Fishery Data Series No. 05-68

Escapement, Terminal Harvest, and Juvenile Tagging of Chilkat River Chinook Salmon in 2004

by

Randolph P. Ericksen

December 2005

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

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Department of Fish and Game	ADF&G
Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$log_{2,}$ etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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ABSTRACT

The spring harvest of Chinook salmon *Oncorhynchus tshawytscha* in the Haines marine sport fishery and escapement into the Chilkat River are estimated annually to monitor this important sport fishery and the salmon stock that supports it. I used an age-stratified mark-recapture experiment to estimate spawning abundance of Chinook salmon returning to the Chilkat River in 2004. Angler effort and spring harvest of wild mature Chinook salmon in the Haines marine sport fishery were estimated using an onsite creel survey. Harvest of large (≥ 28 inches total length) Chinook salmon and chartered angler effort and harvest were also estimated.

We captured 324 Chinook salmon with drift gillnets and fish wheels; 307 of these were marked and released in the lower Chilkat River between June 8 and August 13, 2004. Technicians examined 789 Chinook salmon in spawning tributaries of the Chilkat River, and 44 of these were marked. I estimated that 5,525 (SE = 880) Chinook salmon immigrated into the Chilkat River during 2004. An estimated 742 (SE = 273) were small (age-1.1), 1,361 (SE = 492) were medium (age-1.2), and 3,422 (SE = 456) were large (age-1.3 and older) fish.

An estimated 12,761 angler-h (SE = 763) of effort (12,518 salmon-h, SE = 744) were expended in the spring Haines marine sport fishery for a harvest of 403 (SE = 44) Chinook salmon (≥ 28 inches), of which 269 (SE = 29) were wild, mature fish. Chartered anglers accounted for 5% of the targeted salmon effort and 14% of the harvest of large Chinook salmon.

Wild Chinook salmon fry were trapped in three locations of the Chilkat River drainage during fall 2004. Technicians captured and released a total of 37,245 fry with coded wire tags during the fall of 2004 and 5,825 smolt in the spring of 2005. They averaged 66 mm (SD = 7.2) fork length in the fall and 69 mm (SD = 7.7) in the spring. Future recoveries of these fish will allow Alaska Department of Fish and Game to estimate fall rearing abundance and marine harvest of these brood years.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, age-stratified, mark-recapture, escapement, angler effort, creel survey, harvest, angler-h, salmon-h, Haines marine sport fishery, coded wire tags, length-at-age.

INTRODUCTION

The Chilkat River drainage produces the third or fourth largest run of Chinook salmon *Oncorhynchus tshawytscha* in Southeast Alaska (McPherson et al. 2003). This large glacial system has its headwaters 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) of which 867.6 km^2 are considered accessible to anadromous fish (Ericksen and McPherson 2004). Chilkat River Chinook salmon rear primarily in the inside waters of northern Southeast Alaska, and less so in the Gulf of Alaska, Prince William Sound, and Kachemak Bay (Pahlke 1991; Johnson et al. 1993; Ericksen 1996, 1999).

A boat-based sport fishery occurs each spring in the marine waters of Chilkat Inlet. This fishery targets the run of mature Chinook salmon destined for the Chilkat River. A creel survey has been used to estimate harvest in this fishery since 1984. The harvest in this fishery peaked at over 1,600 Chinook salmon in 1985 and 1986 (Neimark 1985; Mecum and Suchanek 1986, 1987; Bingham et al. 1988; Suchanek and Bingham 1989, 1991; Ericksen 1994–2000; 2001b; 2002–2004). The fishery contributes significantly to the local economy in Haines, supports a salmon derby, and is popular with local and non-local anglers (Bethers 1986; Jones & Stokes 1991).

Beginning in 1981, the Alaska Department of Fish and Game (ADF&G), Division of Sport Fish began using aerial survey counts in Stonehouse and Big Boulder creeks (Figure 1) to monitor escapement trends of Chinook salmon abundance in the Chilkat River (Kissner 1982).

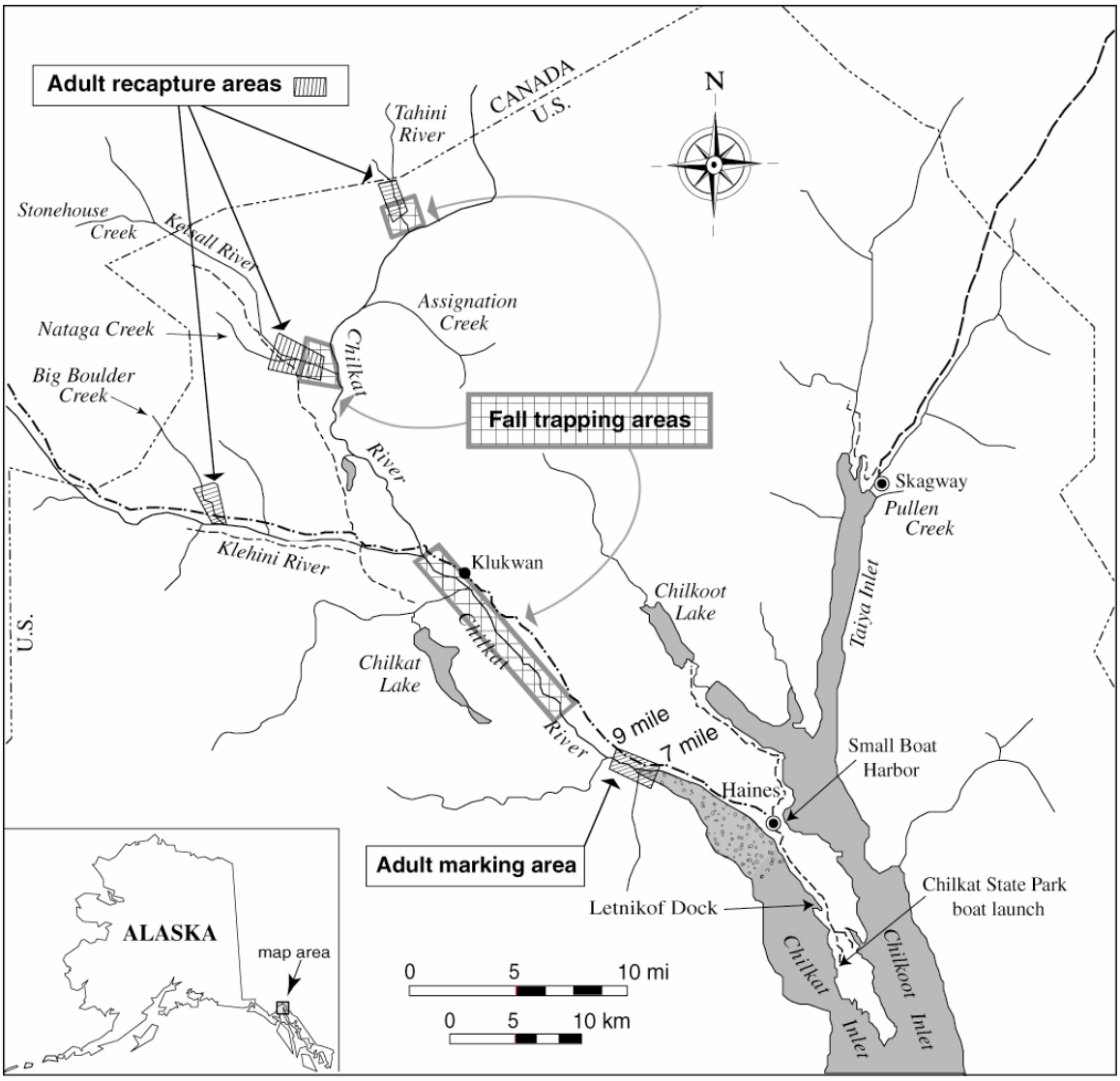


Figure 1.–Location of sampling sites and release sites of coded wire tagged Chinook salmon near Haines and Skagway in Southeast Alaska, 2004.

These areas were selected because they were the only clearwater spawning areas that could provide standardized, consistent survey counts. The indices were used in a regionwide program to monitor Chinook salmon escapements in Southeast Alaska (Pahlke 1992).

Concern about Chilkat River Chinook salmon developed when aerial survey counts declined in 1985 and 1986. This decline coincided with increasing marine harvests of Chinook in the commercial troll, commercial drift gillnet, and sport fisheries in the area. In 1987, ADF&G began to restrict fisheries in upper Lynn Canal, and the spring recreational Chinook fisheries near Haines were closed entirely in 1991 and 1992. The Haines King Salmon Derby was closed between 1988 and 1994.

Because of these concerns, the Division of Sport Fish conducted a coded wire tagging (CWT) program on wild juvenile Chinook salmon in 1989 and 1990 to identify migratory patterns and to estimate contributions to sport and commercial fisheries (Pahlke et al. 1990; Pahlke 1991). The Division of Sport Fish also conducted radio telemetry and mark-recapture experiments in 1991 and 1992 to estimate spawning distribution and

abundance of large (age-1.3 and older) Chinook salmon in the river. Results of this research indicate that most Chinook spawn in two major tributaries of the Chilkat River, the Kelsall and Tahini rivers, and that immature fish are harvested primarily in the inside waters of Southeast Alaska (Johnson et al. 1992, 1993; Ericksen 1996, 1999). Escapements since 1991 have ranged between 2,035 (SE = 334) in 2000 and 8,100 (SE = 1,193) in 1997 (Johnson et al. 1992, 1993; Johnson 1994; Ericksen 1995–2000; 2001b; 2002–2004).

ADF&G adopted a biological escapement goal (BEG) range of 1,750 to 3,500 Chinook salmon 737 mm (29 inches) total length and greater in January 2003 (Ericksen 2004). This BEG formed the basis of the Lynn Canal and Chilkat River king salmon fishery management plan that was adopted by the Alaska Board of Fisheries in February 2003 (5AAC 33.384; Ericksen and McPherson 2004). Regulations in effect during 2004 prevented sport fishing for Chinook salmon near the mouth of the Chilkat River (Figure 1). Regionwide regulations allowed resident anglers to harvest 2 king salmon 28 inches or greater in length per day and in possession. Nonresident anglers were allowed to harvest 1 king salmon 28 inches or greater in length per day and in possession with an annual limit of 3 king salmon. These limits were increased by emergency order on June 3 allowing resident anglers to keep 3, and non-resident anglers to keep 2 king salmon 28 inches or greater in length per day and in possession with a nonresident annual limit of 3 king salmon. In addition, effective June 7, the daily bag and possession limit was 2 king salmon any size with no annual limit for all anglers fishing in Taiya Inlet. This regulation was implemented by emergency order to allow anglers to harvest hatchery fish returning to the Skagway area.

In 1999, we began to CWT Chinook and coho salmon *O. kisutch* smolt each spring to estimate juvenile abundance, non-terminal harvest and total return (Ericksen 2001a). Although technicians were successful in capturing sufficient numbers of coho salmon smolt, the number of Chinook salmon smolt tagged was low. To increase the numbers of CWTd Chinook salmon outmigrating from the Chilkat River, fall juvenile Chinook salmon (fry) were tagged beginning in 2000 (Ericksen 2002).

The purpose of this study was to estimate the sport harvest, escapement, and production of Chinook salmon returning to the Chilkat River during 2004. We tagged juvenile Chinook salmon to estimate production and marine harvest of this stock in the future. This report describes the methods and results of the study during 2004. The long-term goal of this study is to develop maximum harvest guidelines for this stock in accordance with sustained yield management.

Research objectives in 2004 were to estimate:

1. The immigration of Chinook salmon into the Chilkat River in 2004;
2. The age, sex, and length compositions of the escapement of large Chinook salmon in the Chilkat River in 2004;
3. The harvest of wild mature Chinook salmon in the Haines spring marine sport fishery from May 10 to June 27, 2004; and
4. The mean length of juvenile Chinook salmon rearing in the Chilkat River drainage during fall 2004.

METHODS

ESCAPEMENT

An age-stratified mark-recapture experiment was used to estimate the number of Chinook salmon immigrating to the Chilkat River in 2004. Stratifying the estimate by age was done to develop a series of escapement and brood year returns needed to assess escapement goals for this stock. Marks were applied to fish captured in the lower Chilkat River with drift gillnets and fish wheels from June 10 through August 10, between the area adjacent to Haines Highway miles 7 and 9 (Figure 1). Chinook salmon ≥440 mm mid-eye to fork of tail (MEF) were marked with a solid-core spaghetti tag and a hole punch in the upper left operculum prior to release. Chinook salmon less than 440 mm in length were marked in the same manner but given a t-bar anchor tag instead of a spaghetti tag. Water depth (cm), and temperature (°C) were recorded daily at 0700 and

1330 hours near highway mile 8. Fish were examined for marks on three upriver spawning tributaries of the Chilkat River between August 4 and September 2.

Lower River Marking

Nylon gillnets 21.3 m long and 3.0 m deep (70 ft × 10 ft) were drifted in the lower Chilkat River June 13 through July 23, 2004. The gillnets consisted of two equal-length panels: one of 17.1-cm (6.75 inch stretch measured) and the other of 20.3-cm (8.0 inch stretch measured). Technicians attempted to complete 43 drifts between 0600 and 1400 hours each day. Fishing was conducted from an 18-ft boat in six adjoining 0.5-km sections, which were marked along a 3-km section of river (Figure 2). This area was about 100 m wide and 2 to 3 m deep. The 43 drifts took about 6 hours to complete when fish were not captured. Fishing continued uninterrupted from area to area when fish were not captured. If a (0.5-km) drift was prematurely terminated because a fish was caught, or if the net became entangled or drifted into shallow water, the terminated drift was subsequently completed before a new drift was started. If 43 drifts could not be completed during the day, additional drifts were added to the next day's total to make up the balance.

Two 3-basket aluminum fish wheels operated by the ADF&G Commercial Fisheries Division to tag sockeye *O. nerka*, coho, and chum salmon *O. keta* from June 8 to October 19 also captured and marked and Chinook salmon. One fish wheel operated adjacent to the Haines Highway near mile 9 and the other about 300 m downstream (Figure 2). The wheels were located along the east bank of the river where the main flow was

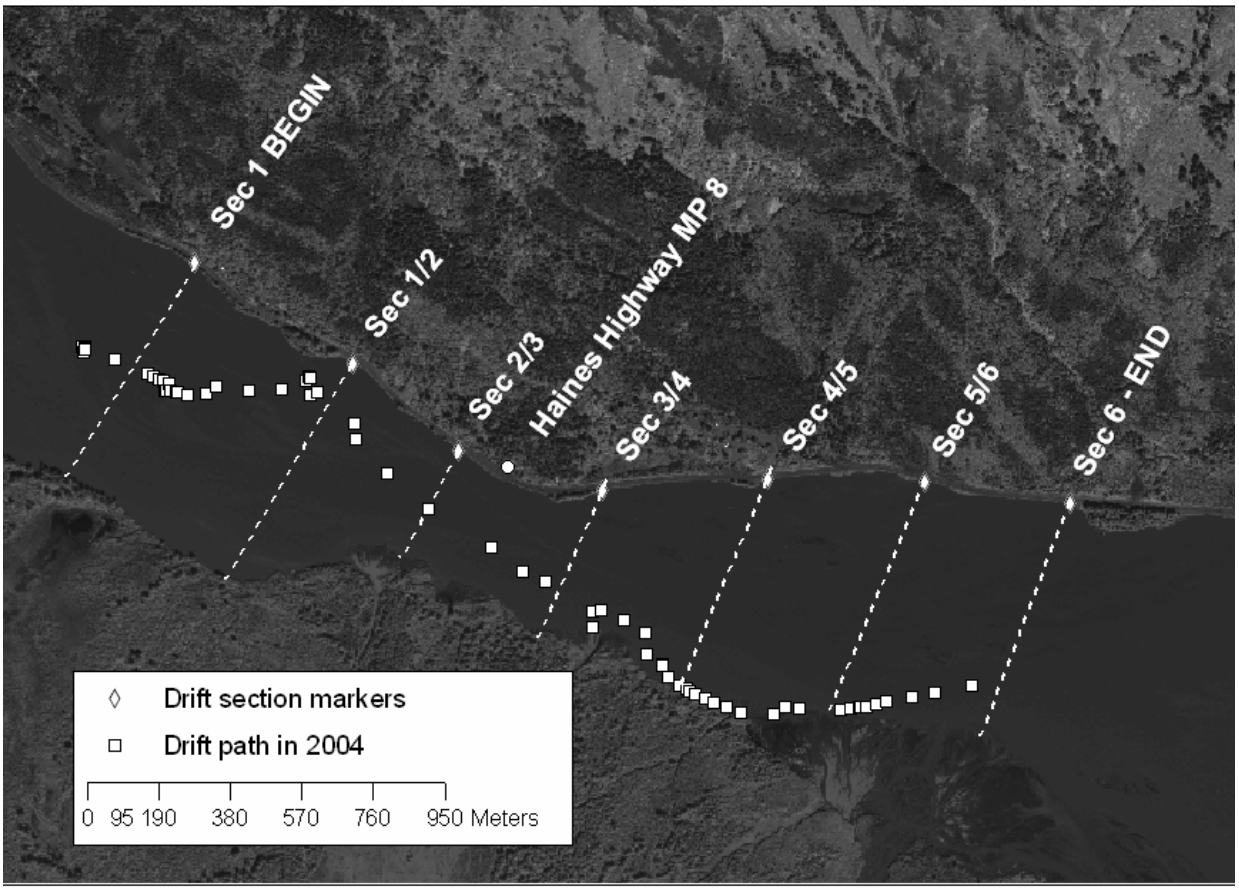


Figure 2.–Section marker locations and drift gill net path in the lower Chilkat River during 2004.

constrained primarily to one side of the floodplain. Fish wheels operated continuously except for maintenance.

Captured Chinook salmon were placed in a water-filled tagging box (see Figure 3 *in* Johnson 1994), inspected for missing adipose fins, and measured to the nearest 5 mm MEF. Fish were initially classified as 'large,' 'medium,' or 'small,' depending on their length: fish ≥660 mm MEF were designated as large, fish ≥440 and <660 mm MEF as medium, and fish <440 mm MEF as small. Heads were removed from all fish with missing adipose fins, marked with an individually numbered strap, and sent to the ADF&G Mark, Tag and Age Laboratory in Juneau for analysis. All vigorous medium and large Chinook salmon possessing an adipose fin were sexed (using external characteristics), had scales removed for aging, and were given a double mark. A uniquely numbered spaghetti tag was threaded over a solid plastic core and sewn through the bones near the base of the dorsal fin as a primary mark, and a ¼-inch hole was punched in the upper edge of the left operculum as a secondary mark. Technicians operating the gillnet also marked fish by clipping (removing) the left axillary appendage. This identified whether the fish was marked in the fish wheel or gillnet in the event of tag loss. Small fish (<440 mm MEF) were sampled and marked as above except they were given a uniquely numbered T-bar anchor tag instead of a spaghetti tag. The age of each fish was determined postseason by counting the scale annuli (Olsen 1992). Each fish was then reclassified as large, medium, or small using ocean age, rather than length, as criteria; fish with three or more ocean years of residence were classified as large, those with two ocean years as medium, and those with one ocean year were classified as small. Any fish whose scales could not be aged was classified by length as described above. The mean date of run timing was calculated using a weighted mean (Mundy 1984).

Spawning Ground Recovery

Escapements in the Kelsall and Tahini rivers (Figure 1) were sampled for marks by two teams of two people. Spawning grounds in the Kelsall River (including Nataga Creek) were sampled from August 5 to September 1. Spawning grounds in the Tahini River were sampled from August 4 to September 1. Chinook salmon were also sampled in Big Boulder Creek from August 4 through August 31, Little Boulder Creek on August 31, and in 37 Mile Creek on August 24. Chinook salmon were captured using gillnets, dip nets, snagging gear, and even bare hands. Duplicate sampling was prevented by punching a hole in the lower edge of the left operculum of all captured fish.

The validity of the mark-recapture experiment rests on several assumptions: (a) that every fish has an equal probability of being marked during event 1, or 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) fish do not lose marks between sample events; (e) all recovered marks are reported; and (f) that duplicate sampling does not occur (Seber 1982).

Stratifying the experiment into small- and medium (age-1.1 and -1.2) and large (age-1.3 and older) fish ensures that abundance and age composition estimates for larger fish are obtained by similar, robust methods each year (estimates for smaller fish have not been possible in some years due to meager sample sizes). In addition, key experimental assumptions (sampling is not selective by size, age, or sex) are strained when smaller fish are pooled with larger fish. Selectivity assumptions for a stratum of smaller fish are, in contrast, robust. These fish are mostly (>95%) male and span a small range of lengths relative to fish age-1.3 and older.

The validity of assumption (a) was tested through a series of hypothesis tests (all at $\alpha = 0.1$). First, a contingency table (chi-square statistic) was used to test the hypothesis that fish sampled at different spawning tributaries were marked at the same rate. Also, a contingency table was used to test the hypothesis that fish marked at different times in the immigration (e.g., early vs. late) were recaptured at the same rate.

The possibility of selective sampling was also investigated because assumption (a) could be

violated if the sampling rate varied by size or sex of the fish. The hypothesis that fish of different sizes were captured with equal probability during the second sampling event was tested with a Kolmogorov-Smirnov (K-S) two-sample test comparing the size distribution of marked fish with those recaptured. If significant differences were observed between size compositions, the abundance estimate could be stratified by size, age, and/or by sex to reduce bias. The remaining assumptions are considered in the Discussion.

Abundance (numbers immigrating) of Chinook salmon by age was estimated using the Chapman's modified Petersen estimator for a closed population (Seber 1982):

$$\hat{N}_a = \frac{(n_{a1}+1)(n_{a2}+1)}{(m_{a2}+1)} - 1 \qquad (1)$$

$$var[\hat{N}_a] = \frac{(n_{a1}+1)(n_{a2}+1)(n_{a1}-m_{a2})(n_{a2}-m_{a2})}{(m_{a2}+1)^2(m_{a2}+2)} \qquad (2)$$

where n_{a1} is the number of Chinook salmon marked by age class in the lower river, n_{a2} is the number examined by age class on the spawning grounds, and m_{a2} is the subset of n_{a2} that had been marked in the lower river.

Age and Sex Composition of the Escapement

Age and sex composition estimates can be biased due to sampling methods. Our fish wheels are usually selective for smaller fish (Ericksen 1995) and for males (Ericksen 1995–2000, 2001b, 2002–2004), and our gillnets are selective for larger fish. Carcass surveys are known to be sex-selective in some situations (Pahlke et al. 1996; McPherson et al. 1997; Zhou 2002; Miyakoshi et al. 2003). In addition, significant variation in age and/or sex compositions between spawning areas can bias composition estimates for the entire drainage when sampling is not proportional to abundance. Potential for bias was reduced in this experiment by stratifying the abundance estimate by age class, and by other actions explained below.

Chinook salmon caught in the lower river and encountered on the spawning grounds were sampled for age, length, and sex. Age compositions were tabulated separately for fish caught in the lower river by gillnet and fish wheels, and in each escapement sampling location (tributary). Standard sample summary statistics (Cochran 1977) were used to calculate age composition, mean length-at-age, and their variances by gear type.

Size selectivity was investigated using two K-S tests: one described above, and the other comparing the lengths of fish marked in the lower river to those sampled on the spawning grounds.

Age and sex selectivity was investigated by contingency table analysis. The number of large Chinook captured by age or sex in the lower river was compared with the number sampled on the spawning grounds. Because sex compositions differed significantly, spawning ground samples alone were used to estimate sex composition, as sex determination is more difficult early in the season while marking fish in the lower river (Ericksen 1995–2000, 2001b, 2002; 2003).

Sex composition of the escapement was obtained for each age class from pooled escapement samples. Proportions by sex for each age class were estimated by:

$$\hat{p}_{a,s} = \frac{n_{a,s}}{n_a} \qquad (3)$$

$$var[\hat{p}_{a,s}] = \frac{\hat{p}_{a,s}\,(1-\hat{p}_{a,s})}{n_a - 1} \qquad (4)$$

where $p_{a,s}$ is the proportion of age class a fish of sex s, $n_{a,s}$ is the number of age class a fish in the sample of sex s, and n_a is the number of age a fish in the sample.

The abundance of age a Chinook salmon by sex in the escapement was estimated as:

$$\hat{N}_{a,s} = \hat{N}_a\,\hat{p}_{a,s} \qquad (5)$$

$$var[\hat{N}_{a,s}] = var[\hat{p}_{a,s}]\hat{N}_a^{\,2} + var[\hat{N}_a]\hat{p}_{a,s}^{\,2} - var[\hat{p}_{a,s}]var[\hat{N}_a] \qquad (6)$$

where $\hat{N}_a$ is the estimated abundance of age a Chinook salmon.

TERMINAL HARVEST

2004 Haines Marine Sport Fishery Harvest

A stratified two-stage direct expansion creel survey was used to estimate the harvest of Chinook salmon in the Haines marine sport fishery. Spatial stratification was by harbor. Temporal stratification included 7-day (weekly) periods at one high-use site and 14-day (biweekly) periods at two low-use sites. A separate temporal stratum existed during the two weekends of the Haines Derby (May 29, 30, 31, June 5 and 6) at both high- and low-use sites. Each fishing day was defined as starting at 0800 hours and ending at civil twilight, which ranged from 2225 to 2351 hours. Midday was defined as the time midway between 0800 hours and civil twilight.

The three access locations were the Letnikof Dock (the high-use site), the Chilkat State Park boat launch, and the Small Boat harbor (Figure 1). Prior surveys indicate that with the exception of 2000, anglers landing their catch at the Letnikof Dock account for 51–93% of the harvest of Chinook salmon. Sampling at each location had days as primary sampling units and boat-parties as secondary units.

Sampling at Letnikof Dock occurred from May 10 to June 27, 2004, and contained morning/evening stratification and weekend/weekday stratification of evening strata during the peak of the season. Morning sampling strata lasted from 0800 hours until 2 hours before midday, and evening sampling strata lasted from 2 hours before midday until civil twilight. This stratification scheme was designed to increase the precision of estimates by maximizing sampling during hours when most anglers exit the fishery. Random selections determined primary units to sample in each stratum. Two morning and three evening strata were sampled each week, except as noted below.

During the peak of the fishery (May 10–June 13) the evening strata at Letnikof Dock were further divided into weekday and weekend stratification. During this time, two morning, two weekday evening, and two weekend/holiday evening periods were sampled each week. In total, 17 unique strata were sampled at Letnikof Dock in 2004.

Sampling at the Small Boat Harbor was initiated on May 10 and continued through June 27. Sampling at the Chilkat State Park boat launch was initiated on May 17, and ended on June 27. There was no type of day stratification at the low-use sites. Each biweekly period was divided into 14 morning and 14 evening periods of equal length at the Small Boat Harbor, except during the Haines King Salmon derby, when the biweek was divided into one 5-day (derby) with no time-of-day stratification and one 9-day (non-derby). Because of the short sampling schedule at Chilkat State Park boat launch, there was one 5-day (derby) stratum with no time-of-day stratification and one 12-day period stratum. Random selections determined primary units to sample in each morning and evening stratum. To accommodate the impossibility of sampling three sites simultaneously with only two technicians, 8 changes (period moves) were made to the randomized sampling schedule at low-use sites. Eighteen (18) unique strata were sampled at the low-use harbors during 2004.

During each sample period, all sport fishing boats returning to the harbor were counted. Boat-parties returning to the dock were interviewed to determine: the number of rods fished; hours fished; type of trip (charter or non-charter); target species (Chinook salmon, Pacific halibut *Hippoglossus stenolepis*); and number of fish caught/kept by species. Interviewing boat-parties also included sampling all harvested Chinook salmon for maturity and missing adipose fins. Maturity was determined (Appendix A in Ericksen 1994) in order to estimate the harvest of wild mature fish assumed to be returning to the Chilkat River. In rare cases, some parties were not interviewed, or the maturity status of harvested fish could not be determined. When one or more boat-parties could not be interviewed, total effort and catch for the stratum was estimated by expanding by the total number of parties returning to the dock during that period. Similarly, when a boat-party had fish of undetermined maturity status, interview information for that boat-party was ignored and expansions (by sample period) were made from harvests by remaining boat-parties and the total number of boat-parties counted.

The harvest in each stratum ($\hat{H}_h$) was estimated (Cochran 1977):

$$\hat{H}_h = D_h \overline{H}_h \tag{7}$$

$$\overline{H}_h = \frac{\sum_{i=1}^{d_h} \hat{H}_{hi}}{d_h} \tag{8}$$

$$\hat{H}_{hi} = M_{hi} \frac{\sum_{j=1}^{m_{hi}} h_{hij}}{m_{hi}} \tag{9}$$

where h_{hij} is the harvest on boat j in sampling days (periods) i stratum h, m_{hi} is the number of boat parties interviewed in day i, M_{hi} is the number of boat-parties counted in day i, d_h is the number of days (morning or evening periods) sampled in stratum h, and D_h is the number of days in stratum h. The variance of the harvest by stratum was estimated:

$$\begin{aligned} var\left[\hat{H}_h\right] &= (1 - f_{1h}) D_h^{\,2} \frac{\sum_{i=1}^{d_h} (\hat{H}_{hi} - \overline{H}_h)^2}{d_h (d_h - 1)} \\ &+ D_h \sum_{i=1}^{d_h} M_{hi}^{\,2} (1 - f_{2hi}) \frac{\sum_{j=1}^{m_{hi}} (h_{hij} - \overline{h}_{hi})^2}{d_h m_{hi} (m_{hi} - 1)} \end{aligned} \tag{10}$$

where f_{1h} is the sampling fraction for periods and f_{2hi} is the sampling fraction for boat-parties. Catch and effort was estimated similarly, substituting C and E for H in equations (7) through (10). Total harvests for the season are the sums across strata ΣH_h and $\Sigma var[H_h]$. Similarly, effort and harvest by charterboat anglers were estimated by considering only data collected from chartered anglers in equations (7) through (10).

Harvested Chinook salmon were measured to the nearest 5 mm FL. Five scales were removed from the left side of each sampled fish (right side if left side scales were missing or regenerated as determined by visual inspection), along a line two scale rows above the lateral line between the posterior insertion of the dorsal fin and anterior insertion of the anal fin. A triacetate impression of the scales (30 s at 3,500 lb/in² at a temperature of 97°C) was later used to determine age (Olsen 1992). Information recorded for each Chinook salmon sampled included sex, length, maturity, and presence or absence of adipose fins.

For each harbor sampling site, age composition (p_a) was estimated for each stratum by substituting p_a, n_a and n, for p_{as} n_{as} and n_a in equations (3) and (4), where p_a is the proportion with estimated age a, n is the number successfully aged, and n_a is the subset of n having estimated age a. Because sampling was not proportional across strata, the estimate for the whole fishery was estimated as:

$$\hat{p}_a = \frac{\sum_h \hat{H}_h \, \hat{p}_{a,h}}{\sum_h \hat{H}_h} \tag{11}$$

where h denotes a (time, harbor, or time-harbor) stratum and the estimated harvests supply appropriate 'weights' for the different stratum sizes. Variance was estimated:

$$\begin{aligned} var\left[\hat{p}_a\right] &\approx \sum_h \frac{\left(\hat{p}_{a,h}\left(\sum_i \hat{H}_i\right) - \left(\sum_i \hat{p}_{a,i} \hat{H}_i\right)\right)^2}{\left(\sum_i \hat{H}_i\right)^4} var\left[\hat{H}_h\right] \\ &+ \sum_h \left(\frac{\hat{H}_h}{\left(\sum_i \hat{H}_i\right)}\right)^2 var\left[\hat{p}_{a,h}\right] \end{aligned} \tag{12}$$

where $p_{a,h}$ is the proportion age a fish sampled in stratum h, and variance is approximated from a second order Taylor's series expansion around the expected values of the parameter estimates and substituting estimated values for the expected values (Mood et al. 1974, p. 181).

Contribution of Coded Wire Tagged Stocks

Technicians retained heads from Chinook salmon in the marine sport fishery with missing adipose fins, and a plastic strap with a unique number was inserted through the jaw of the head. Heads and CWT recovery data were sent to the ADF&G Mark, Tag and Age Laboratory in Juneau where heads were dissected for the presence of coded wire. Coded wire tags were subsequently decoded and all corresponding information was then entered into the ADF&G Mark, Tag, and Age Laboratory database.

The contribution of all tagged stocks to the 2004 Haines marine boat sport fishery was estimated:

$$\hat{r}_{ij} = \hat{H}_i \left(\frac{m_{ij}}{\lambda_i n_i} \right) \hat{\theta}_j^{-1} \qquad (13)$$

where $\hat{H}_i$ is the estimated harvest in stratum *i*, $\hat{\theta}_j$ is the fraction of stock *j* marked with CWTs, n_i is the subset of $\hat{H}_i$ examined for missing adipose fins, m_{ij} is the number of decoded CWTs recovered from stock *j*, and $\lambda_i = (a_i' t_i')/(a_i t_i)$ is the decoding rate for CWTs from recovered salmon. See Bernard and Clark (1996) for further details. Statistics were stratified bi-weekly.

Variance of $\hat{r}_{ij}$ was estimated by means of the appropriate large-sample formulations in Bernard and Clark (1996, their Table 2) for wild or hatchery stocks harvested in the recreational fishery. The total contribution of one or more cohorts to one or more fisheries is the sum of harvests and variances from the individual cohorts and strata.

FALL FRY TAGGING

Juvenile Chinook salmon (brood year 2003) were captured in primary rearing areas of the Chilkat River drainage during the fall of 2004 (fry) and in the mainstem of the Chilkat River during the spring of 2005 (smolt) and marked with an adipose fin clip and a CWT. Adult fish will be sampled from the escapement between 2006 and 2010 to estimate the marked fraction for each brood year. This information will allow ADF&G to estimate the fall rearing abundance in 2004 and smolt emigration in 2005. In addition, random recoveries of CWTs in sampled marine fisheries will allow the department to estimate total marine harvest of this stock.

Chinook salmon fry were captured in G-40 minnow traps at three locations in the Chilkat River drainage during fall 2004. Trapping began in upriver locations and moved downstream as the season progressed. The Tahini River was trapped from mid to late September; the Kelsall River was trapped during the first two weeks of October, and the lower Chilkat River near highway mile 19 (the Council Grounds) during the last week of October.

A crew consisting of four people fished approximately 75 traps per day. Traps were baited with disinfected salmon roe and checked at least once per day. Crew members immediately released non-target species at the trapping site. Remaining fish were transported to holding boxes for processing at a central tagging location.

Following the methods in Koerner (1977), all healthy Chinook ≥50 mm FL were injected with a CWT and externally marked by excision of the adipose fin. Prior to marking, fish were first tranquilized in a solution of Tricaine methanesulfonate (MS 222) buffered with sodium bicarbonate. Every 90th fish tagged with a CWT was additionally measured to the nearest mm FL.

All marked fish were held overnight to check for 24-hour tag retention and handling-induced mortality. The following morning 100 fish in the previous day's catch were randomly selected and checked for the retention of CWTs and mortality. 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 was checked for tag retention and those that tested negative were retagged. 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 ADF&G Mark, Tag, and Age Lab in Juneau at the completion of the field season.

In an effort to gather information on the potential relationship between water temperature and smolt production, a battery operated HOBO® temperature data logger was installed in the Kelsall River in 2002 (Ericksen 2004). The data logger continuously recorded water temperature every two hours throughout the year. The data logger was replaced and the data downloaded each spring. The temperature data from May 1, 2004 to May 11, 2005 are summarized in Appendix A. Information from this long-term study will be used to determine if there is a correlation between smolt production and water temperatures.

RESULTS

ESCAPEMENT

We captured 219 large, 48 medium, and 57 small Chinook salmon in the lower Chilkat River with drift gillnets and fish wheels between June 8 and August 13, 2004 (Table 1, Figure 3). Of those captured, 208 large, 45 medium, and 54 small Chinook salmon were given a uniquely numbered external tag and an upper left operculum punch. Two large Chinook salmon captured in the fish wheels escaped prior to being marked. One large Chinook salmon was lethargic and released without marking. Five large, 2 medium, and 2 small fish were missing adipose fins and were sacrificed to recover coded wire tags. Capture rates of large Chinook salmon peaked on July 4. The mean date of migratory timing in the lower river was July 6 (Figure 4).

Fish captured in gillnets were predominantly age-1.3 (55.0%) and classified as female (63.3%, Table 2). Those captured in the fish wheels were classified mostly as males (69.8%) and most commonly age-1.3 (30.2%) (Table 2). Most (77) of the fish in the drift gillnet were captured in the large mesh (8-in) panel. However, most (8) medium fish in the drift gillnet were caught in the small mesh (6.75-in) panel. Large fish caught in the fish wheels were not significantly different in size than those caught in the drift gillnet (K-S test, $d_{max} = 0.113$, $P = 0.503$).

We examined 665 large, 95 medium, and 29 small Chinook salmon on the spawning grounds for marks: 39 large, 3 medium, and 2 small fish possessed marks from the tagging event (Table 3). Only one (1) large Chinook salmon that was partially eaten by a bear was recovered missing the primary spaghetti tag. This fish was

Table 1.–Numbers of Chinook salmon caught in the lower Chilkat River by time period, gear type and size, June 8–August 16, 2004.

	Drift gillnet			Fish wheels			Combined			
Time period	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small	Total
6/08-6/12	0	0	0	2	1	1	2	1	1	4
6/13-6/17	5	0	0	0	0	1	5	0	1	6
6/18-6/22	9	1	0	3	3	0	12	4	0	16
6/23-6/27	17	2	0	9	4	2	26	6	2	34
6/28-7/02	12	2	0	11	4	6	23	6	6	35
7/03-7/07	36	1	1	32	12	21	68	13	22	103
7/08-7/12	26	3	0	10	7	17	36	10	17	63
7/13-7/17	12	1	0	9	4	6	21	5	6	32
7/18-7/22	8	1	0	7	2	1	15	3	1	19
7/23-7/27	2	0	0	3	0	1	5	0	1	6
7/28-8/01				3	0	0	3	0	0	3
8/02-8/06				1	0	0	1	0	0	1
8/07-8/11				1	0	0	1	0	0	1
8/12-8/16				1	0	0	1	0	0	1
	127	11	1	92	37	56	219	48	57	324

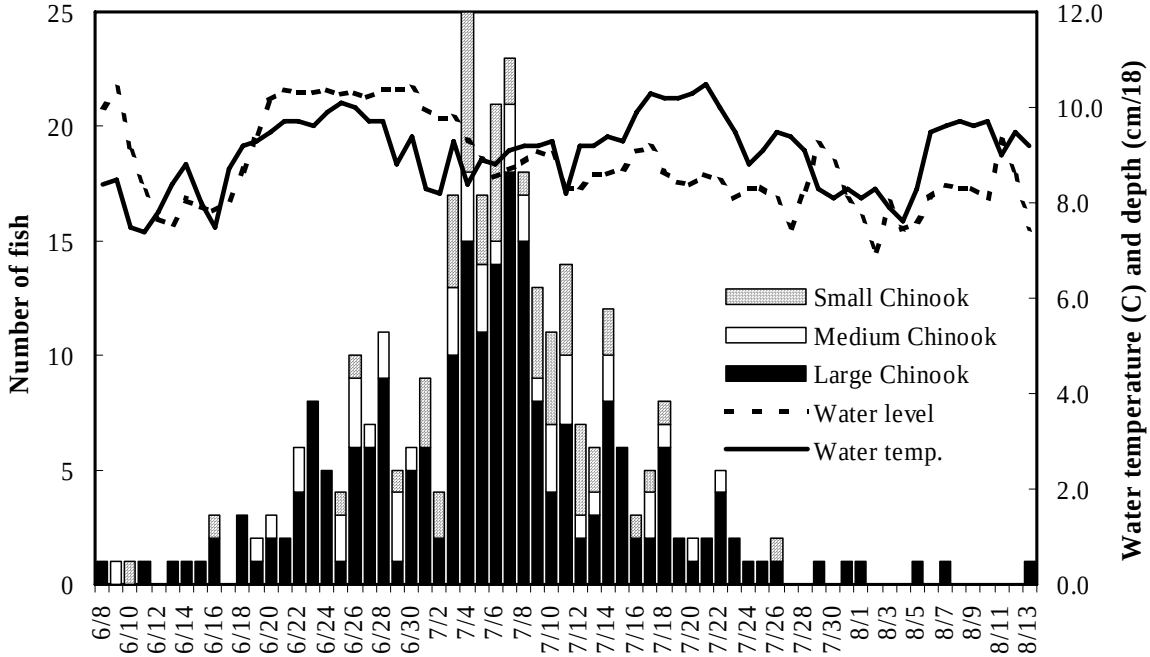


Figure 3.–Daily water depth (cm/18), temperature (°C), and catches of small (age-1.1), medium (age-1.2), and large (≥ age-1.3) Chinook salmon in drift gillnets and fish wheels operating in the lower Chilkat River, June 8–August 13, 2004.

identified as having been marked earlier in the tagging event by the presence of the operculum punch. Large fish sampled from the Kelsall River were not significantly different in size than those sampled from the Tahini River (K-S test, d_{max} = 0.102, P < 0.116). Recapture rates of large fish marked in June were not significantly different from those marked in July (χ^2 = 2.462, df = 1, P = 0.117).

Similar fractions of large (χ^2 = 0.439, df = 2, P = 0.803) and small/medium (χ^2 = 0.372, df = 2, P = 0.830) Chinook salmon sampled at each spawning tributary were marked. Thus, Petersen models were used to estimate abundance for each size group.

The empirical cumulative distribution function (CDF) of lengths of large Chinook salmon marked in the lower Chilkat River was not significantly different from the CDF of marked Chinook salmon recaptured on the spawning grounds (K-S test, dmax = 0.116, P = 0.773; Figure 5, top). The CDF of lengths of large fish sampled in the lower river was also not significantly different from the CDF of those examined for marks on the spawning grounds (K-S test, dmax = 0.055, P = 0.709, Figure 5, bottom). Therefore, I did not detect size selective sampling during either event. However as done in recent years, the estimate of large fish was stratified by two age classes to facilitate an unbiased estimate for each age class. Thus, an estimated 5,525 (SE = 880) Chinook salmon of all ages immigrated into the Chilkat River in 2004 (Table 4). Of those, 2,103 (SE = 753) were age-1.1 and -1.2; 1,999 (SE = 333) were age-1.3; and, 1,423 (SE = 312) were age-1.4 and older. The stratified estimate of 5,525 (SE = 880) was not significantly different from the pooled estimate of 5,424 (SE = 718). These estimates were germane to the time of tagging in the lower river since an unknown number of tags were removed due to predation and unreported subsistence harvests in the time between tagging and recovery events.

Table 2.–Age composition and mean length-at-age (MEF) of Chinook salmon sampled during tagging operations on the Chilkat River by gear type, 2004.

		Brood year and age class					
		2001	2000	1999	1998	**Total**	**Total**
		1.1	1.2	1.3	1.4	**aged**	**sampled**[a]
				DRIFT GILLNET			
Males	Sample size	1	10	29	13	53	63
	Percent	1.9	18.9	54.7	24.5		52.5
	SD	1.9	5.4	6.8	5.9		4.6
	Mean length	390	628	759	918		
	SD		11.4	11.8	14.4		
Females	Sample size	0	0	37	30	67	76
	Percent		0.0	55.2	44.8		63.3
	SD		0.0	6.1	6.1		4.4
	Mean length		0	793	890		
	SD			6.8	8.7		
All fish	Sample size	1	10	66	43	120	139
	Percent	0.8	8.3	55.0	35.8		
	SD	0.8	2.5	4.5	4.4		
	Mean length	390	628	778	898		
	SD		11.4	6.7	7.6		
				FISH WHEELS			
Males	Sample size	45	26	18	8	97	111
	Percent	46.4	26.8	18.6	8.2		69.8
	SD	5.1	4.5	3.9	2.8		3.6
	Mean length	366	560	763	899		
	SD	4.2	17.0	18.1	33.2		
Females	Sample size	0	9	30	23	62	73
	Percent		14.5	48.4	37.1		45.9
	SD		4.5	6.3	6.1		4.0
	Mean length		559	785	860		
	SD		27.6	6.5	9.2		
All fish	Sample size	45	35	48	31	159	184
	Percent	28.3	22.0	30.2	19.5		
	SD	3.6	3.3	3.6	3.1		
	Mean length	366	560	777	870		
	SD	4.2	14.3	7.9	11.0		

[a] Includes fish that were not assigned an age.

Age and Sex Composition of the Escapement

We sampled 785 Chinook salmon on the spawning grounds for age and sex. Of those sampled, 671 were successfully aged (Table 5). The proportion of large fish that were age-1.4 and older sampled from the lower river was not significantly different from those sampled on the spawning grounds (χ^2 = 0.252, df = 1, P = 0.874). Therefore, all samples were pooled to estimate the age composition of the escapement.

Sex was estimated better early in the season as compared to past years. Only 1 of the 43 recaptures was sexed incorrectly during the marking event, as judged by sex determination on the spawning ground (where sexual

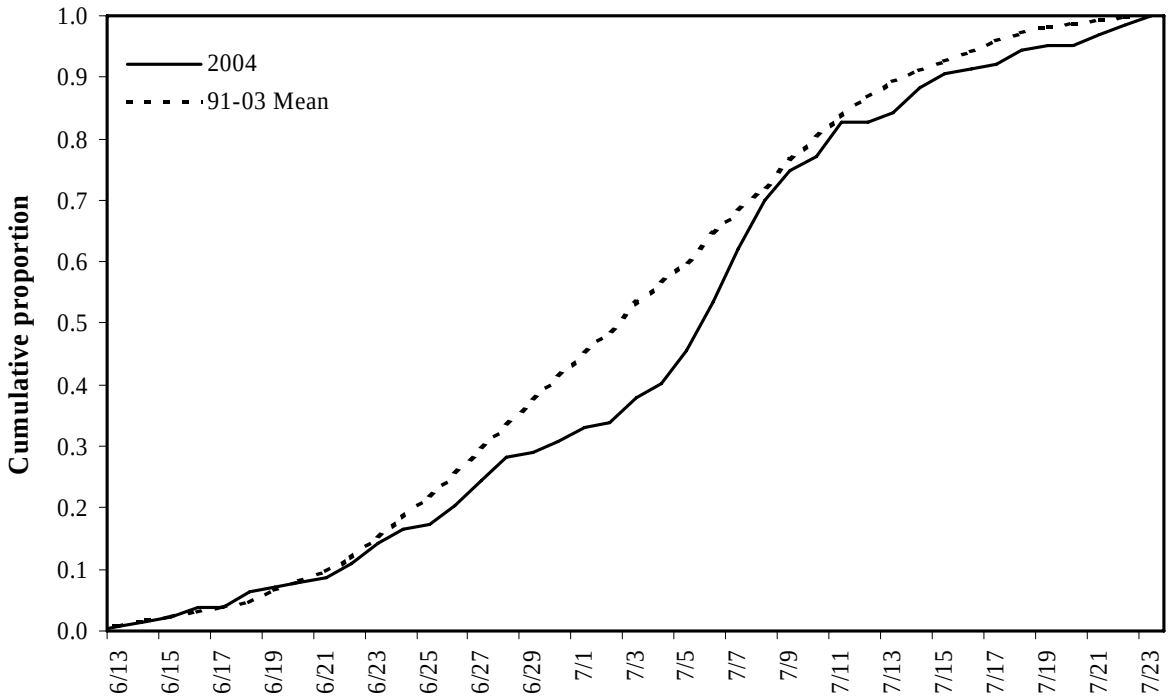


Figure 4.–Cumulative proportion of large **(≥ age-1.3)** Chinook salmon captured with drift gillnets in the lower Chilkat River in 2004 compared to the mean cumulative proportion, 1991–2003.

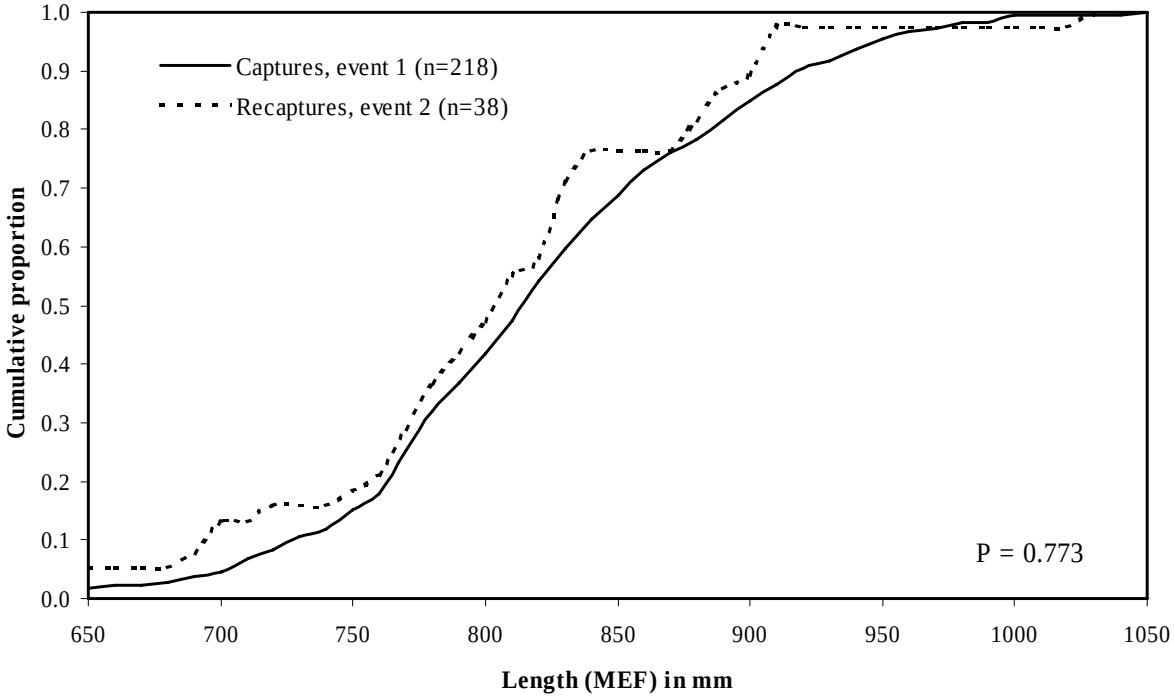
Table 3.–Number of Chinook salmon inspected for marks and number of marked fish recaptured during tag recovery surveys in the Chilkat River drainage by location, size and sex in 2004.

		Inspected[a]								**Marked**[a]						
		Large				**Medium**		**Small**		**Large**			**Medium**		**Small**	
	Dates	M	F	U	Total	M	Total	M	Total	M	F	Total	M	Total	M	Total
Kelsall River	8/05-9/01	137	168	2	307	38	38	18	18	11	9	20	1	1	1	1
Tahini River	8/04-9/01	84	178	0	262	26	26	7	7	4	10	14	1	1	0	0
Big Boulder	8/04-8/31	40	48	1	89	31	31	3	3	2	3	5	1	1	1	1
Little Boulder	8/31	1	3	0	4	0	0	1	1	0	0	0	0	0	0	0
37 Mile Creek	8/24	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0
Total		262	400	3	665	95	95	29	29	17	22	39	3	3	2	2

[a] M = male, F = female, U = not sexed

dimorphism is more evident). This fish was sexed as a female when tagged, and as a male on the spawning grounds during 2004. However, because past studies (e.g. Ericksen 2004) have demonstrated uncertainty in sexing fish early in the season, only the spawning ground samples were used to estimate sex composition (by age) in the escapement.

The major age class (36%) in the estimated escapement of Chinook salmon in 2004 was age-1.3 fish (1999 brood year; Table 6). The remainder of the escapement was composed of 13% age-1.1, 25% age-1.2, 25% age-1.4, and 1% age-1.5 fish. Most (63%) of the fish were males (Table 6).



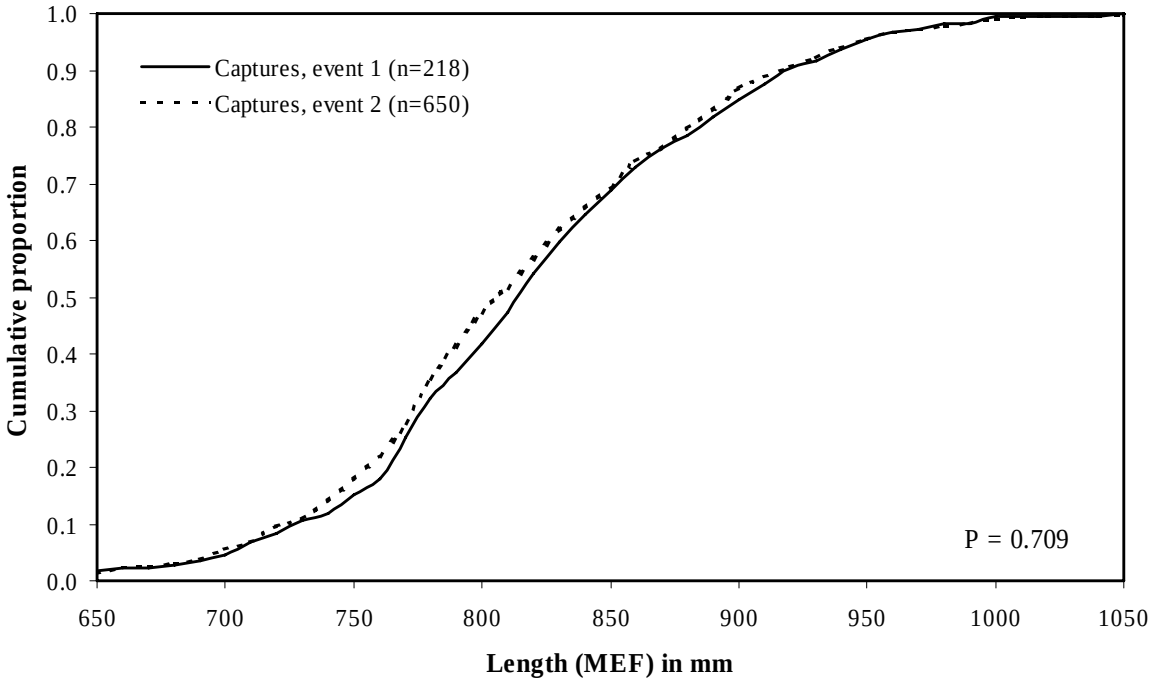


Figure 5.–Empirical cumulative distribution function (CDF) of MEF lengths of large (≥age-1.3) Chinook salmon marked in the lower Chilkat River versus lengths of marked fish recaptured on the spawning grounds (top) and versus lengths of large fish examined for marks on the spawning grounds (bottom), 2004**.**

Table 4.–Abundance estimates and sampling statistics of Chilkat River Chinook salmon by age stratum in 2004.

	Marked	Examined	Recaptures	Abundance	
Stratum	n_1	n_2	m_2	$\hat{N}_a$	$SE\left(\hat{N}_a\right)$
age-1.1+1.2	100	124	5	2,103	753
age-1.3	129	399	25	1,999	333
age-1.4+1.5	79	266	14	1,423	312
Total	308	789	44	5,525	880

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An estimated total 12,761 (SE = 763) angler-h of effort were expended in the Haines marine sport fishery between May 10 and June 27, 2004 to catch 413 (SE = 46) and harvest 403 (SE = 44) large Chinook salmon (Table 7). This estimate is based on a sample of 472 boat-parties who fished 4,229 angler-h (4,168 salmon-h), and harvested 194 large (≥28 inches TL) Chinook salmon (Table 7). An estimated 269 (SE = 29) of the Chinook salmon harvested in this fishery were wild mature fish assumed to be returning to the Chilkat River. About 98% (12,518 salmon-h, SE = 744) of angler effort targeted Chinook salmon, and the remainder was directed toward other species, primarily Pacific halibut. Anglers caught an estimated 275 (SE = 52) small (<28 inches TL) Chinook salmon, of which 17 (SE = 10) were kept. Eighty-three percent (83%) of the estimated salmon effort and 91% of the estimated harvest of Chinook salmon occurred between May 24 and June 20 (Table 7).

Angling pressure for Chinook salmon was relatively light during the first and last week, so our coverage of the fishery for mature Chinook salmon was essentially complete.

Estimates by site are presented in Appendices B1 through B3. Charterboat anglers accounted for about 5% of the salmon effort (687 salmon-h, SE = 198), and 14% of the harvest (55, SE = 21) of large Chinook salmon in this fishery.

Anglers returning to Letnikof Dock (the high-use site) were responsible for 85% of the estimated salmon effort (10,598 salmon-h, SE = 647) and 70% of the estimated harvest (283, SE = 29) of large Chinook salmon (Appendix B1). Anglers returning to the Chilkat State Park boat launch accounted for an estimated 210 (SE = 64) salmon-h of effort and harvested 14 (SE = 14) large Chinook salmon (Appendix B2). Those returning to the Small Boat Harbor expended 1,710 (SE = 362) salmon-h and harvested 101 (SE = 31) large Chinook salmon (Appendix B3).

Age and Length of Harvest

We sampled a total of 193 Chinook salmon for age, sex, and length from the angler harvest; 157 were assigned an age. The age composition of fish landed at the Small Boat Harbor was significantly different from that of fish landed at the Chilkat Inlet harbors (χ^2 = 7.686, df = 2, P = 0.021). Thus, these samples were analyzed separately.

We sampled 159 Chinook salmon for age and length at the Chilkat Inlet harbors (Letnikof Dock and Chilkat State Park boat launch), and 129 of these were assigned an age (Table 8). Most (64.4%, SE = 3.9%) of the fish harvested were male. The predominant age class was age-1.3 (47.4%, SE = 4.8%).

We sampled 34 Chinook salmon for age and length at the Small Boat Harbor and 26 of these were assigned an age. Most (59.4%, SE = 8.8%) of the fish harvested were female. The predominant age class was age-1.3 (58.5%, SE = 14.7%).

Forty-eight (48) Chinook salmon from the Chilkat Inlet subsistence fishery were also sampled for age and length between June 19 and July 4, 2004. Subsistence fishers reported harvesting 146 Chinook salmon in this fishery in 2004. These fish were predominately age-1.3 (47.4%, SE = 8.2%, Appendix B4).

Table 5.–Age composition and mean length-at-age (MEF) of Chinook salmon sampled during recovery surveys on the Chilkat River drainage by spawning tributary in 2004**.**

		Brood year and age class							
		2001	2000	1999	1998	1998	1997	**Total**	**Total**
		1.1	1.2	1.3	1.4	2.3	1.5	**aged**	**sampled**[a]
				TAHINI RIVER					
Males	Sample size	7	24	49	25	0	2	107	117
	Percent	6.5	22.4	45.8	23.4		1.9		45.7
	SD	2.4	4.0	4.8	4.1		1.3		3.1
	Mean length	372	586	774	922		983		
	SD	11.7	10.7	10.9	16.7		67.5		
Females	Sample size	0	0	72	71	1	5	149	178
	Percent			48.3	47.7	0.7	3.4		69.5
	SD			4.1	4.1	0.7	1.5		2.9
	Mean length			788	869	820	955		
	SD			4.7	5.6		31.6		
All fish	Sample size	7	24	121	96	1	7	256	295
	Percent	2.7	9.4	47.3	37.5	0.4	2.7		
	SD	1.0	1.8	3.1	3.0	0.4	1.0		
	Mean length	372	586	782	883	820	963		
	SD	11.7	10.7	5.2	6.4		26.8		
				KLEHINI TRIBUTARIES					
Males	Sample size	4	30	29	4	0	1	64	75
	Percent	6.3	46.9	45.3	6.3		1.6		68.2
	SD	3.0	6.2	6.2	3.0		1.6		4.1
	Mean length	380	566	744	798		685		
	SD	11.4	10.8	11.0	36.0				
Females	Sample size	0	0	29	15	0	1	45	54
	Percent			64.4	33.3		2.2		49.1
	SD			7.1	7.0		2.2		4.4
	Mean length			787	836		780		
	SD			7.6	16.9				
All fish	Sample size	4	30	59	19	0	2	110	129
	Percent	3.6	27.3	53.6	17.3		1.8		
	SD	1.8	4.2	4.8	3.6		1.3		
	Mean length	380	566	766	828		733		
	SD	11.4	10.8	7.1	15.3		47.5		
				KELSALL RIVER/NATAGA CREEK					
Males	Sample size	16	35	84	32	0	0	167	193
	Percent	9.6	21.0	50.3	19.2				53.5
	SD	2.3	3.1	3.9	3.0				2.6
	Mean length	385	612	781	915				
	SD	10.8	11.9	7.1	12.9				
Females	Sample size	0	0	78	60	0	0	138	168
	Percent			56.5	43.5				46.5
	SD			4.2	4.2				2.6
	Mean length			786	854				
	SD			5.2	6.9				
All fish	Sample size	16	35	162	92	0	0	305	361
	Percent	5.2	11.5	53.1	30.2				
	SD	1.3	1.8	2.9	2.6				
	Mean length	385	612	783	875				
	SD	10.8	11.9	4.5	7.0				

[a] Includes fish that were not assigned a valid age. Not all fish examined for marks were sampled for scales (e.g., carcass decayed, part of body missing, etc.).

Table 6.–Estimated abundance of Chinook salmon in the Chilkat River escapement by age and sex in 2004.

	Brood year and age class					
	2001	2000	1999	1998	1997	
	1.1	1.2	1.3	1.4	1.5	**Total**
Male	742	1,361	950	406	15	3,474
SE	273	492	167	99	6	595
Female			1,049	973	29	2,051
SE			183	218	11	284
All fish	742	1,361	1,999	1,379	44	5,525
SE	273	492	333	303	17	880

Table 7.–Biweekly sampling statistics and estimated effort, catch, and harvest of Chinook salmon in the Haines marine sport fishery, May 10–June 27, 2004.

	May 10–May 23	May 24–June 06		June 07–June 20	June 21–June 27	Total
		Non-derby	Derby			
Boats counted	168	83	113	92	16	472
Angler-hs. sampled	1,134	674	1,734	582	105	4,229
Salmon-hs. sampled	1,124	674	1,722	575	73	4,168
Chinook sampled	19	40	111	22	2	194
Sampled for ad-clips	19	40	111	22	2	194
Ad-clips	1	0	15	4	0	20
Angler-hours						
Estimate	1,843	2,220	6,641	1,660	397	12,761
Variance	44,645	401,989	43,964	69,909	21,333	581,840
Salmon-hours						
Estimate	1,815	2,220	6,581	1,617	285	12,518
Variance	38,437	401,989	48,284	57,687	7,327	553,724
Large Chinook catch						
Estimate	34	140	162	72	5	413
Variance	19	1,393	214	457	12	2,095
Large Chinook kept						
Estimate	34	134	161	72	2	403
Variance	19	1,237	218	457	3	1,934
Wild mature Chinook kept (excluding hatchery and immature fish)						
Estimate	23	99	112	33	2	269
Variance	42	498	43	241	3	827
Small Chinook catch						
Estimate	10	90	112	49	14	275
Variance	4	1,533	28	1,101	0	2,666
Small Chinook kept						
Estimate	0	3	0	7	7	17
Variance	0	6	0	42	42	90

Table 8.–Estimated age composition and mean length-at-age (snout to fork of tail in mm) of harvested Chinook salmon in the Haines marine sport fishery by harbor location, May 10–June 27, 2004**.**

		Brood year and age class						
		2001 1.1	2000 1.2	1999 1.3	1998 1.4	1997 1.5	**Total aged**	**Total sampled**[a]
				CHILKAT INLET HARBORS				
Males	Sample size	0	9	43	26	2	71	96
	Mean length		716	826	1,004	1,185		64.4%
	SE		16	13	16	78		3.9%
Females	Sample size	0	0	17	23	2	42	53
	Mean length			821	955	1,088		35.6%
	SE			18	10	88		3.9%
Combined	Sample size	0	10	62	53	4	129	159
	Percent		7.4	47.4	42.3	2.9		
	SE		2.4	4.8	4.7	1.6		
	Mean length		715	827	981	1,136		
	SE		14	10	10	51		
				SMALL BOAT HARBOR				
Males	Sample size	1	3	8	0	0	12	13
	Mean length	400	743	837				40.6%
	SE		13	26				8.8%
Females	Sample size	0	1	8	5	0	14	19
	Mean length		630	789	960			59.4%
	SE			29	11			8.8%
Combined	Sample size	1	4	18	5	0	26	34
	Percent	12.2	15.9	58.5	13.5			
	SE	12.8	7.5	14.7	6.4			
	Mean length	400	715	811	960			
	SE		34	18	11			

[a] Includes fish that were not assigned a valid age. Not all fish were sampled for sex data.

Contribution of Coded Wire Tagged Stocks

Chinook salmon incubated and reared at the Douglas Island Pink and Chum, Inc. (DIPAC) Macaulay hatchery facility; the Southern Southeast Regional Aquaculture Association Crystal Lake hatchery; and the Northern Southeast Regional Aquaculture Association Hidden Falls hatchery were recovered in the 2004 Haines marine creel survey (Table 9). In addition, wild Chilkat River Chinook salmon (1998 and 1999 broods) with CWTs were recovered in this fishery. Fish landed at the Small Boat Harbor were more likely to be from hatchery releases in Taiya Inlet, so these samples were analyzed separately. Fifteen (15) of the 159 large and none of the small (illegal) Chinook salmon sampled at the Chilkat Inlet harbors (Letnikof Dock and Chilkat State Park boat launch) were missing their adipose fins. Forty (40; SE = 27) of the estimated 302 large Chinook salmon landed at the Chilkat Inlet harbors were of hatchery origin (Table 9). Four (4) of the 32 large and the 1 of the 2 small (harvested in the Taiya Inlet terminal hatchery area) Chinook salmon sampled at the Small Boat Harbor were missing their adipose fins. Fifty-two (52; SE = 36) of estimated 101 large Chinook salmon harvested and 13 (SE = 13) of the 14 small landed at the Small Boat Harbor were of hatchery origin.

Table 9.–Contribution estimate (*r*) of coded-wire-tagged Chinook salmon to the Haines marine sport fishery, May 10–June 27, 2004, along with statistics used for computing estimates. Contribution estimates for wild Chilkat River fish are preliminary as marked fractions will not be estimated until returns from all brood years are complete.

			Brood	Harvest		Sample	Ad-clip	Head	Detect	Decode	Tags	Contribution	
Agency[a]	**Release site**	**Tag code**	**year**	N	SE[N]	***n***	***a***	***a'***	***t***	***t'***	***m***	***r***	SE
CHILKAT INLET RECOVERIES													
					Large Fish								
ADFG	Chilkat River wild	04-03-62	1998	302	32	159	15	6	13	13	1	2	1
ADFG	Chilkat River wild	04-01-66,67; 04-03-64,66	1999	302	32	159	15	6	13	13	8	16	4
SSRAA	Crystal Lake	04-01-87	1999	302	32	159	15	6	13	13	1	12	12
DIPAC	Pullen Creek	04-03-93	1999	302	32	159	15	6	13	13	2	4	2
NSRAA	Hidden Falls	04-48-19	1999	302	32	159	15	6	13	13	1	24	24
Subtotal												**58**	**28**
SMALL BOAT HARBOR RECOVERIES													
					Large Fish								
ADFG	Chilkat River wild	04-01-66, 67	1999	101	31	32	4	4	4	4	2	6	4
DIPAC	Gastineau Channel	04-01-59	1998	101	31	32	4	4	4	4	1	22	21
DIPAC	Auke Bay	04-01-57	1999	101	31	32	4	4	4	4	1	30	29
Subtotal												**58**	**39**
					Small Fish								
DIPAC	Pullen Creek	04-03-94	2001	14	9	2	1	1	1	1	1	13	13
Subtotal												**13**	**13**
Grand total large												**117**	**48**
Grand total small												**13**	**13**

[a] ADFG = Alaska Department of Fish and Game
DIPAC = Douglas Island Pink and Chum, Inc.
NSRAA = Northern Southeast Regional Aquaculture Association
SSRAA = Southern Southeast Regional Aquaculture Association

FALL FRY TAGGING

We captured 37,279 Chinook salmon fry during fall 2004 (Table 10). Catch rates were lowest in the Tahini River and highest in the Kelsall River. Of those captured, 37,245 in 2004 were released with a valid CWT and adipose fin clip (Table 11). In addition, technicians released 5,825 smolt during spring 2005 with valid CWTs and an adipose fin clip (Table 11).

We sampled 406 Chinook salmon fry for length during fall 2004 (Table 12). The mean length of fry was 66 mm (SD = 7.2 mm). In addition, 293 smolt were sampled for length during the spring of 2005 (Table 12). Smolt averaged 69 mm (SD = 7.7 mm) fork length and 3.3 g (SD = 1.3g) weight.

DATA FILES

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

DISCUSSION

Several assumptions underlie the estimate of abundance. Considerable efforts were made to catch and mark fish in proportion to their abundance (assumption a) by sampling uniformly across the escapement. Also, sampling effort for

Table 10.–Results of juvenile Chinook salmon trapping in the Chilkat River drainage in fall 2004 and spring 2005.

Year	Trapping area	Dates	Days fished	Trap sets	No. caught	CPUE[a]
2004	Tahini River	09/18-09/22	5	337	5,680	16.9
2004	Kelsall River	10/01-10/14	13	937	19,417	20.7
2004	Chilkat River	10/22-10/30	9	593	12,182	20.5
	Fall 2004 subtotal		**27**	**1,867**	**37,279**	**20.0**
2005	Chilkat River	04/08-05/27	50	4,954	5,838	1.2

[a] Catch per unit of effort expressed as the number of fry caught per trap set.

Table 11.–Number of 2003 brood year Chinook salmon coded wire tagged in the Chilkat River drainage by area and tag year.

Tag year	Tag code	Sequence	Location	Last date	Stage	Tagged	24h Morts	Marked	Shed tags	Valid CWTs
2004	041028	256-9,781	Tahini River	09/23/04	Fingerling	5,680	9	5,671	0	5,671
2004	041028	9,981-44,886	Kelsall River	10/15/04	Fingerling	19,417	22	19,395	0	19,395
2004	041028	44,999-57,059	Chilkat River	10/29/04	Fingerling	7,149	0	7,149	0	7,149
2004	040962	NA	Chilkat River	10/31/04	Fingerling	5,033	3	5,030	0	5,030
		Fall subtotal				37,279	34	37,245	0	37,245
2005	041136	NA	Chilkat River	05/29/05	Smolt	5,838	13	5,825	0	5,825
2003 brood year total						43,117	47	43,070	0	43,070

Table 12.–Mean length and smolt weight of 2003 brood year Chinook salmon in the Chilkat River drainage by trapping location and year.

			Length (snout to fork of tail in mm)			
Sample year	**Trapping location**	**Sample dates**	**n**	**Range**	**Mean**	**SD**
2004	Tahini River	09/18–09/22	59	58-83	70	5.6
2004	Kelsall River	10/01–10/14	205	51-96	67	6.7
2004	Chilkat River	10/22–10/30	142	51-84	63	5.6
Fall subtotal			406	51-96	66	7.2
2005	Chilkat River	04/08–05/27	293	53-94	69	7.7
			weight (g)	1.4-9.0	3.3	1.3

tag recovery on the Kelsall and Tahini rivers (where >90% of spawning occurred in 1991 and 1992; Johnson et al. 1992, 1993) was fairly constant across the time when spawning fish die and are available for sampling. Previous research on the Chilkat River (Johnson et al. 1992, 1993) suggested that immigration timing is similar for Tahini and Kelsall River stocks. Tagging ratios of large Chinook salmon found on the Tahini (0.053) and Kelsall-Nataga (0.065) Rivers in 2004 were very similar. Although carcass surveys can be sex-selective in some situations (Miyakoshi et al. 2003; Pahlke et al. 1996; McPherson et al. 1997; Zhou 2002), this could not be detected using a battery of tests. The assumption of no recruitment during the experiment is reasonable, because tagging effort was relatively constant and continued until only about one fish per day was being caught. The assumption that marking does not affect catchability of fish could not be tested directly. However, recovery rates were not significantly different between large fish marked in the gillnet and those marked in the fish wheels, (χ^2 = 1.198, df = 1, P = 0.274). This suggests fish

Table 13.–Estimated annual age compositions and brood year returns of large (≥ age-1.3) Chinook salmon immigrating into the Chilkat River, 1991–2004.

Return year		Age class 1.3	1.4	1.5	Total
1991[a]	Abundance	3,211	2,563	123	5,897
	SE	558	445	18	1,005
1992[b]	Abundance	1,689	3,595	0	5,284
	SE	309	662		949
1993[c]	Abundance	2,217	2,180	75	4,472
	SE	432	425	10	851
1994[d]	Abundance	2,565	4,148	82	6,795
	SE	415	656	11	1,057
1995[e]	Abundance	530	3,074	186	3,790
	SE	111	660	37	805
1996[f]	Abundance	4,140	737	43	4,920
	SE	641	112	4	751
1997[g]	Abundance	1,943	6,157	0	8,100
	SE	354	930		1,193
1998[h]	Abundance	1,016	2,440	219	3,675
	SE	169	381	48	565
1999[i]	Abundance	534	1,656	80	2,271
	SE	109	302	27	408
2000[j]	Abundance	1,350	653	32	2,035
	SE	227	118	14	334
2001[k]	Abundance	2,529	1,988	0	4,517
	SE	376	617		722
2002[l]	Abundance	2,353	1,667	31	4,051
	SE	312	294	19	429
2003[m]	Abundance	1,833	3,783	41	5,657
	SE	362	582	29	690
2004	Abundance	1,999	1,379	44	3,422
	SE	333	303	17	456
Average Percent		43.0	55.5	1.5	
Average Abundance		1,994	2,573	68	4,635

BROOD YEAR RETURNS

Brood year	Age class 1.3	1.4	1.5	Total	SE
1986	3,211	3,595	75	6,881	866
1987	1,689	2,180	82	3,951	526
1988	2,217	4,148	186	6,551	787
1989	2,565	3,074	43	5,683	780
1990	530	737	0	1,267	158
1991	4,140	6,157	219	10,516	1,131
1992	1,943	2,440	80	4,463	521
1993	1,016	1,656	32	2,705	347
1994	534	653	0	1,188	160
1995	1,350	1,988	31	3,369	658
1996	2,529	1,667	41	4,236	478
1997	2,353	3,783	44	6,180	661
1998	1,833	1,379		3,212	472
1999	1,999			1,999	333
Avg.	1,994	2,574	69	4,637	

[a] Data taken from Johnson et al. (1992).
[b] Data taken from Johnson et al. (1993).
[c] Data taken from Johnson (1994).
[d] Data taken from Ericksen (1995).
[e] Data taken from Ericksen (1996).
[f] Data taken from Ericksen (1997).
[g] Data taken from Ericksen (1998).
[h] Data taken from Ericksen (1999).
[i] Data taken from Ericksen (2000).
[j] Data taken from Ericksen (2001b).
[k] Data taken from Ericksen (2002).
[l] Data taken from Ericksen (2003).
[m] Data taken from Ericksen (2004).

marked at the fish wheels and gillnets had similar fates. Because all fish had secondary marks that were not lost, assumption (d) was satisfied. Personnel sampling the spawning tributaries carefully examined each fish for marks; therefore failure of assumption (e) is unlikely. The hypothesis that fish sampled on the different spawning grounds were marked at the same rate was not rejected. This is consistent with the results of a meta-analysis of past data (Ericksen 2001b).

The 2004 immigration of 3,422 large Chinook salmon (SE = 456) was below the 1991–2003 average (Table 13) and was composed mainly of age-1.3 fish from the 1999 brood year (Table 13).

The immigration timing of Chinook salmon through the lower Chilkat River was about four

Table 14.–Estimated angler effort, and large (≥ 28 in.) Chinook salmon catch and harvest in the Haines marine sport fishery for similar sample periods, 1984–2004.

		Effort				Large (≥28") fish				
Year	**Survey dates**	Angler-hs	SE	Salmon-hs	SE	Catch	SE	Harvest	SE	**CPUE**[a]
1984[b]	5/06-6/30	10,253	[c]	9,855	[c]	1,072	[c]	1,072	[c]	0.109
1985[d]	4/15-7/15	21,598	[c]	20,582	[c]	1,705	[c]	1,696	[c]	0.083
1986[e]	4/14-7/13	33,857	[c]	32,533	[c]	1,659	[c]	1,638	[c]	0.051
1987[f]	4/20-7/12	26,621	2,557	22,848	2,191	1,094	189	1,094	189	0.048
1988[g]	4/11-7/10	36,222	3,553	32,723	3,476	505	103	481	101	0.015
1989[h]	4/24-6/25	10,526	999	9,363	922	237	42	235	42	0.025
1990[i]	4/23-6/21	[i]	[i]	11,972	1,169	248	60	241	57	0.021
1993[j]	4/26-7/18	11,919	1,559	9,069	1,479	349	63	314	55	0.038
1994[k]	5/09-7/03	9,726	723	7,682	597	269	41	220	32	0.035
1995[l]	5/08-7/02	9,457	501	8,606	483	255	42	228	41	0.030
1996[m]	5/06-6/30	10,082	880	9,596	866	367	43	354	41	0.038
1997[n]	5/12-6/29	9,432	861	8,758	697	381	46	381	46	0.044
1998[o]	5/11-6/28	8,200	811	7,546	747	222	60	215	56	0.029
1999[p]	5/10-6/27	6,206	736	6,097	734	184	24	184	24	0.030
2000[q]	5/08-6/25	4,428	607	4,043	532	103	34	49	12	0.025
2001[r]	5/07-6/24	5,299	815	5,107	804	199	26	185	26	0.039
2002[s]	5/06-6/30	7,770	636	7,566	634	343	40	337	40	0.045
2003[t]	5/05-6/29	10,651	596	10,055	578	405	40	404	40	0.040
2004	5/10-6/27	12,761	763	12,518	744	413	46	403	44	0.033
1984–86 average		21,903		20,990		1,479		1,469		0.081
1987-90 average		24,456		19,227		521		513		0.027
1995–04 average		8,429		7,989		287		274		0.035
2000–04 average		8,182		7,858		293		276		0.037

[a] Catch of large Chinook salmon per salmon h of effort.
[b] Neimark (1985).
[c] Estimates of variance were not provided until 1987.
[d] Mecum and Suchanek (1986).
[e] Mecum and Suchanek (1987).
[f] Bingham et al. (1988).
[g] Suchanek and Bingham (1989).
[h] Suchanek and Bingham (1990).
[i] Suchanek and Bingham (1991); no estimate of total angler effort and harvest was provided
[j] Ericksen (1994).
[k] Ericksen (1995).
[l] Ericksen (1996).
[m] Ericksen (1997).
[n] Ericksen (1998).
[o] Ericksen (1999).
[p] Ericksen (2000).
[q] Ericksen (2001b).
[r] Ericksen (2002).
[s] Ericksen (2003).
[t] Ericksen (2004).

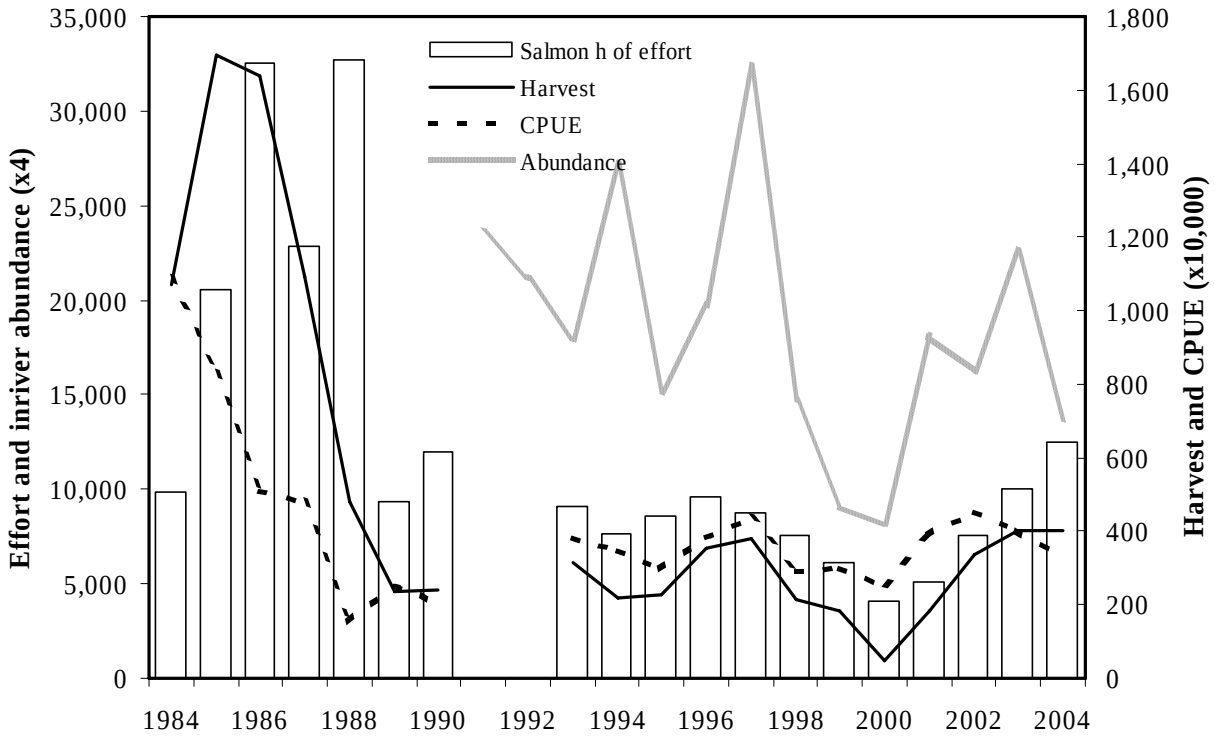

Figure 6.–Estimated angler effort for, and harvest and catch of large Chinook salmon per salmon h of effort (CPUE) in the Haines spring marine sport fishery, 1984–2004, and estimated inriver abundance of large Chinook salmon in the Chilkat River, 1991–2004. Data taken from Tables 13 and 14 (fishery closed in 1991 and 1992).

days later than past years. The mean date of migratory timing (Mundy 1984) was July 6, which compares with the mean date of July 2 for 1991–2003 (Figure 4).

Sportfishing harvest patterns observed during 2004 were similar to historical patterns. During 2004, 70% of the estimated harvest of Chinook salmon was landed at the Letnikof Dock. The proportion of harvest from this harbor averaged 85% in 1988 and 1989 (Suchanek and Bingham 1991). In contrast, 59% of the average total harvest over the past five years was landed at this harbor. The 2004 estimated harvest of large Chinook salmon was greater than the average since 1993 but much lower than observed during the mid 1980s (Figure 6, Table 14). Also, sport fishing effort increased from recent years but remained lower than the peak in the mid 1980s.

Trapping Chinook salmon fry in the fall increased the number of CWTd fish released for a given brood year relative to tagging smolt in the spring. The benefits of tagging in the fall are somewhat offset by overwinter mortality of the fry. The cost effectiveness of fall trapping will be better assessed once adequate adult samples are obtained to estimate overwinter survival.

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APPENDIX A

Appendix A1.–Daily minimum, mean, and maximum water temperatures recorded from the Kelsall River, May 1, 2004–May 11, 2005.

	Temperature °C				Temperature °C				Temperature °C		
Date	**Min.**	**Mean**	**Max.**	**Date**	**Min.**	**Mean**	**Max.**	**Date**	**Min.**	**Mean**	**Max.**
5/1/04	1.2	1.8	2.9	6/16/04	Out of water			8/1/04	Out of water		
5/2/04	1.6	2.1	2.9	6/17/04	Out of water			8/2/04	Out of water		
5/3/04	1.4	2.0	3.3	6/18/04	Out of water			8/3/04	Out of water		
5/4/04	1.2	2.2	3.7	6/19/04	Out of water			8/4/04	Out of water		
5/5/04	1.6	2.7	4.6	6/20/04	Out of water			8/5/04	Out of water		
5/6/04	1.6	2.7	4.6	6/21/04	Out of water			8/6/04	Out of water		
5/7/04	1.6	2.8	4.6	6/22/04	Out of water			8/7/04	Out of water		
5/8/04	1.6	2.8	5.0	6/23/04	Out of water			8/8/04	Out of water		
5/9/04	1.6	2.4	3.3	6/24/04	Out of water			8/9/04	12.9	13.1	13.3
5/10/04	1.6	2.6	4.6	6/25/04	Out of water			8/10/04	11.0	12.6	14.1
5/11/04	1.6	2.8	4.6	6/26/04	Out of water			8/11/04	11.0	11.8	12.9
5/12/04	1.6	2.9	5.0	6/27/04	Out of water			8/12/04	9.0	10.3	11.4
5/13/04	2.0	3.1	5.0	6/28/04	Out of water			8/13/04	9.8	11.4	12.9
5/14/04	2.0	3.1	5.0	6/29/04	Out of water			8/14/04	10.6	12.1	13.3
5/15/04	2.0	3.3	5.0	6/30/04	Out of water			8/15/04	11.4	12.4	13.3
5/16/04	2.5	3.3	4.6	7/1/04	Out of water			8/16/04	10.6	12.2	14.1
5/17/04	2.5	3.5	5.0	7/2/04	Out of water			8/17/04	11.4	12.9	14.1
5/18/04	2.5	3.7	5.4	7/3/04	Out of water			8/18/04	11.0	12.0	12.9
5/19/04	2.5	3.8	5.4	7/4/04	Out of water			8/19/04	11.4	11.9	12.2
5/20/04	2.5	3.6	5.0	7/5/04	Out of water			8/20/04	10.6	11.7	12.9
5/21/04	2.5	3.7	5.0	7/6/04	Out of water			8/21/04	10.6	11.8	12.9
5/22/04	2.9	4.0	5.4	7/7/04	Out of water			8/22/04	10.2	11.6	12.6
5/23/04	2.9	4.3	5.8	7/8/04	Out of water			8/23/04	9.4	10.9	11.8
5/24/04	3.3	3.7	4.2	7/9/04	Out of water			8/24/04	9.0	10.4	11.8
5/25/04	3.3	3.8	4.6	7/10/04	Out of water			8/25/04	9.8	10.4	11.4
5/26/04	3.3	3.9	5.0	7/11/04	Out of water			8/26/04	10.2	10.2	10.6
5/27/04	3.3	4.3	5.4	7/12/04	Out of water			8/27/04	9.4	10.1	11.0
5/28/04	3.3	4.4	5.4	7/13/04	Out of water			8/28/04	9.8	10.2	10.6
5/29/04	3.3	4.4	5.8	7/14/04	Out of water			8/29/04	9.8	10.4	11.0
5/30/04	2.9	4.1	5.4	7/15/04	Out of water			8/30/04	9.8	10.7	11.4
5/31/04	3.7	5.0	6.2	7/16/04	Out of water			8/31/04	9.0	10.3	11.4
6/1/04	3.3	4.7	5.8	7/17/04	Out of water			9/1/04	8.6	10.0	11.0
6/2/04	3.7	4.7	5.8	7/18/04	Out of water			9/2/04	9.0	9.6	10.6
6/3/04	3.3	5.1	7.4	7/19/04	Out of water			9/3/04	9.0	9.3	9.8
6/4/04	3.7	5.6	7.4	7/20/04	Out of water			9/4/04	8.6	8.9	9.4
6/5/04	4.6	5.0	5.4	7/21/04	Out of water			9/5/04	7.4	7.8	8.6
6/6/04	4.6	5.7	7.4	7/22/04	Out of water			9/6/04	7.4	7.8	8.2
6/7/04	4.6	4.9	5.4	7/23/04	Out of water			9/7/04	6.2	6.7	7.8
6/8/04	Out of water			7/24/04	Out of water			9/8/04	5.4	6.0	6.6
6/9/04	Out of water			7/25/04	Out of water			9/9/04	5.0	5.8	6.6
6/10/04	Out of water			7/26/04	Out of water			9/10/04	5.0	5.7	6.2
6/11/04	Out of water			7/27/04	Out of water			9/11/04	6.2	6.7	7.0
6/12/04	Out of water			7/28/04	Out of water			9/12/04	6.2	6.5	6.6
6/13/04	Out of water			7/29/04	Out of water			9/13/04	6.2	6.8	7.4
6/14/04	Out of water			7/30/04	Out of water			9/14/04	7.4	7.8	8.2
6/15/04	Out of water			7/31/04	Out of water			9/15/04	6.6	7.1	7.4

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	Temperature °C				Temperature °C				Temperature °C		
Date	**Min.**	**Mean**	**Max.**	**Date**	**Min.**	**Mean**	**Max.**	**Date**	**Min.**	**Mean**	**Max.**
9/16/04	6.2	6.8	7.4	11/1/04	0.7	1.0	1.2	12/17/04	0.3	0.4	0.7
9/17/04	6.2	6.6	7.0	11/2/04	0.7	0.8	1.2	12/18/04	0.3	0.6	0.7
9/18/04	5.4	6.1	6.6	11/3/04	0.3	0.5	0.7	12/19/04	0.7	1.0	1.2
9/19/04	3.3	4.4	5.0	11/4/04	0.3	0.6	1.2	12/20/04	-0.2	0.7	1.2
9/20/04	5.0	5.5	6.2	11/5/04	-0.6	0.1	0.3	12/21/04	-0.6	-0.4	-0.2
9/21/04	5.8	6.5	7.0	11/6/04	-0.6	-0.5	-0.2	12/22/04	-0.2	0.0	0.3
9/22/04	6.2	6.5	6.6	11/7/04	-0.6	-0.4	-0.2	12/23/04	0.3	0.8	1.2
9/23/04	6.2	6.4	6.6	11/8/04	-0.6	-0.4	-0.2	12/24/04	-0.6	0.8	1.2
9/24/04	6.2	6.6	7.0	11/9/04	-0.2	-0.2	-0.2	12/25/04	-0.6	-0.6	-0.6
9/25/04	5.4	5.8	6.2	11/10/04	-0.2	-0.2	-0.2	12/26/04	-0.6	-0.6	-0.6
9/26/04	5.4	5.8	5.8	11/11/04	-0.6	-0.3	-0.2	12/27/04	-0.6	-0.6	-0.6
9/27/04	5.0	5.4	5.8	11/12/04	-0.2	0.1	0.3	12/28/04	-0.6	-0.6	-0.6
9/28/04	4.2	5.0	5.4	11/13/04	0.3	0.8	1.2	12/29/04	-0.6	-0.6	-0.6
9/29/04	5.4	5.8	6.2	11/14/04	1.2	1.4	1.6	12/30/04	-0.6	-0.6	-0.6
9/30/04	6.2	6.6	7.4	11/15/04	1.2	1.5	1.6	12/31/04	-0.6	-0.4	-0.2
10/1/04	6.6	6.9	7.0	11/16/04	1.6	1.7	2.0	1/1/05	-0.6	-0.5	-0.2
10/2/04	6.2	6.6	7.0	11/17/04	1.2	1.5	1.6	1/2/05	-0.6	-0.6	-0.6
10/3/04	6.2	6.5	6.6	11/18/04	1.2	1.4	1.6	1/3/05	-0.6	-0.6	-0.6
10/4/04	6.2	6.4	6.6	11/19/04	0.7	1.1	1.6	1/4/05	-0.6	-0.6	-0.6
10/5/04	5.8	6.0	6.2	11/20/04	0.7	1.3	1.6	1/5/05	-0.6	-0.5	-0.2
10/6/04	5.0	5.6	6.2	11/21/04	0.7	1.0	1.2	1/6/05	-0.6	-0.3	-0.2
10/7/04	5.4	5.6	5.8	11/22/04	-0.2	0.1	0.7	1/7/05	-0.6	-0.2	-0.2
10/8/04	5.0	5.4	5.8	11/23/04	-0.2	0.3	0.7	1/8/05	-0.2	-0.2	-0.2
10/9/04	5.0	5.3	5.8	11/24/04	0.3	0.6	0.7	1/9/05	-0.2	-0.2	-0.2
10/10/04	5.4	5.6	5.8	11/25/04	0.3	1.0	1.2	1/10/05	-0.6	-0.4	-0.2
10/11/04	4.2	5.1	5.8	11/26/04	-0.2	0.2	0.7	1/11/05	-0.2	0.7	1.2
10/12/04	3.3	3.7	4.2	11/27/04	-0.2	0.0	0.3	1/12/05	-0.6	0.4	0.7
10/13/04	4.6	4.9	5.4	11/28/04	0.3	0.7	1.2	1/13/05	-0.6	-0.4	-0.2
10/14/04	4.2	4.9	5.4	11/29/04	1.2	1.2	1.6	1/14/05	-0.6	-0.1	0.3
10/15/04	4.2	5.0	5.4	11/30/04	1.2	1.4	1.6	1/15/05	-0.6	-0.3	0.3
10/16/04	2.5	3.0	3.7	12/1/04	1.6	1.6	1.6	1/16/05	-0.6	-0.6	-0.6
10/17/04		Out of water		12/2/04	0.7	1.2	1.6	1/17/05	-0.6	-0.6	-0.6
10/18/04		Out of water		12/3/04	1.2	1.3	1.6	1/18/05	-0.6	-0.6	-0.6
10/19/04		Out of water		12/4/04	-0.6	0.0	1.2	1/19/05	-0.6	-0.6	-0.6
10/20/04	0.3	0.3	0.3	12/5/04	-0.2	-0.2	-0.2	1/20/05	-0.6	-0.5	-0.2
10/21/04	-0.2	0.7	1.2	12/6/04	-0.6	-0.2	-0.2	1/21/05	-0.6	-0.3	-0.2
10/22/04	-0.2	0.7	1.2	12/7/04	-0.6	-0.6	-0.6	1/22/05	-0.2	-0.2	-0.2
10/23/04	-0.6	-0.6	-0.2	12/8/04	-0.6	-0.6	-0.6	1/23/05	-0.2	-0.2	-0.2
10/24/04	-0.6	-0.2	0.3	12/9/04	-0.6	-0.6	-0.6	1/24/05	-0.2	-0.2	-0.2
10/25/04	0.3	0.6	1.2	12/10/04	-0.6	-0.6	-0.6	1/25/05	-0.2	-0.2	-0.2
10/26/04	-0.6	0.2	0.7	12/11/04	-0.6	-0.6	-0.6	1/26/05	-0.2	-0.2	-0.2
10/27/04	-0.2	0.9	1.6	12/12/04	-0.6	-0.6	-0.6	1/27/05	-0.2	-0.2	-0.2
10/28/04	1.6	1.8	2.0	12/13/04	-0.6	-0.3	-0.2	1/28/05	-0.2	-0.2	-0.2
10/29/04	1.2	1.6	2.0	12/14/04	-0.2	-0.2	-0.2	1/29/05	-0.2	-0.2	-0.2
10/30/04	1.6	1.8	2.0	12/15/04	-0.2	-0.2	-0.2	1/30/05	-0.2	-0.2	-0.2
10/31/04	1.6	1.7	2.0	12/16/04	-0.2	0.0	0.3	1/31/05	-0.2	-0.2	-0.2

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	Temperature °C				Temperature °C				Temperature °C		
Date	**Min.**	**Mean**	**Max.**	**Date**	**Min.**	**Mean**	**Max.**	**Date**	**Min.**	**Mean**	**Max.**
2/1/05	-0.6	-0.5	-0.2	3/19/05	0.3	0.3	0.7	5/4/05	2.5	3.5	4.6
2/2/05	-0.6	-0.4	0.3	3/20/05	0.3	0.5	0.7	5/5/05	2.0	3.6	5.4
2/3/05	-0.6	-0.3	-0.2	3/21/05	0.3	0.3	0.3	5/6/05	2.0	3.8	5.8
2/4/05	-0.6	-0.5	-0.2	3/22/05	0.3	0.4	0.7	5/7/05	2.0	3.8	5.4
2/5/05	-0.6	-0.3	0.3	3/23/05	0.7	0.9	1.2	5/8/05	2.5	3.8	5.8
2/6/05	-0.6	-0.3	0.3	3/24/05	0.3	0.7	1.2	5/9/05	2.5	3.9	5.8
2/7/05	-0.6	-0.5	-0.2	3/25/05	0.7	0.9	1.2	5/10/05	2.5	3.9	5.8
2/8/05	-0.6	-0.5	-0.2	3/26/05	1.2	1.3	1.6	5/11/05	2.5	3.3	5.0
2/9/05	-0.6	-0.3	-0.2	3/27/05	1.2	1.5	1.6				
2/10/05	-0.6	-0.2	-0.2	3/28/05	1.2	1.6	2.0				
2/11/05	-0.2	-0.2	-0.2	3/29/05	1.2	1.6	1.6				
2/12/05	-0.2	-0.2	-0.2	3/30/05	1.2	1.3	1.6				
2/13/05	-0.2	-0.2	-0.2	3/31/05	1.2	1.2	1.6				
2/14/05	-0.2	-0.2	-0.2	4/1/05	1.2	1.3	1.6				
2/15/05	-0.2	-0.1	0.3	4/2/05	1.2	1.3	1.6				
2/16/05	-0.2	0.3	0.3	4/3/05	1.2	1.3	1.6				
2/17/05	0.3	0.3	0.3	4/4/05	1.2	1.5	2.0				
2/18/05	0.3	0.3	0.3	4/5/05	1.2	1.6	2.0				
2/19/05	0.3	0.3	0.3	4/6/05	1.2	1.7	2.0				
2/20/05	0.3	0.3	0.3	4/7/05	1.2	1.3	1.6				
2/21/05	0.3	0.3	0.3	4/8/05	0.7	1.2	1.6				
2/22/05	0.3	0.3	0.3	4/9/05	1.2	1.4	1.6				
2/23/05	0.3	0.3	0.7	4/10/05	1.2	1.6	2.0				
2/24/05	0.3	0.3	0.7	4/11/05	1.2	1.6	2.0				
2/25/05	0.3	0.4	0.7	4/12/05	1.6	2.0	2.5				
2/26/05	0.3	0.3	0.7	4/13/05	2.0	2.2	2.5				
2/27/05	0.3	0.3	0.3	4/14/05	2.0	2.3	2.9				
2/28/05	0.3	0.3	0.3	4/15/05	1.6	2.1	2.5				
3/1/05	0.3	0.3	0.3	4/16/05	1.6	2.0	2.5				
3/2/05	0.3	0.3	0.3	4/17/05	1.6	2.0	2.5				
3/3/05	0.3	0.4	0.7	4/18/05	2.0	2.2	2.5				
3/4/05	0.3	0.3	0.3	4/19/05	2.0	2.3	2.9				
3/5/05	0.3	0.6	1.2	4/20/05	2.5	2.7	2.9				
3/6/05	0.7	1.0	1.2	4/21/05	2.0	2.3	2.5				
3/7/05	1.2	1.2	1.2	4/22/05	1.6	2.0	2.5				
3/8/05	1.2	1.2	1.2	4/23/05	2.0	2.6	3.3				
3/9/05	1.2	1.2	1.2	4/24/05	1.6	2.3	2.9				
3/10/05	0.7	1.1	1.2	4/25/05	1.6	2.2	2.9				
3/11/05	1.2	1.2	1.2	4/26/05	1.6	2.5	3.7				
3/12/05	1.2	1.3	1.6	4/27/05	1.6	2.7	5.0				
3/13/05	1.2	1.5	1.6	4/28/05	1.6	2.7	4.6				
3/14/05	1.2	1.5	1.6	4/29/05	1.6	2.7	4.6				
3/15/05	1.2	1.3	1.6	4/30/05	1.6	2.8	4.6				
3/16/05	0.7	0.9	1.2	5/1/05	1.6	2.9	4.6				
3/17/05	0.3	0.7	1.2	5/2/05	1.6	3.2	5.0				
3/18/05	0.3	0.7	0.7	5/3/05	2.5	3.7	5.0				

APPENDIX B

Appendix B1.–Weekly sampling statistics and estimated effort, catch, and harvest of Chinook salmon at the Letnikof Dock, May 10–June 27, 2004.

	May 10–May 16	May 17–May 23	May 24–June 06- Non-derby	May 24–June 06- Derby	June 07–June 13	June 14–June 20	June 21–June 27	Total
Boats counted	40	121	67	101	40	33	11	413
Angler-hs. sampled	291	821	541	1,635	271	220	82	3,861
Salmon-hs. sampled	291	813	541	1,635	270	220	50	3,820
Chinook sampled	3	16	29	92	5	11	1	157
Sampled for ad-clips	3	16	29	92	5	11	1	157
Ad-clips	1	0	0	11	0	1	0	13
Angler-hours								
Estimate	486	1,218	1,622	6,145	442	579	239	10,731
Variance	111	44,530	316,791	42,583	4,514	15,727	14,770	439,026
Salmon-hours								
Estimate	486	1,198	1,622	6,145	441	579	127	10,598
Variance	111	38,288	316,791	42,583	4,514	15,727	764	418,778
Large Chinook catch								
Estimate	7	27	90	127	5	32	5	293
Variance	13	6	684	14	0	247	12	976
Large Chinook kept								
Estimate	7	27	84	126	5	32	2	283
Variance	13	6	528	18	0	247	3	815
Wild mature Chinook kept (excluding hatchery and immature fish)								
Estimate	4	19	72	95	4	29	2	225
Variance	4	38	372	3	0	241	3	661
Small Chinook catch								
Estimate	0	10	54	107	0	7	0	178
Variance	0	4	966	8	0	9	0	987
Small Chinook kept								
Estimate	0	0	3	0	0	0	0	3
Variance	0	0	6	0	0	0	0	6

Appendix B2.–Biweekly sampling statistics and estimated effort, catch, and harvest of Chinook salmon at the Chilkat State Park boat launch, May 17–June 27, 2004.

		May 24–June 06				
	May 17–May 23	**Non-derby**	**Derby**	**June 07–June 20**	**June 21–June 27**	**Total**
Boats counted	3	4	4	2	0	13
Angler-hs. sampled	4	10	20	8	0	42
Salmon-hs. sampled	2	10	20	8	0	40
Chinook sampled	0	0	1	2	0	3
Sampled for ad-clips	0	0	1	2	0	3
Ad-clips	0	0	0	2	0	2
Angler-hours						
Estimate	15	46	101	56	0	218
Variance	1	1,206	1,201	1,680		4,088
Salmon-hours						
Estimate	7	46	101	56	0	210
Variance	35	1,206	1,201	1,680		4,122
Large Chinook catch						
Estimate	0	0	5	14	0	19
Variance			20	168		188
Large Chinook kept						
Estimate	0	0	5	14	0	19
Variance			20	168		188
Wild mature Chinook kept (excluding hatchery and immature fish)						
Estimate	0	0	5	0	0	5
Variance			20			20
Small Chinook catch						
Estimate	0	0	5	0	0	5
Variance			20			20
Small Chinook kept						
Estimate	0	0	0	0	0	0
Variance						

Appendix B3.–Biweekly sampling statistics and estimated effort, catch, and harvest of Chinook salmon at the Small Boat Harbor, May 10–June 27, 2004.

		May 24–June 06				
	May 10–May 23	**Non-derby**	**Derby**	**June 07–June 20**	**June 21–June 27**	**Total**
Boats counted	4	12	8	17	5	46
Angler-hs. sampled	18	123	79	83	23	326
Salmon-hs. sampled	18	123	67	77	23	308
Chinook sampled	0	11	18	4	1	34
Sampled for ad-clips	0	11	18	4	1	34
Ad-clips	0	0	4	1	0	5
Angler-hours						
Estimate	124	552	395	583	158	1,812
Variance	3	83,992	180	47,988	6,563	138,726
Salmon-hours						
Estimate	124	552	335	541	158	1,710
Variance	3	83,992	4,500	35,766	6,563	130,824
Large Chinook catch						
Estimate	0	50	30	21	0	101
Variance		709	180	42		931
Large Chinook kept						
Estimate	0	50	30	21	0	101
Variance		709	180	42		931
Wild mature Chinook kept (excluding hatchery and immature fish)						
Estimate	0	27	12	0	0	39
Variance		126	20			146
Small Chinook catch						
Estimate	0	36	0	42	14	92
Variance		567		1,092		1,659
Small Chinook kept						
Estimate	0	0	0	7	7	14
Variance				42	42	84

Appendix B4.–Estimated age composition and mean length-at-age (snout to fork of tail in mm) of harvested Chinook salmon in the Chilkat Inlet subsistence gillnet fishery, June 19–July 4, 2004.

		Brood year and age class					
		2001	2000	1999	1998	**Total**	**Total**
		1.1	1.2	1.3	1.4	**aged**	**sampled**[a]
Males	Sample size	1	9	11	4	25	32
	Percent	4.0	36.0	44.0	16.0		69.6
	SE	4.0	9.8	10.1	7.5		6.9
	Mean length	480	673	865	933		
	SE		30.1	20.8	62.6		
Females	Sample size	0	2	7	2	11	14
	Percent		18.2	63.6	18.2		30.4
	SE		12.2	15.2	12.2		6.9
	Mean length		738	868	960		
	SE		3.5	17.8	42.4		
Combined[b]	Sample size	2	12	18	6	38	48
	Percent	5.2	31.6	47.4	15.8		
	SE	3.7	7.6	8.2	6.0		
	Mean length	455	674	866	942		
	SE		26.0	13.7	39.1		

[a] Includes fish that were not assigned an age.

[b] Includes fish not sampled for sex information.

APPENDIX C

Appendix C1.–Computer data files used in the analysis of this report.

FILE NAME	DESCRIPTION
04FallChinookCWT.XLS	Excel workbook containing raw trapping and sampling data from fall Chinook cwt project in 2004.
04FallChinookCWT.PRN	Space delimited text file with raw trapping data from fall Chinook cwt project in 2004.
04FallChinookCWT.TXT	Text file describing heading and column layout for 04FallChinookCWT.PRN
04KelsallTemp.PRN	Space delimited text file with bi-hourly water temperature data recorded at the Kelsall River from May 2005 to May 2005.
04KelsallTemp.TXT	Text file describing heading and column layout for 04KelsallTemp.PRN
BY03ChinookLength.PRN	Space delimited text file with length data from all 2003 brood year juvenile Chinook sampled in 2004 and 2005.
BY03ChinookLength.TXT	Text file describing heading and column layout for BY03ChinookLength.PRN
F2008100M012004.DTA	Mark-sense ASCII file containing angler interview data from the Haines marine sport fishery in 2004.
F2008200A012004.DTA	Mark-sense ASCII file containing Chinook age & length data from the Haines marine sport fishery in 2004.
F2008202A012004.DTA	Mark-sense ASCII file containing Chinook age & length data from the Chilkat Inlet subsistence fishery in 2004.
HAINE4.PRG	Dbase program to generate SAS data file from mark-sense file.
04HAINESCT.PRN	Count file (text) used in HAMC04.SAS to expand for missing interview data.
HAMC04.SAS	SAS program to estimate effort and harvest in the Haines marine sport fishery using 04HAINESCT.PRN and output from HAINE4.PRG.
04STRATPOPEST.XLS	Excel workbook used to estimate 2004 abundance of Chilkat River Chinook.
04SPAWN.XLS	Excel workbook containing raw data from Chinook sampled on the Chilkat River spawning tributaries during 2004.
04SPAWN.PRN	Space delimited text file with raw data from Chinook sampled on the Chilkat River spawning tributaries during 2004.
04SPAWN.TXT	Text file describing heading and column layout for 04SPAWN.PRN
04TAGS.XLS	Excel workbook containing raw data from Chinook captured in the lower Chilkat River during 2004.
04TAGS.PRN	Space delimited text file with raw data from Chinook captured in the lower Chilkat River during 2004.
04TAGS.TXT	Text file describing heading and column layout for 04TAGS.PRN