

Technical Report No. 18-08

Hoonah Airport Mitigation Monitoring, 2013–2018 Final Report

by

Nicole M. Legere



December 2018

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)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-fork	MEF
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	mid-eye-to-tail fork	METF
hectare	ha	at	@	standard length	SL
kilogram	kg	compass directions:		total length	TL
kilometer	km	east	E		
liter	L	north	N	Mathematics, statistics	
meter	m	south	S	<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	west	W	alternate hypothesis	H _A
millimeter	mm	copyright	©	base of natural logarithm	<i>e</i>
		corporate suffixes:		catch per unit effort	CPUE
Weights and measures (English)		Company	Co.	coefficient of variation	CV
cubic feet per second	ft ³ /s	Corporation	Corp.	common test statistics	(F, t, χ^2 , etc.)
foot	ft	Incorporated	Inc.	confidence interval	CI
gallon	gal	Limited	Ltd.	correlation coefficient (multiple)	R
inch	in	District of Columbia	D.C.	correlation coefficient (simple)	r
mile	mi	et alii (and others)	et al.	covariance	cov
nautical mile	nmi	et cetera (and so forth)	etc.	degree (angular)	°
ounce	oz	exempli gratia		degrees of freedom	df
pound	lb	(for example)	e.g.	expected value	<i>E</i>
quart	qt	Federal Information Code	FIC	greater than	>
yard	yd	id est (that is)	i.e.	greater than or equal to	≥
		latitude or longitude	lat. or long.	harvest per unit effort	HPUE
Time and temperature		monetary symbols (U.S.)	\$, ¢	less than	<
day	d	months (tables and figures): first three letters	Jan, ..., Dec	less than or equal to	≤
degrees Celsius	°C	registered trademark	®	logarithm (natural)	ln
degrees Fahrenheit	°F	trademark	™	logarithm (base 10)	log
degrees kelvin	K	United States (adjective)	U.S.	logarithm (specify base)	log ₂ , etc.
hour	h	United States of America (noun)	USA	minute (angular)	'
minute	min	U.S.C.	United States Code	no data	ND
second	s	U.S. state	use two-letter abbreviations (e.g., AK, WA)	not significant	NS
Physics and chemistry				null hypothesis	H ₀
all atomic symbols				percent	%
alternating current	AC			probability	P
ampere	A			probability of a type I error (rejection of the null hypothesis when true)	α
calorie	cal			probability of a type II error (acceptance of the null hypothesis when false)	β
direct current	DC			second (angular)	"
hertz	Hz			standard deviation	SD
horsepower	hp			standard error	SE
hydrogen ion activity (negative log of)	pH			variance	
parts per million	ppm			population	Var
parts per thousand	ppt, ‰			sample	var
volts	V				
watts	W				

TECHNICAL REPORT NO. 18-08

**HOONAH AIRPORT MITIGATION MONITORING, 2013–2018
FINAL REPORT**

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December 2018

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Cover: Coho salmon and sculpin captured in Coho Creek.

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- A.2. Number and length range of salmonids captured in Shotter Creek.
- A.3. Number and length range of salmonids captured in Unnamed Creek.

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Thank you all for your contribution.

EXECUTIVE SUMMARY

In 2012 and 2013, the Alaska Department of Transportation and Public Facilities (ADOT&PF), in cooperation with the Federal Aviation Administration (FAA), expanded the Hoonah Airport runway and improved other airport infrastructure in accordance with the 2004 Hoonah Airport Master Plan Update (ADOT&PF 2004). In addition, ADOT&PF removed a beaver dam on Coho Creek to reduce bird strike potential in the runway extension area.

ADOT&PF, in collaboration with the Alaska Department of Fish and Game (ADF&G), U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers (USACE), and National Marine Fisheries Service, prepared the Hoonah Airport Runway Extension 5-Year Monitoring Plan (ADOT&PF 2012). The monitoring plan was developed to meet the requirements of the USACE permit, POA-2010-0682, Special Condition No. 12. ADOT&PF contracted with the ADF&G Division of Habitat to conduct the monitoring.

The monitoring plan included as-built surveys, fish presence, and vegetation success in Coho Creek, Shotter Creek, and Unnamed Creek. In addition, ADF&G collected basic water quality data at each site.

In Coho Creek, we captured juvenile coho salmon *Oncorhynchus kisutch*, pink salmon *O. gorbuscha*, and chum salmon *O. keta*, Dolly Varden char *Salvelinus malma*, cutthroat trout *O. clarkii*, sculpin *Cottus* sp., threespine stickleback *Gasterosteus aculeatus*, and starry flounder *Platichthys stellatus* and we observed adult pink and coho salmon. We documented the relocated reach of Coho Creek has completely revegetated, and after the beaver dam was removed, the open water habitat was replaced by palustrine-emergent and palustrine scrub-shrub wetland.

In Shotter Creek, we captured juvenile coho, pink, and chum salmon, Dolly Varden char, cutthroat trout, sculpin, threespine stickleback, and starry flounder and we observed adult pink and coho salmon. Freshwater connectivity with the intertidal zone has been restored in Shotter Creek since the culvert replacement.

In Unnamed Creek, we captured juvenile coho salmon, Dolly Varden char, cutthroat trout, sculpin, and threespine stickleback. Fish passage was restricted when water levels were low or flowed subterranean. We documented that except for the south end of the east bank, the relocated reach of Unnamed Creek has completely revegetated with willows and grasses.

INTRODUCTION

The Hoonah Airport is located about 1.5 mi^a southeast of downtown Hoonah. The airport property consists of about 175 acres of open meadow and forested land in the tidal delta of Gartina Creek (Stream No. 114-31-10090; Johnson and Blossom 2018). The developed portion of the property is approximately 108 acres (ADOT&PF 2010). The airport is owned and operated by the State of Alaska and managed by the ADOT&PF.

In 2012 and 2013, the ADOT&PF completed the following projects to mitigate the unavoidable loss of 2.21 acres of wetlands and 1,132 linear ft of stream from construction (Figure 1; ADOT&PF 2012):

- Installed a 120-inch culvert in Coho Creek;
- Replaced a perched 48-inch culvert with a new a 60-inch culvert in Shotter Creek;
- Constructed 450 linear ft of new stream channel in Coho Creek; and
- Constructed 500 linear ft of new stream channel with alcoves in Unnamed Creek.

^a For the purpose of being consistent with the ADOT&PF documents we reference, we use Imperial units in the Introduction to describe the general project area, impacts, and mitigation. We use metric units in the rest of the technical report.



Figure 1.-Hoonah Airport.

PURPOSE

This technical report summarizes monitoring data collected between 2013 and 2018 to evaluate if fish passage is improved in Coho Creek and Shotter Creek and if the relocated reaches of Coho Creek and Unnamed Creek are stable and provide fish habitat. This report satisfies Special Condition No. 12 of the USACE Permit POA-2010-0682.

MONITORING STUDIES

We completed the Hoonah Airport monitoring studies required in the Hoonah Airport Runway Extension 5-Year Monitoring Plan (Table 1; ADOT&PF 2012).

Table 1.–5-year monitoring schedule.

	Coho Creek	Shotter Creek	Unnamed Creek
As-built survey	2013 (ADOT&PF) 2015 (ADOT&PF)	NA NA	2013 (ADOT&PF) 2015 (ADOT&PF)
Fish presence			
Minnow traps	12/2010 and 06/2011 08/2013 and 01/2014 07/2014 and 01/2015 07/2015 and 01/2016 07/2016 and 01/2017 07/2017 and 01/2018	12/2010 and 06/2011 08/2013 and 01/2014 07/2014 and 01/2015 07/2015 and 01/2016 07/2016 and 01/2017 07/2017 and 01/2018	12/2010 and 06/2011 08/2013 and 01/2014 07/2014 and 01/2015 07/2015 and 01/2016 07/2016 and 01/2017 07/2017 and 01/2018
Adult salmon counts	Between July and September 2014-2017 Between October and December 2014-2017	Between July and September 2014-2017 Between October and December 2014-2017	Between July and September 2014-2017 Between October and December 2014-2017
Beach seine	04/2014-2017	04/2014-2017	NA
Vegetation monitoring	07/2014 07/2015 07/2016 07/2017	NA NA NA NA	07/2014 07/2015 07/2016 07/2017

Note: Bold indicates pre-construction monitoring.

STUDY AREA

Coho Creek

Coho Creek is a small palustrine channel and provides rearing and spawning habitat for coho, chum, and pink salmon, and Dolly Varden char (Stream No. 114-31-10080; Johnson and Blossom 2018). We also documented cutthroat trout, sculpin, threespine stickleback, and starry flounder.

We sampled fish presence in Reaches 1–3 and vegetative cover in Reach 2.

Shotter Creek

The stream reach where the culvert was replaced on Shotter Creek is a small estuarine channel and provides rearing and spawning habitat for coho, chum, and pink salmon (Stream No. 114-31-

10080-2001; Johnson and Blossom 2018). We also documented cutthroat trout, Dolly Varden char, sculpin, threespine stickleback, and starry flounder.

Prior to replacement, the culvert was perched and there was no freshwater connectivity with the intertidal zone except during flood stages. Over time Shotter Creek formed a channel parallel to the access road and merged with Coho Creek.

We sampled fish presence in Shotter Creek.

Unnamed Creek

The relocated reach of Unnamed Creek (Stream No. 114-31-10080-2005; Johnson and Blossom 2018) is a small ditch along the east side of the airport apron and provides rearing habitat for coho salmon. We also documented cutthroat trout, Dolly Varden char, sculpin, and threespine stickleback.

We sampled fish presence and vegetative cover in Unnamed Creek.

METHODS

AS-BUILT SURVEYS

ADOT&PF surveyors used a total station to document changes in stream morphology in Coho Creek and Unnamed Creek relocations and Coho Creek and Shotter Creek culvert replacements. ADOT&PF surveyors conducted surveys immediately after installation and again in September 2015 according to methods in the 5-year monitoring plan.^b We visually monitored culvert condition using photo points.

FISH PRESENCE

Minnow Traps

Each summer and winter, we set two-piece 0.635 cm galvanized steel minnow traps at established locations^c in Coho Creek, Shotter Creek, and Unnamed Creek, following methods in (Magnus et al. 2006). We baited the minnow traps with disinfected salmon eggs contained in a punctured plastic bag and soaked the traps overnight. Initially, we measured FL of all salmonids^d, but due to the abundance of fish captured per trap, time, and weather constraints, we changed our protocol in January 2015 to measure a subsample of 10 coho salmon, 10 Dolly Varden char, and 10 cutthroat trout per minnow trap and counted and released the remaining fish. We counted and released the sculpin and threespine stickleback.

For each site and by sample period, we present the mean number of coho salmon captured per minnow trap in a graph and provide the raw data in Appendix A. We include pre-construction capture data for comparison.

Adult Salmon Counts

Each year we surveyed Coho Creek, Shotter Creek, and Unnamed Creek on foot, once between July and September and again between October and December, and counted the number of adult coho salmon, pink salmon and carcasses. We began each survey approximately 30 m downstream of the culverts and walked upstream to the upper extent of the minnow trap sampling reach. We used polarized glasses as necessary to improve visibility.

For each site, we present the number of fish observed by species in a table.

Beach Seine

Each April, we surveyed Coho Creek and Shotter Creek for juvenile coho, chum, and pink salmon with a 0.318 cm mesh beach seine. We began each survey during low tide in the estuary downstream of the culverts. We held the seine in the river perpendicular to the bank for five min. We closed the seine by sweeping the outer end upriver and back to the bank. We placed the fish in a bucket, identified, measured, counted, and released the fish.

^b Alaska Department of Transportation and Public Facilities Southcoast Region. 2014. Hoonah Airport runway extension, Project No. 68303 AIP No. 3-02-0123-005-2012 as-built plans. <http://www.dot.state.ak.us/sereg/asbuilts/Assets/HNH/68303.pdf> (Accessed November 2018).

^c We did not set a trap if the established location was dry or the ice was too thick to break through.

^d Species codes: CO = coho salmon, CH = chum salmon, P = pink salmon, DV = Dolly Varden char, CT = cutthroat trout.

For each site, we present number of fish and FL range of each salmonid species captured in a table.

WATER QUALITY

We collected basic water quality data with a Yellow Springs Instrument Pro 2030 and calibrated the instrument onsite per the manufacturer's instructions before sampling.

For each site, we present the data in a table.

VEGETATION MONITORING

Beginning in 2014, each July we took photos at established locations to document if the relocated reaches on Coho Creek and Unnamed Creek were providing functional riparian habitat.

For each site, we present photographs to document the revegetated riparian habitat.

RESULTS

COHO CREEK

As-built Surveys

In 2013 and 2015, ADOT&PF conducted as-built surveys of the Coho Creek relocation and culvert installation and the project engineer concluded they were constructed as designed (Figures 2, 3). We used photo points and documented no observable changes to the culvert over 5 years.



Figure 2.—Root wads embedded in relocated reach of Coho Creek, July 2016.



Figure 3.—Coho Creek culvert after installation, April 2015.

Fish Presence

Minnow Traps

We established three sample reaches in Coho Creek (Figure 4):

Reach 1: below relocated channel

Reach 2: relocated channel and area immediately upstream from removed beaver dam

Reach 3: above removed beaver dam

We captured juvenile coho salmon, cutthroat trout, Dolly Varden char, sculpin, and threespine stickleback. The number of salmonids we captured varied between reach, season, and year, and were similar to pre-construction sampling results. The mean number of coho salmon captured per minnow trap was the greatest in Reach 2 and winter catches were more than summer (Figures 5, 6).



Figure 4.–Coho Creek reaches and minnow trap and water quality locations.

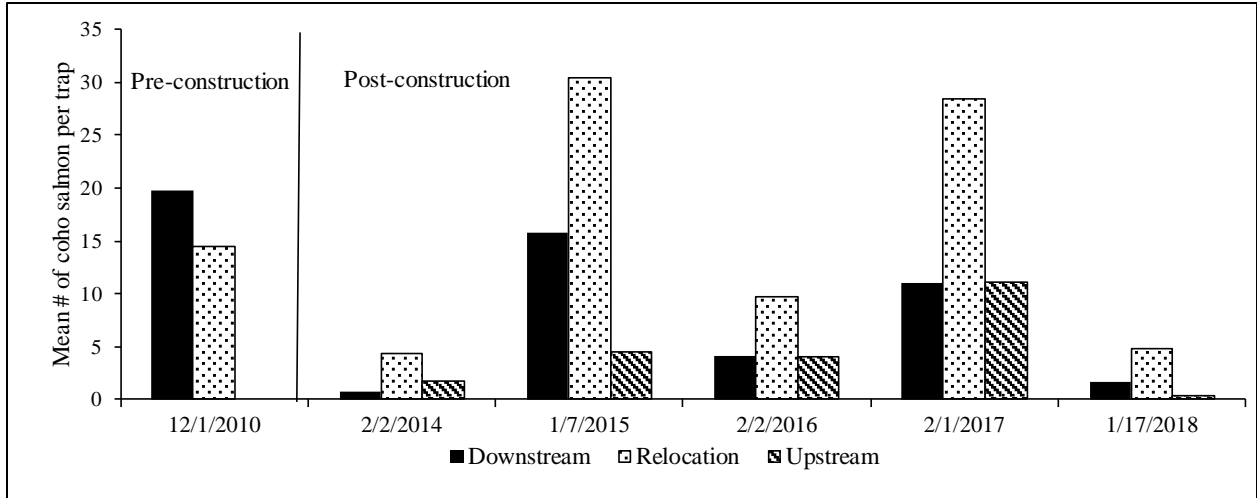


Figure 5.—Mean number of coho salmon captured per minnow trap during the winter in Coho Creek.

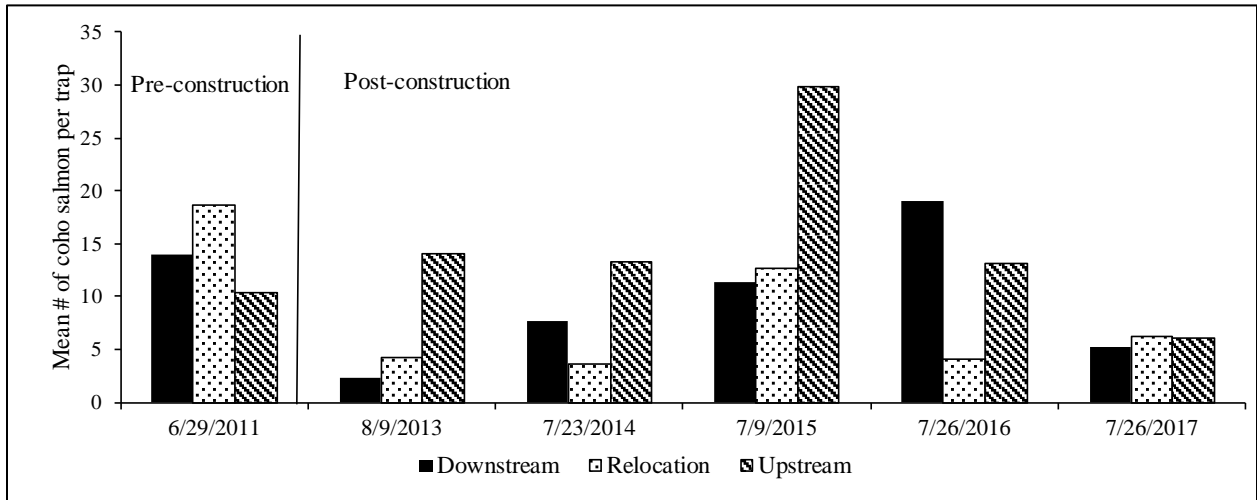


Figure 6.—Mean number of coho salmon captured per minnow trap during the summer in Coho Creek.

Adult Salmon Counts

We counted adult salmon and carcasses upstream of the culvert replacement (Table 2; Figure 7). On October 1, 2014 we observed 1 coho salmon on a redd upstream of the stream relocation (Figure 8).

Table 2.–Coho Creek adult salmon counts.

Date	# of coho salmon		# of pink salmon	
	Live	Carcasses	Live	Carcasses
08/08/13	0	0	0	0
09/10/13	0	0	1	2
07/24/14	0	0	0	0
10/01/14	3	1	0	0
07/09/15	0	0	0	0
09/23/15	0	0	0	6
09/28/16	0	0	0	0
11/09/16	0	0	0	0
08/23/17	0	0	0	0
10/05/17	2	0	0	0



Figure 7.–Coho salmon carcass observed in Coho Creek, October 1, 2014.



Figure 8.–Coho salmon redd in Coho Creek.

Beach Seine

We captured juvenile coho, chum, and pink salmon, sculpin, threespine stickleback, and starry flounder with a beach seine in the estuary downstream of the culvert replacement (Table 3; Figure 9). Prior to April 2014, chum salmon fry were not documented in Coho Creek. We submitted this information and it was accepted in the Anadromous Waters Catalog (AWC).

Table 3.–Coho Creek beach seine capture data.

Date	CO	FL range (mm)	CH	FL range (mm)	P	FL range (mm)
04/21/14	0	ND	2	36-40	0	ND
04/07/15	0	ND	46	35-45	0	ND
04/07/16	2	30	1710	40	3	30
04/17/17	0	ND	2	45	0	ND



Figure 9.–Chum salmon fry captured in Coho Creek.

Water Quality

We measured water quality in Coho Creek at locations 13, 23, and 28 (Figure 4; Table 4).

Table 4.–Coho Creek water quality data.

Date	Location	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Conductivity (µS/cm)	Salinity (ppt)
02/04/14	13	0.5	13.0	87	153.5	0.1
	23	0.5	13.4	90	71.5	0.0
	28	0.6	11.8	79	120.7	0.1
07/23/14	13	18.7	7.8	82	207.7	0.1
	23	18.3	7.2	75	204.3	0.1
	28	19.0	6.0	61	205.2	0.1
01/07/15	13	0.2	ND	ND	172.9	0.1
	23	0.2	ND	ND	173.7	0.1
	28	0.3	ND	ND	175.4	0.1
07/08/15	13	20.3	6.7	71	223.0	0.1
	23	19.7	5.3	60	217.7	0.1
	28	20.5	3.3	36	219.0	0.1
02/02/16	13	2.1	10.7	79	77.7	0.1
	23	2.0	10.8	77	76.5	0.1
	28	1.7	10.0	67	67.3	0.1
07/25/16	13	16.1	7.4	75	169.4	0.1
	23	16.7	7.5	77	170.0	0.1
	28	16.7	4.4	44	168.3	0.1
01/31/17	13	0.4	12.9	86	74.3	0.1
	23	0.5	13.2	89	71.3	0.1
	28	0.6	12.2	82	72.2	0.1
07/25/17	13	14.5	ND	ND	115.0	0.1
	23	14.3	ND	ND	106.0	0.1
	28	15.3	ND	ND	109.2	0.1
01/16/18	13	0.2	13.5	93	54.2	0.0
	23	0.3	14.5	98	54.4	0.0
	28	0.3	12.8	89	55.4	0.0

Note: ND dissolved oxygen sensor was not calibrating correctly.

Vegetation Monitoring

We documented that the relocated reach of Coho Creek completely revegetated with low grasses and ferns (Figures 10, 11). Since the beaver dam has been removed, the creek has reestablished a channel and the open water habitat has been replaced by palustrine-emergent and palustrine scrub-shrub wetlands (Figures 12–15).



Figure 10.—Relocated reach, July 2014.



Figure 11.—Relocated reach, July 2017.



Figure 12.—Looking downstream at Coho Creek before the beaver dam removal, June 2011.



Figure 13.—Looking downstream at Coho Creek after the beaver dam removal, September 2013.



Figure 14.—Looking upstream at Coho Creek before the beaver dam removal, June 2011.



Figure 15.—Looking downstream at Coho Creek after the beaver dam removal, September 2013.

SHOTTER CREEK

As-built Surveys

In 2013 and 2015, ADOT&PF conducted an as-built survey of the Shotter Creek culvert replacement and the project engineer concluded the culvert was installed as designed (Figures 16–19). We used photo points and documented no observable changes to the culvert over 5 years.



Figure 16.—Inlet of Shotter Creek culvert pre-construction, June 2011.



Figure 17.—Inlet of Shotter Creek culvert post-construction, July 2014.



Figure 18.—Perched outlet of Shotter Creek culvert pre-construction, August 2010.



Figure 19.—Outlet of Shotter Creek culvert post-construction, February 2014.

Fish Presence

Minnow Traps

We set 10 minnow traps at established locations and captured juvenile coho salmon, cutthroat trout, Dolly Varden char, sculpin, and threespine stickleback (Figures 20–22). The number of salmonids we captured varied between seasons and years. The mean number of coho salmon captured per minnow trap was more in the summer (Figure 23). We generally captured more coho salmon per minnow trap in the winter during pre-construction monitoring.



Figure 20.—Shotter Creek minnow trap and water quality locations.



Figure 21.—Coho salmon captured in Shotter Creek, January 2018.



Figure 22.—Cutthroat trout captured in Shotter Creek, January 2018.

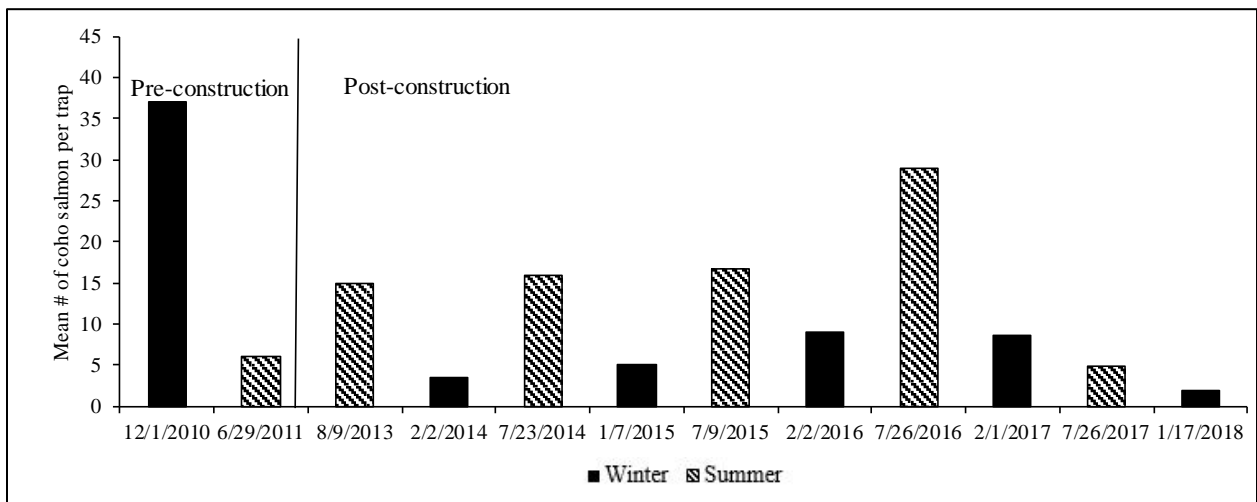


Figure 23.—Mean number of coho salmon captured per minnow trap in Shotter Creek.

Adult Salmon Counts

We counted adult salmon and carcasses upstream of the culvert replacement (Table 5). Prior to September 2013, adult pink salmon were not documented in Shotter Creek. We submitted this information and it was accepted in the AWC.

Table 5.–Shotter Creek adult salmon counts.

Date	# of coho salmon		# of pink salmon	
	Live	Carcasses	Live	Carcasses
08/08/13	0	0	0	0
09/10/13	0	0	1	12
07/24/14	0	0	0	0
10/01/14	15	0	0	0
07/09/15	0	0	0	0
09/23/15	0	0	0	5
09/28/16	0	0	0	0
11/09/16	4	0	0	0
08/23/17	0	0	0	0
10/05/17	0	0	0	0

Beach Seine

We captured juvenile coho, chum, and pink salmon, sculpin, threespine stickleback, and starry flounder with a beach seine in the estuary downstream of the culvert. (Table 6). Prior to April 2014, chum salmon fry were not documented in Shotter Creek and prior to April 2016 pink salmon fry were not documented in Shotter Creek (Figures 24, 25). We submitted this information and it was accepted in the AWC.

Table 6.–Shotter Creek beach seine capture data.

Date	CO	FL range (mm)	CH	FL range (mm)	P	FL range (mm)
04/21/14	0	ND	11	32-43	0	ND
04/07/15	0	ND	160	35-50	0	ND
04/07/16	110	30-90	5000+	30-40	20	30
04/17/17	1	65	3	34-45	0	ND



Figure 24.–Chum salmon fry captured in Shotter Creek, April 2014.

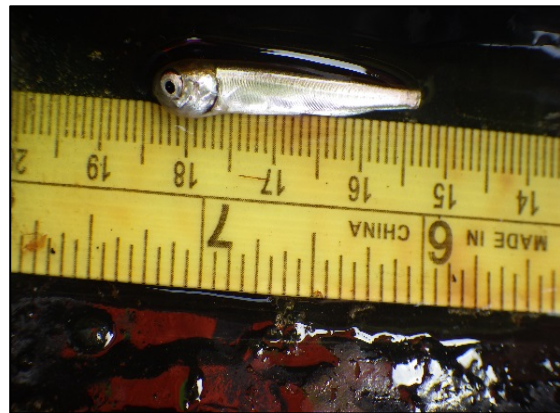


Figure 25.–Pink salmon fry captured in Shotter Creek, April 2016.

Water Quality

We measured water quality at location 8 (Figure 20; Table 7).

Table 7.–Shotter Creek water quality data.

Date	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Conductivity (µS/cm)	Salinity (ppt)
02/04/14	0.1	14.9	99	214.3	0.1
07/23/14	11.0	11.0	101	248.1	0.1
01/07/15	0.1	ND	ND	226.2	0.1
07/08/15	14.2	9.2	88	289.2	0.1
02/02/16	1.9	11.7	84	116.4	0.0
07/26/16	12.6	8.4	78	205.0	0.1
01/31/17	1.1	15.0	102	119.5	0.1
07/25/17	11.0	ND	ND	183.2	0.1
01/16/18	2.5	14.1	109	106.4	0.1

Note: ND dissolved oxygen sensor was not calibrating correctly.

UNNAMED CREEK

As-built Surveys

In 2013 and 2015, ADOT&PF conducted an as-built survey of the Unnamed Creek relocation and the project engineer concluded the relocation and alcoves were constructed as designed (Figures 26, 27).



Figure 26.–Unnamed Creek, August 2017.



Figure 27.–Looking down at the alcoves, September 2013.

Fish Presence

Minnow Traps

We set up to 5 minnow traps in Unnamed Creek, always setting one minnow trap in the pool at the downstream end of the relocated reach and one in the pool immediately upstream of the relocated reach (Figure 28). We set other minnow traps within the reach if water was available. We captured juvenile coho salmon, cutthroat trout, Dolly Varden char, sculpin, and threespine stickleback. The number of salmonids we captured varied between seasons and year, with coho salmon being the most common species. The mean number of coho salmon captured per minnow trap was generally more in the summer than the winter and we captured more coho salmon per minnow trap during all sampling events^e than during pre-construction (Figure 29). Prior to 2014, Unnamed Creek was known to provide habitat for juvenile coho salmon, but this information was never submitted to the AWC. We submitted this information and it was accepted in the AWC.

During some of our site visits to Unnamed Creek there was little to no water in the relocated reach (Figure 30). We usually observed the most water in the fall and winter (Figure 31). The root wads that were placed in the creek during construction are fish passage barriers at low water (Figure 32). In the winter, ADOT&PF Maintenance and Operations staff plows snow from the airport apron into Unnamed Creek and blocks fish passage until the water erodes out a channel under the snow (Figures 33–36).

^e Except for 2014 and 2018 winters.



Figure 28.—Unnamed Creek minnow trap and water quality locations.^f

^f Note the aerial imagery shows snow was plowed into Unnamed Creek.

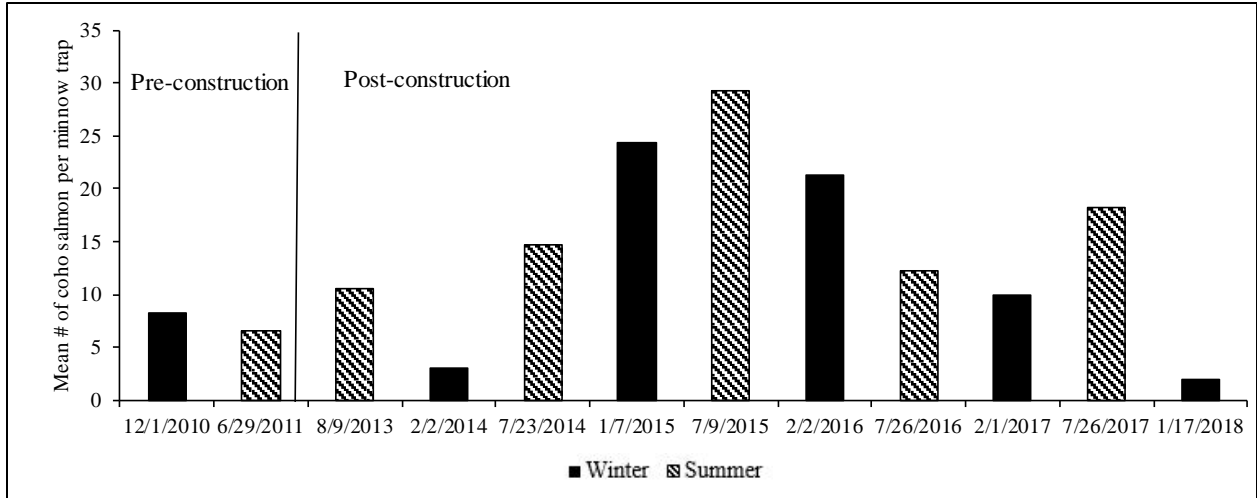


Figure 29.—Mean number of coho salmon captured per minnow trap in Unnamed Creek.

Adult Salmon Counts

We did not observe adult salmon in Unnamed Creek.



Figure 30.—Dry relocated reach, July 2014.



Figure 31.—Most flow we documented in the relocated reach, October 2014.



Figure 32.—Root wad blocking fish passage during low water, September 2016.



Figure 33.—Unnamed Creek the day before a fresh snowfall, January 6, 2015.



Figure 34.—Unnamed Creek the day after ADOT&PF plowed the apron, January 7, 2015.



Figure 35.–Unnamed Creek, April 2015.



Figure 36.–Unnamed Creek, April 2017.

Water Quality

We measured water quality at location 1 (Table 8).

Table 8.–Unnamed Creek water quality data.

Date	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Conductivity (µS/cm)	Salinity (ppt)
02/04/14	1.0	12.3	84	ND	0.0
07/23/14	12.3	9.4	86	587.0	0.3
01/07/15	0.1	ND	ND	105.8	0.0
07/08/15	14.4	7.8	76	393.4	0.2
02/02/16	3.2	10.0	74	238.4	0.2
07/25/16	13.5	8.2	77	342.9	0.2
01/31/17	2.2	12.9	91	211.1	0.2
07/25/17	11.5	ND	ND	179.0	0.1
01/16/18	3.2	12.0	90	224.9	0.2

Note: ND dissolved oxygen sensor was not calibrating correctly.

Vegetation Monitoring

We documented that the relocated reach of Unnamed Creek revegetated with willows and grasses, except the south end of the east bank only had a few surviving willows (Figures 37–39). Sand and gravel from the plowed snow has started to build up on the bank and is falling into the creek and may prevent vegetation from growing (Figure 40).



Figure 37.—Unnamed Creek, July 2014.



Figure 38.—Unnamed Creek, July 2017.



Figure 39.—Unvegetated bank of Unnamed Creek.



Figure 40.—Sand and gravel from snow melt on the bank of Unnamed Creek.

RECOMMENDATIONS

COHO CREEK

ADOT&PF installed the Coho Creek culvert, removed a longstanding beaver dam, and relocated the stream below the beaver dam, as specified. We documented adult coho and pink salmon can freely pass upstream of the structure. We also documented the relocated channel, the area upstream of the former beaver dam, and the large woody debris provide summer and overwintering habitat for salmonids, including coho salmon. Of note, we captured more upstream juvenile coho salmon after the beaver dam was removed than prior to its removal, suggesting new spawning habitat has been exposed and fish passage in and out of the area is improved. We captured pink and chum salmon fry in a beach seine suggesting pink and chum salmon are spawning in the intertidal reach. We added chum salmon use of the water body in the AWC. Water quality at the Coho Creek sampling stations remained similar throughout the study, and the Coho Creek relocated reach and upstream riparian areas now support lush vegetation.

SHOTTER CREEK

ADOT&PF replaced the Shotter Creek culvert as specified, and it is functioning as designed. Freshwater connectivity with the intertidal zone has been restored, and while the stream continues to provide summer and overwintering habitat for salmonids, more juvenile coho salmon used Shotter Creek as overwintering habitat prior to culvert replacement. We documented adult coho and pink salmon can freely pass upstream of the structure. We also captured pink and chum salmon fry in a beach seine, suggesting pink and chum salmon adults are spawning in the intertidal reach. We added pink and chum salmon use of the water body in the AWC. Water quality at the Shotter Creek sampling station remained similar throughout the study.

UNNAMED CREEK

ADOT&PF relocated Unnamed Creek as specified. However, when water levels are low, water flows subterranean in some locations and the root wads placed in the creek to provide fish habitat present a juvenile fish passage barrier. Given the obstruction, we recommend moving or altering the root wads to allow fish passage at all flows.

The relocated reach periodically provides summer and overwintering habitat for salmonids, including coho salmon. Low water and overgrown vegetation prevented us from setting minnow traps in the alcoves, so their value as fish habitat is unknown. We did not document adult salmon in Unnamed Creek. Water quality at the Unnamed Creek sampling station remained similar throughout the study with salinity the highest throughout the study. The Unnamed Creek riparian has nearly all revegetated except for the south end of the east bank where we found sand and gravel accumulating from snow plowing.

According to Special Condition No. 7 in USACE Permit POA-2010-0682, “Snow disposal and/or storage will not occur within the newly constructed stream channels of Coho Creek and the unnamed tributary to Coho Creek”. We recommend ADOT&PF comply with the permit, or if the activity will continue, apply for a USACE Permit modification and a Fish Habitat Permit. A Fish Habitat Permit will include conditions to prevent further stream degradation and fish passage blocks.

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APPENDIX A: MINNOW TRAP CAPTURE DATA

Appendix A.1.—Number and length range of salmonids captured in Coho Creek.

Reach	Date	CO	FL range (mm)	DV	FL range (mm)	CT	FL range (mm)	Number of traps
1	12/01/10	138	ND	0	ND	0	ND	7
1	06/29/11	125	ND	1	ND	3	ND	9
1	08/09/13	16	40-105	0	ND	0	ND	7
1	02/05/14	5	50-80	0	ND	0	ND	7
1	07/23/14	54	40-95	3	114-125	3	94-140	7
1	01/07/15	110	49-110	0	ND	2	107-113	7
1	07/09/15	79	45-75	0	ND	0	ND	7
1	02/02/16	29	55-100	0	ND	0	ND	7
1	07/26/16	133	45-90	2	70-85	2	135-160	7
1	02/01/17	77	55-120	3	ND	0	ND	7
1	07/26/17	37	45-95	3	130-170	2	125-145	7
1	01/17/18	12	50-120	0	ND	0	ND	7
2	12/01/10	187	ND	6	ND	0	ND	10
2	06/29/11	298	ND	4	ND	0	ND	16
2	08/09/13	56	40-110	ND	ND	2	125-140	13
2	02/05/14	57	45-105	0	ND	0	ND	13
2	07/23/14	47	48-104	16	90-135	2	110-137	13
2	01/07/15	335	46-125	1	132	0	ND	11
2	07/09/15	152	42-100	0	ND	0	ND	12
2	02/02/16	126	50-100	0	ND	0	ND	13
2	07/26/16	53	45-95	1	90	0	ND	13
2	02/01/17	371	55-115	0	ND	2	120-130	13
2	07/26/17	80	45-110	3	90-115	5	125-155	13
2	01/17/18	58	55-120	0	ND	0	ND	12
3	12/01/10	ND	ND	ND	ND	ND	ND	0
3	06/29/11	103	ND	17	ND	0	ND	10
3	08/09/13	84	40-105	9	95-140	3	110-125	6
3	02/05/14	16	45-100	0	ND	1	105	9
3	07/23/14	120	49-106	15	73-138	1	139	9
3	01/07/15	36	48-125	0	ND	0	ND	8
3	07/09/15	268	40-130	5	ND	2	90-120	9
3	02/02/16	36	55-130	0	ND	0	ND	9
3	07/26/16	111	50-110	14	ND	2	140	9
3	02/01/17	78	55-100	0	ND	0	ND	7
3	07/26/17	49	40-130	8	80-130	1	120	8
3	01/17/18	3	70-75	0	ND	0	ND	8

Note: Bold indicates pre-construction monitoring.

Appendix A.2.–Number and length range of salmonids captured in Shotter Creek.

Date	CO	FL range (mm)	DV	FL range (mm)	CT	FL range (mm)	Number of Traps
12/01/10	37	ND	0	ND	0	ND	1
06/29/11	55	ND	37	ND	28	ND	9
08/09/13	150	40-100	76	50-110	29	50-135	10
02/05/14	36	45-90	1	75	1	50	10
07/23/14	160	42-104	47	65-126	14	80-130	10
01/07/15	51	46-110	2	90-132	3	90-115	10
07/09/15	168	40-113	57	ND	20	ND	10
02/02/16	91	55-125	7	ND	5	ND	10
07/26/16	290	40-100	41	ND	16	ND	10
02/01/17	87	45-100	8	50-100	3	65-100	10
07/26/17	48	55-115	44	55-135	14	80-145	10
01/17/18	19	40-100	4	75-120	2	120-130	10

Note: Bold indicates pre-construction monitoring.

Appendix A.3.–Number and length range of salmonids captured in Unnamed Creek.

Date	CO	FL range (mm)	DV	FL range (mm)	CT	FL range (mm)	Number of Traps
12/01/10	50	ND	6	ND	0	ND	6
06/29/11	66	ND	0	ND	1	ND	10
08/09/13	53	30–135	3	80–100	1	70	5
02/05/14	6	40–85	0	ND	0	ND	2
07/23/14	44	42–97	3	80–109	2	87–97	3
01/07/15	97	52–104	0	ND	0	ND	4
07/09/15	88	40–95	0	ND	0	ND	3
02/02/16	64	40–90	1	ND	0	ND	3
07/26/16	37	55–105	0	ND	0	ND	3
02/01/17	30	50–100	0	ND	0	ND	3
07/26/17	55	45–95	1	95	0	ND	3
01/17/18	6	55–85	0	ND	0	ND	3

Note: Bold indicates pre-construction monitoring.