ice cover	0	0	0	0	0	0
				Total	11	1	1	0	26	0

Figure 13.–Gartina Creek overtopping the dam after a rain event, November 9, 2016.

Figure 14.–Bypass reach partially covered in ice, November 22, 2017.

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APPENDIX A: PHOTO POINTS

Appendix A.1 Page 1 of 8.–2016 photo point 1.

July 25, 2016

August 4, 2016

August 11, 2016

August 19, 2016

August 26, 2016

September 2, 2016

September 8, 2016

September 16, 2016

September 23, 2016

September 28, 2016

October 7, 2016

October 13, 2016

October 20, 2016

October 27, 2016

November 2, 2016

November 9, 2016

November 16, 2016

November 23, 2016

November 30, 2016

July 25, 2016

August 4, 2016

August 11, 2016

August 19, 2016

August 26, 2016

September 2, 2016

September 8, 2016

September 16, 2016

September 23, 2016

September 28, 2016

October 7, 2016

October 13, 2016

October 20, 2016

October 27, 2016

November 2, 2016

November 9, 2016

November 16, 2016

November 23, 2016

November 30, 2016

July 25, 2016

August 4, 2016

August 11, 2016

August 19, 2016

August 26, 2016

September 2, 2016

September 8, 2016

September 16, 2016

September 23, 2016

September 28, 2016

October 7, 2016

October 13, 2016

October 20, 2016

October 27, 2016

November 2, 2016

November 9, 2016

November 16, 2016

November 23, 2016

November 30, 2016

July 25, 2016

August 4, 2016

August 11, 2016

August 19, 2016

August 26, 2016

September 2, 2016

September 8, 2016

September 16, 2016

September 23, 2016

September 28, 2016

October 7, 2016

October 13, 2016

October 20, 2016

October 27, 2016

November 2, 2016

November 9, 2016

November 16, 2016

November 23, 2016

November 30, 2016

July 13, 2017

July 21, 2017

July 27, 2017

August 3, 2017

August 10, 2017

August 17, 2017

August 23, 2017

September 1, 2017

September 8, 2017

September 14, 2017

September 21, 2017

September 28, 2017

October 5, 2017

October 12, 2017

October 20, 2017

October 25, 2017

November 2, 2017

November 8, 2017

November 14, 2017

November 22, 2017

July 13, 2017

July 21, 2017

July 27, 2017

August 3, 2017

August 10, 2017

August 17, 2017

August 23, 2017

September 1, 2017

September 8, 2017

September 14, 2017

September 21, 2017

September 28, 2017

October 5, 2017

October 12, 2017

October 20, 2017

October 25, 2017

November 2, 2017

November 8, 2017

November 14, 2017

November 22, 2017

July 13, 2017

July 21, 2017

July 27, 2017

August 3, 2017

August 10, 2017

August 17, 2017

August 23, 2017

September 1, 2017

September 8, 2017

September 14, 2017

September 21, 2017

September 28, 2017

October 5, 2017

October 12, 2017

October 20, 2017

October 25, 2017

November 2, 2017

November 8, 2017

November 14, 2017

November 22, 2017

July 13, 2017

July 21, 2017

July 27, 2017

August 3, 2017

August 10, 2017

August 17, 2017

August 23, 2017

September 1, 2017

September 8, 2017

September 14, 2017

September 21, 2017

September 28, 2017

October 5, 2017

October 12, 2017

October 20, 2017

October 25, 2017

November 2, 2017

November 8, 2017

November 14, 2017

November 22, 2017