

**Fishery Data Series No. 09-65**

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**Production and Escapement of Coho Salmon from the  
Chilkat River, 2005–2006**

by

**Brian W. Elliott**

December 2009

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



## Symbols and Abbreviations

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

<b>Weights and measures (metric)</b>		<b>General</b>		<b>Measures (fisheries)</b>	
centimeter	cm	Alaska Department of		fork length	FL
deciliter	dL	Fish and Game	ADF&G	mid-eye-to-fork	MEF
gram	g	Alaska Administrative		mid-eye-to-tail-fork	METF
hectare	ha	Code	AAC	standard length	SL
kilogram	kg	all commonly accepted		total length	TL
kilometer	km	abbreviations	e.g., Mr., Mrs., AM, PM, etc.		
liter	L			<b>Mathematics, statistics</b>	
meter	m	all commonly accepted		<i>all standard mathematical</i>	
milliliter	mL	professional titles	e.g., Dr., Ph.D., R.N., etc.	<i>signs, symbols and</i>	
millimeter	mm			<i>abbreviations</i>	
		at	@	alternate hypothesis	H <sub>A</sub>
<b>Weights and measures (English)</b>		compass directions:		base of natural logarithm	<i>e</i>
cubic feet per second	ft <sup>3</sup> /s	east	E	catch per unit effort	CPUE
foot	ft	north	N	coefficient of variation	CV
gallon	gal	south	S	common test statistics	(F, t, $\chi^2$ , etc.)
inch	in	west	W	confidence interval	CI
mile	mi	copyright	©	correlation coefficient	
nautical mile	nmi	corporate suffixes:		(multiple)	R
ounce	oz	Company	Co.	correlation coefficient	
pound	lb	Corporation	Corp.	(simple)	r
quart	qt	Incorporated	Inc.	covariance	cov
yard	yd	Limited	Ltd.	degree (angular )	°
		District of Columbia	D.C.	degrees of freedom	df
<b>Time and temperature</b>		et alii (and others)	et al.	expected value	<i>E</i>
day	d	et cetera (and so forth)	etc.	greater than	>
degrees Celsius	°C	exempli gratia		greater than or equal to	≥
degrees Fahrenheit	°F	(for example)	e.g.	harvest per unit effort	HPUE
degrees kelvin	K	Federal Information		less than	<
hour	h	Code	FIC	less than or equal to	≤
minute	min	id est (that is)	i.e.	logarithm (natural)	ln
second	s	latitude or longitude	lat. or long.	logarithm (base 10)	log
		monetary symbols		logarithm (specify base)	log <sub>2</sub> , etc.
<b>Physics and chemistry</b>		(U.S.)	\$. ¢	minute (angular)	'
all atomic symbols		months (tables and		not significant	NS
alternating current	AC	figures): first three		null hypothesis	H <sub>0</sub>
ampere	A	letters	Jan,...,Dec	percent	%
calorie	cal	registered trademark	®	probability	P
direct current	DC	trademark	™	probability of a type I error	
hertz	Hz	United States		(rejection of the null	
horsepower	hp	(adjective)	U.S.	hypothesis when true)	$\alpha$
pH	pH	United States of		probability of a type II error	
(negative log of)		America (noun)	USA	(acceptance of the null	
parts per million	ppm	U.S.C.	United States	hypothesis when false)	$\beta$
parts per thousand	ppt, ‰	U.S. state	Code	second (angular)	"
				standard deviation	SD
volts	V		use two-letter	standard error	SE
watts	W		abbreviations	variance	
			(e.g., AK, WA)	population	Var
				sample	var

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CHILKAT RIVER, 2005–2006**

by  
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December 2009

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# TABLE OF CONTENTS

	<b>Page</b>
LIST OF TABLES.....	ii
LIST OF FIGURES.....	ii
LIST OF APPENDICES.....	iii
ABSTRACT.....	1
INTRODUCTION.....	1
METHODS.....	2
Smolt Capture, Sampling, and Marking.....	3
Lower River Adult Sampling.....	4
Smolt Abundance.....	4
Adult Harvest.....	5
Adult Escapement.....	5
Age, Sex, and Size Compositions.....	6
Run Size, Exploitation Rate, and Marine Survival.....	6
RESULTS.....	7
2005 Smolt Tagging, Age and Size.....	7
2006 Lower River Adult Sampling.....	7
Smolt Abundance.....	7
Coded Wire Tag Recovery.....	7
Harvest.....	8
Escapement.....	9
Age and Sex Composition of the Escapement.....	9
Marine Exploitation and Survival.....	10
Data Files.....	11
DISCUSSION.....	11
ACKNOWLEDGMENTS.....	21
REFERENCES CITED.....	21
APPENDIX A.....	25

## LIST OF TABLES

<b>Table</b>	<b>Page</b>
1. Peak survey counts and estimated escapement of coho salmon to the Chilkat River, 1987–2006. ....	3
2. Number of traps checked and smolt caught and tagged in the Chilkat River by time period, April 8 through May 28, 2005 and captured at Chilkat Lake outlet, May 18 through June 18, 2005.....	8
3. Summary of coded wire tagging data in the Chilkat River drainage during spring 2005.....	8
4. Estimated age and size composition of coho salmon smolt $\geq 75$ mm FL marked in the Chilkat River and sampled at Chilkat Lake, 2005.....	9
5. Number of adult coho salmon sampled in the lower Chilkat River for missing adipose fins and coded wire tags, 2006. ....	10
6. Sampled age/sex composition and length of coho salmon captured in the fish wheels, and estimated escapement in the Chilkat River, 2006.....	11
7. Random marine recoveries of CWTs from Chilkat River coho salmon by tag code, fishery, and statistical week, 2006. ....	14
8. Estimated marine harvest in 2006 of adult coho salmon bound for the Chilkat River, by fishery and temporal stratum (troll period, purse seine and gillnet statistical week, or marine sport biweek).....	15
9. Total (marine and freshwater) harvest and estimated Chilkat River harvest of coho salmon in Alaska fisheries, by fishery and area, 2006.....	16
10. Estimated stock assessment parameters for coho salmon that emigrated from the Chilkat River in 2005–2006.....	16
11. Estimates of Chilkat River coho salmon smolt and adult production, 2000–2006.....	18
12. Smolt estimate, average smolt sizes, and marine survival for Chilkat River coho salmon, 1999–2005.....	19

## LIST OF FIGURES

<b>Figure</b>	<b>Page</b>
1. The Chilkat River drainage, showing location of sampling sites. ....	2
2. Catches of coho salmon smolt $\geq 75$ mm, daily water temperature ( $^{\circ}$ C), and depth (cm/25), in the Chilkat River, April 8 through May 27, 2005.....	9
3. Fish wheel catch of adult coho salmon, daily water depth (cm/18), and temperature ( $^{\circ}$ C) in the lower Chilkat River, July 31 through October 14, 2006.....	10
4. Commercial troll quadrants and migration routes of Chilkat River coho salmon through northern Southeast Alaska .....	12
5. Estimated marine harvests of coho salmon bound for the Chilkat River, by fishery and statistical week, 2006. Weekly estimates of harvest in the troll (period) and marine sport fisheries (biweek) are approximated.....	13
6. Cumulative proportion of adult coho salmon captured in Chilkat River fish wheels during 2006 compared to the mean cumulative proportion of 1997–2005.....	17
7. Estimated total return, marine survival, and marine exploitation rate of Chilkat River coho salmon, 2000–2006.....	17
8. Estimated smolt emigration and resulting total return of Chilkat River coho salmon, 2000–2006. Linear regression results in an $R^2$ value of 0.98 and a slope of 0.11 with a p-value of 1.6E-06.....	19
9. Estimated smolt emigration and smolt sizes (K factor) of Chilkat River coho salmon, 1999–2005.....	20
10. Estimated smolt sizes as expressed by the K factor and resulting marine survival for Chilkat River coho salmon, 1999–2005.....	20
11. Smolt out-migration estimates and marine survival for Chilkat River coho salmon, 2000–2006. Linear regression results in an $R^2$ value of 0.009 and an insignificant slope with P-value of 0.84.....	21

## LIST OF APPENDICES

<b>Appendix</b>	<b>Page</b>
A1. Random and select recoveries of coded wire tagged Chilkat River coho salmon in 2006. ....	26
A2. Age, sex, and length composition of coho salmon sampled at the Chilkat River fish wheels in the first of two time strata, August 1–September 23, 2006. ....	32
A3. Age, sex, and length composition of coho salmon sampled at the Chilkat River fish wheels in the second of two time strata, September 24–October 14, 2006. ....	33
A4. Computer files used in the analysis of data for this report. ....	34



## ABSTRACT

The purpose of this study was to conduct a full stock assessment of Chilkat River coho salmon *Oncorhynchus kisutch*. Coho salmon smolt were captured in the Chilkat River during spring 2005, marked with an adipose finclip and a coded wire tag (CWT), and sampled for age, weight, and length. In 2006, adult coho salmon were sampled for CWTs in recreational and commercial fisheries harvests throughout Southeast Alaska, and in the Chilkat River to determine the marked fraction. In addition, the escapement of adult coho salmon to the Chilkat River in 2006 was estimated by expanding peak survey counts.

We estimated that 1,807,837 (SE = 217,352) coho salmon smolt emigrated from the Chilkat River in 2005. Most (91.3%, SE = 1.4%) of the smolt emigrating were age 1. The total (non-jack) run of Chilkat River coho salmon in 2006 was estimated at 151,945 (SE = 16,130), of which 70,813 (SE = 7,302) were harvested in marine fisheries, 2,082 (SE = 293) were harvested inriver, and 79,050 (SE = 14,382) escaped into the Chilkat River. Most (58.5%) of the harvest occurred in the commercial troll fishery (42,620, SE = 5,932). The majority of the escapement was age 1.1 (2003 brood year, 72.1%, SE=1.4%), and male (53.2%, SE = 1.9%). The marine survival (smolt-to-adult) and exploitation rates for this stock were estimated at 8.4% (SE = 1.3%) and 46.6% (SE = 5.2%), respectively.

Key words: abundance, escapement, coded wire tag, harvest, contribution, subsistence fishery, recreational fishery, troll fishery, drift gillnet fishery, seine fishery, age composition, size composition, sex composition, length-at-age, marine survival, exploitation rate, coho salmon, *Oncorhynchus kisutch*, Chilkat River, Haines, Southeast Alaska

## INTRODUCTION

The purpose of this study was to conduct a full stock assessment of Chilkat River coho salmon *Oncorhynchus kisutch*. The long-term goal of this study is to gather information needed to manage harvests in accordance with sustained yield principles.

The Chilkat River produces annual adult returns of 100,000 to 300,000 coho salmon, making it one of the largest runs in Southeast Alaska. Research conducted during the 1980s on coho salmon stocks in Lynn Canal (including the Chilkat River) concluded that these stocks have, at times, been subjected to very high (over 85%) exploitation rates (Elliott and Kuntz 1988; Shaul et al. 1991).

The Chilkat River is a large glacial system that originates in British Columbia, Canada, flows through rugged dissected mountainous terrain, and terminates in Chilkat Inlet near Haines, Alaska (Figure 1). The mainstem and major tributaries comprise approximately 350 km of river channel in a watershed covering about 2,600 km<sup>2</sup> (Bugliosi 1988).

The freshwater coho salmon fishery in Haines provides a small but important component of the local economy. In 1988, anglers fishing in Haines and Skagway for coho salmon spent an estimated

\$181,000 (Stokes 1991). This fishery operates late in the year when other fisheries have finished and is popular with local and non-local anglers. In 2003, 62% of anglers who fished in freshwater areas of Haines were nonresidents (Jennings et al. 2006b). In Southeast Alaska, nonresidents made up an even higher proportion of freshwater anglers (73.1%) from 1999 to 2004 (Jennings et al. 2007). The Chilkat River produces most of the coho salmon harvested in Haines area recreational fisheries and supports one of the largest freshwater coho fisheries in Southeast Alaska, with an average annual harvest of about 1,800 coho salmon over the past 5 years (Howe et al. 2001; Jennings et al. 2004; 2006a-b; Walker et al. 2003). This stock also contributes a significant number (more than 40,000 per year) of fish to the commercial troll, gillnet, and seine fisheries in northern Southeast Alaska (Elliott and Kuntz 1988; Shaul et al. 1991; Ericksen 2001-2003; Ericksen and Chapell 2005).

The current management program for Chilkat River coho salmon relies on monitoring of spawning escapements on 4 index streams: Clear Creek, Spring Creek, Tahini River, and Kellsall River (Figure 1). Alaska Department of Fish and Game (ADF&G) personnel survey the index streams by foot or boat on a weekly basis during peak spawning, and count all observed coho

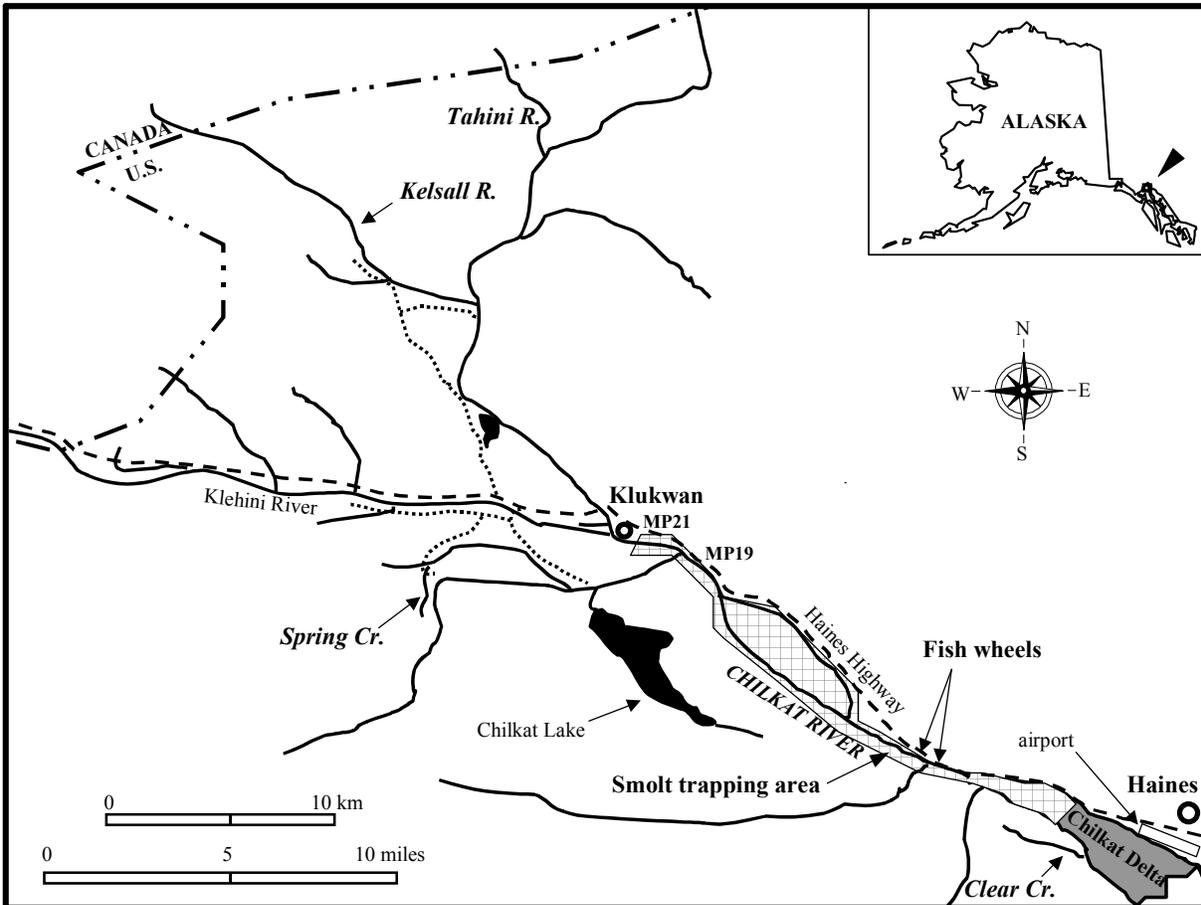


Figure 1.—The Chilkat River drainage, showing location of sampling sites.

salmon. As conditions allow, peak index counts are bracketed with lower counts before and after the peak count occurs. The peak number counted for each stream is used as the index count for that year. The escapement of coho salmon to the Chilkat River drainage has also been estimated by mark-recapture experiments for 5 years (1990, 1998, 2002, 2003, and 2005). The estimated escapement was 79,807 (SE = 9,980) in 1990; 50,758 (SE = 10,698) in 1998; 205,429 (SE = 31,165) in 2002; 134,340 (SE = 15,070) in 2003; and 38,589 (SE = 4,625) in 2005 (Table 1, Ericksen 2006).

This was the sixth consecutive study designed to monitor the cycle of smolt production and subsequent adult harvest of Chilkat River coho salmon. During the first 5 cycles, 1.2–3.0 million smolt emigrated from the Chilkat River and contributed 41,000–131,000 adults to commercial, sport, and subsistence fisheries (Ericksen 2001, 2003 2006; Ericksen and

Chapell 2005). Research objectives for this study were to:

1. estimate the number of coho salmon smolt leaving the Chilkat River in 2005;
2. estimate the age composition of coho salmon smolt leaving the Chilkat River in 2005;
3. estimate the escapement of coho salmon to the Chilkat River in 2006;
4. estimate the age, sex and length composition of large adult coho salmon entering the Chilkat River in 2006; and,
5. estimate the marine harvest of Chilkat River coho salmon in 2006.

## METHODS

Coho salmon smolt were captured in the mainstem of the Chilkat River during spring 2005 and marked with an adipose fin clip and a coded

Table 1.—Peak survey counts and estimated escapement of coho salmon to the Chilkat River, 1987–2006. Escapement estimates in bold were estimated directly through mark–recapture studies (inriver abundance minus inriver harvest). All others were expanded from the combined peak surveys.

	Peak surveys					Estimated	
	Spring Creek	Kellsall River	Tahini River	Clear Creek	Combined (C <sub>i</sub> )	escapement ( $\hat{N}_e$ )	SE ( $\hat{N}_e$ )
1987	99	197	792	25	1,113	37,432	6,672
1988	87	160	590	40	877	29,495	5,257
1989	57	190	1,064	141	1,452	48,833	8,705
1990	88	379	2,766	150	3,383	<b>79,807</b>	<b>9,980</b>
1991	176	417	1,785	135	2,513	84,517	15,065
1992	183	281	1,143	700	2,307	77,588	13,830
1993	101	129	1,041	460	1,731	58,217	10,377
1994	451	440	4,482	408	5,781	194,425	34,656
1995	268	197	1,033	189	1,687	56,737	10,113
1996	204	179	412	315	1,110	37,331	6,654
1997	227	133	684	250	1,294	43,519	7,757
1998	271	265	649	275	1,460	<b>50,758</b>	<b>10,698</b>
1999	335	207	962	195	1,699	57,140	10,185
2000	305	571	1,324	435	2,635	88,620	15,796
2001	450	225	1,272	1,285	3,232	108,698	19,375
2002	1,328	440	2,582	1,310	5,660	<b>205,429</b>	<b>31,165</b>
2003	500	356	1,419	1,675	3,950	<b>134,340</b>	<b>15,070</b>
2004	564	170	827	445	2,006	67,465	12,026
2005	221	42	219	495	977	<b>38,589</b>	<b>4,625</b>
2006	503	220	761	915	2,399	80,683	14,382
Mean	321	260	1,290	492	2,363	78,981	15,577
Min					877	29,495	
Max					5,781	205,429	
					Expansion factor(p)	33.6	
					SE(p)	3.1	

wire tag (CWT). Adult coho salmon were sampled for CWTs in recreational and commercial fisheries harvests throughout Southeast Alaska in 2006. In addition, returning adult coho salmon were sampled in the Chilkat River in 2006 to determine the CWT mark fraction for estimating the abundance of the 2005 coho smolt emigration, and the marine harvest of adult coho salmon in sampled fisheries in 2006.

### SMOLT CAPTURE, SAMPLING, AND MARKING

Smolt were captured in the mainstem of the Chilkat River from the airport upstream to approximately Haines Highway milepost (MP) 21 during spring 2005 (Figure 1). Two 2-person crews fished an average of 100 G-40 minnow traps per day between April 8 and May 27. Traps were baited with disinfected salmon roe and checked at least once per day. Crew members immediately released coho salmon obviously less than 75 mm FL and non-target species at the

capture site. Remaining fish were transported to holding pens for processing at the tagging site, located on the bank of the Chilkat River adjacent to Haines Highway milepost (MP) 19. Water depth (cm) and temperature (°C) were recorded each morning near the tagging site.

All healthy juvenile coho  $\geq 75$  mm FL were marked with an adipose fin clip and given a CWT following the methods in Koerner (1977). Fish were first tranquilized in a solution of tricain-methane sulfonate (MS 222) buffered with sodium bicarbonate. All Chinook salmon smolt  $\geq 50$  mm were also marked as above using a separate tag code.

All marked smolt were held overnight to check for 24-hour tag retention and handling induced mortality. The following morning, 100 fish from the previous day's catch were checked for the retention of CWTs. If tag retention was 98/100 or greater, mortalities were counted and all live fish from that batch were released. If tag

retention was less than 98/100, the entire batch of smolt was checked for tag retention and those that tested negative were re-tagged. The number of fish tagged, number of tagging-related mortalities, and number of fish that had shed their tags were compiled and submitted to the Division of Commercial Fisheries (DCF) Mark, Tag, and Age Laboratory in Juneau at the completion of the field season.

Every 60<sup>th</sup> coho salmon smolt tagged was measured to the nearest mm FL, weighed to the nearest gram, and scale sampled (for age). Twelve to 15 scales were taken 2 rows above the lateral line on the left side of each sampled smolt just in front of the adipose fin (Scarnecchia 1979). Scales were mounted individually between two 25 mm × 75 mm glass slides and viewed through a microfiche reader at 70× magnification. Age was determined once for each fish and reported in European notation.

### LOWER RIVER ADULT SAMPLING

Returning coho salmon were captured in fish wheels operating adjacent to MP 9 (Figure 1) during 2006. DCF personnel installed two 3-basket aluminum fish wheels in early June to estimate escapement of coho, sockeye *O. nerka*, Chinook *O. tshawytscha*, and chum salmon *O. keta*, to the Chilkat River. One fish wheel operated adjacent to MP 9, and the other about 300 m downstream of the first. The fish wheels were operated continuously from June 8 through October 14, except for maintenance. The wheels were located along the east bank of the river where the main flow was constrained primarily to one side of the floodplain. Water depth (cm) and temperature (°C) were recorded each morning near MP 8.

All captured coho salmon were inspected for missing adipose fins and sampled for sex determination and length (measured to the nearest 5 mm MEF). Every third fish was systematically sampled for scales. Five scales were removed from the left side of the fish, along a line 2 to 4 scale rows above the lateral line between the posterior insertion of the dorsal fin and anterior insertion of the anal fin. Ages were determined from patterns of circuli according to protocols in Mosher (1968).

Fish wheel personnel retained heads from all coho salmon with missing adipose fins, and a plastic cinch strap with a unique number was inserted through the jaw of the head. Heads and CWT recovery data were sent to the DCF Mark, Tag, and Age Laboratory in Juneau where any tags present were removed and decoded; corresponding information was entered into the lab database.

### SMOLT ABUNDANCE

A two-event mark–recapture experiment was used to estimate the abundance of coho salmon smolt ( $\hat{N}_s$ ) emigrating from Chilkat River in 2005. The number of smolt marked during spring 2005 defined the first sampling event. Sampling returning adults for missing adipose fins during fall 2006 defined the second sampling event.

The number of emigrating coho salmon smolt was estimated using the Chapman’s modified Petersen estimator for a closed population (Seber 1982):

$$\hat{N}_s = \frac{(n_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1 \quad (1a)$$

$$\text{var}[\hat{N}_s] = \frac{(n_1 + 1)(n_2 + 1)(n_1 - m_2)(n_2 - m_2)}{(m_2 + 1)^2(m_2 + 2)} \quad (1b)$$

where  $n_1$  is the number of smolt marked in the spring of 2005,  $n_2$  is the number of age-1.1 and -2.1 coho salmon captured in the Chilkat River fish wheels in 2006, and  $m_2$  is the subset of  $n_2$  which had been marked with an adipose finclip as coho smolt in 2005 ( $\theta_s$  represents the fraction marked).

The validity of the Petersen mark–recapture experiment rests on several assumptions: (a) that every fish has an equal probability of being marked during event 1, that every fish has an equal probability of being captured in event 2, or that marked fish mix completely with unmarked fish; (b) that recruitment and “death” (emigration) do not both occur between sampling events; (c) that marking does not affect catchability (or mortality) of the fish; (d) that fish do not lose marks between sample events; (e) that all recovered marks are reported; and (f) that double sampling does not occur (Seber 1982).

## ADULT HARVEST

Harvest in 2006 of coho salmon originating from the Chilkat River was estimated from fish sampled for CWTs in marine, commercial, and recreational fisheries harvests, and in the Chilkat River escapement to determine the fraction of marked fish carrying a CWT, represented by the parameter theta ( $\theta_h$ ).

The DCF Port Sampling program sampled landings from commercial drift gillnet, set gillnet, purse seine, and troll fisheries throughout Southeast Alaska and Yakutat. During summer and early fall, samplers were stationed at processors in Ketchikan, Craig, Wrangell, Petersburg, Sitka, Pelican, Port Alexander, Elfin Cove, Excursion Inlet, and Juneau. The sample goal was to inspect at least 20% of the total catch of Chinook and coho salmon for missing adipose fins. Heads from fish missing their adipose fin were sent to the DCF Mark, Tag, and Age Laboratory in Juneau on a weekly basis where CWTs were removed and decoded, and the resulting information compiled.

The annual DCF Port Sampling manual (ADF&G *Unpublished*) provides a detailed explanation of commercial catch sampling procedures and logistics.

Because several fisheries exploited coho salmon over several months in 2006, harvest was estimated over several strata, each a combination of time, area, and type of fishery. Statistics from the commercial troll fishery were stratified by fishing period and quadrant. Statistics from drift gillnet fisheries were stratified by week and district. Statistics from the recreational fishery were stratified by fortnight. Hubartt et al. (1997) describe methods of sampling recreational fisheries in Southeast Alaska. Because there was no on-site sampling in the Haines area, the estimated harvest of Chilkat River coho salmon in the Haines marine and Chilkat River sport fisheries came from the Division of Sport Fish postal Statewide Harvest Survey (SWHS). Harvests within the Chilkat River drainage were identified in the SWHS and summed to estimate the total inriver coho salmon harvest. The marine sport fishery estimates were restricted to locations in the SWHS near the terminus of the Chilkat River, and all coho salmon harvested

within these locations were assumed to be of Chilkat River origin.

Data from the port sampling program were used to estimate the commercial harvest of coho salmon bound for the Chilkat River  $\hat{r}_i$  and its variance (by stratum) using the procedures in Bernard and Clark (1996). Estimates of harvest were summed across strata and across fisheries to obtain an estimate of the total  $\hat{T}$  :

$$\hat{T} = \sum_i \hat{r}_i \quad (2a)$$

$$v[\hat{T}] = \sum_i v[\hat{r}_i] \quad (2b)$$

Variance was estimated as the sum of variances across strata because sampling was independent across strata and fisheries.

The mean date of harvest for a commercial fishery was estimated as (Mundy 1982):

$$\hat{d} = \sum_{d=1}^n d\hat{P}_d \quad (3)$$

where  $\hat{P}_d$  is the estimated proportion of harvest on day  $d$ :

$$\hat{P}_d = \frac{\hat{H}_d}{\sum_d H_d} \quad (4)$$

where  $\hat{H}_d$  is the estimated number of Chilkat River coho salmon harvested on day  $d$ .

## ADULT ESCAPEMENT

The escapement of coho salmon to the Chilkat River in 2006 was estimated by expanding the combined peak survey counts on 4 spawning tributaries. The peak survey count program on the Chilkat River has been standardized in time and area since 1987. The surveys were done multiple times during the peak spawning period of October 1 to October 31. One surveyor has conducted essentially all surveys since inception to ensure that the peak survey counts captured trends in relative spawning abundance. Independent mark-recapture studies were conducted 5 times between 1990 and 2005. These studies validated that the peak survey counts are a good relative measure of coho escapement to the Chilkat River (Ericksen 2006).

The results of these studies were used to expand the peak survey counts as follows:

The ratio ( $\hat{\pi}_i$ ) of abundance to peak survey counts for spawning Chilkat coho salmon in year  $i$  was:

$$\hat{\pi}_i = \hat{N}_i / C_i \quad (5a)$$

$$v(\hat{\pi}_i) = v(\hat{N}_i) / C_i^2 \quad (5b)$$

where  $\hat{N}_i$  was the mark-recapture escapement estimate of coho salmon (inriver abundance minus inriver harvest) and  $C_i$  was the total of peak survey counts for that year.

The mean ratio from the 5 years with mark-recapture estimates was used to expand peak survey counts in years  $t$  without such estimates:

$$\hat{N}_t = \bar{\pi} C_t \quad (6a)$$

$$v(\hat{N}_t) = C_t^2 v(\bar{\pi}) \quad (6b)$$

where

$$\bar{\pi} = \frac{1}{5} \sum_{i=1}^5 \hat{\pi}_i \quad (7a)$$

$$v(\bar{\pi}) = \frac{\sum_{i=1}^5 (\hat{\pi}_i - \bar{\pi})^2}{5-1} = \frac{\sum_{i=1}^5 v(\hat{\pi}_i)}{5} \quad (7b)$$

Note that  $v(\bar{\pi})$  instead of  $v(\pi)$  was used in equation 6b to capture the expected year-to-year variability in the expansion factor, while simultaneously accounting for measurement error from the mark-recapture experiments.

### AGE, SEX, AND SIZE COMPOSITIONS

Age composition of coho salmon smolt in 2005 and age and sex compositions of adults in 2006 were estimated from systematically drawn samples as described above. Standard sample summary statistics were used to calculate estimates of mean length- and mean weight-at-age and their variances (Cochran 1977). Proportions in the age (or sex) compositions and their variances were estimated as:

$$\hat{p}_a = \frac{n_a}{n} \quad (8a)$$

$$v[\hat{p}_a] = \frac{\hat{p}_a (1 - \hat{p}_a)}{n-1} \quad (8b)$$

where  $n$  is the number of successfully aged (or sexed) fish and  $n_a$  is the subset of  $n$  determined to be age (or sex)  $a$ .

The abundance of sex  $x$  coho salmon in the escapement was estimated as:

$$\hat{N}_x = \hat{N}_e \hat{p}_x \quad (9a)$$

$$v[\hat{N}_x] = v[\hat{p}_x] \hat{N}_e^2 + v[\hat{N}_e] \hat{p}_x^2 - v[\hat{p}_x] v[\hat{N}_e] \quad (9b)$$

where  $\hat{N}_e$  is the estimated escapement of coho salmon in 2006. The abundance of age  $a$  coho salmon by sex in the escapement  $\hat{N}_{x,a}$  was estimated by substituting  $\hat{N}_x$  and  $\hat{p}_{x,a}$  for  $\hat{N}_e$  and  $\hat{p}_x$  in equations 9a and 9b.

### RUN SIZE, EXPLOITATION RATE, AND MARINE SURVIVAL

Run size (harvest plus escapement) of coho salmon returning to the Chilkat River in 2006 was estimated as:

$$\hat{N}_R = \hat{T} + \hat{N}_e \quad (10a)$$

$$v[\hat{N}_R] = v[\hat{T}] + v[\hat{N}_e] \quad (10b)$$

The fraction of the run harvested (the exploitation rate) was calculated as:

$$\hat{E} = \frac{\hat{T}}{\hat{N}_R} \quad (11a)$$

$$v[\hat{E}] \approx \frac{v[\hat{T}] \hat{N}_e^2}{\hat{N}_R^4} + \frac{v[\hat{N}_e] \hat{T}^2}{\hat{N}_R^4} \quad (11b)$$

where the variance is an approximation from the delta method (Seber 1982).

The estimated marine survival rate (smolt to adult) and the delta method approximation of its variance were calculated as:

$$\hat{S} = \frac{\hat{N}_R}{\hat{N}_s} \quad (12a)$$

$$v[\hat{S}] \approx \hat{S}^2 \left[ \frac{v[\hat{N}_R]}{\hat{N}_R^2} + \frac{v[\hat{N}_s]}{\hat{N}_s^2} \right] \quad (12b)$$

## RESULTS

### 2005 SMOLT TAGGING, AGE AND SIZE

In spring 2005, 26,364 coho salmon smolt  $\geq 75$  mm FL were marked with an adipose finclip and a CWT (Table 2). Twenty-two (22) of these died and 21 lost their tags within 24h of tagging, leaving a total marked population of 26,321 (Table 3). In addition, we captured 5,827 Chinook salmon during the spring of 2005 (Table 2).

After large initial catches (April 8–9), the catch of coho salmon peaked on May 7 (Figure 2). The average weekly catch of coho smolt per minnow trap (CPUE) peaked between April 17 and April 23, and again between May 1 and May 7 (Table 2).

Four hundred forty (440) coho salmon smolt  $\geq 75$  mm were sampled from the Chilkat River for age (scales), weight and length during spring 2005 (Table 4). Those sampled averaged 85 mm FL (SE = 9.7 mm) and weighed 6.3 g (SE = 2.3 g). Of the 436 samples successfully aged, age-1 fish dominated the emigration (91.3%, SE = 1.4%) of smolt from the Chilkat River (Table 4).

NSRAA personnel captured 5,733 coho salmon smolt emigrating out of Chilkat Lake between May 18, and June 18, 2005. A total of 234 were sampled for age, weight, and length, and 221 of those samples were successfully aged (Table 4). These smolt were significantly older than those sampled from the Chilkat River (21.7% vs. 8.7% age 2;  $\chi^2 = 6.56$ ,  $df = 1$ ,  $P = 0.010$ ). Those sampled at Chilkat Lake were also larger on average (107 mm, 11.9 g) than those sampled from the Chilkat River (85 mm, 6.3 g).

### 2006 LOWER RIVER ADULT SAMPLING

Between July 31 and October 14, 2006, we captured a total of 4,848 adult coho salmon in the

fish wheels (Figure 3), of which 4,691 were examined for missing adipose fins (Table 5). Sixty-six (66) fish were missing an adipose fin, and their heads were examined for CWTs. Sixty contained decodable tags, all of which were released in the Chilkat River in 2005.

We obtained scale samples from 1,642 coho salmon and 1,393 were successfully aged. Of these, 98% were age 1.1 or 2.1 (ocean age-1; Table 6). Based on this information, we estimate that 4,597 adults sampled for missing adipose fins in 2006 emigrated as smolt during 2005.

### SMOLT ABUNDANCE

The estimated number of coho salmon smolt that emigrated from the Chilkat River in 2005 was 1,807,837 (SE = 217,352). This estimate is based on  $n_1 = 26,342$  smolt released in spring 2005,  $n_2 = 4,597$  ocean-age-1 adults sampled from the fish wheels in 2006, and a total of  $m_2 = 66$  marked fish recovered inriver (60 with 2005 Chilkat River tag codes and 6 missing tags). The estimated marked fraction  $\theta_s$  relevant to calculating smolt abundance was 0.0144 (SE = 0.0018).

### CODED WIRE TAG RECOVERY

In 2006, 217 CWTs with Chilkat River codes were recovered from coho salmon during the random sampling of various sport and commercial marine harvests (Table 7, Appendix A1). Most tags (130) were recovered in the commercial troll fisheries (Figure 4), followed by 79 recoveries in the commercial drift gillnet fisheries (Table 7). Three gillnet and 2 troll-caught fish were recovered in mixed-district batches and were discarded from further analysis. CWTs were also recovered in the inside purse seine fishery (1), and the Elfin Cove, Haines, Juneau, and Yakutat marine sport fisheries (7).

Coho salmon bearing the different Chilkat River tag codes were recovered with similar relative frequencies in the District 115 (Lynn Canal) drift gillnet fishery from August 20 to October 7, and in the Northwest Quadrant troll fishery from July 9 to September 30 (Table 7). This indicates that tagged fish mixed well in the ocean environment. The combined troll (60%) and gillnet (36%) fisheries comprised 96% of all Chilkat tag recoveries.

Table 2.—Number of traps checked and smolt caught and tagged in the Chilkat River by time period, April 8 through May 28, 2005 and captured at Chilkat Lake outlet, May 18 through June 18, 2005.

Dates	Chilkat River					Chilkat Lake <sup>b</sup> Coho catch
	Traps checked	Number tagged		CPUE <sup>a</sup>		
		Coho	Chinook	Coho	Chinook	
4/8–4/9	199	2,133	868	10.7	4.4	
4/10–4/16	679	3,590	2,004	5.3	3.0	
4/17–4/23	699	4,259	1,596	6.1	2.3	
4/24–4/30	695	3,180	488	4.6	0.7	
5/1–5/7	648	6,121	507	9.4	0.8	
5/8–5/14	635	2,758	154	4.3	0.2	
5/15–5/21	682	2,433	106	3.6	0.2	918
5/22–5/28	502	1,890	104	3.8	0.2	1,642
5/29–6/4						2,264
6/5–6/11						708
6/12–6/18						201
6/19–6/25						
6/26–7/2						
<b>Total</b>	<b>4,739</b>	<b>26,364</b>	<b>5,827</b>	<b>5.6</b>	<b>1.2</b>	<b>5,733</b>

<sup>a</sup> Catch of smolt per trap day.

<sup>b</sup> Northern Southeast Regional Aquaculture Association (NSRAA) personnel operated a smolt trap on the outlet of Chilkat Lake to monitor the emigration of sockeye salmon smolt. They counted and sampled coho salmon smolt.

Table 3.—Summary of coded wire tagging data in the Chilkat River drainage during spring 2005.

Tag code	Species	Last date	Tagged	24h morts	Marked	Shed tags	Valid CWTs
04-11-33	coho	04/26/2005	11,007	5	11,002	0	11,002
04-11-34	coho	05/12/2005	10,263	6	10,257	21	10,236
04-11-35	coho	05/28/2005	5,094	11	5,083	0	5,083
<b>Coho subtotal</b>			<b>26,364</b>	<b>22</b>	<b>26,342</b>	<b>21</b>	<b>26,321</b>

There were 3 select recoveries (2 were returned from a location with a sampling program and 1 was returned from an area with no sampling program) of coho salmon bearing 2005 Chilkat River tag codes in 2006 (Appendix A1). Additionally, one coho salmon bearing a 2005 Chilkat River tag was voluntarily turned in from the Chilkat River sport fishery in 2006 (Appendix A1).

## HARVEST

The tagged fraction  $\theta_b$ , important for estimating marine harvest contributions, was 0.013 (SE = 0.0017). This estimate is based on the 60 fish with decoded Chilkat River tags in the 4,597 1-ocean adult coho salmon inspected for marks in 2006.

An estimated 70,381 (SE = 7,632) coho salmon bound for the Chilkat River were harvested in sampled marine commercial and sport fisheries in

2006 (Table 8). An additional 655 coho salmon were harvested in the Chilkat Inlet and Chilkat River subsistence fisheries, an estimated 1,782 (SE = 293) in Chilkat River recreational fisheries, and 78 (SE = 58) in Haines marine recreational fisheries, for a total harvest of 72,895 (SE = 7,638, Table 9). Most of the harvest (58.5%; 42,620, SE = 6,293) occurred in the commercial troll fisheries, followed by the commercial drift gillnet fisheries (36.0%; 26,246, SE = 4,265). The remainder of the harvest occurred in the recreational (4.2%), subsistence (0.9%), and commercial seine (0.4%) fisheries. Harvests in the troll fisheries occurred earlier and over a longer duration than in the other fisheries. Harvests in the troll fisheries occurred from mid July through September (Figure 5). In contrast, the harvest in the drift gillnet fishery occurred from mid August through the first week of October, and in the purse seine and Juneau sport fisheries from early August

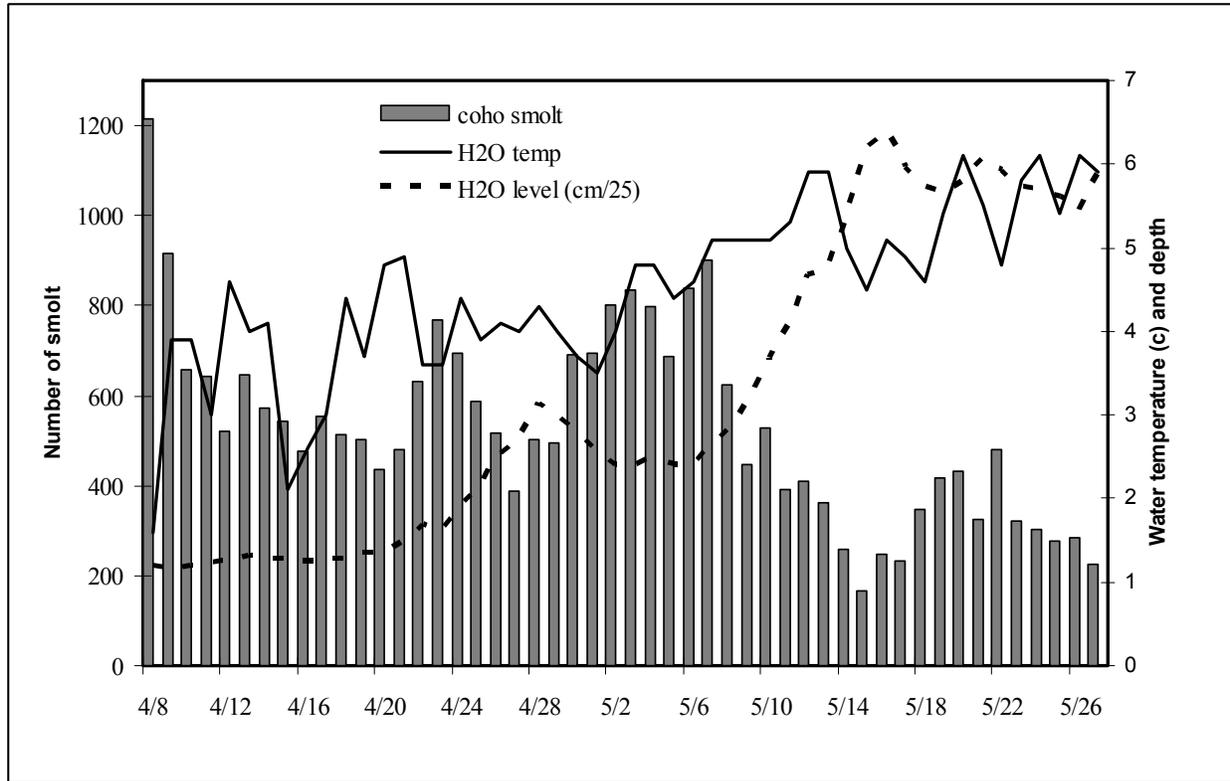


Figure 2.—Catches of coho salmon smolt  $\geq 75$  mm, daily water temperature ( $^{\circ}\text{C}$ ), and depth (cm/25), in the Chilkat River, April 8 through May 27, 2005.

Table 4.—Estimated age and size composition of coho salmon smolt  $\geq 75$  mm FL marked in the Chilkat River and sampled at Chilkat Lake, 2005.

		Age 1	Age 2	Total aged	Total sampled
Chilkat River	sample size	398	38	436	440
	percent (SE)	91.3 (1.4)	8.7 (4.6)		
	mean length (SE)	83 (7.3)	105 (9.1)		85 (9.7)
	mean weight (SE)	5.9 (1.7)	11.2 (2.9)		6.3 (2.3)
Chilkat Lake <sup>a</sup>	sample size	173	48	221	234
	percent (SE)	78.3 (3.1)	21.7 (6.0)		
	mean length (SE)	103 (10.1)	123 (11.7)		107 (13.3)
	mean weight (SE)	10.4 (2.8)	17.4 (5.1)		11.9 (4.5)

<sup>a</sup> Coho smolt were sampled at the Chilkat Lake outlet by Northern Southeast Regional Aquaculture Association (NSRAA).

to early September. The estimated mean date of harvest in the Northwest Quadrant troll fishery was September 5 compared to September 18 for the Lynn Canal drift gillnet fishery.

### ESCAPEMENT

A total of 2,399 coho salmon were counted during peak surveys in the Chilkat River drainage in 2006 (Table 1). The expansion factors from past years ranged from 23.6 (SE = 2.95) in 1990 to 39.5 (SE = 4.73) in 2005. The mean expansion factor 33.63 (SE = 5.99) was used to estimate that

80,683 (SE = 14,382) coho salmon spawned in the Chilkat River in 2006 (Table 1).

### AGE AND SEX COMPOSITION OF THE ESCAPEMENT

The age composition was nearly identical between the first (prior to September 24) and second half of the immigration ( $\chi^2 = 0.002$ ,  $df = 1$ ,  $P = 0.968$ ). Sex compositions, however, did vary significantly over time for age-1.1 ( $\chi^2 = 26.8$ ,  $df = 1$ ,  $P < 0.0001$ ) or age-2.1 fish ( $\chi^2 = 4.9$ ,  $df = 1$ ,  $P = 0.027$ ). Thus, the samples were temporally

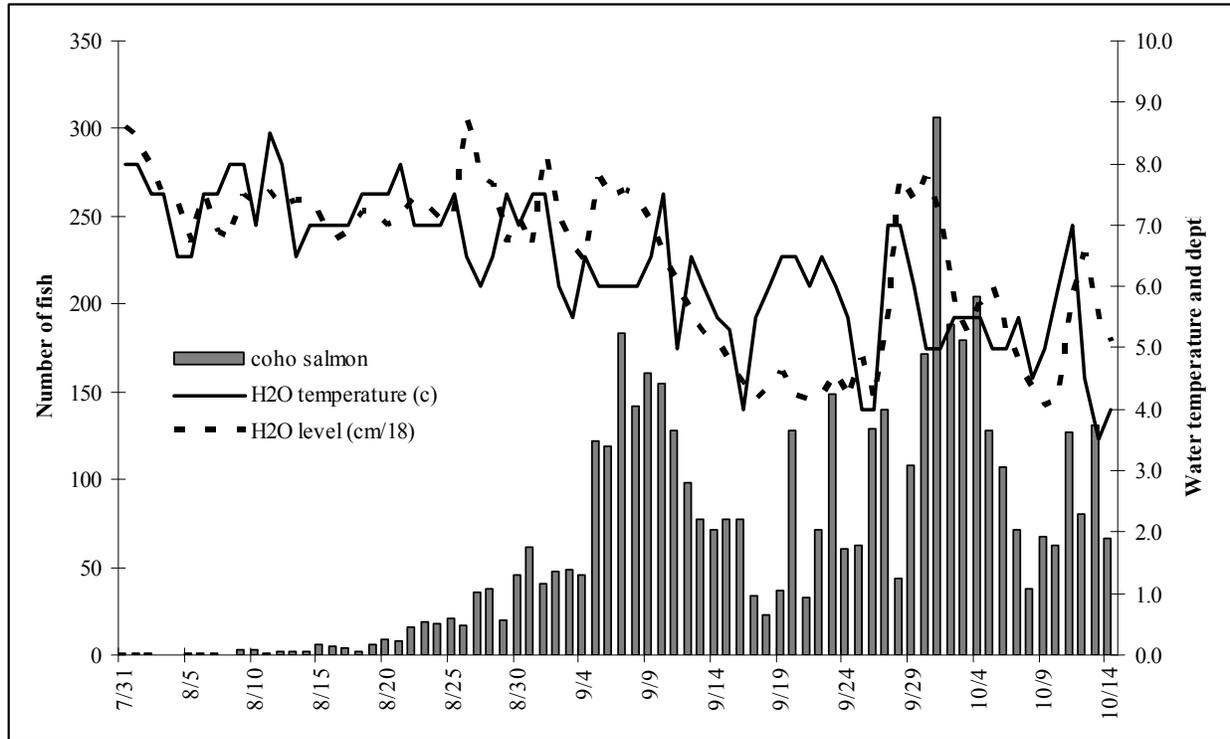


Figure 3.–Fish wheel catch of adult coho salmon, daily water depth (cm/18), and temperature (°C) in the lower Chilkat River, July 31 through October 14, 2006.

Table 5.–Number of adult coho salmon sampled in the lower Chilkat River for missing adipose fins and coded wire tags, 2006.

Statistical week	Number sampled	Tag code			No tag	Total adipose clips	Percent marked
		04-11-33	04-11-34	04-11-35			
31	4					0	0.000
32	11					0	0.000
33	27					0	0.000
34	108					0	0.000
35	287	1	1	1	1	4	0.014
36	801	5	5		1	11	0.014
37	679	5	6	2		13	0.019
38	460	2	3		1	6	0.013
39	717	3	6	3	3	15	0.021
40	1,079	4	6			10	0.009
41	518	3	3	1		7	0.014
Total	4,691	23	30	7	6	66	0.014

stratified to estimate the age and sex composition of the escapement (Appendix A2 and A3). During the first half of the escapement (August 1–September 23), age-1.1 females comprised 29.2% (SE = 3.2%) of sampled fish, compared with 40.7% (SE = 3.0%) in the second half of the escapement (September 24–October 14). Similarly, age-1.1 males comprised 43.2% (SE = 2.8%) of the first half sample, and only 31.1%

(SE=3.2%) of the second half sample. Overall, males comprised 53.2% (SE = 1.9%), and age-1.1 fish comprised 72.1% (SE = 1.4%) of the escapement (Table 6).

#### MARINE EXPLOITATION AND SURVIVAL

Applying the combined proportion of age-1.1 and -2.1 fish (98%; SE = 2.7% Table 6), the ocean age-1 component of the escapement was

Table 6.—Sampled age/sex composition and length of coho salmon captured in the fish wheels, and estimated escapement in the Chilkat River, 2006.

	Brood year and age class				Total aged	Total <sup>a</sup>
	2004 1.0	2003 2.0	2003 1.1	2002 2.1		
Females						
Sample size	0	0	485	204	689	2270
Percent	0	0	34.8	14.6		0.468
SE			2.2	2.5		0.0190
Number	0	0	28,214	11,846		40,060
SE			5,369	2,876		6,906
Mean length			629	649		
SD			47	38		
Males						
Sample size	1	27	520	156	704	2578
Percent	0.07	1.9	37.3	11.2		0.532
SE	0	2.7	2.1	2.5		0.0188
Number	60	1,573	29,989	9,002		40,623
SE	10	2,175	5,666	2,563		7,799
Mean length	290	335	607	625		
SD	0	23	84	79		
All fish <sup>b</sup>						
Sample size	1	27	1,005	360	1,393	4,848
Percent	0.07	1.9	72.1	25.8		
SE	0	2.7	1.4	2.3		
Number	60	1,573	58,203	20,848		80,683
SE	10	2,175	7,806	3,852		14,382
Mean length	290	335	618	639		
SD	0	23	70	61		

<sup>a</sup> Includes fish not assigned an age.

<sup>b</sup> Includes fish with no sex information.

estimated at 79,050 fish. Assuming all 70,813 fish harvested in marine fisheries and 2,082 fish harvested in river fisheries in 2006 (Table 8 and 9) were age-1, the total 2006 run of age-1 Chilkat River coho salmon was 151,945 fish, (Table 10, SE = 16,282). The estimated marine survival rate for 2005 emigrants was 8.4% (SE = 1.3%). The marine exploitation of this stock was estimated at 46.6% (Table 10, SE = 5.2%).

## DATA FILES

Data collected during this study (Appendix A4) have been archived in ADF&G offices in Haines, Douglas, and Anchorage.

## DISCUSSION

Several assumptions, as noted above, underlie our estimate of smolt abundance. We attempted to ensure every smolt had an equal chance of being marked. Although smolt were still being captured when trapping ceased on May 27, catch rates were

declining (Table 2). Therefore, the majority of the emigration was probably sampled. In addition, sampling effort for adults in the fish wheels (to estimate the marked fraction) was relatively constant over time, tending to equalize probability of capture during the second sampling event. While the population in this experiment was not closed to losses from mortality, it was closed to recruitment (assumption [b]) because salmon return to their natal stream to spawn. Because different capture gear was used during the first and second sampling events, it is unlikely that marking affected the catchability of adults (assumption [c]). Other studies have shown that marked coho smolt do not suffer significantly higher mortality than unmarked fish (Elliott and Sterritt 1990; Vincent-Lang 1993). Because all fish had secondary marks (adipose finclips) that were not lost, assumption (d) was satisfied. Personnel sampling the fish wheels were able to examine 96.8% of captured fish (4,691 examined

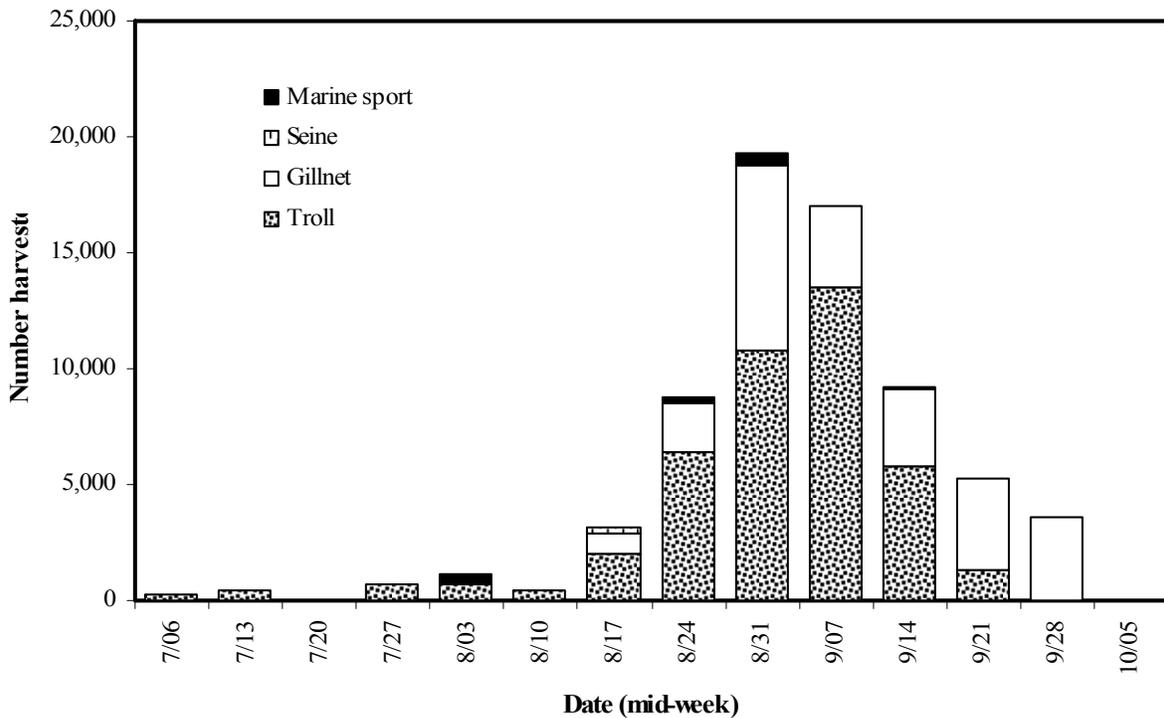


Figure 4.–Commercial troll quadrants and migration routes of Chilkat River coho salmon through northern Southeast Alaska

out of 4,848 captured) for missing adipose fins. Fish were not examined due to sampling error or escaping during the sampling protocol. Once examined, fish were marked to prevent re-sampling; thus it was impossible that fish were sampled more than once. Similarly, it is unlikely that fish were examined for missing adipose fins more than once, thus assumption (e) was robust.

Age-2. smolt appeared to have better marine survival than age-1. fish. While age-2. fish represented approximately 9% of the smolt emigration, they represented nearly 28% of the adult escapement. An alternate explanation of this discrepancy is size bias of the minnow traps because the limited diameter of the entrance tunnel excludes the largest coho salmon smolt. This phenomenon has been investigated on the Unuk River and was a result of differential mark and survival rates between large and small smolt (Weller et al. 2005). This can result in smolt estimates that are biased low by up to 20%. In the spring of 2006, we started differentially marking large and small coho salmon smolt to assess this incongruity in proportions, and if necessary, compensate for this bias.

Similar to estimating the composition of age-1. and age-2. fish, the sex ratio observed at the fish wheels may be biased. Ericksen (2006) examined 62 coho salmon that were sampled at the fish wheels and recaptured and sexed on the spawning grounds. Assuming that spawning ground sex determination is more reliable than in the lower river, 8 of 62 fish were incorrectly identified as females, and 6 out of 62 were incorrectly identified as males at the fish wheels. In mark-recapture years, sex compositions determined in the second sampling event could be used to accurately estimate proportions at age of males and females. Without spawning ground sampling in survey index years, however, sex composition from the lower river may overestimate the proportion of females, based on 2005 data.

The 2006 total escapement estimate of coho salmon (including jacks) to the Chilkat River (80,683, SE=14,382, CV = 18%) was slightly above average, and greater than 13 of the last 19 abundance estimates for Chilkat River coho salmon (Table 1). The timing of the coho salmon escapement into the Chilkat River was slightly later than average.

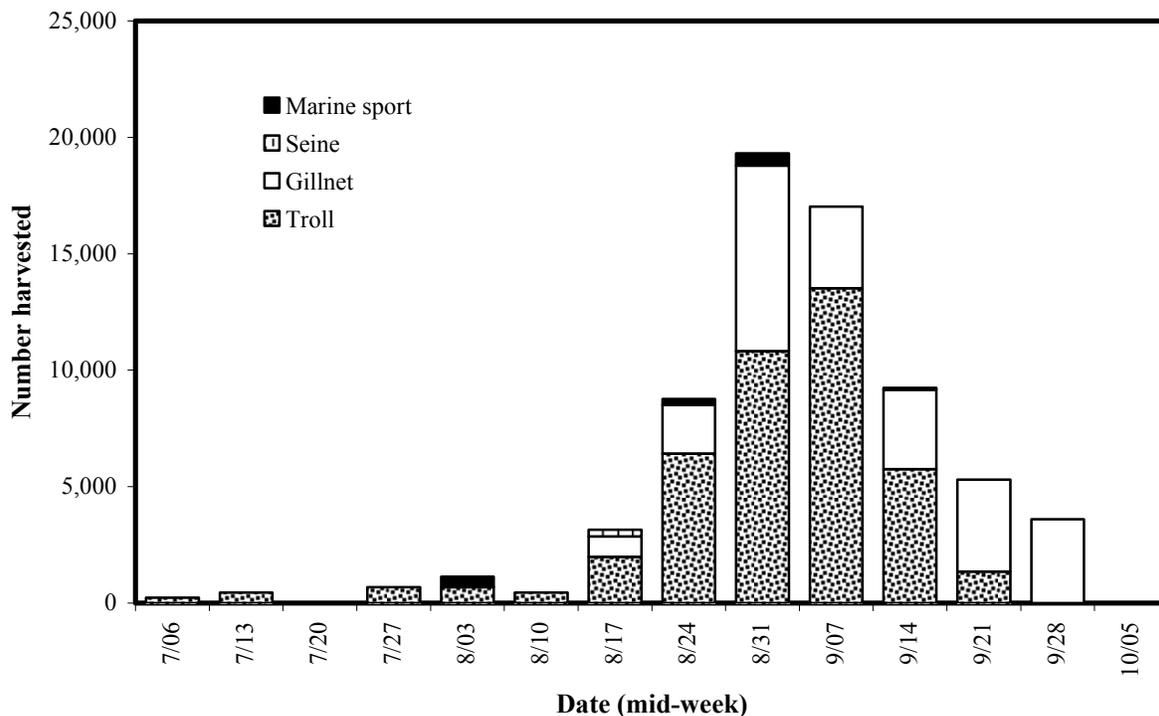


Figure 5.—Estimated marine harvests of coho salmon bound for the Chilkat River, by fishery and statistical week, 2006. Weekly estimates of harvest in the troll (period) and marine sport fisheries (biweek) are approximated.

The mean date of migratory timing in 2006 was September 24. In contrast, the mean date for past years was September 20 (Figure 6).

Daily fishwheel catches in the lower Chilkat River were highly variable, as evidenced by the 2 highest catches occurring 24 days apart, on September 7 (183 captures) and October 1 (306 captures) (Figure 3). The estimated total fish wheel catch of 1-ocean coho salmon in 2006 (4,597) was the second highest recorded since 1997. Before 1997, operation of the Chilkat River fish wheels ended around September 15th, making comparisons difficult.

The percent of Chilkat River coho salmon in the fishery harvest increased as a function of proximity to the Chilkat River. Although we estimated that the Northwest Quadrant troll fishery harvested the greatest number (42,075) of Chilkat River fish, they represented only 4.8% of this harvest (Table 9). The second largest harvest occurred in the Lynn Canal drift gillnet fishery (25,313) where Chilkat River fish represented 24.3% of the total harvest. As one might expect,

Chilkat River fish contributed a greater percentage to the harvest in fisheries closer to the Chilkat River because the number of stocks present decreases with proximity to natal streams.

There is increasing evidence that smolt occasionally migrate through salt water to another freshwater drainage to rear for a period of time. One juvenile coho salmon with a Chilkat River tag code was captured moving upstream into Auke Creek near Juneau (Ericksen and Chapell 2005). This is the first time that a juvenile Chilkat River fish was captured migrating upstream into another freshwater drainage during the fall. However, smolt have been recovered from other freshwater drainages with Chilkat River codes. One coho salmon smolt with a 2001 Chilkat River tag code was sampled as it emigrated from Jordan Creek near Juneau in 2002 (Ericksen 2003). Two smolt were recaptured in the Berners River in 2000 with 1999 codes (Ericksen 2001). In addition, adult coho salmon have been recovered in a Chilkat

Table 7.—Random marine recoveries of CWTs from Chilkat River coho salmon by tag code, fishery, and statistical week, 2006.

Statistical Week	Dates	Tag code			Total
		04-11-33	04-11-34	04-11-35	
District 115 gillnet					
34	8/20–8/26	0	0	3	3
35	8/27–9/2	2	5	2	9
36	9/3–9/9	5	0	1	6
37	9/10–9/16	7	3	4	14
38	9/17–9/23	3	8	3	14
39	9/24–9/30	5	7	2	14
40	10/1–10/7	7	8	1	16
Mixed District gillnet					
36	9/3–9/9		1		1
37	9/10–9/16		1		1
38	9/17–9/23	1			1
Gillnet subtotal		30	33	16	79
NW Quadrant troll					
28	7/9–7/15	0	1	0	1
29	7/15–7/22	0	1	1	2
31	7/30–8/5	1	2	0	3
32	8/6–8/12	2	0	1	3
33	8/13–8/19	0	1	1	2
34	8/20–8/26	1	2	2	5
35	8/27–9/2	9	7	3	19
36	9/3–9/9	17	10	5	32
37	9/10–9/16	14	20	6	40
38	9/17–9/23	9	6	2	17
39	9/24–9/30	3	1	0	4
Mixed quadrant troll					
30	7/23–7/29		1		1
34	8/20–8/26		1		1
Troll subtotal		56	53	21	130
District 114 purse seine					
34	8/20–8/26		1		1
Purse seine subtotal			1		1
Elfin Cove marine sport					
35	8/27–9/2	2	1	0	3
36	9/3–9/9	1	0	0	1
Juneau marine sport					
32	8/6–8/12	0	1	0	1
36	9/3–9/9	0	1	0	1
Yakutat marine sport					
38	9/17–9/23		1		1
Marine sport subtotal		3	4	0	7
Total recoveries		89	91	37	217
Percent gillnet		34%	36%	43%	36%
Percent troll		63%	58%	57%	60%
Percent gillnet & troll		97%	95%	100%	96%

Table 8.—Estimated marine harvest in 2006 of adult coho salmon bound for the Chilkat River, by fishery and temporal stratum (troll period, purse seine and gillnet statistical week, or marine sport biweek).

Fishery	District	Stat week	Catch harvest	Var[N]	n	a	a'	t	t'	m	r	SE[r]
NW troll period 3		27-33	469,807		134,965	1,476	1,413	1,033	1,033	9	2,507	888
SE troll period 3		27-33	74,432		24,050	211	202	124	124	1	248	247
NW troll period 4		34-37	405,761		96,590	1,568	1,519	1,270	1,269	119	39,568	6,218
NE troll period 4		34-37	106,264		27,849	333	327	244	244	1	298	297
		troll subtotal	1,056,264		283,454	3,588	3,461	2,671	2,670	130	42,620	6,293
NW Purse seine	114	34	1,136		295	3	3	3	3	1	295	295
		Purse seine subtotal	1,136		295	3	3	3	3	1	295	295
Icy Strait marine sport	113,114	10-18	770	100,489	716	23	23	4	4	4	329	204
		Icy Strait marine sport subtotal	770	100,489	716	23	23	4	4	4	329	167
Yakutat marine sport	116	11-19	2,164	592,900	1,837	8	8	1	1	1	90	90
		Yakutat marine sport subtotal	2,164	592,900	1,837	8	8	1	1	1	90	90
Juneau marine sport	111,112,115	16-18	29,716	12,109,058	6,507	56	49	42	42	2	800	573
		Juneau marine sport subtotal	29,716	12,109,058	6,507	56	49	42	42	2	800	573
Lynn Canal gillnet	115	34	6,642		1,759	12	12	12	12	3	868	508
Lynn Canal gillnet	115	35	12,679		4,191	46	46	40	40	9	2,086	738
Lynn Canal gillnet	115	36	20,666		1,193	26	26	25	25	6	7,963	3,381
Lynn Canal gillnet	115	37	25,817		7,952	228	227	209	209	14	3,498	1,028
Lynn Canal gillnet	115	38-40	38,504		11,933	523	522	502	502	44	10,898	2,144
District 111 gillnet	111	36-38	76,520		19,668	559	536	486	486	3	933	546
		Gillnet subtotal	180,828		46,696	1,394	1,369	1,274	1,274	79	26,246	4,264
		Total	1,270,878	12,802,447	339,506	5,072	4,913	3,995	3,994	217	70,381	7,632

Table 9.—Total (marine and freshwater) harvest and estimated Chilkat River harvest of coho salmon in Alaska fisheries, by fishery and area, 2006.

Fishery	Area	Coho salmon harvest			Percent of harvest	
		Total	Chilkat	SE	Fishery	Chilkat
Drift gillnet	District 115	104,308	25,313	4,230	24.3	34.7
	District 111	76,520	933	546	1.2	1.3
	Subtotal	180,828	26,246	4,265	14.5	36.0
U.S. troll fishery	NW Quadrant	875,568	42,075	6,281	4.8	57.7
	SE Quadrant	74,432	248	247	0.3	0.3
	NE Quadrant	106,264	298	297	0.3	0.4
	Subtotal	1,056,264	42,620	6,293	4.0	58.5
Seine fishery	District 114	1,136	295	295	26.0	0.4
	Subtotal	1,136	295	295	26.0	0.4
Recreational	Icy Strait marine <sup>a</sup>	770	329	204	42.8	0.5
	Yakutat marine <sup>a</sup>	2,164	90	90	4.2	0.1
	Juneau marine	29,716	800	573	2.7	1.1
	Haines marine <sup>a</sup>	403	78	58	19.4	0.1
	Chilkat River <sup>a</sup>	1,782	1,782	293	100.0	2.4
	Subtotal	34,835	3,079	684	8.8	4.2
Subsistence	Chilkat Inlet <sup>b</sup>	355	355	0	100.0	0.5
	Chilkat River <sup>b</sup>	300	300	0	100.0	0.4
	Subtotal	655	655	0	100.0	0.9
<b>Total</b>		<b>1,016,502</b>	<b>72,895</b>	<b>7,638</b>	<b>7.2</b>	<b>100.0</b>

<sup>a</sup> These estimates came from the Statewide Harvest Survey.

<sup>b</sup> Subsistence harvests as reported on returned permits.

Table 10.—Estimated stock assessment parameters for coho salmon that emigrated from the Chilkat River in 2005–2006.

Parameter	Estimate	SE
2005 smolt emigration	1,807,837	217,352
2006 marine harvest	70,813	7,632
2006 inriver harvest <sup>a</sup>	2,082	293
2006 1-ocean age escapement <sup>b</sup>	79,050	14,379
Total 2006 run	151,945	16,282
Marine exploitation rate	46.6%	5.2%
Marine survival	8.4%	1.3%

<sup>a</sup> Includes Haines marine recreational and Chilkat Inlet subsistence harvest estimates from the Statewide Harvest Survey.

<sup>b</sup> Total escapement excluding age 1.0 and 2.0 coho salmon

River fish wheels with tags from other drainages (Ericksen 1999; Ericksen and Chapell 2005). These fish may have originated from the Chilkat River and reared in other drainages. We did not experience any outlying juvenile coho salmon captures in 2005–2006 with Chilkat River tag codes.

The estimates of the total harvest of Chilkat River coho salmon in 2006 may be biased low because not all fisheries were sampled and some were not sampled at rates sufficient to detect

small harvests. For example, some marine sport fisheries (including those in Pelican, Prince William Sound, and Cook Inlet) were not sampled for CWTs. Thus, the contribution of various stocks to these fisheries cannot be estimated. Furthermore, harvest contributions of Chilkat River coho salmon tags recovered from mixed district fisheries also cannot be determined. Expansions of harvest for Chilkat coho salmon are based on overall harvests for a particular district (Table 8). Uncertainties of total harvest quantities for individual districts, then, preclude estimation of Chilkat River coho salmon harvest, and underestimates total harvest.

Overall, the exploitation of Chilkat River coho salmon in 2006 (46.6%) was comparable and slightly above the average exploitation rate from 2000–2005 (40.5%, Figure 7). Marine survival in 2006 (8.4%), however, matched 2005 as the lowest since the coho salmon CWT project began (Table 11), while the estimated return of 151,945 fish was only 15.2% below the 2000–2005 average of 179,130. There is little association between return and marine exploitation rate, as both data appear variable and unrelated (Table 11). In 2004, for example, the return estimate

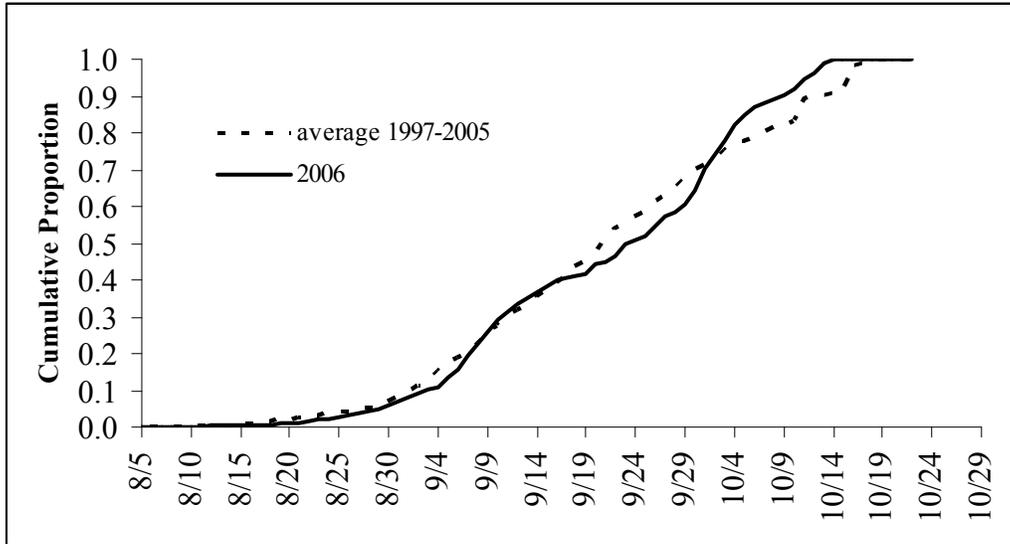


Figure 6.—Cumulative proportion of adult coho salmon captured in Chilkat River fish wheels during 2006 compared to the mean cumulative proportion of 1997–2005.

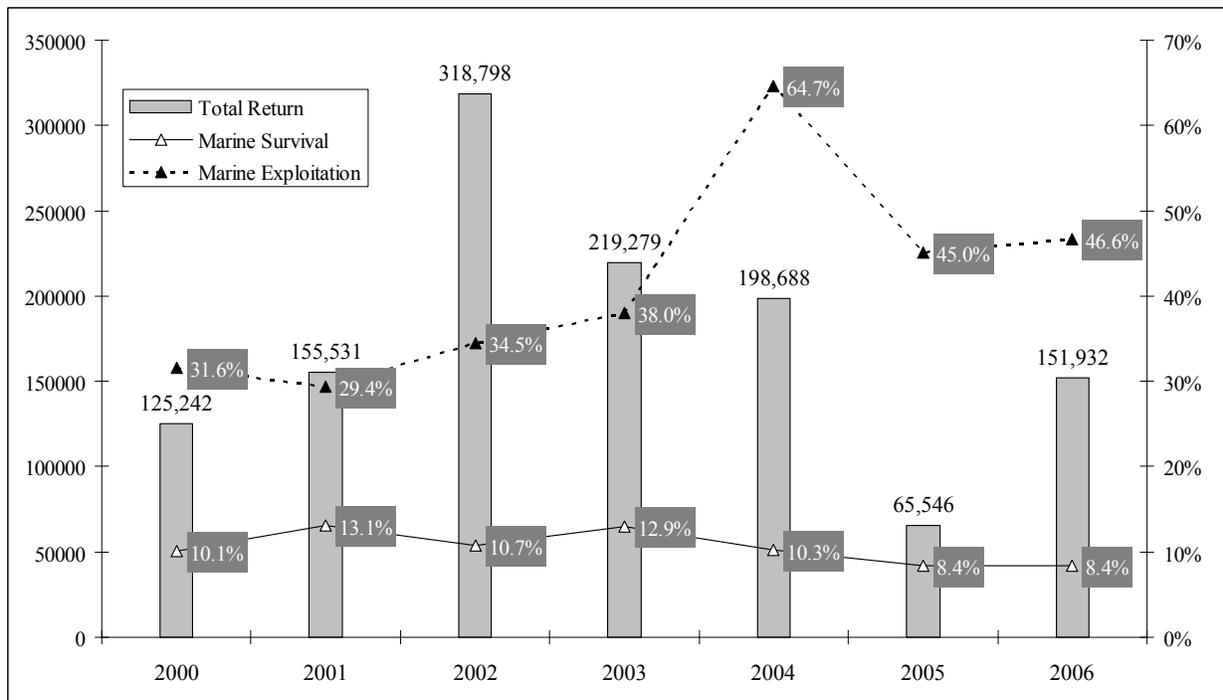


Figure 7.—Estimated total return, marine survival, and marine exploitation rate of Chilkat River coho salmon, 2000–2006.

was 198,688, with a corresponding exploitation rate of 64.7%, approximately 60% higher than the 6-year average.

Marine survival has remained relatively stable from 2000–2006 (average 10.5%, SE 1.9%), and is a poor predictor of return. Conversely, the

total return of Chilkat River coho salmon is largely dependent on the smolt emigration (Figure 8). In 2002, for example, when marine survival was average (10.7%), the estimated return of 318,798 coho salmon was 80% higher than the 2000–2006 average, largely due to a

Table 11.—Estimates of Chilkat River coho salmon smolt and adult production, 2000–2006.

Return year	2000	2001	2002	2003	2004	2005	2006
Number CWT smolt	25,915	25,016	36,114	25,296	24,563	17,276	26,342
Theta	0.019	0.021	0.012	0.015	0.012	0.021	0.014
Smolt estimate	1,237,056	1,185,804	2,970,458	1,696,212	1,938,322	776,934	1,807,837
SE	219,715	164,121	377,695	190,330	401,419	147,738	217,352
Marine harvest	39,546	45,658	110,105	83,302	128,466	29,518	70,813
SE	3,745	7,194	10,355	6,956	19,882	3,483	7,632
Inriver harvest	853	2,176	3,888	2,932	3,169	1,453	2,082
SE	221	451	742	497	661	293	293
Age x.1 escapement	84,843	107,697	204,805	133,045	67,053	34,575	79,050
SE	15,763	19,335	31,172	15,067	5,215	4,561	14,379
Total return	125,242	155,531	318,798	219,279	198,688	65,546	151,945
SE	16,202	20,630	32,839	16,588	20,565	5,731	16,282
Marine exploitation	0.32	0.29	0.35	0.38	0.65	0.45	0.47
SE	0.05	0.05	0.04	0.03	0.04	0.04	0.05
Marine survival	0.10	0.13	0.11	0.13	0.10	0.08	0.08
SE	0.02	0.03	0.02	0.02	0.02	0.02	0.01

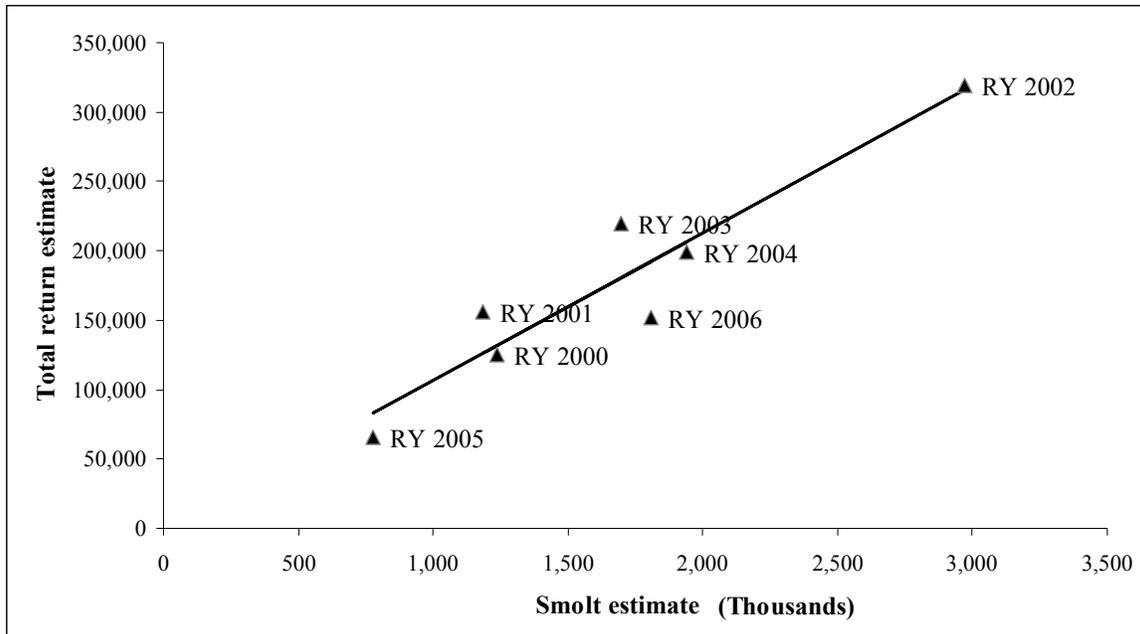


Figure 8.—Estimated smolt emigration and resulting total return of Chilkat River coho salmon, 2000–2006. Linear regression results in an  $R^2$  value of 0.98 and a slope of 0.11 with a p-value of 1.6E-06.

large outmigration year in 2001. Conversely, marine survival was estimated at 13.1% for return year 2001, however the smolt outmigration was a below average 1,185,804 (Figure 8, Table 11). Using simple linear regression to relate smolt emigration data with estimates of total return yields an  $R^2$  value of 0.98 (Figure 8). The previous year’s smolt estimate, then, can be a useful predictor of return for Chilkat River coho salmon.

Although there is some evidence of density dependence during freshwater rearing, average fish sizes, as well as the estimated smolt emigration size, are unrelated to marine survival. Thomas Fulton, among others in the early 20<sup>th</sup> century, developed a statistical method to

measure the robustness of fish populations, called the K factor, which relates weight to length as an indicator of fish condition (Fulton 1902, Ricker 1975). When comparing smolt emigration sizes with the associated K factor, the data indicates an amount of density dependence (Table 12, Figure 9). For example, in emigration year 2001, the smolt estimate was the highest since the CWT project began (2,970,458, SE = 377,695), and the K factor was the lowest (0.995). Other years such as 1999 and 2004 show an opposite relationship: low smolt years are combined with higher K factors, indicating better accessibility to freshwater food sources.

Paired data of average smolt length and weight, as expressed by the K factor, and resulting

Table 12.—Smolt estimate, average smolt sizes, and marine survival for Chilkat River coho salmon, 1999–2005.

Smolt year	Smolt estimate	Age 1. n	Age 1. length	Age 1. weight	Age 2. n	Age 2. length	Age 2. weight	All ages K factor	Marine survival
1999	1,237,056	236	80.0	5.4	46	101.0	10.3	1.046	0.101
2000	1,185,804	184	86.3	6.5	22	102.0	10.4	1.008	0.131
2001	2,970,458	379	85.0	6.4	58	101.0	7.1	0.995	0.107
2002	1,696,212	266	83.0	6.0	61	96.0	8.8	1.039	0.129
2003	1,938,322	315	85.0	6.2	22	104.0	10.9	1.007	0.103
2004	776,934	203	83.5	6.1	15	102.1	10.9	1.046	0.084
2005	1,807,837	398	83.0	5.9	38	105.0	11.2	1.026	0.084

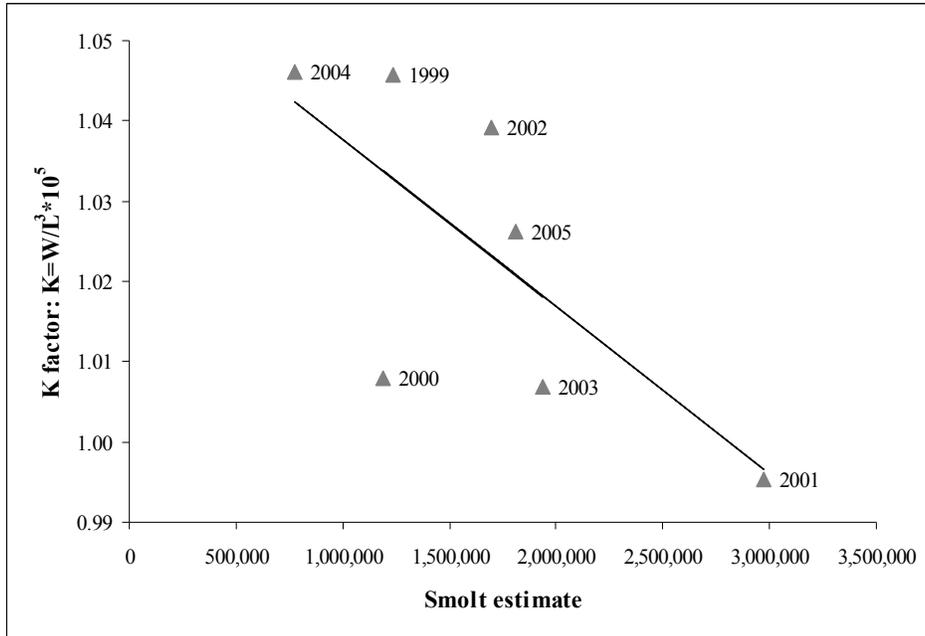


Figure 9.—Estimated smolt emigration and smolt sizes (K factor) of Chilkat River coho salmon, 1999–2005. Linear regression results in an  $R^2$  value of 0.51 and slope with P-value of 0.07, and indicates some amount of density dependence in the Chilkat River drainage.

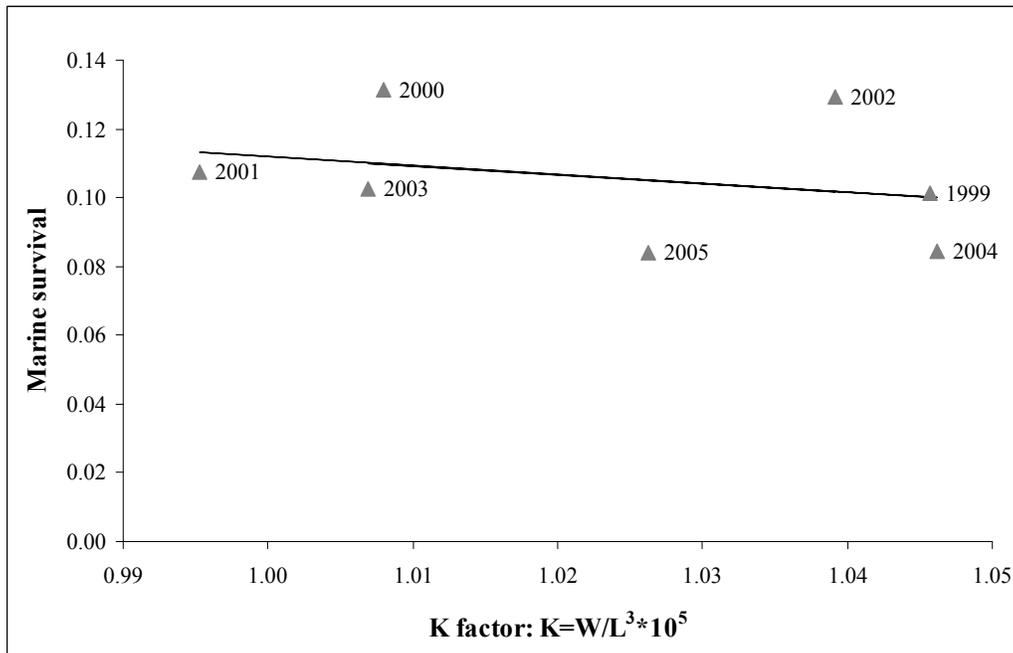


Figure 10.—Estimated smolt sizes as expressed by the K factor and resulting marine survival for Chilkat River coho salmon, 1999–2005. The data is unrelated as evidenced by an insignificant slope with P-value of 0.54.

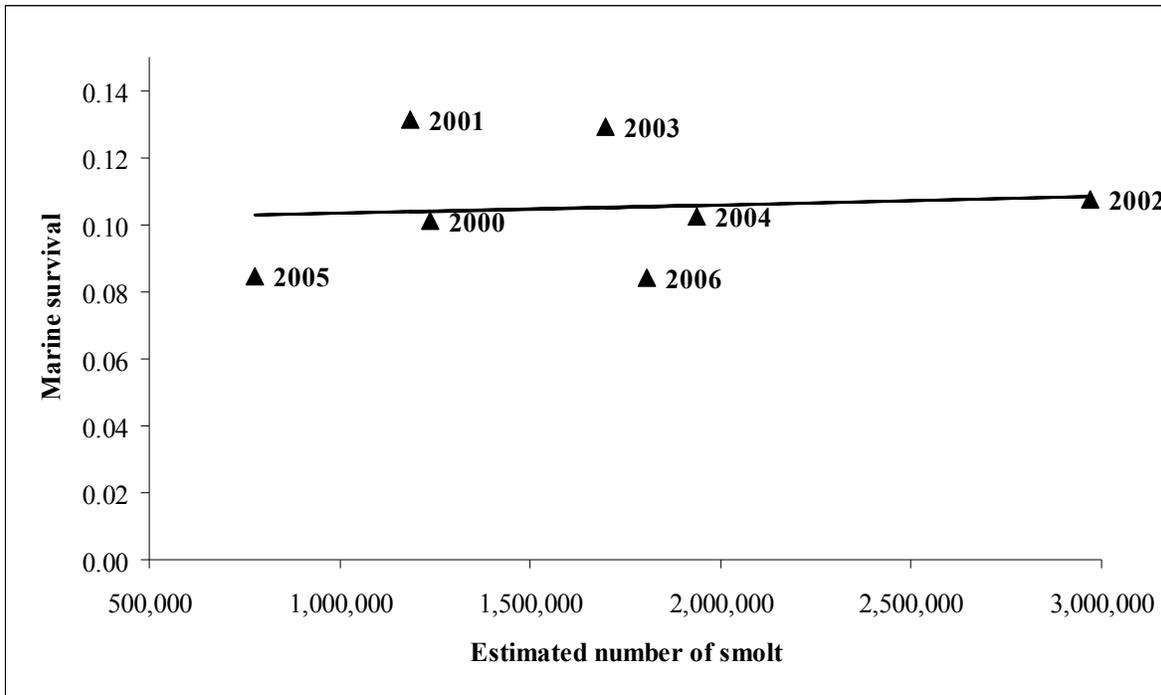


Figure 11.—Smolt out-migration estimates and marine survival for Chilkat River coho salmon, 2000–2006. Linear regression results in an  $R^2$  value of 0.009 and an insignificant slope with P-value of 0.84.

marine survival was also examined (Figure 10). The average size of smolt has little effect on marine survival, as regression yields little towards finding a relationship in the data. There is also no correlation between the run size of outmigrating coho salmon and their marine survivability (Figure 11). Linear regression provides an  $R^2$  value of 0.009 and an insignificant slope with a P value of 0.84. This indicates the lack of density dependence in marine environments, as large numbers of outmigrating smolt survive just as well as smaller outmigration years.

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Ted Lambert, Mark Brouwer, Larry Derby, Dana Van Burgh III, and Richard Chapell worked in the field to capture, mark, and sample smolt during the spring of 2005. Todd Buxton and other NSRAA personnel sampled coho salmon smolt at the Chilkat lake outlet during the spring of 2005. Reid Barber, Brian White, Will Prisciandaro, Lou Cenicola captured, sampled, and marked adult coho salmon at the fish wheels during the fall of 2006. Dejon Delights and Chilkoot Fish & Caviar

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## **APPENDIX A**

Appendix A1.–Random and select recoveries of coded wire tagged Chilkat River coho salmon in 2006.

Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
RANDOM RECOVERIES									
46800	41135	Gillnet	Excursion Inlet	8/24/2006	34	NE	115		545
46799	41135	Gillnet	Excursion Inlet	8/24/2006	34	NE	115		620
46798	41135	Gillnet	Excursion Inlet	8/24/2006	34	NE	115		650
517855	41133	Gillnet	Excursion Inlet	8/28/2006	35	NE	115		565
517854	41134	Gillnet	Excursion Inlet	8/28/2006	35	NE	115		555
517856	41134	Gillnet	Excursion Inlet	8/28/2006	35	NE	115		675
517853	41135	Gillnet	Excursion Inlet	8/28/2006	35	NE	115		690
517866	41133	Gillnet	Excursion Inlet	8/31/2006	35	NE	115		690
517863	41134	Gillnet	Excursion Inlet	8/31/2006	35	NE	115		500
517865	41134	Gillnet	Excursion Inlet	8/31/2006	35	NE	115		590
517868	41134	Gillnet	Excursion Inlet	8/31/2006	35	NE	115		700
517870	41135	Gillnet	Excursion Inlet	8/31/2006	35	NE	115		535
517903	41133	Gillnet	Excursion Inlet	9/4/2006	36	NE	115		620
517906	41133	Gillnet	Excursion Inlet	9/4/2006	36	NE	115		630
517912	41133	Gillnet	Excursion Inlet	9/4/2006	36	NE	115		760
517916	41133	Gillnet	Excursion Inlet	9/6/2006	36	NE	115		560
517914	41133	Gillnet	Excursion Inlet	9/6/2006	36	NE	115		650
517917	41135	Gillnet	Excursion Inlet	9/6/2006	36	NE	115		540
529429	41134	Gillnet	Juneau	9/11/2006	37	NE	111		665
539967	41133	Gillnet	Juneau	9/12/2006	37	NE	115		635
517931	41133	Gillnet	Juneau	9/12/2006	37	NE	115		650
517946	41133	Gillnet	Juneau	9/12/2006	37	NE	115		685
517925	41134	Gillnet	Juneau	9/12/2006	37	NE	115		595
517942	41135	Gillnet	Juneau	9/12/2006	37	NE	115		590
539996	41135	Gillnet	Juneau	9/12/2006	37	NE	115		610
539994	41135	Gillnet	Juneau	9/12/2006	37	NE	115		615
529578	41134	Gillnet	Juneau	9/13/2006	37	NE	115		675
522215	41133	Gillnet	Juneau	9/14/2006	37	NE	115		640
522222	41133	Gillnet	Juneau	9/14/2006	37	NE	115		655
522213	41133	Gillnet	Juneau	9/14/2006	37	NE	115		660
522223	41133	Gillnet	Juneau	9/14/2006	37	NE	115		675
522224	41134	Gillnet	Juneau	9/14/2006	37	NE	115		660
522214	41135	Gillnet	Juneau	9/14/2006	37	NE	115		585
522449	41134	Gillnet	Juneau	9/19/2006	38	NE	115		610
522253	41134	Gillnet	Juneau	9/19/2006	38	NE	115		615
522480	41134	Gillnet	Juneau	9/19/2006	38	NE	115		645
522496	41135	Gillnet	Juneau	9/19/2006	38	NE	115		590
522497	41135	Gillnet	Juneau	9/19/2006	38	NE	115		650
522286	41133	Gillnet	Juneau	9/20/2006	38	NE	111		670
522115	41133	Gillnet	Juneau	9/21/2006	38	NE	115		605
522004	41133	Gillnet	Juneau	9/21/2006	38	NE	115		608
522123	41133	Gillnet	Juneau	9/21/2006	38	NE	115		665
522127	41134	Gillnet	Juneau	9/21/2006	38	NE	115		611
522130	41134	Gillnet	Juneau	9/21/2006	38	NE	115		628
522137	41134	Gillnet	Juneau	9/21/2006	38	NE	115		634
522134	41134	Gillnet	Juneau	9/21/2006	38	NE	115		655
522125	41134	Gillnet	Juneau	9/21/2006	38	NE	115		660
522128	41135	Gillnet	Juneau	9/21/2006	38	NE	115		630
522055	41133	Gillnet	Juneau	9/26/2006	39	NE	115		664

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
RANDOM RECOVERIES									
522071	41133	Gillnet	Juneau	9/26/2006	39	NE	115		674
522066	41133	Gillnet	Juneau	9/26/2006	39	NE	115		683
522063	41133	Gillnet	Juneau	9/26/2006	39	NE	115		705
522067	41134	Gillnet	Juneau	9/26/2006	39	NE	115		638
522070	41134	Gillnet	Juneau	9/26/2006	39	NE	115		640
522057	41134	Gillnet	Juneau	9/26/2006	39	NE	115		654
522065	41134	Gillnet	Juneau	9/26/2006	39	NE	115		668
522072	41134	Gillnet	Juneau	9/26/2006	39	NE	115		680
522068	41135	Gillnet	Juneau	9/26/2006	39	NE	115		590
522069	41135	Gillnet	Juneau	9/26/2006	39	NE	115		645
522092	41133	Gillnet	Juneau	9/27/2006	39	NE	115		700
522013	41134	Gillnet	Juneau	9/27/2006	39	NE	115		582
522091	41134	Gillnet	Juneau	9/27/2006	39	NE	115		640
522018	41133	Gillnet	Juneau	10/4/2006	40	NE	115		
522022	41133	Gillnet	Juneau	10/4/2006	40	NE	115		
522027	41133	Gillnet	Juneau	10/4/2006	40	NE	115		
522028	41133	Gillnet	Juneau	10/4/2006	40	NE	115		
522029	41133	Gillnet	Juneau	10/4/2006	40	NE	115		
522032	41133	Gillnet	Juneau	10/4/2006	40	NE	115		
522037	41133	Gillnet	Juneau	10/4/2006	40	NE	115		
522019	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522020	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522024	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522031	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522033	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522034	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522038	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522039	41134	Gillnet	Juneau	10/4/2006	40	NE	115		
522036	41135	Gillnet	Juneau	10/4/2006	40	NE	115		
46797	41134	Seine	Excursion Inlet	8/24/2006	34	NW	114	25	620
245622	41134	Sport	Juneau	8/7/2006	32	NE			610
252598	41133	Sport	Elfin Cove	8/31/2006	35	NW	114	21	715
252599	41133	Sport	Elfin Cove	8/31/2006	35	NW	114	21	745
252600	41134	Sport	Elfin Cove	8/31/2006	35	NW	114	21	745
98701	41133	Sport	Elfin Cove	9/3/2006	36	NW	114	21	665
265665	41134	Sport	Juneau	9/4/2006	36	NE	111	50	620
245388	41134	Sport	Yakutat	9/18/2006	38	NW	181	60	690
254370	41134	Sport	Haines	10/15/2006	42	NE	115	32	650
314108	41134	Troll	Sitka	7/13/2006	28	NW	113	81	550
27231	41135	Troll	Pelican	7/18/2006	29	NW	113	91	540
27252	41134	Troll	Pelican	7/20/2006	29	NW	116	11	520
291955	41134	Troll	Craig	7/24/2006	30	SE	105	10	560
94515	41133	Troll	Pelican	7/31/2006	31	NW			460
94439	41134	Troll	Pelican	7/31/2006	31	NW			580
94601	41134	Troll	Pelican	8/4/2006	31	NW	114	21	495
299705	41133	Troll	Hoonah	8/7/2006	32	NW			630
314087	41135	Troll	Sitka	8/8/2006	32	NW			580
299770	41133	Troll	Hoonah	8/9/2006	32	NW	114		591
46766	41134	Troll	Excursion Inlet	8/16/2006	33	NW			605
299804	41135	Troll	Hoonah	8/16/2006	33	NW	114	25	502

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
RANDOM RECOVERIES									
299920	41134	Troll	Hoonah	8/21/2006	34	NW			581
46776	41135	Troll	Excursion Inlet	8/22/2006	34	NW	114	21	690
94855	41133	Troll	Pelican	8/23/2006	34	NW	114	21	575
266538	41134	Troll	Juneau	8/23/2006	34	NE	112	65	
315071	41135	Troll	Sitka	8/23/2006	34	NW	113	45	640
27779	41133	Troll	Elfin Cove	8/29/2006	35	NW	114	21	570
299997	41133	Troll	Hoonah	8/29/2006	35	NW	114	21	660
96131	41134	Troll	Hoonah	8/29/2006	35	NW	114	21	717
299989	41134	Troll	Hoonah	8/29/2006	35	NW	114	25	637
299981	41134	Troll	Hoonah	8/29/2006	35	NW	114	25	686
305569	41134	Troll	Yakutat	8/29/2006	35	NW	189	30	650
96110	41133	Troll	Hoonah	8/30/2006	35	NW	114	25	621
305590	41133	Troll	Yakutat	8/30/2006	35	NW	189	30	580
305580	41133	Troll	Yakutat	8/30/2006	35	NW	189	30	610
305577	41133	Troll	Yakutat	8/30/2006	35	NW	189	30	620
27789	41135	Troll	Elfin Cove	8/30/2006	35	NW	114	21	670
96111	41135	Troll	Hoonah	8/31/2006	35	NW	114	25	891
94903	41133	Troll	Pelican	9/1/2006	35	NW	113	91	660
94891	41133	Troll	Pelican	9/1/2006	35	NW			540
94904	41134	Troll	Pelican	9/1/2006	35	NW	113	91	585
96143	41134	Troll	Hoonah	9/1/2006	35	NW	114	25	671
94918	41133	Troll	Pelican	9/2/2006	35	NW			650
517897	41135	Troll	Excursion Inlet	9/2/2006	35	NW	114	21	630
96159	40960	Troll	Hoonah	9/5/2006	36	NW	114	25	682
315172	41133	Troll	Sitka	9/5/2006	36	NW	113	91	650
27799	41133	Troll	Elfin Cove	9/5/2006	36	NW	114	21	620
96204	41133	Troll	Hoonah	9/5/2006	36	NW	114	21	654
94929	41133	Troll	Pelican	9/5/2006	36	NW	114	21	655
27798	41133	Troll	Elfin Cove	9/5/2006	36	NW	114	21	660
96201	41133	Troll	Hoonah	9/5/2006	36	NW	114	21	727
96178	41134	Troll	Hoonah	9/5/2006	36	NW	114	25	636
96185	41134	Troll	Hoonah	9/5/2006	36	NW	114	27	616
96168	41135	Troll	Hoonah	9/5/2006	36	NW	114	21	657
96183	41135	Troll	Hoonah	9/5/2006	36	NW	114	25	611
321019	41135	Troll	Yakutat	9/5/2006	36	NW	189	30	575
94926	41135	Troll	Pelican	9/5/2006	36	NW			635
96237	41133	Troll	Hoonah	9/6/2006	36	NW	114	25	681
96195	41133	Troll	Hoonah	9/6/2006	36	NW	114		607
96194	41133	Troll	Hoonah	9/6/2006	36	NW	114		621
315194	41133	Troll	Sitka	9/6/2006	36	NW	116	11	635
96231	41133	Troll	Hoonah	9/6/2006	36	NW			661
96199	41134	Troll	Hoonah	9/6/2006	36	NW	114		639
321045	41134	Troll	Yakutat	9/6/2006	36	NW	189	30	660
321032	41134	Troll	Yakutat	9/6/2006	36	NW	189	30	685
94953	41133	Troll	Pelican	9/7/2006	36	NW	114	21	545
94935	41133	Troll	Pelican	9/7/2006	36	NW	114	21	620
94941	41133	Troll	Pelican	9/7/2006	36	NW	114	21	640
96216	41133	Troll	Hoonah	9/7/2006	36	NW	114	21	646
96215	41133	Troll	Hoonah	9/7/2006	36	NW	114	21	670
317002	41133	Troll	Sitka	9/7/2006	36				640

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
RANDOM RECOVERIES									
94945	41134	Troll	Pelican	9/7/2006	36	NW	114	21	570
94944	41134	Troll	Pelican	9/7/2006	36	NW	114	21	625
94952	41134	Troll	Pelican	9/7/2006	36	NW	114	21	670
317004	41134	Troll	Sitka	9/7/2006	36				660
94936	41135	Troll	Pelican	9/7/2006	36	NW	114	21	665
94976	41133	Troll	Pelican	9/10/2006	37	NW	114	21	595
94984	41133	Troll	Pelican	9/10/2006	37	NW	114	21	660
94993	41134	Troll	Pelican	9/10/2006	37	NW	114	21	610
94979	41134	Troll	Pelican	9/10/2006	37	NW	114	21	650
96258	41133	Troll	Hoonah	9/11/2006	37	NW	114		671
317045	41133	Troll	Sitka	9/11/2006	37				540
96238	41134	Troll	Hoonah	9/11/2006	37	NW	114	21	657
96241	41134	Troll	Hoonah	9/11/2006	37	NW	114	21	658
96245	41134	Troll	Hoonah	9/11/2006	37	NW	114		568
96255	41134	Troll	Hoonah	9/11/2006	37	NW	114		670
96256	41134	Troll	Hoonah	9/11/2006	37	NW	114		690
317050	41134	Troll	Sitka	9/11/2006	37				580
317043	41134	Troll	Sitka	9/11/2006	37				605
317067	41134	Troll	Sitka	9/11/2006	37				630
96277	41133	Troll	Hoonah	9/12/2006	37	NW	114	21	597
317059	41133	Troll	Sitka	9/12/2006	37	NW	114		610
317063	41133	Troll	Sitka	9/12/2006	37	NW	114		610
96268	41133	Troll	Hoonah	9/12/2006	37	NW			606
96276	41134	Troll	Hoonah	9/12/2006	37	NW	114	21	601
96274	41134	Troll	Hoonah	9/12/2006	37	NW			656
96264	41134	Troll	Hoonah	9/12/2006	37	NW			672
95232	41135	Troll	Pelican	9/12/2006	37	NW			570
95290	41134	Troll	Pelican	9/13/2006	37	NW			655
95287	41134	Troll	Pelican	9/13/2006	37	NW			680
317093	41134	Troll	Sitka	9/13/2006	37				565
95292	41135	Troll	Pelican	9/13/2006	37	NW			670
95586	41133	Troll	Pelican	9/14/2006	37	NW	114	21	680
96308	41134	Troll	Hoonah	9/14/2006	37	NW	114	21	590
96317	41134	Troll	Hoonah	9/14/2006	37	NW	114	21	625
96289	41135	Troll	Hoonah	9/14/2006	37	NW	114	21	680
315647	41133	Troll	Sitka	9/15/2006	37	NW			665
95590	41133	Troll	Pelican	9/16/2006	37	NW	114	21	565
96348	41133	Troll	Hoonah	9/16/2006	37	NW			693
317125	41133	Troll	Sitka	9/16/2006	37				645
317124	41133	Troll	Sitka	9/16/2006	37				655
96367	41134	Troll	Hoonah	9/16/2006	37	NW			621
317137	41134	Troll	Sitka	9/16/2006	37				665
96360	41135	Troll	Hoonah	9/16/2006	37	NW			560
95591	41135	Troll	Pelican	9/16/2006	37	NW			575
317129	41135	Troll	Sitka	9/16/2006	37				660
96375	41133	Troll	Hoonah	9/18/2006	38	NW	114		642
96403	41133	Troll	Hoonah	9/18/2006	38	NW	114		667
96385	41134	Troll	Hoonah	9/18/2006	38	NW	114		690
95667	41133	Troll	Pelican	9/19/2006	38	NW			575
95654	41133	Troll	Pelican	9/19/2006	38	NW			710

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
RANDOM RECOVERIES									
95675	41134	Troll	Pelican	9/19/2006	38	NW			580
95653	41134	Troll	Pelican	9/19/2006	38	NW			640
522504	41133	Troll	Pelican	9/20/2006	38	NW	114	21	590
95693	41133	Troll	Pelican	9/20/2006	38	NW			635
95691	41133	Troll	Pelican	9/20/2006	38	NW			640
95696	41135	Troll	Pelican	9/20/2006	38	NW	114	21	540
96432	41133	Troll	Hoonah	9/21/2006	38	NW	114	27	676
317158	41134	Troll	Sitka	9/21/2006	38	NW	113	91	680
317156	41135	Troll	Sitka	9/21/2006	38	NW	113	91	585
522508	41133	Troll	Pelican	9/23/2006	38	NW	114	21	605
317200	41134	Troll	Sitka	9/23/2006	38				655
317187	41134	Troll	Sitka	9/23/2006	38				680
522513	41134	Troll	Pelican	9/24/2006	39	NW	114	21	590
96446	41133	Troll	Hoonah	9/26/2006	39	NW	114	21	639
522514	41133	Troll	Pelican	9/29/2006	39	NW	114	21	640
316838	41133	Troll	Sitka	9/29/2006	39				660
252409	41135	Fish Wheels	Chilkat River	8/28/2006	35	NE	115	32	650
252411	41134	Fish Wheels	Chilkat River	8/30/2006	35	NE	115	32	660
252412	41133	Fish Wheels	Chilkat River	9/2/2006	35	NE	115	32	650
252413	41134	Fish Wheels	Chilkat River	9/3/2006	36	NE	115	32	650
252414	41134	Fish Wheels	Chilkat River	9/5/2006	36	NE	115	32	525
252417	41133	Fish Wheels	Chilkat River	9/6/2006	36	NE	115	32	655
252416	41133	Fish Wheels	Chilkat River	9/6/2006	36	NE	115	32	680
252415	41134	Fish Wheels	Chilkat River	9/6/2006	36	NE	115	32	635
252418	41134	Fish Wheels	Chilkat River	9/7/2006	36	NE	115	32	650
252420	41133	Fish Wheels	Chilkat River	9/8/2006	36	NE	115	32	695
252422	41133	Fish Wheels	Chilkat River	9/9/2006	36	NE	115	32	580
252423	41133	Fish Wheels	Chilkat River	9/9/2006	36	NE	115	32	670
252421	41134	Fish Wheels	Chilkat River	9/9/2006	36	NE	115	32	690
252424	41133	Fish Wheels	Chilkat River	9/10/2006	37	NE	115	32	440
252426	41134	Fish Wheels	Chilkat River	9/11/2006	37	NE	115	32	630
252425	41134	Fish Wheels	Chilkat River	9/11/2006	37	NE	115	32	655
252433	41133	Fish Wheels	Chilkat River	9/13/2006	37	NE	115	32	525
252431	41133	Fish Wheels	Chilkat River	9/13/2006	37	NE	115	32	600
252432	41134	Fish Wheels	Chilkat River	9/13/2006	37	NE	115	32	670
252434	41134	Fish Wheels	Chilkat River	9/14/2006	37	NE	115	32	570
252436	41134	Fish Wheels	Chilkat River	9/14/2006	37	NE	115	32	625
252435	41135	Fish Wheels	Chilkat River	9/14/2006	37	NE	115	32	650
252437	41133	Fish Wheels	Chilkat River	9/15/2006	37	NE	115	32	720
252439	41133	Fish Wheels	Chilkat River	9/16/2006	37	NE	115	32	550
252440	41134	Fish Wheels	Chilkat River	9/16/2006	37	NE	115	32	655
252438	41135	Fish Wheels	Chilkat River	9/16/2006	37	NE	115	32	615
252441	41134	Fish Wheels	Chilkat River	9/17/2006	38	NE	115	32	440
252443	41134	Fish Wheels	Chilkat River	9/20/2006	38	NE	115	32	585
252445	41133	Fish Wheels	Chilkat River	9/22/2006	38	NE	115	32	610
252444	41133	Fish Wheels	Chilkat River	9/22/2006	38	NE	115	32	685
252446	41134	Fish Wheels	Chilkat River	9/23/2006	38	NE	115	32	545
252447	41134	Fish Wheels	Chilkat River	9/24/2006	39	NE	115	32	630
252449	41134	Fish Wheels	Chilkat River	9/25/2006	39	NE	115	32	655
252448	41134	Fish Wheels	Chilkat River	9/25/2006	39	NE	115	32	670

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
RANDOM RECOVERIES									
252453	41133	Fish Wheels	Chilkat River	9/26/2006	39	NE	115	32	675
252452	41134	Fish Wheels	Chilkat River	9/26/2006	39	NE	115	32	670
252451	41135	Fish Wheels	Chilkat River	9/26/2006	39	NE	115	32	480
252454	41133	Fish Wheels	Chilkat River	9/27/2006	39	NE	115	32	540
252456	41133	Fish Wheels	Chilkat River	9/29/2006	39	NE	115	32	670
252457	41134	Fish Wheels	Chilkat River	9/29/2006	39	NE	115	32	590
252458	41134	Fish Wheels	Chilkat River	9/30/2006	39	NE	115	32	690
252460	41135	Fish Wheels	Chilkat River	9/30/2006	39	NE	115	32	570
252459	41135	Fish Wheels	Chilkat River	9/30/2006	39	NE	115	32	630
252462	41133	Fish Wheels	Chilkat River	10/1/2006	40	NE	115	32	680
252464	41133	Fish Wheels	Chilkat River	10/2/2006	40	NE	115	32	530
252465	41133	Fish Wheels	Chilkat River	10/2/2006	40	NE	115	32	615
252463	41134	Fish Wheels	Chilkat River	10/2/2006	40	NE	115	32	520
252466	41134	Fish Wheels	Chilkat River	10/3/2006	40	NE	115	32	615
252467	41134	Fish Wheels	Chilkat River	10/3/2006	40	NE	115	32	670
252468	41134	Fish Wheels	Chilkat River	10/4/2006	40	NE	115	32	360
252469	41133	Fish Wheels	Chilkat River	10/5/2006	40	NE	115	32	640
252470	41134	Fish Wheels	Chilkat River	10/5/2006	40	NE	115	32	590
252471	41134	Fish Wheels	Chilkat River	10/6/2006	40	NE	115	32	620
252472	41135	Fish Wheels	Chilkat River	10/8/2006	41	NE	115	32	600
252473	41134	Fish Wheels	Chilkat River	10/10/2006	41	NE	115	32	550
252475	41133	Fish Wheels	Chilkat River	10/11/2006	41	NE	115	32	560
252476	41133	Fish Wheels	Chilkat River	10/11/2006	41	NE	115	32	590
252474	41134	Fish Wheels	Chilkat River	10/11/2006	41	NE	115	32	605
252477	41134	Fish Wheels	Chilkat River	10/13/2006	41	NE	115	32	660
252478	41133	Fish Wheels	Chilkat River	10/14/2006	41	NE	115	32	670
SELECT RECOVERIES									
94971	41134	Troll	Pelican	8/31/2006	35	NW	114	21	
903206	41135		Unknown Port						
901131	41134	Troll	Sitka	9/6/2006	36	NW	154		
VOLUNTARY RECOVERIES									
254370	41134	Sport	Haines	10/15/2006	41	NE	115	32	650

Appendix A2.—Age, sex, and length composition of coho salmon sampled at the Chilkat River fish wheels in the first of two time strata, August 1–September 23, 2006.

	Brood year and age class				Total aged	Total <sup>a</sup>
	2004 1.0	2003 2.0	2003 1.1	2002 2.1		
Females						
Sample size	0	0	209	95	304	1079
Percent	0	0	29.2	13.3		0.445
SE			3.2	3.5		0.0286
Number	0	0	11,792	5,360		17,152
SE			3,218	1,922		4,662
Mean length			631	648		
SD			45	38		
Males						
Sample size	0	11	309	91	411	1,345
Percent		1.5	43.2	12.7		0.555
SE	0	3.9	2.8	3.5		0.0245
Number	0	621	17,434	5,134		23,189
SE	0	1,527	4,531	1,886		5,724
Mean length		331	595	612		
SD		28	95	86		
All fish <sup>b</sup>						
Sample size	0	11	518	186	715	2,424
Percent		1.5	72.4	26.0		0.50
SE	0	0	2.0	3.2		0.0102
Number	0	621	29,226	10,494		40,342
SE	0	1,527	5,557	2,693		10,170
Mean length		331	609	630		
SD		28	81	68		

Appendix A3.—Age, sex, and length composition of coho salmon sampled at the Chilkat River fish wheels in the second of two time strata, September 24–October 14, 2006.

	Brood year and age class				Total aged	Total <sup>a</sup>
	2004 1.0	2003 2.0	2003 1.1	2002 2.1		
	Females					
Sample size	0	0	276	109	385	1,191
Percent	0	0	40.7	16.1		0.491
SE			3.0	3.5		0.0255
Number	0	0	16,422	6,486		22,908
SE			4,298	2,139		5,095
Mean length			627	650		
SD			47	37		
	Males					
Sample size	1	16	211	65	293	1,233
Percent	1.5	2.4	31.1	9.6		0.509
SE	0	3.9	3.2	3.9		0.0293
Number	60	952	12,555	3,868		17,434
SE	15	1,549	3,402	1,736		5,297
Mean length	290	338	625	643		
SD	0	19	63	66		
	All fish <sup>b</sup>					
Sample size	1	16	487	174	678	2,424
Percent	1.5	2.4	71.8	25.7		0.50
SE	0	3.9	2.0	3.3		0.0102
Number	60	952	28,977	10,353		40,342
SE	15	1,549	5,482	2,755		10,170
Mean length	290	338	626	648		
SD	0	19	54	50		

Appendix A4.–Computer files used in the analysis of data for this report.

FILE NAME	DESCRIPTION
05trapsum.xls	Excel workbook containing 2005 Chilkat River coho salmon smolt trapping and coded wire tagging data.
05trapsum.prn	Space delimited text file with raw 2005 Chilkat River coho salmon smolt trapping and coded wire tagging data.
05trapsum.txt	Text file describing heading and column layout in 03trapsum.prn
Smoltawl2005.xls	Excel workbook containing 2005 Chilkat River coho salmon smolt age-weight-length data.
Smoltawl2005.prn	Space delimited text file with raw 2005 Chilkat River coho salmon smolt age-weight-length data.
Smoltawl2005.txt	Text file describing heading and column layout in Smoltawl2005.prn
06FWCoho.xls	Excel workbook containing 2006 Chilkat River fish wheel coho salmon catch, marking, and age-length sample data.
065FWCoho.prn	Space delimited text file with raw 2006 Chilkat River fish wheel coho salmon catch, marking, and age-length sample data.
06FWCoho.txt	Text file describing heading and column layout in 06FWCoho.prn
Allcwtrecoveries2006.xls	Excel workbook containing recovery data and harvest estimates of Chilkat River coho salmon tagged as smolt during 2005.
Allcwtrecoveries2006.prn	Space delimited text file with raw recovery data of Chilkat River coho salmon tagged as smolt during 2005.
Allcwtrecoveries2006.txt	Text file describing heading and column layout in Allcwtrecoveries2006.prn

Note: Data files are archived at Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services, 333 Raspberry Road, Anchorage Alaska 99518-1599.