Pacific Salmon Commission, Northern Fund Final Report

Northern & Transboundary Sockeye Salmon Matched Scale-Tissue Sampling – Final Report for Northern Fund, COOP-18-005; NF-2017-I-7

By

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and

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July 2018

Alaska Department of Fish and Game **Division of Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, Special Publications and the Division of Commercial Fisheries Regional Reports. 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 figure 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)	'
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

PACIFIC SALMON COMMISSION, NORTHERN FUND FINAL REPORT

NORTHERN & TRANSBOUNDARY SOCKEYE SALMON MATCHED SCALE-TISSUE SAMPLING YEAR 10

(COOP-18-005; NF-2017-I-7)

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The Regional Information Report Series was established in 1987 and was redefined in 2007 to meet the Division of Commercial Fisheries regional need for publishing and archiving information such as project operational plans, area management plans, budgetary information, staff comments and opinions to Board of Fisheries proposals, interim or preliminary data and grant agency reports, special meeting or minor workshop results and other regional information not generally reported elsewhere. Reports in this series may contain raw data and preliminary results. Reports in this series receive varying degrees of regional, biometric and editorial review; information in this series may be subsequently finalized and published in a different department reporting series or in the formal literature. Please contact the author or the Division of Commercial Fisheries if in doubt of the level of review or preliminary nature of the data reported. Regional Information Reports are available through the Alaska State Library and on the Internet at: http://www.sf.adfg.ak.us/statewide/divreprots/htlm/intersearch.cfm.

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TABLE OF CONTENTS

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

ABSTRACT

Correct estimates of the Nass, Skeena, Stikine, and Taku River sockeye salmon contribution to the commercial catch in Southeast Alaska must be calculated to fulfill Pacific Salmon Treaty harvest-sharing agreements. Matched sockeye salmon scale and tissue samples for stock identification analyses were collected from the weekly catches in the 2017 and early 2018 Southeast Alaska drift gillnet fishing districts 101, 106, 108, and 111. Matched samples were also collected from sockeye harvested in the Southeast Alaska purse seine fisheries in districts 101, 102, 103, and 104. A total of 18,990 matched samples were collected from July 1–August 31, 2017 and 1,135 matched samples were collected from June 1–June 30, 2018. These matched samples will be used to determine the age composition (scales), hatchery contribution (otoliths), and stock composition proportions (DNA) of the sockeye caught in commercial net fisheries in Southeast Alaska.

Key words: sockeye salmon, *Oncorhynchus nerka*, matched biological sampling, scale pattern analysis, Southeast Alaska, Canada, Northern Boundary Area, Transboundary Area

INTRODUCTION

Provisions of the 2009 Pacific Salmon Treaty (PST) specify abundance-based harvest sharing agreements for Canadian Nass and Skeena River and Transboundary Stikine River and Taku River sockeye salmon in selected Southeast Alaska fisheries. In these fisheries the United States is allowed to harvest a fixed percentage of the return of Nass, Skeena, Stikine, and Taku sockeye stocks. Accurate estimates of the catch of these stocks of sockeye salmon in all United States and Canadian commercial fisheries is required, along with escapement estimates, to calculate their total return, and the percentage of that return caught in treaty-limited fisheries.

In the District 104 purse seine fishery, prior to statistical week 31 (late July), the United States is allowed to harvest 2.45% of the combined AAH of Nass and Skeena River sockeye salmon returns (Figure 1). In the District 101 gillnet fishery the United States is allowed to harvest 13.8% of the Annual Allowable Harvest (AAH) of Nass River sockeye stocks (Figure 2). In the Southeast Alaska fishing Districts 106 and 108 the United States is allowed to harvest 50% of the Total Allowable Catch (TAC) of Stikine River sockeye salmon each week as determined by the pre-season forecast and in-season model (Figure3). In Southeast Alaska fishing District 111 the PST specifies that the United States and Canada will manage the return of Taku River sockeye to ensure that each country obtains catches equivalent to their share of wild sockeye and a 50% share of enhanced sockeye (Figure 4). The relative strength of the wild and enhanced returns of sockeye salmon need to be assessed in season by inspecting otoliths for thermal marks to avoid over-harvest of wild stocks.

In the District 106, 108 and 111 gillnet fisheries the United States is allowed to harvest 50% of the annual Total Allowable Catch (TAC) of Stikine River wild and enhanced sockeye salmon. Significant numbers of enhanced sockeye propagated under treaty agreement are caught in the District 106, 108 and 111 gillnet fisheries and the relative strength of the wild and enhanced returns need to be assessed in season by inspecting otoliths for thermal marks to avoid over-harvest of wild stocks.

In 1982 the Alaska Department of Fish and Game conducted a study to determine if scale pattern analysis (SPA) of sockeye salmon scales was useful in discriminating stocks harvested in Southeast Alaska (Marshall, 1984). Results of this study showed that SPA could accurately

distinguish sockeye scales. From 1982–2010 the catch of Canadian Nass and Skeena sockeye salmon in the District 101, 106, and 108 gillnet fisheries and the Districts 101-104 purse seine fisheries has been estimated using scale pattern analysis (SPA). SPA has also been used from 1982–2011 to estimate the catch of Transboundary Stikine River sockeye salmon in the District 106 and 108 gillnet fisheries and the catch of Transboundary Taku River sockeye salmon in the District 111 gillnet fishery.

Scale pattern stock identification analysis of sockeye salmon, primarily based on patterns of freshwater rearing growth, can only identify relatively large groups of stocks; e.g. Alaska, Nass, Skeena, and Stikine. Scale analysis is not cost effective, is labor intensive, time consuming and requires yearly sampling of escapements to form an annual baseline which precludes its use in-season. These and other problems in accurately estimating stock-specific catches and total returns of sockeye salmon resulted in an extensive investigation by the Northern Boundary Technical Committee (NBTC) of the run reconstruction modeling process currently used. The NBTC concluded that improved stock identification techniques capable of accurately estimating specific groups of stocks are needed to accurately evaluate effectiveness of and improve, if possible, existing run reconstruction methods.

Genetic Stock Identification (GSI) analyses are a powerful and well documented technology. Various types of genetic stock identification techniques, including mitochondrial (mDNA) and single nucleotide polymorphism (SNP) analyses, have demonstrated accuracy in estimating the contribution of specific sockeye salmon stocks to mixed stock fisheries in Southeast Alaska and northern British Columbia. Fisheries and Oceans Canada (DFO) started using mixed stock analysis (MSA) based on genetic markers as a marine stock identification tool in 1996. This method has been used along with SPA for stock separation of Canadian Nass and Skeena in-river fisheries and DFO has a long-term plan to use MSA solely in their analysis. Matched scale-tissue samples have allowed side-by-side comparison of GSI and SPA based stock identification estimates in Southeast Alaska fisheries. This will be useful in indexing the new GSI estimates to the SPA estimates which go back to 1982 and were used in calculating the current harvest sharing agreements.

OBJECTIVE

The objective of this study was to representatively collect matched scale and tissue samples from sockeye that were commercially harvested each statistical week from the Districts 101, 106, 108 and 111 gillnet fisheries, the District 182-30 set gillnet fishery, and the Districts 101, 102, 103, and 104 purse seine fisheries. Matched samples are required for several PST related stock identification projects including: 1) Boundary Area Alaska-Nass-Skeena run reconstruction, 2) McDonald Lake run reconstruction, 3) Stikine River run reconstruction, and 4) Taku-Snettisham run reconstruction. Scales were used for age composition and DNA tissues were used for stock identification. Otoliths were used in-season to estimate the relative strength of wild and enhanced McDonald, Taku, Snettisham, and Stikine sockeye returns.

This report covers only matched sampling collection as performed by the Alaska Fish and Game Commercial Fisheries Port Sampling Project. GSI and otolith analysis are separate projects.

METHODS

ADF&G commercial port samplers were stationed onboard tenders buying fish on the fishing grounds and in port during dockside deliveries in Ketchikan, Petersburg, Wrangell, and Juneau. Port samplers determined where a specific boat was fishing or from what fishing districts a tender bought fish and collected up to 40 sockeye salmon from each boat or up to 200 from a tender. Port samplers also collected biological data from each fish, including scale samples, sex,

and an axillary fin clip. A measurement (nearest 5mm mid-eye to fork) was collected for a sub-set of fish that were sampled. Scale samples were collected from the left side of the fish; two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Scales were mounted on gum cards with forceps. Scale samples were sent to the ADF&G Region 1 Scale Aging Laboratory in Douglas weekly for age processing. Impressions of the scales were made in cellulose acetate. Scale impressions were then examined under moderate (70x) magnification to determine age. Criteria used to assign ages were similar to those of Mosher (1968), and ages were reported in European notation (Koo 1962).

For those sockeye salmon sampled from fishing Districts 106, 108, and 111 port samplers applied a uniquely numbered six-digit coordination tag to the fish head so it could later be collected in a processing plant. The six-digit coordination tag number was recorded in the right margin of the ADF&G Commercial Fisheries Age-Sex-Length (ASL) form and on the back of the form for upload into the ADF&G Southeast Region database. Tagged heads were recovered at processing plants and shipped to the ADF&G Thermal Mark Laboratory in Juneau for otolith extraction and processing. The coordination tag number linked the otolith tray and specimen numbers to the scale and DNA specimens.

Approximately 0.5-1 inch of the axillary process or "spine" located above the pelvic fin was collected for DNA from each sockeye using clippers. Each axillary process was placed on a 40 grid Whatman card and then place in a pelican case with desiccant packs to quickly dry out the samples. The Whatman card and individual grid number was recorded next to the corresponding coordination tag number on the ADF&G Matched Sample Form. The Whatman card number was entered into the ADF&G Region database by technicians working in the Douglas Scale Aging Laboratory on a weekly basis. The DNA tissue samples were processed and analyzed by the ADF&G Gene Conservation Laboratory and the Auke Bay Laboratories/Ted Stevens Marine Research Institute.

RESULTS

A total of 19,225 matched scale-tissue samples were collected from July 1, 2017- June 30, 2018 (Tables 1-9). Weekly sampling goals were sometimes not achieved due to low catches or catches from different fisheries being mixed onboard fish tenders before being delivered to processors. District specific purse seine samples are particularly difficult to obtain since numerous areas are open at the same time and seiners move between areas frequently seeking concentrations of fish resulting in mixed sub-area deliveries in port.

DISCUSSION

Pacific Salmon Treaty based harvest sharing agreements were renewed in 2009 for the Northern Boundary area fisheries Alaska District 104 purse seine, Alaska District 101 drift gillnet, Canadian Area 3 net, and Canadian Area 1 troll. The agreements are "abundance based" where the allowable harvest is a percentage of the Annual Allowable Harvest (AAH).

In the District 104 purse seine fishery, from the beginning of the season through Statistical Week 30, of 2.45% of the combined AAH of both the Nass and Skeena River sockeye salmon runs. The District 104 purse seine fishery opens by regulation on the first Sunday in July. In 2017, the first potential opening was July 2 (week 27), but due to Skeena River sockeye salmon concerns ADF&G kept the fishery closed for the first two weeks of the season. The pre-week 31 fishing plan for District 104 was based on the preseason Canadian Department of Fisheries and Oceans (DFO) forecast returns of approximately 1,049,000 Nass and Skeena sockeye salmon (2017 Northern Boundary Technical Committee Bilateral Report in prep).

In the District 101 (Tree Point) drift gillnet fishery, the AAH is calculated as the total run of Nass sockeye salmon minus either the escapement requirement of 200,000 or the actual in-river escapement, whichever is less. The agreement specifies a harvest of 13.8 percent of the AAH of the Nass River sockeye salmon run. The return of Nass sockeye salmon was forecast at 454,000 in 2017 which, minus an escapement goal of 200,000, would result in an AAH of about 254,000 fish. Using this forecast, the 2017 allowable harvest in the District 101 drift gillnet fishery was approximately 35,100 Nass River sockeye salmon. A total of 25,073 sockeye salmon were harvested, which was only 21% of the 1985-2016 average of 117,456 fish and was the lowest harvest since the inception of the Pacific Salmon Treaty (2017 Northern Boundary Technical Committee Bilateral Report in prep).

In 2017 and June 2018 progress in achieving sampling goals, sample quality control, and the quality of record keeping necessary to match stock composition estimates, were monitored daily by port sampling supervisors in Juneau, Ketchikan and Petersburg and on a weekly basis by the regional data coordinator and project supervisor in Juneau. Representative sampling of the landed catch was assured by: 1) sampling landings in Petersburg, Wrangell, Ketchikan, Juneau, and Yakutat; 2) collecting no more than 40 samples from individual fishing boat deliveries or 200 from individual tender deliveries; 3) placing samplers onboard vessels purchasing fish on the grounds to obtain unmixed sub district specific samples; 4) sampling throughout the duration of each weekly opening; and 5) interviewing vessel personnel and checking fish tickets to assure that all fish onboard were caught in the targeted fishery.

Replacement of SPA with an accurate, genetically based, stock identification techniques has facilitated: 1) reduced sampling costs since the annual baseline escapement samples needed for scale analysis will no longer be needed; 2) much finer resolution of individual stocks allowing stock specific migratory routing and timing studies; 3) the potential for in season stock identification analyses which cannot be done with scale analysis because the baseline samples required cannot be collected until early fall; 4) stock specific spawner-recruit analyses; and 5) providing managers with the ability to shift time and area openings to access surplus stocks or avoid weak stocks.

The negotiated percentages of the annual allowable harvest of Nass and Skeena sockeye that can be taken in Alaska's District 101 gillnet and 104 purse seine fisheries are based on average interception rates in these fisheries estimated by scale pattern analyses between 1985 and 1997. Having matched scale-tissue samples has allowed direct comparison of the two techniques which will allow researchers to determine if any apparent changes in interception rates are real or are due to differences in estimates produced by the two techniques. The comparison of both scale patterns analysis and DNA for years 2004-2008 is complete and digitizing of sockeye scales collected in Southeast Alaska Districts 101-104 is no longer conducted following the 2009 collection year.

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Mosher, K. H. 1968. Photographic atlas of sockeye salmon scales. Fishery Bulletin 67(2):243 279.

Pacific Salmon Commission Bilateral Northern Boundary Technical Committee. 2017. U.S./Canada Northern Boundary Area 2016 Salmon Fisheries Management Report and 2018 Preliminary Expectations. Pacific Salmon Comm. Tech. Rep. No. (18)- in prep.

Table 1.–Weekly matched scale-tissue samples collected for stock identification analysis from Alaska's District 101 gillnet fishery July 1, 2017–June 30, 2018.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
8-Jul-17	27	3,131	220
15-Jul-17	28	2,488	256
22-Jul-17	29	2,163	260
29-Jul-17	30	1,945	260
5-Aug-17	31	3,337	260
12-Aug-17	32	2,470	258
19-Aug-17	33	1,048	260
26-Aug-17	34	1,057	121
2-Sep-17	35	1,083	220
23-Jun-18	25	1,109	234
30-Jun-18	26	1,812	260
	Total	21,643	2,609

Table 2.–Weekly matched scale-tissue samples collected for stock identification analysis from Alaska's District 106 gillnet fishery July 1, 2017–June 30, 2018.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
8-Jul-17	27	6,645	536
15-Jul-17	28	6,473	600
22-Jul-17	29	6,359	600
29-Jul-17	30	4,380	346
5-Aug-17	31	3,051	373
12-Aug-17	32	4,015	600
19-Aug-17	33	2,781	568
26-Aug-17	34	869	313
2-Sep-17	35	1,071	326
23-Jun-18	25	427	10
30-Jun-18	26	1,600	80
	Total	37,671	4,352

Table 3.–Weekly matched scale-tissue samples collected for stock identification analysis from Alaska's District 108 gillnet fishery July 1, 2017–September 2nd, 2017. District 108 was not open in June in 2018.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
8-Jul-17	27	3,962	376
15-Jul-17	28	3,388	520
22-Jul-17	29	2,372	520
29-Jul-17	30	1,277	422
5-Aug-17	31	501	250
12-Aug-17	32	874	278
19-Aug-17	33	317	109
26-Aug-17	34	131	56
2-Sep-17	35	110	109
Total		12,932	2,640

Table 4.–Weekly matched scale-tissue samples collected for stock identification analysis from Alaska's District 111 gillnet fishery July 1, 2017–June 30, 2018.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
8-Jul-17	27	2,898	141
15-Jul-17	28	6,229	606
22-Jul-17	29	16,439	800
29-Jul-17	30	24,888	732
5-Aug-17	31	25,464	600
12-Aug-17	32	10,617	600
19-Aug-17	33	7,800	450
26-Aug-17	34	9,391	600
2-Sep-17	35	5,436	200
23-Jun-18	25	350	66
30-Jun-18	26	1300	246
	Total	110,812	5,041

Table 5.–Weekly matched scale-tissue samples collected for scale pattern analysis from Alaska's District 101 purse seine fishery July 2017–September 2017.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
8-Jul-17	27	1,107	192
15-Jul-17	28	980	197
22-Jul-17	29	2,090	243
29-Jul-17	30	783	274
5-Aug-17	31	942	227
12-Aug-17	32	571	260
19-Aug-17	33	1,204	260
26-Aug-17	34	6,651	260
2-Sep-17	35	1,042	130

	Total	15,370	2,043

Table 6.-Weekly matched scale-tissue samples collected for scale pattern analysis from Alaska's District 102 purse seine fishery July 1, 2017 - June 30, 2018.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
8-Jul-17	27	2,981	235
15-Jul-17	28	2,815	260
22-Jul-17	29	3,370	229
29-Jul-17	30	787	0
5-Aug-17	31	59	0
12-Aug-17	32	154	36
19-Aug-17	33	12	0
26-Aug-17	34	344	0
23-Jun-18	25	66	37
30-Jun-18	26	314	202
	Total	10,902	999

Table 7.–Weekly matched scale-tissue samples collected for scale pattern analysis from Alaska's District 103 purse seine fishery July–August 2017.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
29-Jul-17	30	529	0
5-Aug-17	31	33	0
12-Aug-17	32	1,706	175
19-Aug-17	33	2,511	160
26-Aug-17	34	4,657	98
2-Sep-17	35	3,187	7
	Total	12,623	440

Table 8.–Weekly matched scale-tissue samples collected for scale pattern analysis from Alaska's District 104 purse seine fishery July–August 2017.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
22-Jul-17	29	7,492	260
29-Jul-17	30	4,544	0
5-Aug-17	31	19,349	310
12-Aug-17	32	16,269	260
19-Aug-17	33	9,662	300
26-Aug-17	34	20,025	300
2-Sep-17	35	19,182	250
	Total	96,523	1,680

Table 9.–Weekly matched scale-tissue samples collected for scale pattern analysis from Alaska's District 182-30 set gillnet fishery July–August, 2017.

Week Ending	Statistical Week	Sockeye Catch	Matched Scale-Tissue Samples
8-Jul-17	27	734	80
15-Jul-17	28	309	4
22-Jul-17	29	337	77
29-Jul-17	30	389	80
5-Aug-17	31	866	80
	Total	2,635	321

Table 10.–Age composition of sockeye salmon scale samples collected from July 2017–September 2017 in Southeast Alaska net fisheries (ages for late June 2018 samples are pending).

	District	0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3
Drift Gillnet	101		23	1		47	727	14		218	438	3		
	106	2	34			178	2255	22	1	161	828	6	13	8
	108	1	58	3		93	1427	23	1	48	224		12	
	111	30	318	18	9	675	2946	24	1	123	109	1		
Purse Seine	101	4	19			97	917	11	6	126	304		1	
	102	3	2			119	305	5	2	65	72			
	103		1			62	142	1	1	36	54			
	104		3			244	804	8	3	72	105			
Set Gillnet	182-30		13		2	8	151	2		1	9			

Figure 1.–Geographic location of the ADF&G commercial purse seine fisheries in district 101-114.

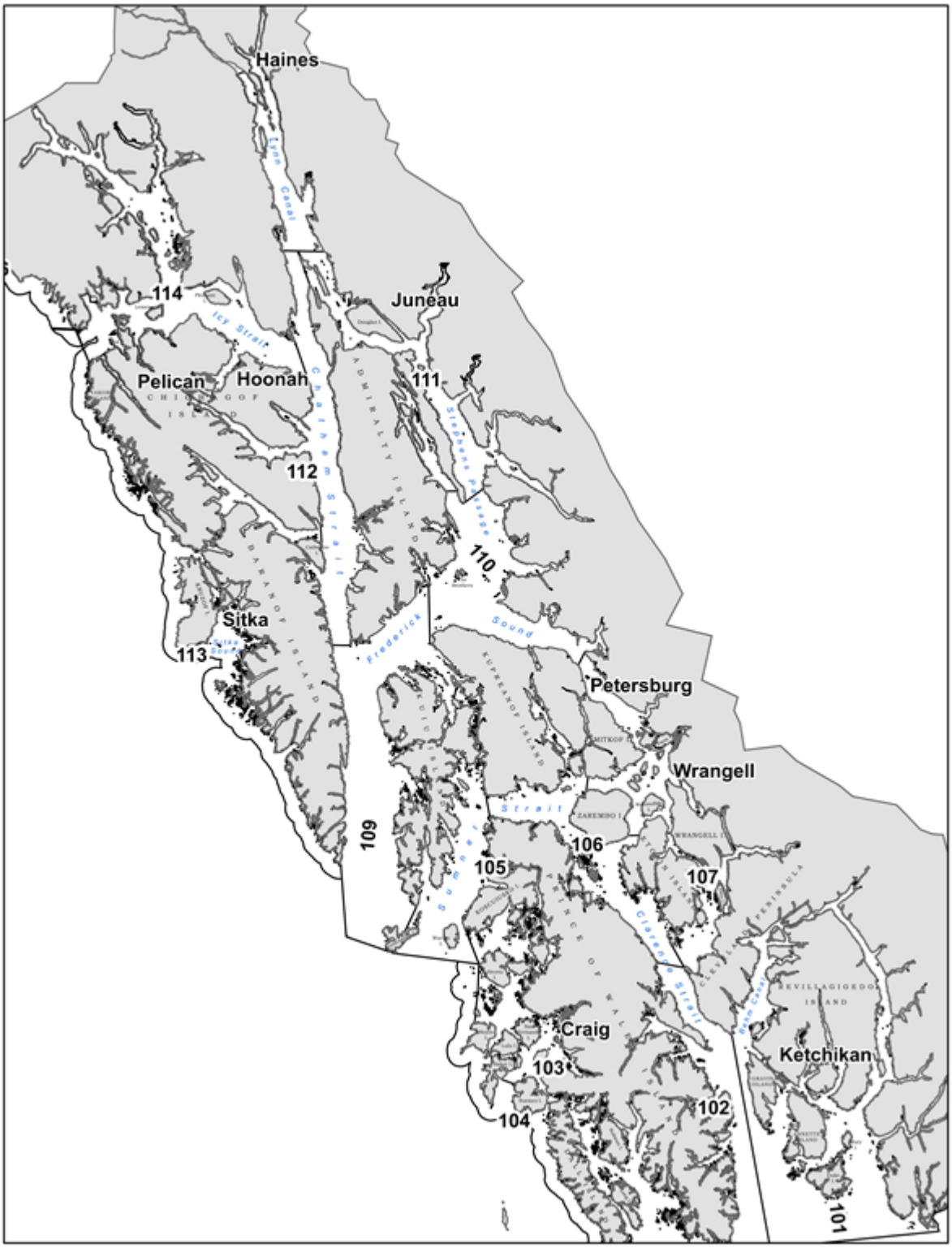


Figure 2.–Geographic location of the ADF&G commercial drift gillnet fishery in district 101-11.

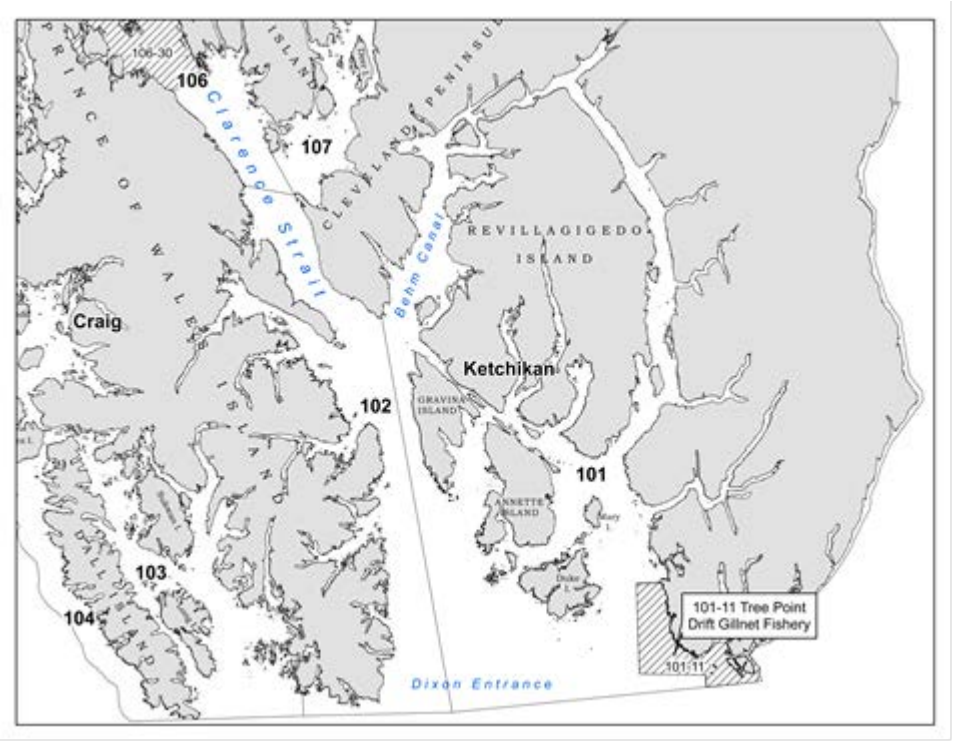


Figure 3.–Geographic location of ADF&G commercial drift gillnet fishery in districts 106 and 108.

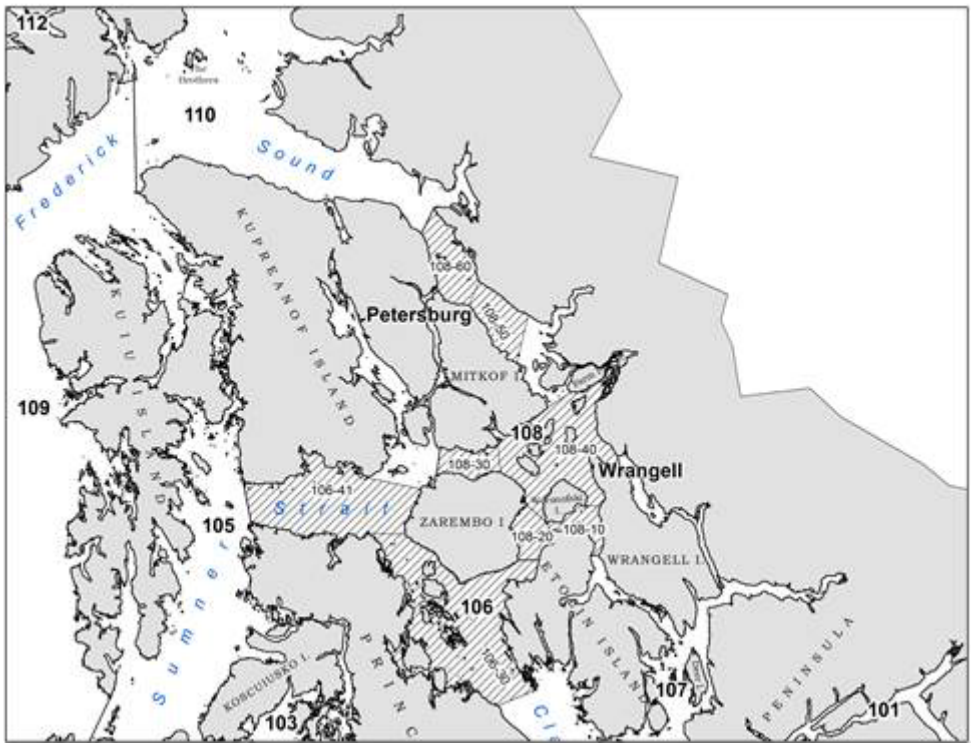
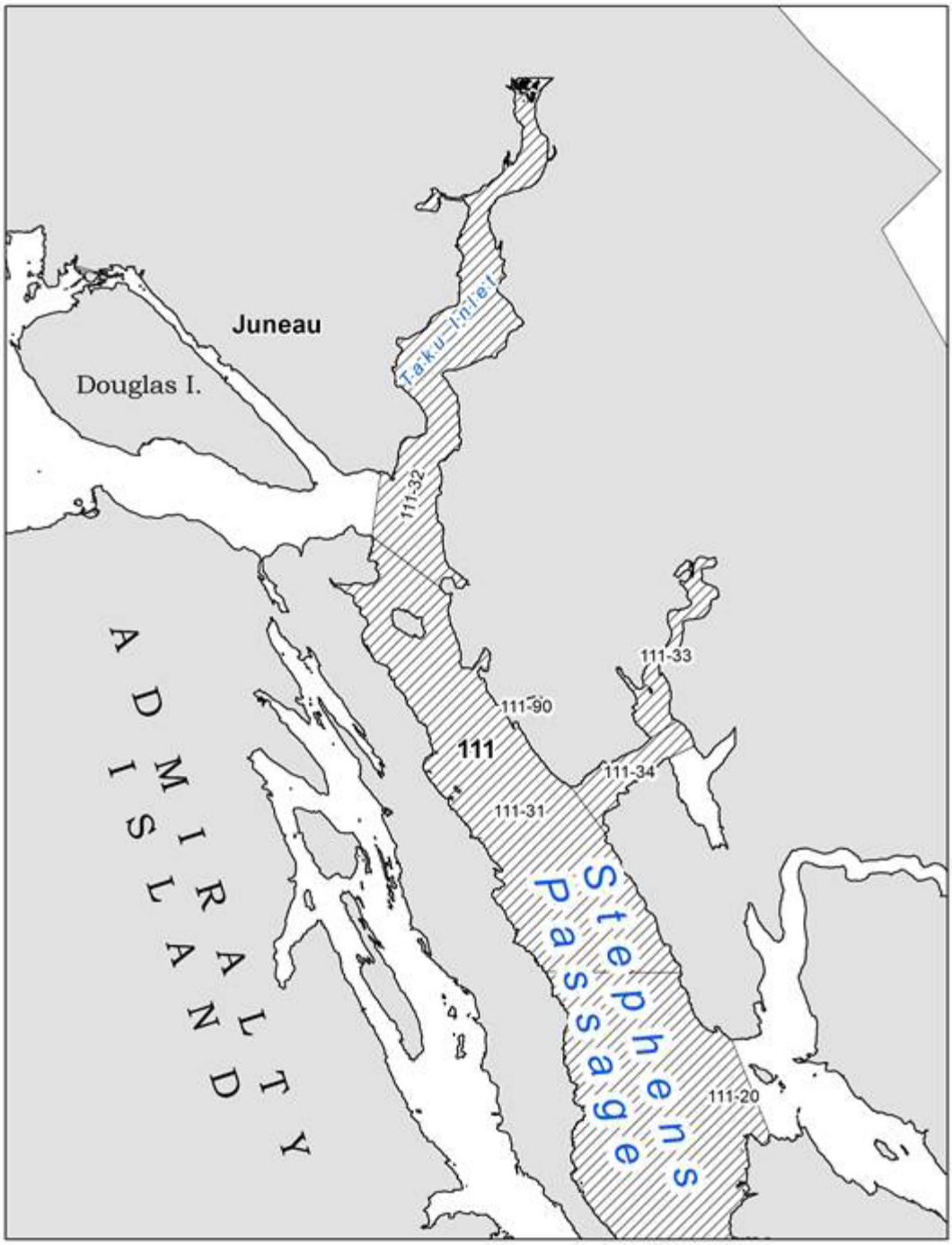


Figure 4.–Geographic location of ADF&G commercial drift gillnet fishery in district 111.



BUDGET SUMMARY

The budget allocation for this project was as follows:

Salary for ADF&G port sampling personnel:		$193,678
Travel; to/from Juneau, Ketchikan, Petersburg, Wrangell		$2,060
Contractual; pay to tenders for onboard samplers, cell phone charges, shipping, etc.		$9,900
Supplies; raingear, forms, tags, gloves, etc.		$3,716
Subtotal Direct	$209,354	
ADF&G Overhead: $209,354 x 22.74%		$44,255
TOTAL		$253,609

Total direct project expenditures by Alaska Fish and Game have not been calculated at the time of this report. All project expenditures by Alaska Fish and Game were for personnel, travel, contractual and commodities related to matched sample collection in Ketchikan, Petersburg, Wrangell, and Juneau as well as project supervision from Juneau. ADF&G personnel coded to this project included: 1) Brandi Adams, Antonio Florendo, Iris Frank, Gabriel Cohen and Esther Bower; Juneau port sampling and Region 1 Scale Laboratory 2) Lezlie Rice, Andrea Gillen and Stephanie Cartwright; Wrangell port sampling; 3) Jennifer McGrath, Jill Walker, Isaiah Navales, Mena Heinl and Kia Arnold; Ketchikan port sampling, 4) Vera Goudima, Matthew Lenard, Vittoria DeAngelis, James Spignesi, Nicholas Hofstad, Brandon Ware, Tyler Lantiegne; and Jeffrey Rice; Petersburg port sampling.