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**Production and Escapement of Coho Salmon from
the Chilkat River, 2003–2004**

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Randolph P. Ericksen

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March 2006

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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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 2003, marked with an adipose fin clip and a coded wire tag (CWT), and sampled for age, weight, and length. In 2004, 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 2004 was estimated by expanding peak survey counts.

We estimated that 1,938,322 (SE = 401,419) coho salmon smolt emigrated from the Chilkat River in 2003. Most (93.5%, SE = 1.3%) of the smolt emigrating were age-1. The total (non-jack) run of Chilkat River coho salmon in 2004 was estimated at 195,765 (SE = 20,565), of which 128,466 (SE = 19,882) were harvested in marine fisheries, 3,169 (SE = 661) were harvested inriver, and 64,130 (SE = 5,215) escaped into the Chilkat River. Most (64.0%) of the harvest occurred in the commercial troll fishery (84,286, SE = 18,681). The majority of the escapement (51,736, SE = 3,696) was age-1.1 (2001 brood year), and male (34,706, SE = 3,237). The marine survival rate (smolt-to-adult) was estimated at 10.1% (SE = 2.3%) and marine exploitation rate at 65.6% (SE = 3.8%) for this stock.

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 of coho salmon, making it the second or third largest 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 km² (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 (Jones and Stokes 1991). This fishery operates late in the year when other fisheries have finished and is equally popular with local and non-local anglers—62% of anglers who fished in fresh water areas of Haines during 2003 were nonresidents (Jennings et al. *In prep-b*). 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 the Southeast region, with an average annual harvest of about 1,800 coho salmon over the past five years (Howe et al. 2001; Jennings et al. 2004; Jennings et al. *In prep-a*, *In prep-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, 2002, 2003; Ericksen and Chapell 2005).

The current management program for Chilkat River coho salmon relies on monitoring of spawning escapements on four index streams: Clear Creek, Spring Creek, Tahini River, and Kelsall 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 the number of

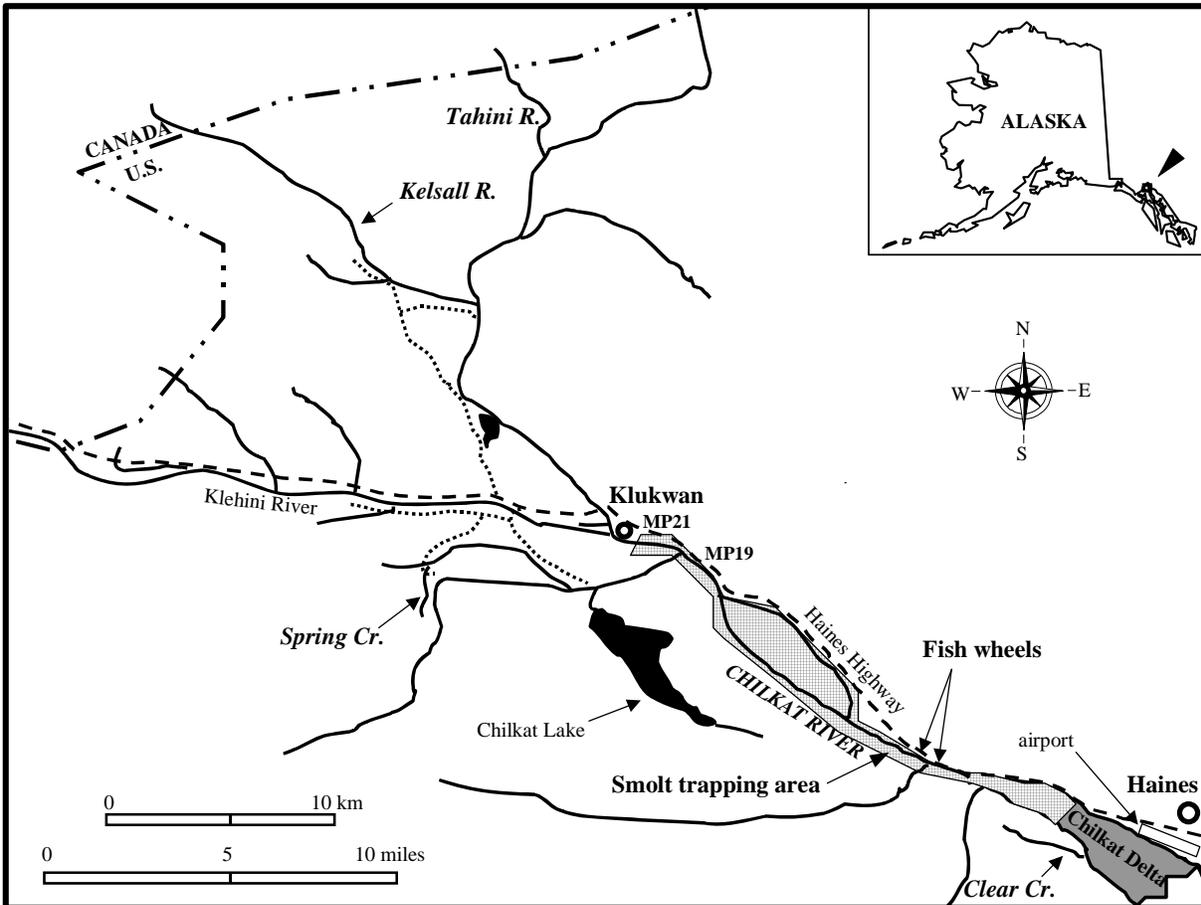


Figure 1.—The Chilkat River drainage, showing location of sampling sites.

adult coho salmon. 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 been estimated for 4 years (1990, 1998, 2002, and 2003). The estimated inriver run (escapement plus inriver harvests) was 80,700 (SE = 9,984, Dangel et al. *Unpublished*) in 1980; 37,132 (large fish, SE = 7,432; Ericksen 1999) in 1998; 209,311 (SE = 26,587; Ericksen 2003) in 2002; and 137,313 (SE = 15,078; Ericksen and Chapell 2005) in 2003.

This was the fifth consecutive study designed to monitor the cycle of smolt production and subsequent adult harvest of Chilkat River coho salmon. During the first four cycles, 1.2 – 3.0 million smolt emigrated from the Chilkat River and contributed 41,000–114,000 adults to

commercial, sport, and subsistence fisheries (Ericksen 2001, 2003; Ericksen and Chapell 2005). Research objectives for this study were to:

1. Estimate the number of coho salmon smolt leaving the Chilkat River in 2003;
2. Estimate the age composition of coho salmon smolt leaving the Chilkat River in 2003;
3. Estimate the escapement of coho salmon to the Chilkat River in 2004;
4. Estimate the age, sex and length composition of large adult coho salmon entering the Chilkat River in 2004; and,
5. Estimate the marine harvest of Chilkat River coho salmon in 2004.

METHODS

Coho salmon smolt were captured in the mainstem of the Chilkat River during spring 2003 and marked with an adipose fin clip and a coded wire tag (CWT). Adult coho salmon were sampled for CWTs in recreational and commercial fisheries harvests throughout Southeast Alaska in 2004. In addition, returning adult coho salmon were sampled in the Chilkat River in 2004 to determine the marked fraction for estimating the 2003 coho smolt emigration and the marine harvest of adult coho salmon in sampled fisheries in 2004.

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 2003 (Figure 1). Two 2-person crews fished an average of 80 G-40 minnow traps per day between April 9 and May 30. Traps were baited with disinfected salmon roe and checked at least once per day. Crew members immediately released obviously undersized or non-target species at the capture site. Remaining fish were transported to holding boxes for processing at the tagging site located on the bank of the Chilkat River MP 19. Water depth (cm), and temperature (°C) were recorded each morning near the tagging site.

All healthy juvenile coho ≥ 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 ≥ 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 Commercial Fisheries Division (CFD) Mark, Tag, and Age Laboratory in Juneau at the completion of the field season.

Every 75th coho salmon smolt tagged was measured to the nearest mm FL, weighed to the nearest g, and scale sampled (for age). Twelve to 15 scales were taken two rows above the lateral line on the left side of each sampled smolt just ahead of the adipose fin (Scarnecchia 1979). Scales were mounted individually between two 25 mm \times 75 mm glass slides and viewed through a microfiche reader at 70 \times magnification. Age was determined once for each fish and reported in European notation. In addition, coho salmon smolt were captured by Northern Southeast Regional Aquaculture Association (NSRAA) personnel between May 16 and July 1, 2003 as they emigrated from Chilkat Lake. Ten smolt were sampled each day for length, weight, and scales from this site between May 17 and June 18. The results from this project are presented here for comparison.

LOWER RIVER ADULT SAMPLING

Returning coho salmon were captured in fish wheels operating adjacent to MP 9 (Figure 1) during 2004. CFD 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 18, 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. Every fifth fish was systematically sampled for sex determination, length (measured to the nearest mm MEF), and 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 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 CFD Mark, Tag, and Age Laboratory in Juneau where any tags present were removed, decoded, and corresponding information 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 2003. The number of smolt marked during spring 2003 defined the first sampling event. Sampling returning adults for missing adipose fins during fall 2004 defined the second sampling event.

Smolt abundance (number emigrating) of 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 2003, n_2 is the number of age-1.1 and -2.1 coho salmon captured in the Chilkat River fish wheels in 2004, and m_2 is the subset of n_2 which had been marked with an adipose fin clip as coho smolt in 2003 (θ_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 2004 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 marked carrying a cwt θ_h .

The CFD 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 CFD Mark, Tag, and Age Laboratory in Juneau on a weekly basis where CWTs were removed and decoded, and the resulting information compiled.

The annual CFD 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 2004, 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. Since 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 Sport Fish Division's postal Statewide Harvest Study (SWHS; Jennings et al. *In prep-c*). 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 :

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

and 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 2004 was estimated by expanding the combined peak survey counts on four 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 four times between 1990 and 2003. These studies validated that the peak survey counts are a good relative measure of coho escapement to the Chilkat River (Ericksen and Chapell 2005). 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 four 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

$$\bar{\pi} = \frac{1}{4} \sum_{i=1}^4 \hat{\pi}_i \quad (7a)$$

$$v(\bar{\pi}) = \frac{\sum_{i=1}^4 (\hat{\pi}_i - \bar{\pi})^2}{4-1} - \frac{\sum_{i=1}^4 v(\hat{\pi}_i)}{4} \quad (7b)$$

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 2003 and age and sex compositions of adults in 2004 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 by 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 coho salmon in 2004. 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 2004 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

2003 SMOLT TAGGING, AGE AND SIZE

In spring 2003, 24,616 coho salmon smolt ≥ 75 mm FL were marked with an adipose fin clip and a CWT (Table 1). Fifty-three (53) of these died and three lost their tags within 24h of tagging, leaving a total marked population of 24,560 (Table 2). In addition, we captured 2,807 Chinook salmon during the spring of 2003 (Table 1).

The catch of coho salmon peaked on May 19 (Figure 2). The average weekly catch of coho smolt per minnow trap (CPUE) peaked between April 13 and April 19, and again between May 18 and May 24 (Table 1).

Three hundred forty-one (341) coho salmon smolt ≥ 75 mm were sampled from the Chilkat River for age (scales), weight and length during spring 2003 (Table 3). Those sampled averaged 86 mm FL (SE = 0.5 mm) and 6.5 g (SE = 0.2.2 g) in weight.

Table 1.—Number of traps checked and smolt caught and tagged in the Chilkat River by time period, April 10 through May 30, 2003 and captured at Chilkat Lake outlet, May 16 through July 1, 2003.

Dates	Chilkat River					Chilkat Lake ^b
	Traps checked	Number tagged		CPUE ^a		Coho catch
		Coho	Chinook	Coho	Chinook	
04/10–04/12	206	765	144	3.7	0.7	
04/13–04/19	522	4,084	693	7.8	1.3	
04/20–04/26	586	3,557	788	6.1	1.3	
04/27–05/03	546	2,924	135	5.4	0.2	
05/04–05/10	648	3,460	454	5.3	0.7	
05/11–05/17	635	3,418	306	5.4	0.5	424
05/18–05/24	682	4,639	246	6.8	0.4	5,459
05/25–05/31	502	1,769	41	3.5	0.1	8,908
06/01–06/07						5,089
06/08–06/14						2,263
06/15–06/21						466
06/22–06/28						92
06/29–07/01						15
Total	4,327	24,616	2,807	5.7	0.6	22,716

^a Catch of smolt per trap day.

^b 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 2.—Summary of coded wire tagging data in the Chilkat River drainage during spring 2003.

Tag code	Species	Last date	Tagged	24h morts	Marked	Shed tags	Valid CWTs
04-08-25	coho	05/02/2003	10,573	3	10,570	0	10,570
04-08-26	coho	05/22/2003	10,044	7	10,037	0	10,037
04-08-27	coho	05/30/2003	3,999	43	3,956	3	3,953
Coho subtotal			24,616	53	24,563	3	24,560

Age-1 dominated the emigration (93.5%, SE = 1.3%) of smolt from the Chilkat River (Table 3).

NSRAA personnel captured 22,716 coho salmon smolt emigrating out of Chilkat Lake between May 16, and July 1, 2003. A total of 384 were sampled for age, weight, and length (Table 3). These smolt were significantly older (52.1% age-2) than those sampled from the Chilkat River (48% vs. 6.5% age-2 $\chi^2 = 60.6$, $df = 1$, $P < 0.001$). Those sampled at Chilkat Lake were also larger on average (106 mm, 11.8 g) than those sampled from the Chilkat River (86 mm, 6.5 g).

2004 LOWER RIVER ADULT SAMPLING

Between August 1 and October 18, 2004, we captured a total of 1,746 adult coho salmon in the fish wheels (Figure 3) and examined them for missing adipose fins (Table 4). Twenty-one (21) fish were missing an adipose fin and their heads were examined for CWTs. Eighteen contained decodable tags, all of which were released in the Chilkat River in 2003.

We obtained scale samples from 396 coho salmon and 329 were successfully aged. Of these, 99.4%

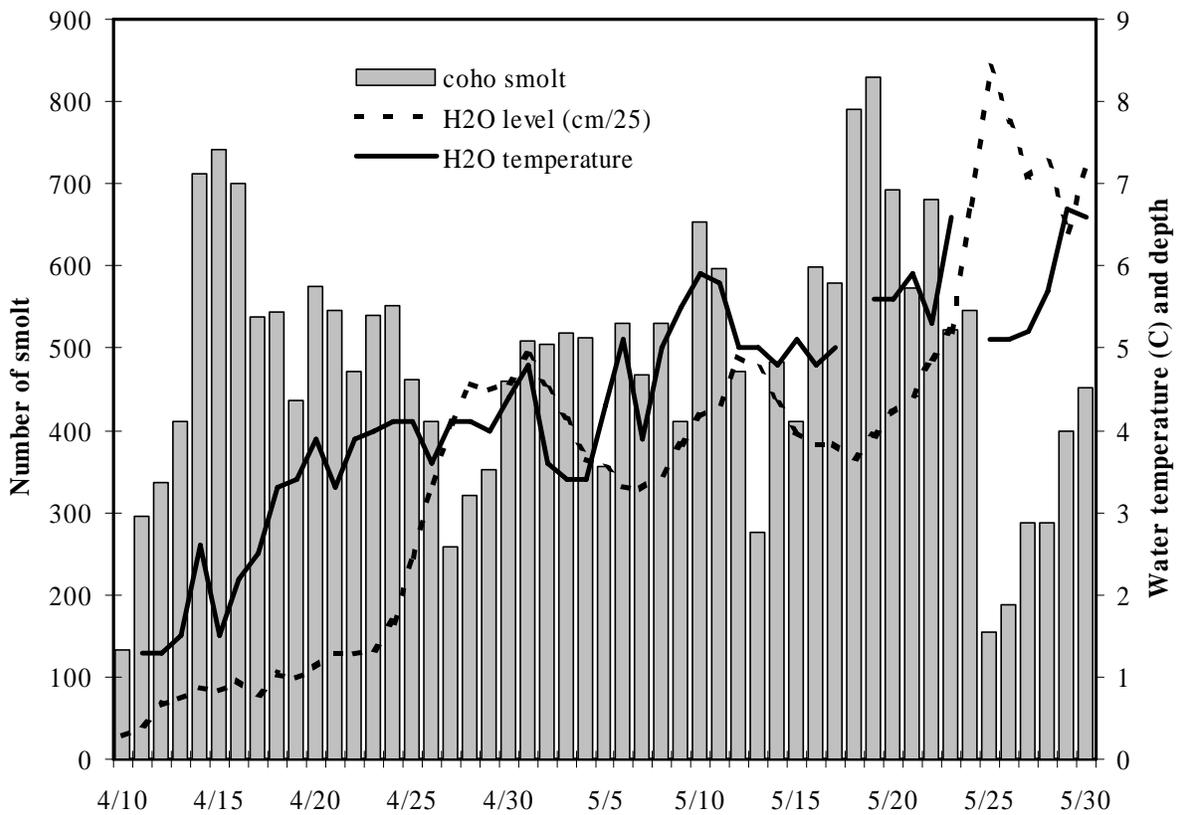


Figure 2.—Catches of coho salmon smolt ≥ 75 mm, daily water depth (cm/25), and temperature ($^{\circ}$ C) in Chilkat River, April 10 through May 30, 2003.

Table 3.—Estimated age and size composition of coho salmon smolt ≥ 75 mm FL marked in the Chilkat River and sampled at Chilkat Lake, 2003.

		Age-1	Age-2	Total aged	Total sampled
Chilkat River	sample size	315	22	337	341
	percent (SE)	93.5 (1.3)	6.5 (1.3)		
	mean length (SE)	85 (0.4)	104 (2.3)		86 (0.5)
	mean weight (SE)	6.2 (1.8)	10.9 (3.1)		6.5 (2.2)
Chilkat Lake ^a	sample size	175	78	253	384
	weighted percent (SE) ^b	52.0 (4.4)	48.0 (4.4)		
	mean length (SE)	96 (0.8)	122 (1.4)		106 (0.8)
	mean weight (SE)	8.5 (0.2)	16.8 (0.6)		11.8 (0.3)

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

^b Chilkat Lake samples were weighted to correct for non-proportional sampling

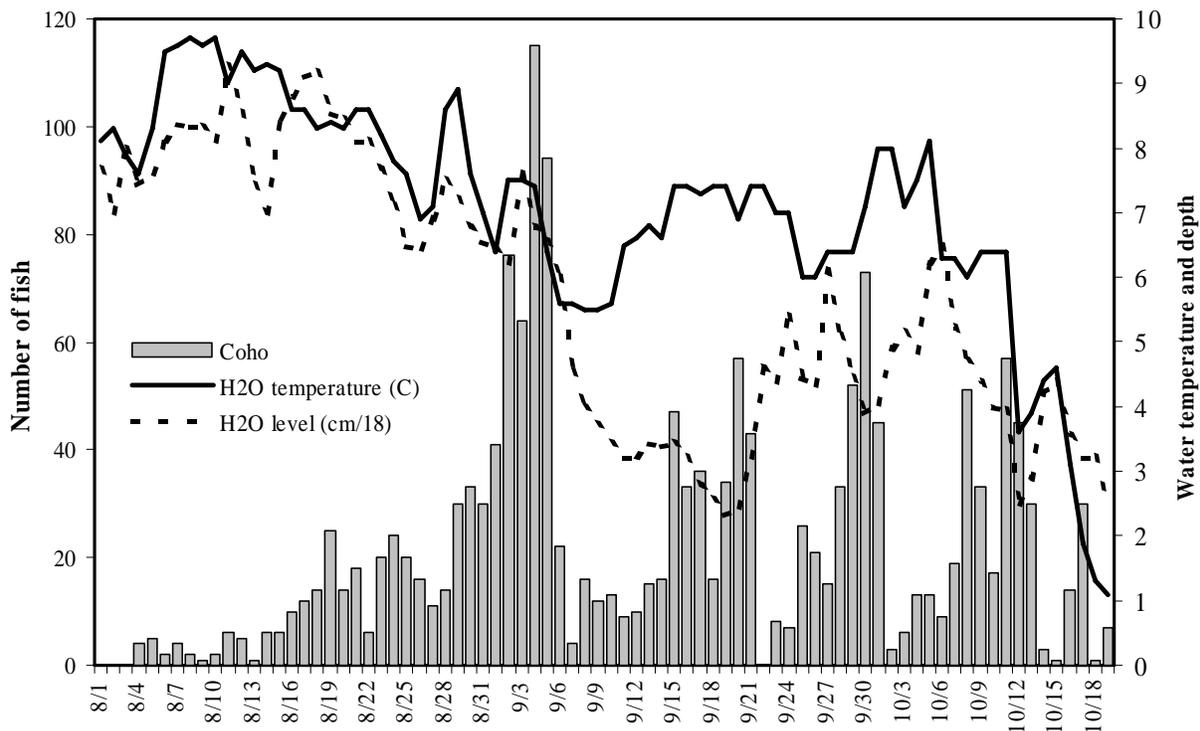


Figure 3.—Fish wheel catch of adult coho salmon, daily water depth (cm/18), and temperature (°C) in the lower Chilkat River, August 1 through October 19, 2004.

Table 4.—Number of adult coho salmon sampled in the lower Chilkat River for missing adipose fins and coded wire tags, 2004.

Statistical week	Number sampled	Tag code			No tag	Total adipose-clips	Percent marked
		04-08-25	04-08-26	04-08-27			
32	15					0	0.0
33	23					0	0.0
34	99			1		1	1.0
35	111			1		1	0.9
36	389	1	1			2	0.5
37	170	1				1	0.6
38	173	1	2			3	1.7
39	175		1		1	2	1.1
40	242	1				1	0.4
41	144		1			1	0.7
42	167	3	3		1	7	4.2
43	38		1		1	2	5.3
Total	1,746	7	9	2	3	21	1.2

were age-1.1 or 2.1 (ocean age-1; Table 5). Based on this information, we estimate that 1,735 adults sampled for missing adipose fins in 2004 emigrated as smolt during 2003.

SMOLT ABUNDANCE

The estimated number of coho salmon smolt that emigrated from the Chilkat River in 2003 was 1,938,322 (SE = 401,419). This estimate is based on $n_1 = 24,563$ smolt released in spring 2003, $n_2 = 1,735$ ocean-age-1 adults sampled from the fish wheels in 2004, and a total of $m_2 = 21$ marked fish recovered inriver (18 with 2003 Chilkat River tag codes and three missing tags). The estimated marked fraction θ_s germane to smolt abundance was 0.0121 (SE = 0.0026).

CODED WIRE TAG RECOVERY

In 2004, 258 CWTs with Chilkat River codes were recovered from coho salmon during the random sampling of various sport and commercial marine harvests (Table 6; Appendix A1). Most tags (189) were recovered in the commercial troll fisheries (Figure 4), followed by 56 recoveries in the commercial drift gillnet fisheries (Table 6). One gillnet and three troll-caught fish were recovered in mixed district batches and were discarded from further analysis. CWTs were also recovered in the inside purse seine fisheries (2), and the Yakutat, Elfin Cove, Gustavus, and Juneau marine sport fisheries (11).

Table 5.—Sampled age/sex composition, and length at fish wheels and estimated escapement in the Chilkat River, 2004.

	Brood year and age class				Total aged	Total sampled ^a
	2002 1.0	2001 2.0	2001 1.1	2000 2.1		
	Females					
Sample size	0	0	123	29	152	183
Percent	0	0	37.4	8.8		46.2
SE			2.7	1.6		2.5
Number	0	0	24,129	5,689		29,818
SE			2,478	723		2,901
Mean length			595	642		
SD			80	64		
	Males					
Sample size	1	1	140	34	176	213
Percent	0.3	0.3	42.8	10.4		53.8
SE	0.3	0.3	2.7	1.7		2.5
Number	197	197	27,607	6,705		34,706
SE	107	107	2,742	853		3,237
Mean length	280	390	590	605		
SD			97	108		
	All fish^b					
Sample size	1	1	264	63	329	396
Percent	0.3	0.3	80.2	19.2		
SE	0.1	0.1	2.2	2.2		
Number	197	197	51,736	12,394		64,524
SE	107	107	3,696	1,118		5,217
Mean length	280	390	592	622		
SD			89	92		

^a Includes fish not assigned an age.

^b Includes fish with no sex information.

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 8 to October 2, and in the Northwest Quadrant troll fishery from July 11 to October 2 (Table 6). This indicates that tagged fish mixed well in the ocean environment. The troll (73%) and gillnet (22%) fisheries together comprised 95% of all Chilkat tag recoveries.

There were seven select recoveries (returned from a location with a sampling program) and one voluntary recovery (returned from an area with no sampling program) of coho salmon bearing 2003 Chilkat River tag codes in 2004 (Appendix A1). Two adult coho salmon were voluntarily turned in from the troll fishery, one from an unknown source (Hoonah), and three from the Chilkat River sport fishery in 2003. One juvenile coho salmon was captured migrating up Auke Creek near Juneau on September 10, and an adult was turned in to ADF&G that was caught in the Homer marine sport fishery.

HARVEST

The tagged fraction θ_h germane to estimating harvest contributions was 0.0104 (SE = 0.0024). This estimate is based on the 18 fish with decoded Chilkat River tags in the 1,735 1-ocean adult coho salmon inspected for marks in 2004.

An estimated 127,988 (SE = 19,938) coho salmon bound for the Chilkat River were harvested in sampled marine commercial and sport fisheries in 2004 (Table 7). An additional 454 coho salmon were harvested in the Chilkat Inlet and Chilkat River subsistence fisheries, and 3,193 (SE = 673) in Haines area recreational fisheries for a total harvest of 131,635 (SE = 19,893, Table 8). Most of the harvest (64.0%; 84,286, SE = 18,681) occurred in the commercial troll fisheries followed by the commercial drift gillnet fisheries (26.8%; 35,155, SE = 6,271). The remainder of the harvest occurred in the recreational (8.2%), commercial seine (0.7%), and subsistence (0.3%) fisheries. Harvests in the troll fisheries occurred earlier and over a longer period 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 to early September. The estimated mean date of harvest in the Northwest quadrant troll fishery was September 4 compared to September 14 for the Lynn Canal gillnet fishery.

ESCAPEMENT

A total of 2,006 coho salmon were counted during peak surveys in the Chilkat River drainage in 2004 (Table 9). The expansion factors from past years ranged from 23.6 (SE = 2.95) in 1990 to 36.3 (SE = 5.51) in 2002. The mean expansion factor 32.2 (SE = 2.60) was used to estimate that 64,524 (SE = 5,217) coho salmon spawned in the Chilkat River in 2004 (Table 9).

AGE AND SEX COMPOSITION OF THE ESCAPEMENT

The age composition was nearly identical between the first (prior to September 11) and second half of the immigration ($\chi^2 = 0.006$, df = 1, P = 0.936). In addition, sex compositions did not vary significantly over time for age-1.1 ($\chi^2 = 2.572$, df = 1, P = 0.109) or -2.1 fish ($\chi^2 = 1.419$, df = 1, P = 0.233). Thus, the samples were pooled to estimate the age and sex composition of the escapement. Males comprised 54% (SE=3%), and age-1.1 fish comprised 80.2% (SE=2.2%) of the escapement (Table 5).

MARINE EXPLOITATION AND SURVIVAL

Based on a total run in 2004 of 195,765, age-1 Chilkat River coho salmon (SE = 20,565), the estimated marine survival rate at 10.1% (Table 10, SE = 2.3%). The marine exploitation of this stock was estimated at 65.6% (Table 10, SE = 3.8%).

DATA FILES

Data collected during this study (Appendix A2) 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 30, catch rates were declining (Table 1). Therefore, the majority of the

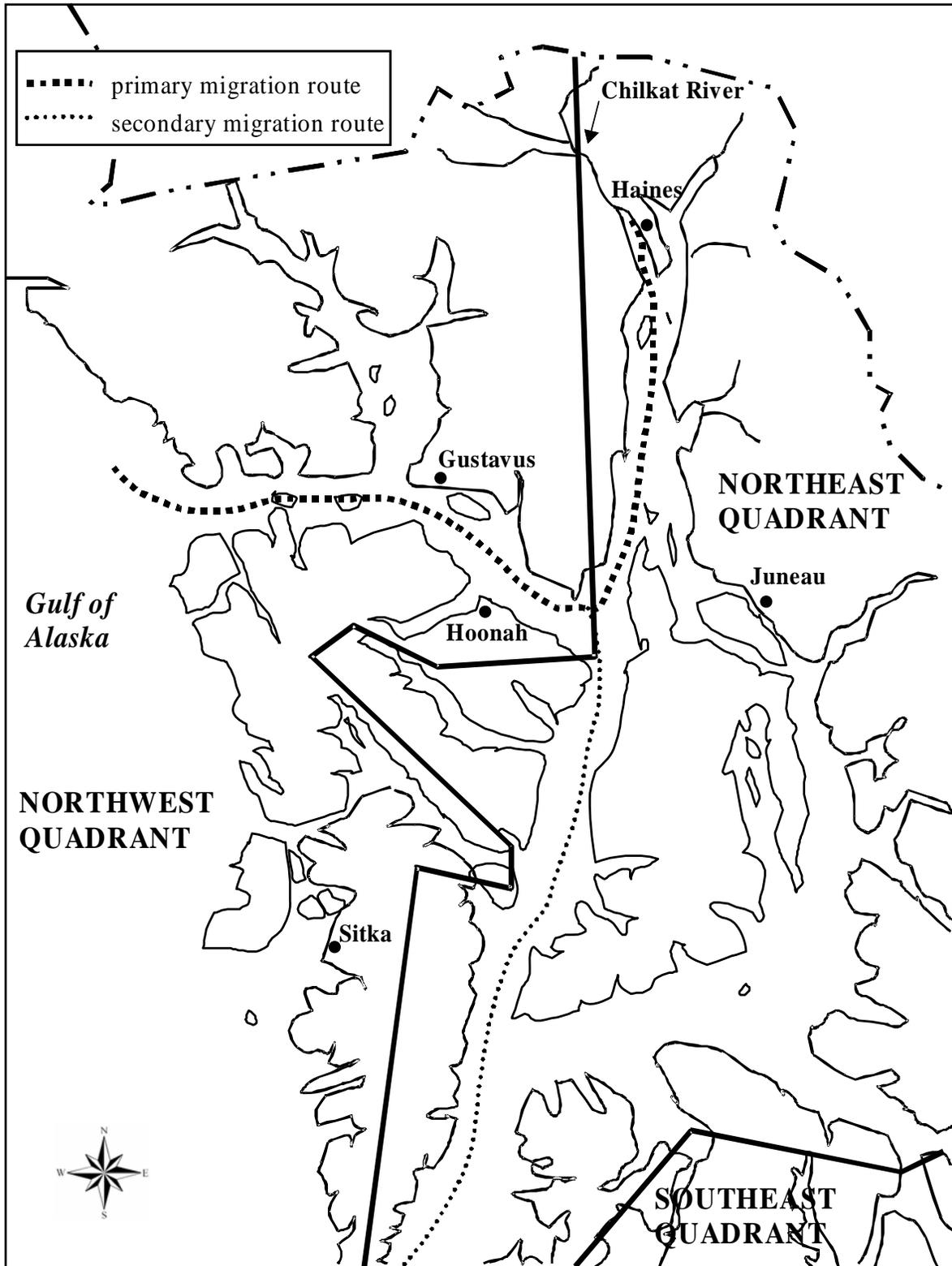


Figure 4.—Commercial troll quadrants and migration routes of Chilkat River coho salmon through northern Southeast Alaska

Table 6.—Random marine recoveries of CWTs from Chilkat River coho salmon by tag code, fishery, and statistical week, 2004.

Statistical week	Dates	Tag code			Total
		04-08-25	04-08-26	04-08-27	
District 115 Gillnet Fishery					
33	08/08-08/14	0	1	0	1
35	08/22-08/28	1	3	0	4
36	08/29-09/04	1	2	2	5
37	09/05-09/11	3	3	2	8
38	09/12-09/18	8	13	2	23
39	09/19-09/25	7	4	1	12
40	09/26-10/02	0	1	0	1
District 111 Gillnet Fishery					
38	09/12-09/18	0	1	0	1
Mixed District Gillnet Fishery					
39	09/19-09/25	0	1	0	1
Gillnet subtotal		20	29	7	56
Northeast Quadrant Troll					
34	08/15-08/21	0	1	0	1
35	08/22-08/28	3	0	0	3
36	08/29-09/04	0	2	0	2
Northwest Quadrant Troll					
29	07/11-07/17	1	1	0	2
31	07/25-07/31	1	2	1	4
32	08/01-08/07	6	1	1	8
33	08/08-08/14	3	2	1	6
34	08/15-08/21	3	4	3	10
35	08/22-08/28	9	10	3	22
36	08/29-09/04	13	16	4	33
37	09/05-09/11	21	24	7	52
38	09/12-09/18	7	16	6	29
39	09/19-09/25	5	7	1	13
40	09/26-10/02	0	1	0	1
Mixed Quadrant Troll					
32	08/01-08/07	1	0	0	1
36	08/29-09/04	1	0	0	1
38	09/12-09/18	0	1	0	1
Troll subtotal		74	88	27	189
District 112 Purse Seine Fishery					
35	08/22-08/28	1	0	0	1
District 114 Purse Seine Fishery					
38	09/12-09/18	1	0	0	1
Purse seine subtotal		2	0	0	2
Yakutat Marine Sport Fishery					
37	09/05-09/11	1	1	0	2
Elfin Cove Marine Sport Fishery					
35	08/22-08/28	0	0	1	1
36	08/29-09/04	0	1	0	1
Gustavus Marine Sport Fishery					
35	08/22-08/28	0	0	1	1
36	08/29-09/04	0	2	0	2

-continued-

Table 6.—Page 2 of 2.

Statistical week	Dates	Tag code			Total
		04-08-25	04-08-26	04-08-27	
Juneau Marine Sport Fishery					
34	08/15-08/21	1	0	0	1
35	08/22-08/28	0	0	1	1
37	09/05-09/11	1	0	0	1
38	09/12-09/18	1	0	0	1
Marine sport subtotal		4	4	3	11
Total recoveries		100	121	37	258
Valid tags released		10,570	10,037	3,953	24,560
Percent gillnet		20	24	19	22
Percent troll		74	73	73	73
Percent gillnet & troll		94	97	92	95

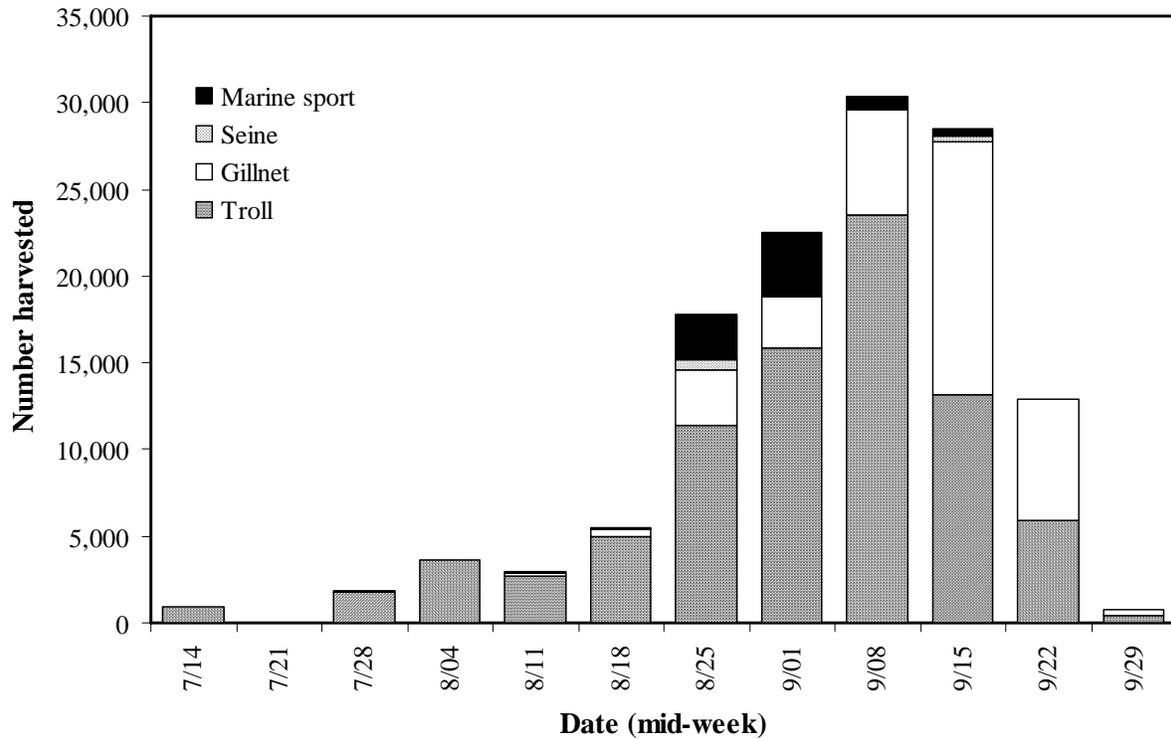


Figure 5.—Estimated marine harvests of coho salmon bound for the Chilkat River, by fishery and statistical week, 2004. Weekly estimates of harvest in the troll (period) and marine sport fisheries (biweek) are approximated.

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 fin clips) that were not lost, assumption (d) was satisfied. Personnel sampling the fish wheels examined each fish for missing adipose fins. Fish were not marked to prevent resampling; thus it was possible that some fish were sampled more than once. However, it is unlikely that many fish were examined for missing adipose fins more than once, thus assumption (e) was relatively robust.

Age-2 smolt appeared to have better marine survival than age-1 fish. While age-2 fish represented less than 7% of the smolt emigration, they represented nearly 20% of the adult escapement. 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%. Future studies should differentially mark large and small smolt to assess, and if necessary, compensate for this bias.

The timing of the coho salmon escapement into the Chilkat River was early and displayed a more sporadic pattern relative to years when the fish wheels were operated into October (1990 and 1997–2003). The mean date of migratory timing in 2004 was September 15. In contrast, the mean date for past years was September 20 (Figure 6).

The percent of Chilkat River coho salmon in the harvest varied greatly depending on the

proximity of the fishery to the Chilkat River. Although we estimated that the NW troll fishery harvested the greatest number (81,444) of Chilkat River fish, they represented only 6.6% of this harvest (Tables 7 and 8). The second largest harvest occurred in the Lynn Canal drift gillnet fishery (34,427) where Chilkat River fish represented 66.4% 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 likely decreases with proximity.

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 (Appendix A1). 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 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.

The estimates of the total harvest of Chilkat River coho salmon in 2004 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 coded wire tags. The voluntary recovery of a Chilkat River coho salmon in Homer could not be used to estimate harvest in this fishery but provides evidence that they are caught there. Thus, the contribution of various stocks to these fisheries cannot be estimated. The exploitation of

Chilkat River coho salmon was higher than estimated in recent years. This was primarily because of two factors. First the price of coho salmon paid to commercial fishers was much higher than in the recent past. This provided more incentive for fishers to increase effort to catch coho salmon. Second, the commercial

troll fishery was extended due to the high abundance of coho salmon in outside waters. The 2004 escapement of coho salmon to the Chilkat River (64,524) was slightly below average. However, escapements have been much lower in the past (Table 9).

Table 7.—Estimated marine harvest in 2004 of adult coho salmon bound for the Chilkat River, by fishery and temporal stratum (statistical week, except biweeks in the marine recreational fisheries).

Fishery	District	Stat. week	Harvest	Var[H]	n	a	a'	t	t'	m	r	SE[r]
Lynn Canal gillnet	115	27-34	2,904	0	1,186	17	17	13	13	1	236	236
Lynn Canal gillnet	115	35	3,049	0	368	5	5	5	5	4	3,194	1,723
Lynn Canal gillnet	115	36	4,240	0	694	21	21	19	19	5	2,944	1,454
Lynn Canal gillnet	115	37	8,054	0	1,027	52	52	50	50	8	6,047	2,515
Lynn Canal gillnet	115	38	20,314	0	3,071	142	142	135	135	23	14,665	4,544
Lynn Canal gillnet	115	39	12,126	0	2,000	92	92	87	87	12	7,013	2,564
Lynn Canal gillnet	115	40-41	1,200	0	353	26	26	24	24	1	328	327
Lynn Canal gillnet subtotal			51,887	0	8,699	355	355	333	333	54	34,427	6,228
Dist. 111 gillnet	111	38	10,901	0	1,618	28	25	22	22	1	727	727
Taku Inlet gillnet subtotal			10,901	0	1,618	28	25	22	22	1	727	727
NW troll period 3		27-32	547,304	0	118,686	1,587	1,560	1,230	1,229	14	6,336	2,216
NW troll period 4		33-40	690,256	0	149,828	2,760	2,710	2,229	2,228	166	75,108	18,503
NW troll subtotal			1,237,560	0	268,514	4,347	4,270	3,459	3,457	180	81,444	18,636
NE troll period 4		33-40	131,422	0	27,257	443	436	333	332	6	2,842	1,309
NE troll subtotal			131,422	0	27,257	443	436	333	332	6	2,842	1,309
Purse seine	112	35	25,332	0	3,839	70	70	61	61	1	636	636
Purse seine	114	38	1,893	0	606	11	11	7	7	1	301	301
Purse seine subtotal			27,225	0	4,445	81	81	68	68	2	937	703
Yakutat marine sport	181	16-18	7,425	1,200,206	3,923	10	10	6	6	2	365	267
Yakutat marine sport subtotal			7,425	1,200,206	3,923	10	10	6	6	2	365	267
Icy Strait marine sport	113, 114	11-18	26,114	6,411,024	2,290	57	57	50	50	5	5,496	2,753
Icy Strait marine sport subtotal			26,114	6,411,024	2,290	57	57	50	50	5	5,496	2,753
Juneau marine sport	111, 115	17	8,774	839,139	4,959	103	102	82	82	1	172	172
Juneau marine sport	111, 115	18-19	2,551	401,609	561	24	20	18	18	3	1,578	1,008
Juneau marine sport subtotal			11,325	1,240,748	5,520	127	122	100	100	4	1,750	1,023
Total			1,503,859	8,851,978	322,266	5,448	5,356	4,371	4,368	254	127,988	19,938

Table 8.—Total (marine and freshwater) coho salmon harvest and estimated Chilkat River salmon harvest in Alaska fisheries, by fishery and area, 2004.

Fishery	Area	Coho salmon harvest			Percent of harvest	
		Total	Chilkat	SE	Fishery	Chilkat
Drift gillnet	District 111	45,289	727	727	1.6	0.6
	District 115	51,887	34,427	6,228	66.4	26.2
	Subtotal	97,176	35,155	6,271	36.2	26.8
U.S. troll fishery	NW Quadrant	1,237,623	81,444	18,636	6.6	61.9
	NE Quadrant	228,725	2,842	1,309	1.2	2.1
	Subtotal	1,466,348	84,286	18,681	5.7	64.0
Seine fishery	District 112	83,284	636	636	0.8	0.5
	District 114	10,097	301	301	3.0	0.2
	Subtotal	83,284	937	703	1.1	0.7
Recreational	Yakutat marine	7,425	365	267	4.9	0.3
	Icy Strait marine	26,114	5,496	2,753	21.0	4.2
	Juneau marine	20,543	1,750	1,023	8.5	1.3
	Haines marine ^a	727	371	124	51.0	0.3
	Chilkat River ^a	2,822	2,822	661	100.0	2.1
	Subtotal	57,631	10,804	3,025	18.7	8.2
Subsistence ^b	Chilkat Inlet	107	107	0	100.0	0.1
	Chilkat River	347	347	0	100.0	0.2
	Subtotal	454	454	0	100.0	0.3
Total		1,430,879	131,635	19,893	9.2	100.0

^a These estimates came from the Statewide Harvest Survey.

^b Subsistence harvests as reported on returned permits.

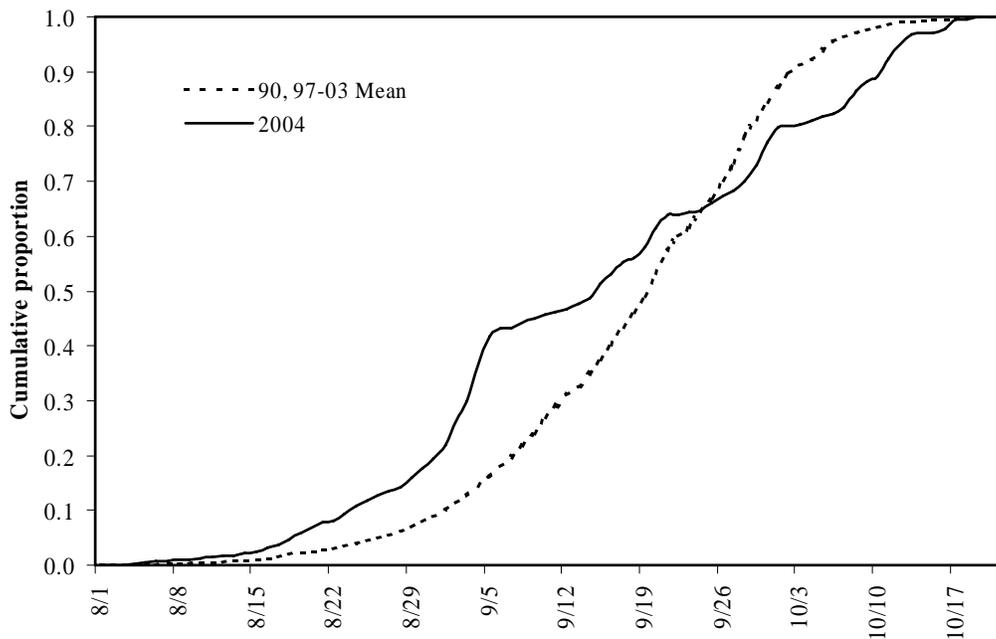


Figure 6.—Cumulative proportion of adult coho salmon captured in Chilkat River fish wheels during 2004 compared to the mean cumulative proportion of 1990, and 1997–2003.

Table 9.—Peak survey counts and estimated escapement of coho salmon to the Chilkat River, 1987–2004. 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	Kelsall River	Tahini River	Clear Creek	Combined (C_t)	escapement (\hat{N})	SE(\hat{N})
1987	99	197	792	25	1,113	35,800	1,795
1988	87	160	590	40	877	28,209	1,414
1989	57	190	1,064	141	1,452	46,704	2,342
1990	88	379	2,766	150	3,383	79,807	9,980
1991	176	417	1,785	135	2,513	80,831	4,053
1992	183	281	1,143	700	2,307	74,205	3,720
1993	101	129	1,041	460	1,731	55,678	2,792
1994	451	440	4,482	408	5,781	185,948	9,323
1995	268	197	1,033	189	1,687	54,263	2,721
1996	204	179	412	315	1,110	35,704	1,790
1997	227	133	684	250	1,294	41,622	2,087
1998	271	265	649	275	1,460	50,758	10,698
1999	335	207	962	195	1,699	54,649	2,740
2000	305	571	1,324	435	2,635	84,756	4,249
2001	450	225	1,272	1,285	3,232	103,958	5,212
2002	1,328	440	2,582	1,310	5,660	205,429	31,165
2003	500	356	1,419	1,675	3,950	134,340	15,070
2004	564	170	827	445	2,006	64,524	5,217
Mean	316	274	1,379	469	2,438	78,733	9,554
				Min.	877	28,209	
				Max.	5,781	205,429	
					Expansion factor ($\bar{\pi}$)	32.2	
					$v(\pi)$	6.8	

Table 10.—Estimated stock assessment parameters for coho salmon that emigrated from the Chilkat River in 2003.

Parameter	Estimate	SE
2003 smolt emigration	1,938,322	401,419
2004 marine harvest	128,466	19,882
2004 inriver harvest	3,169	661
2004 1-ocean age escapement	64,130	5,215
Total 2004 run	195,765	20,565
Marine exploitation rate	65.6%	3.8%
Marine survival	10.1%	2.3%

^a Total escapement excluding age-1.0 and 2.0-fish.

ACKNOWLEDGMENTS

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APPENDIX A

Appendix A1.—Random, select, and voluntary recoveries of coded wire tagged Chilkat River coho salmon in 2004.

Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
RANDOM RECOVERIES									
538301	40826	Gillnet	Excursion Inlet	8/11/2004	33	NE	115		760
538412	40825	Gillnet	Excursion Inlet	8/25/2004	35	NE	115		625
538434	40826	Gillnet	Excursion Inlet	8/26/2004	35	NE	115		600
538437	40826	Gillnet	Excursion Inlet	8/26/2004	35	NE	115		661
538436	40826	Gillnet	Excursion Inlet	8/26/2004	35	NE	115		757
538480	40825	Gillnet	Excursion Inlet	8/31/2004	36	NE	115		720
538477	40826	Gillnet	Excursion Inlet	8/31/2004	36	NE	115		722
538476	40827	Gillnet	Excursion Inlet	8/31/2004	36	NE	115		694
538492	40826	Gillnet	Excursion Inlet	9/1/2004	36	NE	115		693
538497	40827	Gillnet	Excursion Inlet	9/1/2004	36	NE	115		728
538529	40825	Gillnet	Excursion Inlet	9/7/2004	37	NE	115		722
538516	40825	Gillnet	Excursion Inlet	9/7/2004	37	NE	115		755
538525	40826	Gillnet	Excursion Inlet	9/7/2004	37	NE	115		720
538558	40825	Gillnet	Excursion Inlet	9/8/2004	37	NE	115		740
538574	40826	Gillnet	Excursion Inlet	9/8/2004	37	NE	115		582
538570	40826	Gillnet	Excursion Inlet	9/8/2004	37	NE	115		750
538576	40827	Gillnet	Excursion Inlet	9/8/2004	37	NE	115		641
538578	40827	Gillnet	Excursion Inlet	9/8/2004	37	NE	115		664
538630	40825	Gillnet	Excursion Inlet	9/14/2004	38	NE	115		757
538632	40826	Gillnet	Excursion Inlet	9/14/2004	38	NE	115		668
538622	40826	Gillnet	Excursion Inlet	9/14/2004	38	NE	115		678
538623	40826	Gillnet	Excursion Inlet	9/14/2004	38	NE	115		688
538629	40826	Gillnet	Excursion Inlet	9/14/2004	38	NE	115		722
538624	40826	Gillnet	Excursion Inlet	9/14/2004	38	NE	115		723
538627	40827	Gillnet	Excursion Inlet	9/14/2004	38	NE	115		675
538668	40825	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		610
538706	40825	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		705
538713	40825	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		730
538687	40825	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		740
538721	40825	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		746
538710	40825	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		810
538715	40825	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		815
538681	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		640
538714	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		650
538711	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		680
538693	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		700
538722	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		703
538649	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		710
538700	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		715
538644	40826	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		740
538659	40827	Gillnet	Excursion Inlet	9/16/2004	38	NE	115		810
539121	40826	Gillnet	Juneau	9/16/2004	38	NE	111	32	739
539351	40826	Gillnet	Juneau	9/21/2004	39	NE	111/115		683
539349	40825	Gillnet	Juneau	9/21/2004	39	NE	115		684
539350	40825	Gillnet	Juneau	9/21/2004	39	NE	115		708
25908	40825	Gillnet	Juneau	9/21/2004	39	NE	115		750

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
539147	40826	Gillnet	Juneau	9/21/2004	39	NE	115		648
539375	40825	Gillnet	Juneau	9/22/2004	39	NE	115		672
539379	40825	Gillnet	Juneau	9/22/2004	39	NE	115		711
539388	40825	Gillnet	Juneau	9/22/2004	39	NE	115		732
539376	40825	Gillnet	Juneau	9/22/2004	39	NE	115		767
539372	40826	Gillnet	Juneau	9/22/2004	39	NE	115		723
539362	40826	Gillnet	Juneau	9/22/2004	39	NE	115		732
539378	40826	Gillnet	Juneau	9/22/2004	39	NE	115		759
539365	40827	Gillnet	Juneau	9/22/2004	39	NE	115		626
539153	40826	Gillnet	Juneau	9/29/2004	40	NE	115		725
538395	40825	Seine	Excursion Inlet	8/22/2004	35	NE	112	16	576
538606	40825	Seine	Excursion Inlet	9/13/2004	38	NW	114	80	750
294222	40825	Sport	Juneau	8/20/2004	34	NE			725
294263	40827	Sport	Juneau	8/22/2004	35	NE			705
510898	40827	Sport	Gustavus	8/26/2004	35	NW	114	21	635
288467	40827	Sport	Elfin Cove	8/27/2004	35	NW	113	91	635
510900	40826	Sport	Gustavus	8/30/2004	36	NW	113	93	675
510899	40826	Sport	Gustavus	8/30/2004	36	NW	114	25	795
288482	40826	Sport	Elfin Cove	9/4/2004	36	NW	114	21	675
265839	40825	Sport	Juneau	9/6/2004	37	NE	111	50	690
530725	40826	Sport	Yakutat	9/7/2004	37	NW	181	60	790
530726	40825	Sport	Yakutat	9/11/2004	37	NW	181	60	715
265527	40825	Sport	Juneau	9/12/2004	38	NE	115	20	
538193	40826	Troll	Excursion Inlet	7/14/2004	29	NW			682
273712	40825	Troll	Hoonah	7/16/2004	29	NW	113	93	680
519307	40825	Troll	Elfin Cove	7/26/2004	31	NW	114	21	670
519301	40826	Troll	Elfin Cove	7/26/2004	31	NW	114	21	665
273782	40826	Troll	Hoonah	7/26/2004	31	NW			710
273761	40827	Troll	Hoonah	7/26/2004	31	NW			585
273860	40825	Troll	Hoonah	8/1/2004	32	NW			450
273869	40827	Troll	Hoonah	8/1/2004	32	NW			510
273849	40826	Troll	Hoonah	8/2/2004	32	NW	114	27	555
273848	40825	Troll	Hoonah	8/2/2004	32				610
273932	40825	Troll	Hoonah	8/3/2004	32	NW			540
273923	40825	Troll	Hoonah	8/3/2004	32	NW			550
273928	40825	Troll	Hoonah	8/3/2004	32	NW			570
273919	40825	Troll	Hoonah	8/3/2004	32	NW			620
273906	40825	Troll	Hoonah	8/4/2004	32	NW	116		610
262846	40826	Troll	Sitka	8/8/2004	33	NW	113	41	595
262838	40826	Troll	Sitka	8/8/2004	33	NW	113	45	633
273969	40825	Troll	Hoonah	8/9/2004	33	NW	114	23	590
249770	40825	Troll	Sitka	8/9/2004	33	NW	113	45	700
260009	40825	Troll	Sitka	8/9/2004	33	NW	113		588
266350	40827	Troll	Pelican	8/10/2004	33	NW	116	11	627
274070	40826	Troll	Hoonah	8/15/2004	34	NW	114	23	550
274061	40827	Troll	Hoonah	8/15/2004	34	NW	114	23	675
265359	40826	Troll	Port Alexander	8/15/2004	34	NE	109	61	650
274092	40825	Troll	Hoonah	8/16/2004	34	NW	116		730
530945	40825	Troll	Yakutat	8/16/2004	34	NW			770
519360	40827	Troll	Elfin Cove	8/17/2004	34	NW	114	21	

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
519391	40825	Troll	Elfin Cove	8/19/2004	34	NW	114	21	750
274144	40826	Troll	Hoonah	8/19/2004	34	NW	114	25	555
274111	40826	Troll	Hoonah	8/19/2004	34	NW	114	27	680
266717	40826	Troll	Pelican	8/19/2004	34	NW	113	91	658
266710	40827	Troll	Pelican	8/19/2004	34	NW	113	91	663
274178	40825	Troll	Hoonah	8/23/2004	35	NW	114	23	670
274164	40826	Troll	Hoonah	8/23/2004	35	NW	114	23	825
274162	40827	Troll	Hoonah	8/23/2004	35	NW	114	23	655
274174	40825	Troll	Hoonah	8/23/2004	35	NW	114	25	735
260794	40825	Troll	Sitka	8/23/2004	35	NW	113	81	650
163497	40826	Troll	Yakutat	8/23/2004	35	NW			655
274332	40826	Troll	Hoonah	8/24/2004	35	NW	114	25	775
274315	40825	Troll	Hoonah	8/24/2004	35	NW			675
274320	40826	Troll	Hoonah	8/24/2004	35	NW			625
274311	40826	Troll	Hoonah	8/24/2004	35	NW			740
266760	40827	Troll	Pelican	8/24/2004	35	NW	114	21	578
519403	40826	Troll	Elfin Cove	8/25/2004	35	NW	113	91	605
274354	40826	Troll	Hoonah	8/25/2004	35	NW	114	23	565
274338	40826	Troll	Hoonah	8/25/2004	35	NW	114	23	715
266768	40825	Troll	Pelican	8/25/2004	35	NW	113	91	728
274358	40825	Troll	Hoonah	8/26/2004	35	NE	112	16	745
260335	40825	Troll	Sitka	8/26/2004	35	NW			643
260339	40825	Troll	Sitka	8/26/2004	35	NW			712
260347	40826	Troll	Sitka	8/26/2004	35	NW			675
274370	40825	Troll	Hoonah	8/28/2004	35	NE	112	16	645
274371	40825	Troll	Hoonah	8/28/2004	35	NE	112	16	740
266800	40825	Troll	Pelican	8/28/2004	35	NW	114	21	750
261059	40825	Troll	Sitka	8/28/2004	35	NW	113	91	587
261067	40826	Troll	Sitka	8/28/2004	35	NW	113	91	622
261063	40827	Troll	Sitka	8/28/2004	35	NW	113	91	588
274445	40826	Troll	Hoonah	8/29/2004	36	NW			720
519425	40825	Troll	Elfin Cove	8/30/2004	36	NW	114	21	770
274411	40825	Troll	Hoonah	8/30/2004	36	NW	116		700
274390	40826	Troll	Hoonah	8/30/2004	36	NW	154		600
274379	40827	Troll	Hoonah	8/30/2004	36	NW	154		585
266932	40825	Troll	Pelican	8/30/2004	36	NW	113	91	645
266928	40825	Troll	Pelican	8/30/2004	36	NW	114	21	634
274420	40826	Troll	Hoonah	8/31/2004	36	NW	114	25	730
266958	40825	Troll	Pelican	8/31/2004	36	NW	114	21	630
266964	40825	Troll	Pelican	8/31/2004	36	NW	114	21	740
266961	40826	Troll	Pelican	8/31/2004	36	NW	114	21	688
266973	40827	Troll	Pelican	8/31/2004	36	NW	114	21	564
274494	40826	Troll	Hoonah	9/1/2004	36	NE	112	63	640
274495	40826	Troll	Hoonah	9/1/2004	36	NE	112	63	680
274492	40826	Troll	Hoonah	9/1/2004	36	NW	114		740
274478	40826	Troll	Hoonah	9/1/2004	36	NW	189		520
266988	40826	Troll	Pelican	9/1/2004	36	NW	116	14	700
266989	40826	Troll	Pelican	9/1/2004	36	NW	116	14	707
267003	40826	Troll	Pelican	9/1/2004	36	NW	116	14	758
274535	40825	Troll	Hoonah	9/2/2004	36	NW	114	21	645
274543	40825	Troll	Hoonah	9/2/2004	36	NW	114	21	645
274509	40825	Troll	Hoonah	9/2/2004	36	NW	114	21	660
274527	40827	Troll	Hoonah	9/2/2004	36	NW	114	21	600
274504	40825	Troll	Hoonah	9/2/2004	36				625

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
267008	40825	Troll	Pelican	9/2/2004	36	NW			660
260515	40826	Troll	Sitka	9/2/2004	36	NW			744
288619	40825	Troll	Yakutat	9/2/2004	36	NW	181	60	676
288618	40826	Troll	Yakutat	9/2/2004	36	NW	181	60	772
267064	40825	Troll	Pelican	9/3/2004	36	NW	114	21	725
267083	40826	Troll	Pelican	9/3/2004	36	NW	114	21	515
267067	40826	Troll	Pelican	9/3/2004	36	NW	114	21	565
261135	40826	Troll	Sitka	9/3/2004	36	NW	113		610
274569	40825	Troll	Hoonah	9/4/2004	36	NW			560
274615	40826	Troll	Hoonah	9/4/2004	36	NW			680
274597	40826	Troll	Hoonah	9/4/2004	36	NW			795
274617	40827	Troll	Hoonah	9/4/2004	36	NW			745
538506	40825	Troll	Excursion Inlet	9/5/2004	37	NW	114	21	718
538501	40826	Troll	Excursion Inlet	9/5/2004	37	NW	114	21	676
261195	40826	Troll	Sitka	9/5/2004	37	NW	113	45	776
267088	40826	Troll	Pelican	9/6/2004	37	NW	114	21	652
519459	40825	Troll	Elfin Cove	9/7/2004	37	NW	114	21	680
274579	40826	Troll	Hoonah	9/7/2004	37	NW	114	25	755
274638	40826	Troll	Hoonah	9/7/2004	37	NW			705
274653	40826	Troll	Hoonah	9/7/2004	37	NW			709
267094	40825	Troll	Pelican	9/7/2004	37	NW			620
266802	40825	Troll	Pelican	9/7/2004	37	NW			733
267099	40826	Troll	Pelican	9/7/2004	37	NW			728
267100	40826	Troll	Pelican	9/7/2004	37	NW			730
519469	40825	Troll	Elfin Cove	9/8/2004	37	NW	114	21	800
519468	40826	Troll	Elfin Cove	9/8/2004	37	NW	114	21	660
519470	40827	Troll	Elfin Cove	9/8/2004	37	NW	114	21	760
274593	40825	Troll	Hoonah	9/8/2004	37	NW	114	25	770
266831	40827	Troll	Pelican	9/8/2004	37	NW	114	21	645
519495	40826	Troll	Elfin Cove	9/9/2004	37	NW	114	21	740
519485	40826	Troll	Elfin Cove	9/9/2004	37	NW	114	21	790
519492	40827	Troll	Elfin Cove	9/9/2004	37	NW	114	21	675
519483	40827	Troll	Elfin Cove	9/9/2004	37	NW	114	21	740
274631	40827	Troll	Hoonah	9/9/2004	37	NW	114	25	780
274713	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	647
274724	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	650
274704	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	675
274679	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	680
274722	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	698
274701	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	705
274716	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	728
274706	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	770
274707	40825	Troll	Hoonah	9/10/2004	37	NW	114	25	790
274661	40826	Troll	Hoonah	9/10/2004	37	NW	114	25	535
274675	40826	Troll	Hoonah	9/10/2004	37	NW	114	25	663
274658	40826	Troll	Hoonah	9/10/2004	37	NW	114	25	670
274667	40826	Troll	Hoonah	9/10/2004	37	NW	114	25	710
274683	40826	Troll	Hoonah	9/10/2004	37	NW	114	25	715
274720	40827	Troll	Hoonah	9/10/2004	37	NW	114	25	545
260548	40825	Troll	Sitka	9/10/2004	37	NW	116	14	727
260549	40825	Troll	Sitka	9/10/2004	37	NW	116	14	732
260544	40826	Troll	Sitka	9/10/2004	37	NW	116	14	726
260546	40826	Troll	Sitka	9/10/2004	37	NW	116	14	774
538589	40825	Troll	Excursion Inlet	9/11/2004	37	NW			695
538582	40825	Troll	Excursion Inlet	9/11/2004	37	NW			720

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
538593	40826	Troll	Excursion Inlet	9/11/2004	37	NW			722
538584	40826	Troll	Excursion Inlet	9/11/2004	37	NW			734
274749	40826	Troll	Hoonah	9/11/2004	37	NW			620
274744	40826	Troll	Hoonah	9/11/2004	37	NW			732
274737	40826	Troll	Hoonah	9/11/2004	37	NW			750
274739	40826	Troll	Hoonah	9/11/2004	37	NW			791
274752	40827	Troll	Hoonah	9/11/2004	37	NW			636
266848	40825	Troll	Pelican	9/11/2004	37	NW	114	21	672
261279	40825	Troll	Sitka	9/11/2004	37	NW	113	91	708
538601	40826	Troll	Excursion Inlet	9/12/2004	38	NW	114	25	670
538596	40826	Troll	Excursion Inlet	9/12/2004	38	NW	114	25	730
538607	40825	Troll	Excursion Inlet	9/13/2004	38	NW			755
538615	40825	Troll	Excursion Inlet	9/13/2004	38	NW			759
538609	40826	Troll	Excursion Inlet	9/13/2004	38	NW			740
538618	40827	Troll	Excursion Inlet	9/13/2004	38	NW			702
268412	40825	Troll	Elfin Cove	9/14/2004	38	NW	114	21	730
268417	40826	Troll	Elfin Cove	9/14/2004	38	NW	114	21	705
268418	40826	Troll	Elfin Cove	9/14/2004	38	NW	114	21	
268416	40827	Troll	Elfin Cove	9/14/2004	38	NW	114	21	650
274769	40826	Troll	Hoonah	9/14/2004	38	NW	114	27	760
274765	40826	Troll	Hoonah	9/14/2004	38				731
268419	40825	Troll	Elfin Cove	9/15/2004	38	NW	114	21	740
268420	40826	Troll	Elfin Cove	9/15/2004	38	NW	114	21	690
268424	40827	Troll	Elfin Cove	9/15/2004	38	NW	114	21	710
266875	40825	Troll	Pelican	9/15/2004	38	NW	114	21	703
266869	40826	Troll	Pelican	9/15/2004	38	NW	114	21	720
266883	40826	Troll	Pelican	9/15/2004	38	NW	114	21	725
266882	40827	Troll	Pelican	9/15/2004	38	NW	114	21	664
268437	40825	Troll	Elfin Cove	9/16/2004	38	NW	114	21	685
268441	40825	Troll	Elfin Cove	9/16/2004	38	NW	114	21	730
268435	40826	Troll	Elfin Cove	9/16/2004	38	NW	114	21	765
268428	40827	Troll	Elfin Cove	9/16/2004	38	NW	114	21	695
268443	40826	Troll	Elfin Cove	9/17/2004	38	NW	114	21	710
274829	40826	Troll	Hoonah	9/18/2004	38	NW	114	21	737
274778	40826	Troll	Hoonah	9/18/2004	38	NW	114	25	608
274774	40826	Troll	Hoonah	9/18/2004	38	NW	114	25	700
274784	40826	Troll	Hoonah	9/18/2004	38	NW	114	25	725
274785	40827	Troll	Hoonah	9/18/2004	38	NW	114	25	747
261306	40826	Troll	Sitka	9/18/2004	38	NW	113	81	643
274800	40825	Troll	Hoonah	9/19/2004	39	NW	114	21	714
274802	40826	Troll	Hoonah	9/19/2004	39	NW	114	21	520
274805	40826	Troll	Hoonah	9/19/2004	39	NW	114	21	682
274820	40826	Troll	Hoonah	9/19/2004	39	NW	114	25	672
274858	40826	Troll	Hoonah	9/19/2004	39	NW			735
268447	40825	Troll	Elfin Cove	9/20/2004	39	NW	114	21	640
274812	40825	Troll	Hoonah	9/20/2004	39	NW	114	25	742
274815	40826	Troll	Hoonah	9/20/2004	39	NW	114	25	746
274865	40825	Troll	Hoonah	9/23/2004	39	NW	114	21	671
274866	40826	Troll	Hoonah	9/23/2004	39	NW	114	21	627
274872	40826	Troll	Hoonah	9/23/2004	39	NW	114	21	642
274870	40827	Troll	Hoonah	9/23/2004	39	NW	114	21	785
274894	40825	Troll	Hoonah	9/25/2004	39	NW	114		736
274899	40826	Troll	Hoonah	9/29/2004	40	NW	114	25	685
254301	40827	Fish Wheels	Chilkat River	8/19/2004	34	NE	115	32	600

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Head number	Tag code	Gear	Port	Recovery date	Stat. week	Quadrant	Dist.	Sub-dist.	Length
254302	40827	Fish Wheels	Chilkat River	8/23/2004	35	NE	115	32	520
254303	40826	Fish Wheels	Chilkat River	9/2/2004	36	NE	115	32	490
254304	40825	Fish Wheels	Chilkat River	9/4/2004	36	NE	115	32	650
254305	40825	Fish Wheels	Chilkat River	9/5/2004	37	NE	115	32	595
254306	40825	Fish Wheels	Chilkat River	9/14/2004	38	NE	115	32	690
254308	40826	Fish Wheels	Chilkat River	9/17/2004	38	NE	115	32	625
254307	40826	Fish Wheels	Chilkat River	9/17/2004	38	NE	115	32	685
254310	40826	Fish Wheels	Chilkat River	9/21/2004	39	NE	115	32	655
254312	40825	Fish Wheels	Chilkat River	10/1/2004	40	NE	115	32	450
254313	40826	Fish Wheels	Chilkat River	10/8/2004	41	NE	115	32	690
254314	40825	Fish Wheels	Chilkat River	10/11/2004	42	NE	115	32	630
254316	40825	Fish Wheels	Chilkat River	10/11/2004	42	NE	115	32	675
254317	40826	Fish Wheels	Chilkat River	10/11/2004	42	NE	115	32	655
254318	40825	Fish Wheels	Chilkat River	10/12/2004	42	NE	115	32	590
254319	40826	Fish Wheels	Chilkat River	10/12/2004	42	NE	115	32	660
254321	40826	Fish Wheels	Chilkat River	10/16/2004	42	NE	115	32	670
254322	40826	Fish Wheels	Chilkat River	10/17/2004	43	NE	115	32	515
254217	40826	Sport	Chilkat River	10/9/2004	41	NE	115	32	560
254216	40826	Sport	Chilkat River	10/9/2004	41	NE	115	32	610
254218	40826	Sport	Chilkat River	10/10/2004	42	NE	115	32	625
221450	40826	Sport	Chilkat River	10/23/2004	43	NE	115	32	690
221451	40825	Sport	Chilkat River	10/24/2004	44	NE	115	32	740
221452	40826	Sport	Chilkat River	10/24/2004	44	NE	115	32	780
SELECT RECOVERIES									
900289	40825	Troll	Sitka	7/16/2004	29	NW	157		
901320	40826	Troll	Sitka	8/31/2004	36	Unknown			
274512	40826	Unknown	Hoonah	Unknown		Unknown			660
254320	40827	Sport	Chilkat River	10/11/2004	42	NE	115	32	540
221448	40825	Sport	Chilkat River	10/13/2004	42	NE	115	32	
221425	40827	Sport	Chilkat River	10/25/2004	44	NE	115	32	
06403	40961	Juvenile recovery	Juneau (Auke Cr.)	9/10/2004	37	NE	111	50	142
VOLUNTARY RECOVERY									
277006	40825	Sport	Homer	8/30/2004	36	LC	241	11	

Appendix A2.—Computer files used in the analysis of data for this report.

FILE NAME	DESCRIPTION
03trapsum.xls	Excel workbook containing 2003 Chilkat River coho salmon smolt trapping and coded wire tagging data.
03trapsum.prn	Space delimited text file with raw 2003 Chilkat River coho salmon smolt trapping and coded wire tagging data.
03trapsum.txt	Text file describing heading and column layout in 03trapsum.prn
Smoltawl2003.xls	Excel workbook containing 2003 Chilkat River coho salmon smolt age-weight-length data.
Smoltawl2003.prn	Space delimited text file with raw 2003 Chilkat River coho salmon smolt age-weight-length data.
Smoltawl2003.txt	Text file describing heading and column layout in Smoltawl2003.prn
04FWCoho.xls	Excel workbook containing 2004 Chilkat River fish wheel coho salmon catch, marking, and age-length sample data.
04FWCoho.prn	Space delimited text file with raw 2004 Chilkat River fish wheel coho salmon catch, marking, and age-length sample data.
04FWCoho.txt	Text file describing heading and column layout in 04FWCoho.prn
Allcwtrecoveries2004.xls	Excel workbook containing recovery data and harvest estimates of Chilkat River coho salmon tagged as smolt during 2004.
Allcwtrecoveries2004.prn	Space delimited text file with raw recovery data of Chilkat River coho salmon tagged as smolt during 2003.
Allcwtrecoveries2004.txt	Text file describing heading and column layout in All cwt recoveries2004.prn