Fishery Data Series No. 98-18

Production of Coho Salmon from the Taku River, 1996–1997

by

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August 1998

Alaska Department of Fish and Game **Division of Sport Fish**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L (see Gregg 537)
meter	m
metric ton	mt
milliliter	ml
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
ounce	oz
pound	lb
quart	qt
yard	yd
Spell out acre and ton.	

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
hour (spell out for 24-hour clock)	h
minute	min
second	s
Spell out year, month, and week.	

Physics and chemistry

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

General

All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.
All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.
and	&
at	@
Compass directions:	
east	E
north	N
south	S
west	W
Copyright	©
Corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
et alii (and other people)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.,
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
number (before a number)	# (e.g., #10)
pounds (after a number)	# (e.g., 10#)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)

Mathematics, statistics, fisheries

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	C.I.
correlation coefficient	R (multiple)
correlation coefficient	r (simple)
covariance	cov
degree (angular or temperature)	°
degrees of freedom	df
divided by	÷ or / (in equations)
equals	=
expected value	E
fork length	FL
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.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
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
standard length	SL
total length	TL
variance	Var

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ABSTRACT

Recovery of coded wire tags from adults in 1997 tagged as smolt in 1996 was used to estimate smolt abundance, harvest, exploitation rate, and production of coho salmon *Oncorhynchus kisutch* from the Taku River, near Juneau, Alaska. Four rotary smolt traps and/or 12-124 baited G-40 minnow traps were fished daily near Canyon Island on the Taku River from 1 May through 26 June. During this period, 10,249 coho salmon smolt ≥70 mm fork length were tagged and released alive with valid tags with tag code 04-42-33. Sampled smolt averaged 89 mm fork length and were 0.4% age 0.0, 96.5% age 1.0, and 3.1% age 2.0. In 1997, 66 adult coho salmon bearing coded wire tags were recovered in random sampling of marine fisheries corresponding to an estimated harvest of 15,825 (SE = 2,690) in U. S. marine waters. Of this harvest, the troll fishery took an estimated 56%, recreational fisheries took 31%, drift gillnet fisheries took 9% and seine fisheries took 4%. An estimated 35,035 (SE = 4,160) adults passed by Canyon Island, according to a mark-recapture experiment partially funded by Sport Fish Division that was conducted by the Commercial Fisheries Management and Development Division and the Canadian Department of Fisheries and Oceans. Of this inriver return, 2,690 were harvested by inriver fishers above the U.S./Canada border, leaving an estimated escapement past all fisheries of 32,345. Estimated total run (escapement plus harvest) in 1997 for coho salmon originating *above* Canyon Island is 50,859 (SE = 5,133); marine exploitation rate on this run is an estimated 31% (SE = 4.9%). Estimated total run in 1997 for *all* coho salmon from the Taku River is 65,204 (SE ≅ 6,581), accounting for those fish originating below Canyon Island. Contribution of all Taku River coho salmon to the Juneau marine sport fishery was about 50% of the estimated harvest in that fishery. Estimated smolt abundance in 1996 from above Canyon Island was 759,763 (SE = 154,051), obtained by using a modified Petersen estimator, and marine survival rate of coho salmon smolt from above Canyon Island is an estimated 6.7% (SE = 1.5%).

Key words: Coho salmon, *Oncorhynchus kisutch*, Taku River, harvest, troll fishery, drift gillnet fishery, recreational fishery, seine fishery, escapement, migratory timing, production, return, exploitation rate, marine survival

INTRODUCTION

The Taku River produces an estimated 65,000–450,000 adult coho salmon *Oncorhynchus kisutch* annually, many of which are caught in commercial and recreational fisheries in northern Southeast Alaska (PSC 1996; Elliott and Bernard 1994; McPherson and Bernard 1995, 1996; McPherson et al. 1997).

Run sizes vary depending on escapements and on freshwater and marine survival rates. Coho salmon returning to the Taku River pass through an offshore troll fishery before entering inside waters through Icy Strait (Figure 1), then pass through a seine fishery in Icy and Chatham straits and a drift gillnet fishery in lower Lynn Canal. They next transit the recreational fishery near Juneau and the drift gillnet fishery in Taku Inlet/Stephens Passage before ascending the Taku River (Figure 2). After entering the river, the remaining coho salmon are exposed to a drift/set gillnet fishery just inside Canada (Figure 2). Due to the large production of coho salmon from the Taku River, and because of the many fisheries that utilize this production, the Alaska Department of Fish and Game (ADF&G) and the Canadian Department of Fisheries and Oceans (DFO) operate a cooperative program of stock assessment and management. Past studies of Taku River coho salmon stocks are listed in Appendix A1. Taku River coho salmon are currently managed as a single stock, and the stock assessment program has mirrored that emphasis since 1991 (McPherson et al 1997; PSC 1996).

Objectives of this year's study were to estimate (1) abundance, mean length and age composition of coho salmon smolt leaving the Taku River in 1996, (2) harvest of adults returning to the Taku River in 1997; and (3) escapement and age composition of returning adults in 1997. These objectives were accomplished by tagging and sampling smolt in 1996 in the lower Taku River. Other projects in our agency or in Canada supplied data on returning adults which were harvested or escaped to spawn in 1997.

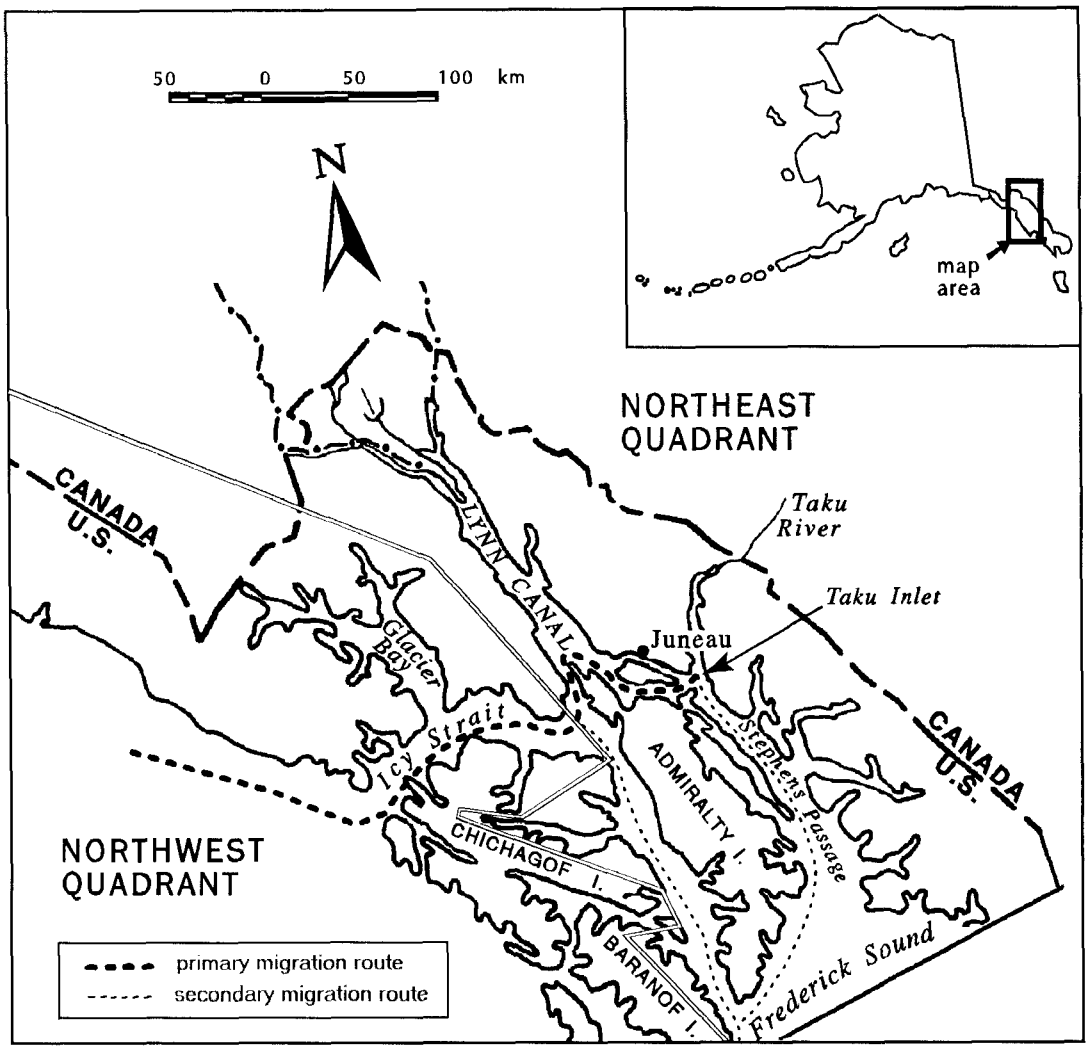

Figure 1.–Migration routes through northern Southeast Alaska of coho salmon bound for the Taku River.

METHODS

SMOLT CAPTURE, CODED WIRE TAGGING, AND SAMPLING

Four rotary smolt traps (two 12′ in diameter and two 8′ in diameter), constructed by E.G. Solutions of Corvallis, Oregon, were fished above Canyon Island (approximately 3 km below the U.S./ Canada border) and below the border (Figure 3). Operations, locations and configurations of screw traps were similar to those in 1995 (McPherson et al. 1997). One 12′-diameter-cone trap was fished at site 3 (Figure 3) from 21 May to 23 June. The other 12′ trap was fished from 18 May to 1 June at site 2, from 2 to 10 June at site 4 and from 11 to 22 June at site 7. One 8′ trap was fished from 4 May to 26 June at site 2. The other 8′ trap was fished from 28 May to 26 June at site 2 in tandem with the other 8′ trap. Descriptions of sites are included in McPherson et al. (1997).

Between 12 and 124 G-40 minnow traps, baited with salmon roe, were fished daily for 24 hours from 1 May to 25 June between Canyon Island and the border along both sides of the river. Traps were located along mainstem banks and in some backwater areas, depending on river levels. Minnow traps were checked daily when water levels were stable and more frequently when water levels were unstable.

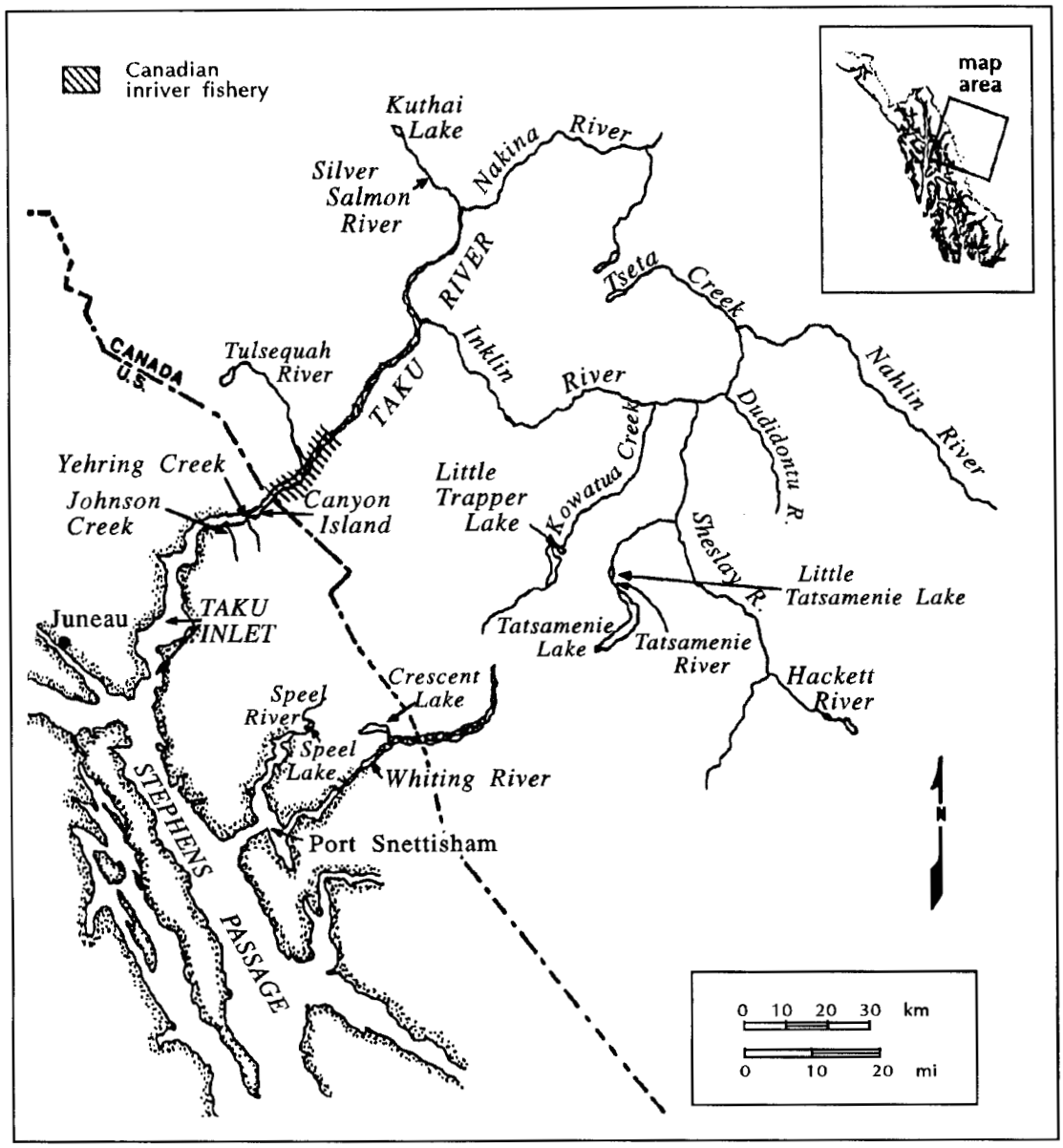

Figure 2.–Taku River drainage, northwestern British Columbia and Southeast Alaska.

Two members of a four- to six-person crew were on duty or on call at all times to keep the minnow traps and rotary traps fishing regularly. Early in the season, water levels were low and the field crew concentrated efforts with minnow traps. After that time, both minnow traps and rotary traps were equally deployed for the most part.

Water levels remained below average for the duration of the season, and debris, which tends to clog the rotary traps, was inconsequential in 1996, except during the first week of June when water levels were above 6 ft (as measured at a permanent staff gauge at Canyon Island). During this period, the cones of the rotary traps were hosed frequently with a gasoline-powered water pump to clear fine debris. The field crew checked the rotary traps every 2–8 hours, depending on debris load and catch rates.

Salmonid smolt and fry were removed from rotary trap liveboxes and minnow traps during each visit, transported to holding boxes at camp, and processed each morning. Coho and chinook

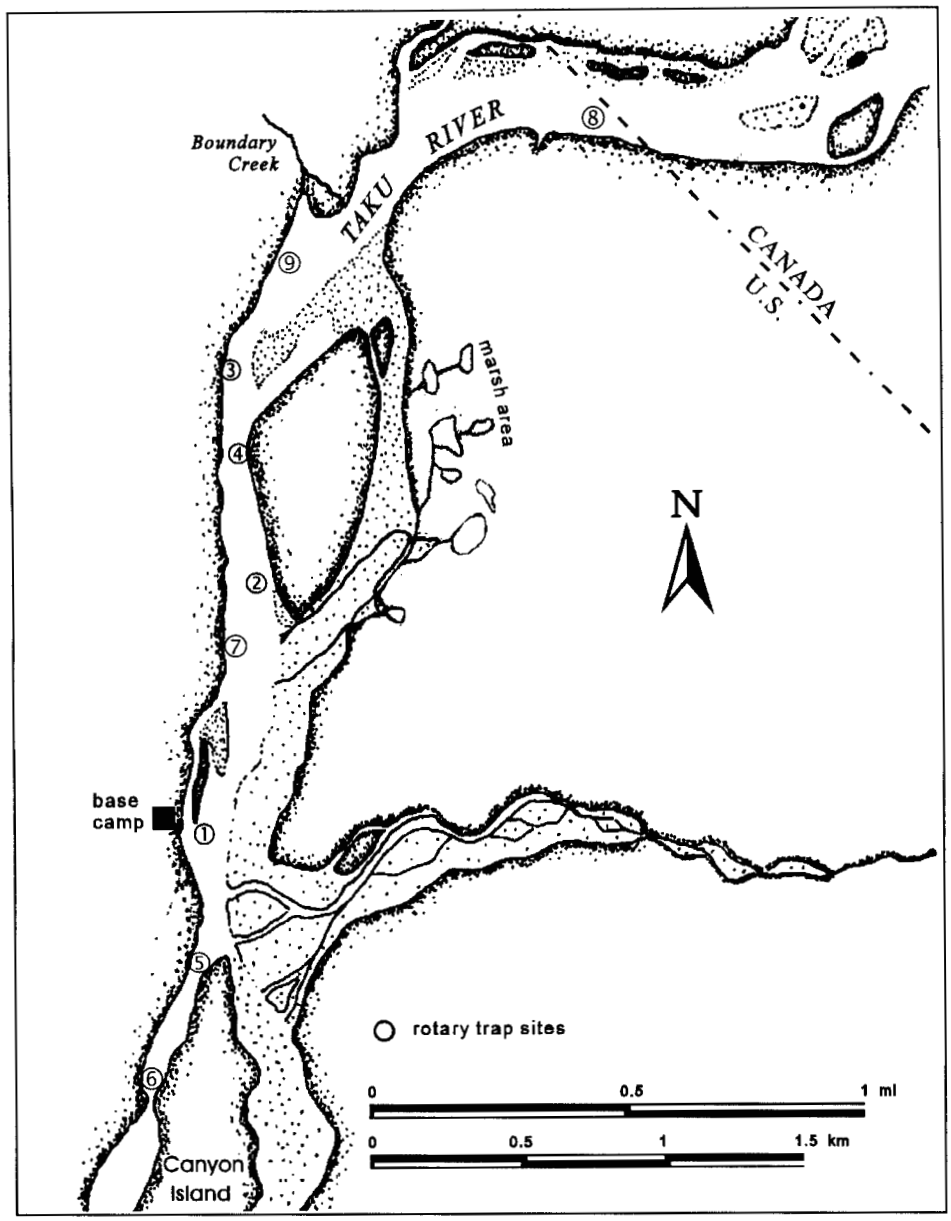

Figure 3.–Location of study area on Taku River near Canyon Island.

salmon *Oncorhynchus tshawytscha* smolt were separated by inspection from other species of salmon and Dolly Varden *Salvelinus malma*. Coho and chinook salmon smolt were carefully examined, and species were separated using a combination of external morphological characteristics. A clear 'window' in the pigmentation of the adipose fin (Meehan and Vania 1961; McConnell and Snyder 1972) indicated a chinook salmon smolt. Chinook salmon smolt also appear more 'silver' in sheen from a side view, whereas coho salmon smolt are usually darker, have narrower par marks, show a greater number of small, darkly pigmented spots from a dorsal view, and have longer anterior rays on their anal fins (Pollard et al. 1997).

All live coho salmon smolt ≥ 70 mm FL were tranquilized in a solution of tricain-methane sulfonate (MS 222), buffered with sodium bicarbonate. The MS 222 solution was maintained at constant river temperature by pumping it through

a continuous loop containing a coil of aluminum tubing submerged in the river. All fish were tagged with a coded wire tag (CWT) and marked by excision of the adipose fin, following methods in Koerner (1977), and released. All live coho salmon smolt 50–69 mm FL were also tagged, but with a separate tag code. All chinook salmon smolt ≥50 mm FL were also tagged with separate tag codes.

Fifty fish from each day's catch, selected midway through the day's tagging, were held in a separate livebox and checked 24 hours later for retention of CWTs and tagging mortality. When fewer than 50 fish of a species were caught in a day, half the catch was held for 24 hours. The number of fish tagged, number of tagging-related mortalities, and number of fish that had shed their tags were compiled and recorded on *ADF&G CWT Tagging Summary and Release Information Forms* which were submitted to the Commercial Fisheries Division (CFD) Tag Lab in Juneau when field work ended.

Age composition of emigrating coho salmon smolt in 1996 was estimated by systematically sampling every 20th smolt captured above Canyon Island. Each sampled smolt was measured to the nearest mm FL. A smear of scales was taken two rows above the lateral line on the left side of each sampled smolt just ahead of the adipose fin (the 'preferred area' for sampling scales from coho smolt described in Scarnecchia [1979]). Scales were carefully spread and mounted between two 25-mm by 75-mm glass slides and viewed through a microfiche reader at 70× magnification. Age was determined once for each fish; ages are reported in European notation. Proportions q_i in the age composition and their variances were estimated as

$$\hat{q}_i = \frac{n_{si}}{n_s} \quad (1a)$$

$$v[\hat{q}_i] = \frac{\hat{q}_i(1-\hat{q}_i)}{n_s - 1} \quad (1b)$$

where n_s is the number of smolts sampled and n_{si} the subset of these smolts determined to be of age i (see Table 1 for definitions of all notation).

Estimate of Smolt Abundance

Abundance of smolt originating above Canyon Island in 1996 was estimated in a two-sample, mark-recapture experiment with Petersen's estimator as modified by Bailey (1951, 1952):

$$\hat{N}_s = \frac{n_c(n_e+1)}{m_a+1} \quad (2a)$$

$$v[\hat{N}_s] = \frac{n_c^2(n_e+1)(n_e-m_a)}{(m_a+1)^2(m_a+2)} \quad (2b)$$

where N_S is number of smolt emigrating past Canyon Island in 1996, n_c is the number of smolt tagged in 1996, n_e the number of adults sampled in 1997 at Canyon Island, and m_a the number of adults in that sample with missing adipose fins.

Estimate of Harvest

Harvest in 1997 of coho salmon originating from the Taku River above Canyon Island was estimated from fish sampled from catches in commercial and recreational fisheries and from the escapement past Canyon Island. Because several fisheries exploited coho salmon over several months in 1997, 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 by fishing quadrant. Statistics from drift gillnet fisheries were stratified by week and by fishing district. Statistics from the recreational fishery were stratified by fortnight. Estimates of harvest $\hat{r}_i$ were calculated for each stratum, then summed across strata and across fisheries to obtain an estimate of the total $\hat{T}$:

$$\hat{T} = \sum_i \hat{r}_i \quad (3a)$$

Table 1.—Notation used to describe parameters involved in estimators of harvest, escapement and smolt abundance of coho salmon from the Taku River. Coded wire tags are abbreviated as CWTs.

a_i	=	Number of adults missing adipose fins in a sample from catch in a stratum
a_i'	=	Number of heads that arrive at Juneau for dissection (subset of a_i) in a stratum
E	=	Exploitation rate of adults in commercial and sport fisheries in 1997
H_i	=	Number of adults caught in a stratum in 1997
λ_i	=	Decoding rate [$= (a_i' t_i')/(a_i t_i)$]
m_{ci}	=	Number of CWTs with the appropriate code(s) (subset of t_i') in a stratum
m_a	=	Number of adults sampled at Canyon Island in 1997 with missing adipose fins
m_e	=	Number of adults sampled at Canyon Island in 1997 with detected tags (a subset of m_a)
n_i	=	Number of adults caught in a stratum inspected for missing adipose fins
n_c	=	Number of smolt tagged in 1996
n_e	=	Number of adults sampled in 1997 to estimate θ
n_s	=	Number of smolt sampled to estimate age composition in 1996
N_e	=	Number of adults in escapement to Taku River past Canyon Island in 1997
N_R	=	Number of adults returning to the Taku River past Canyon Island in 1997
N_s	=	Number of smolts emigrating from the Taku River past Canyon Island in 1996
q_i	=	Fraction of smolt with freshwater age i in 1996
p_i	=	Fraction of catch with a CWT from a stratum in 1997
P_d	=	Fraction of catch in fishery made on day d
ϕ_i	=	Fraction of catch sampled in a stratum in 1997
r_i	=	Harvest in 1997 of coho salmon originating above Canyon Island in a stratum
S	=	Survival rate from smolts in 1996 to adults in 1997
t_i	=	Number of heads with tags detected magnetically (subset of a_i') in a stratum
t_i'	=	Number of CWTs found through dissection and decoded (subset of t_i) in a stratum
T	=	Number of adults harvested in all strata and all fisheries in 1997
θ	=	Fraction of the stock tagged with CWTs

$$v[\hat{T}] = \sum_i v[\hat{r}_i] \qquad (3b)$$

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

A subset n_i of the catch in each stratum was counted and inspected to find recaptured fish. Of those a_i salmon in this sample without adipose fins, heads were retrieved from a subset, marked, and sent to Juneau for dissection. Of the a_i' heads that arrived in Juneau, all were passed through a magnetometer to detect a CWT. Of the t_i tags detected, t_i' were successfully decoded under a microscope, after dissection of which m_{ci} had come from the Taku River.

Oliver (1990) and Hubartt et al. (1995) present details of sampling commercial and recreational fisheries, respectively. The fraction θ of the return to the Taku River with tags was estimated from catches in fish wheels located at Canyon Island, operations of which are described by

Kelley and Milligan 1998), as the fraction of the sample composed of adults with CWTs ($\hat{\theta}=m_e/n_e$).

Information from catch and field sampling programs was expanded to estimate harvest of coho salmon bound for the Taku River for each stratum. From Bernard and Clark (1996), estimated harvest and an estimate of its variance for a stratum were calculated as

$$\hat{r}_i = \hat{H}_i \hat{p}_i \hat{\theta}^{-1} \quad (4a)$$

$$v[\hat{r}_i] = \hat{r}_i^2 (G[\hat{H}_i] + G[\hat{p}_i] + G[\hat{\theta}^{-1}] - G[\hat{H}_i]G[\hat{p}_i] - G[\hat{H}_i]G[\hat{\theta}^{-1}] - G[\hat{p}_i]G[\hat{\theta}^{-1}] + G[\hat{H}_i]G[\hat{p}_i]G[\hat{\theta}^{-1}] \quad (4b)$$

where $G(\ )$ is the squared coefficient of variation for the specified variable and $\hat{H}_i$ the estimated catch for a stratum. Note that $G[\hat{H}_i]=0$ for commercial and inriver fisheries. Estimated fraction of catch composed of recovered, tagged fish $\hat{p}_i$ and $G[\hat{p}_i]$ were calculated per Table 2 in Bernard and Clark (1996):

$$\hat{p}_i = \frac{m_i}{\lambda_i n_i} \quad (5a)$$

$$G[\hat{p}_i] = \frac{1 - \lambda_i \hat{\phi}_i \hat{\theta}}{m_i} \quad (5b)$$

where ϕ_i is the fraction of catch sampled ($=n_i/H_i$) and $\lambda_i=(a_i't_i')/(a_it_i)$.

Monte Carlo simulation was used to estimate precision from field sampling programs (see Geiger 1990). Because sampling with fish wheels at Canyon Island was continuous, and equal sampling effort was expended throughout the passage of the escapement, the binomial probability distribution was considered an adequate model for the recovery of tagged fish.

A vector of B simulated statistics $\{\theta_1^*,\theta_2^*,...,\theta_B^*\}$ was generated by drawing B samples each of size n_e from Binom $(\hat{\theta},n_e)$ where $\theta_b^*=m_e^*/n_e$. Calculations followed as

$$\left\{\theta_1^{*-1},\theta_2^{*-1},\ldots,\theta_B^{*-1}\right\} = \left\{y_1^*,y_2^*,\ldots,y_B^*\right\}$$

$$\hat{v}[\theta^{-1}]) = \frac{\sum_{b=1}^{B}\left(y_b^* - \bar{y}^*\right)^2}{B-1}$$

$$\hat{G}[\theta^{-1}] = \hat{v}[\theta^{-1}])\hat{\theta}^2$$

Estimate of Escapement

The escapement of coho salmon past Canyon Island in 1997 was estimated directly from an ongoing mark-recapture experiment in another division of the Department (see Kelley and Milligan [1998] for a description of this experiment). Coho salmon in this experiment were captured in two fish wheels at Canyon Island, tagged through the back with individually numbered plastic spaghetti tags, released, and recovered along with unmarked fish in set gillnet fisheries 5–10 km upstream in Canada. The estimated escapement $\hat{N}_e$ past Canyon Island through 30 September was obtained from a mark-recapture experiment, using a maximum likelihood Darroch estimator with seven capture and seven recapture strata (Kelley and Milligan 1998). It is believed that this estimate covered almost all of the escapement above Canyon Island in 1997.

Estimates of Run Size, Rate of Exploitation, and Marine Survival

Estimates of total run size (harvest plus escapement) of coho salmon returning to the Taku River above Canyon Island in 1997 and the associated exploitation rate in commercial and sport fisheries are based on the sum of estimated harvest and estimated escapement

$$\hat{N}_R = \hat{T} + \hat{N}_e \quad (6a)$$

The variance of the estimated run was calculated as the sum of the variances for estimated escapement and estimated harvest:

$$v[\hat{N}_R] = v[\hat{T}] + v[\hat{N}_e] \qquad (6b)$$

The estimate of exploitation rate was calculated as

$$\hat{E} = \frac{\hat{T}}{\hat{N}_R} \qquad (7a)$$

$$v[\hat{N}_R] \approx \frac{v[\hat{T}]\hat{N}_e^2}{\hat{N}_R^4} + \frac{v[\hat{N}_e]\hat{T}^2}{N_R^4} \qquad (7b)$$

The variance in equation (7) was approximated with the delta method (Seber 1982). The estimated survival rate of smolt to adults was calculated as

$$\hat{S} = \frac{\hat{N}_R}{\hat{N}_s} \qquad (8a)$$

$$v[\hat{S}] \approx \hat{S}^2 \left[\frac{v[\hat{N}_R]}{\hat{N}_R^2} + \frac{v[\hat{N}_s]}{\hat{N}_s^2} \right] \qquad (8b)$$

The variance in equation (8) was also approximated with the delta method (Seber 1982).

Estimates of Mean Date of Harvest

Estimates of the mean dates of harvest for commercial and sport fisheries were calculated from the time series of estimated proportions of catches by strata within a fishery following the methods of Mundy (1982):

$$\hat{P}_d = \frac{\hat{H}_d}{\sum_i H_i} \qquad (9)$$

where P_d is the fraction of Taku River coho salmon in a fishery on day d. The mean date of harvest $\bar{d}$ in each fishery was calculated as:

$$\hat{\bar{d}} = \sum_d d\hat{P}_d \qquad (10)$$

RESULTS

Smolt Tagging, Age, and Length in 1996

From 1 May to 26 June 1996, 10,266 coho salmon smolt ≥70 mm FL were captured at Canyon Island (Figure 3) all of which were marked and tagged (Table 2). Of those, 13 were estimated to have died after tagging and 4 were estimated to have shed tags, leaving 10,249 (= n_C) coho salmon smolt released with valid CWTs with code 04-42-33. An additional 4,639 coho salmon 50–69 mm FL were tagged and released with code 04-42-16. None of these undersize coho salmon were observed to have returned in 1997 and were not used in any subsequent calculations.

Ninety percent of captured coho smolt were taken between 4 May and 19 June (Figure 4; Table 2). Peak catches occurred from 27 May to 2 June, although catches were protracted through most of the run. Fifty percent (50%) of the catch occurred by 27 May. Similar timing was observed by Meehan and Siniff (1962), when a modified scoop trap was operated in the narrows of Canyon Island from 12 April through 15 June.

Both gear types were fished throughout the season, with higher trapping effort when screw trap catches were low (Table 2). Overall, minnow traps accounted for 61% of the coho salmon smolts ≥70 mm FL caught.

Coho salmon smolt averaged an estimated 89 mm FL in 1996 (Table 3; Figure 5), and age 1.0 smolt dominated the catch (Table 3).

Smolts and young of other species of salmon were also captured. Of 21,771 chinook salmon smolt captured and tagged, 154 were estimated to have died after tagging and 35 to have shed their tags, leaving a valid release of 21,582 smolts (10,220 bearing code 04-42-34, 10,707 bearing code 04-42-35, and 655 bearing code 04-43-33 [Table 2]). Analyses of these tagging

Table 2.–Number of salmon smolt caught and tagged in four rotary screw traps and minnow traps near Canyon Island on the Taku River during 1996. Coho ≥70 mm FL total includes 13 overnight tagging mortalities and four shed tags. Coho <70 mm FL total includes 45 overnight tagging mortalities and four shed tags. Chinook total includes 154 overnight tagging mortalities and 35 shed tags.

	Minnow Traps			Screw Traps		Total							Water			
	Traps	≥70 mm		≥70 mm		≥70 mm		<70 mm	Sock-	Steel-	Air Temp. (°C)		Temp.	Precip	Water	Depth
Date	Set	Coho	Chinook	Coho	Chinook	Coho	Chinook	Coho	eye	head	Min	Max	°C	(in)	(in)	(ft)
01-May	35	110	169	0	0	110	169	67	0	0	-4.0	15.0		0.00	-8	-0.7
02-May	48	118	181	0	0	118	181	132	1	0	-5.0	18.0		0.00	-8	-0.7
03-May	49	143	275	0	0	143	275	146	0	0	-2.0	22.0		0.00	-8	-0.7
04-May	63	84	187	0	0	84	187	100	0	0	-3.0	19.0		0.00	-1	-0.1
05-May	79	162	349	0	0	162	349	125	0	1	-3.0	20.0		0.00	2	0.2
06-May	84	166	393	14	18	180	411	158	4	0	-4.0	16.0	6.0	0.00	2	0.2
07-May	86	213	523	5	24	218	547	151	0	0	-6.0	16.0	5.0	0.00	0	0.0
08-May	127	240	741	9	21	249	762	204	6	0	1.0	17.0	5.0	0.00	-3	-0.3
09-May	139	204	859	3	23	207	882	149	0	0	1.0	13.0	5.0	0.00	-6	-0.5
10-May	139	207	991	0	3	207	994	177	0	0	-6.0	18.0	5.0	0.00	-8	-0.7
11-May	139	183	877	1	0	184	877	182	7	0	-4.0	20.0	5.0	0.00	-7	-0.6
12-May	139	202	911	0	1	202	912	81	4	0	6.0	12.0	7.0	0.00	-3	-0.3
13-May	139	153	776	6	11	159	787	74	4	0	-2.0	25.0	7.0	0.00	5	0.4
14-May	139	134	639	20	28	154	667	70	3	0	4.0	26.0	7.0	0.00	14	1.2
15-May	138	135	224	34	64	169	288	58	4	0	5.0	15.0	6.0	0.02	20	1.7
16-May	122	152	202	65	102	217	304	89	6	0	0.0	15.0	6.0	0.05	25	2.1
17-May	118	190	271	67	169	257	440	87	12	0	3.0	20.0	7.0	0.01	28	2.3
18-May	104	235	306	85	223	320	529	192	10	1	-2.0	23.0	6.0	0.00	31	2.6
19-May	98	124	321	9	13	133	334	90	1	0	2.0	24.0	7.0	0.00	34	2.8
20-May	111	73	190	22	32	95	222	11	2	1	11.0	24.0	8.0	0.10	41	3.4
21-May	46	44	128	17	73	61	201	30	3	0	1.0	17.0	7.0	0.00	47	3.9
22-May	39	31	46	60	110	91	156	7	8	0				0.00	51	4.3
23-May	29	0	0	68	133	68	133	5	7	1	1.0	22.0		0.01	61	5.1
24-May	15	20	41	256	426	276	467	36	47	3	7.0	22.0	7.0	0.06	65	5.4
25-May	12	17	39	226	302	243	341	22	63	7	4.0	13.0	6.0	0.32	66	5.5
26-May	16	10	29	239	247	249	276	11	79	2	4.0	31.0	6.5	0.12	66	5.5
27-May	34	197	83	221	257	418	340	103	92	6	4.0	11.0	7.0	0.06	61	5.1
28-May	39	202	74	180	233	382	307	117	108	5	5.0	18.0	8.0	0.00	54	4.5
29-May	48	178	49	105	228	283	277	130	96	4	2.0	26.0	7.0	0.00	56	4.7
30-May	49	208	179	156	346	364	525	95	187	7	2.0	25.0	8.5	0.00	64	5.3
31-May	50	139	163	174	344	313	507	94	187	6	2.0	25.0	8.0	0.00	72	6.0
01-Jun	51	129	247	248	501	377	748	98	153	10	5.0	25.0	8.0	0.00	78	6.5
02-Jun	54	114	183	253	558	367	741	83	120	2	5.0	25.0	8.5	0.00	86	7.2
03-Jun	56	98	44	166	498	264	542	62	49	2	3.0	26.0	8.0	0.00	98	8.2
04-Jun	51	61	131	126	580	187	711	45	75	4	3.0	27.0	9.0	0.00	102	8.5
05-Jun	49	147	138	68	583	215	721	68	78	2	7.0	20.0	7.0	0.38	98	8.2
06-Jun	48	65	87	152	329	217	416	45	125	0	3.0	19.0	8.0	0.04	94	7.8

-continued-

Table 2.– Page 2 of 2.

Date	Minnow Traps Traps Set	Minnow Traps ≥70 mm Coho	Minnow Traps ≥70 mm Chinook	Screw Traps ≥70 mm Coho	Screw Traps ≥70 mm Chinook	Total ≥70 mm Coho	Total ≥70 mm Chinook	<70 mm Coho	Sock-eye	Steel-head	Air Temp. (°C) Min	Air Temp. (°C) Max	Water Temp. °C	Precip (in)	Water (in)	Depth (ft)
07-Jun	48	82	186	192	420	274	606	59	211	5	7.0	19.0	7.5	0.07	88	7.3
08-Jun	72	113	191	117	301	230	492	107	338	2	6.0	20.0	8.0	0.03	87	7.3
09-Jun	76	103	131	119	215	222	346	104	343	5	4.0	18.0	8.0	0.14	81	6.8
10-Jun	83	95	90	85	125	180	215	71	231	3	3.0	18.0	7.0	0.10	74	6.2
11-Jun	92	70	48	87	95	157	143	79	176	7	6.0	16.0	8.0	0.18	67	5.6
12-Jun	104	88	134	67	79	155	213	92	153	2	5.0	17.0	8.0	0.21	61	5.1
13-Jun	124	105	74	74	49	179	123	106	102	3	4.0	18.0	9.0	0.18	59	4.9
14-Jun	116	66	65	31	44	97	109	105	99	3	0.0	16.0	7.0	0.03	50	4.2
15-Jun	122	87	34	20	24	107	58	88	100	0	6.0	20.0	8.5	0.00	46	3.8
16-Jun	122	46	41	8	20	54	61	58	36	0	5.0	21.0	8.5	0.18	46	3.8
17-Jun	122	11	90	13	40	24	130	36	34	0	8.0	18.0	9.0	0.00	49	4.1
18-Jun	100	123	83	15	51	138	134	63	50	0	8.0	18.0	9.0	0.00	54	4.5
19-Jun	63	9	51	33	75	42	126	27	61	2	8.0	16.0	9.0	0.00	60	5.0
20-Jun	94	83	80	15	170	98	250	64	56	2	8.0	16.0	9.0	0.00	66	5.5
21-Jun	83	79	53	23	214	102	267	46	93	3	4.0	22.0	9.8	0.00	70	5.8
22-Jun	58	81	73	23	238	104	311	58	123	3	9.0	25.0	9.0	0.01	79	6.6
23-Jun	62	35	98	26	222	61	320	42	58	1	8.0	28.0	9.0	0.01	87	7.3
24-Jun	47	37	51	6	91	43	142	39	39	2	6.0	29.0	9.0	0.00	93	7.8
25-Jun	37	24	24	8	74	32	98	31	24	0	9.0	28.0	9.0	0.00	96	8.0
26-Jun				24	101	24	101	19	37	2	10.0	28.0	9.0	0.02	97	8.1
Total	4,407	6,225	12,643	4,041	9,128	10,266	21,771	4,688	3,905	109				2.33		
Avg.	78.7	111.2	225.8	70.9	160.1	180.1	381.9	82.2	68.5	1.9	3.1	20.4	7.5	0.04	48.8	4.1

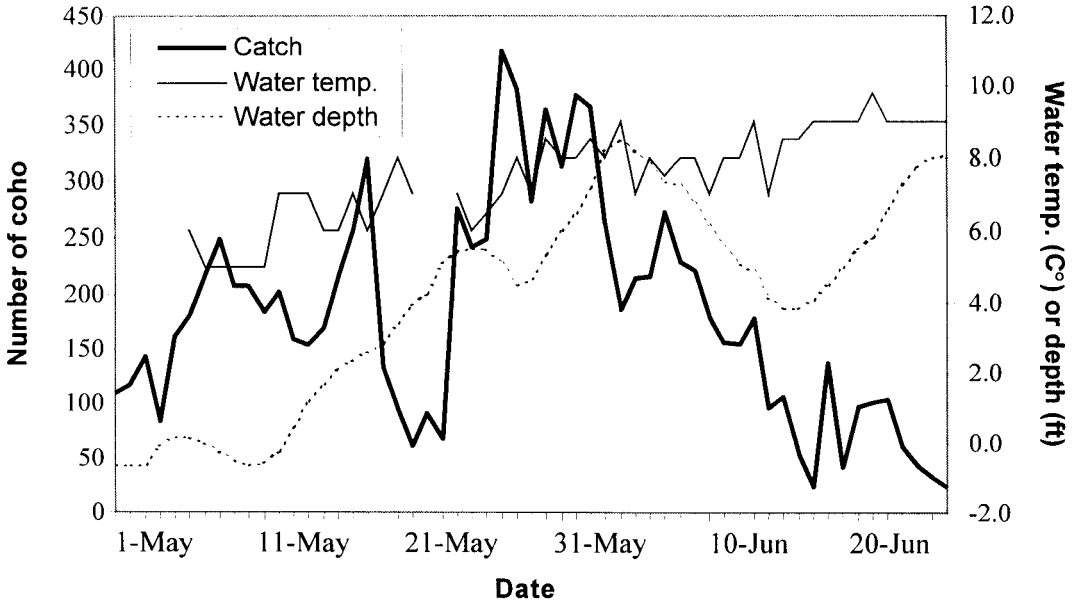

Figure 4.–Catch of coho salmon smolt ≥70 mm FL, daily water temperature, and water depth near Canyon Island, Taku River, during 1996.

data will be published when catches from that brood (1994) are completed after calendar year 2001. Also captured, but not marked or tagged, were 3,905 sockeye salmon *O. nerka*, 109 steelhead salmon *O. mykiss*, and uncounted numbers of chum salmon *O. keta*, pink salmon *O. gorbuscha*, and Dolly Varden *Salvelinus malma*.

Coded Wire Tag Recovery

In 1997, 66 CWTs with codes from Canyon Island were recovered from coho salmon in the various fisheries as random recoveries in port or creel sampling programs (Appendix A2). The greatest number (34) of tags were recovered from the commercial troll fishery, all in the Northwest Quadrant on the outside coast (see Figure 1). In marine gillnet fisheries, 16 tags were recovered, all from District 111 (Taku Inlet/Stephens Passage). Thirteen tags were recovered in the marine recreational fishery around Juneau in July through Sept. Three CWTs were recovered in the seine fishery in upper Chatham and Icy straits.

Table 3.–Mean fork length and age composition of coho salmon smolt ≥70 mm FL sampled from rotary and minnow traps near Canyon Island, Taku River, during 1996 and mean length (mid-eye to fork of tail) and age composition of mature coho salmon sampled from fish wheels at Canyon Island during 1997.

SMOLT SAMPLED IN 1996

	Parent year			
	1995 Age 0.0	1994 Age 1.0	1993 Age 2.0	Total
Number sampled	2	522	17	541
Mean length (mm)	74	88	126	89
SD	1	12	14	14
SE	1.00	0.53	3.29	0.59
Percent composition	0.4%	96.5%	3.1%	100%
SE	0.3%	0.8%	0.8%	

ADULTS SAMPLED IN 1997

	Parent year		
	1994 Age 1.1	1993 Age 2.1	Total
Number sampled	309	169	478
Mean length (mm)	575	603	585
SD	77	72	77
SE	4.4	5.5	3.5
Percent	64.6%	35.4%	100%
SE	2.2%	2.2%	

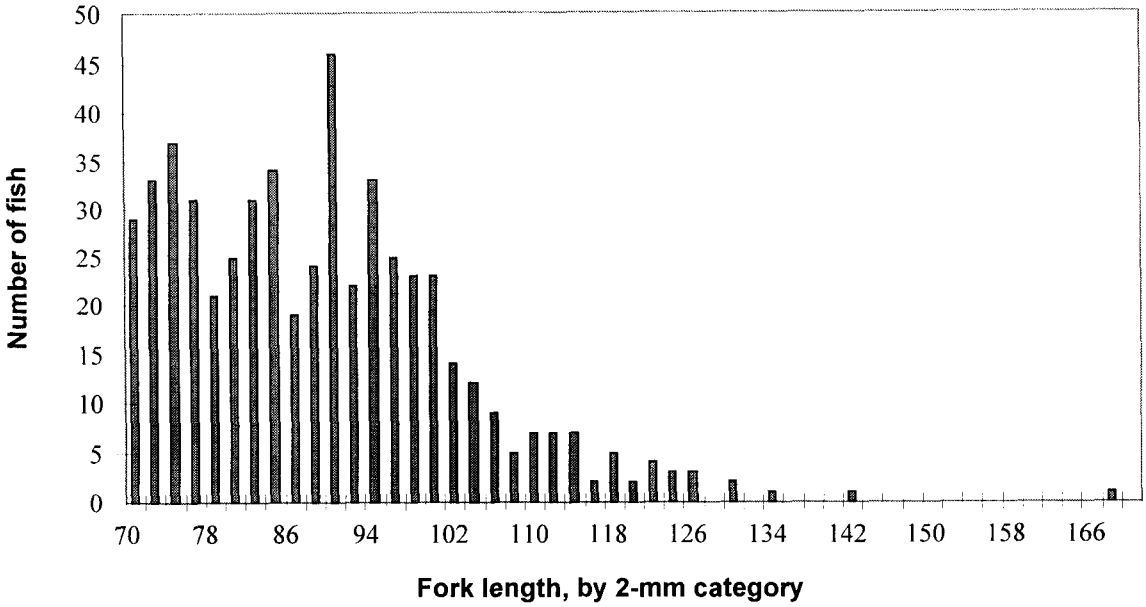

Figure 5.–Length frequency of coho salmon smolt ≥70 mm FL captured and measured at Canyon Island, Taku River, 1996.

Coho salmon bearing Canyon Island tags recovered in the District 111 gillnet fishery were all recovered in August, after which this fishery was closed (Table 4). In the Northwest Quadrant of the troll fishery, recoveries of tag code 04-42-33 were highest earlier in the season. This was due, in large part, to closure of the northern entry corridor in September (see Discussion).

Estimates of θ and smolt abundance

The estimate of θ was 0.0129 (= 22/1,704) with SE = 0.0027, and the estimate of smolt abundance above Canyon Island $\hat{N}_s$ for 1996 is 759,763 [= 10,249 $(1{,}704+1)(22+1)^{-1}$] with SE = 154,051. Both estimates were based on 1,704 coho salmon adults inspected in 1997 from catches in two fish wheels operated at Canyon Island and the test fishery just above Canyon Island (Appendix A3). Twenty-two (22) of the fish inspected were missing adipose fins, and all were sacrificed to determine the tag codes present; 20 contained Canyon Island tags implanted the previous year, and two heads were lost in transit to the tag lab. We assumed the two lost heads bore valid Canyon Island tags from 1996, since past sampling at Canyon Island yielded only tags of Canyon Island origin, the incidence of naturally-missing adipose fins has been low, and tag retention has been high (McPherson et al. 1997).

Estimates of Harvest, Escapement and Exploitation in 1997

An estimated 15,825 (SE = 2,690) coho salmon originating above Canyon Island were harvested in marine commercial and sport fisheries in 1997 (Table 5). The troll fishery in the Northwest Quadrant took 55.8% of the estimated marine harvest, and the drift gillnet fishery in Taku Inlet/Stephens Passage took 9.4% (Table 6). Almost all of the harvests in these two fisheries occurred in July and August, due primarily to management restrictions in Sept. The troll harvest was spread over a long period (July to mid-Sept.), and all of the gillnet harvests occurred in August (Figure 6). Estimated mean date of harvest in the troll fishery was 11 August, compared to 20 August for the gillnet fishery (Appendix A4). Coho

Table 4.–Frequency of CWTs recovered during sampling of the harvest of coho salmon in the drift gillnet fishery in District 111 and in the troll fishery in the Northwest Quadrant in 1997. Recoveries are from smolt marked at Canyon Island in 1996 with tag code 04-42-33, plus four other tag codes from Canyon Island.

PANEL A:
DISTRICT 111 GILLNET FISHERY

Stat. week	Date	Tag code 04-42-33[a]	Sampled harvest	Percent marked	Total harvest	Percent sampled
25	Jun 15–21					
26	22–28					
27	29–05				3	0.0
28	Jul 6–12		5		15	33.3
29	13–19		21		13	161.5
30	20–26		19		58	32.8
31	27–02		70		205	34.1
32	Aug 03–09	3	250	1.20	248	100.8
33	10–16	3	465	0.65	638	72.9
34	17–23	3	641	0.47	835	76.8
35	24–30	7	1,275	0.55	1,499	85.1
36	31–06		fishery	closed		
37	Sep 07–13		fishery	closed		
38	14–20		fishery	closed		
Total		16	2,746	0.58	3,514	78.1
25-33	6/15–8/16	6	830	0.723	1,180	70.3
34-35	8/17–8/30	10	1,916	0.522	2,334	82.1
36-38	8/31–9/20		fishery	closed		
Total		16	2,746	0.58	3,514	78.1

PANEL B:
NORTHWEST QUADRANT TROLL FISHERY

27-33	6/29–8/16	17	159,835	0.011	516,258	31.0
34-35	8/17–8/30	13	54,315	0.024	189,801	28.6
36-40	8/31–10/4	4	53,340	0.007	158,073	33.7
Total		34	267,490	0.013	864,132	31.0

[a] Also included are: one tag code 04-42-12 (<70 mm FL marked in 1995) recovered in week 29; one tag code 04-42-34 (marked as a chinook in 1996) recovered in week 32; and two tag codes 04-42-32 (≥70 mm FL marked in 1995)—one recovered in week 32 and one in week 34.

salmon originating above Canyon Island contributed an estimated 42% (1,489 fish) of the District 111 gillnet catch (3,515 fish). Fifty percent of the estimated harvest occurred by 23 August, which is similar to 1995 but later than 1994 and 1996 (McPherson and Bernard 1995, 1996; McPherson et al. 1997).

Estimated harvest in the Juneau marine recreational fishery is 4,963 fish—or 31% of all estimated harvest and 40% of the estimated 12,477 coho salmon caught in the Juneau marine fishery, using harvest and sampling data from Hubartt et al. (*In press*).

Table 5.–Estimated marine harvest of adult coho salmon bound for the Taku River in 1997, with $\hat{\theta}$ = 0.0129 and $G[\hat{\theta}^{-1}]$ = 0.061. In fishing periods and fishing quadrants for which no CWT was recovered with the appropriate code, harvest was assumed to be zero.

TROLL FISHERY

Stat. Wk.	Dates	Per.	Quad.	N	v[$\hat{N}$]	n	a	a'	t	t'	m_c	$\hat{r}$	SE[$\hat{r}$]	RP[$\hat{r}$]
27-33	6/29-8/16	3	NW	516,258	0	159,835	2,342	2,301	1,868	1,867	17	4,331	1,476	66.8%
34-35	8/17-8/30	4	NW	189,801	0	54,315	944	934	790	790	13	3,556	1,297	71.5%
36-40	8/31-10/4	5	NW	158,073	0	53,340	1,311	1,290	1,115	1,113	4	935	508	106.4%
Subtotal troll fishery				864,132	0	267,490	4,597	4,525	3,773	3,770	34	8,822	2,029	45.1%

GILLNET FISHERY

Stat. Wk.	Dates	District	N	v[$\hat{N}$]	n	a	a'	t	t'	m_c	$\hat{r}$	SE[$\hat{r}$]	RP[$\hat{r}$]
32	8/3-8/9	111	248	0	250	3	3	3	3	3	231	140	119.2%
33	8/10-8/16	111	638	0	465	10	10	7	7	3	319	194	119.4%
34	8/17-8/23	111	835	0	641	9	9	7	7	3	303	184	119.4%
35	8/24-8/30	111	1,499	0	1,275	53	53	47	47	7	637	281	86.3%
Subtotal gillnet fishery			3,220	0	2,631	75	75	64	64	16	1,489	412	54.3%

SPORT FISHERY

Biweek	Dates	Derby	Area	$\hat{N}$	v[$\hat{N}$]	n	a	a'	t	t'	m_c	$\hat{r}$	SE[$\hat{r}$]	RP[$\hat{r}$]
15	7/21-8/3	No	Juneau	1,290	82,691	163	2	2	2	2	1	613	613	195.9%
16	8/4-8/17	No	Juneau	2,423	160,692	421	9	8	8	8	1	501	501	195.8%
17	8/18-8/31	Yes	Juneau	1,597	0	1,597	52	52	46	46	3	232	141	119.2%
17	8/18-8/31	No	Juneau	1,825	367,787	539	12	10	10	10	4	1,259	769	119.7%
18	9/1-9/14	No	Juneau	3,624	396,104	659	41	31	29	29	3	1,690	1,059	122.8%
19	9/15-9/28	No	Juneau	974	115,400	113	3	3	3	3	1	668	667	195.9%
Subtotal sport fishery				11,733	1,122,674	3,492	119	106	98	98	13	4,963	1,674	66.1%

SEINE FISHERY

Stat. wk.	Dates	District	$\hat{N}$	v[$\hat{N}$]	n	a	a'	t	t'	m_c	$\hat{r}$	SE[$\hat{r}$]	RP[$\hat{r}$]
32	8/3-8/9	112	215	0	148	1	1	1	1	1	113	112	195.2%
33	8/10-8/16	112	3,839	0	812	18	18	14	14	1	366	366	195.7%
35	8/24-8/30	114	2,094	0	2,274	55	55	49	49	1	71	71	194.7%
Subtotal seine fishery			6,148	0	3,234	74	74	64	64	3	550	389	138.6%
TOTAL			879,085	1,122,674	273,613	4,791	4,706	3,935	3,932	66	15,825	2,690	33.3%

Table 6.–Estimated harvest, exploitation, and total run of Taku River coho salmon from above Canyon Island in 1997.

Fishery	Area	Estimated harvest	SE	Percent of marine harvest	Percent of total run	Removal Rate[a]
U.S. troll fishery	NW Quad	8,822	2,029	55.8%	17.3%	
	Subtotal	8,822	2,029	55.8%	17.3%	17.3%
Drift gillnet	Dist. 111	1,489	412	9.4%	2.9%	
	Subtotal	1,489	412	9.4%	2.9%	4.1%
Seine fishery	Dist. 112	479	383	3.0%	0.9%	
	Dist. 114	71	71	0.4%	0.1%	
	Subtotal	550	389	3.5%	1.1%	1.3%
Recreational	Juneau	4,963	1,674	31.4%	9.8%	
	Subtotal	4,963	1,674	31.4%	9.8%	12.0%
Total marine harvest		15,825	2,690	100%	31.1%	31.1%
Escapement		32,345			63.6%	
Canadian catch		2,690			5.3%	7.7%
Inriver run		35,035	4,160			
TOTAL RUN		50,860	4,954			

[a]Percent of available population harvested by a fishery.

An estimated 50,860 (SE = 4,954) coho salmon bound for spawning grounds near or above Canyon Island returned in 1997, making the estimated marine survival rate 6.7% (SE = 1.5%) and the estimated exploitation rate in marine commercial and sport fisheries 31.1% (SE = 4.4%; Appendix A5). An estimated 35,035 (SE = 4,160) adult coho salmon migrated past Canyon Island prior to 1 October (Kelley and Milligan 1998), and this number is considered to constitute the entire run for the year. Inriver harvest above Canyon Island was 2,690 in 1997, making 32,345 (SE = 4,160) the estimated escapement for the year.

Age composition of adult coho salmon sampled from catches in Canyon Island fish wheels in 1997 was 64.6% (SE = 2.2%) age 1.1 and 35.4% (SE = 2.2%) age 2.1 (Table 3), and the mean length of adults at Canyon Island was 585 mm (SE = 3.5) mid-eye to fork of tail.

DISCUSSION

Smolt captured and tagged in 1996 were slightly smaller in size than smolt captured and tagged from 1991–1995 on the Taku River. In 1996, smolt captured at Canyon Island averaged 89 mm FL, compared to 94 mm FL in 1995 (McPherson et al. 1997), 101 mm FL in 1994 (McPherson and Bernard 1996), 98 mm in 1993 (McPherson and Bernard 1995), 105 mm at Barrel Point in 1992 (McPherson et al. 1994), and 100 mm at Barrel Point in 1991 (Elliott and Bernard 1994). In 1996, 61% of coho ≥70 mm FL tagged

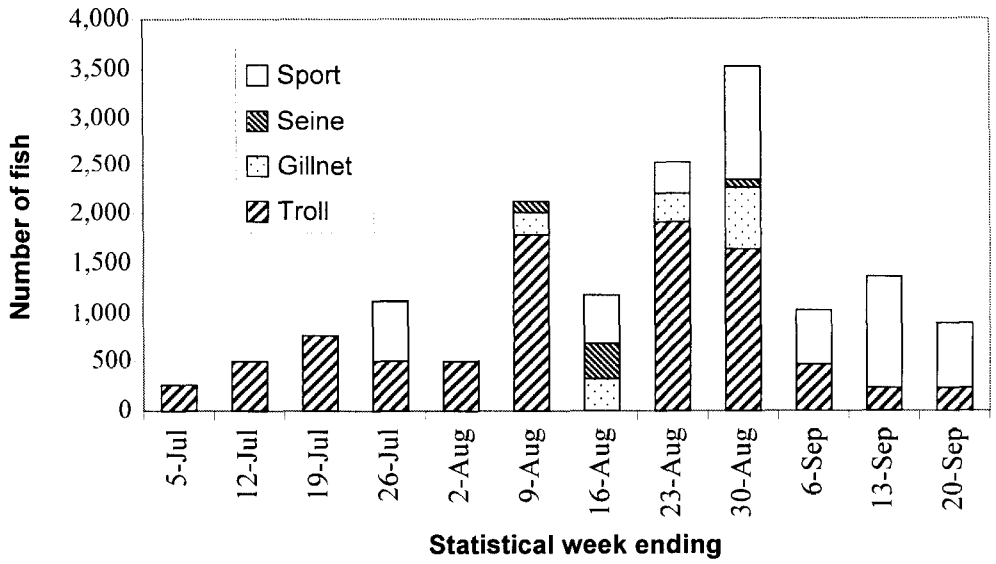

Figure 6.–Estimated harvest of coho salmon bound for Taku River by marine commercial and recreational fisheries in 1997 by statistical week. Weekly estimates of harvest in the troll fishery are approximated.

were caught in minnow traps, which may catch smaller fish, whereas in previous years almost all coho tagged were caught in rotary screw traps.

Age composition of coho salmon sampled from smolt catches in 1996 at Canyon Island were significantly different (χ^2 = 178, df = 2, P<0.001) from adults sampled from fish wheel catches in 1997 at Canyon Island; e.g., smolt captured were 97% age 1. whereas adults were 65% age 1. This difference may be due to:

- size selection for smaller (younger) smolt in sampling;
- rearing below Canyon Island of progeny of spawners above Canyon Island that migrate to the lower river midsummer and spend a second year rearing before smoltification as documented by Murphy et al. (1988); and/or
- younger smolt survive at a lower rate than do older smolt.

If coho smolt catches were biased toward smaller fish and smaller smolt had a lower survival rate, our estimate of smolt abundance is biased high and our estimate of marine survival rate is biased low.

Our estimated marine survival rate (6.7%) is less than estimated for other wild stocks in Southeast Alaska for 1997; estimated marine survivals were 19% for Auke Lake, 12% for Berners River and 8% for Hugh Smith Lake (L. Shaul, ADF&G, CMDD, Douglas; personal communication).

Circumstances and results indicate that the other conditions for obtaining accurate estimates of smolt abundance with mark-recapture experiments were met. Bailey's modification of the Petersen estimate was used because of the systematic nature of sampling smolts and adults (see below). While the population in this experiment was not closed to losses from mortality, it was closed to recruitment, because salmon return to their natal stream to spawn. The models we used to estimate harvest of coho salmon from the Taku River are based on sampling as a random process, yet our capture of smolts at Canyon Island and catch sampling of harvests were not random, but systematic. Representative samples can be drawn with a systematic process only if (1) every smolt has an equal chance of being marked, (2) every adult has an equal chance of being sampled, or (3) marked and unmarked fish mix completely between sampling events.

Our fishing effort near Canyon Island for smolt was relatively constant in minnow traps for the season and for all four rotary traps after mid-May in 1996. Also, the drawn-out recovery of CWTs indicated considerable mixing of marked and unmarked coho salmon during their 14 to 16 months at sea (see Table 5).

Tagging a representative sample of smolt or having tagged and untagged fish mix completely are also crucial to accurately estimating harvest of adult coho salmon. The marked fraction of CWTd coho in catches in the Canyon Island fish wheels increased slightly through the season, as judged from dividing catches into three equal periods of abundance. The marked fraction was 0.007 (4/549) from 3 July to 25 August, 0.013 (7/560) from 26 August to 12 Sept. and 0.018 (10/556) from 13 Sept. to 1 October. No significant difference was detected amongst the three periods ($\chi^2 = 2.54$, df = 2, P = 0.28). The test of this data was of limited power due to sample sizes.

Our estimates of escapement (32,345), catch (15,825 + 2,690) and total run (50,860) are minimum estimates of those parameters for the Taku River, because many fish spawn downstream of Canyon Island. As much as 22% of the spawning occurs below the Canadian border (Eiler et al. *In press*), and only a small portion of the U.S. population is believed to spawn above Canyon Island. Using that expansion, we estimated escapement in the entire Taku River in 1997 at 42,227 ([32,345 + 2,690]/0.78 – 2,690), marine harvest at 20,288 (15,825/0.78), and total run at 65,205. Exploitation rate (31.1%) and marine survival (6.7%) remain the same as for estimates for fish from above Canyon Island. Estimated harvest of all coho salmon from the Taku River to the Juneau area marine boat fishery are 6,363 (4,963/0.78) or 51% of the sport harvest of 12,477 coho salmon.

Results from this project are contributing to development of a long-term database. We estimated smolt production in 1996 and adult production in 1997, the sixth consecutive year these parameters have been estimated for this population (see Appendix A5). Escapements have been estimated since 1987 by CFMD, DFO and SFD (see Appendices A6 and A7). This program is already providing valuable management tools, such as inseason assessment of run strength. For example, in mid-August of the 1997 season, estimates of escapement and total harvest were estimated at less than 20% of average. After two weeks of additional monitoring of the Taku and other CWTd northern inside stocks (Berners River and Auke Lake), run strength did not improve. The cumulative marine harvest of Taku River coho was estimated to be about 14% of average and the inriver run above Canyon Island was projected to be about 18,000 coho salmon (including inriver harvest) for the season. It was projected that, without fishery conservation measures, that the escapement would fall well below the escapement goal range of 27,500 to 35,000 coho spawners. As a result, several fishery restrictions were put in place at the end of August: (1) the Taku Inlet gillnet fishery was closed for the season, (2) the northern inside migratory corridor (from Cape Fairweather to Yakobi Island, all of Icy Strait, upper Chatham Strait, etc.) was closed to commercial trolling and (3) the bag limit was reduced and the area around Taku Inlet was closed in the Juneau marine recreational fishery. Additionally, the inriver harvest in Canada was the lowest in more than 10 years (Appendix A5). Without these restrictions we would not have achieved an escapement of 32,345 fish.

CONCLUSION AND RECOMMENDATIONS

Since this project is planned to continue annually, we recommend some strategies to improve the precision of smolt and adult parameter estimates. First, precision of estimates of harvest, particularly in the sport fishery, and smolt abundance can be improved by tagging more smolt with CWTs. This may be accomplished by starting slightly earlier to cover a greater proportion of smolt emigration and by deploying more or different trapping gear and

improving the gear currently deployed; a greater number of tags would then be recovered from the fisheries. Also the precision of θ would be improved during recovery of adults from inriver fish wheels. Second, we can test whether θ is time invariant during the return migration. We also test for size selectivity of coho salmon in the minnow traps and rotary screw traps.

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APPENDIX A

Appendix A1.–Bibliography of historical stock assessment studies conducted on the Taku River.

Citation	Location	Objective
Eiler et al. *in press*	Taku River	Spawning distribution
Elliott 1987	Yehring Creek	1986 escapement
Elliott and Kuntz 1988	Yehring Creek	1987 smolt samples 1987 escapement
Elliott et al. 1989	Yehring Creek	1988 harvest and escapement 1987 smolt abundance and survival 1988 smolt abundance
	Nahlin River	1988 harvest and escapement 1988 juvenile tagging
Elliott and Sterritt 1990	Yehring Creek	1989 harvest and escapement 1988 smolt abundance and survival 1989 smolt abundance
Elliott and Sterritt 1991	Yehring Creek	1990 harvest and escapement 1989 smolt abundance and survival
	Nahlin River	1990 smolt tagging
Elliott 1992	Yehring Creek	Smolt capture methods
Elliott and Bernard 1994	Taku River	1991 smolt abundance and 1992 adult harvest and escapement
Gray et al. 1978	Moose Creek	Harvest estimate
	Johnson Creek	Harvest estimate
	Yehring Creek	Harvest estimate
	Other tribs.	Harvest estimate
Kelley et al. 1997	Taku River	1995 escapement
Kelley and Milligan 1997	Taku River	1996 escapement
Kelley and Milligan 1998	Taku River	1997 escapement
McGregor and Clark 1988	Taku River	Estimated escapement
McGregor and Clark 1989	Taku River	Estimated escapement
McGregor et al. 1991	Taku River	Estimated escapement
McPherson et al. 1994	Taku River	1992 smolt abundance and survival 1993 harvest and escapement
McPherson and Bernard 1995	Taku River	1993 smolt abundance and survival 1994 harvest and escapement
McPherson and Bernard 1996	Taku River	1994 smolt abundance and survival 1995 harvest and escapement
McPherson et al. 1997	Taku River	1995 smolt abundance and survival 1996 harvest and escapement
Murphy et al. 1988	Taku River	1987 smolt tagging
PSC 1993	Taku River	Estimated escapement
Shaul 1987	Nahlin River	1986 escapement 1986 juvenile tagging
	Tatsamenie L.	1986 escapement
Shaul 1987	Tatsamenie L.	1986 juvenile tagging
	Dudidontu R.	1986 escapement

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Citation	Location	Objective
Shaul 1988	Tatsamenie L.	1987 juvenile tagging
Shaul 1989	Nahlin River	1988 harvest
	Mainstem	1988 harvest
	Tatsamenie L.	1988 harvest
	Sheslay R.	1988 harvest
	Yehring Creek	1988 harvest
	U.S. tribs.	1988 escapement
Shaul 1990	Nahlin River	1989 harvest
	Mainstem	1989 harvest
	Tatsameni L.	1989 harvest
	Yehring Creek	1989 harvest
	U.S. tribs.	1989 escapement
Shaul 1992	Nahlin River	1990 harvest
	Mainstem	1990 harvest
	Tatsameni L.	1990 harvest
	Yehring Creek	1990 harvest
	U.S. tribs.	1990 escapement

Appendix A2.–Random and select recoveries of coded wire tagged coho salmon bound for Taku River above Canyon Island in 1997.

Head. number	Tag code	Gear	Recovery date	Stat. week	Quad-rant	District	Sub-dist.	Length	N	n	a	a'	t	t'
RANDOM RECOVERIES														
15148	44233	TROLL	5-Jul-97	27	NW	113	91	600	516,258	159,835	2,342	2,301	1,868	1,867
123383	44233	TROLL	8-Jul-97	28	NW	113	91	622	516,258	159,835	2,342	2,301	1,868	1,867
118171	44233	TROLL	10-Jul-97	28	NW	116	14	665	516,258	159,835	2,342	2,301	1,868	1,867
6513	44233	TROLL	15-Jul-97	29	NW			602	516,258	159,835	2,342	2,301	1,868	1,867
63419	44233	TROLL	18-Jul-97	29	NW	113	45	551	516,258	159,835	2,342	2,301	1,868	1,867
119283	44212	TROLL	19-Jul-97	29	NW			580	516,258	159,835	2,342	2,301	1,868	1,867
12955	44233	TROLL	24-Jul-97	30	NW	113	91	487	516,258	159,835	2,342	2,301	1,868	1,867
15543	44233	TROLL	26-Jul-97	30	NW	113	91	641	516,258	159,835	2,342	2,301	1,868	1,867
13103	44233	TROLL	31-Jul-97	31	NW	116	12	561	516,258	159,835	2,342	2,301	1,868	1,867
15621	44233	TROLL	2-Aug-97	31	NW	116	11	657	516,258	159,835	2,342	2,301	1,868	1,867
123446	44233	TROLL	4-Aug-97	32	NW	116		475	516,258	159,835	2,342	2,301	1,868	1,867
119666	44234	TROLL	5-Aug-97	32	NW	113	91	696	516,258	159,835	2,342	2,301	1,868	1,867
45136	44232	TROLL	6-Aug-97	32	NW	189		580	516,258	159,835	2,342	2,301	1,868	1,867
123460	44233	TROLL	7-Aug-97	32	NW	114	21	540	516,258	159,835	2,342	2,301	1,868	1,867
13088	44233	TROLL	7-Aug-97	32	NW	116	11	590	516,258	159,835	2,342	2,301	1,868	1,867
13087	44233	TROLL	7-Aug-97	32	NW	116	11	642	516,258	159,835	2,342	2,301	1,868	1,867
15674	44233	TROLL	8-Aug-97	32	NW	114		667	516,258	159,835	2,342	2,301	1,868	1,867
123474	44233	TROLL	19-Aug-97	34	NW	114	21	660	189,801	54,315	944	934	790	790
13194	44232	TROLL	20-Aug-97	34	NW	113	91	675	189,801	54,315	944	934	790	790
63902	44233	TROLL	20-Aug-97	34	NW	113	45	648	189,801	54,315	944	934	790	790
15709	44233	TROLL	20-Aug-97	34	NW	114		665	189,801	54,315	944	934	790	790
15726	44233	TROLL	21-Aug-97	34	NW			666	189,801	54,315	944	934	790	790
64923	44233	TROLL	22-Aug-97	34	NW	113		705	189,801	54,315	944	934	790	790
13299	44233	TROLL	23-Aug-97	34	NW	113	91	604	189,801	54,315	944	934	790	790
13342	44233	TROLL	24-Aug-97	35	NW	113	91	766	189,801	54,315	944	934	790	790
15850	44233	TROLL	25-Aug-97	35	NW	114	25	610	189,801	54,315	944	934	790	790
6418	44233	TROLL	25-Aug-97	35	NW			655	189,801	54,315	944	934	790	790
62062	44233	TROLL	25-Aug-97	35	NW			700	189,801	54,315	944	934	790	790
15866	44233	TROLL	26-Aug-97	35	NW	114	25	627	189,801	54,315	944	934	790	790
15859	44233	TROLL	27-Aug-97	35	NW	114	25	612	189,801	54,315	944	934	790	790
13687	44233	TROLL	1-Sep-97	36	NW	113	91	725	158,073	53,340	1,311	1,290	1,115	1,113
45208	44233	TROLL	6-Sep-97	36	NW	189	30	736	158,073	53,340	1,311	1,290	1,115	1,113
86027	44233	TROLL	8-Sep-97	37	NW	113	91	730	158,073	53,340	1,311	1,290	1,115	1,113
79845	44233	TROLL	15-Sep-97	38	NW	113	91	683	158,073	53,340	1,311	1,290	1,115	1,113
35222	44233	SEINE	5-Aug-97	32	NE	112	16	555	215	148	1	1	1	1
6337	44233	SEINE	13-Aug-97	33	NE	112	16	490	215	148	1	1	1	1
6441	44233	SEINE	26-Aug-97	35	NW	114	27	600	2,094	2,274	55	55	49	49
1808	44233	SPORT	26-Jul-97	30	NE	111	50		1,290	163	2	2	2	2
1810	44233	SPORT	15-Aug-97	33	NE	111	50		2,423	421	9	8	8	8
1562	44233	SPORT	20-Aug-97	34	NE	111	50		1,825	539	12	10	10	10
70629	44233	SPORT	24-Aug-97	35	NE			480	1,597	1,597	52	52	46	46
1568	44233	SPORT	26-Aug-97	35	NE	111	50		1,825	539	12	10	10	10
79148	44233	SPORT	27-Aug-97	35	NE			705	1,597	1,597	52	52	46	46
79146	44233	SPORT	27-Aug-97	35	NE			778	1,597	1,597	52	52	46	46
1812	44233	SPORT	28-Aug-97	35	NE	111	40		1,825	539	12	10	10	10
1972	44233	SPORT	29-Aug-97	35	NE	111	50	715	1,825	539	12	10	10	10

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Head. number	Tag code	Gear	Recovery date	Stat. week	Quad-rant	District	Sub-dist.	Length	N	n	a	a'	t	t'
1988	44233	SPORT	6-Sep-97	36	NE	111	50		3,624	659	41	31	29	29
1999	44233	SPORT	7-Sep-97	37	NE	111	50	595	3,624	659	41	31	29	29
1997	44233	SPORT	7-Sep-97	37	NE	112	16	715	3,624	659	41	31	29	29
1817	44233	SPORT	20-Sep-97	38	NE	111	40		974	113	3	3	3	3
6332	44233	GILLNET	5-Aug-97	32	NE	111		495	248	250	3	3	3	3
6331	44233	GILLNET	5-Aug-97	32	NE	111		654	248	250	3	3	3	3
10831	44233	GILLNET	6-Aug-97	32	NE	111	32	682	248	250	3	3	3	3
10834	44233	GILLNET	11-Aug-97	33	NE	111	32	675	638	465	10	10	7	7
6499	44233	GILLNET	12-Aug-97	33	NE	111		566	638	465	10	10	7	7
6495	44233	GILLNET	12-Aug-97	33	NE	111		617	638	465	10	10	7	7
6712	44233	GILLNET	19-Aug-97	34	NE	111		635	835	641	9	9	7	7
6710	44233	GILLNET	19-Aug-97	34	NE	111		656	835	641	9	9	7	7
6711	44233	GILLNET	19-Aug-97	34	NE	111		700	835	641	9	9	7	7
6797	44233	GILLNET	27-Aug-97	35	NE	111	32	590	1,499	1,275	53	53	47	47
10875	44233	GILLNET	27-Aug-97	35	NE	111	32	590	1,499	1,275	53	53	47	47
6794	44233	GILLNET	27-Aug-97	35	NE	111	32	622	1,499	1,275	53	53	47	47
6791	44233	GILLNET	27-Aug-97	35	NE	111	32	671	1,499	1,275	53	53	47	47
34638	44233	GILLNET	27-Aug-97	35	NE	111		645	1,499	1,275	53	53	47	47
34636	44233	GILLNET	27-Aug-97	35	NE	111		709	1,499	1,275	53	53	47	47
34639	44233	GILLNET	27-Aug-97	35	NE	111		752	1,499	1,275	53	53	47	47
88962	44233	ESC. SURV.	6-Aug-97	32	NE	111	32	565						
88963	44233	ESC. SURV.	9-Aug-97	32	NE	111	32	445						
88964	44233	ESC. SURV.	10-Aug-97	33	NE	111	32	710						
88965	44233	ESC. SURV.	16-Aug-97	33	NE	111	32	475						
88969	44233	ESC. SURV.	28-Aug-97	35	NE	111	32	600						
88970	44233	ESC. SURV.	31-Aug-97	36	NE	111	32	465						
88971	44233	ESC. SURV.	1-Sep-97	36	NE	111	32	665						
88972	44233	ESC. SURV.	2-Sep-97	36	NE	111	32	680						
88973	44233	ESC. SURV.	10-Sep-97	37	NE	111	32	700						
88974	44233	ESC. SURV.	11-Sep-97	37	NE	111	32	680						
88975	44233	ESC. SURV.	11-Sep-97	37	NE	111	32	680						
88976	44233	ESC. SURV.	13-Sep-97	37	NE	111	32	680						
88977	44233	ESC. SURV.	14-Sep-97	38	NE	111	32	460						
88978	44233	ESC. SURV.	16-Sep-97	38	NE	111	32	745						
88979	44233	ESC. SURV.	19-Sep-97	38	NE	111	32	655						
88981	44233	ESC. SURV.	20-Sep-97	38	NE	111	32	655						
88980	44233	ESC. SURV.	20-Sep-97	38	NE	111	32	700						
88982	44233	ESC. SURV.	21-Sep-97	39	NE	111	32	675						
88983	44233	ESC. SURV.	23-Sep-97	39	NE	111	32	660						
88984	LOST	ESC. SURV.	26-Sep-97	39	NE	111	32							
88985	LOST	ESC. SURV.	27-Sep-97	39	NE	111	32							
122577	44233	TEST FISH.	2-Oct-97	39	NE	111	32	680						
SELECT RECOVERIES														
15603	44233	TROLL	29-Jul-97	31	NW	113	91	670	516,258	159,835	2,342	2,301	1,868	1,867
61399	44233	TROLL	29-Jul-97	31										

Appendix A3.–Numbers of coded wire tagged and untagged coho salmon in samples of immigrating salmon at Canyon Island fish wheels and test fishery in 1997.

Date	Number examined	Number of clips	Valid tags	Head number	Tag code	Release site
			EXAMINED AT FISH WHEELS			
03-Jul	1					
04-Jul	0					
05-Jul	0					
06-Jul	0					
07-Jul	0					
08-Jul	0					
09-Jul	1					
10-Jul	0					
11-Jul	0					
12-Jul	0					
13-Jul	0					
14-Jul	2					
15-Jul	0					
16-Jul	0					
17-Jul	1					
18-Jul	0					
19-Jul	0					
20-Jul	0					
21-Jul	1					
22-Jul	2					
23-Jul	4					
24-Jul	5					
25-Jul	1					
26-Jul	0					
27-Jul	0					
28-Jul	3					
29-Jul	5					
30-Jul	13					
31-Jul	7					
01-Aug	6					
02-Aug	13					
03-Aug	29					
04-Aug	24					
05-Aug	28					
06-Aug	22	1	1	88962	04-42-33	Canyon Island
07-Aug	19					
08-Aug	20					
09-Aug	33	1	1	88963	04-42-33	Canyon Island
10-Aug	29	1	1	88964	04-42-33	Canyon Island
11-Aug	15					
12-Aug	9					
13-Aug	1					
14-Aug	0					
15-Aug	3					
16-Aug	55	1	1	88965	04-42-33	Canyon Island
17-Aug	33					
18-Aug	14					
19-Aug	16					
20-Aug	15					
21-Aug	20					
22-Aug	16					

-continued-

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Date	Number examined	Number of clips	Valid tags	Head number	Tag code	Release site
23-Aug	19					
24-Aug	26					
25-Aug	38					
26-Aug	19					
27-Aug	40					
28-Aug	40	1	1	88969	04-42-33	Canyon Island
29-Aug	17					
30-Aug	25					
31-Aug	36	1	1	88970	04-42-33	Canyon Island
01-Sep	26	1	1	88971	04-42-33	Canyon Island
02-Sep	30	1	1	88972	04-42-33	Canyon Island
03-Sep	25					
04-Sep	22					
05-Sep	32					
06-Sep	31					
07-Sep	32					
08-Sep	6					
09-Sep	39					
10-Sep	52	1	1	88973	04-42-33	Canyon Island
11-Sep	32	1	1	88974	04-42-33	Canyon Island
		1	1	88975	04-42-33	Canyon Island
12-Sep	56					
13-Sep	52	1	1	88976	04-42-33	Canyon Island
14-Sep	49	1	1	88977	04-42-33	Canyon Island
15-Sep	42					
16-Sep	42	1	1	88978	04-42-33	Canyon Island
17-Sep	13					
18-Sep	7					
19-Sep	29	1	1	88979	04-42-33	Canyon Island
20-Sep	78	1	1	88981	04-42-33	Canyon Island
		1	1	88980	04-42-33	Canyon Island
21-Sep	58	1	1	88982	04-42-33	Canyon Island
22-Sep	28					
23-Sep	22	1	1	88983	04-42-33	Canyon Island
24-Sep	0					
25-Sep	0					
26-Sep	31	1		88984	LOST	assume Canyon Island
27-Sep	53	1		88985	LOST	assume Canyon Island
28-Sep	17					
29-Sep	21					
30-Sep	12					
1-Oct	2					
Total	1,665	21	19			
			TEST FISHERY			
27-Sep – 2-Oct	39	1	1	122577	04-42-33	Canyon Island
Grand Total	1,704	22	20			
Marked fraction [$\hat{\theta}$]		0.0129				
SE[$\hat{\theta}$]		0.0027				

Appendix A4.–Estimated harvests of coho salmon bound for Taku River above Canyon Island in 1997 in marine commercial and sport fisheries by statistical week. Harvest in the troll fishery (NW Quadrant) was approximated by weighting period catches by the number of tags recovered in a statistical week.

		Estimated harvest by fishery									
		Troll Northwest Quadrant									
Stat week	Ending date	NW troll tags	NW Quad. troll period	NW Quad. troll stat. week	Gillnet	Seine	Sport	TOTAL	Estimated weekly prop. harvest	Estimated cum. total harvest	Estimated cum. prop. harvest
27	5-Jul	1		255				255	0.02	255	0.02
28	12-Jul	2		510				510	0.03	764	0.05
29	19-Jul	3		764				764	0.05	1,529	0.10
30	26-Jul	2		510			613	1,123	0.07	2,651	0.17
31	2-Aug	2		510				510	0.03	3,161	0.20
32	9-Aug	7		1,783	231	113		2,126	0.13	5,287	0.33
33	16-Aug	0	4,331	0	319	366	501	1,187	0.07	6,474	0.41
34	23-Aug	7		1,915	303		315	2,532	0.16	9,006	0.57
35	30-Aug	6	3,556	1,641	637	71	1,176	3,527	0.22	12,532	0.79
36	6-Sep	2		467			563	1,031	0.07	13,563	0.86
37	13-Sep	1		234			1,127	1,360	0.09	14,924	0.94
38	20-Sep	1		234			668	901	0.06	15,825	1.00
39	27-Sep	0									
40	4-Oct	0	935								
Total		34	8,822	8,822	1,489	550	4,963	15,825	1.000		
Estimated mean date of harvest				11-Aug.	20-Aug.	13-Aug.	27-Aug.	17-Aug.			

Appendix A5.–Summary of population parameters for the Taku River coho salmon run, 1987–1997.

COHO SALMON FROM ABOVE CANYON ISLAND NEAR CANADIAN BORDER

Calendar year	Escape-ment	Canadian harvest	Inriver run	Est. U.S. marine harvest	Estimated total run	Total harvest rate	U.S. marine harvest Rate	Smolt in year t-1	Marine survival
1987	55,457	6,519	61,976						
1988	39,450	3,643	43,093						
1989	56,808	4,033	60,841						
1990	72,196	3,685	75,881						
1991	127,484	5,439	132,923						
1992	84,853	5,541	90,394	96,283	186,677	54.5%	51.6%	743,164	NE
1993	109,457	4,634	114,091	97,758	211,849	48.3%	46.1%	1,510,032	14.0%
1994	96,343	14,693	111,036	228,607	339,643	71.6%	67.3%	1,475,874	23.0%
1995	55,710	13,738	69,448	111,571	181,019	69.2%	61.6%	1,525,330	11.9%
1996	44,635	5,052	49,687	44,529	94,216	52.6%	47.3%	986,489	9.6%
1997	32,345	2,690	35,035	15,825	50,860	36.4%	31.1%	759,763	6.7%
Standard Errors									
1992			19,033	24,005	30,635		8.2%	247,000	
1993			17,503	19,256	26,022		6.2%	418,051	4.2%
1994			6,529	36,734	37,310		3.8%	368,411	6.3%
1995			3,242	12,186	12,610		2.8%	339,822	2.8%
1996			3,650	6,494	7,449		4.1%	214,152	2.2%
1997			4,120	2,690	4,920		4.4%	154,051	1.5%

COHO SALMON FROM ENTIRE TAKU RIVER DRAINAGE

Calendar year	Escape-ment	Canadian harvest	Inriver run	Est. U.S. marine harvest	Estimated total run	Total harvest rate	U.S. marine harvest Rate	Smolt in year t-1	Marine survival
1987	72,937	6,519	79,456						
1988	51,604	3,643	55,247						
1989	73,968	4,033	78,001						
1990	93,598	3,685	97,283						
1991	164,975	5,439	170,414						
1992	110,349	5,541	115,890	123,440	239,330	53.9%	51.6%	990,885	NE
1993	141,637	4,634	146,271	125,331	271,602	47.9%	46.1%	1,935,939	14.0%
1994	127,661	14,693	142,354	293,086	435,440	70.7%	67.3%	1,892,147	23.0%
1995	75,298	13,738	89,036	143,040	232,076	67.6%	61.6%	1,955,551	11.9%
1996	58,649	5,052	63,701	57,088	120,790	51.4%	47.3%	1,264,729	9.6%
1997	42,227	2,690	44,917	20,288	65,205	35.2%	31.1%	974,055	6.7%
Standard Errors									
1992			24,401	30,776	39,276		8.2%	374,000	
1993			22,440	24,687	33,362		6.2%	536,091	4.3%
1994			8,371	47,095	47,833		3.8%	472,321	6.3%
1995			4,156	15,623	16,167		2.8%	435,669	2.8%
1996			4,679	8,326	9,551		4.1%	274,554	2.2%
1997			5,282	3,449	6,308		4.4%	197,501	1.5%

Appendix A6.–Weekly and season estimates of inriver abundance, harvest and escapement of coho salmon in the Taku River, 1987–1997.

Recovery week	Year											1987–1997 average
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
27										45		45
28										464	5	235
29									1,460	853	106	806
30		548	1,425	1,479	2,517	3,298	641	3,348	2,628	1,525	134	1,754
31	3,841	1,060	878	2,186	2,209	1,741	2,386	5,026	4,582	2,159	843	2,446
32	2,529	1,526	2,693	1,051	4,157	10,040	3,186	3,988	2,100	6,216	738	3,475
33	3,623	1,257	300	1,910	4,867	4,875	4,550	4,308	5,299	5,337	1,265	3,417
34	4,721	7,412	9,598	11,095	1,740	500	12,759	9,827	8,764	6,589	1,542	6,777
35	3,503	8,366	8,385	17,739	27,296	2,170	3,424	15,029	10,565	7,861	2,589	9,721
36	4,061	5,583	14,038	17,855	5,924	13,332	19,703	7,904	10,951	7,362	3,028	9,976
37	3,843	11,371	10,181	12,563	17,411	14,601	15,427	34,400	7,118	2,900	10,211	12,730
38	6,009	1,446	3,351	9,596	4,708			13,583	5,889	1,312	10,236	6,237
39	11,440	4,524	8,031	407	9,100			787	2,109	1,549	1,462	4,379
40			1,960		33,009			443	273		2,875	7,712
41					11,371							11,371
42					4,410							4,410
43					4,204							4,204
MR total	43,570	43,093	60,841	75,881	132,923	50,557	62,076	98,643	61,738	44,172	35,035	64,412
SE	2,849	7,162	11,174	21,813	19,051	10,645	9,523	5,800	2,882	3,245	4,120	8,933
CV	6.5%	16.6%	18.4%	28.7%	14.3%	21.1%	15.3%	5.9%	4.7%	7.3%	11.8%	13.7%
Total inriver catch	6,519	3,643	4,033	3,685	5,439	5,541	4,634	14,693	13,738	5,052	2,690	6,333
Expanded total [a]	61,976	43,093	60,841	75,881	132,923	90,394	114,091	111,036	69,448	49,687	35,035	76,764
SE	4,053	7,162	11,174	21,813	19,051	19,033	17,503	6,529	3,242	3,650	4,120	10,666
Escapement above Canyon Island	55,457	39,450	56,808	72,196	127,484	84,853	109,457	96,343	55,710	44,635	32,345	70,431

[a] Expanded for end of season by migratory timing statistics for District 111 gillnet fishery.

Appendix A7.–Estimated age and length composition of coho salmon sampled from catches in fish wheels at Canyon Island, 1983–1997.

Year	Sample size	Percent by age class[a]					
		1.0	1.1	2.0	2.1	3.1	4.0
1983	476	0.0	64.7	0.0	35.3	0.0	0.0
1984	620	0.0	60.6	0.2	39.0	0.2	0.0
1985	772	0.0	53.0	0.0	46.6	0.4	0.0
1986	465	0.4	45.2	0.0	54.0	0.4	0.0
1987	654	0.2	37.3	0.3	61.5	0.6	0.2
1988	613	0.0	47.8	0.0	51.7	0.5	0.0
1989	624	0.0	58.2	0.0	41.5	0.3	0.0
1990	644	0.0	41.8	0.0	58.2	0.0	0.0
1991	569	0.0	61.5	0.0	38.5	0.0	0.0
1992	526	0.4	55.3	0.2	44.1	0.0	0.0
1993	567	0.0	47.9	0.4	51.5	0.2	0.0
1994	553	0.0	56.4	0.4	43.2	0.0	0.0
1995	599	0.0	53.9	0.0	46.1	0.0	0.0
1996	592	0.0	54.1	0.0	45.6	0.3	0.0
1997	472	0.0	64.6	0.0	35.4	0.0	0.0
Average(83–97)	583	0.1	53.4	0.1	46.6	0.2	0.0
SD(83–97)		0.1	8.1	0.2	7.9	0.2	0.1
CV(83–97)		217%	15%	156%	17%	110%	387%

Year	Sample size	Average length by age class in MEF[a]					
		1.0	1.1	2.0	2.1	3.1	Total
1983	476		589		610		596
1984	620		566	320	608	565	582
1985	765		584		616	625	599
1986	455	320	577		598	645	587
1987	633	330	568	310	592	596	582
1988	607		595		612	655	604
1989	621		581		601	623	589
1990	639		569		623		600
1991	592		607		623		614
1992	524	303	574	325	606		587
1993	567		578	270	592	680	584
1994	553		592	333	611		599
1995	597		584		588		586
1996	592		575		602	588	588
1997	478		575		603		585
Average(83–97)	581	318	581	312	606	622	592
SD(83–97)		14	11	25	11	38	9
CV(83–97)		4%	2%	8%	2%	6%	2%

[a] Estimates by age class calculated from re-aging of entire historical scale collection in 1998.

Appendix A8.–Computer data files on 1996 Taku River coho salmon smolt and subsequent estimates of 1997 Taku River adult coho salmon run parameters.

FILE NAME	DESCRIPTION
97TAKCWT.xls	Excel (Office 97) workbook with spreadsheets of (1) random and select recoveries of CWTs in 1996, (2) estimated harvest calculations by strata and season.
97TAKREP.xls	Excel (Office 97) workbook with spreadsheets of (1) CWT sampling in Canyon Island fish wheels; estimation of smolt, total runs, marine survival, Table 5, Table 7, Appendix A4, (2) smolt catches, (3) Appendix A2, (4) historical population parameters.