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Hatchery Chum Salmon Contribution to Southern Southeast Alaska Commercial Net Fisheries, 2011–2015

by

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Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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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

FISHERY MANUSCRIPT NO. 22-04

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ABSTRACT

The Southeast Alaska commercial chum salmon harvest increased dramatically over the past 3 decades, primarily due to hatchery production. Hatchery-reared chum salmon accounted for an average 73% of the total common property chum salmon harvest from 2001 to 2010 and 86% from 2011 to 2015. Methods used by hatchery operators to estimate contributions to mixed stock fisheries vary and have not all been described in published reports; likewise, detailed harvest information useful for managing mixed stock fisheries, such as weekly contributions by area, are not readily available. Southern Southeast Regional Aquaculture Association otolith-marks 100% of their chum salmon releases and conducts a comprehensive commercial fisheries sampling program to estimate contributions to regional harvests. Our goal was to document the abundance and distribution of hatchery summer and fall chum salmon, as well as unmarked fish, in the southern Southeast Alaska mixed stock fisheries. From 2011 to 2015, hatchery chum salmon averaged 68% (approximately 908,000 fish) of the overall chum salmon harvest in the District 101–104 and 107 purse seine fisheries combined, and 80% (approximately 457,000 fish) of the District 101, 106, and 108 drift gillnet fisheries combined. Hatchery summer chum salmon harvests in most net fisheries peaked in statistical weeks 27–31 (late June through July). Hatchery fall chum salmon harvests were greatest in District 101 and 106 fisheries and typically peaked in statistical weeks 35–38 (late August to mid-September). Peak harvests of unmarked chum salmon occurred at similar times to marked fish in most cases, indicating that wild and hatchery stocks shared similar run timing in southern Southeast Alaska fisheries.

Keywords: chum salmon, commercial fisheries, drift gillnet, harvest contributions, harvest distribution, hatchery, *Oncorhynchus keta,* otolith, otolith-mark, purse seine, Southeast Alaska

INTRODUCTION

Over the past 5 decades, the commercial common property harvest[1] of chum salmon (*Oncorhynchus keta*) in Southeast Alaska increased from an annual average of 1.8 million fish during 1960–1990 to 7.4 million fish during 1991–2015 (Figure 1). This dramatic increase was largely due to increased hatchery production (Van Alen 2000). In 1980, hatchery operators in Southeast Alaska released 8.7 million chum salmon fry at 8 locations; by 2016, 515 million fry were released at 21 locations (Piston and Heinl 2017; Figure 2). Chum salmon are produced in northern Southeast Alaska by Douglas Island Pink and Chum, Inc. (DIPAC), Armstrong Keta, Inc. (AKI), Sheldon Jackson Hatchery (SJ), Kake Nonprofit Fisheries Corporation (KNFC), and Northern Southeast Regional Aquaculture Association (NSRAA). In southern Southeast Alaska hatchery chum salmon are produced by Metlakatla Indian Community (MIC) and Southern Southeast Regional Aquaculture Association (SSRAA; Figure 2). Based on contribution estimates provided by hatchery operators to the Alaska Department of Fish and Game (ADF&G), hatchery-produced chum salmon accounted for an average 85% of the Southeast Alaska commercial common property chum salmon harvest from 2007 to 2016 (Piston and Heinl 2017). Chum salmon are primarily harvested incidentally to other species in traditional mixed stock fisheries, which are managed based on abundance of other target species (Piston and Heinl 2017). In years when purse seine fisheries were curtailed due to low pink salmon (*O. gorbuscha)* abundance, chum salmon fisheries in terminal hatchery areas have provided fishers a valuable economic safety net (Piston and Heinl 2017).

[1] Common property harvest is total harvest minus hatchery cost recovery fisheries.

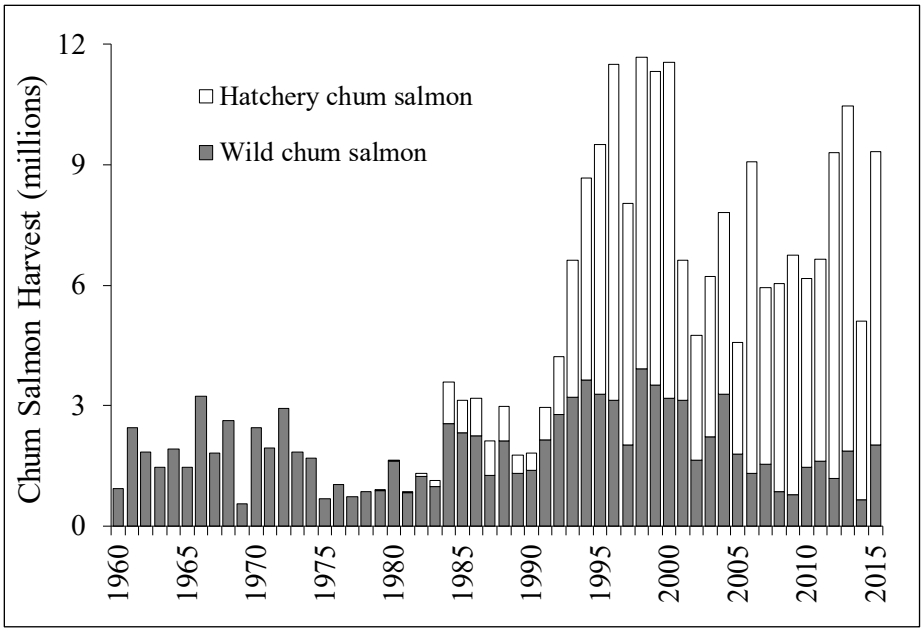

Figure 1.–Common property chum salmon harvest in Southeast Alaska, 1960–2015.

Hatchery operators are required to provide ADF&G with annual estimates of the contribution of hatchery fish to common property commercial fisheries, separated by gear group, which are compiled in an annual ADF&G salmon enhancement report (e.g., Stopha 2016). A large portion of the annual common property chum salmon harvest (59% over the past decade) occurs within terminal harvest areas adjacent to hatchery release sites where stock composition is assumed to be entirely hatchery fish. However, methods used to estimate contributions to mixed stock fisheries outside of terminal harvest areas vary among hatchery operators, from comprehensive thermal mark sampling of fisheries landings to "best estimates," which are sometimes based on consultation with ADF&G management biologists (Heinl 2005). Methods and contribution estimates by fishery and statistical week were provided by Brunette et al. (2013) for southern Southeast Alaska for 2006–2010; however, only certain fisheries are sampled by hatchery operators in the northern half of the region, thus a comprehensive and detailed accounting of hatchery chum salmon harvest regionwide is not currently possible.

Management of traditional mixed stock commercial fisheries is accomplished inseason by adjusting time and area to control harvest in specific areas in accordance with salmon run strength and timing (Gray et al. 2018). Comparisons of current-year fishing performance to historical fishing success (e.g., catch per unit effort [CPUE] analysis) are a major component of inseason run strength assessment, particularly for drift gillnet fisheries. Where inseason management is based on fishery performance, it may be difficult or impossible to gauge wild stock run strength if significant numbers of hatchery fish are present in the harvest (Gray et al. 2018). This is particularly true for chum salmon, because hatchery fish often constitute a very large portion of mixed stock fishery harvests in Southeast Alaska (Heinl 2005; Eggers and Heinl 2008; Piston and Heinl 2011, 2014, 2017).

The most comprehensive information on hatchery chum salmon harvests has been collected by SSRAA, the largest hatchery operator in the southern half of the region (Eggers and Heinl 2008).

SSRAA accounted for 95% of the hatchery chum salmon released in southern Southeast Alaska from 2006 to 2015, including both summer and fall chum salmon, which are primarily harvested in Districts 101–108 (Figures 3 and 4). Marking has long been a fundamental part of SSRAA's research and evaluation process and is used to estimate contribution to mixed stock fisheries, estimate total run size, develop inseason abundance estimates with which to better manage terminal hatchery fisheries, and to improve forecasts. Contributions of SSRAA chum salmon to mixed stock fisheries have been estimated annually through mark–recovery programs; first with coded wire tags in the 1979–2002 release years, then with thermal otolith marks since the 2002 release year (Eggers and Heinl 2008).

In 2005, SSRAA implemented a program to sample and analyze otoliths from traditional mixed stock net fishery landings at Ketchikan and Petersburg. Although this sampling program was not intended to provide precise weekly estimates of the harvest of hatchery fish in every fishery, a very large portion (>90%)[2] of annual harvests in the District 101–108 fisheries have been sampled to some degree (Brunette et al. 2013). A blind test between otolith readers at the ADF&G Thermal Mark Laboratory in Juneau and the SSRAA otolith laboratory in Ketchikan in 2009 and 2010 showed high agreement on specimen identification and reader accuracy (Lorna Wilson, Fishery Biologist, ADF&G Thermal Mark Laboratory, personal communication).

The purpose of this report is to outline methods and results from SSRAA's commercial fisheries sampling program for the 5 years: 2011–2015. The first report in this series (Brunette et al. 2013) covered 2006 to 2010. We document the weekly harvest, distribution, and timing of otolith-marked hatchery summer and fall chum salmon and unmarked chum salmon in the southern Southeast Alaska commercial net fisheries. The information collected by SSRAA forms the most complete data set of its kind in Southeast Alaska, and thus provides valuable insights into trends in the harvest timing and abundance of both hatchery and unmarked chum salmon in southern Southeast Alaska fisheries.

[2] Purse seine fisheries in District 103 were the one exception. From 2012 to 2014 the proportion of total District 103 harvest that was not sampled ranged from 24% to 79%.

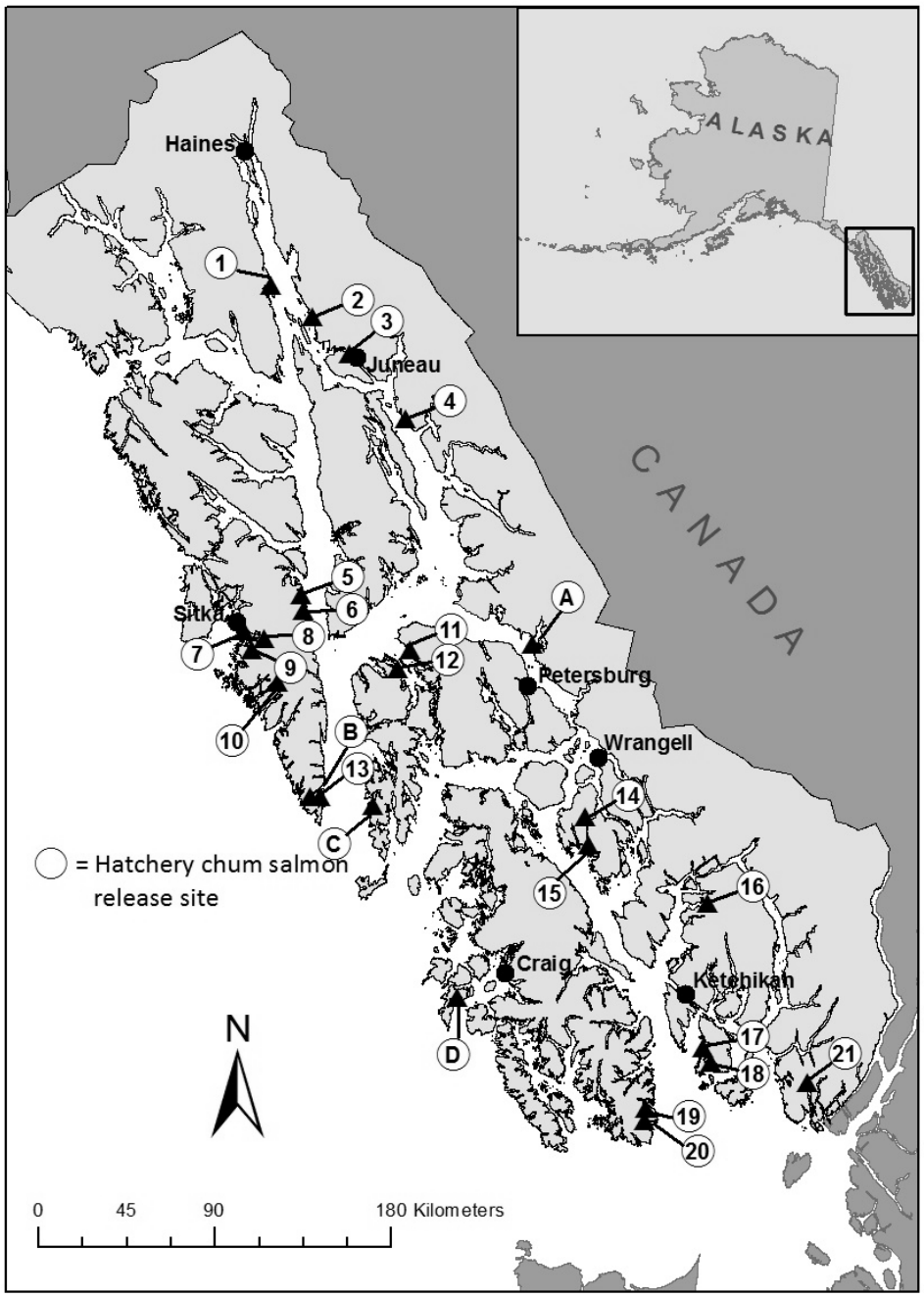

Figure 2.–Map of Southeast Alaska showing major towns and current hatchery chum salmon release sites. Hatchery release sites and operators are represented by numbered circles: (1) Boat Harbor (DIPAC), (2) Amalga Harbor (DIPAC), (3) Gastineau Channel (DIPAC), (4) Limestone Inlet (DIPAC), (5) Kasnyku Bay (NSRAA), (6) Takatz Bay (NSRAA), (7) Crescent Bay (Sitka Sound Science Center), (8) Bear Cove (NSRAA), (9) Deep Inlet (NSRAA), (10) Crawfish Inlet (NSRAA), (11) Kake (Kake Non-Profit Fisheries Corporation), (12) Southeast Cove (NSRAA), (13) Port Armstrong (Armstrong-Keta Inc.), (14) Anita Bay (SSRAA), (15) Burnett Inlet (SSRAA), (16) Neets Bay (SSRAA), (17) Chester Bay (Metlakatla Indian Community), (18) Tamgas Harbor (Metlakatla Indian Community), (19) Kendrick Bay (SSRAA), (20) McLean Arm (SSRAA), and (21) Nakat Inlet (SSRAA). Chum salmon have yet to be released at 4 recently approved release sites as of 2016: (A) Thomas Bay (NSRAA), (B) Port Lucy (Armstrong-Keta Inc.), (C) Port Malmesbury (NSRAA), and (D) Port Asumcion (SSRAA).

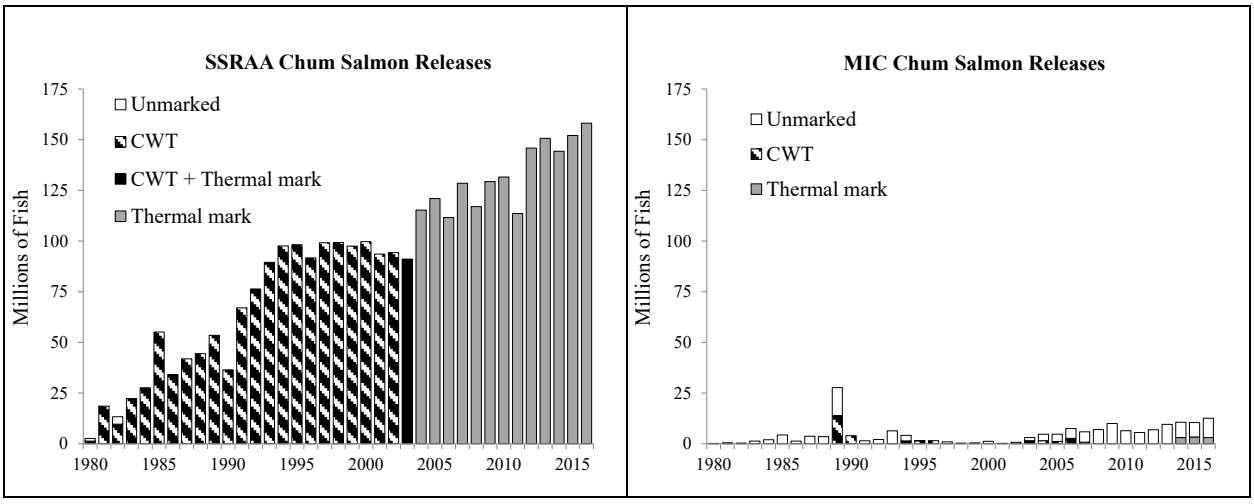

Figure 3.–Number of chum salmon fry released annually by SSRAA and Metlakatla Indian Community (MIC) in southern Southeast Alaska, 1980–2015. Releases are presented by type of mark: unmarked, coded wire tag (CWT), thermal mark, or coded wire tag and thermal mark combined.

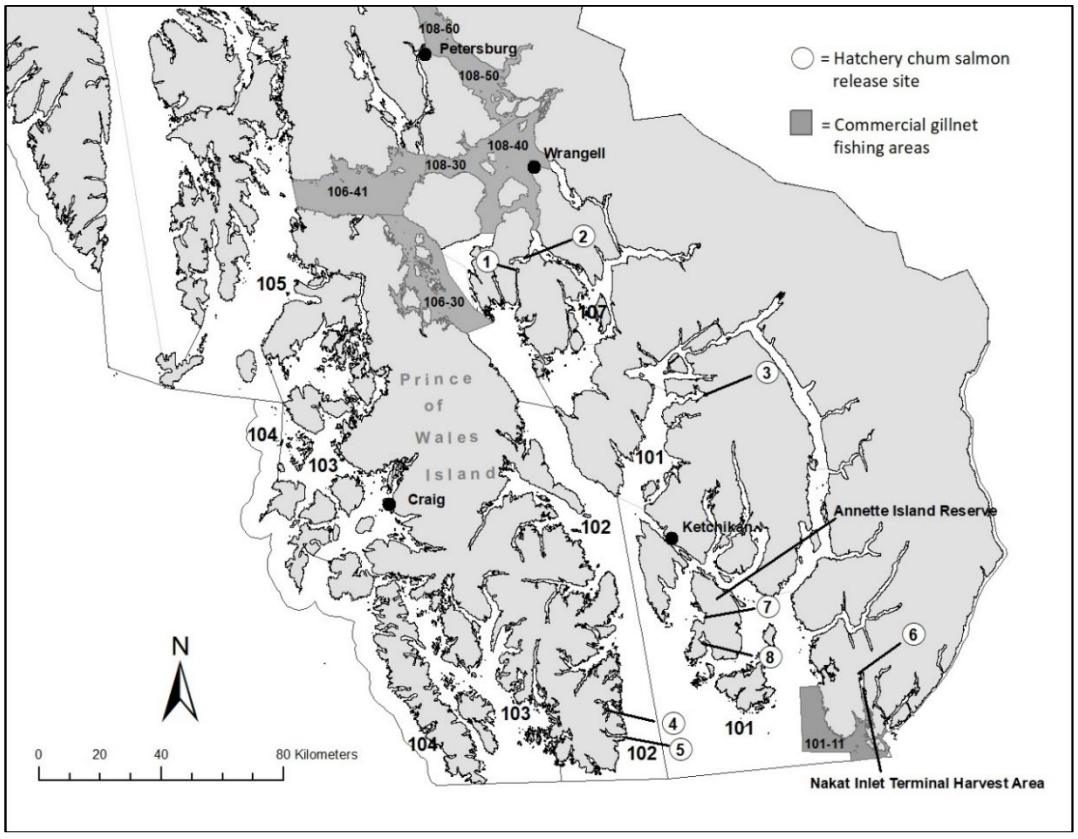

Figure 4.–Map of southern Southeast Alaska showing major towns, current hatchery chum salmon release sites, regulatory districts, and drift gillnet fishing areas mentioned in the text. Hatchery release sites and operators are represented by numbered circles: (1) Burnett Inlet (SSRAA), (2) Anita Bay (SSRAA), (3) Neets Bay (SSRAA), (4) Kendrick Bay (SSRAA), (5) McLean Arm (SSRAA), (6) Nakat Inlet (SSRAA), (7) Chester Bay (MIC), and (8) Tamgas Harbor (MIC).

METHODS

We will report on harvest in southern Southeast Alaska, which encompasses all state waters from Sumner Strait south to Dixon Entrance and is divided into 8 ADF&G regulatory districts (Districts 101–108; Figure 4). Net fisheries in all districts were sampled except fisheries within Annette Island Reserve, in District 101, which is open exclusively to MIC members. Most fish harvested within the reserve were landed at the Annette Island Packing Co., in Metlakatla; however, Annette Island fish were occasionally landed in Ketchikan and opportunistically sampled by SSRAA personnel. We assume that Annette Island harvests are composed of a mixture of wild and MIC and SSRAA hatchery fish, but information from those fisheries are not included in this report.

Information was summarized by "statistical week", a classification used by ADF&G to divide the year into sequentially numbered weeks for management of the salmon fisheries. Each year, statistical week 1 begins the first week of January and ends on the first Saturday of the month; subsequent statistical weeks start on Sunday at 12:01 AM and end on the following Saturday at midnight (see Appendix A for 2011–2015 ADF&G statistical week calendars).

Otolith samples were collected throughout the fishing season by SSRAA personnel stationed at processing facilities in Ketchikan and Petersburg. SSRAA personnel also traveled to Wrangell periodically throughout the 2012–2015 seasons to collect samples. Weekly sample sizes were established to provide estimates within 5% of the true value 95% of the time, as described by Hagen (2001), and adjusted inseason as necessary. A maximum of 12 otolith samples were collected from individual drift gillnet or purse seine boats and 36 samples were collected from tenders; however, more samples were routinely collected from tenders in areas where opportunities to sample tender deliveries were limited (e.g., ≤48 samples per tender from the Districts 106 and 108 drift gillnet fisheries). Sampling events were distributed throughout the week, and subdistricts with the most fishing effort were sampled more often. Tender deliveries with fish from more than 1 gear type or fishing district were not sampled. Deliveries with fish from multiple harvest types were sampled if confirmed from ADF&G fish tickets that 95% or more of the fish were from only 1 harvest type; however, all samples collected from terminal harvests were excluded from this analysis. Whenever possible, samples were collected systematically from the entire hold as it was offloaded to ensure they were representative of the entire delivery.

The left and right sagittal otoliths were dissected from whole fish, cleaned using a treatment described by Hagen et al. (1995), and air dried. The right otolith was mounted to a microscope slide using thermoplastic glue and ground to reveal the primordia and potential thermal mark. A compound microscope was used to examine prepared specimens and identify thermal marks. Detailed information including hatch code, mark identification, brood year, rearing agency, and catch data were catalogued for each specimen in a Microsoft Access database. Prior to the start of each season, SSRAA staff created a key of all SSRAA marks that might be encountered that year to assist with mark identification and to maintain consistency between readers. The key included voucher photos, measurements, and possible variations of SSRAA marks along with mark variations from other agencies. Additional notes were compiled for thermal marks that were particularly similar in appearance to help readers differentiate between them. When a thermal mark was indistinguishable, it was entered into the database as "questionable", and questionable samples were excluded from this analysis. Samples collected from multiple districts or terminal fisheries were also excluded.

All otolith samples were read inseason, usually within 3–5 days of collection. Samples from fisheries that contained a wide variety of marks from various agencies (e.g., District 106 and 108 drift gillnet fisheries) and any questionable samples were all read a second time postseason. For all other areas, 20% of otoliths were read a second time postseason.

UNMARKED HATCHERY CHUM SALMON

For this analysis, we report proportions of "marked" and "unmarked" chum salmon, rather than "hatchery" and "wild" chum salmon, because not all hatchery fish were otolith-marked. Hatchery chum salmon harvested between 2011 and 2015 were released as fry between 2006 and 2013 (Table 1). MIC released a total of 55.6 million unmarked summer chum salmon from 2 sites at Annette Island during that time (Figure 4), which represented 5% of all hatchery chum salmon released in southern Southeast Alaska. Hatchery operators in northern Southeast Alaska (north of Sumner Strait; Figure 3) also released unmarked chum salmon that could not be identified in fisheries samples: 38 million unmarked chum salmon were released by SJ (2006–2010), 73 million unmarked chum salmon were released by KNFC (2007, 2008, and 2010), and 165 million unmarked chum salmon were released by NSRAA (2005–2012). The total proportion of unmarked hatchery chum salmon released regionwide ranged from 2% to 18% from 2006 to 2013.

In addition to unmarked Alaska hatchery fish, unmarked chum salmon from British Columbia hatcheries in Canada would also not be detectable in southern Southeast Alaska commercial harvests. Unmarked hatchery chum salmon releases from the North Coast and Haida Gwaii regions of British Columbia averaged 7.7 million fish from 2006 to 2013, representing an average 8% of total annual provincial releases (NPAFC 2018a). Most British Columbia hatchery chum salmon production occurs along the southern coast and west coast of Vancouver Island, where approximately 34% of annual hatchery releases were thermal marked (2006–2013; NPAFC 2018b). Although most hatchery chum salmon harvested in southern Southeast Alaska are of SSRAA origin (Brunette et al. 2013), harvest estimates of hatchery chum salmon likely underrepresent the actual contribution due to the presence of unmarked hatchery fish.

Table 1.–Hatchery fish brood years that contributed to harvests sampled in 2011–2015.

		Age and return year			
Brood year	Release year	0.2	0.3	0.4	0.5
2005	2006	–	–	–	2011
2006	2007	–	–	2011	2012
2007	2008	–	2011	2012	2013
2008	2009	2011	2012	2013	2014
2009	2010	2012	2013	2014	2015
2010	2011	2013	2014	2015	–
2011	2012	2014	2015	–	–
2012	2013	2015	–	–	–

SAMPLING THE COMMERCIAL DRIFT GILLNET FISHERIES

District 101

The traditional District 101 drift gillnet fishery takes place entirely within subdistrict 101-11, located around Tree Point at the southernmost end of the Southeast Alaska mainland (Figure 4). Virtually all of the District 101 drift gillnet harvest was delivered by tenders to 2 processing

facilities in Ketchikan. Gillnetters also harvest hatchery chum salmon within the adjacent Nakat Inlet Terminal Harvest Area (THA) in subdistrict 101-10 (Figure 4). Tenders occasionally kept the traditional harvest from subdistrict 101-11 separate from the terminal harvest from subdistrict 101-10 by putting fish in separate holds; however, it was common for fish from both subdistricts to arrive in Ketchikan mixed together. Samples from THA harvests and mixed harvest type landings were not included in this analysis. The District 101-11 traditional drift gillnet fishery was sampled weekly from mid-June to mid-September each year.

District 106

The District 106 drift gillnet fishery bends around the northeastern tip of Prince of Wales Island and is composed of 2 main areas: Sumner Strait (subdistrict 106-41) and northern Clarence Strait (subdistrict 106-30; Figure 4). Most of the subdistrict 106-41 harvest was delivered directly to the dock in Petersburg by individual boats or tenders. Most of the subdistrict 106-30 harvest was delivered to Ketchikan by tenders; however, depending on run strength and distribution of boats, tenders routinely moved from one subdistrict to another to accommodate the fishing fleet, consequentially mixing fish from different subdistricts onboard before returning to port. For this reason, ADF&G deployed a tender rider specifically to collect biological samples from subdistrict 106-30 and to flag chum salmon for SSRAA samplers in Ketchikan. Otolith samples were collected from both subdistricts weekly from mid-June to the 3rd week of September, except in 2015 when samples were only collected from subdistrict 106-30 through the 1st week of September.

District 108

District 108 lies between the mainland and Mitkof Island and includes waters surrounding the entrance to the Stikine River. Fish harvested in subdistricts 108-10, 108-30, 108-40, 108-50, and 108-60 were delivered to Petersburg, Wrangell, and Ketchikan (Figure 4). To ensure sampling effort was distributed over the entire district and not mixed with other districts, tender operators in District 108 set aside some chum salmon for SSRAA personnel to sample in Ketchikan and Petersburg. Otolith samples were collected weekly from late June through early-to-mid August, except in 2011 and 2012 when samples were collected through early September.

SAMPLING THE COMMERCIAL PURSE SEINE FISHERIES

Nearly all chum salmon harvested in Districts 101 and 102 purse seine fisheries were delivered to processing facilities in Ketchikan, where SSRAA samplers and staff had access to individual boat and tender deliveries. Otolith samples were collected weekly from mid-June to early September. Chum salmon harvested along the west coast of Prince of Wales Island in Districts 103 and 104 were delivered to Petersburg, Craig, and Ketchikan (Figure 4). No SSRAA samplers were stationed at Craig, because purse seine fisheries on the outer coast were not a high sampling priority due to the small proportion of SSRAA hatchery chum salmon in the harvest. Adequate sampling opportunities for these outer coast fisheries, however, were available to SSRAA staff based in Petersburg and Ketchikan. Samples from Districts 105, 106, and 107 purse seine fisheries were primarily collected by a SSRAA sampler stationed in Petersburg.

DATA ANALYSIS

Data analysis was very similar to that outlined in Heinl et al. (2007). Let π_i denote the proportion of otolith marks in 1 of the sampling domains (i.e., statistical weeks), and suppose there are D total

domains (i = 1,2,3, ... D). Let n_i denote the number of sampled otoliths decoded in statistical week i, and let x_i denote the number of otolith marks observed from statistical week i. We assumed independent binomial models for the number of otolith marks, x_i:

$$x_i \sim \text{Bin}(n_i, \pi_i),\ i = 1, \ldots D,$$

with the number of sampled otoliths decoded, n_i , known. The parameters π_i were assumed to be independent samples from a beta distribution:

$$\pi_i \sim \text{Beta}(\alpha, \beta),\ i = 1, \ldots D.$$

The beta distribution is a prior distribution for π_i. To estimate the prior parameters, α and β, we used all the data, $\{\pi_i\} = \{x_i / n_i\}$, from total domains ($i$ = 1 ... D). Since $\pi_i \sim$ Beta (α, β), we have:

$$E(\pi_i) = \frac{\alpha}{\alpha+\beta}, \text{var}(\pi_i) = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)};$$

Then we have:

$$\alpha + \beta = \frac{E(\pi_i)(1-E(\pi_i))}{\text{var}(\pi_i)} - 1,$$

$$\alpha = (\alpha+\beta)E(\pi_i), \text{ and}$$

$$\beta = (\alpha+\beta)(1-E(\pi_i)).$$

$E(\pi_i)$ and $var(\pi_i)$ were estimated as the sample mean, $\bar{\pi} = \frac{1}{D}\sum_{i=1}^{D}\pi_i$, and sample variance, $s^2 = \frac{1}{D-1}\sum_{i=1}^{D}(\pi_i - \bar{\pi})^2$, respectively. The analysis using the data to estimate the prior parameters is called empirical Bayes (Gelman et al. 2004).

The beta distribution is a conjugate prior for binomial likelihood; that is, the posterior distributions are also beta distributions with new parameters, ($\alpha + x_i$) and ($\beta + n_i - x_i$):

$$\pi_i|(x_i \text{ and } n_i) \sim \text{Beta}(\alpha + x_i, \beta + n_i - x_i),\ i = 1,2,3, \ldots D.$$

The posterior mean of π_i, given x_i and n_i, which can be interpreted as the proportion of otolith marks from the population in statistical week i, is now

$$E(\pi_i) = \frac{\alpha + x_i}{\alpha + \beta + n_i}, \tag{1}$$

which always lies between the sample proportion, x_i / n_i, and the prior mean, $\alpha /(\alpha+\beta)$. The posterior variance is

$$\text{var}(\pi_i) = \frac{(\alpha + x_i)(\beta + n_i - x_i)}{(\alpha+\beta+n_i)^2(\alpha+\beta+n_i+1)}. \tag{2}$$

Inference about the proportions of otolith-marked chum salmon in each domain was calculated through this posterior distribution. We then reported the posterior mean and a measure of precision (credible interval) for each sampling domain (Appendices D and E). Harvest estimates for otolith-marked summer and fall chum salmon were reported rounded to the nearest thousand fish, which, in some cases, resulted in a different sum than the total marked chum salmon harvest estimate, rounded to the nearest thousand fish.

In order to calculate total annual proportions of marked and unmarked fish, we had to account for weeks that were not sampled. In many cases, unsampled weeks were at the beginning or the end of the season when the weekly harvest was small and samples were difficult to obtain. In these situations, we pooled statistical weeks. If the unsampled week was in the middle of the season, sample size, harvest, and proportions of marked and unmarked fish in the preceding and following weeks were evaluated to determine if the unsampled week should be pooled with adjacent weeks.

RESULTS

DISTRICT 101 DRIFT GILLNET FISHERY

From 2011 to 2015, otolith-marked hatchery fish accounted for an average 79% of the chum salmon harvested in the District 101 drift gillnet fishery, or an annual average of 241,000 fish (Table 2). The coefficient of variation of these estimates ranged from 1.1% (2014) to 2.0% (2011). The harvest of otolith-marked summer chum salmon peaked in early July (statistical weeks 28–29) in all years except for 2015 when the harvest peaked in late July (statistical week 31). The harvest of otolith-marked fall chum salmon peaked in late August–early September (statistical weeks 35–36). Hatchery summer chum salmon returning to Nakat Inlet represented an average 49% of the total marked otoliths recovered, followed by Nakat Inlet fall chum salmon (27%), Neets Bay summer chum salmon (8%), and Kendrick Bay/McLean Arm summer chum salmon (7%; Appendix B). Marked fish from northern Southeast Alaska hatchery release sites (NSRAA, DIPAC, and AKI) accounted for <0.5% of marked otoliths recovered annually.

Table 2.–Proportion of otolith-marked and unmarked chum salmon harvested in the District 101 drift gillnet fishery, 2011–2015.

	Total chum salmon	Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	340,000	80%	271,000	261,000–281,000	20%	69,000	58,000–79,000
2012	314,000	82%	258,000	251,000–266,000	18%	56,000	48,000–64,000
2013	232,000	79%	183,000	178,000–188,000	21%	49,000	44,000–54,000
2014	184,000	75%	139,000	136,000–142,000	25%	45,000	42,000–49,000
2015	453,000	78%	354,000	343,000–365,000	22%	99,000	88,000–110,000
Average		79%	241,000		21%	64,000	

2011

Otolith-marked hatchery chum salmon represented an estimated 80% of the total chum salmon harvest in the District 101 drift gillnet fishery in 2011 (Table 2). We estimated 231,000 of all otolith-marked fish were summer chum salmon, and 40,000 were fall chum salmon (Appendix D). A peak harvest of 59,100 hatchery summer chum salmon occurred in statistical week 29 and a peak harvest of 13,300 hatchery fall chum salmon occurred in statistical week 36 (Figure 5, Appendix D). Hatchery summer chum salmon were dominant in the fishery through statistical

week 32, and the fishery transitioned to a fall chum salmon fishery by statistical week 34 (Figure 5). A peak harvest of 17,100 unmarked summer chum salmon occurred in statistical week 30, and a peak harvest of 2,500 unmarked fall chum salmon occurred in statistical week 35 (Figure 5, Appendix D).

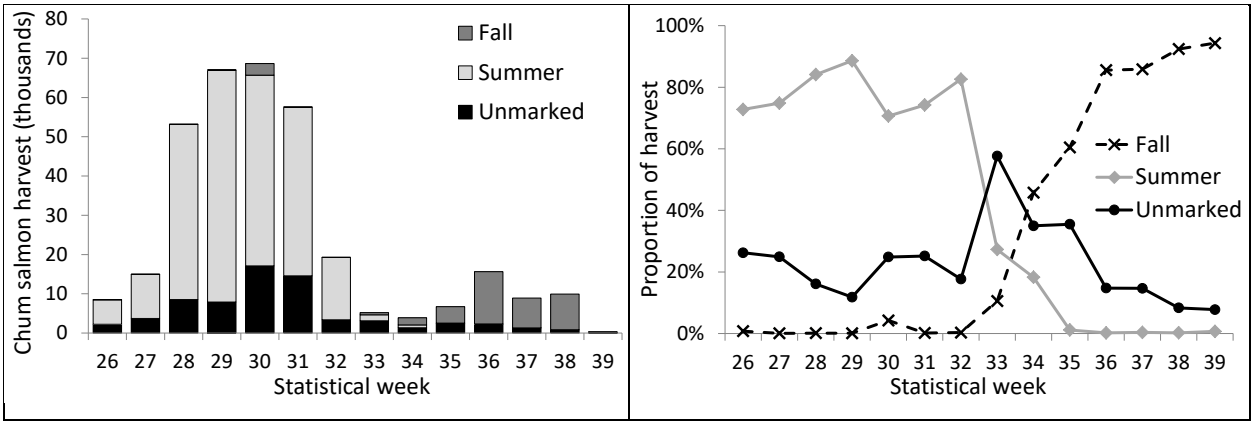

Figure 5.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 drift gillnet harvest, 2011.

2012

Otolith-marked hatchery chum salmon represented an estimated 82% of the total chum salmon harvest in the District 101 drift gillnet fishery in 2012 (Table 2). We estimated 230,000 of all otolith-marked fish were summer chum salmon and 29,000 were fall chum salmon (Appendix D). A peak harvest of 47,400 hatchery summer chum salmon occurred in statistical week 28 and a peak harvest of 7,500 hatchery fall chum salmon occurred in statistical week 36 (Figure 6, Appendix D). The transition from a summer chum salmon dominant fishery to a fall chum salmon fishery occurred during statistical week 34 (Figure 6). A peak harvest of 8,100 unmarked summer chum salmon occurred in statistical week 31, and a peak harvest of 5,100 unmarked fall chum salmon occurred in statistical week 34 (Figure 6, Appendix D).

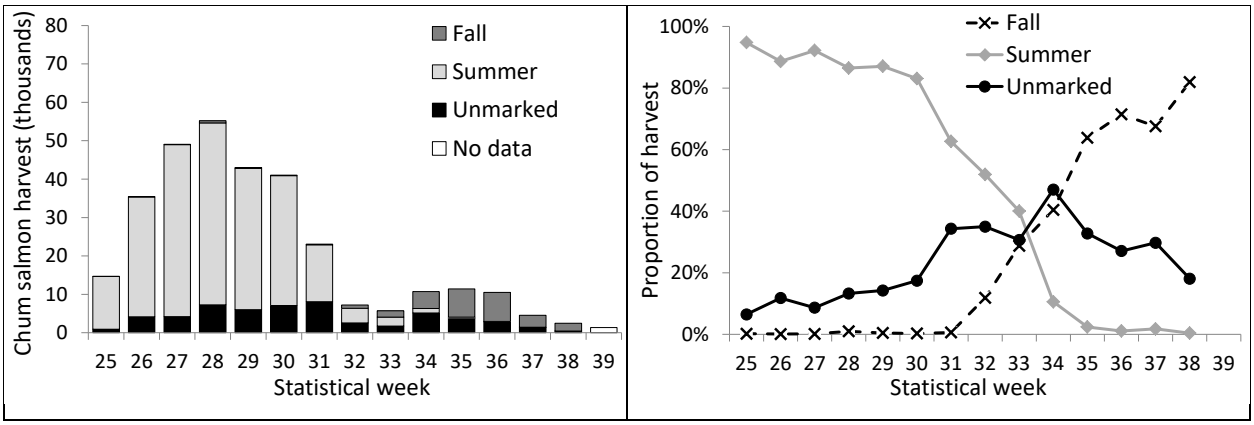

Figure 6.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 drift gillnet harvest, 2012. No samples were collected in statistical week 39.

2013

Otolith-marked hatchery chum salmon represented an estimated 79% of the total chum salmon harvest in the District 101 drift gillnet fishery in 2013 (Table 2). We estimated 162,000 of all otolith-marked fish were summer chum salmon and 22,000 were fall chum salmon (Appendix D). A peak harvest of 44,500 hatchery summer chum salmon occurred in statistical week 28 and a peak harvest of 7,000 hatchery fall chum salmon occurred in statistical week 35 (Figure 7, Appendix D). The transition from a summer chum salmon dominant fishery to fall chum salmon dominant fishery occurred in statistical week 34 (Figure 7). A peak harvest of 8,800 unmarked summer chum salmon occurred in statistical week 28, and a peak harvest of 4,100 unmarked fall chum salmon occurred in statistical week 34 (Figure 7, Appendix D).

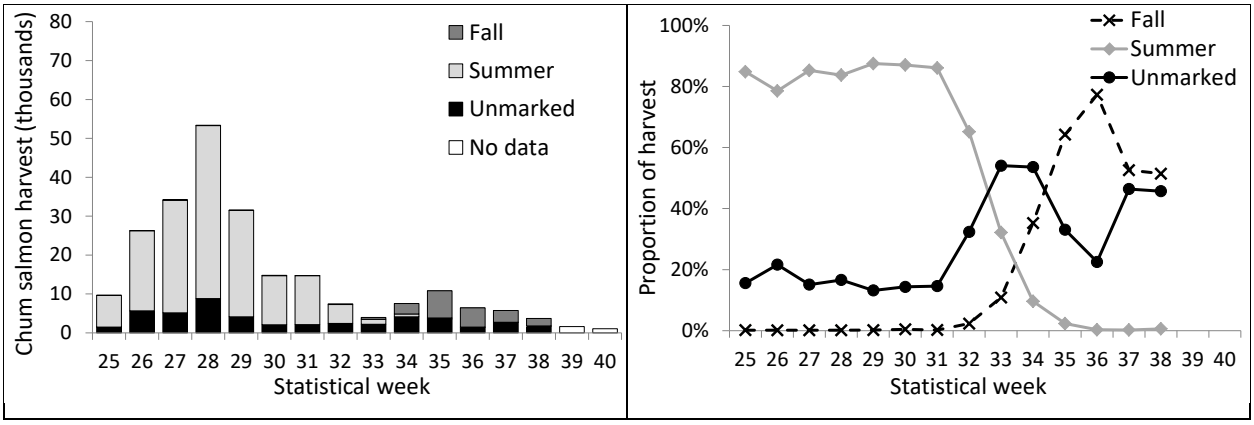

Figure 7.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 drift gillnet harvest, 2013. No samples were collected in statistical weeks 39–40.

2014

Otolith-marked hatchery chum salmon represented an estimated 75% of the total chum salmon harvest in the District 101 drift gillnet fishery in 2014 (Table 2). We estimated 120,000 of all

otolith-marked fish were summer chum salmon and 19,000 were fall chum salmon (Appendix D). A peak harvest of 33,200 hatchery summer chum salmon occurred in statistical week 28, and a peak harvest of 4,600 hatchery fall chum salmon occurred in statistical week 36 (Figure 8, Appendix D). The transition from a summer chum salmon dominant fishery to fall chum salmon dominant fishery occurred during statistical week 35 (Figure 8). A peak harvest of 7,600 unmarked summer chum salmon occurred in statistical week 29, and a peak harvest of 3,600 unmarked fall chum salmon occurred in statistical week 36 (Figure 8, Appendix D).

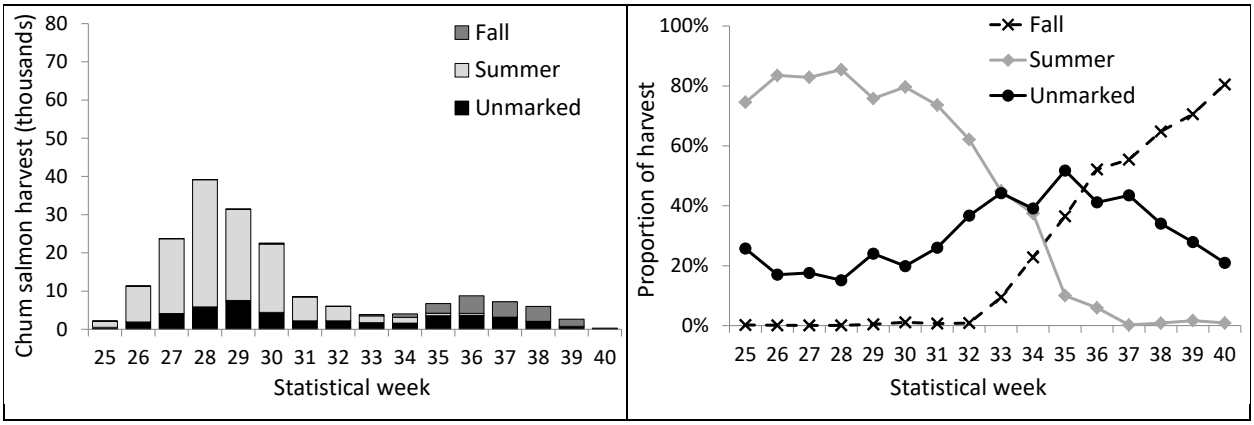

Figure 8.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 drift gillnet harvest, 2014.

2015

Otolith-marked hatchery chum salmon represented an estimated 78% of the total chum salmon harvest in the District 101 drift gillnet fishery in 2015 (Table 2). We estimated 245,000 of all otolith-marked fish were summer chum salmon and 105,000 were fall chum salmon (Appendix D). A peak harvest of 55,800 hatchery summer chum salmon occurred in statistical week 31, and a peak harvest of 29,200 hatchery fall chum salmon occurred in statistical week 36 (Figure 9, Appendix D). The transition from a summer chum salmon dominant fishery to fall chum salmon dominant fishery occurred during statistical week 34 (Figure 9). A peak harvest of 19,700 unmarked summer chum salmon occurred in statistical week 31, and a peak harvest of 8,000 unmarked fall chum salmon occurred in statistical week 36 (Figure 9, Appendix D).

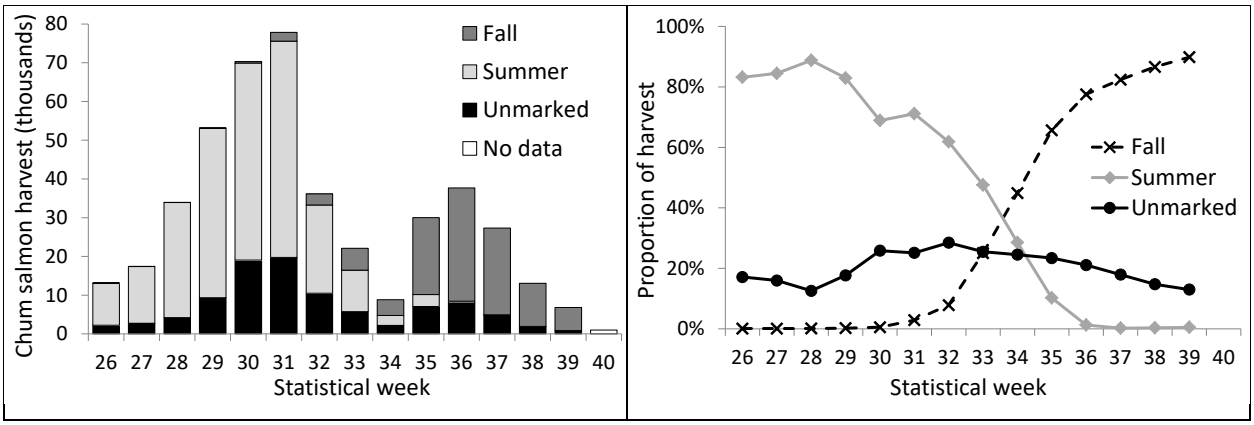

Figure 9.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 drift gillnet harvest, 2015. No samples were collected in statistical week 40.

DISTRICT 106 DRIFT GILLNET FISHERY

No samples were obtained from the subdistrict 106-41 chum salmon harvest of 111,169 fish in 2015; thus, estimates for total District 106 harvest were only available from 2011 to 2014. Otolith-marked hatchery fish accounted for an average 77% of the chum salmon harvest in the District 106 drift gillnet fishery in those years (Table 3). The coefficient of variation of these estimates ranged from 1.1% (2014) to 1.9% (2013). In 2015, otolith-marked hatchery fish accounted for 89% of the chum salmon harvest in the subdistrict 106-30 drift gillnet fishery (Table 3). Generally, otolith-marked summer chum salmon were dominant in the fishery from late June to late July (statistical weeks 27–31). Abundance of unmarked and otolith-marked fall chum salmon peaked simultaneously from late August to mid-September (statistical weeks 35–37) in most years. Hatchery summer chum salmon returning to Anita Bay represented an average 37% of the total marked otoliths recovered, followed by Neets Bay summer chum salmon (33%), Neets Bay fall chum salmon (15%), and Kendrick Bay/McLean Arm summer chum salmon (9%; Appendix B). Marked DIPAC and NSRAA hatchery fish from northern Southeast Alaska release sites accounted for an average 5% and 1% of marked otoliths recovered, respectively.

Table 3.–Proportion of otolith-marked and unmarked chum salmon caught in the District 106 drift gillnet fishery, 2011–2015.

		Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	Total chum salmon harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	158,000	72%	115,000	112,000–118,000	27%	43,000	40,000–47,000
2012	104,000	79%	82,000	81,000–84,000	21%	22,000	20,000–24,000
2013	94,000	72%	68,000	66,000–71,000	28%	26,000	23,000–29,000
2014	106,000	82%	87,000	85,000–89,000	18%	19,000	17,000–21,000
2011–2014 Average		77%	88,000		23%	27,500	
2015	121,000[a]	89%	108,000	105,000–111,000	11%	13,000	10,000–16,000

[a] Subdistrict 106-41was not sampled in 2015. Chum salmon harvest is from subdistrict 106-30.

2011

Otolith-marked hatchery chum salmon represented an estimated 73% of the total chum salmon harvest in the District 106 drift gillnet fishery in 2011 (subdistricts 106-30 and 106-41 combined; Table 3). We estimated 88,000 of all otolith-marked fish were summer chum salmon and 28,000 were fall chum salmon (Appendix D). A peak harvest of 21,100 hatchery summer chum salmon occurred in statistical week 29 and a peak harvest of 10,600 hatchery fall chum salmon occurred in statistical week 38 (Figure 10, Appendix D). The transition from a summer chum salmon dominant fishery to fall chum salmon dominant fishery occurred during statistical week 34 (Figure 10). A peak harvest of 5,300 unmarked summer chum salmon occurred in statistical week 31 and a peak harvest of 7,000 unmarked fall chum salmon occurred in statistical week 38 (Figure 10, Appendix D).

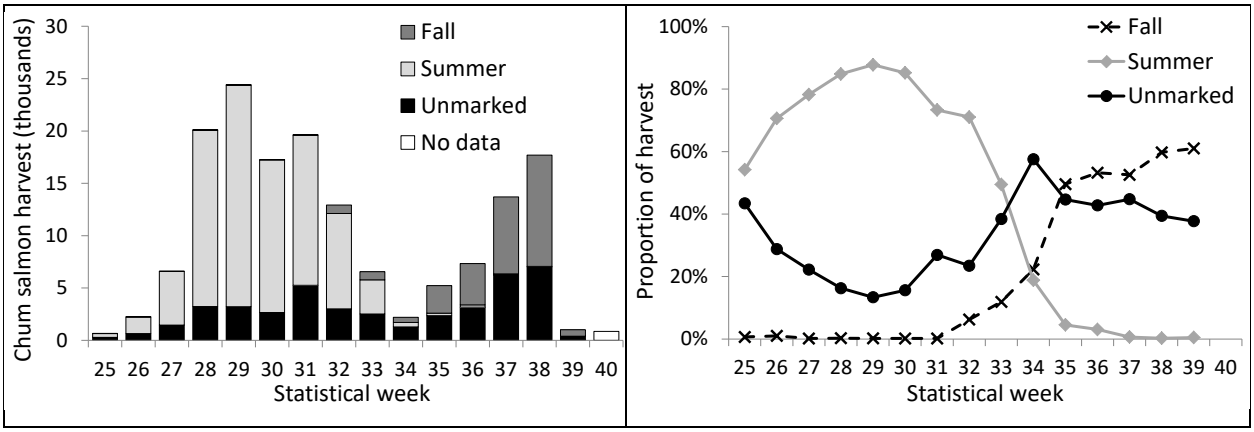

Figure 10.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 106 drift gillnet harvest (subdistrict 106-30 and subdistrict 106-41 combined), 2011. No samples were collected in statistical week 40.

2012

Otolith-marked hatchery chum salmon represented an estimated 79% of the total chum salmon harvest in the District 106 drift gillnet fishery in 2012 (subdistricts 106-30 and 106-41 combined; Table 3). We estimated that 76,000 of all otolith-marked fish were summer chum salmon and 7,000 were fall chum salmon (Figure 11). A peak harvest of 16,900 hatchery summer chum salmon occurred in statistical week 27, and the peak harvest of 1,600 hatchery fall chum salmon occurred in statistical week 35 (Figure 11, Appendix D). The transition from a summer chum salmon dominant fishery to fall chum salmon dominant fishery occurred during statistical week 34 (Figure 11). A peak harvest of 3,300 unmarked summer chum salmon occurred in statistical week 30, and the peak harvest of 2,000 unmarked fall chum salmon occurred in statistical week 36 (Figure 11, Appendix D).

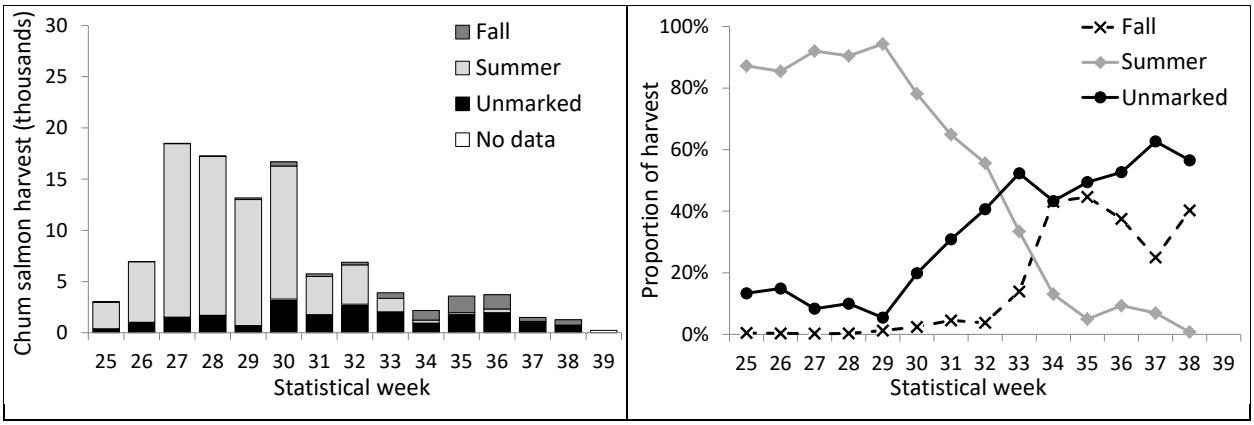

Figure 11.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 106 drift gillnet harvest (subdistrict 106-30 and subdistrict 106-41 combined), 2012. No samples were collected in statistical week 39.

2013

Otolith-marked hatchery chum salmon represented an estimated 72% of the total chum salmon harvest in the District 106 drift gillnet fishery in 2013 (subdistricts 106-30 and 106-41 combined; Table 3). We estimated 68,000 of all otolith-marked fish were summer chum salmon and 1,000 were fall chum salmon (Appendix D). A peak harvest of 13,200 hatchery summer chum salmon occurred in statistical week 29 (Figure 12). Weekly harvests of hatchery fall chum salmon were estimated to be less than 250 fish all season. A peak harvest of 5,500 unmarked summer chum salmon occurred in statistical week 29, and a peak harvest of 1,300 unmarked fall chum salmon likely occurred in statistical week 35 (Figure 12, Appendix D).

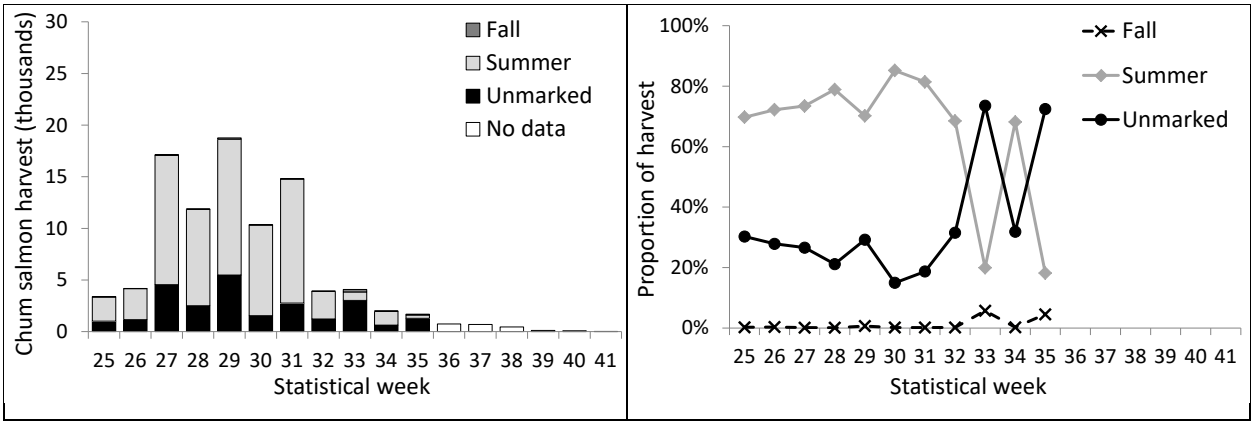

Figure 12.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 106 drift gillnet harvest (subdistrict 106-30 and subdistrict 106-41 combined), 2013. No samples were collected in statistical weeks 36–41.

2014

Otolith-marked hatchery chum salmon represented an estimated 82% of the total chum salmon harvest in the District 106 drift gillnet fishery in 2014 (subdistricts 106-30 and 106-41 combined; Table 3). We estimated 74,000 of all otolith-marked fish were summer chum salmon and 13,000

were fall chum salmon (Appendix D). A peak harvest of 19,600 hatchery summer chum salmon occurred in statistical week 28, and a peak harvest of 4,700 hatchery fall chum salmon occurred in statistical week 37 (Figure 13, Appendix D). The transition from a summer chum salmon dominant fishery to fall chum salmon dominant fishery occurred during statistical week 35 (Figure 13). A peak harvest of 2,700 unmarked summer chum salmon occurred in statistical week 30, and a peak harvest of 2,300 unmarked fall chum salmon occurred in statistical week 37 (Figure 13, Appendix D).

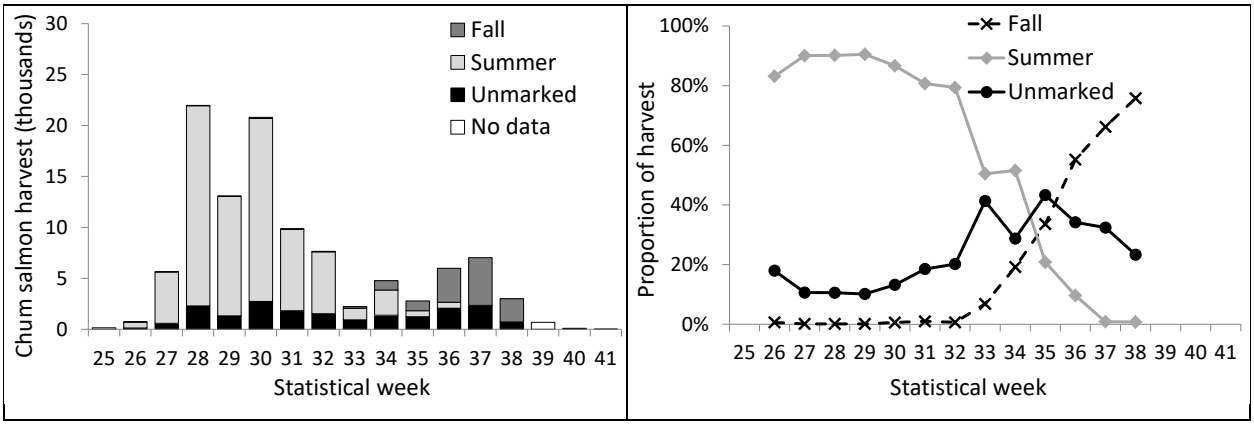

Figure 13.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 106 drift gillnet harvest (subdistrict 106-30 and subdistrict 106-41 combined), 2014. No samples were collected in statistical weeks 25 and 39–41.

2015

The subdistrict 106-41 drift gillnet fishery was not sampled in 2015. Otolith-marked hatchery chum salmon represented an estimated 91% of the total chum salmon harvest in the subdistrict 106-30 drift gillnet fishery in 2015 (Table 3). We estimated 96,000 of all otolith-marked fish in that subdistrict were summer chum salmon and 12,000 were fall chum salmon (Appendix D). A peak harvest of 25,600 hatchery summer chum salmon occurred in statistical week 31, and a peak harvest of 3,600 hatchery fall chum salmon occurred in statistical week 36 (Figure 13, Appendix D). The transition from a summer chum salmon dominant fishery to fall chum salmon dominant fishery occurred during statistical week 34 (Figure 13). A peak harvest of 3,600 unmarked summer chum salmon occurred in statistical week 32, and a peak harvest of 700 unmarked fall chum salmon occurred in statistical week 36 (Figure 13, Appendix D).

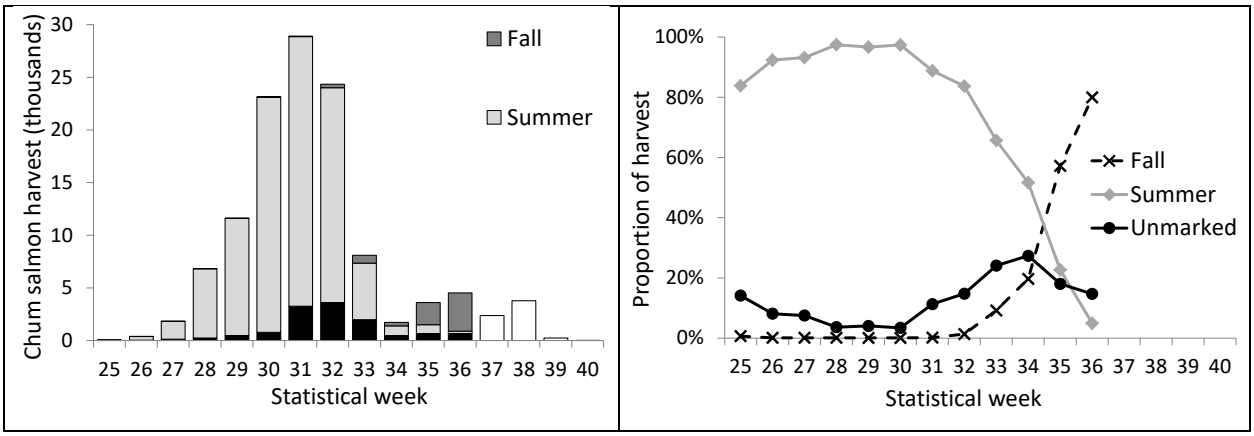

Figure 14.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly subdistrict 106-30 drift gillnet harvest (subdistrict 106-41 not included), 2015. No samples were collected in statistical weeks 37–40; harvest from subdistrict 106-41 was not sampled in 2015.

DISTRICT 108 DRIFT GILLNET FISHERY

From 2011 to 2015, otolith-marked hatchery fish accounted for an average 81% of the chum salmon harvested in the District 108 drift gillnet fishery (Subdistricts 108-10, 108-20, 108- 30, 108-40, 108-41, 108-50, and 108-60 combined; Table 4). The coefficient of variation of these estimates ranged from 0.5% (2015) to 4.0% (2011). Hatchery summer chum salmon returning to Anita Bay represented an average 85% of the total marked otoliths recovered, followed by Neets Bay summer chum salmon (6%; Appendix B). Very few fall chum salmon were harvested in District 108. Marked DIPAC hatchery fish from northern Southeast Alaska hatchery release sites accounted for an average 6% of marked otoliths recovered annually; fish from NSRAA release sites accounted for <1% of marked otoliths recovered annually.

Table 4.–Proportion of otolith-marked and unmarked chum salmon caught in the District 108 drift gillnet fishery, 2011–2015.

		Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	Total chum salmon harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	143,000	62%	89,000	82,000–96,000	38%	53,000	46,000–61,000
2012	241,000	90%	216,000	211,000–220,000	10%	25,000	21,000–30,000
2013	103,000	73%	76,000	72,000–79,000	27%	28,000	24,000–31,000
2014	85,000	80%	68,000	64,000–71,000	20%	17,000	13,000–21,000
2015	166,000	98%	162,000	161,000–164,000	2%	4,000	2,000–5,000
Average		81%	122,000		19%	25,000	

2011

Otolith-marked hatchery chum salmon represented an estimated 62% of the total chum salmon harvest in the District 108 drift gillnet fishery in 2011 (Table 4). We estimated 88,000 of all otolith-marked fish were summer chum salmon and 1,000 were fall chum salmon (Appendix D). Peak

harvests of hatchery summer chum salmon (34,700 fish) and unmarked summer chum salmon (17,400 fish) occurred in statistical week 32 (Figure 15, Appendix D).

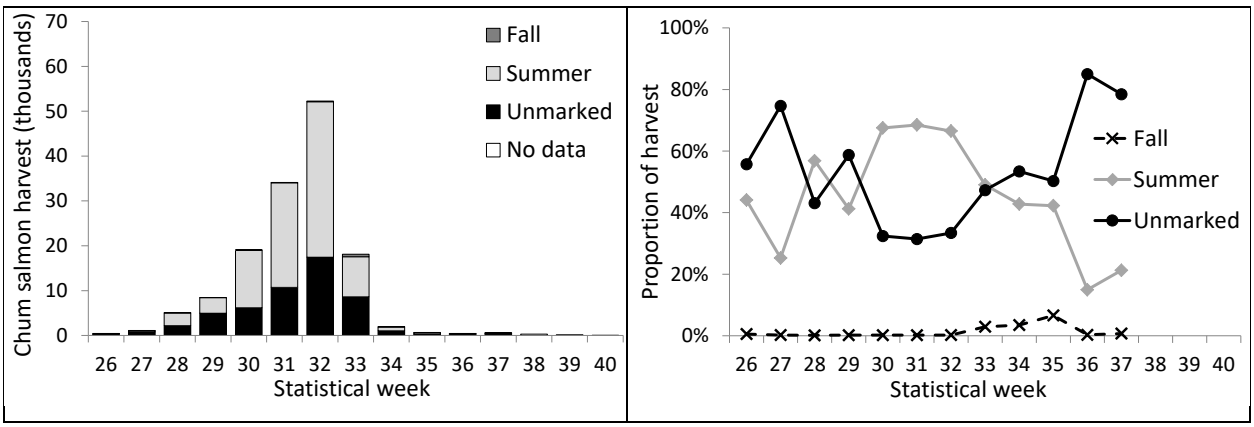

Figure 15.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 108 drift gillnet harvest, 2011. No samples were collected in statistical weeks 38–40.

2012

Otolith-marked hatchery chum salmon represented an estimated 90% of the 2012 total chum salmon harvest in the District 108 drift gillnet fishery (Table 4). We estimated 215,000 of all otolith-marked fish were summer chum salmon and 500 were fall chum salmon (Appendix D). A peak harvest of 65,600 hatchery summer chum salmon occurred in statistical week 29, and a peak harvest of 7,300 unmarked summer chum salmon occurred in statistical week 28 (Figure 16, Appendix D).

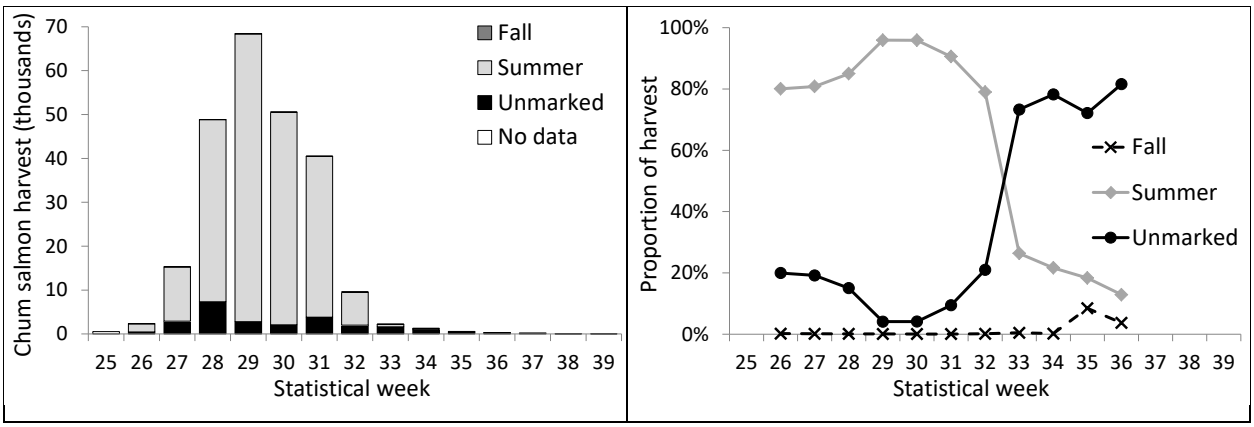

Figure 16.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 108 drift gillnet harvest, 2012. No samples were collected in statistical weeks 25 and 37–39.

2013

Otolith-marked hatchery chum salmon represented an estimated 73% of the 2013 total chum salmon harvest in the District 108 drift gillnet fishery (Table 4). We estimated 75,600 of all otolith-

marked fish were summer chum salmon. No otolith-marked fall chum salmon were identified in samples collected through statistical week 33 in 2013 (Appendix D). A peak harvest of 23,100 hatchery summer chum salmon occurred in statistical week 29, and a peak harvest of 6,200 unmarked summer chum salmon occurred in statistical week 32 (Figure 17).

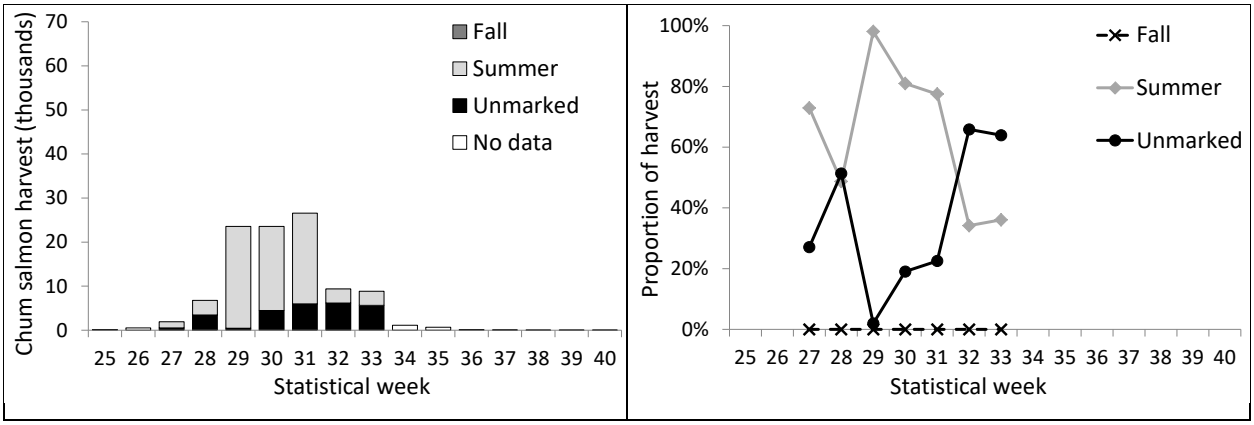

Figure 17.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 108 drift gillnet harvest, 2013. No samples were collected in statistical weeks 25–26 and 34–40.

2014

Otolith-marked hatchery chum salmon represented an estimated 80% of the 2014 total chum salmon harvest in the District 108 drift gillnet fishery (Table 4). We estimated 67,600 of all otolith-marked fish were summer chum salmon. No otolith-marked fall chum salmon were identified in the samples collected through statistical week 32 (Appendix D). A peak harvest of 28,800 hatchery summer chum salmon occurred in statistical week 30, and a peak harvest of 4,100 unmarked summer chum salmon occurred in statistical week 29 (Figure 18, Appendix D).

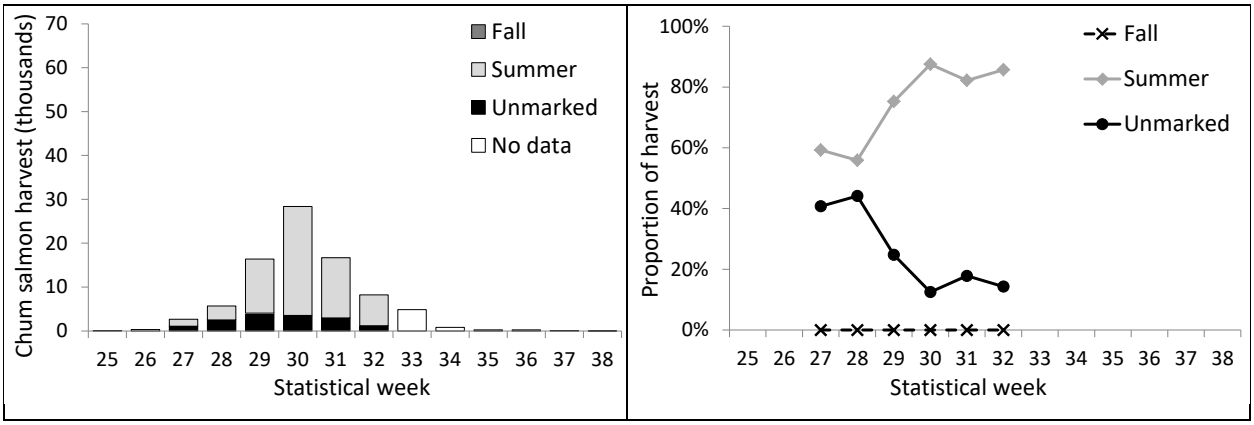

Figure 18.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 108 drift gillnet harvest, 2014. No samples were collected in statistical weeks 25–26 and 33–38.

2015

Otolith-marked hatchery chum salmon represented an estimated 98% of the 2015 total chum salmon harvest in the District 108 drift gillnet fishery (Table 4). We estimated 161,900 of all otolith-marked fish were summer chum salmon and 1,000 were fall chum salmon (Appendix D). A peak harvest of 44,400 hatchery summer chum salmon occurred in statistical week 31, and a peak harvest of 1,300 unmarked summer chum salmon occurred in statistical week 33 (Figure 19, Appendix D).

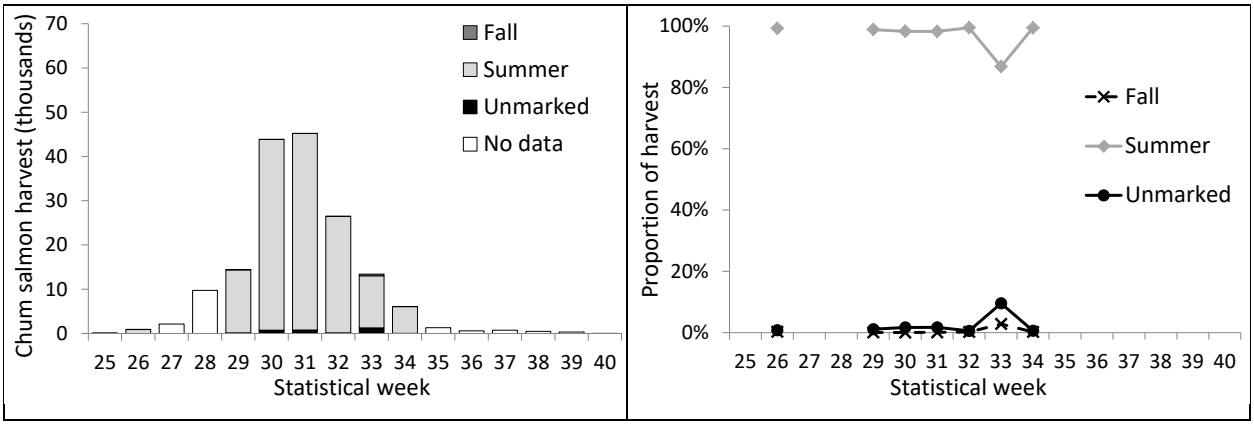

Figure 19.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 108 drift gillnet harvest, 2015. No samples were collected in statistical weeks 25, 27–28, and 35–40.

DISTRICT 101 PURSE SEINE FISHERY

From 2011 to 2015, the proportion of otolith-marked hatchery fish in the chum salmon harvest in the District 101 purse seine fishery ranged from 48% (2014) to 73% (2015) and averaged 60% (Table 5). The coefficient of variation of these estimates ranged from 1.8% (2015) to 4.4% (2012). The proportion of otolith-marked summer chum salmon was above 50% in almost all weeks through statistical week 31. The peak harvest of unmarked chum salmon occurred in statistical weeks 30 or 31. Hatchery summer chum salmon returning to Neets Bay represented an average 44% of the total marked otoliths recovered, followed by Kendrick Bay/McLean Arm summer chum salmon (22%), Nakat Inlet summer chum salmon (13%), and Anita Bay and Neets Bay fall chum salmon (10%; Appendix C). Marked fish from northern Southeast Alaska hatchery release sites (NSRAA, DIPAC, and AKI combined) accounted for <1% of marked otoliths recovered annually.

Table 5.–Proportion of otolith-marked and unmarked chum salmon caught in the District 101 purse seine fishery, 2011–2015.

		Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	Total chum salmon harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	103,000	63%	65,000	61,000–69,000	37%	38,000	34,000–42,000
2012	188,000	56%	106,000	97,000–115,000	44%	82,000	73,000–91,000
2013	184,000	59%	109,000	103,000–114,000	41%	76,000	70,000–81,000
2014	152,000	48%	73,000	69,000–77,000	52%	78,000	74,000–83,000
2015	578,000	73%	423,000	407,000–438,000	27%	156,000	141,000–171,000
Average		60%	155,200		40%	86,000	

2011

Otolith-marked hatchery chum salmon represented an estimated 63% of the 2011 total chum salmon harvest in the District 101 purse seine fishery (Table 5). We estimated 63,000 of all otolith-marked fish were summer chum salmon and 3,000 were fall chum salmon. Peak harvests of hatchery summer chum salmon (42,100 fish) and unmarked chum salmon (17,400 fish) occurred in statistical week 30 (Figure 20, Appendix E).

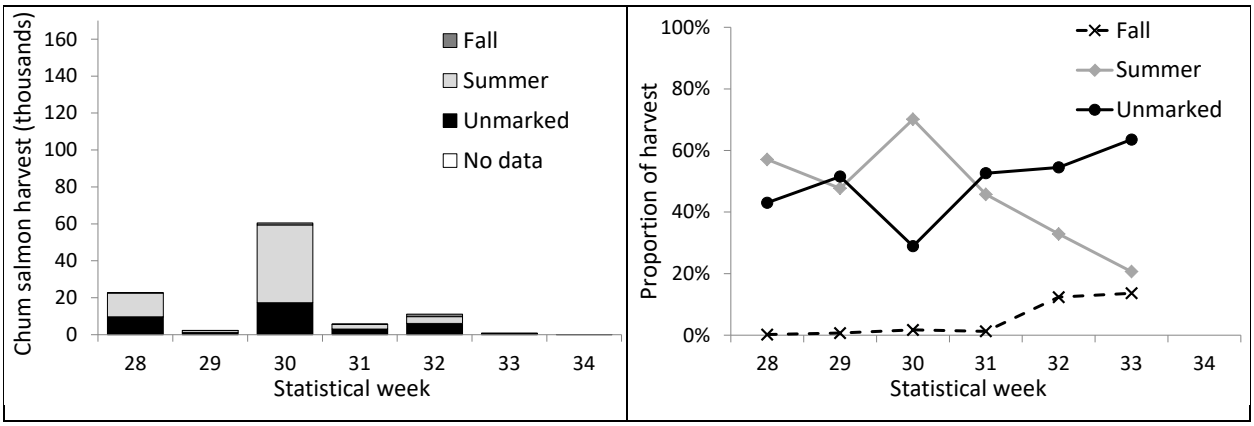

Figure 20.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 purse seine harvest, 2011. No samples were collected in statistical week 34.

2012

Otolith-marked hatchery chum salmon represented an estimated 56% of the 2012 total chum salmon harvest in the District 101 purse seine fishery (Table 5). We estimated 79,000 of all otolith-marked fish were summer chum salmon and 28,000 were fall chum salmon. A peak harvest of 25,900 hatchery summer chum salmon occurred in statistical week 30 and a peak harvest of 15,100 hatchery fall chum salmon occurred in statistical week 34. The peak harvest of 15,200 unmarked chum salmon occurred in statistical week 31 (Figure 21, Appendix E).

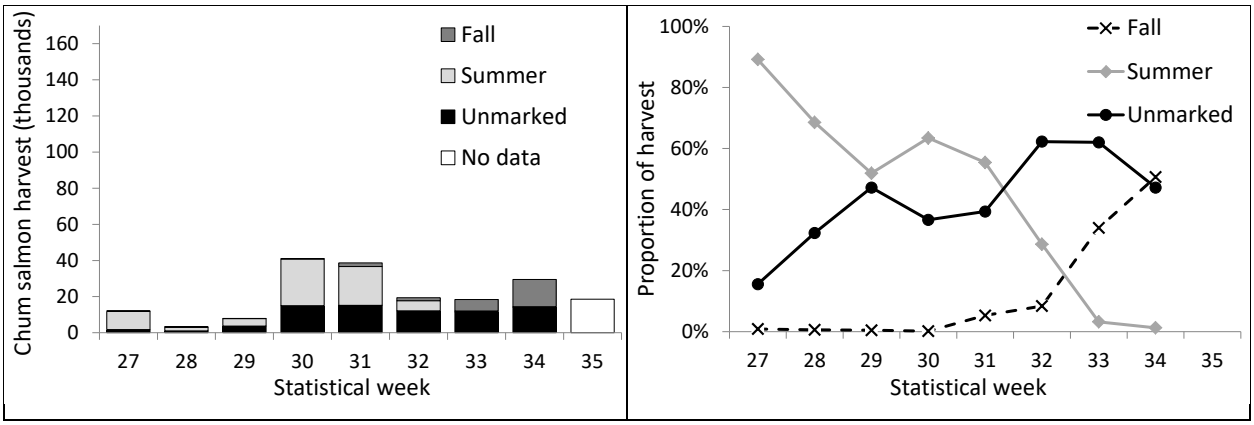

Figure 21.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 purse seine harvest, 2012. No samples were collected in statistical week 35.

2013

Otolith-marked hatchery chum salmon represented an estimated 59% of the 2013 total chum salmon harvest in the District 101 purse seine fishery (Table 5). We estimated that 105,000 of all otolith-marked fish were summer chum salmon and 4,000 were fall chum salmon. A peak harvest of 28,400 hatchery summer chum salmon occurred in statistical week 30 and a peak harvest of 1,000 hatchery fall chum salmon occurred in statistical week 35 (Figure 22, Appendix E). The peak harvest of 14,300 unmarked chum salmon occurred in statistical week 31 (Figure 22, Appendix E). Unmarked chum salmon represented the largest proportion of the harvest after statistical week 31.

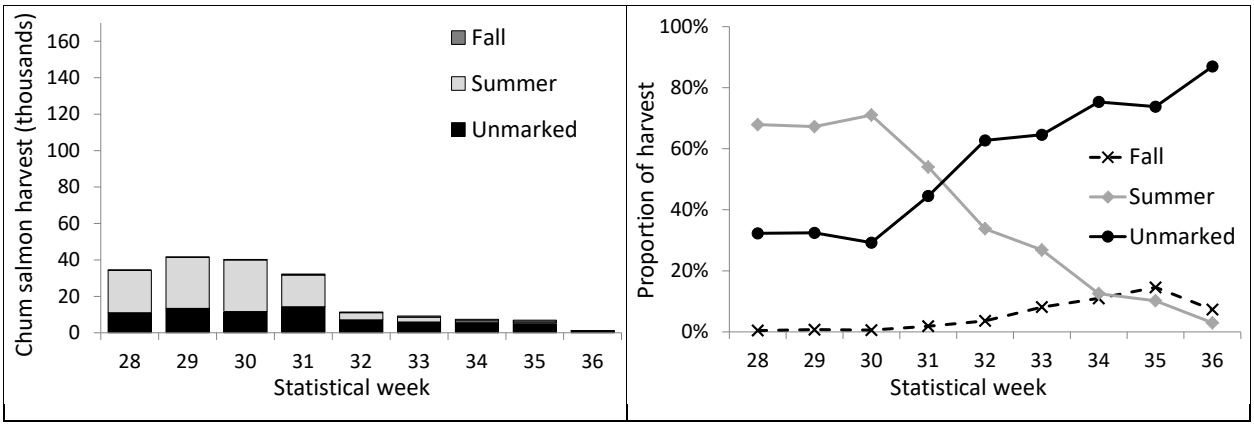

Figure 22.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 purse seine harvest, 2013.

2014

Otolith-marked hatchery chum salmon represented an estimated 48% of the 2014 total chum salmon harvest in the District 101 purse seine fishery (Table 5). We estimated 70,000 of all otolith-marked fish were summer chum salmon and 4,000 were fall chum salmon. A peak harvest of 20,900 hatchery summer chum salmon occurred in statistical week 31 and a peak harvest of 2,000

hatchery fall chum salmon occurred in statistical week 34 (Figure 23, Appendix E). The peak harvest of 18,800 unmarked chum salmon occurred in statistical week 30 (Figure 23, Appendix E). Unmarked chum salmon represented the largest proportion of the harvest after statistical week 31.

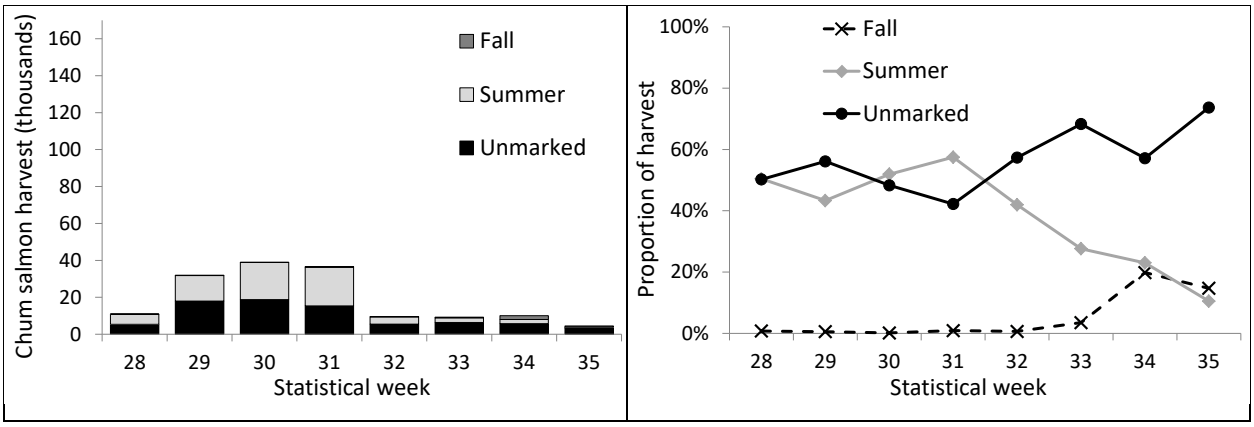

Figure 23.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 purse seine harvest, 2014.

2015

Otolith-marked hatchery chum salmon represented an estimated 73% of the 2015 total chum salmon harvest in the District 101 purse seine fishery (Table 5). We estimated 420,000 of all otolith-marked fish were summer chum salmon and 3,000 were fall chum salmon. A peak harvest of 121,800 hatchery summer chum salmon occurred in statistical week 30 (Figure 23, Appendix E). The peak harvest of 43,400 unmarked chum salmon also occurred in statistical week 30 (Figure 23, Appendix E). Hatchery summer chum salmon were dominant the entire season, except during the last week of the fishery (Figure 23).

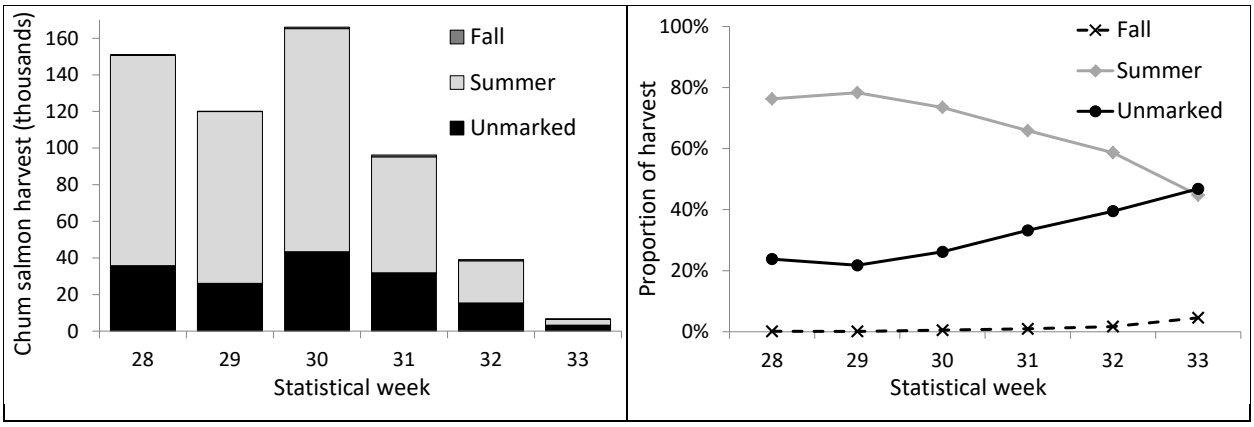

Figure 24.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 101 purse seine harvest, 2015.

DISTRICT 102 PURSE SEINE FISHERY

From 2011 to 2015, the proportion of otolith-marked hatchery fish in the chum salmon harvest in the District 102 purse seine fishery ranged from 73% (2011) to 90% (2014) and averaged 81%

(Table 6). The coefficient of variation of these estimates ranged from 1.0% (2014) to 2.3% (2011). Otolith-marked summer chum salmon accounted for 75% or more of the harvest from late June through July (statistical weeks 25–31) in nearly all years. The weekly proportions of otolith-marked fall chum salmon in the harvest were typically very low and peaked on, or after, statistical week 34. The vast majority of the fall chum salmon harvested in District 2 were unmarked fish (Figures 25–29). Hatchery summer chum salmon returning to Kendrick Bay/McLean Arm represented an average 78% of the total marked otoliths recovered, followed by Neets Bay summer chum salmon (13%), and Anita Bay summer chum salmon (5%; Appendix C). Marked fish from northern Southeast Alaska hatchery release sites (NSRAA, DIPAC, and AKI combined) accounted for 1% or less of marked otoliths recovered annually.

Table 6.–Proportion of otolith-marked and unmarked chum salmon caught in the District 102 purse seine fishery, 2011–2015.

	Total chum	Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	salmon harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	792,000	73%	580,000	553,000–606,000	27%	212,000	185,000–239,000
2012	1,292,000	86%	1,117,000	1,090,000–1,143,000	14%	175,000	149,000–202,000
2013	538,000	83%	445,000	436,000–455,000	17%	93,000	83,000–102,000
2014	412,000	90%	370,000	362,000–377,000	10%	42,000	34,000–49,000
2015	649,000	74%	479,000	467,000–492,000	26%	170,000	157,000–182,000
Average		81%	598,200		19%	138,400	

2011

Otolith-marked hatchery chum salmon represented an estimated 73% of the 2011 total chum salmon harvest in the District 102 purse seine fishery (Table 6). We estimated 573,000 of all otolith-marked fish were summer chum salmon and 8,000 were fall chum salmon (Appendix E). A peak harvest of 177,100 hatchery summer chum salmon occurred in statistical week 29 and a peak harvest of 30,000 unmarked summer chum salmon occurred in statistical week 30. A peak harvest of 1,200 hatchery fall chum salmon occurred in statistical week 35, and a peak harvest of 38,400 unmarked fall chum salmon occurred in statistical week 36 (Figure 25, Appendix E). Unmarked chum salmon accounted for the vast majority of the harvest after statistical week 32.

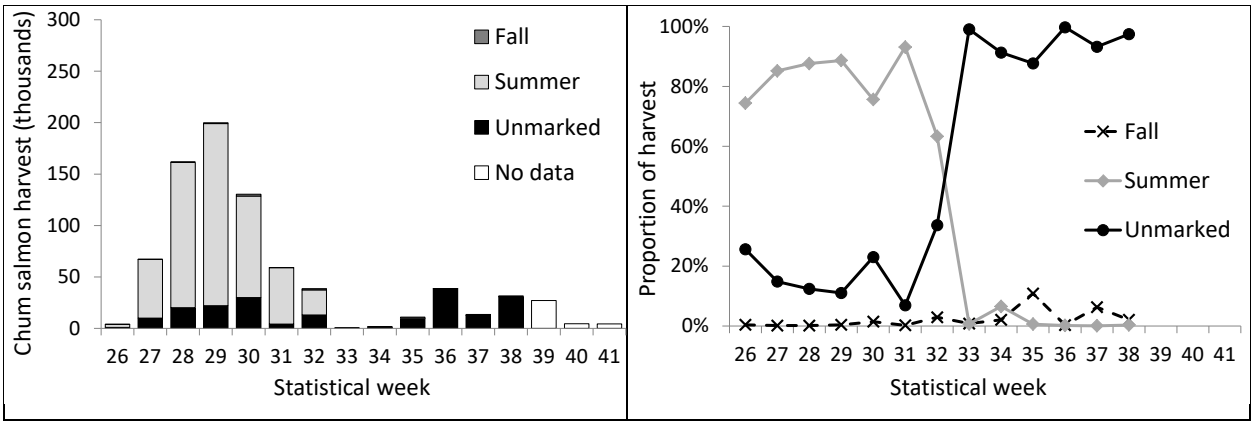

Figure 25.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 102 purse seine harvest, 2011. No samples were collected in statistical weeks 39–41.

2012

Otolith-marked hatchery chum salmon represented an estimated 86% of the 2012 total chum salmon harvest in the District 102 purse seine fishery (Table 6). We estimated 1,106,000 of all otolith-marked fish were summer chum salmon and 11,000 were fall chum salmon (Appendix E). A peak harvest of 443,500 hatchery summer chum salmon occurred in statistical week 27 and a peak harvest of 30,000 unmarked summer chum salmon occurred in statistical week 31. A peak harvest of 4,200 hatchery fall chum salmon occurred in statistical week 32 (Figure 26, Appendix E). Unmarked chum salmon accounted for the vast majority of the harvest after statistical week 32.

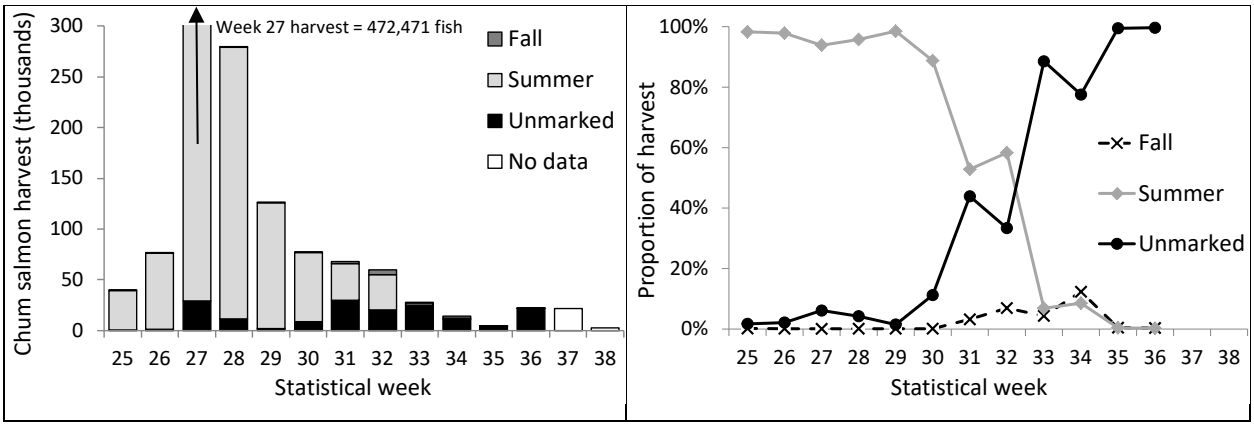

Figure 26.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 102 purse seine harvest, 2012. No samples were collected in statistical weeks 37 and 38.

2013

Otolith-marked hatchery chum salmon represented an estimated 83% of the 2013 total chum salmon harvest in the District 102 purse seine fishery (Table 6). We estimated 442,000 of all otolith-marked fish were summer chum salmon and 4,000 were fall chum salmon (Appendix E).

A peak harvest of 150,300 hatchery summer chum salmon occurred in statistical week 27, and a peak harvest of 10,000 unmarked summer chum salmon occurred in statistical week 32. Peak harvests of 1,200 hatchery fall chum salmon and 21,400 unmarked fall chum salmon occurred in statistical week 35 (Figure 27, Appendix E). Unmarked chum salmon accounted for the vast majority of the harvest after statistical week 33.

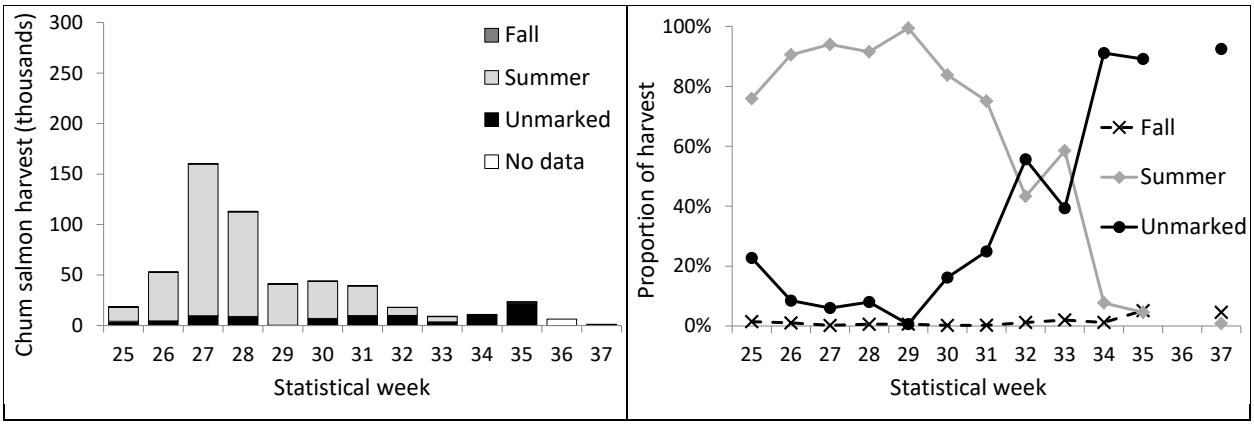

Figure 27.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 102 purse seine harvest, 2013. No samples were collected in statistical week 36.

2014

Otolith-marked hatchery chum salmon represented an estimated 90% of the 2014 total chum salmon harvest in the District 102 purse seine fishery (Table 6). We estimated 368,000 of all otolith-marked fish were summer chum salmon and 2,000 were fall chum salmon (Appendix E). A peak harvest of 90,500 hatchery summer chum salmon occurred in statistical week 28 and a peak harvest of 8,800 unmarked summer chum salmon occurred in statistical week 32. A peak harvest of 1,100 hatchery fall chum salmon occurred in statistical week 33 (Figure 28, Appendix E). Unmarked chum salmon accounted for the majority of the harvest after statistical week 32.

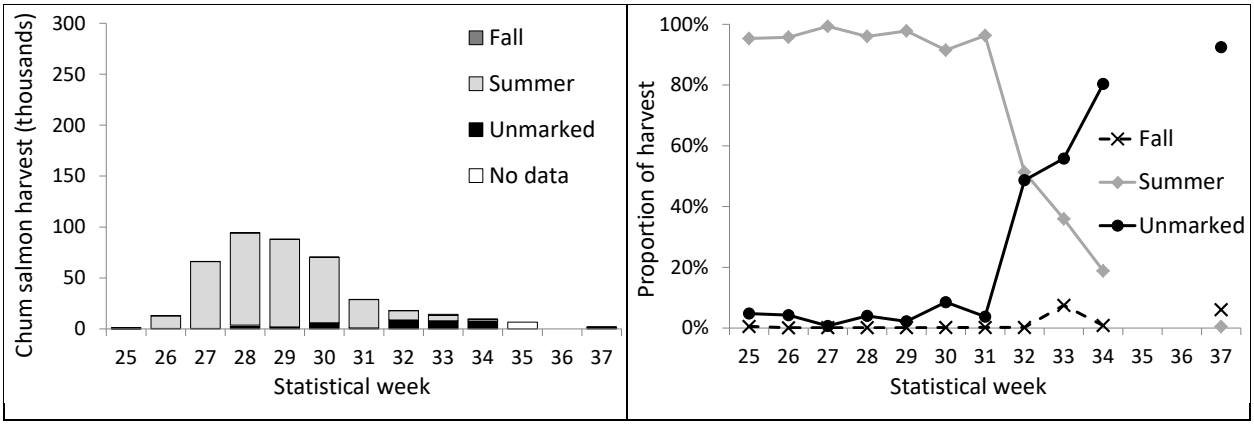

Figure 28.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 102 purse seine harvest, 2014. No samples were collected in statistical week 35.

2015

Otolith-marked hatchery chum salmon represented an estimated 74% of the 2015 total chum salmon harvest in the District 102 purse seine fishery (Table 6). We estimated 472,000 of all otolith-marked fish were summer chum salmon and 8,000 were fall chum salmon (Appendix E). A peak harvest of 100,800 hatchery summer chum salmon occurred in statistical week 27 and a peak harvest of 38,200 unmarked summer chum salmon occurred in statistical week 32. Peak harvests of 1,800 hatchery fall chum salmon occurred in statistical week 32, and a peak harvest of 19,000 unmarked fall chum salmon occurred in statistical week 38 (Figure 28, Appendix E). Unmarked chum salmon accounted for the vast majority of the harvest after statistical week 32.

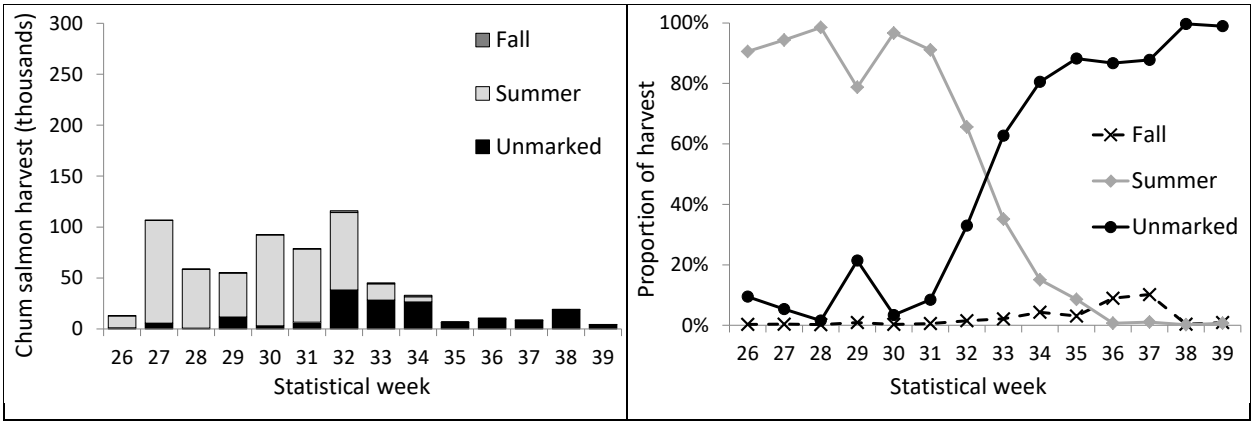

Figure 29.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 102 purse seine harvest, 2015.

DISTRICT 103 PURSE SEINE FISHERY

From 2011 to 2015, the proportion of otolith-marked hatchery fish in the chum salmon harvest in the District 103 summer purse seine fishery ranged from 0% in 2013 to 14% in 2015 (Table 7). The coefficient of variation of these estimates ranged from 17.8% (2011) to 96.1% (2012). Unmarked chum salmon accounted for the majority of the harvest in all years. Hatchery summer chum salmon returning to Neets Bay represented an average 28% of the total marked otoliths recovered, followed by Kendrick Bay/McLean Arm summer chum salmon (24%), Anita Bay summer chum salmon (23%), and Neets Bay fall chum salmon (14%; Appendix C). Marked fish from northern Southeast Alaska hatchery release sites (NSRAA, DIPAC, and AKI combined) accounted for 0–15% of marked otoliths recovered annually.

Table 7.–Proportion of otolith-marked and unmarked chum salmon caught in the District 103 purse seine fishery, 2011–2015.

	Total chum	Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	salmon harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	79,000	5%	4,000	3,000–5,000	95%	74,000	73,000–76,000
2012	44,000	7%	3,000	0–10,000	93%	41,000	35,000–47,000
2013	113,000	0%	0	NA	100%	113,000	NA
2014	53,000	9%	5,000	2,000–7,000	91%	48,000	45,000–50,000
2015	90,000	14%	12,000	8,000–17,000	86%	78,000	73,000–82,000
Average		7%	5,000		93%	71,000	

2011

Otolith-marked hatchery chum salmon represented an estimated 5% of the 2011 total chum salmon harvest in the District 103 purse seine fishery (Table 7). We estimated 3,000 of all otolith-marked fish were summer chum salmon and 1,000 were fall chum salmon (Appendix E). Peak harvests of hatchery summer chum salmon (800 fish) occurred in statistical weeks 32 and 33, and peak harvests of hatchery fall chum salmon (600 fish) occurred in statistical weeks 34 and 36. A peak harvest of 25,200 unmarked chum salmon occurred in statistical week 34 (Figure 30, Appendix E).

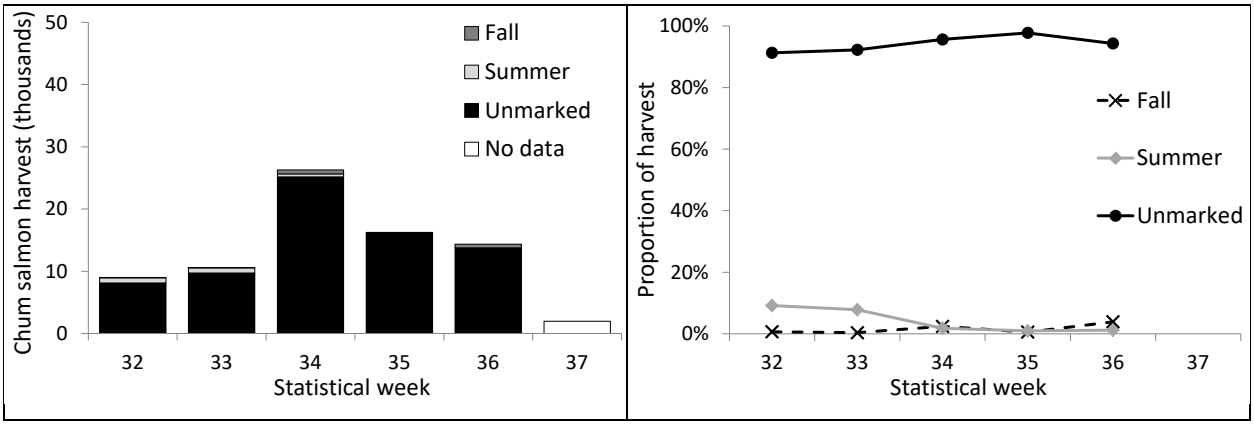

Figure 30.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 103 purse seine harvest, 2011. No samples were collected in statistical week 37.

2012

Otolith-marked hatchery chum salmon represented an estimated 7% of the 2012 total chum salmon harvest in the District 103 purse seine fishery (Table 7). We estimated all 3,000 otolith-marked fish were summer chum salmon (Appendix E). Peak harvests of 19,900 unmarked chum salmon and 2,000 hatchery summer chum salmon likely occurred in statistical week 33 when no samples were collected (Figure 31, Appendix E).

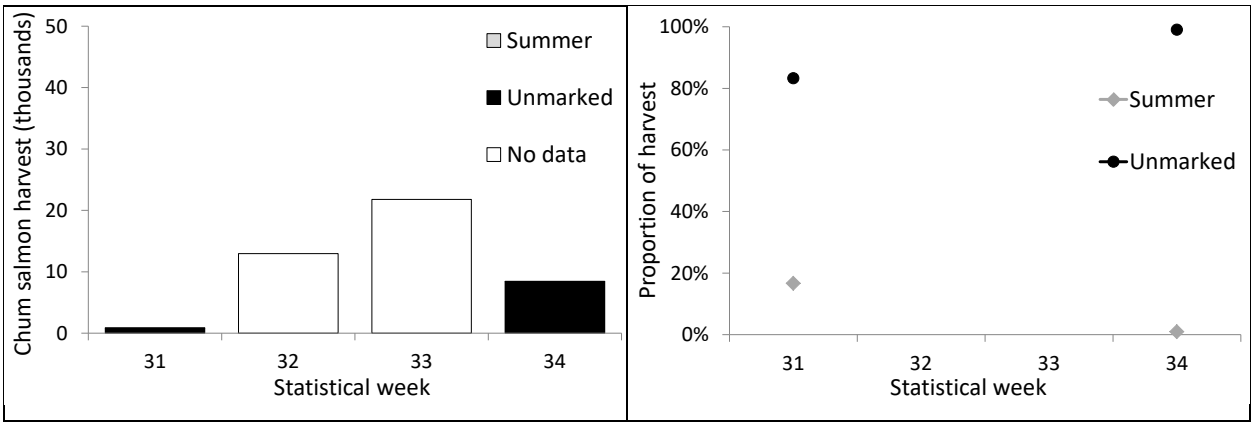

Figure 31.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 103 purse seine harvest, 2012. No samples were collected in statistical weeks 32 and 33.

2013

No marked fish were identified in samples collected from the District 103 purse seine fishery in statistical weeks 33 and 34, thus we estimated all 66,697 chum salmon harvested in those weeks were unmarked. It is likely that small numbers of hatchery chum salmon were present in the fishery. The peak harvest of unmarked chum salmon occurred in statistical week 34 (Appendix E).

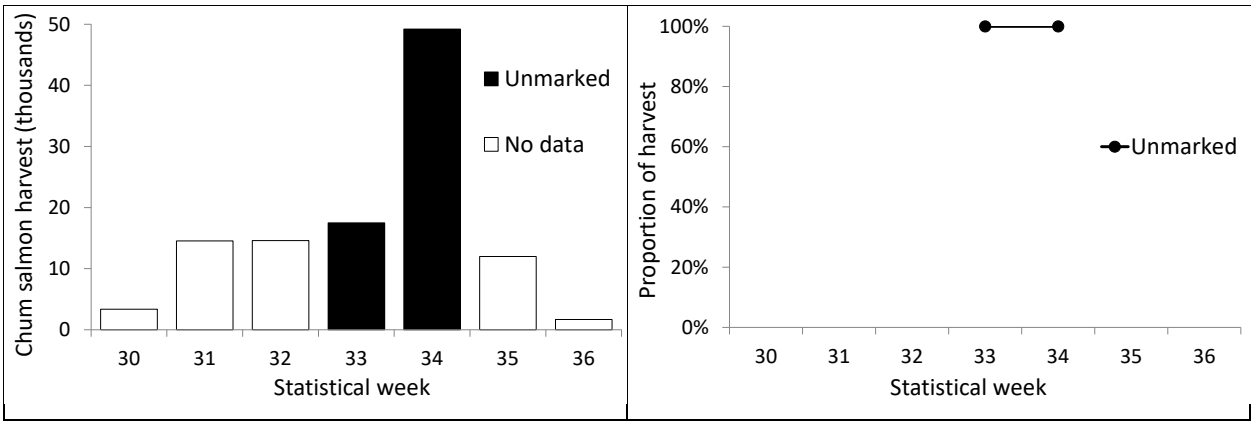

Figure 32.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 103 purse seine harvest, 2013. No samples were collected in statistical week 30–32, and 35–36.

2014

Otolith-marked hatchery chum salmon represented an estimated 9% of the 2014 total chum salmon harvest in the District 103 purse seine fishery (Table 7). No otolith-marked fall chum salmon were identified in samples; thus, we estimated all otolith-marked fish to be hatchery summer chum salmon (Table 7). A peak harvest of 2,700 hatchery summer chum salmon occurred in statistical week 32, and a peak harvest of 12,400 unmarked chum salmon occurred in statistical week 33 (Figure 33).

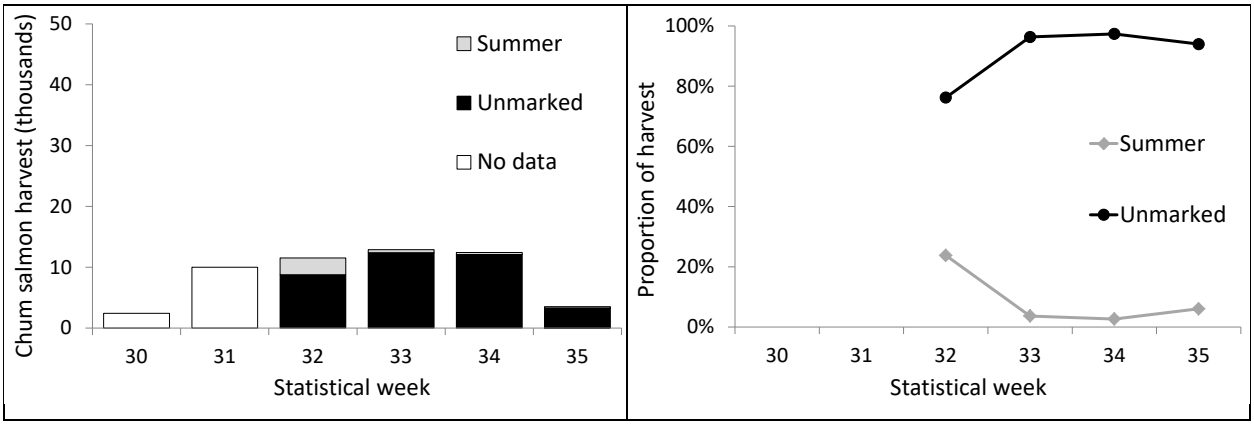

Figure 33.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 103 purse seine harvest, 2014. No samples were collected in statistical weeks 30 and 31.

2015

Otolith-marked hatchery chum salmon represented an estimated 14% of the 2015 total chum salmon harvest in the District 103 purse seine fishery (Table 7). We estimated 9,000 of all otolith-marked fish were summer chum salmon and 9,000 were fall chum salmon (Appendix E). The unmarked chum salmon harvest represented 64–97% of the weekly harvest, with a peak harvest of 19,400 fish in statistical week 33 (Figure 33).

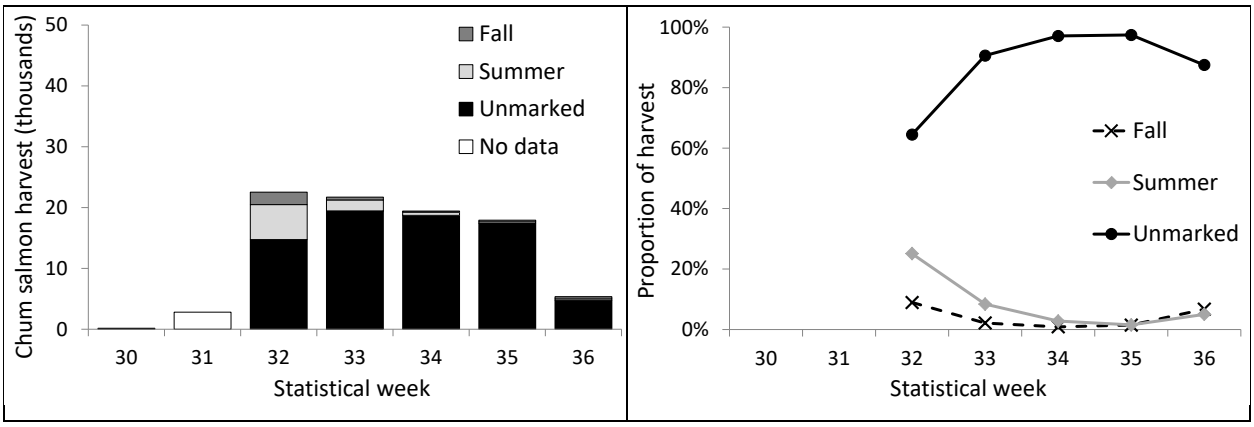

Figure 34.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 103 purse seine harvest, 2015. No samples were collected in statistical weeks 30 and 31.

DISTRICT 104 PURSE SEINE FISHERY

From 2011 to 2015, the proportion of otolith-marked hatchery fish in the District 104 purse seine chum salmon harvest ranged from 27% (2013) to 56% (2014) and averaged 42% (Table 8). The coefficient of variation of these estimates ranged from 2.4% (2014) to 6.2% (2013). In general, otolith-marked summer chum salmon comprised 53–86% of the harvest through mid-July (statistical weeks 29 or 30) after which unmarked chum salmon comprised 50–89% of the harvest. Hatchery summer chum salmon returning to Neets Bay represented an average 37% of the total marked otoliths recovered, followed by Kendrick Bay/McLean Arm summer chum salmon (25%), Neets Bay fall chum salmon (15%), and Anita Bay summer chum salmon (14%; Appendix C). Marked fish from northern Southeast Alaska hatchery release sites (NSRAA, DIPAC, and AKI combined) accounted for 0–8% of marked otoliths recovered annually.

Table 8.–Proportion of otolith-marked and unmarked chum salmon caught in the District 104 purse seine fishery, 2011–2015.

		Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	Total chum salmon harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	137,000	51%	70,000	64,000–76,000	49%	67,000	61,000–73,000
2012	258,000	34%	86,000	79,000–94,000	66%	172,000	164,000–179,000
2013	84,000	27%	23,000	20,000–25,000	73%	62,000	59,000–64,000
2014	169,000	56%	95,000	91,000–100,000	44%	74,000	69,000–78,000
2015	217,000	41%	89,000	80,000–98,000	59%	127,000	118,000–137,000
Average		42%	73,000		58%	100,000	

2011

Otolith-marked hatchery chum salmon represented an estimated 51% of the 2011 total chum salmon harvest in the District 104 purse seine fishery (Table 8). We estimated 58,000 of all otolith-marked fish were summer chum salmon and 12,000 were fall chum salmon (Appendix E). A peak harvest of 19,800 hatchery summer chum salmon occurred in statistical week 30 and a peak harvest of 2,500 hatchery fall chum salmon occurred in statistical weeks 30 and 36. After statistical week 30, the majority of the chum salmon harvest was unmarked (Figure 35). An estimated peak harvest of 21,100 unmarked chum salmon occurred in statistical week 32 (Figure 35, Appendix E).

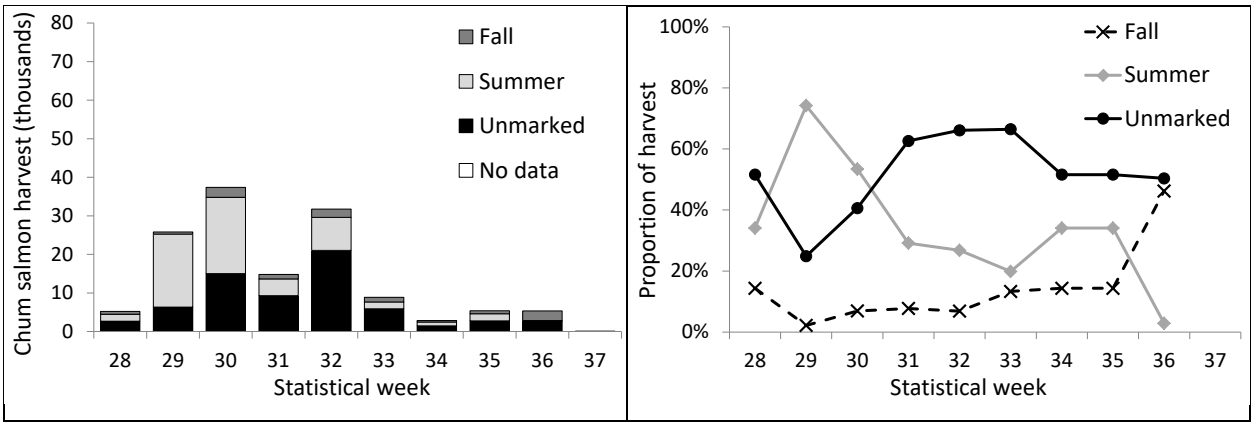

Figure 35.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 104 purse seine harvest, 2011. No samples were collected in statistical week 37.

2012

Otolith-marked hatchery chum salmon represented an estimated 34% of the 2012 total chum salmon harvest in the District 104 purse seine fishery (Table 8). We estimated 51,000 of all otolith-marked fish were summer chum salmon and 36,000 were fall chum salmon. A peak harvest of 11,800 hatchery summer chum salmon occurred in statistical week 28. After statistical week 29, the majority of the chum salmon harvest was unmarked. Peak harvests of 15,700 hatchery fall chum salmon and 55,900 unmarked chum salmon occurred in statistical week 33 (Figure 36, Appendix E).

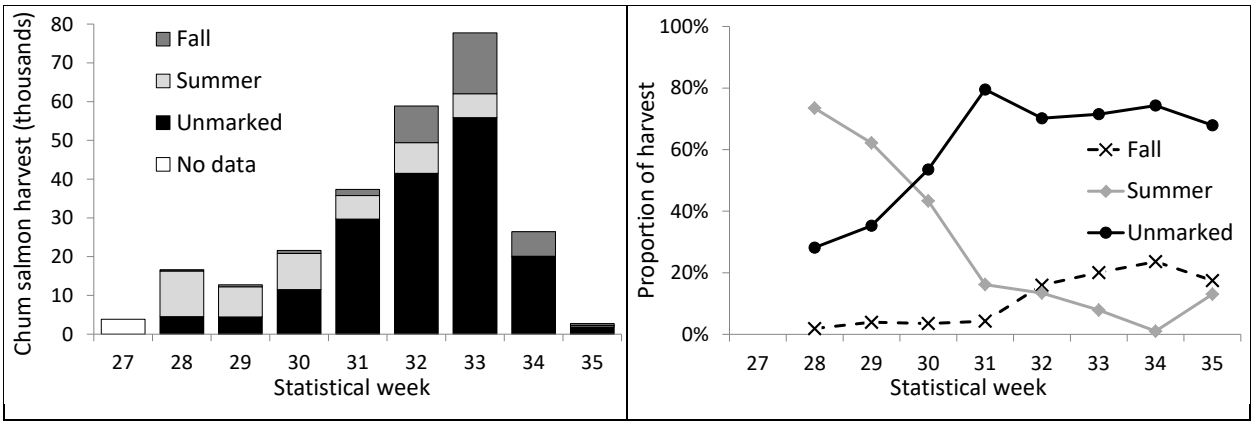

Figure 36.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 104 purse seine harvest, 2012. No samples were collected in statistical week 27.

2013

Otolith-marked hatchery chum salmon represented an estimated 27% of the 2013 total chum salmon harvest in the District 104 purse seine fishery (Table 8). We estimated 20,000 of all otolith-marked fish were summer chum salmon and 3,000 were fall chum salmon. A peak harvest of 7,000 hatchery summer chum salmon occurred in statistical week 28, and a peak harvest of 1,200 otolith-marked fall chum salmon occurred in statistical week 34. An estimated peak harvest of 14,800 unmarked chum salmon occurred in statistical week 32 (Figure 37, Appendix E).

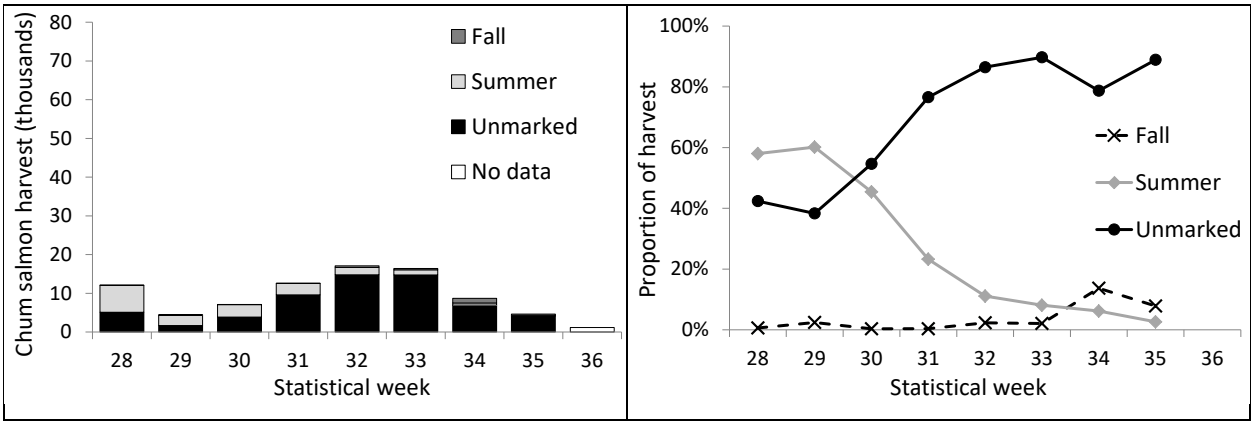

Figure 37.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 104 purse seine harvest, 2013. No samples were collected in statistical week 36.

2014

Otolith-marked hatchery chum salmon represented an estimated 56% of the 2014 total chum salmon harvest in the District 104 purse seine fishery (Table 8). We estimated 92,000 of all otolith-marked fish were summer chum salmon and 3,000 were fall chum salmon. A peak harvest of 30,500 hatchery summer chum salmon occurred in statistical week 29 and peak harvests of 600

hatchery fall chum salmon occurred in statistical weeks 32–34. An estimated peak harvest of 14,400 unmarked chum salmon occurred in statistical week 32 (Figure 38, Appendix E).

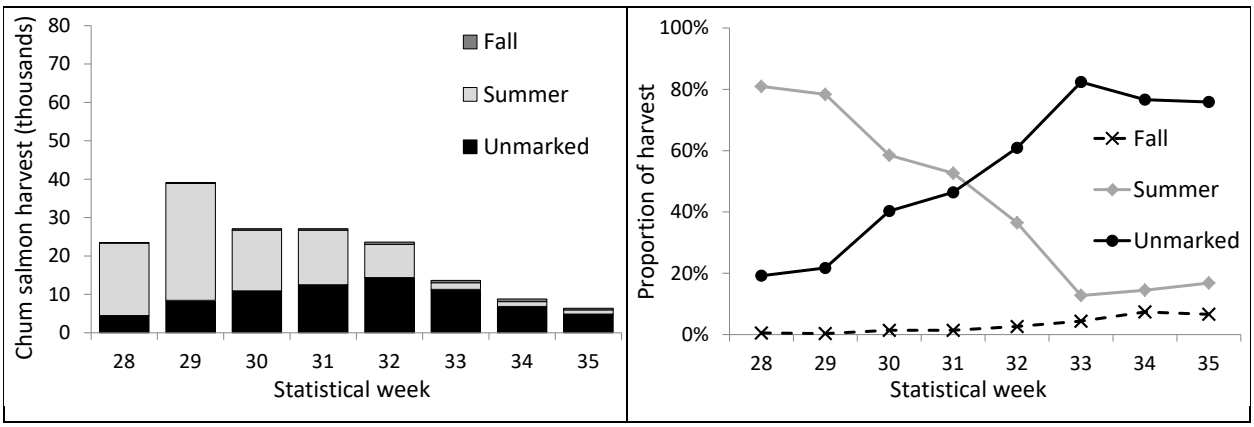

Figure 38.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 104 purse seine harvest, 2014.

2015

Otolith-marked hatchery chum salmon represented an estimated 41% of the 2015 total chum salmon harvest in the District 104 purse seine fishery (Table 8). We estimated 81,000 of all otolith-marked fish were summer chum salmon and 9,000 were fall chum salmon. A peak harvest of 25,800 hatchery summer chum salmon occurred in statistical week 31 and a peak harvest of 2,400 hatchery fall chum salmon occurred in statistical week 34 (Figure 39, Appendix E). An estimated peak harvest of 42,600 unmarked chum salmon occurred in statistical week 32 (Figure 39, Appendix E).

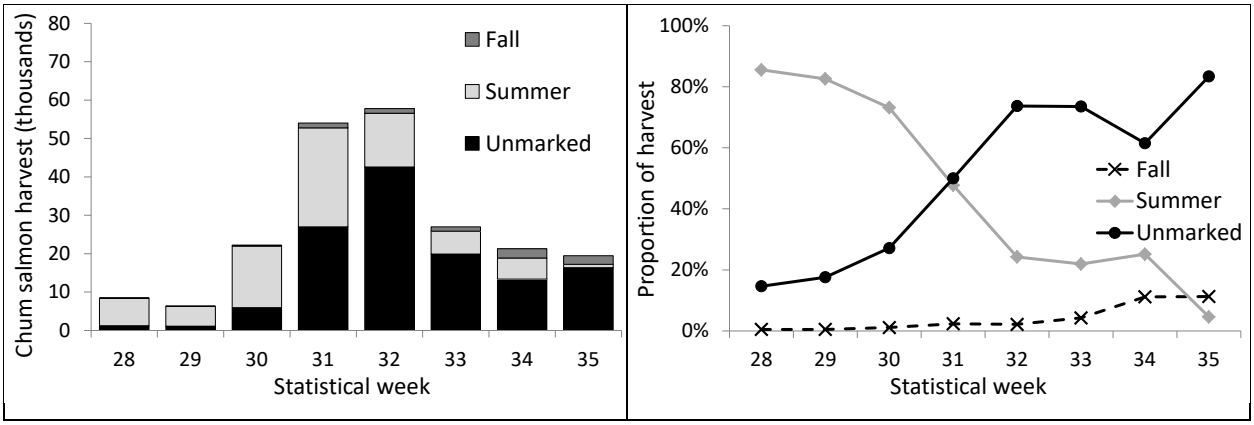

Figure 39.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 104 purse seine harvest, 2015.

DISTRICT 105 PURSE SEINE FISHERY

From 2011 to 2015, the vast majority of the 61,000 chum salmon harvested in the District 105 purse seine fishery appeared to be unmarked (Appendix E). In 2011, the proportion of unmarked

fish in the chum salmon harvest was 92%. From 2012 to 2014, very few samples were collected, and no otolith-marked fish were detected. No samples were obtained from District 105 in 2015.

DISTRICT 107 PURSE SEINE FISHERY

From 2011 to 2015, the proportion of otolith-marked hatchery fish in the chum salmon harvest from the District 107 purse seine fishery ranged from 80% (2011) to 96% (2012) and averaged 91% (Table 9). The coefficient of variation of these estimates ranged from 0.8% (2014) to 1.3% (2011). Hatchery summer chum salmon returning to Anita Bay represented an average 72% of the total marked otoliths recovered, followed by Neets Bay summer chum salmon (24%; Appendix C). Marked fish from northern Southeast Alaska hatchery release sites (NSRAA, DIPAC, and AKI combined) accounted for 0–7% of marked otoliths recovered annually.

Table 9.–Proportion of otolith-marked and unmarked chum salmon caught in the District 107 purse seine fishery, 2011–2015.

		Otolith-marked hatchery chum salmon			Unmarked chum salmon		
Year	Total chum salmon harvest	Proportion	Estimated harvest	95% credible interval	Proportion	Estimated harvest	95% credible interval
2011	3,000	80%	2,300	2,200–2,400	20%	550	500–600
2012	127,000	96%	121,000	119,000–123,000	4%	6,000	4,000–8,000
2013	191,000	95%	180,000	176,000–184,000	5%	10,000	6,000–14,000
2014	117,000	94%	109,000	108,000–111,000	6%	7,000	5,000–9,000
2015	39,000	ND	35,000	ND	11%	4,000	ND
Average		91%	89,000		9%	6,000	

2011

The District 107 purse seine fishery was only opened in statistical weeks 28 and 29 in 2011. Otolith-marked hatchery chum salmon represented an estimated 80% of the total chum salmon harvest in those 2 weeks (Table 9). No otolith-marked fall chum salmon were identified in samples, so we estimated all 2,000 otolith-marked fish were summer chum salmon. A harvest of 1,500 hatchery summer chum salmon and 400 unmarked chum salmon occurred in statistical week 29 (Figure 40, Appendix E).

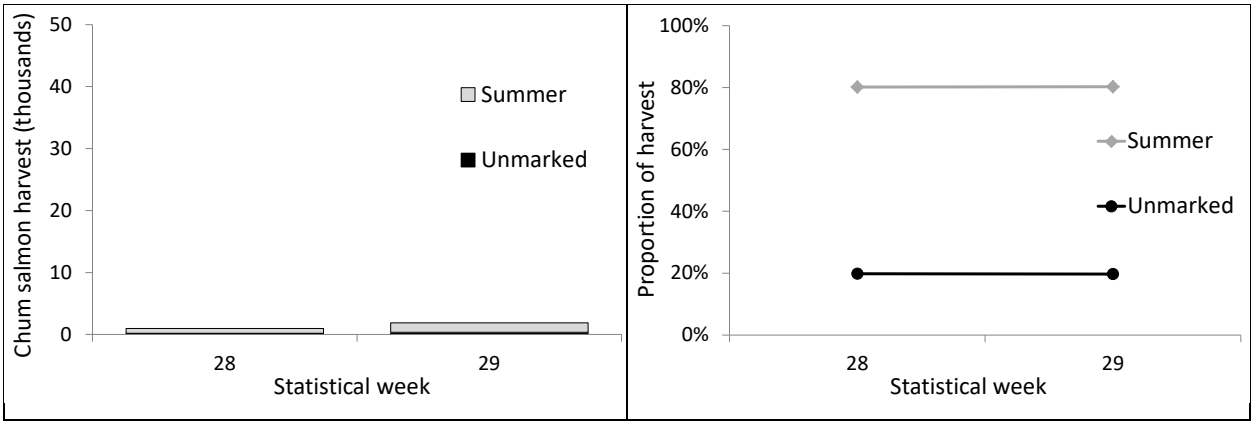

Figure 40.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 107 purse seine harvest, 2011.

2012

Otolith-marked hatchery chum salmon represented an estimated 96% of the 2012 total chum salmon harvest in the District 107 purse seine fishery (Table 9). We estimated 121,000 of all otolith-marked fish were summer chum salmon and 1,000 were fall chum salmon. A peak harvest of 41,200 hatchery summer chum salmon occurred in statistical week 30 (Figure 41, Appendix E).

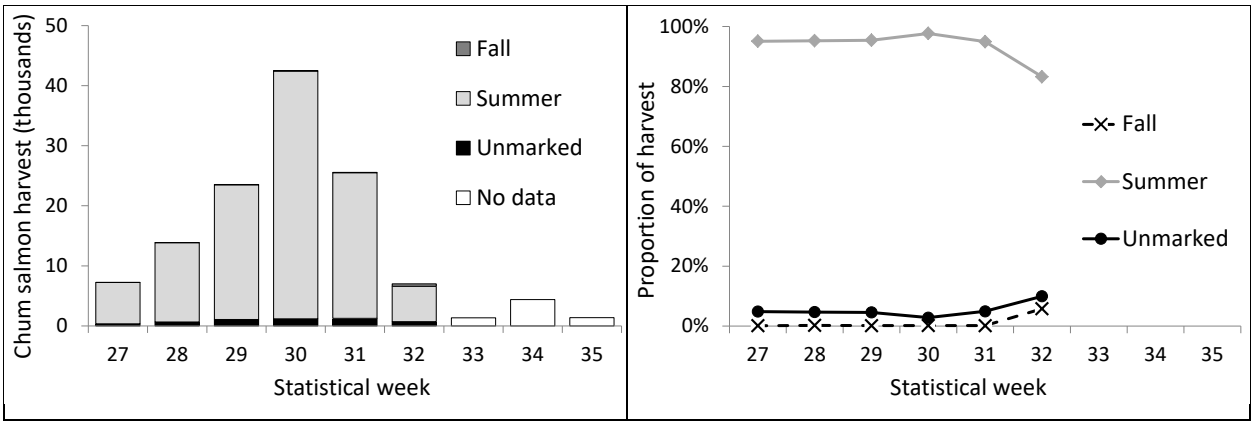

Figure 41.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 107 purse seine harvest, 2012. No samples were collected in statistical weeks 33–35.

2013

Otolith-marked hatchery chum salmon represented an estimated 95% of the 2013 total chum salmon harvest in the District 107 purse seine fishery (Table 9). We estimated 180,000 of all otolith-marked fish were summer chum salmon and fewer than 200 were fall chum salmon. Peak harvests of 93,700 hatchery summer chum salmon and 4,300 unmarked chum salmon occurred in statistical week 30 (Figure 42, Appendix E).

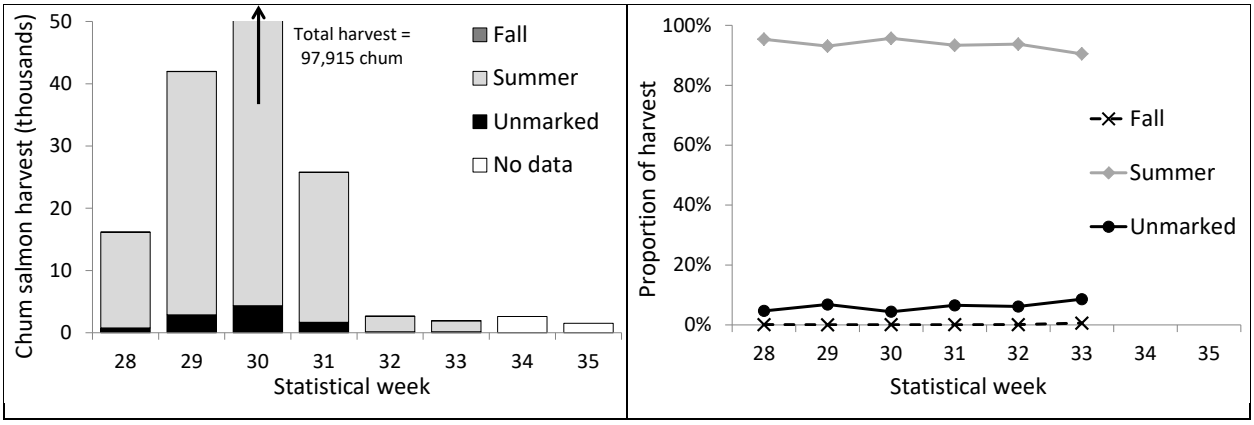

Figure 42.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 107 purse seine harvest, 2013. No samples were collected in statistical weeks 34 and 35.

2014

Otolith-marked hatchery chum salmon represented an estimated 94% of the 2014 total chum salmon harvest in the District 107 purse seine fishery (Table 9). We estimated 109,000 of all otolith-marked fish were summer chum salmon and fewer than 300 were fall chum salmon. Peak harvests of 45,500 hatchery summer chum salmon and 3,100 unmarked chum salmon occurred in statistical week 31 (Figure 42, Appendix E).

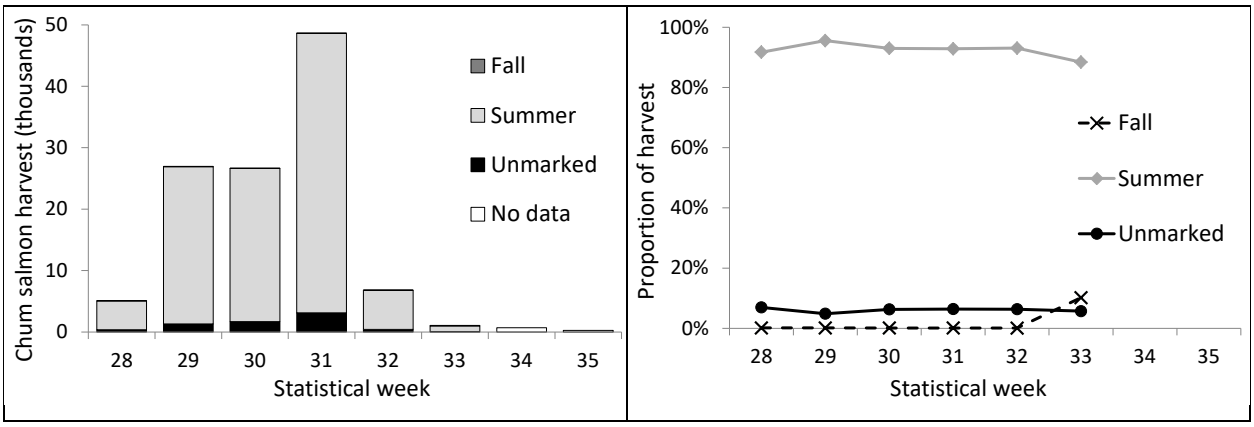

Figure 43.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 107 purse seine harvest, 2014. No samples were collected in statistical weeks 34 and 35.

2015

Marked hatchery summer chum salmon represented 89% of the chum salmon harvested in statistical week 28, the only week data were obtained in 2015 (Table 9, Figure 44, and Appendix E).

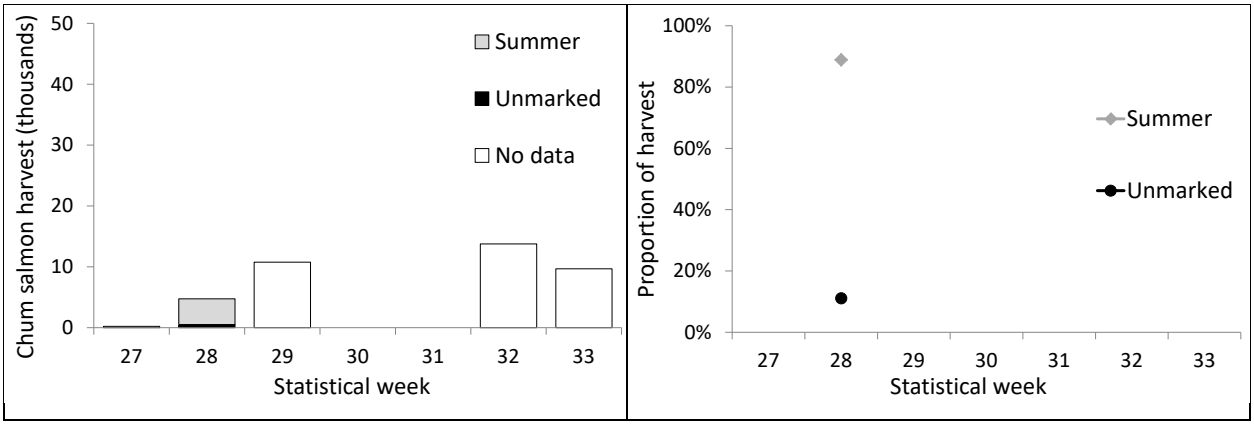

Figure 44.–Number and proportion of otolith-marked summer and fall chum salmon and unmarked chum salmon in the weekly District 107 purse seine harvest, 2015. No samples were collected in statistical weeks 27, 29, 32, and 33.

DISCUSSION

Hatchery chum salmon contributed to every mixed stock commercial net fishery in southern Southeast Alaska. From 2011 to 2015, approximately 908,000 hatchery chum salmon were harvested annually in the District 101–104 and 107 purse seine fisheries, combined; and nearly 457,000 were harvested annually the in District 101, 106, and 108 drift gillnet fisheries, combined (Tables 2–8, Appendix C). Contributions of hatchery chum salmon were lower in fisheries on the outer coast, farther from hatchery release sites, where they accounted for an average of only 7% of the total harvest in District 103 (5,000 fish) and 42% of the harvest in District 104 (73,000 fish; Tables 7 and 8). On the inside waters, contributions of hatchery chum salmon were much higher. Contributions of hatchery chum salmon were highest in District 102, where annual harvests of hatchery chum salmon averaged 591,000 fish, or 80% of the total district chum salmon harvest (Table 6). Although contributions of hatchery chum salmon were smaller in District 107 (average 89,000 fish), the proportion of hatchery fish in the harvest averaged 91%, the highest proportion over all sampled fisheries. Over the 5 years 2011–2015, 80% of the total annual chum salmon harvest in District 101, 106, and 108 drift gillnet fisheries was hatchery chum salmon. Estimates of hatchery chum salmon in each drift gillnet fishery varied considerably from year-to-year (range: 67,000–350,000 fish) due to changes in hatchery run size, migration routes, and fishing time and effort.

Precision of annual contribution estimates for marked chum salmon varied considerably among districts. The coefficient of variation of annual estimates ranged from 0.5% (District 108 drift gillnet fishery, 2015) to 96.1% (District 103 purse seine, 2012). Fisheries that were consistently sampled throughout the season and generated large weekly sample sizes had the lowest coefficients of variation (annual CV ≤4.0% in the District 101 and 102 purse seine fisheries and District 101-11, 106, and 108 drift gillnet fisheries). Estimates of marked chum salmon in District 103 were the least precise every year (CV range 18.3–96.1%). One of SSRAA's sampling priorities was to target deliveries from areas with the majority of the annual harvest in order to maximize coverage with limited staff. Sampling the District 103 chum salmon harvest was a low priority—only a small fraction of the traditional chum salmon harvest in southern Southeast Alaska came from District 103 (Appendix E), and contribution of SSRAA hatchery chum salmon in that area was expected to be low because no SSRAA chum salmon were released from the west coast of Prince of Wales Island during this time period.

Peak timing for unmarked summer chum salmon was similar to or the same as marked fish in most fisheries, indicating wild and hatchery chum salmon share similar run timing in southern Southeast Alaska fisheries. This is not unexpected because all SSRAA hatchery chum salmon released from 2006 to 2013 share ancestry with local wild summer and fall chum salmon stocks. Harvest of hatchery summer chum salmon in most southern Southeast Alaska net fisheries peaked in statistical weeks 27–31 (July). The earliest peak harvests occurred in District 102 purse seine and District 106 drift gillnet fisheries during statistical weeks 27–29 (early July), and in 4 of 5 years, the peak harvest of summer chum salmon occurred simultaneously in these 2 districts. Peak harvests in the Tree Point drift gillnet fishery (subdistrict 101-11) occurred slightly later, during statistical weeks 28–31 (mid- to late July), followed by fisheries on the more inside waters of Districts 101 and 108 during statistical weeks 29–32 (late July and early August).

Run timing of hatchery summer chum salmon was difficult to distinguish in the outside waters of Districts 103 and 104. Due to restrictions of the Pacific Salmon Treaty, fishing opportunity in

District 104 was limited prior to statistical week 31 when abundance of hatchery chum salmon would be expected to be greatest (Gray et al. 2018). Proportions of hatchery summer chum salmon were highest during initial openings in statistical weeks 28 and 29, when harvest opportunity was curtailed. As fishing opportunity in District 104 increased after statistical week 31, the proportion of hatchery summer chum salmon declined, indicating peak abundance in District 104 is likely earlier than the first opening, and potentially earlier or very similar to timing in Districts 102 and 106. Similarly, run timing of hatchery summer chum salmon in adjacent District 103 was difficult to determine due to the later timing of pink salmon runs and, thus, purse seine openings in that area. The first purse seine openings occurred in statistical week 30 or later (late July), probably after the peak passage of summer chum salmon. Proportions of hatchery summer chum salmon were largest during the first opening and declined thereafter indicating peak abundance occurred prior to or at the initial opening.

Hatchery release sites for fall chum salmon in southern Southeast Alaska are all located within District 101, which explains the large component of hatchery fall chum salmon in the harvest along their migration routes through the District 101 and District 106 fisheries. Otolith-marked fall chum salmon were most abundant in the District 101-11 drift gillnet fishery, adjacent to the Nakat Inlet remote release site, and peak harvests occurred in statistical weeks 35 or 36 (late August or early September). Peak harvests of hatchery fall chum salmon in the District 106 drift gillnet fishery typically occurred in statistical weeks 35–38 (early September) and were largely composed of fish returning to Neets Bay (Appendix B). Peak harvests of unmarked fall chum salmon and hatchery fall chum salmon generally occurred during the exact same week or within a week of each other in those districts.

Unmarked chum salmon constituted more than 50% of the chum salmon harvest in District 104 along the outer coast of Prince of Wales Island from statistical week 32 (early August) until the end of the fishery in all years. In most years, the transition from a summer chum salmon fishery to a fall chum salmon fishery on inside waters in Districts 101, 102, and 106 occurred around statistical week 34 (mid-August) so it seems likely that the large number of unmarked chum salmon harvested on the outer coast after statistical week 32 were primarily wild fall chum salmon. We would expect few wild summer chum salmon destined for Southeast Alaska streams to be on the outer coast that late in the season since wild summer chum salmon escapements in southern Southeast Alaska are at, or past, their peak by statistical week 33 (mid-August).

In southern Southeast Alaska, 98% of marked chum salmon in unweighted samples originated from SSRAA release sites (Appendix B). In general, most marked chum salmon were harvested in the fisheries closest to their release site. For example, hatchery summer and fall chum salmon released at Nakat Inlet (101-10) were primarily harvested in the adjacent District 101-11 drift gillnet fishery, where they accounted for more than 72% of marked fish in 4 of 5 years, and more than 83% of the total in 2 of those years. Additionally, 74–83% of all marked chum salmon in samples from the District 102 purse seine fishery were summer chum salmon returning to either Kendrick Bay (102-15) or McLean Arm (102-15). Kendrick/McLean hatchery summer chum salmon also contributed to purse seine fisheries in Districts 101, 103, and 104, averaging 22%, 24%, and 25% of those harvests across all years, respectively. Neets Bay (101-95) hatchery summer chum salmon contributed to all southern Southeast Alaska commercial fisheries and averaged 44% of marked fish in samples from the District 101 purse seine fishery. The highest proportions of Neets Bay hatchery fall chum salmon were in samples from the District 106 drift gillnet fishery, which is often open through statistical week 39 (late September). Hatchery chum

salmon returning to Anita Bay were found in the highest proportions in samples from the drift gillnet fisheries in District 108 (average 85%) and District 106 (average 37%). Small numbers of hatchery chum salmon from northern Southeast Alaska release sites were present in southern Southeast Alaska fisheries. Northern hatchery fish accounted for an average 6–7% of marked fish recovered in Districts 106, 108, and 103, but typically accounted for 1% in other districts (Appendix B).

Our hatchery chum salmon harvest estimates for southern Southeast Alaska net fisheries underestimate the total contribution of hatchery fish in many cases due to the presence of unmarked hatchery chum salmon. The primary source of unmarked hatchery fish is from MIC releases at Annette Island in District 101. No chum salmon released there from 2006 to 2013 were marked.[3] It is assumed that many MIC fish are harvested in District 101 drift gillnet, Districts 101 and 102 purse seine fisheries, and in net fisheries occurring within Annette Island Reserve. Unmarked hatchery fish originating from release sites in northern Southeast Alaska would also be undetectable. Based on the low recovery rates of marked northern Southeast hatchery fish, however, those unmarked fish would likely account for a tiny proportion of harvests in most southern Southeast fisheries. As hatchery operators develop rearing, marking, and evaluation programs, the proportion of detectable otolith-marked hatchery chum salmon released throughout Southeast Alaska increased to 98% in 2015. MIC has been working to acquire new infrastructure to enable thermal marking, and their 2017 release of 7.6 million summer chum salmon was 43% otolith-marked. If they are successful with their plan to thermal mark all their fish in the future, 100% of hatchery-reared chum salmon released in southern Southeast Alaska would be thermal-marked.

ACKNOWLEDGEMENTS

We would like to thank Southern Southeast Regional Aquaculture Association for thermal marking all of their chum salmon releases since 2003 and for sharing data from their commercial fisheries sampling program with ADF&G because information for this report would not otherwise be available. In particular, we would like to thank Michelle Leitz and Alan Murray for collecting and analyzing chum salmon otoliths, as well as Matthew Lenhard, Andrew Kirby, Pamela Speck, Taylor Hendricks, Tessa Frost, Jesse Lindgren, Courtney Born, Gunnar Farstad, Leo James, Whitney Crittenden, and Diane Mattson for collecting chum salmon otoliths during the summers of 2011–2015. Constant coordination between SSRAA personnel, seafood processors, boat operators, and the ADF&G port sampling staff was integral to the success of SSRAA's commercial sampling program. We also gratefully acknowledge Sara Miller (ADF&G) for her biometric support and data analysis.

[3] Some MIC hatchery chum salmon were adipose fin-clipped (2.7 million in 2006 and 800,000 in 2007); however, chum salmon landings have not been checked for missing adipose fins by ADF&G since 2006. No thermal marks were applied to any MIC chum salmon released from 2006–2013, so for this report, adipose-fin-clipped fish are considered unmarked.

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APPENDICES

Appendix A.–Start and end dates for ADF&G statistical weeks 24–41, 2011–2015.

Statistical week	2011		2012		2013		2014		2015	
	Start	End	Start	End	Start	End	Start	End	Start	End
24	5-Jun	11-Jun	10-Jun	16-Jun	9-Jun	15-Jun	8-Jun	14-Jun	7-Jun	13-Jun
25	12-Jun	18-Jun	17-Jun	23-Jun	16-Jun	22-Jun	15-Jun	21-Jun	14-Jun	20-Jun
26	19-Jun	25-Jun	24-Jun	30-Jun	23-Jun	29-Jun	22-Jun	28-Jun	21-Jun	27-Jun
27	26-Jun	2-Jul	1-Jul	7-Jul	30-Jun	6-Jul	29-Jun	5-Jul	28-Jun	4-Jul
28	3-Jul	9-Jul	8-Jul	14-Jul	7-Jul	13-Jul	6-Jul	12-Jul	5-Jul	11-Jul
29	10-Jul	16-Jul	15-Jul	21-Jul	14-Jul	20-Jul	13-Jul	19-Jul	12-Jul	18-Jul
30	17-Jul	23-Jul	22-Jul	28-Jul	21-Jul	27-Jul	20-Jul	26-Jul	19-Jul	25-Jul
31	24-Jul	30-Jul	29-Jul	4-Aug	28-Jul	3-Aug	27-Jul	2-Aug	26-Jul	1-Aug
32	31-Jul	6-Aug	5-Aug	11-Aug	4-Aug	10-Aug	3-Aug	9-Aug	2-Aug	8-Aug
33	7-Aug	13-Aug	12-Aug	18-Aug	11-Aug	17-Aug	10-Aug	16-Aug	9-Aug	15-Aug
34	14-Aug	20-Aug	19-Aug	25-Aug	18-Aug	24-Aug	17-Aug	23-Aug	16-Aug	22-Aug
35	21-Aug	27-Aug	26-Aug	1-Sep	25-Aug	31-Aug	24-Aug	30-Aug	23-Aug	29-Aug
36	28-Aug	3-Sep	2-Sep	8-Sep	1-Sep	7-Sep	31-Aug	6-Sep	30-Aug	5-Sep
37	4-Sep	10-Sep	9-Sep	15-Sep	8-Sep	14-Sep	7-Sep	13-Sep	6-Sep	12-Sep
38	11-Sep	17-Sep	16-Sep	22-Sep	15-Sep	21-Sep	14-Sep	20-Sep	13-Sep	19-Sep
39	18-Sep	24-Sep	23-Sep	29-Sep	22-Sep	28-Sep	21-Sep	27-Sep	20-Sep	26-Sep
40	25-Sep	1-Oct	30-Sep	6-Oct	29-Sep	5-Oct	28-Sep	4-Oct	27-Sep	3-Oct
41	2-Oct	8-Oct	7-Oct	13-Oct	6-Oct	12-Oct	5-Oct	11-Oct	4-Oct	10-Oct

Appendix B.–Unweighted number of otolith-marked chum salmon recovered annually in drift gillnet fisheries by hatchery release site and operator, 2011–2015. Fish identified in 2014 and 2015 with hatch code 4H were released by multiple agencies from multiple locations and are not included in this table.

		SSRAA							NSRAA[a]					DIPAC[b]	AKI	
		Summer-run					Fall-run									
District	Year	Anita Bay	Kendrick Bay	McLean Arm	Nakat Inlet	Neets Bay	Nakat Inlet	Neets Bay	Bear Cove	Deep Inlet	Hidden Falls	SE Cove	Takatz Bay	All release sites	Port Armstrong	Total
101-11	2011	20	29	0	446	54	315	43	0	0	0	0	0	0	0	907
101-11	2012	67	16	0	598	33	277	63	0	0	0	0	0	2	0	1,056
101-11	2013	55	61	0	614	100	215	64	0	0	2	0	0	3	0	1,114
101-11	2014	39	144	0	1,110	276	426	125	0	1	1	0	0	2	0	2,124
101-11	2015	19	263	13	423	159	455	58	0	1	0	0	0	0	0	1,391
106	2011	355	141	0	6	383	1	342	0	0	2	0	6	92	0	1,328
106	2012	521	97	0	17	247	2	249	0	0	9	0	0	64	3	1,209
106	2013	428	29	0	5	141	0	9	0	0	14	0	1	65	2	694
106	2014	374	78	0	1	577	28	253	2	0	3	0	1	25	1	1,343
106-30	2015	206	116	10	4	463	6	58	0	0	3	1	3	5	0	875
108	2011	337	2	0	4	20	0	10	0	0	3	0	2	51	0	429
108	2012	770	6	0	25	35	0	9	0	0	1	0	0	86	0	932
108	2013	333	0	0	3	1	0	0	0	0	4	0	2	25	1	369
108	2014	285	0	0	0	19	0	0	0	0	0	0	3	6	1	314
108	2015	592	1	1	0	110	1	2	0	0	0	0	0	0	0	707
	Total	4,401	983	24	3,256	2,618	1,726	1,285	2	2	42	1	18	426	8	14,792

[a] Additional marked NSRAA hatchery fish not included in the table: 19 fish were marked with the same hatch code but released from two different locations (18 fish in District 106 and 1 fish in District 108 in 2013).

[b] DIPAC chum salmon from the same brood year received the same hatch code and were released at multiple sites around Juneau in varying proportions each year (Amalga Harbor, Boat Harbor, Gastineau Channel, Limestone Inlet, and Thane).

Appendix C.–Unweighted number of otolith-marked chum salmon recovered annually in purse seine fisheries by hatchery release site and operator, 2011–2015. Fish identified in 2014 and 2015 with hatch code 4H were released by multiple agencies from multiple locations and are not included in this table.

		SSRAA							NSRAA[a]					DIPAC[b]	AKI	
		Summer-run					Fall-run									
District	Year	Anita Bay	Kendrick Bay	McLean Arm	Nakat Inlet	Neets Bay	Nakat Inlet	Neets Bay	Bear Cove	Deep Inlet	Hidden Falls	SE Cove	Takatz Bay	All release sites	Port Armstrong	Total
101	2011	22	85	0	61	169	2	33	0	0	0	0	0	2	1	375
101	2012	35	84	0	69	119	0	96	0	0	0	0	0	0	0	403
101	2013	123	96	0	69	284	6	39	0	0	1	0	0	1	0	619
101	2014	61	79	0	62	377	11	68	0	0	0	0	0	0	0	658
101	2015	59	268	35	70	348	3	3	0	0	0	0	0	0	0	786
102	2011	27	775	0	12	136	2	40	0	0	0	0	0	4	1	997
102	2012	74	1,020	0	33	213	0	26	0	1	2	0	0	14	0	1,383
102	2013	83	802	0	9	131	1	16	0	0	0	0	0	13	0	1,055
102	2014	35	751	0	2	147	1	14	0	1	0	0	1	5	0	957
102	2015	49	845	160	11	104	5	36	0	0	1	1	1	1	0	1,214
103	2011	3	4	0	0	7	0	8	0	0	0	0	0	1	0	23
103	2012	4	1	0	0	1	0	0	0	0	0	0	0	0	0	6
103	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	2014	2	10	0	0	10	0	0	1	1	0	0	0	0	0	24
103	2015	1	4	1	1	6	3	6	2	2	0	0	0	0	0	26
104	2011	29	88	0	8	115	9	57	0	1	0	0	0	0	0	307
104	2012	51	75	0	16	99	8	118	1	2	1	0	0	1	1	373
104	2013	31	23	0	4	38	2	22	2	3	1	0	1	3	1	131
104	2014[c]	70	142	0	22	346	7	25	3	19	0	0	0	0	1	635
104	2015	40	116	15	17	137	10	21	0	6	0	0	1	0	1	364
105	2011	4	1	0	0	2	1	27	0	0	0	0	0	1	0	36
105	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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		SSRAA							NSRAA[a]					DIPAC[b]	AKI	
		Summer-run					Fall-run									
District	Year	Anita Bay	Kendrick Bay	McLean Arm	Nakat Inlet	Neets Bay	Nakat Inlet	Neets Bay	Bear Cove	Deep Inlet	Hidden Falls	SE Cove	Takatz Bay	All release sites	Port Armstrong	Total
106	2011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
106	2012	62	9	0	1	21	0	13	0	0	0	0	0	0	0	106
106	2013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
106	2014	97	12	0	0	121	2	16	0	0	0	0	0	0	0	248
106	2015	0	0	1	0	6	0	1	0	0	0	0	0	0	0	8
107	2011	47	0	0	0	7	0	0	0	0	0	0	1	3	0	58
107	2012	343	2	0	8	82	0	6	0	0	0	0	0	0	1	442
107	2013	348	1	0	1	88	1	0	0	0	1	0	1	18	0	459
107	2014	355	1	0	0	243	0	3	0	0	0	0	0	1	0	603
107	2015	22	1	0	0	9	0	0	0	0	0	0	0	0	0	32
	Total	2,077	5,295	212	476	3,366	74	694	9	36	7	1	6	68	7	12,328

[a] Additional marked fish not included in table: 53 NSRAA fish were marked with the same hatch code but released from 2 different locations: 3 fish in District 102 (2013), and 50 fish in District 104 (49 in 2013 and 1 in 2015).

[b] DIPAC chum salmon from the same brood year received the same hatch code and were released at multiple sites around Juneau in varying proportions each year (Amalga Harbor, Boat Harbor, Gastineau Channel, Limestone Inlet, and Thane).

[c] Two chum salmon released from Nitinat River Hatchery were recovered in the District 104 purse seine fishery in 2014.

Appendix D.–Weekly chum salmon harvest, otolith sample size (*n*), and estimated proportion, 95% credible interval, and contribution of marked summer and fall hatchery fish and unmarked fish in the commercial drift gillnet fisheries in Districts 101–108, 2006–2010.

					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
					Estimated	95% CI		Estimated	Estimated	95% CI		Estimated	Estimated	95% CI		Estimated
Year	District	Week	Total harvest	*n*	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution
2011	101-11	26	8,544	144	73%	65%	80%	6,218	1%	0%	3%	66	26%	20%	34%	2,242
2011	101-11	27	14,988	132	75%	67%	82%	11,217	0%	0%	1%	14	25%	18%	32%	3,733
2011	101-11	28	53,055	96	84%	76%	91%	44,616	0%	0%	1%	66	16%	10%	24%	8,552
2011	101-11	29	66,677	108	89%	82%	94%	59,083	0%	0%	1%	74	12%	7%	18%	7,881
2011	101-11	30	68,788	96	71%	61%	79%	48,594	4%	1%	9%	2,942	25%	17%	34%	17,112
2011	101-11	31	57,842	59	74%	63%	84%	42,934	0%	0%	2%	117	25%	16%	36%	14,568
2011	101-11	32	19,197	36	83%	69%	93%	15,858	0%	0%	3%	64	18%	8%	30%	3,396
2011	101-11	33	5,452	48	27%	16%	40%	1,488	11%	4%	21%	577	58%	44%	70%	3,142
2011	101-11	34	3,923	72	18%	10%	28%	717	46%	35%	57%	1,796	35%	25%	46%	1,373
2011	101-11	35	6,937	23	1%	0%	8%	81	60%	40%	79%	4,195	35%	20%	53%	2,462
2011	101-11	36	15,553	119	0%	0%	2%	36	86%	79%	91%	13,308	15%	9%	21%	2,296
2011	101-11	37	8,819	72	0%	0%	2%	34	86%	77%	93%	7,572	15%	8%	23%	1,295
2011	101-11	38	9,823	108	0%	0%	2%	25	92%	87%	97%	9,077	8%	4%	14%	819
2011	101-11	39	329	39	1%	0%	5%	2	94%	85%	99%	310	8%	2%	17%	26
2011	101-11	Total	339,927	1,152	68%	65%	71%	230,903	12%	11%	13%	40,178	20%	17%	23%	68,895
2012	101-11	25	14,473	101	95%	90%	98%	13,720	0%	0%	2%	32	6%	3%	12%	938
2012	101-11	26	35,209	187	89%	84%	93%	31,213	0%	0%	1%	42	12%	8%	17%	4,154
2012	101-11	27	48,579	131	92%	87%	96%	44,781	0%	0%	1%	82	9%	5%	14%	4,208
2012	101-11	28	54,775	120	86%	80%	92%	47,376	1%	0%	3%	554	13%	8%	20%	7,270
2012	101-11	29	42,268	48	87%	76%	95%	36,797	0%	0%	3%	193	14%	7%	24%	6,022
2012	101-11	30	40,701	72	83%	74%	91%	33,810	0%	0%	2%	125	17%	10%	26%	7,094
2012	101-11	31	23,628	35	63%	46%	78%	14,803	1%	0%	4%	147	34%	21%	49%	8,107
2012	101-11	32	7,313	77	52%	41%	63%	3,798	12%	6%	20%	866	35%	25%	45%	2,559
2012	101-11	33	5,741	125	40%	32%	49%	2,299	29%	21%	37%	1,652	31%	23%	39%	1,761
2012	101-11	34	10,943	106	11%	6%	17%	1,159	40%	31%	50%	4,427	47%	38%	56%	5,146
2012	101-11	35	11,533	95	2%	0%	6%	276	64%	54%	73%	7,367	33%	24%	42%	3,781
2012	101-11	36	10,534	117	1%	0%	4%	116	71%	63%	79%	7,528	27%	20%	35%	2,851
2012	101-11	37	4,579	72	2%	0%	6%	81	68%	56%	78%	3,094	30%	20%	40%	1,363
2012	101-11	38–39	3,826	69	0%	0%	3%	16	82%	72%	90%	3,134	18%	10%	27%	692
2012	101-11	Total	314,102	1,355	73%	71%	76%	230,246	9%	9%	10%	29,245	18%	15%	20%	55,948
2013	101-11	25	9,585	140	85%	79%	90%	8,134	0%	0%	1%	14	16%	10%	22%	1,494
2013	101-11	26	26,223	164	79%	72%	85%	20,600	0%	0%	1%	33	22%	16%	28%	5,667

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2013	101-11	27	34,018	178	85%	80%	90%	29,010	0%	0%	1%	40	15%	10%	21%	5,131
2013	101-11	28	53,099	155	84%	78%	89%	44,468	0%	0%	1%	71	17%	11%	23%	8,822
2013	101-11	29	31,263	106	88%	81%	93%	27,365	0%	0%	1%	61	13%	8%	20%	4,119
2013	101-11	30	14,512	48	87%	76%	95%	12,634	0%	0%	3%	62	14%	6%	25%	2,084
2013	101-11	31	14,579	95	86%	79%	92%	12,552	0%	0%	2%	32	15%	9%	22%	2,129
2013	101-11	32	7,446	95	65%	55%	74%	4,853	2%	0%	6%	171	32%	24%	42%	2,412
2013	101-11	33	4,066	47	32%	20%	46%	1,307	11%	4%	21%	441	54%	41%	67%	2,199
2013	101-11	34	7,672	96	10%	5%	16%	738	35%	26%	45%	2,706	54%	44%	63%	4,111
2013	101-11	35	10,855	99	2%	0%	6%	250	64%	55%	73%	6,971	33%	24%	42%	3,588
2013	101-11	36	6,423	95	0%	0%	2%	19	77%	69%	85%	4,966	23%	15%	31%	1,446
2013	101-11	37	5,802	142	0%	0%	1%	12	53%	44%	61%	3,052	46%	39%	54%	2,692
2013	101-11	38–40	6,442	48	1%	0%	4%	38	51%	38%	65%	3,315	46%	33%	59%	2,944
2013	101-11	Total	231,985	1,508	70%	68%	72%	161,981	10%	9%	10%	21,935	21%	19%	23%	48,837
2014	101-11	25	2,120	119	75%	66%	82%	1,581	0%	0%	1%	4	26%	19%	34%	545
2014	101-11	26	11,230	251	84%	79%	88%	9,380	0%	0%	1%	11	17%	13%	22%	1,912
2014	101-11	27	23,590	288	83%	78%	87%	19,548	0%	0%	1%	21	18%	14%	22%	4,149
2014	101-11	28	38,903	264	85%	81%	89%	33,249	0%	0%	1%	37	15%	11%	20%	5,890
2014	101-11	29	31,443	274	76%	71%	81%	23,837	0%	0%	2%	143	24%	19%	29%	7,552
2014	101-11	30	22,416	203	80%	74%	85%	17,854	1%	0%	3%	247	20%	15%	25%	4,456
2014	101-11	31	8,523	179	74%	67%	80%	6,273	1%	0%	2%	59	26%	20%	32%	2,217
2014	101-11	32	6,063	262	62%	56%	68%	3,768	1%	0%	2%	52	37%	31%	43%	2,225
2014	101-11	33	3,951	118	45%	36%	54%	1,775	9%	5%	15%	374	44%	36%	53%	1,747
2014	101-11	34	4,084	171	37%	30%	45%	1,530	23%	17%	29%	932	39%	32%	46%	1,597
2014	101-11	35	6,862	153	10%	6%	15%	687	37%	29%	44%	2,506	52%	44%	59%	3,552
2014	101-11	36	8,858	174	6%	3%	10%	527	52%	45%	60%	4,618	41%	34%	48%	3,644
2014	101-11	37	7,260	187	0%	0%	1%	16	55%	48%	63%	4,026	43%	37%	50%	3,156
2014	101-11	38	6,001	166	1%	0%	3%	51	65%	57%	72%	3,890	34%	27%	41%	2,043
2014	101-11	39	2,659	141	2%	0%	4%	45	71%	63%	78%	1,877	28%	21%	35%	741
2014	101-11	40	326	44	1%	0%	5%	3	81%	68%	91%	263	21%	12%	32%	68
2014	101-11	Total	184,289	2,994	65%	64%	67%	120,124	10%	10%	11%	19,060	25%	23%	26%	45,494
2015	101-11	26	13,076	216	83%	78%	88%	10,877	0%	0%	1%	12	17%	13%	22%	2,242
2015	101-11	27	17,299	215	84%	79%	89%	14,617	0%	0%	1%	15	16%	12%	21%	2,767
2015	101-11	28	33,465	155	89%	83%	93%	29,716	0%	0%	1%	41	13%	8%	18%	4,204
2015	101-11	29	52,738	84	83%	74%	90%	43,750	0%	0%	2%	120	18%	11%	25%	9,331

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2015	101-11	30	73,798	36	69%	53%	83%	50,841	1%	0%	4%	388	26%	16%	37%	19,075
2015	101-11	31	78,493	181	71%	64%	77%	55,848	3%	1%	6%	2,245	25%	20%	31%	19,742
2015	101-11	32	36,819	142	62%	54%	70%	22,781	8%	4%	13%	2,891	29%	22%	35%	10,494
2015	101-11	33	22,538	84	48%	37%	58%	10,727	25%	16%	35%	5,649	25%	18%	34%	5,746
2015	101-11	34	9,011	60	29%	18%	40%	2,574	45%	33%	57%	4,046	25%	16%	34%	2,210
2015	101-11	35	30,234	120	10%	6%	16%	3,096	66%	57%	74%	19,860	23%	17%	30%	7,073
2015	101-11	36	37,705	108	1%	0%	4%	476	78%	69%	85%	29,243	21%	15%	28%	7,957
2015	101-11	37	27,151	155	0%	0%	1%	65	82%	76%	88%	22,375	18%	13%	24%	4,868
2015	101-11	38	12,830	107	0%	0%	2%	45	87%	80%	92%	11,117	15%	9%	21%	1,893
2015	101-11	39–40	7,602	72	1%	0%	3%	39	90%	82%	96%	6,830	13%	7%	20%	986
2015	101-11	Total	452,759	1,735	54%	51.2%	57.2%	245,452	23%	21.9%	24.4%	104,831	22%	19.4%	24.2%	98,589
2011	106	25	673	46	54%	40%	68%	365	1%	0%	4%	4	43%	31%	56%	292
2011	106	26	2,247	130	71%	63%	78%	1,586	1%	0%	3%	22	29%	22%	37%	647
2011	106	27	6,569	185	78%	72%	84%	5,139	0%	0%	1%	11	22%	17%	28%	1,460
2011	106	28	19,853	121	85%	78%	91%	16,844	0%	0%	2%	51	16%	10%	23%	3,232
2011	106	29	24,095	142	88%	82%	93%	21,149	0%	0%	1%	53	13%	8%	19%	3,223
2011	106	30	17,097	178	85%	80%	90%	14,567	0%	0%	1%	30	16%	11%	21%	2,667
2011	106	31	19,553	162	73%	66%	80%	14,334	0%	0%	1%	38	27%	21%	34%	5,266
2011	106	32	12,828	132	71%	63%	78%	9,114	6%	3%	11%	799	23%	17%	31%	3,011
2011	106	33	6,575	186	49%	42%	57%	3,251	12%	8%	17%	783	38%	32%	45%	2,527
2011	106	34	2,235	166	19%	13%	25%	420	22%	16%	29%	498	58%	50%	65%	1,287
2011	106	35	5,298	96	5%	1%	10%	240	50%	40%	59%	2,626	45%	35%	54%	2,365
2011	106	36	7,402	110	3%	1%	7%	226	53%	44%	62%	3,939	43%	34%	52%	3,166
2011	106	37	13,990	60	1%	0%	4%	90	53%	40%	65%	7,354	45%	33%	56%	6,259
2011	106	38	17,802	143	0%	0%	2%	48	60%	52%	68%	10,636	39%	32%	47%	7,019
2011	106	39–40	1,879	81	0%	0%	3%	9	61%	50%	71%	1,146	38%	28%	48%	709
2011	106	Total	158,096	1938	55%	54%	57%	87382.36	18%	16%	19%	27,989	27%	25%	29%	43,129
2012	106	25	2,980	88	87%	80%	93%	2,599	0%	0%	3%	14	13%	7%	21%	398
2012	106	26	6,908	132	85%	79%	91%	5,901	0%	0%	2%	22	15%	9%	21%	1,030
2012	106	27	18,393	179	92%	88%	96%	16,925	0%	0%	1%	43	8%	5%	13%	1,534
2012	106	28	17,139	139	90%	85%	95%	15,502	0%	0%	2%	52	10%	6%	15%	1,710
2012	106	29	13,035	111	94%	89%	98%	12,294	1%	0%	4%	164	5%	2%	10%	709
2012	106	30	16,620	179	78%	72%	84%	12,981	2%	1%	5%	405	20%	14%	26%	3,296
2012	106	31	5,747	117	65%	56%	73%	3,728	5%	2%	9%	261	31%	23%	39%	1,773

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2012	106	32	6,891	115	56%	47%	65%	3,833	4%	1%	8%	259	41%	32%	50%	2,800
2012	106	33	3,922	144	33%	26%	41%	1,311	14%	9%	20%	546	52%	44%	60%	2,051
2012	106	34	2,191	140	13%	8%	19%	286	43%	35%	51%	943	43%	35%	51%	949
2012	106	35	3,614	108	5%	2%	10%	178	45%	36%	54%	1,613	49%	40%	59%	1,787
2012	106	36	3,740	217	9%	6%	14%	350	38%	31%	44%	1,403	53%	46%	59%	1,970
2012	106	37	1,590	19	7%	0%	21%	110	25%	10%	45%	397	63%	42%	81%	996
2012	106	38–39	1,537	48	1%	0%	4%	11	40%	27%	54%	619	57%	43%	70%	869
2012	106	Total	104,307	1,736	73%	71%	75%	76,009	7%	6%	7%	6,741	21%	19%	23%	21,871
2013	106	25	3,369	60	70%	58%	80%	2,349	0%	0%	2%	9	30%	20%	42%	1,020
2013	106	26	4,160	44	72%	59%	84%	3,004	0%	0%	3%	14	28%	16%	41%	1,159
2013	106	27	17,091	129	73%	66%	81%	12,552	0%	0%	1%	24	27%	19%	34%	4,545
2013	106	28	11,856	163	79%	72%	85%	9,354	0%	0%	1%	13	21%	15%	28%	2,509
2013	106	29	18,751	165	70%	63%	77%	13,162	1%	0%	2%	125	29%	23%	36%	5,479
2013	106	30	10,324	105	85%	78%	91%	8,793	0%	0%	1%	17	15%	9%	22%	1,545
2013	106	31	14,773	94	81%	73%	88%	12,028	0%	0%	1%	27	19%	12%	27%	2,763
2013	106	32	3,911	86	68%	58%	78%	2,677	0%	0%	2%	8	32%	22%	41%	1,234
2013	106	33	4,120	111	20%	13%	28%	822	6%	2%	10%	236	74%	65%	81%	3,031
2013	106	34	1,989	60	68%	56%	79%	1,355	0%	0%	2%	5	32%	21%	44%	634
2013	106	35–41	3,916	12	18%	4%	41%	711	5%	0%	15%	178	72%	49%	91%	2,836
2013	106	Total	94,260	1,029	71%	68%	74%	66,807	1%	0%	1%	658	28%	26%	31%	26,753
2014	106	25–26	858	31	83%	69%	94%	714	1%	0%	5%	5	18%	8%	31%	154
2014	106	27	5,596	144	90%	85%	94%	5,041	0%	0%	1%	8	11%	6%	16%	595
2014	106	28	21,788	145	90%	85%	94%	19,643	0%	0%	1%	29	11%	6%	16%	2,302
2014	106	29	12,973	161	91%	86%	95%	11,742	0%	0%	1%	16	10%	6%	15%	1,318
2014	106	30	20,704	197	87%	82%	91%	17,945	1%	0%	2%	125	13%	9%	18%	2,737
2014	106	31	9,868	224	81%	75%	86%	7,965	1%	0%	3%	96	19%	14%	24%	1,828
2014	106	32	7,634	185	79%	73%	85%	6,058	1%	0%	2%	49	20%	15%	26%	1,541
2014	106	33	2,262	119	50%	42%	59%	1,141	7%	3%	12%	155	41%	33%	50%	935
2014	106	34	4,800	99	52%	42%	61%	2,475	19%	12%	27%	922	29%	21%	38%	1,380
2014	106	35	2,846	83	21%	13%	30%	593	34%	24%	44%	956	43%	33%	53%	1,233
2014	106	36	6,050	108	10%	5%	16%	582	55%	46%	64%	3,342	34%	26%	43%	2,068
2014	106	37	7,077	173	1%	0%	3%	60	66%	59%	73%	4,686	32%	26%	39%	2,294
2014	106	38–41	3,787	60	1%	0%	4%	29	76%	64%	86%	2,869	23%	14%	34%	884
2014	106	Total	106,243	1,729	70%	68%	71%	73,987	13%	12%	13%	13,256	18%	16%	20%	19,270

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2015	106-30	25	32	13	84%	61%	97%	27	1%	0%	7%	0	14%	4%	30%	5
2015	106-30	26	375	94	92%	86%	97%	346	0%	0%	1%	0	8%	4%	14%	30
2015	106-30	27	1,799	76	93%	87%	98%	1,676	0%	0%	1%	2	7%	3%	14%	135
2015	106-30	28	6,741	88	97%	93%	100%	6,571	0%	0%	1%	7	4%	1%	8%	245
2015	106-30	29	11,526	127	97%	93%	99%	11,144	0%	0%	1%	8	4%	1%	8%	467
2015	106-30	30	22,944	124	97%	94%	99%	22,349	0%	0%	1%	16	3%	1%	7%	783
2015	106-30	31	28,834	55	89%	79%	96%	25,615	0%	0%	2%	46	11%	5%	20%	3,254
2015	106-30	32	24,383	154	84%	78%	89%	20,410	1%	0%	4%	329	15%	10%	21%	3,603
2015	106-30	33	8,186	131	66%	57%	74%	5,378	9%	5%	15%	752	24%	17%	31%	1,971
2015	106-30	34	1,752	132	52%	43%	60%	905	20%	13%	27%	345	27%	20%	35%	479
2015	106-30	35	3,677	24	23%	9%	41%	833	57%	38%	76%	2,105	18%	8%	32%	663
2015	106-30	36–40	10,972	12	5%	0%	21%	539	80%	55%	96%	8,775	15%	4%	31%	1,613
2015	106-30	Total	121,221	1,030	79%	76%	82%	95,794	10%	8%	12%	12,384	11%	8%	14%	13,248
2011	108	26	397	25	44%	27%	62%	175	1%	0%	4%	2	56%	38%	73%	221
2011	108	27	1,082	87	25%	17%	35%	273	0%	0%	2%	3	75%	65%	83%	808
2011	108	28	5,034	129	57%	48%	65%	2,863	0%	0%	1%	8	43%	35%	52%	2,168
2011	108	29	8,423	95	41%	32%	51%	3,473	0%	0%	2%	18	59%	49%	68%	4,945
2011	108	30	19,052	96	68%	58%	76%	12,862	0%	0%	1%	41	32%	24%	42%	6,174
2011	108	31	34,075	96	69%	59%	77%	23,342	0%	0%	1%	74	31%	23%	41%	10,705
2011	108	32	52,184	84	67%	56%	76%	34,704	0%	0%	2%	127	33%	24%	43%	17,432
2011	108	33	18,243	24	49%	31%	67%	8,942	3%	0%	10%	535	47%	30%	65%	8,629
2011	108	34	1,975	75	43%	32%	54%	845	3%	1%	8%	69	53%	42%	64%	1,054
2011	108	35	668	76	42%	32%	53%	282	7%	3%	12%	44	50%	39%	61%	336
2011	108	36	391	57	15%	7%	25%	58	0%	0%	2%	1	85%	75%	93%	332
2011	108	37–40	1,002	15	21%	7%	41%	213	1%	0%	5%	7	78%	59%	93%	786
2011	108	Total	142,526	859	62%	57%	67%	88,033	1%	0%	1%	930	38%	33%	43%	53,591
2012	108	25-26	2,885	71	80%	70%	88%	2,309	0%	0%	2%	6	20%	12%	30%	576
2012	108	27	15,276	100	81%	73%	88%	12,347	0%	0%	1%	23	19%	12%	27%	2,932
2012	108	28	48,811	128	85%	78%	91%	41,486	0%	0%	1%	58	15%	9%	22%	7,336
2012	108	29	68,334	155	96%	92%	98%	65,553	0%	0%	1%	68	4%	2%	8%	2,803
2012	108	30	50,534	227	96%	93%	98%	48,462	0%	0%	1%	35	4%	2%	7%	2,083
2012	108	31	40,485	215	91%	86%	94%	36,670	0%	0%	1%	30	9%	6%	14%	3,822
2012	108	32	9,539	96	79%	70%	86%	7,536	0%	0%	1%	15	21%	14%	30%	2,004

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2012	108	33	2,233	24	26%	11%	45%	589	0%	0%	4%	10	73%	55%	88%	1,637
2012	108	34	1,258	71	22%	13%	32%	272	0%	0%	2%	3	78%	68%	87%	984
2012	108	35	609	84	18%	11%	27%	112	8%	4%	15%	52	72%	62%	81%	439
2012	108	36–39	602	19	13%	2%	30%	78	4%	0%	12%	22	82%	62%	95%	491
2012	108	Total	240,566	1,190	90%	88%	91%	215,414	0%	0%	0%	322	10%	9%	12%	25,109
2013	108	25–27	2,577	23	73%	54%	88%	1,879	0%	0%	0%	0	27%	12%	46%	698
2013	108	28	6,785	11	49%	24%	74%	3,303	0%	0%	0%	0	51%	26%	76%	3,482
2013	108	29	23,553	94	98%	94%	100%	23,092	0%	0%	0%	0	2%	0%	6%	461
2013	108	30	23,563	144	81%	74%	87%	19,075	0%	0%	0%	0	19%	13%	26%	4,488
2013	108	31	26,583	148	77%	70%	84%	20,594	0%	0%	0%	0	23%	16%	30%	5,989
2013	108	32	9,373	46	34%	22%	48%	3,200	0%	0%	0%	0	66%	52%	78%	6,173
2013	108	33–40	10,931	24	36%	19%	55%	3,944	0%	0%	0%	0	64%	45%	81%	6,987
2013	108	Total	103,365	490	73%	69%	76%	75,087	0%	0%	0%	0	27%	24%	31%	28,278
2014	108	25-27	3,095	20	59%	40%	77%	1,834	0%	0%	0%	0	41%	23%	60%	1,261
2014	108	28	5,683	18	56%	36%	75%	3,175	0%	0%	0%	0	44%	25%	64%	2,508
2014	108	29	16,403	53	75%	64%	85%	12,339	0%	0%	0%	0	25%	15%	36%	4,064
2014	108	30	28,358	95	87%	80%	93%	24,810	0%	0%	0%	0	13%	7%	20%	3,548
2014	108	31	16,705	48	82%	71%	91%	13,726	0%	0%	0%	0	18%	9%	29%	2,979
2014	108	32–38	14,527	152	86%	80%	91%	12,446	0%	0%	0%	0	14%	9%	20%	2,081
2014	108	Total	84,771	386	81%	77%	85%	68,330	0%	0%	0%	0	19%	15%	23%	16,441
2015	108	25–27	3,199	24	99%	95%	100%	3,176	0%	0%	2%	9	1%	0%	5%	25
2015	108	28–29	24,165	192	99%	97%	100%	23,896	0%	0%	1%	15	1%	0%	3%	269
2015	108	30	43,841	240	98%	96%	100%	43,095	0%	0%	0%	23	2%	0%	4%	742
2015	108	31	45,196	119	98%	95%	100%	44,406	0%	0%	1%	42	2%	0%	5%	781
2015	108	32	26,435	36	99%	96%	100%	26,298	0%	0%	2%	58	1%	0%	4%	153
2015	108	33	13,529	84	87%	79%	93%	11,743	3%	1%	7%	383	10%	5%	16%	1,292
2015	108	34–40	9,644	34	99%	96%	100%	9,592	1%	0%	4%	22	1%	0%	4%	58
2015	108	Total	166,009	729	98%	97%	99%	162,207	0%	0%	1%	551	2%	1%	3%	3,320

Appendix E.–Weekly chum salmon harvest, otolith sample size (*n*), and estimated proportion, 95% credible interval, and contribution of marked summer and fall hatchery fish and unmarked fish in the commercial purse seine fisheries in Districts 101–107, 2006–2010. Bold values were imputed.

					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
					Estimated	95% CI		Estimated	Estimated	95% CI		Estimated	Estimated	95% CI		Estimated
Year	District	Week	Total harvest	*n*	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution
2011	101	28	22,590	174	57%	50%	64%	12,891	0%	0%	1%	51	43%	36%	50%	9,719
2011	101	29	2,303	50	48%	35%	61%	1,099	1%	0%	4%	16	52%	39%	64%	1,187
2011	101	30	60,029	189	70%	64%	76%	42,083	2%	0%	4%	1,037	29%	23%	35%	17,360
2011	101	31	5,725	24	46%	29%	63%	2,618	1%	0%	7%	73	53%	37%	68%	3,013
2011	101	32	11,192	197	33%	27%	39%	3,679	12%	8%	17%	1,385	55%	48%	61%	6,101
2011	**101**	**33–34**	**871**	**46**	**21%**	**11%**	**33%**	**180**	**14%**	**6%**	**24%**	**119**	**64%**	**51%**	**75%**	**554**
2011	101	Total	102,710	680	61%	57%	65%	62,550	3%	1%	4%	2,681	37%	33%	41%	37,934
2012	101	27	11,406	24	89%	75%	98%	10,173	1%	0%	6%	99	16%	5%	30%	1,775
2012	101	28	3,175	36	69%	53%	82%	2,177	1%	0%	4%	19	32%	19%	47%	1,026
2012	101	29	7,908	48	52%	38%	66%	4,104	0%	0%	3%	36	47%	34%	60%	3,734
2012	101	30	40,831	132	63%	55%	71%	25,908	0%	0%	1%	68	37%	29%	45%	14,958
2012	101	31	38,627	191	55%	48%	62%	21,410	5%	3%	9%	2,048	39%	33%	46%	15,203
2012	101	32	19,562	144	29%	22%	36%	5,601	8%	4%	13%	1,640	62%	54%	70%	12,182
2012	101	33	18,523	143	3%	1%	7%	592	34%	27%	42%	6,297	62%	54%	70%	11,489
2012	**101**	**34–35**	**48,356**	**48**	**1%**	**0%**	**6%**	**605**	**51%**	**37%**	**64%**	**24,495**	**47%**	**34%**	**60%**	**22,831**
2012	101	Total	188,388	766	37%	35%	40%	70,570	18%	15%	22%	34,702	44%	40%	48%	83,197
2013	101	28	34,270	167	68%	61%	75%	23,271	0%	0%	2%	151	32%	25%	39%	11,058
2013	101	29	41,505	237	67%	61%	73%	27,917	1%	0%	2%	297	32%	27%	38%	13,463
2013	101	30	39,918	130	71%	63%	78%	28,353	1%	0%	2%	221	29%	22%	37%	11,667
2013	101	31	32,150	192	54%	47%	61%	17,361	2%	0%	4%	592	44%	38%	51%	14,306
2013	101	32	11,420	175	34%	27%	41%	3,856	4%	1%	7%	410	63%	56%	70%	7,163
2013	101	33	9,292	94	27%	19%	36%	2,494	8%	4%	14%	755	65%	55%	74%	6,000
2013	101	34	7,455	84	13%	6%	20%	933	11%	6%	18%	818	75%	66%	84%	5,618
2013	101	35	7,100	94	10%	5%	17%	722	15%	9%	22%	1,035	74%	65%	82%	5,239
2013	101	36	1,246	24	3%	0%	12%	37	7%	1%	17%	91	87%	72%	97%	1,084
2013	101	Total	184,356	1,197	57%	54%	60%	104,944	2%	2%	3%	4,371	41%	38%	44%	75,597
2014	101	28	10,785	36	50%	36%	65%	5,439	1%	0%	5%	84	50%	37%	63%	5,419
2014	101	29	31,984	230	43%	37%	50%	13,858	1%	0%	2%	180	56%	50%	62%	17,947
2014	101	30	38,816	212	52%	45%	58%	20,149	0%	0%	1%	59	48%	42%	55%	18,753
2014	101	31	36,413	250	57%	51%	63%	20,924	1%	0%	2%	331	42%	36%	48%	15,365
2014	101	32	9,560	202	42%	35%	49%	4,011	1%	0%	2%	61	57%	51%	64%	5,483
2014	101	33	9,334	202	28%	22%	34%	2,577	4%	1%	6%	328	68%	62%	74%	6,374

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
					Estimated	95% CI		Estimated	Estimated	95% CI		Estimated	Estimated	95% CI		Estimated
Year	District	Week	Total harvest	*n*	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution
2014	101	34	10,050	222	23%	18%	29%	2,313	20%	15%	25%	1,993	57%	51%	63%	5,744
2014	101	35	4,563	152	11%	6%	16%	480	15%	10%	21%	672	74%	67%	80%	3,362
2014	101	Total	151,505	1,506	46%	43%	49%	69,751	2%	2%	3%	3,708	52%	49%	55%	78,447
2015	101	28	150,560	227	76%	71%	82%	114,864	0%	0%	1%	196	24%	19%	29%	35,840
2015	101	29	119,845	263	78%	73%	83%	93,889	0%	0%	1%	136	22%	17%	27%	26,088
2015	101	30	165,789	240	73%	68%	79%	121,837	1%	0%	2%	850	26%	21%	32%	43,374
2015	101	31	96,136	226	66%	60%	72%	63,339	1%	0%	3%	917	33%	27%	39%	31,924
2015	101	32	39,145	120	59%	50%	67%	22,965	2%	0%	4%	663	39%	31%	48%	15,458
2015	101	33	7,014	12	45%	24%	67%	3,136	5%	0%	14%	321	47%	27%	67%	3,283
2015	101	Total	578,489	1,088	73%	70%	75%	420,031	1%	0%	1%	3,082	27%	24%	30%	155,968
2011	102	26	3,866	63	74%	63%	84%	2,877	0%	0%	3%	17	26%	16%	37%	991
2011	102	27	66,958	190	85%	80%	90%	57,035	0%	0%	1%	110	15%	10%	20%	9,936
2011	102	28	161,461	187	88%	83%	92%	141,459	0%	0%	1%	270	12%	8%	17%	20,038
2011	102	29	199,723	310	89%	85%	92%	177,064	0%	0%	1%	820	11%	8%	15%	22,044
2011	102	30	130,346	144	76%	68%	82%	98,556	1%	0%	4%	1,904	23%	17%	30%	30,011
2011	102	31	59,022	119	93%	88%	97%	54,961	0%	0%	2%	148	7%	3%	12%	4,085
2011	102	32	38,561	131	63%	55%	71%	24,410	3%	1%	6%	1,137	34%	26%	42%	12,981
2011	102	33	131	24	1%	0%	6%	1	1%	0%	5%	1	99%	93%	100%	130
2011	102	34	1,223	48	7%	1%	15%	80	2%	0%	7%	26	91%	82%	97%	1,116
2011	102	35	11,061	180	1%	0%	2%	72	11%	7%	16%	1,203	88%	83%	92%	9,699
2011	102	36	38,545	83	0%	0%	2%	78	0%	0%	2%	132	100%	98%	100%	38,437
2011	102	37	13,520	180	0%	0%	1%	13	6%	3%	10%	850	93%	89%	96%	12,604
2011	102	**38–41**	**67,276**	**48**	**0%**	**0%**	**3%**	**236**	**2%**	**0%**	**7%**	**1,404**	**97%**	**92%**	**100%**	**65,565**
2011	102	Total	791,693	1,707	70%	68%	72%	556,843	1%	1%	2%	8,021	29%	27%	31%	227,636
2012	102	25	39,468	125	98%	95%	100%	38,797	0%	0%	1%	82	2%	0%	5%	679
2012	102	26	76,386	239	98%	96%	99%	74,749	0%	0%	1%	86	2%	1%	4%	1,645
2012	102	27	472,471	263	94%	91%	96%	443,528	0%	0%	1%	486	6%	4%	9%	28,982
2012	102	28	279,110	215	96%	93%	98%	267,275	0%	0%	1%	348	4%	2%	7%	11,866
2012	102	29	126,067	211	99%	97%	100%	124,200	0%	0%	1%	160	1%	0%	4%	1,883
2012	102	30	76,892	214	89%	84%	93%	68,234	0%	0%	1%	96	11%	7%	16%	8,664
2012	102	31	68,140	214	53%	46%	59%	35,986	3%	1%	6%	2,203	44%	37%	51%	29,925
2012	102	32	60,423	36	58%	42%	74%	35,247	7%	2%	16%	4,194	33%	19%	49%	20,180
2012	102	33	28,172	133	7%	3%	12%	1,940	4%	2%	8%	1,227	89%	83%	93%	24,953
2012	102	34	14,351	72	9%	3%	16%	1,227	12%	6%	20%	1,772	78%	67%	86%	11,131

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2012	102	35	4,033	47	0%	0%	3%	15	0%	0%	3%	20	99%	96%	100%	4,012
2012	102	**36–38**	**46,541**	**72**	**0%**	**0%**	**2%**	**117**	**0%**	**0%**	**2%**	**158**	**100%**	**98%**	**100%**	**46,384**
2012	102	Total	1,292,054	1,841	85%	83%	86%	1,091,315	1%	0%	1%	10,832	15%	13%	16%	190,304
2013	102	25	18,456	71	76%	65%	85%	14,009	1%	0%	5%	273	23%	14%	33%	4,192
2013	102	26	53,183	203	91%	86%	94%	48,150	1%	0%	3%	569	8%	5%	13%	4,519
2013	102	27	159,901	187	94%	90%	97%	150,296	0%	0%	1%	361	6%	3%	10%	9,635
2013	102	28	113,002	215	92%	87%	95%	103,428	1%	0%	2%	688	8%	5%	12%	9,067
2013	102	29	41,015	48	99%	96%	100%	40,783	1%	0%	3%	259	1%	0%	4%	268
2013	102	30	43,852	180	84%	78%	89%	36,747	0%	0%	1%	102	16%	11%	22%	7,110
2013	102	31	39,296	165	75%	68%	81%	29,507	0%	0%	1%	99	25%	19%	32%	9,791
2013	102	32	18,002	95	43%	34%	53%	7,792	1%	0%	4%	215	56%	46%	65%	10,015
2013	102	33	9,095	94	59%	49%	68%	5,323	2%	0%	5%	183	39%	30%	49%	3,579
2013	102	34	10,904	95	8%	3%	14%	845	1%	0%	4%	130	91%	85%	96%	9,935
2013	102	35	23,964	96	5%	1%	10%	1,095	5%	2%	10%	1239	89%	82%	94%	21,360
2013	102	**36–37**	**7,345**	**46**	**1%**	**0%**	**5%**	**66**	**5%**	**1%**	**10%**	**339**	**92%**	**83%**	**98%**	**6,793**
2013	102	Total	538,015	1,495	81%	80%	83%	438,041	1%	0%	1%	4457	18%	16%	20%	96,263
2014	102	25	1,026	24	95%	84%	100%	978	1%	0%	4%	6	5%	0%	16%	49
2014	102	26	12,819	191	96%	92%	98%	12,274	0%	0%	1%	13	4%	2%	8%	547
2014	102	27	66,156	167	99%	98%	100%	65,704	0%	0%	1%	76	1%	0%	2%	463
2014	102	28	94,252	153	96%	92%	98%	90,480	0%	0%	1%	117	4%	2%	8%	3,788
2014	102	29	87,831	143	98%	95%	100%	85,907	0%	0%	1%	116	2%	0%	5%	1,941
2014	102	30	70,379	107	91%	86%	96%	64,393	0%	0%	1%	120	9%	4%	14%	5,999
2014	102	31	28,858	84	96%	91%	99%	27,784	0%	0%	2%	61	4%	1%	9%	1,082
2014	102	32	18,020	84	51%	41%	62%	9,245	0%	0%	2%	38	49%	38%	59%	8,767
2014	102	33	14,416	109	36%	27%	45%	5,181	7%	4%	13%	1,077	56%	46%	65%	8,044
2014	102	**34–35**	**16,205**	**129**	**19%**	**13%**	**26%**	**3,047**	**1%**	**0%**	**3%**	**137**	**80%**	**73%**	**87%**	**13,023**
2014	102	37	1,879	72	0%	0%	3%	9	6%	2%	12%	113	92%	85%	97%	1,738
2014	102	Total	411,841	1,263	89%	87%	90%	365,002	0%	0%	1%	1,874	11%	10%	12%	45,441
2015	102	26	12,824	97	91%	84%	96%	11,614	0%	0%	2%	39	9%	5%	16%	1,217
2015	102	27	106,855	321	94%	92%	97%	100,809	0%	0%	1%	427	5%	3%	8%	5,734
2015	102	28	58,611	144	98%	96%	100%	57,725	0%	0%	1%	125	2%	0%	4%	913
2015	102	29	54,763	24	79%	61%	92%	43,110	1%	0%	5%	495	21%	8%	39%	11,733
2015	102	30	92,289	95	97%	92%	99%	89,209	0%	0%	2%	287	3%	1%	8%	3,142
2015	102	31	78,849	215	91%	87%	95%	71,826	1%	0%	2%	462	8%	5%	13%	6,678

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
					Estimated	95% CI		Estimated	Estimated	95% CI		Estimated	Estimated	95% CI		Estimated
Year	District	Week	Total harvest	*n*	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution	proportion	Lower	Upper	contribution
2015	102	32	115,996	337	66%	60%	71%	76,048	2%	1%	3%	1,767	33%	28%	38%	38,235
2015	102	33	45,257	188	35%	28%	42%	15,899	2%	1%	5%	975	63%	56%	69%	28,389
2015	102	34	33,032	273	15%	11%	20%	4,975	4%	2%	7%	1,424	81%	76%	85%	26,600
2015	102	35	6,858	95	9%	4%	15%	588	3%	1%	7%	211	88%	81%	94%	6,050
2015	102	36	11,180	24	1%	0%	6%	78	9%	2%	20%	1,001	87%	71%	97%	9,693
2015	102	37	9,145	108	1%	0%	4%	99	10%	5%	16%	930	88%	81%	93%	8,028
2015	102	38	19,083	84	0%	0%	2%	38	0%	0%	2%	66	100%	98%	100%	19,024
2015	102	39	4,352	24	1%	0%	6%	30	1%	0%	5%	39	99%	93%	100%	4,306
2015	102	Total	649,094	2,029	73%	71%	75%	472,048	1%	1%	2%	8,250	26%	24%	28%	169,742
2011	103	32	8,910	36	9%	3%	18%	817	1%	0%	4%	59	91%	83%	97%	8,132
2011	103	33	10,544	83	8%	3%	14%	825	0%	0%	2%	40	92%	87%	96%	9,727
2011	103	34	26,317	239	2%	1%	4%	478	2%	1%	5%	638	96%	93%	98%	25,167
2011	103	35	16,365	48	1%	0%	4%	158	1%	0%	3%	91	98%	94%	100%	15,997
2011	103	**36–37**	**16,409**	**36**	**1%**	**0%**	**5%**	**196**	**4%**	**1%**	**10%**	**645**	**94%**	**88%**	**98%**	**15,475**
2011	103	Total	78,545	442	3%	2%	5%	2,475	2%	1%	3%	1,473	95%	93%	97%	74,498
2012	103	31	901	34	17%	7%	30%	150	0%	0%	0%	0	83%	70%	93%	751
2012	103	**32–33**	**34,765**	**0**	**9%**	**0%**	**45%**	**3,068**	**0%**	**0%**	**0%**	**0**	**91%**	**55%**	**100%**	**31,698**
2012	103	34	8,456	35	1%	0%	5%	79	0%	0%	0%	0	99%	95%	100%	8,377
2012	103	Total	44,122	69	7%	-7%	22%	3,298	0%	0%	0%	0	93%	78%	107%	40,825
2013	103	30–32	32,492	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2013	103	33–34	66,697	47	0%	0%	0%	0	0%	0%	0%	0	100%	100%	100%	66,697
2013	103	35–36	13,672	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2013	103	Total	112,861	47	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2014	103	**30–32**	**23,935**	**72**	**24%**	**15%**	**34%**	**5,690**	**0%**	**0%**	**0%**	**0**	**76%**	**66%**	**85%**	**18,245**
2014	103	33	12,873	36	4%	0%	11%	470	0%	0%	0%	0	96%	89%	100%	12,403
2014	103	34	12,433	128	3%	1%	6%	328	0%	0%	0%	0	97%	94%	99%	12,105
2014	103	35	3,508	36	6%	1%	15%	212	0%	0%	0%	0	94%	85%	99%	3,296
2014	103	Total	52,749	272	13%	8%	17%	6,699	0%	0%	0%	0	87%	83%	92%	46,050
2015	103	**30–32**	**25,824**	**48**	**25%**	**15%**	**37%**	**6,479**	**9%**	**3%**	**17%**	**2,311**	**64%**	**51%**	**77%**	**16,648**
2015	103	33	21,460	12	8%	1%	25%	1,803	2%	0%	10%	461	91%	73%	99%	19,443
2015	103	34	19,266	48	3%	0%	8%	535	1%	0%	4%	174	97%	91%	100%	18,706
2015	103	35	17,845	93	2%	0%	5%	270	1%	0%	4%	260	97%	93%	100%	17,383
2015	103	36	5,388	24	5%	0%	15%	270	7%	1%	16%	362	87%	73%	97%	4,714
2015	103	Total	89,783	225	10%	6%	15%	9,358	4%	1%	7%	3,567	86%	80%	91%	76,895
2011	104	**28–29**	**30,717**	**108**	**74%**	**66%**	**82%**	**22,788**	**2%**	**0%**	**6%**	**668**	**25%**	**17%**	**33%**	**7,641**

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2011	104	30	37,030	61	53%	41%	65%	19,776	7%	2%	14%	2,557	41%	29%	52%	15,035
2011	104	31	14,880	93	29%	21%	39%	4,337	8%	3%	14%	1,150	63%	53%	72%	9,317
2011	104	32	31,859	236	27%	21%	33%	8,526	7%	4%	10%	2,189	66%	60%	72%	21,057
2011	104	**33–34**	**11,764**	**188**	**20%**	**15%**	**26%**	**2,335**	**13%**	**9%**	**18%**	**1,566**	**66%**	**60%**	**73%**	**7,819**
2011	104	**35–37**	**10,866**	**24**	**3%**	**0%**	**12%**	**309**	**46%**	**28%**	**65%**	**5,021**	**50%**	**33%**	**68%**	**5,472**
2011	104	Total	137,116	710	42%	38%	47%	58,072	10%	7%	12%	13,151	48%	44%	53%	66,341
2012	104	**27–28**	**19,873**	**48**	**73%**	**60%**	**85%**	**14,599**	**2%**	**0%**	**7%**	**377**	**28%**	**17%**	**41%**	**5,599**
2012	104	29	12,546	94	62%	52%	72%	7,801	4%	1%	8%	495	35%	26%	45%	4,429
2012	104	30	21,496	191	43%	36%	50%	9,314	4%	1%	6%	760	54%	47%	60%	11,513
2012	104	31	37,361	156	16%	11%	22%	6,038	4%	2%	8%	1,599	80%	73%	85%	29,709
2012	104	32	59,125	166	13%	9%	19%	7,928	16%	11%	22%	9,454	70%	63%	77%	41,494
2012	104	33	78,170	195	8%	5%	12%	6,153	20%	15%	26%	15,693	72%	65%	78%	55,896
2012	104	34	26,702	143	1%	0%	3%	273	24%	17%	31%	6,311	74%	67%	81%	19,849
2012	104	35	2,770	48	13%	5%	24%	361	17%	9%	28%	485	68%	55%	80%	1,882
2012	104	Total	258,043	1041	20%	18%	23%	52,467	14%	11%	16%	35,173	66%	63%	69%	170,372
2013	104	28	12,023	54	58%	45%	70%	6,974	1%	0%	3%	77	42%	30%	55%	5,096
2013	104	29	4,426	47	60%	46%	73%	2,663	2%	0%	8%	108	38%	26%	52%	1,697
2013	104	30	7,066	107	45%	36%	55%	3,209	0%	0%	2%	25	55%	45%	64%	3,862
2013	104	31	12,573	95	23%	15%	32%	2,923	0%	0%	2%	50	77%	68%	84%	9,629
2013	104	32	17,100	93	11%	6%	18%	1,903	2%	0%	6%	397	86%	79%	93%	14,789
2013	104	33	16,430	104	8%	4%	14%	1,329	2%	0%	5%	345	90%	83%	95%	14,744
2013	104	34	8,845	72	6%	2%	13%	547	14%	7%	22%	1,213	79%	69%	87%	6,964
2013	104	**35–36**	**5,867**	**96**	**3%**	**0%**	**7%**	**155**	**8%**	**4%**	**14%**	**461**	**89%**	**82%**	**94%**	**5,216**
2013	104	Total	84,330	668	23%	20%	26%	19,702	3%	2%	4%	2,675	74%	70%	77%	61,997
2014	104	28	23,322	130	81%	74%	87%	18,880	1%	0%	2%	124	19%	13%	26%	4,479
2014	104	29	38,924	225	78%	73%	83%	30,498	0%	0%	1%	128	22%	17%	27%	8,458
2014	104	30	27,032	249	59%	52%	65%	15,817	1%	0%	3%	376	40%	34%	46%	10,896
2014	104	31	26,968	106	53%	43%	62%	14,201	1%	0%	4%	373	46%	37%	56%	12,514
2014	104	32	23,620	195	36%	30%	43%	8,618	3%	1%	5%	623	61%	54%	68%	14,387
2014	104	33	13,704	107	13%	7%	20%	1,747	4%	2%	8%	600	82%	75%	89%	11,291
2014	104	34	8,911	80	15%	8%	23%	1,292	7%	3%	13%	657	77%	67%	85%	6,831
2014	104	35	6,412	152	17%	11%	23%	1,078	7%	3%	11%	426	76%	69%	82%	4,866
2014	104	Total	168,893	1244	55%	52%	57%	92,131	2%	1%	3%	3,307	44%	41%	46%	73,722

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					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2015	104	28	8,402	94	86%	78%	92%	7,189	0%	0%	2%	41	15%	8%	22%	1,231
2015	104	29	6,287	95	83%	74%	89%	5,193	0%	0%	2%	31	18%	11%	26%	1,106
2015	104	30	21,920	35	73%	58%	86%	16,035	1%	0%	5%	242	27%	14%	42%	5,952
2015	104	31	53,986	224	48%	41%	54%	25,781	2%	1%	5%	1,261	50%	44%	57%	26,994
2015	104	32	57,746	59	24%	14%	36%	14,004	2%	0%	7%	1,232	74%	62%	84%	42,561
2015	104	33	27,063	70	22%	13%	32%	5,931	4%	1%	10%	1,156	74%	63%	83%	19,906
2015	104	34	21,754	37	25%	13%	40%	5,465	11%	4%	21%	2,429	61%	46%	76%	13,377
2015	104	35	19,583	143	5%	2%	9%	903	11%	7%	17%	2,207	83%	77%	89%	16,334
2015	104	Total	216,741	757	37%	33%	41%	80,501	4%	2%	6%	8,599	59%	55%	63%	127,461
2011	105	32	8,622	96	0%	0%	2%	22	0%	0%	2%	33	99%	97%	100%	8,572
2011	105	33	3,844	60	9%	3%	17%	344	8%	3%	16%	321	82%	72%	90%	3,160
2011	105	34	2,069	239	1%	0%	2%	19	1%	0%	2%	12	99%	97%	100%	2,039
2011	105	**35–36**	**2,877**	**85**	**0%**	**0%**	**2%**	**8**	**25%**	**17%**	**34%**	**720**	**75%**	**66%**	**83%**	**2,156**
2011	105	Total	17,412	480	2%	1%	4%	393	6%	4%	8%	1,086	91%	89%	94%	15,927
2012	105	32	5,422	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2012	105	35	151	13	0%	0%	0%	0	0%	0%	0%	0	100%	100%	100%	151
2012	105	Total	5,573	13	0%	0%	0%	0	0%	0%	0%	0	100%	100%	100%	151
2013	105	30	5,180	24	0%	0%	0%	0	0%	0%	0%	0	100%	100%	100%	5,180
2013	105	31	2,812	23	0%	0%	0%	0	0%	0%	0%	0	100%	100%	100%	2,812
2013	105	32	8,793	96	0%	0%	0%	0	0%	0%	0%	0	100%	100%	100%	8,793
2013	105	**33–36**	**11,025**	**60**	**0%**	**0%**	**0%**	0	**0%**	**0%**	**0%**	0	**100%**	**100%**	**100%**	**11,025**
2013	105	Total	27,810	203	0%	0%	0%	0	0%	0%	0%	0	100%	100%	100%	27,810
2014	105	Total	**2,586**	**24**	**0%**	**0%**	**0%**	**0**	**0%**	**0%**	**0%**	**0**	**100%**	**100%**	**100%**	**2,586**
2015	105	Total	7,673	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2011	106	Total	0	0	No fishery occurred											
2012	106	32	6,526	144	62%	54%	70%	4,064	6%	3%	10%	383	33%	26%	40%	2,136
2012	106	**33–34**	**227**	**16**	**21%**	**6%**	**42%**	**47**	**29%**	**12%**	**50%**	**66**	**46%**	**29%**	**64%**	**104**
2012	106	Total	6,753	160	61%	53%	68%	4,111	7%	3%	10%	448	33%	26%	40%	2,240
2013	106	Total	5,642	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2014	106	31	2,346	48	92%	83%	98%	2,156	1%	0%	4%	17	9%	3%	17%	200
2014	106	32	5,954	96	80%	71%	87%	4,751	0%	0%	2%	24	20%	13%	28%	1,201
2014	106	33	2,213	96	54%	44%	63%	1,190	4%	1%	9%	92	42%	32%	51%	922
2014	106	**34–35**	**1,144**	**109**	**53%**	**44%**	**62%**	**605**	**12%**	**7%**	**19%**	**139**	**34%**	**26%**	**43%**	**393**
2014	106	Total	11,657	349	75%	70%	79%	8,703	2%	1%	4%	272	23%	19%	28%	2,717

-continued-

					Otolith-marked summer chum salmon				Otolith-marked fall chum salmon				Unmarked chum salmon			
						95% CI				95% CI				95% CI		
Year	District	Week	Total harvest	*n*	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution	Estimated proportion	Lower	Upper	Estimated contribution
2015	106	Total	**7,473**	**24**	**29%**	ND	ND	**2,167**	**4%**	ND	ND	**311**	**67%**	ND	ND	**4,982**
2011	107	28	985	24	80%	77%	83%	790	0%	0%	0%	0	20%	17%	23%	195
2011	107	29	1,870	48	80%	77%	83%	1,501	0%	0%	0%	0	20%	17%	23%	369
2011	107	Total	2,855	72	80%	78%	82%	2,291	0%	0%	0%	0	20%	18%	22%	564
2012	107	27	7,223	106	95%	91%	98%	6,868	0%	0%	1%	9	5%	2%	9%	351
2012	107	28	13,847	47	95%	89%	99%	13,188	0%	0%	2%	35	5%	1%	10%	651
2012	107	29	23,494	71	95%	90%	99%	22,415	0%	0%	2%	42	5%	2%	9%	1,077
2012	107	30	42,214	69	98%	94%	100%	41,235	0%	0%	2%	78	3%	1%	7%	1,190
2012	107	31	25,533	83	95%	90%	98%	24,244	0%	0%	1%	40	5%	2%	9%	1,265
2012	107	**32–35**	**14,211**	**92**	**83%**	**76%**	**90%**	**11,827**	**6%**	**2%**	**11%**	**824**	**10%**	**5%**	**16%**	**1,415**
2012	107	Total	126,522	468	95%	93%	97%	119,777	1%	0%	1%	1,029	5%	3%	6%	5,948
201320	107	28	16,120	64	95%	91%	98%	15,374	0%	0%	1%	17	5%	2%	9%	756
2013	107	29	42,008	139	93%	89%	96%	39,097	0%	0%	1%	30	7%	4%	11%	2,871
2013	107	30	97,915	72	96%	92%	98%	93,666	0%	0%	1%	97	4%	2%	8%	4,332
2013	107	31	25,781	72	93%	88%	97%	24,065	0%	0%	1%	25	7%	3%	11%	1,685
2013	107	32	2,646	48	94%	88%	97%	2,480	0%	0%	1%	3	6%	3%	11%	163
2013	107	**33–35**	**6,048**	**96**	**90%**	**85%**	**95%**	**5,472**	**1%**	**0%**	**2%**	**37**	**9%**	**5%**	**13%**	**520**
2013	107	Total	190,518	491	95%	92%	97%	180,155	0%	0%	0%	208	5%	3%	7%	10,328
2014	107	28	5,121	108	92%	87%	96%	4,698	0%	0%	1%	6	7%	4%	10%	357
2014	107	29	26,798	96	96%	91%	98%	25,610	0%	0%	1%	37	5%	3%	8%	1,301
2014	107	30	26,815	120	93%	89%	96%	24,944	0%	0%	1%	30	6%	4%	9%	1,684
2014	107	31	48,972	131	93%	89%	96%	45,486	0%	0%	1%	51	6%	4%	10%	3,130
2014	107	32	6,823	165	93%	89%	96%	6,352	0%	0%	1%	6	6%	4%	9%	432
2014	107	**33–35**	**1,980**	**24**	**88%**	**79%**	**95%**	**1,751**	**10%**	**2%**	**23%**	**202**	**6%**	**3%**	**10%**	**113**
2014	107	Total	116,509	644	93%	91%	95%	108,840	0%	0%	1%	332	6%	5%	8%	7,018
2015	107	**27**	219	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2015	107	28	4,744	36	89%	ND	ND	4,217	0%	ND	ND	0	11%	ND	ND	527
2015	107	29	10,766	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2015	107	32–33	23,409	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2015	107	Total	39,138	36	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND