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Optimal Production of Chinook Salmon from the Chilkat River

by

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and

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Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative		fork length	FL
deciliter	dL	Code	AAC	mid-eye-to-fork	MEF
gram	g	all commonly accepted		mid-eye-to-tail-fork	METF
hectare	ha	abbreviations	e.g., Mr., Mrs., AM, PM, etc.	standard length	SL
kilogram	kg			total length	TL
kilometer	km	all commonly accepted			
liter	L	professional titles	e.g., Dr., Ph.D., R.N., etc.		
meter	m	at	@	Mathematics, statistics	
milliliter	mL	compass directions:		<i>all standard mathematical</i>	
millimeter	mm	east	E	<i>signs, symbols and</i>	
		north	N	<i>abbreviations</i>	
		south	S	alternate hypothesis	H _A
		west	W	base of natural logarithm	<i>e</i>
		copyright	©	catch per unit effort	CPUE
		corporate suffixes:		coefficient of variation	CV
		Company	Co.	common test statistics	(F, t, χ^2 , etc.)
		Corporation	Corp.	confidence interval	CI
		Incorporated	Inc.	correlation coefficient	
		Limited	Ltd.	(multiple)	R
		District of Columbia	D.C.	correlation coefficient	
		et alii (and others)	et al.	(simple)	r
		et cetera (and so forth)	etc.	covariance	cov
		exempli gratia		degree (angular)	°
		(for example)	e.g.	degrees of freedom	df
		Federal Information		expected value	<i>E</i>
		Code	FIC	greater than	>
		id est (that is)	i.e.	greater than or equal to	≥
		latitude or longitude	lat. or long.	harvest per unit effort	HPUE
		monetary symbols		less than	<
		(U.S.)	\$, ¢	less than or equal to	≤
		months (tables and		logarithm (natural)	ln
		figures): first three		logarithm (base 10)	log
		letters	Jan, ..., Dec	logarithm (specify base)	log ₂ , etc.
		registered trademark	®	minute (angular)	'
		trademark	™	not significant	NS
		United States		null hypothesis	H ₀
		(adjective)	U.S.	percent	%
		United States of		probability	P
		America (noun)	USA	probability of a type I error	
		U.S.C.	United States	(rejection of the null	
			Code	hypothesis when true)	α
			use two-letter	probability of a type II error	
			abbreviations	(acceptance of the null	
			(e.g., AK, WA)	hypothesis when false)	β
				second (angular)	"
				standard deviation	SD
				standard error	SE
				variance	
				population	Var
				sample	var

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	pH
(negative log of)	
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

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ABSTRACT

An escapement goal range for adult Chinook salmon *Oncorhynchus tshawytscha* from the Chilkat River was developed with information from a stock assessment program (1991-2003) and catch sampling programs of the U.S. gillnet fishery in Lynn Canal and Taku Inlet, the U.S. commercial troll and the U.S. recreational fishery near Haines and Juneau. Stock assessment was based on mark-recapture experiments to estimate abundance of large (mostly age-1.3 and older fish) and age-1.2 salmon on the spawning grounds. Relative age composition was estimated from 1991 through 2003 during the mark-recapture experiments, from samples taken on upstream tributaries. Spawning abundance that would produce high sustained yield S_{MSY} was recommended at 1,750 to 3,500 large salmon from estimation of the replacement value S_R and the relationship of replacement and S_{MSY} in other Southeast Alaska Chinook salmon stocks. This method was corroborated by a model that relates watershed area to S_{MSY} . The Alaska Department of Fish and Game, the Alaska Board of Fisheries and the Chinook Technical Committee (PSC) adopted a biological escapement goal range of 1,750 to 3,500 large spawners for management purposes for this Chinook salmon stock based on the information presented. We recommend continuation or implementation of several stock assessment components to improve estimation of population statistics and management of this stock.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, Chilkat River, spawning abundance, mark-recapture, age, sex and length composition, escapement goal, stock-recruit analysis, watershed area, sustained yield.

INTRODUCTION

The Chilkat River drainage (Figure 1) produces the third or fourth largest run of Chinook salmon *Oncorhynchus tshawytscha* in Southeast Alaska (McPherson et al. 2003). This stock is comprised of a "spring run" of salmon with adults returning to the Chilkat River in Southeast Alaska (SEAK) from late April through late July on their way to spawn upriver from late July to early-September. Almost all juveniles rear for one year in freshwater after emergence. These fish emigrate from freshwater at age-1. as yearling smolt, then rear primarily in the inside waters of northern SEAK (Johnson et al. 1993; Ericksen 1996, 1999). Mature adults return after one to five years at sea. Fish maturing at a younger age (age-1.1 and -1.2 fish) are almost exclusively males, while older fish (age-1.3, -1.4. and -1.5 fish) are, on average, about 50% females. Age-1.2, -1.3, and -1.4 fish dominate the annual spawning population, while age-1.5 fish are uncommon (<5%). Most spawning occurs primarily in two main tributaries to the Chilkat River, the Kelsall and Tahini Rivers and to a lesser degree in smaller tributaries such as Big Boulder Creek, Little Boulder Creek, Assigination Creek, Porcupine Creek, Stonehouse Creek, Nataga Creek, Klehini River, and the

mainstem of the Chilkat River (Johnson et al. 1992, 1993; Figure 1). The mainstem Chilkat River is turbid from late spring through late fall from silts flushed from glaciers in Alaska and British Columbia.

Commercial fisheries have operated in Chilkat Inlet since the late 1800s (Moser 1898). However, with the exception of sporadic effort in the troll fishery, these fisheries are directed at other salmon (sockeye *O. nerka*, chum *O. keta*, and coho *O. kisutch*). A drift gillnet test fishery for Chinook salmon in 1961 concluded that a directed gillnet fishery was not feasible. Commercial harvests near the terminal area (troll and gillnet) in northern Lynn Canal (Area 15A) declined from an average of about 3,000 Chinook salmon in the 1960s to 1,000 during the 1980s (Table 1). Commercial gillnet harvests appear to have averaged 500 or fewer Chinook salmon in the decades since. However, Chinook catches in the gillnet fisheries are often not reported (Ericksen and Marshall 1997) and include harvests of other stocks. The Chilkat Chinook stock undoubtedly contributed to the troll fishery in SEAK since the early 1900s as well, but contribution rates are unknown.

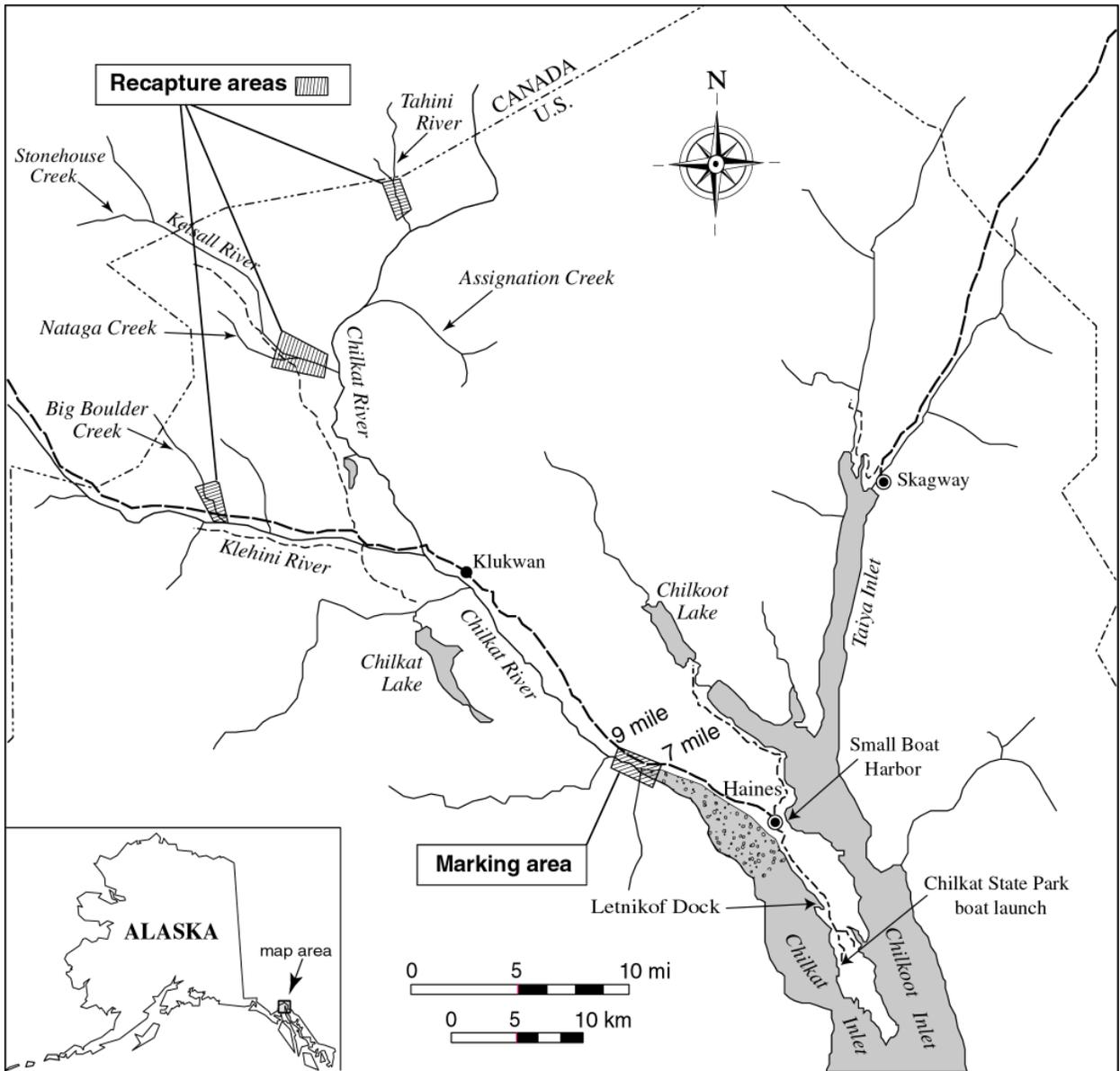


Figure 1.—Chilkat and Chilkoot Inlets and the Chilkat River drainage, with lower river marking and upriver sampling areas for adult mark-recapture projects.

Table 1.—Historical harvest of Chinook salmon in Lynn Canal and Chilkat River escapement information, 1960-2003.

Year	Chinook harvest						Escapement		
	Dist 115A Gillnet to mid July	Dist 115 Troll to mid July	Sport		Chilkat Subsistence ^c	Total harvest	Big Boulder Peak Count	Stonehouse Peak Count	Total estimate ^d
			SWHS ^a	Creel ^b					
1960	1,269	3,404				4,673	316		
1961	619	2,820				3,439			
1962	477	2,749				3,226			
1963	105	1,992				2,097			
1964	599	2,720				3,319			
1965	979	2,526				3,505			
1966	725	1,747				2,472			
1967	1,053	2,243				3,296	150		
1968	1,255	1,692				2,947	259		
1969	1,401	2,065				3,466			
1970	1,479	2,010			13	3,502	176		
1971	2,209	989			0	3,198	56		
1972	704	469			10	1,183	20		
1973	1,429	269			6	1,704			
1974	1,283	717			6	2,006			
1975	699	742			0	1,441	21		
1976	1,441	586			0	2,027	25		
1977	760	1,420			0	2,180	25		
1978	220	85			0	305			
1979	2,290	165			0	2,455			
1980	273	334			40	647			
1981	872	101			1	974	187		
1982	2,025	127			8	2,160	56	123	
1983	639	10			38	687	121	126	
1984	3,679	516		1,072	55	5,322	211	50	
1985	1,412	763		1,696	19	3,890	70	9	
1986	844	117		1,638	28	2,627	20	190	
1987	410	23	1,236	1,094	34	1,561	98	89	
1988	228		652	481	86	795	89	231	
1989	637		343	235	15	887	74	42	
1990	204		410	241	59	504	19	126	
1991	262		173		24	286	54	126	5,897
1992	129		94		11	140	16	39	5,284
1993	232		603	314	16	562	14		4,472
1994	96		413	220	13	329			6,795
1995	41	17	457	228	58	344	104		3,790
1996	58	75	363	354	61	548	75		4,920
1997	167	110	455	381	27	685	116		8,100
1998	177		139	215	47	439	24		3,675
1999	301		553	184	51	536	111		2,271
2000	58		274	49	48	155	77		2,035
2001	71		454	185	65	321	131		4,517
2002	40		641	337	81	458	111		4,051
2003	40		888	404	98	542	107		5,657

^a Statewide Harvest Survey for the entire Haines sub-area. Prior to 1984 was combined with Skagway.

^b Haines marine creel survey conducted annually during May and June.

^c Chinook harvest reported on returned subsistence permits.

^d Estimated escapement of age-1.3 and older Chinook salmon to the entire drainage.

Beginning in 1976, commercial fishing for Chinook salmon in SEAK was reduced substantially in terminal areas as part of what subsequently became a coast-wide, international rebuilding program under the Pacific Salmon Treaty signed in 1985. The spring troll fishery was closed in inside waters of SEAK in 1976, and in the same year, the regulatory opening date of the drift gillnet fishery in Chilkat Inlet (Figure 1) was delayed until the third Sunday in June. Presently, the entire annual migration is only exposed to capture in a marine recreational fishery centered near Haines. This fishery was managed under an annual abundance-based quota for recreational fishing in all areas of SEAK until a management plan was adopted for this stock in 2003. The tail end of each migration is subject to incidental capture in the commercial troll fishery in SEAK, commercial gillnet fisheries for sockeye salmon in Lynn Canal and subsistence fisheries in Chilkat Inlet and Chilkat River. A history of management actions and regulations affecting this stock is contained in Appendix A.

There were two Chinook salmon enhancement projects that occurred on spawning tributaries (Appendix B). First, fry were released into the Tahini River as part of a hatchery broodstock development program initiated by the Alaska Department of Fish and Game (ADF&G), Fisheries Research, Enhancement and Development (FRED) Division in the mid 1980s. A portion of the fry resulting from eggs taken from the Tahini River between 1983 and 1991 were returned to the system to compensate for the removal of broodstock. Second, fry were released into Big Boulder Creek as part of a habitat restoration and highway construction mitigation project (Bishop and Pollard 1991). Chinook salmon eggs taken from Big Boulder Creek from 1991 through 1995, were incubated either at the Douglas Island Pink and Chum (DIPAC) hatchery in Juneau or in a streamside incubation box. All of the resultant fry were released directly into Big Boulder Creek.

The escapement goal for the Chilkat River Chinook salmon stock dates back to 1985 (Pahlke 1997). Although ADF&G began an intensive rebuilding program for Chinook salmon in SEAK in 1981 (ADF&G 1981), it did not specifically address the Chilkat River stock. In 1985, the

escapement goal was set at 2,000 large spawners, based on the professional judgment of ADF&G staff. The goal of 2,000 was used in Pacific Salmon Treaty work and assessment until the early 1990s.

ADF&G adopted a new interim biological escapement goal range (BEG) of 1,750 to 3,500 large spawners for this stock in 2003 based on an analysis of the best available information. This BEG was adopted by the Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC) in 2004. The BEG was also instrumental in developing the Lynn Canal and Chilkat River king salmon fishery management plan (5 AAC 33.384) adopted by the Alaska Board of Fisheries (BOF) in 2003. This report describes the analysis used to develop the escapement goal range for the population of Chinook salmon in the Chilkat River. We provide an overview of the stock assessment programs used to gather information on this population since 1991. Sources of information are cited and analyses described.

STATISTICS

Spawning Abundance

Escapements were assessed with helicopter surveys prior to 1991. Only “large” Chinook salmon, typically 3-ocean (age-1.3) and older (most >660 mm mid-eye to tail fork [MEF]), were counted annually by flying over stretches of Big Boulder and Stonehouse Creeks, according to fixed schedules and protocols (Pahlke 1998; Table 1). These surveys were later found not representative of Chinook escapement to the entire Chilkat River drainage (Johnson et al. 1993) and were therefore not used in this analysis.

Since 1991, escapements of Chinook salmon in the Chilkat River have been estimated with mark-recapture experiments based on annual tagging studies from 1991 to 2003 (Johnson et al. 1992, 1993, Johnson 1994, Ericksen 1995-2004 inclusive) by the Division of Sport Fish of ADF&G. Adults were captured in drift gillnets or fish wheels in the area adjacent to Haines Highway miles 7 and 9 (Figure 1), in the first (marking) sampling event (e.g., Ericksen 2004). Mature fish were sampled on the spawning grounds upriver in the Tahini and Kellsall

Rivers, and Big Boulder Creek, during the second (recovery) sampling event.

Radio telemetry studies were conducted concurrently with the mark-recapture experiments in 1991 and 1992 (Johnson et al. 1992, 1993). These two studies indicated that about 95% of the tagged fish moved upstream to spawning locations after tagging and that the majority of the spawning took place in the Tahini and Kelsall Rivers. Water in the Tahini and Kelsall Rivers are partially occluded from glacial melt and can not be visually surveyed. Additionally, no spawning was detected downstream of the tagging site in the lower river.

Spawning abundance of fish age-1.3 and older has been estimated directly from the mark-recapture program each of the 13 years since 1991 (Erickson 2004). Spawning abundance of age-1.2 (four-year-old) fish has been estimated directly from the mark-recapture experiment in 1999-2003; from 1991-1998 age-1.2 abundance was estimated from the proportion of age-1.2 fish seen on the spawning grounds and the abundance of larger (older) fish. Estimated

abundance \hat{N}_t for the former group in year t is in Table 2, along with estimates of precision.

Estimated abundance in year t for age-sex group a and its estimated variance were calculated as:

$$\hat{N}_{a,t} = \hat{N}_t \hat{p}_{a,t}$$

$$v(\hat{N}_{a,t}) = v(\hat{N}_t)\hat{p}_{a,t}^2 + v(\hat{p}_{a,t})\hat{N}_t^2 - v(\hat{N}_t)v(\hat{p}_{a,t})$$

where estimated abundance \hat{N}_t of large fish and its estimated variance for year t were taken from Table 2 and $\hat{p}_{a,t}$ is the proportion for age group a in each size group (large or medium). Proportions by age group among large fish were estimated from sampling of large fish inriver. The variance for the numbers of age-1.2 fish from 1991-1998 was estimated using bootstrap procedures as modified in McPherson et al. (1996). Table 3 contains the estimates of spawning abundance by age for 1991-2003.

Table 2.—Estimated total spawning abundance \hat{N} with associated standard errors (SE), coefficients of variations (CVs) and approximate 95% confidence intervals for large (\geq age-1.3) Chinook salmon spawning in the Chilkat River from 1991 through 2003.

Year	\hat{N}	SE(\hat{N})	CV(\hat{N})	$\hat{N} - 1.96 \text{ SE}(\hat{N})$	$\hat{N} + 1.96 \text{ SE}(\hat{N})$
1991	5,897	1,005	17.0%	3,927	7,867
1992	5,284	949	18.0%	3,424	7,144
1993	4,472	851	19.0%	2,804	6,140
1994	6,795	1,057	15.6%	4,723	8,867
1995	3,790	805	21.2%	2,212	5,368
1996	4,920	751	15.3%	3,448	6,392
1997	8,100	1,193	14.7%	5,762	10,438
1998	3,675	565	15.4%	2,568	4,782
1999	2,271	408	18.0%	1,471	3,071
2000	2,035	334	16.4%	1,380	2,690
2001	4,517	722	16.0%	3,102	5,932
2002	4,051	429	10.6%	3,210	4,892
2003	5,657	690	12.1%	4,305	7,010

Source: All estimates come directly from mark-recapture experiments (e.g., Erickson 2004).

Table 3.—Estimated numbers \hat{N}_a of Chinook salmon by age and by large (≥ 660 mm MEF) females and males spawning in the Chilkat River from 1991 through 2003.

Year	Age class				Total	Large females	Large males
	Age-1.2	Age-1.3	Age-1.4	Age-1.5			
1991	817 (139)	3,211 (558)	2,563 (445)	123 (18)	6,714(1,015)	2,814 (365)	3,083 (405)
1992	560 (100)	1,689 (304)	3,595 (649)	0	5,844 (954)	3,353 (490)	1,931 (268)
1993	551 (104)	2,217 (424)	2,180 (425)	75 (10)	5,023 (857)	2,576 (355)	1,767 (268)
1994	184 (28)	2,565 (405)	4,148 (657)	82 (10)	6,979(1,057)	4,038 (495)	2,757 (337)
1995	1,384 (295)	530 (111)	3,074 (660)	186 (37)	5,174 (857)	2,522 (489)	1,268 (229)
1996	398 (60)	4,140 (639)	737 (112)	43 (5)	5,318 (753)	2,356 (314)	2,564 (370)
1997	160 (48)	1,943 (354)	6,157 (930)	0	8,260(1,194)	4,458 (584)	3,642 (455)
1998	226 (54)	1,016 (169)	2,440 (381)	219 (48)	3,901 (568)	1,694 (225)	1,981 (235)
1999	427 (94)	534 (109)	1,656 (302)	80 (27)	2,698 (419)	1,050 (181)	1,221 (191)
2000	629 (122)	1,350 (227)	653 (118)	32 (14)	2,664 (356)	1,071 (144)	964 (140)
2001	755 (209)	2,529 (376)	1,988 (617)	0	5,272 (752)	2,008 (386)	2,509 (374)
2002	373 (123)	2,353 (312)	1,667 (294)	30 (19)	4,423 (446)	2,129 (245)	1,921 (220)
2003	1,267 (293)	1,833 (362)	3,783 (582)	41 (29)	6,924 (746)	3,321 (422)	2,336 (302)

Note: Estimated standard errors are in parentheses.

MARINE HARVESTS

A coded wire tagging (CWT) program on wild juvenile Chinook salmon was conducted between 1988 and 1990 to identify migratory patterns and to estimate contributions to sport and commercial fisheries. This program was reinstated in 1999 and has been conducted annually since that time (Appendix C).

The CWT program was used to estimate harvests for five brood years (1984 and 1985 and 1988, 1989 and 1991). The latter three provided harvest estimates for the entire Chilkat drainage, while the first two provided estimates only for the Tahini stock within the Chilkat River. For year classes with tagged fish, CWTs recovered during catch sampling in the three fisheries were expanded for the fraction of the catch inspected and the estimated fraction of each year class marked as per procedures described in Bernard and Clark (1996).

The Chilkat Inlet and River subsistence fisheries annually harvest small numbers of Chinook salmon. These fisheries are directed primarily at

sockeye salmon but incidentally harvest Chinook salmon. Harvests in the subsistence fisheries were enumerated from catch reports returned to ADF&G for permits issued to fishery participants.

Harvest estimates of Chilkat-bound Chinook salmon were generated in the commercial gillnet fishery (in District 115-Lynn Canal and District 111-near Taku River) and in the recreational fishery out of Haines and Juneau, and in the commercial troll fishery in SEAK (northeast and northwest quadrants). Small numbers of these fish were caught in the purse seine fishery in SEAK and in Prince William Sound net fisheries (Appendix D). These CWT expansions showed that Chinook salmon from the Chilkat River are caught as mature and immature fish over varying time frames, but most harvests occur in northern and central SEAK (Johnson et al. 1993, Ericksen 1996, 1999).

PRODUCTION

Estimated production of adults from year class y and its estimated variance were calculated as:

$$\hat{R}_y = \sum_{i=1}^5 \hat{N}_{1,i,y+i+2} + \sum_{i=1}^5 \hat{H}_{1,i,y+i+2}$$

$$v(\hat{R}_y) = \sum_{i=1}^5 v(\hat{N}_{1,i,y+i+2}) + \sum_{i=1}^5 v(\hat{H}_{1,i,y+i+2})$$

where $\hat{N}_{1,i,y+i+2}$ is the estimated number of spawners and $\hat{H}_{1,i,y+i+2}$ the estimated harvest of Chinook salmon age-1. i in year $y+i+2$.

EXPLOITATION RATE

The estimated exploitation rate and its estimated variance were calculated as:

$$\hat{U}_y = \frac{\hat{H}_y}{\hat{R}_y}$$

$$v[\hat{U}_y] \approx \frac{v[\hat{H}_y] \hat{N}_y^2}{\hat{R}_y^4} + \frac{v[\hat{N}_y] \hat{H}^2}{\hat{R}_y^4}$$

The variance above was approximated with the delta method (Seber 1982).

Estimated marine harvests, escapements, returns and exploitation rates for year classes 1988, 1989 and 1991 are shown in Table 4. The average exploitation rate for those years was 0.12, with CVs at 25% or less for each brood. The average exploitation rate for those three years was used to estimate returns for years without CWT-based harvest estimates. It is reasonable to expect that these rates are representative of current exploitation rates as harvest regimes have not changed over the last decade or two. Estimated production by age and estimates of their SEs are in Table 5 (?) for year classes 1991 through 1998. Estimated production for age-1.4 salmon in the 1998 year class was not available at this writing, and was estimated from a sibling regression predicting age-1.4 fish from age-1.3 fish. Estimated brood year production and return rates are presented in Table 6.

Table 4.—Estimated marine harvest, escapement, total return, and exploitation by brood year and age of Chinook salmon bound for the Chilkat River.

Brood year		Age-1.2		Age-1.3		Age-1.4		Age-1.5		Total	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
1988	Harvest	459	163	578	208	607	302	3	1	1,648	402
	Escapement	560	100	2,217	424	4,148	657	186	37	7,111	790
	Return	1,019	192	2,796	473	4,755	723	189	37	8,758	886
	Exploitation									0.19	0.04
1989	Harvest	149	51	402	122	147	74	0	0	698	152
	Escapement	551	104	2,565	405	3,074	660	43	5	6,234	782
	Return	700	116	2,967	424	3,221	664	43	5	6,932	796
	Exploitation									0.10	0.02
1991	Harvest	292	129	473	129	267	104	1	0	1,033	210
	Escapement	1,384	295	4,140	639	6,157	930	219	48	11,899	1,168
	Return	1,676	322	4,613	652	6,424	936	219	48	12,932	1,187
	Exploitation									0.08	0.02
Average exploitation										0.12	0.06

Table 5.—Estimated parent year escapement \hat{S}_y and inriver returns by brood year \hat{E}_y and age class \hat{E}_{ay} for Chilkat River Chinook salmon brood years 1986-1999.

Brood Year	\hat{S}_y	Inriver Returns by age class (\hat{E}_{ay})				Age.3-.5	Age.2-.5
		Age-1.2	Age-1.3	Age-1.4	Age-1.5	\hat{E}_y	\hat{E}_y
1986	NE	855 (226)	3,211 (558)	3,595 (662)	75 (10)	6,881 (866)	7,736 (895)
1987	NE	817 (139)	1,689 (309)	2,180 (425)	82 (11)	3,951 (526)	4,768 (544)
1988	NE	560 (100)	2,217 (432)	4,148 (656)	186 (37)	6,551 (786)	7,111 (793)
1989	NE	551 (104)	2,565 (415)	3,074 (660)	43 (4)	5,682 (780)	6,233 (787)
1990	NE	184 (28)	530 (111)	737 (112)	0 (0)	1,267 (158)	1,451 (160)
1991	5,897	1,384 (295)	4,140 (641)	6,157 (930)	219 (48)	10,516 (1131)	11,900 (1169)
1992	5,284	398 (60)	1,943 (354)	2,440 (381)	80 (27)	4,463 (521)	4,861 (524)
1993	4,472	160 (48)	1,016 (169)	1,656 (302)	32 (14)	2,705 (347)	2,865 (350)
1994	6,795	226 (54)	534 (109)	653 (118)	0 (0)	1,188 (160)	1,414 (169)
1995	3,790	427 (94)	1,350 (227)	1,988 (617)	31 (19)	3,369 (658)	3,796 (664)
1996	4,920	629 (122)	2,529 (376)	1,667 (294)	41 (29)	4,237 (478)	4,866 (493)
1997	8,100	755 (209)	2,353 (312)	3,783 (582)		6,136 (660)	6,891 (693)
1998	3,675	373 (123)	1,833 (362)	2,696 (410)		4,529 (547)	4,902 (561)
1999	2,271	1,267 (293)	3,670				

Note: Standard errors are in parentheses and estimates in italics were derived from regression statistics.

Table 6.—Estimated parent year escapements \hat{S}_y , inriver returns \hat{E}_y , exploitation rates \hat{U}_y , total returns \hat{R}_y , and return rate (\hat{R}_y / \hat{N}_y) by year class for large (age-3-.5) Chinook salmon in the Chilkat River.

Year class	\hat{S}_y	\hat{E}_y	\hat{U}_y	\hat{R}_y	\hat{R}_y / \hat{N}_y
1986	NE	6,881 (866)	NE		NE
1987	NE	3,951 (526)	NE		NE
1988	NE	6,551 (786)	0.188 (0.04)	8,069 (888)	NE
1989	NE	5,682 (780)	0.101 (0.02)	6,318 (801)	NE
1990	NE	1,267 (158)	0.123 (0.06)	1,444 (187)	NE
1991	5,897 (1005)	10,516 (1131)	0.080 (0.02)	11,428 (1187)	1.9 (0.29)
1992	5,284 (949)	4,463 (521)	0.123 (0.06)	5,088 (617)	1.0 (0.16)
1993	4,472 (851)	2,705 (347)	0.123 (0.06)	3,084 (399)	0.7 (0.13)
1994	6,795 (1057)	1,188 (160)	0.123 (0.06)	1,354 (194)	0.2 (0.04)
1995	3,790 (805)	3,369 (658)	0.123 (0.06)	3,840 (711)	1.0 (0.27)
1996	4,920 (751)	4,237 (478)	0.123 (0.06)	4,830 (591)	1.0 (0.16)
1997	8,100 (1193)	6,136 (660)	0.123 (0.06)	6,995 (832)	0.9 (0.14)
1998	3,675 (565)	4,529 (547)	0.123 (0.06)	5,163 (649)	1.4 (0.24)

Note: Standard errors are in parentheses and estimates in italics were derived from regression statistics.

ANALYSIS

SPAWNER-RECRUIT DATA ASSESSMENT

The results to date of the stock assessment program for Chilkat River Chinook salmon, provide a limited basis for escapement goal analysis at this time. While these results are not yet sufficient to estimate maximum sustained yield directly, they suggest that escapements have been hovering around replacement levels.

The escapement estimates for the Chilkat River Chinook stock provide a reliable, but relatively short times series of information. The CVs for estimates of large spawners from 1991-2003 average 16.1% and range from 10.6% to 21.2%. The CVs for total returns in escapements by year class average about 13%. Year classes with estimated recruitment (1991-1998), also show very little contrast in parent escapements, about 2.1:1.

The recruitment data series is limited to eight brood years with parent year escapement estimates. Several empirical observations lead us to conclude that the Chilkat River Chinook stock is hovering around replacement at present levels of escapement.

- Return per spawner rates are low, with all but two observations near 1.0:1 or less.
- Estimated exploitation rates have been low, leading to the expectation that the stock is at or near replacement. The unexpectedly high recruitment for the 1991 year was also observed for the nearby Taku (McPherson et al. 2000) and Situk River stocks.
- Estimated recruitment data supports the conclusion (Figure 2).

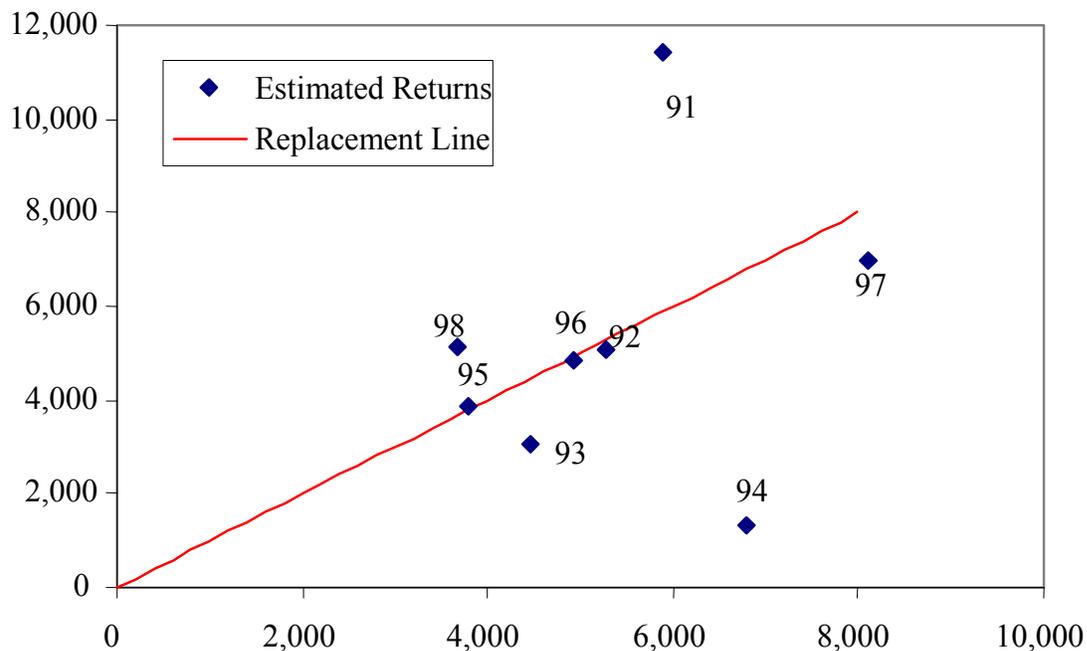


Figure 2.—Spawning abundance of large Chinook and associated production of large Chinook, 1991-1998 broods.

Note: The 1998 BY is based partly on the projected return of age-1.4 fish in 2004.

Table 7.—Stock-recruit parameters for Southeast Alaska Chinook salmon stocks, including the spawning stock levels that result in replacement S_R and maximum sustained yield S_{MSY} .

Stock	S_{MSY}	S_R	S_R/S_{MSY}	S_{MSY}/S_R
King Salmon River	150	420	2.803	35.7%
Andrew Creek	850	2,269	2.669	37.5%
Blossom River	750	2,173	2.897	34.5%
Keta River	750	2,124	2.833	35.3%
Unuk River	3,200	8,614	2.692	37.1%
Chickamin River	2,100	5,833	2.777	36.0%
Situk River	600	1,807	3.012	33.2%
Klukshu River	1,100	3,149	2.863	34.9%
Taku River	35,938	90,260	2.512	39.8%
Stikine River	17,368	39,857	2.295	43.6%
Average			2.735	36.8%
Minimum			2.295	33.2%

PARAMETER ESTIMATES

We estimated an interim escapement goal for the Chilkat River Chinook stock by first estimating replacement for the stock S_R and then using the relationship between replacement and S_{MSY} in 10 other SEAK Chinook stocks. Visual inspection of Table 6 and Figure 2, leads us to believe that 5,000 large spawners may be near equilibrium. Also, escapements from 1991-2003 have averaged 4,728 and, with minimal exploitation (an estimated 12%), total runs have averaged about 5,400 large Chinook.

With a replacement level S_R of 5,000 spawners and using the minimum ratio (most conservative) of 2.295:1 ($S_R:S_{MSY}$) amongst the 10 stocks (Table 7), we estimate S_{MSY} at approximately 2,200 large spawners. In the absence of stock-recruit productivity and capacity parameter estimates, we used the point estimate of 2,200 large spawners and recommendations in Eggers (1993) to define an escapement goal range. Eggers (1993) showed that for sockeye salmon *O. nerka*, a range of 80% to 160% of S_{MSY} produces a yield that is $\geq 90\%$ of MSY. If this same relationship is true for Chinook salmon, the range for the Chilkat River stock is 1,750 (2,200/0.80) to 3,500 (2,200/1.6).

This range was corroborated using a model developed by C. Parken (DFO, Nanaimo, British Columbia, Canada, personal communication),

which regresses \ln (watershed size in km^2) vs. \ln (S_{MSY}). The entire Chilkat River basin encompasses an area approximately 2,600 km^2 (Bugliosi 1988), and 1,667 km^2 are considered accessible to anadromous fish (Brian Frenette, ADF&G, Douglas, personal communication). A watershed size of 1,667 km^2 yielded an S_{MSY} estimate of 3,617 age-2 to -5 fish in the above model. Since the Parken Model estimates optimal spawners for age-.2 to age-.5 fish, we subtracted age-1.2 fish to estimate S_{MSY} of age-.3 to -.5 fish from this model for the Chilkat River Chinook stock. Age-1.2 Chinook salmon from the Chilkat River have comprised, on average, 11.2% of returns and the estimate above translates to 3,219 large (age-.3-.5) spawners for S_{MSY} . This estimate is within the 1,750 to 3,500 range using our method suggesting that this range is reasonable.

CONCLUSIONS

Given the data set for the Chilkat River Chinook salmon stock, the most defensible estimate for S_{MSY} is a range from 1,750 to 3,500 large spawners, estimated as total escapement, i.e., from mark-recapture. This range will provide for a conservative level of harvests until more extensive spawner-recruit data becomes available in three to four years.

We conclude that the Chilkat River Chinook salmon stock is not being overharvested and has been fished at relatively low rates for the past 15 years or more.

DISCUSSION

The escapement goal range for the Chilkat River Chinook salmon stock represents an improvement for managing this stock in the next few years. It provides benchmarks for judging management performance and ensuring the sustainability of this stock. It will allow for a conservative level of harvest in the near future, pending new information. This escapement goal range has been incorporated into the Lynn Canal and Chilkat River king salmon management plan adopted by the Alaska BOF in 2003 (Appendix E).

All ongoing scientific investigations improve with the addition of new information; this will be especially true for future investigations of the Chinook salmon of the Chilkat River. In the next several years, adults will return for year classes that began with considerably fewer numbers of spawners than in the past, just over 2,000 large spawners in 1999 and 2000. Also, we have reinstated a coded-wire tag program for Chilkat River Chinook salmon, at higher tagging levels than were done historically. These efforts will provide reasonably precise estimates of marine harvest, total return and exploitation rates for the 1999-2003 brood years. This will add important information, not limited to providing total return estimates for the two lowest levels of spawning abundance in the time series. These data points will increase the contrast in spawning escapements in the spawner-recruit database to about 4:1, which will enhance our ability to estimate optimal spawning levels by 2005-2006. Levels of spawning abundance below 2,000 may be appropriate for this stock as we gain information in the future.

Managing for the recommended management range of 1,750 to 3,500 large spawners may not be beyond the capability of ADF&G, given refinement of our stock assessment program. We have developed preseason forecasts and a management plan (Appendix E) for this stock, and will continue to refine the precision of the preseason forecasts as stock assessment improves.

RECOMMENDATIONS

Since this analysis may set the stage for future considerations, we recommend some strategies to improve future analyses and improve management.

We believe that preserving long-term stock assessment programs should continue to be one of the highest priorities for ADF&G and the PSC. These types of programs provide information on the population dynamics of the resource, which is often poorly understood due to the lack of long-term programs. For the Chilkat River Chinook stock we recommend that:

- Annual estimates of total spawning abundance from mark-recapture studies be continued.
- Biological sampling be continued annually for all fisheries and in the escapement for age, sex and size structure as well as recovery of CWTs and other tags.
- Chinook smolt be CWTd annually at high rates (20,000 to 25,000), which will be a combination of fall fingerling and smolt tagging.
- Reliable preseason and/or inseason estimates of run size and escapement be developed.
- This escapement goal be reviewed in 2006, incorporating additional data available at that time.

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**APPENDIX A: SUMMARY OF REGULATIONS IN SOUTHEAST
ALASKA FOR SUBSISTENCE, RECREATIONAL, COMMERCIAL
GILLNET AND COMMERCIAL TROLL FISHERIES, WHICH PERTAIN
TO THE HARVEST OF CHILKAT-BOUND CHINOOK SALMON**

Appendix A1.—Major regulatory actions taken in the management of the Chilkat River and Inlet subsistence fisheries since 1955.

Year	Action
1955-1959	Personal use fishery
1960	Title of regulation changed to "subsistence fishery"
1961	Subsistence permit required in all areas (5AAC 115.91)
1969	Subsistence permits for taking king and coho salmon no longer issued (5AAC 33.990) Subsistence salmon fishing in saltwater in District 15A prohibited during the closed periods of commercial net fishery (5AAC 33.990(4))
1972	Subsistence permits for taking coho salmon issued for the Chilkat River adjacent to the Klukwan Reservation (5AAC 33.990(5))
1975	Subsistence set gillnet fishing closed in all of SEAK (5AAC01.720(2))
1976	The use of set gillnet gear allowed in the mainstream of the Chilkat River north of the latitude of Zimovia Point (5AAC 33.990)
1981	Subsistence drift gill netting in all of District 15A allowed by policy during commercial openings
1982	Subsistence fishing for king salmon permitted in the area adjacent to Klukwan on the Chilkat River (5AAC 01.730(b))
1989	Subsistence fisheries in Chilkat Inlet and Chilkat River (except north of 19 mile) closed June 25 through July 15 to reduce incidental harvest of Chinook salmon. A positive Customary & Traditional use (C&T) finding for Alaska residents domiciled in Klukwan (that area west of the Haines Highway between Mile 20 and Mile 24 and east of the Chilkat River) for salmon and smelt. Subsistence permits will not be issued for taking king or coho salmon, but king and coho may be taken incidentally under terms of a subsistence permit (5AAC 01.730(b)).
1991	Subsistence fisheries in Chilkat Inlet and Chilkat River (except adjacent to Klukwan) closed through July 15 to reduce incidental harvest of Chinook salmon.
1992	Same as 1991.
1993	Subsistence fishery closed in Chilkat Inlet north of a line extending from a line from the mouth of Ludaseska Creek to an ADF&G regulatory marker on the north tip of Kochu Island and extending to a marker directly north of Paradise Cove through July 15. Subsistence fishery closed in Chilkat River except adjacent to Klukwan through July 25. C&T findings by community were repealed in spring 1993 because of constitutional considerations. The Board of Fisheries (BOF) delineated geographic areas where subsistence C&T uses took place for each community within which subsistence fishing will be permitted. 5 AAC 01.716. Customary and traditional uses of fish stocks. (2) salmon and smelt in all waters of the Chilkat River and Chilkat Inlet north of the latitude of Glacier Point. Subsistence fishing permits. c) In the Chilkat River, the subsistence fishing permit holder shall be physically present at the net while it is fishing.
1994	Subsistence fisheries in Chilkat River (except adjacent to Klukwan) and Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, closed from June 21 through July 15 to reduce incidental harvest of mature Chinook salmon.
1995	Records are missing, but are believed to be the same as 1994, closed from June 25 through July 15.
1996	Subsistence fishery closed in Chilkat River (except adjacent to Klukwan) and Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, June 28 through July 15.

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Appendix A1.– Page 2 of 2.

Year	Action
1997	Subsistence fishery closed in Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, through July 13. Subsistence fishery closed in Chilkat River except adjacent to Klukwan from June 21 through July 13.
1998	Subsistence fishery closed in Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, through July 17. Subsistence fishery closed in Chilkat River except adjacent to Klukwan from June 25 through July 19.
1999	Subsistence fishery closed in Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, through July 23. Subsistence fishery closed in Chilkat River except adjacent to Klukwan from June 25 through July 26.
2000	Same as 1999.
2001	Subsistence fishery closed in Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, through July 15. Subsistence fishery closed in Chilkat River except adjacent to Klukwan from June 24 through July 20
2002	Subsistence fishery closed in Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, through July 15. Subsistence fishery closed in Chilkat River except adjacent to Klukwan from June 24 through July 21.
2003	The BOF adopted the Lynn Canal and Chilkat River king salmon management plan (5 AAC 33.384) which included the following provisions (b) to reduce incidental harvest of Chilkat River king salmon: The department shall close the subsistence net fisheries in Chilkat Inlet north of a line extending from an ADF&G regulatory marker approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, through July 15. The subsistence net fisheries in the Chilkat River, excluding that portion of the river from Haines Highway mile 19, continuing upstream to Well's Bridge, are closed from the third week of June through the fourth week of July.

Appendix A2.—Sport fishing pre-season booklet regulations in Southeast Alaska affecting the Chilkat River Chinook salmon stock, 1961-2003.

Year	Salt-water season	Saltwater bag and possession limits	Saltwater size limit	Saltwater methods & means restrictions	Regulations specific to Lynn Canal/Chilkat Inlet	Freshwater Regulations
1961	1/1-12/31	50 lb and 1 fish or 3 fish, whichever is less restrictive	26 inches in fork length	no special restrictions	none	fifteen immature salmon daily or in possession
1962	1/1-12/31	same as 1961	same as 1961	salmon shall not be taken by means of treble hook(s)	none	season: 1/1 -12/31; 2 fish per day and in possession over 20 inches; no limit on adult fish under 20 inches
1963	1/1-12/31	three fish daily and in possession	same as 1961	same as 1962	none	closed to king salmon fishing
1964	1/1-12/31	same as 1963	no size restriction	no special restrictions	none	same as 1963
1965	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1966	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1967	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1968	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1969	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1970	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1971	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1972	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1973	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1974	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1975	1/1-12/31	same as 1963	same as 1964	same as 1964	none	same as 1963
1976	1/1-12/31	three fish daily and in possession in SEAK.	26 inch minimum size limit	no special restrictions	One fish daily/possession in Lynn Canal from Pt. Sherman south to Pt Couverden.	same as 1963
1977	1/1-12/31	same as 1976	28 inch minimum size limit	same as 1976	same as 1976	same as 1963
1978	1/1-12/31	same as 1976	same as 1977	same as 1976	same as 1976 and one fish daily/possession in Lynn Canal and all contiguous waters north of Pt. Sherman April 15 thru June 14.	same as 1963
1979	1/1-12/31	same as 1976	same as 1977	same as 1976	same as 1978	same as 1963
1980	1/1-12/31	same as 1976	28 inch minimum size limit from 6/15-3/31; any size of king salmon legal from 4/1-6/14	same as 1976	same as 1978	same as 1963
1981	1/1-12/31	same as 1976	same as 1980	same as 1976	same as 1978	same as 1963
1982	1/1-12/31	same as 1976	same as 1980	same as 1976	same as 1978	same as 1963
1983	1/1-12/31	two fish daily and in possession	28 inch minimum size limit; except, those less than 28 inches with a tag or clipped adipose fin can be retained	not more than 6 lines may be fished from a charter vessel	none	same as 1963

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Year	Salt-water season	Saltwater bag and possession limits	Saltwater size limit	Saltwater methods & means restrictions	Regulations specific to Lynn Canal/Chilkat Inlet	Freshwater Regulations
1984	1/1-12/31	same as 1983	same as 1983	same as 1983	none	same as 1963
1985	1/1-12/31	same as 1983	same as 1983	same as 1983	none	same as 1963
1986	1/1-12/31	same as 1983	same as 1983	same as 1983	none	same as 1963
1987	1/1-12/31	same as 1983	same as 1983	same as 1983	Chilkat Inlet north of a line from Ludaseska Creek to north end of Kochu Island: Closed to king salmon fishing from 5/15-7/15 by EO.	Closed to king salmon fishing
1988	1/1-12/31	two fish daily and in possession. Seasonal limit three fish from 4/15-7/15.	Same as 1983	same as 1983	Chilkat Inlet north of a line from Anchorage Pt. To Letnikof Cove boat ramp: Closed to king salmon fishing from 4/15- 7/15 by EO. Chilkat Inlet north of the latitude of Seduction Pt.: Closed to king salmon fishing from 6/13-7/15 by EO.	Same as 1987
1989	1/1-12/31	two fish daily and in possession. Seasonal limit two fish from 4/15-7/15.	28 inch minimum size limit	not more than 6 lines may be fished from any vessel sport fishing	Chilkat Inlet north of a line from Anchorage Pt. To Letnikof Cove boat ramp: Closed to king salmon fishing from 4/15-7/31 by EO. Chilkat Inlet north of the latitude of Seduction Pt.: Closed to king salmon fishing from 6/19- 7/15 by EO.	Same as 1987
1990	1/1-12/31	same as 1989	same as 1989	same as 1989	Chilkat Inlet north of a line from Anchorage Pt. To Letnikof Cove boat ramp: Closed to king salmon fishing from 4/15-7/31 by EO. Chilkat Inlet north of the latitude of Seduction Pt.: Closed to king salmon fishing from 6/22- 7/22 by EO.	Same as 1989
1991	1/1-12/31	same as 1989	same as 1989	same as 1989	Lynn Canal (including Chilkat Inlet) north of the north end of Sullivan Island and south of the latitude of Mud Bay Point: closed to king salmon fishing 4/15-7/15 by regulation. Closure extended in Chilkat Inlet through 7/31 by EO.	Same as 1989
1992	1/1-12/31	same as 1989	same as 1989	same as 1989 with the addition of: sport fishing may only be conducted by the use of a single line per angler	Lynn Canal (including Chilkat Inlet) north of the north end of Sullivan Island and south of the latitude of Mud Bay Point: closed to king salmon fishing 4/15-7/15 by regulation. Closure extended in Chilkat Inlet through 7/28 by EO	Same as 1989
1993	1/1-12/31	same as 1989	same as 1989	same as 1992	Chilkat Inlet north of a line from Ludaseska Creek to north end of Kochu Island and continuing to a point immediately north of Paradise Cove: Closed to king salmon fishing from 4/15-7/15 by EO.	Same as 1989

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Year	Salt-water season	Saltwater bag and possession limits	Saltwater size limit	Saltwater methods & means restrictions	Regulations specific to Lynn Canal/Chilkat Inlet	Freshwater Regulations
1994	1/1-12/31	same as 1989	28 inch minimum size limit	same as 1992	Chilkat Inlet north of a line from Anchorage Pt. To Letnikof Cove boat ramp: Closed to king salmon fishing from 4/15-7/15 by regulation.	Closed to king salmon fishing ^a
1995	1/1-12/31	same as 1989	same as 1994	same as 1992	same as 1994.	same as 1994
1996	1/1-12/31	two fish daily and in possession. Seasonal limit two fish from 4/15-7/15. Seasonal limit increased to 5 on 6/6.	Same as 1994	same as 1992	same as 1994	same as 1994
1997	1/1-12/31	two fish daily and in possession; in addition, for nonresidents, the annual limit is four fish	same as 1994	Operators and crew members working on a charter vessel may not retain king salmon while clients are aboard; the maximum number of lines allowed is equal to number of paying clients	same as 1994	same as 1994
1998	1/1-12/31	same as 1997	same as 1994	same as 1997	same as 1994	same as 1994
1999	1/1-12/31	two fish daily and in possession; in addition, for nonresidents, the annual limit is four fish. Daily and bag limit reduced to one fish on July 3.	Same as 1994	same as 1997	same as 1994	same as 1994
2000	1/1-12/31	Effective May 3 limits reduced to one fish daily and in possession; in addition, the nonresident annual limit was two fish	same as 1994	same as 1997	same as 1994	same as 1994
2001	1/1-12/31	one fish daily and in possession; in addition, the nonresident annual was two fish	same as 1994	same as 1997	same as 1994	same as 1994
2002	1/1-12/31	Non-guided resident angler bag and possession limit 2 fish; the guided and nonresident angler bag and possession limit 1 fish; the nonresident annual limit 3 fish.	same as 1994	same as 1997	same as 1994	same as 1994
2003	1/1-12/31	Resident angler bag and possession limit 2 fish; the nonresident angler bag and possession limit 1 fish; the nonresident annual limit 3 fish.	same as 1994	same as 1997	same as 1994	same as 1994

Appendix A3.—Commercial fishing pre-season booklet regulations for drift gillnets in District 115 of Southeast Alaska likely affecting the Chilkat River Chinook salmon stock, 1942-2003.

	Season opening date(s) and fishing period(s)	Gillnet mesh	Gillnet length/spacing	Chilkat Inlet closed areas	Chinook size limits
1942	6/20-7/31: Chilkat Closed north of S. shore of Pyramid Is.	5 3/8" or greater knot to knot	250 fathom max.	none	none
1951	Same as 1942.	Same as 1942.	200 fathoms max. Max. depth 4 fathoms.	none	none
1952	6/20-7/31. Weekly fishing period restricted to 6 AM Monday to 6 PM Friday. Chilkat closure eliminated.	Same as 1942.	Same as 1952.	none	none
1953	6/20-7/31. Weekly fishing period changed to 12 PM Monday to 12 PM Friday.	Same as 1942.	Same as 1952.	none	none
1956	Same as 1953.	6" and smaller: 50 meshes; 6 1/8"-7": 45 meshes; 7 1/8"-9": 40 meshes	Same as 1952.	none	none
1957	6/20-8/15: weekly fishing period 12 PM Monday to 12 PM Thursday. 8/16-E.O date: weekly fishing period 12 PM Monday to 12 PM Friday	Same as 1956.	Same as 1952.	none	none
1960	Same as 1957.	6" and smaller: 50 meshes; 6 1/8"-7": 45 meshes; 7 1/8"-9": 40 meshes	50 fathom min. & 200 fathom max. 100 yard minimum spacing.	none	26" limit except from 5/1-7/13 when there was no size limit
1961	6/19-8/15: weekly fishing period 12 PM Monday to 12 PM Thursday. 8/16-E.O. date: weekly fishing period 12 PM Monday to 12 PM Friday	same as 1960	same as 1960	none	same as 1960
1962	6/18-8/15: weekly fishing period 12 PM Monday to 12 PM Thursday. 8/16-E.O date: weekly fishing period 12 PM Monday to 12 PM Friday	6" and smaller: 60 meshes; 6 1/8"-7": 45 meshes; 7 1/8"-9": 40 meshes	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1963	6/17-8/15: weekly fishing period 12 PM Monday to 12 PM Thursday. 8/16-9/26: weekly fishing period 12 PM Monday to 12 PM Friday	less than 8" – 60 mesh max.; 8" and larger – 40 mesh max.	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1964	6/15-8/6: 36 hrs/wk. 8/10- E.O. date: 48 hrs/wk	same as 1963	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1965	6/13-8/4: 36 hrs/wk. 8/8- E.O. date: 48 hrs/wk	same as 1963	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1966	6/12-8/3: 36 hrs/wk. 8/7- E.O. date: 48 hrs/wk	same as 1963	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1967	6/19-8/10: 36 hrs/wk. 8/14- E.O. date: 48 hrs/wk	same as 1963	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1968	6/13- E.O. date: 36 hrs/wk.	Same as 1963	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1969	6/1-6/14: Chilkoot Inlet only 24 hrs/wk. 6/15- E.O. date: 36 hrs/wk	same as 1963	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1970	5/31-6/13: Chilkoot Inlet only – 24 hrs/wk. 6/14- E.O. date: 36 hrs/wk	60 mesh max. for nets smaller than 8"; 40 mesh max. for nets 8" or larger; 6" max. before 7/20	same as 1960	salmon fishing closed north of Letnikof Light	same as 1960
1971	5/30-6/12: Chilkoot Inlet only – 24 hrs/wk. 6/13- E.O. date: 36 hrs/wk	60 mesh max. for nets smaller than 8"; 40 mesh max. for nets 8" or larger; 6" max. before 7/18	50 fathom min. & 200 fathom max. no minimum spacing.	salmon fishing closed north of Letnikof Light	no size limit

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Year	Season opening date(s) and fishing period(s)	Gillnet mesh regulations	Gillnet length/spacing regulations	Chilkat Inlet closed areas	Chinook size limits
1972	5/28-6/17: Chilkoot Inlet only – 24 hrs/wk. 6/18- E.O. date: 36 hrs/wk	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1973	first Monday in June-3 rd Sunday in June: Chilkoot Inlet only 24 hrs/wk 3 rd Monday in June-E.O. date: 36 hrs/wk	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1974	same as 1973	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1975	same as 1973	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1976	first Sunday in June-3 rd Saturday in June: Chilkoot Inlet only 24 hrs/wk 3 rd Sunday in June-E.O. date: 36 hrs/wk	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1977	Season Opens: 3 rd Monday in June-E.O. date: 36 hrs/wk	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1978	same as 1977	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1979	same as 1977	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1980	same as 1977	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1981	same as 1977	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1982	same as 1977	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1983	3 rd Sunday in June-E.O. date: 36 hrs/wk	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1984	same as 1983	same as 1971	same as 1971	salmon fishing closed north of Letnikof Light	none
1985	same as 1983	60 mesh max. for nets smaller than 8"; 40 mesh max. for nets 8" or larger; 6" max. thru 6/30.	Same as 1971	salmon fishing closed north of Letnikof Light	no size limit
1986	3 rd Sunday in June-E.O. date: hrs/wk not specified <i>Drift gill net quota established by Board of Fisheries in 1986 at 7,600 chinook salmon per regulatory year for all of SEAK</i>	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1987	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1988	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1989	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1990	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1991	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1992	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1993	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1994	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none

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Year	Season opening date(s) and fishing period(s)	Gillnet mesh regulations	Gillnet length/spacing regulations	Chilkat Inlet closed areas	Chinook size limits
1995	same as 1986	same as 1985	same as 1971	salmon fishing closed north of Letnikof Light	none
1996	3 rd Sunday in June-E.O. date: hrs/wk not specified	60 mesh max. for nets smaller than 8"; 40 mesh max. for nets 8" or larger; max. mesh of 6" through 4 th Saturday in June; min. size is 6" during periods announced by E.O.	same as 1971	salmon fishing closed north of Letnikof Light	none
1997	same as 1996	same as 1996	same as 1971	salmon fishing closed north of Letnikof Light	none
1998	same as 1996	same as 1996	same as 1971	salmon fishing closed north of Letnikof Light	none
1999	same as 1996	same as 1996	same as 1971	salmon fishing closed north of Letnikof Light	none
2000	same as 1996	same as 1996	200 fathom max.	salmon fishing closed north of Letnikof Light	none
2001	same as 1996	same as 1996	200 fathom max.	salmon fishing closed north of Letnikof Light	none
2002	same as 1996	same as 1996	200 fathom max.	salmon fishing closed north of Letnikof Light	none
2003	same as 1996	same as 1996	200 fathom max.	salmon fishing closed north of Letnikof Light	none

Note: Prior to 1945, gill netting opened on or before May 10 and fishing time was limited only by weather and the general regulation of 1906 which provided for a weekly closure from 6 PM Saturday to 6 PM Monday. Between 1945 and 1953, gill nets were fished in Taku Inlet up to 5.5 days per week through May followed by a three week closure in June. In 1953 and 1954, the fishing period was reduced to 4 days per week in May and June. From 1955-1959, the fishing period was reduced to 3 days per week (72 hours) from May 1st through the Emergency Order (E.O.) closing date.

Appendix A4.—Major regulatory actions taken in the management of the Southeast Alaska troll fishery for Chinook salmon over the past 80 years.

Year	Major Regulatory Actions Associated with Management of Southeast Alaska Troll Fishery
Prior to 1924	Congressional Act in 1906 provided for 36 hour per week closure in all waters of Alaska, but very little enforcement was conducted.
Prior to 1950	Troll fishery was unlimited by area restrictions and continued year round. Trollers were limited to four lines in Territorial waters. In 1941, a minimum size of 6 lbs. dressed weight for Chinook salmon was implemented. In 1941, Burroughs Bay was closed to trolling from 8/16-10/5.
1950	“Outside” waters were closed from 10/31 to 3/15. Portions of northern Lynn Canal were closed from 5/31 to 6/25. Northern Behm Canal was closed from 5/1 to 7/15.
1951	Chinook salmon size limit was modified to either 6 lbs. dressed weight or 26 inches in fork length.
1958	Additional area restrictions were imposed with the closing of portions of Stephens Passage.
1959	Trolling was prohibited in Stikine Straight south of Vank Island during November and December.
1960	Trollers were limited to 4 fishing lines and use of single hooks in State waters and “outside” waters were closed from 11/1 to 4/15.
1962	A portion of northern Behm Canal was closed to trolling. Trolling was limited to 1 day per week in Districts 11A and 11B from late April to mid-June.
1965	The District 8 troll season was open only during days the gill net fishery was open during the gill net season.
1970	Trolling in Yakutat Bay was restricted to the same days as the set net fishery was open.
1971	Trolling was limited to 1 day per week in District 111, District 112 north of Point Couverden and District 115C from 5/1 to the 3 rd Sunday of June.
1973	Yakutat Bay was opened to winter troll fishing.
1974	All State waters north and west of Cape Suckling were closed to troll fishing.
1975	Power trolling was placed under limited entry with 940 permits allowed.
1976	District 11, District 12 north of Point Couverden, and Districts 15B and 15C were closed to trolling from 4/16 to 6/14. District 11A was closed to trolling from 4/16 to 8/14.
1977	Federal waters of the Fishery Conservation Zone west of Cape Suckling were closed to troll fishing. The Chinook salmon minimum size length was increased to 28 inches. Waters in east Behm Canal and in Boca de Quadra were closed to troll fishing.
1978	The eastern Sumner Strait portions of District 6 and adjoining District 8 were closed to trolling from 4/16 to 6/14. The northern Clarence Strait portion of District 6 and adjoining District 8 were closed to trolling from 4/16 to 8/14. District 8 was closed to trolling from 4/16 to the third Monday in June. The southern Frederick Sound portion of District 10 and adjoining District 8 was closed to trolling from 4/16 to 6/14.
1979	A 8-day “on” and 6-day “off” fishing period was implemented for the troll fishery in Districts 12 north of Point Hepburn and in Districts 14, 15A and 15C. Districts 11A and 11B were closed to trolling all year. “Outside” waters were closed to hand trolling.
1980	First of the annual management targets was established for the harvest of Chinook salmon in SEAK by the Alaska Board of Fisheries (BOF) and the North Pacific Fishery Management Council (NPFMC); a guideline harvest level (range) of 286,000 to 320,000 Chinook salmon in the commercial fishery. Limited entry for hand trolling was implemented, 2,150 permits were issued, 1,300 of them as non-transferable permits. The number of lines allowed to be fished in the Federal Conservation Zone was limited to 4 lines per vessel south of Cape Spencer and 6 lines per vessel between Cape Spencer and Cape Suckling with a limit of 6 operational gurdies. A 10-day Chinook salmon non-retention period for the troll fishery from 6/15 to 6/24 was implemented and a 9/21 to 9/30 closure of the troll fishery was implemented.
1981	Guideline harvest level (range) of 272,000 to 285,000 Chinook salmon was established by BOF. The NPFMC however set the guideline level (range) at 243,000 to 286,000 Chinook salmon. The troll fishery was closed from 4/15 to 5/15 for conservation of mature Chinook salmon spawners of local origin. A 6/25 to 7/5 Chinook salmon non-retention period was implemented. A troll fishery closure from 8/10 to 8/19 was implemented. A 9/4 to 9/12 Chinook salmon non-retention period was implemented. The Federal Conservation Zone was closed from 8/10 to 9/20 except in Yakutat Bay. With the exception of Yakutat Bay, the troll fishery was closed from 9/21 to 9/30. A winter Chinook salmon troll fishing season was established from 10/1 to 4/14, a summer troll fishing season was established from 4/15 to 9/20. Portions of District 116 were included in waters open to the winter troll fishery. Hand troll gear was limited to 2 gurdies or 4 fishing poles and the hand troll closure in “outside” waters was repealed.
1982	BOF and the NPFMC set a guideline harvest level of 257,000 Chinook salmon, with a range from 243,000 to 286,000 Chinook salmon (including an estimated 1,500 Chinook salmon produced by Alaskan hatcheries). The troll fishery was closed from 5/15 to 6/14. A Chinook salmon non-retention period from 6/7 to 6/17 and from 7/29 to 9/19 was implemented. Undersized Chinook salmon with adipose fin clips were allowed to be retained by troll fishermen so long as the heads were submitted to ADF&G.

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Year	Major Regulatory Actions Associated with Management of Southeast Alaska Troll Fishery
1983	Guideline harvest level (range) was again set at 243,000 to 286,000 Chinook salmon for the commercial fishery, including the winter troll harvest from 10/1/83 to 4/14/84 by the Alaska BOF and the NPFMC. The troll fishery was closed from 4/15 to 6/5 and from 7/1 to 7/10. The troll fishery was closed to Chinook salmon retention from 7/30 to 9/20.
1984	Guideline harvest level of 243,000 to 272,000 Chinook salmon was set by the BOF and the NPFMC for the commercial fishery, including the winter troll harvest. The troll fishery was closed from 5/15 to 6/5 and from 7/1 to 7/10. The troll fishery was closed to the retention of Chinook salmon from 7/30 to 9/20.
1985	The U.S./Canada Pacific Salmon Treaty (PST) set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 263,000 fish. The summer season definition was extended to 9/30. The troll fishery was closed from 4/15 to 6/3 and from 6/13 to 6/30. Troll fishery Chinook salmon non-retention was implemented from 7/23 to 8/24 and from 8/27 to 9/20.
1986	The PST set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 263,000 fish plus an Alaska hatchery add-on. The troll fishery was closed from 4/15 to 6/20. Selected areas were closed from 7/9 to the end of the season to reduce Chinook salmon catch rates. Remaining areas were closed to Chinook salmon retention from 7/16 to 8/20. Troll fishery Chinook salmon non-retention was implemented from 8/27 to 8/31 and from 9/10 to 9/20. Experimental troll fisheries were allowed in Wrangell Narrows and near Little Port Walter from 6/2 to 6/3, from 6/9 to 6/10, and from 6/16 to 6/17 to harvest hatchery Chinook salmon. The 8-day “on” and 6-day “off” fishing periods in District 14 and waters of District 12 south of Point Couverden were repealed. The prior regulation allowing the retention of under-sized Chinook salmon with missing adipose fins was repealed.
1987	The PST set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 263,000 fish plus an Alaska hatchery add-on. The general summer troll fishery was closed from 4/15 to 6/20. Selected areas were closed from 7/4 to the end of the season to reduce Chinook salmon catch rates. Remaining areas were closed to Chinook salmon retention from 7/13 to 8/2 and from 8/13 to 9/20. Experimental troll fisheries near four Alaskan hatcheries were allowed during June prior to the 6/20 summer season opening.
1988	The PST set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 263,000 fish plus an Alaska hatchery add-on. The general summer troll fishery was closed from 4/15 to 6/30. Chinook salmon non-retention was implemented from 7/12 to 9/20. Experimental troll fisheries near five Alaskan hatcheries were allowed during June and terminal troll fisheries were operated continuously during June in Wrangell Narrows and Carroll Inlet.
1989	The PST set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 263,000 fish plus an Alaska hatchery add-on. The general summer troll fishery was closed from 4/15 to 6/30. Chinook salmon non-retention was implemented from 7/13 to 9/20. Experimental troll fisheries in 9 areas near Alaskan hatcheries were allowed during June (6/12 to 6/13 and 6/26 to 6/28) and terminal troll fisheries were operated during June in Wrangell Narrows (6/12) and Carroll Inlet (6/11 to 6/29). Hatchery access troll fisheries were opened in most of the “inside” waters for two 3-day periods in June during weeks without experimental troll fisheries.
1990	The PST set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 302,000 fish plus an Alaska hatchery add-on. The general summer troll fishery was closed from 4/15 to 6/30. Chinook salmon non-retention was implemented from 7/23 to 8/22 and from 8/25 to 9/20. Experimental and hatchery access troll fisheries near Alaskan hatcheries were allowed during June. Additional terminal areas were opened to troll fishing in Earl West Cove. A quota of 30,000 Chinook salmon excluding Alaska hatchery add-on fish was implemented for the spring troll fisheries. A portion of District 111A, the backside of Douglas Island was opened to trolling during the winter season (10/1 to 4/15).
1991	The PST set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 273,000 fish plus an Alaska hatchery add-on that was projected at 57,800 Chinook salmon. The general summer troll fishery was closed from 4/15 to 6/30. Chinook salmon non-retention was implemented from 7/8 to 9/20. Experimental and hatchery access troll fisheries near Alaskan hatcheries were allowed during June. A quota of 40,000 Chinook salmon excluding Alaska hatchery add-on fish was implemented for the spring troll fisheries.
1992	The PST set a ceiling for the harvest of Chinook salmon in SEAK by all gear groups as 227,400 fish. The BOF required the ADF&G to reduce the estimated 1987-1991 PSC overage from 45,600 to 10,000 fish. Therefore, the original ceiling of 263,000 was reduced by 35,600 to 227,400 fish, plus an Alaska hatchery add-on that was projected at 69,000 Chinook salmon. The BOF allocated 83% of the ceiling to the troll fishery after accounting for a 20,000 Chinook salmon allocation for commercial net fisheries. Winter and spring troll fisheries occurred similar to 1991. The general summer troll fishery was closed from April 15 to June 30. The general summer season opening occurred from 7/1 to 7/6. The troll fishery was closed to Chinook salmon retention from 7/7 to 8/20 and areas of high Chinook salmon abundance were closed to fishing through 9/20. The troll fishery reopened to Chinook salmon retention from 8/21 to 8/25 and from 9/12 to 9/20. From 8/26-9/11 Chinook salmon non-retention was implemented. Snake River fall Chinook salmon listed as “threatened” under the U.S. Endangered Species Act (ESA).

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Year	Major Regulatory Actions Associated with Management of Southeast Alaska Troll Fishery
1993	The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 263,000 fish plus the Alaska hatchery add-on estimated to be 35,900 fish after receiving a Section 7 ESA consultation from the National Marine Fisheries Service. The PST Annex concerning Chinook salmon catch ceilings expired in 1992 and an annex was not successfully negotiated by the parties to the treaty until 1999. The start of the winter troll fishery was delayed until 10/11 and operated until 4/14. As a result of the ESA consultation, the spring hatchery access fishery did not occur. Experimental and terminal fisheries did occur. The general summer season opening was delayed until 7/1 and remained open until 7/6. The troll fishery was closed from 7/7 to 7/11. The troll fishery was reopened on 7/12 with Chinook salmon non-retention and with areas of high Chinook salmon abundance closed to fishing. The troll fishery reopened to Chinook salmon retention from 9/12 to 9/20.
1994	The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 240,000 fish plus the Alaska hatchery add-on after receiving a Section 7 ESA consultation from the National Marine Fisheries Service. The BOF allocated 82% of the ceiling to the troll fishery after accounting for a 20,000 Chinook salmon allocation for commercial net fisheries. The BOF allocated 45,000 of the troll allocation to the winter troll fishery and 70% of remaining troll harvest to a summer fishery with an initial opening beginning July 1. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/8. From 7/8 to 9/20, areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/8 to 8/28. Chinook salmon retention was allowed by trollers from 8/29 to 9/2. Non-retention of Chinook salmon in the troll fishery was implemented from 9/3 to 9/20.
1995	The ADF&G initially managed the Chinook salmon harvest in SEAK for a ceiling of 230,000 fish plus the Alaska hatchery add-on after receiving a Section 7 ESA consultation from the National Marine Fisheries Service. Part way through the general summer season, a temporary restraining order issued by the U.S. District Court, Western District of Washington resulted in the fishery being closed well before reaching the target harvest level. The BOF allocated 81% of the ceiling to the troll fishery after accounting for a 20,000 Chinook salmon allocation for commercial net fisheries. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/10. From 7/11 to 9/20, areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/11 to 7/30. Chinook salmon retention was allowed by trollers from 7/31 to 8/5. Non-retention of Chinook salmon in the troll fishery was implemented from 8/6 to 9/20.
1996	The ADF&G managed the Chinook salmon fisheries in SEAK for a harvest of 140,000 to 155,000 fish, plus the Alaska hatchery add-on, after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and upon the State of Alaska signing a 6/24/96 U.S. Letter of Agreement (U.S. LOA) with southern U.S. representatives of the U.S.-Canada Treaty regarding an abundance-based approach to managing Chinook salmon fisheries in SEAK. The BOF allocated 80% of the ceiling to the troll fishery after accounting for a 20,000 Chinook salmon allocation for commercial net fisheries. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/10. From 7/11 to 9/20, areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/11 to 7/30. Chinook salmon retention was allowed by trollers from 8/19 to 8/20. Non-retention of Chinook salmon in the troll fishery was implemented from 8/21 to 9/20.
1997	The ADF&G managed the Chinook salmon fisheries in SEAK for a harvest of 277,000 to 302,000 fish, plus the Alaska hatchery add-on, after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and applying measures as called for in the 1996 U.S. LOA. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/7. After 7/7 areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/8 to 8/17. Chinook salmon retention was allowed by trollers from 8/18 to 8/24 and again from 8/30-9/5. Non-retention of Chinook salmon in the troll fishery was implemented from 8/25 to 8/29 and again from 9/6-9/23.
1998	The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 260,000 fish, plus the Alaska hatchery add-on, after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and applying measures as called for in the 1996 U.S. LOA. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/11. After 7/11 areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/11 to 8/19. Chinook salmon retention was allowed by trollers from 8/20 to 9/30.

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Year	Major Regulatory Actions Associated with Management of Southeast Alaska Troll Fishery
1999	<p>The 1999 PST Agreement was signed in June of 1999. The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 195,600 fish based on a preliminary Abundance Index (AI); this was subsequently changed to 192,750 (AI=1.15) partway through the season. The final (postseason) quota was 184,164 Chinook salmon (AI=1.12), calculated from the first postseason calibration of the CTC Chinook salmon model run done in the year following the fishery (2000 in this case), as per the 1999 PST Agreement. The harvest was also managed for the Alaska hatchery add-on after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and applying measures as called for in the 1996 U.S. LOA. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/6. After 7/6 areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/7 to 8/17. Chinook salmon retention was allowed by trollers from 8/18 to 8/22. Non-retention of Chinook salmon in the troll fishery was implemented from 8/23 to 9/30.</p>
2000	<p>The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 137,700 fish based on a preliminary AI, which was subsequently changed to 189,900 fish (AI=1.14) in June of 2000. The final postseason quota was 178,500 fish (AI=1.10), calculated from the first postseason calibration of the CTC Chinook salmon model in the spring of 2001. The harvest was also managed for the Alaska hatchery add-on after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and applying measures as called for in the 6/24/96 letter of agreement concerning management of SEAK Chinook salmon fisheries. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/5. After 7/5 areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/6 to 8/10. Chinook salmon retention was allowed by trollers from 8/11 to 8/12, from 8/23-8/30, and again from 9/12-9/20. Non-retention of Chinook salmon in the troll fishery was implemented from 8/13 to 8/22 and again from 8/31-9/11.</p>
2001	<p>The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 189,900 fish based on a preseason AI=1.14, plus the Alaska hatchery add-on, after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and applying measures as called for in the 1996 U.S. LOA. The final postseason quota was 250,259 fish (AI=1.29), calculated from the first postseason calibration of the CTC Chinook salmon model in April of 2002. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/6. After 7/6 areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/7 to 8/17. Chinook salmon retention was allowed by trollers from 8/18 to 9/5. Non-retention of Chinook salmon in the troll fishery was implemented from 9/6-9/30.</p>
2002	<p>The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 356,500 fish based on a preseason AI=1.74, plus the Alaska hatchery add-on, after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and applying measures as called for in the 1996 U.S. LOA. The final postseason quota was 371,933 fish (AI=1.82), calculated from the first postseason calibration of the CTC Chinook salmon model in April of 2003. The winter troll fishery took place from 10/11 to 4/14. Spring troll fisheries consisting of terminal and experimental fisheries were conducted between early May and 6/30. The general summer troll fishery opened on 7/1 and closed on 7/17. After 7/17 areas of high Chinook salmon abundance were closed to troll fishing. Chinook salmon non-retention in the troll fishery was implemented from 7/18 to 8/11. Chinook salmon retention was allowed by trollers from 8/12 to 9/2. Non-retention of Chinook salmon in the troll fishery was implemented from 9/3-9/30. Chilkat Inlet was closed to commercial trolling from 7/1 to 7/15 to protect mature Chinook salmon returning to the Chilkat River.</p>
2003	<p>The ADF&G managed the Chinook salmon harvest in SEAK for a ceiling of 366,100 fish based on a preseason AI=1.79, plus the Alaska hatchery add-on, after receiving a Section 7 ESA consultation from the National Marine Fisheries Service and applying measures as called for in the 6/24/96 letter of agreement concerning management of SEAK Chinook fisheries. The winter troll fishery took place from 10/11 to 4/30. Spring-time troll fisheries consisting of terminal and experimental fisheries were conducted between 4/22 and 6/30. The general summer troll fishery opened on 7/1 and closed on 9/20. Non-retention of Chinook in the troll fishery was implemented on 8/10. The Lynn Canal and Chilkat River fishery management plan (5 AAC 33.384) was adopted by the BOF and closed Chilkat Inlet to commercial trolling through 7/14.</p>

**APPENDIX B: SUMMARY OF CHINOOK SALMON EGG TAKE AND
FRY PLANTING ACTIVITIES IN THE CHILKAT RIVER DRAINAGE**

Appendix B1.—Summary of Chinook Salmon eggs collected from the Tahini River, fry returned to the Tahini River, and hatchery smolt releases of Tahini River origin.

Brood Year	Wild eggs collected^a	Fry returned to Tahini^b	Hatchery releases^c
1983	107,000		60,129
1984	112,000	42,961	46,518
1985	123,000	46,478	57,907
1986	73,000		62,119
1987	61,000		55,498
1988	0		0
1989	70,000	31,549	7,152
1990	71,000	36,316	18,999
1991	68,240	62,579	
Grand Total	685,240	219,883	308,322

^a ADF&G, Fisheries Research, Enhancement and Development (FRED) Division collected fertilized eggs from the Tahini River as part of a hatchery broodstock development program.

^b A portion of the fry resulting from the Tahini River egg takes were returned to the Tahini River as spring fry to compensate for the loss of natural production.

^c Smolt resulting from the Tahini River broodstock development program were released at the Hidden Falls, Burro Creek and Jerry Myers hatcheries.

Appendix B2.—Summary of Chinook Salmon fry released into Big Boulder Creek as mitigation for impacts from the Haines Highway realignment.

Brood year	Big Boulder releases		
	Incubation box ^a	DIPAC ^b	Total
1991		44,820	44,820
1992	25,500	23,389	48,889
1993	24,324	28,062	52,386
1994	45,060		45,060
1995	62,014		62,014
Grand Total	156,898	96,271	253,169

Note: The Alaska Department of Transportation and Public Facilities agreed to install an infiltration gallery and pipeline for streamside incubation boxes at Big Boulder Creek as mitigation for fish habitat impacts from realigning the Haines Highway.

^a A streamside incubation boxes were installed adjacent to Big Boulder Creek in 1991. Chinook salmon eggs collected from Big Boulder Creek were incubated in the boxes and fry were released directly into the stream.

^b Chinook salmon eggs collected from Big Boulder Creek were incubated at the DIPAC Macaulay hatchery facility near Juneau until the incubation boxes were functional and proven. All resultant fry were released back into Big Boulder Creek as spring fry.

**APPENDIX C: RECENT CODED-WIRE TAGGING OF CHILKAT RIVER
CHINOOK SALMON**

Appendix C1.—Number of live coded wire tagged Chinook salmon released into the Chilkat River by brood year and year of release, through 2003.

Brood year	Capture/release site	Release year	Stage	Total marked	Shed tags	Valid tags	
BY 1984 total	Tahini River	1985	Fed fry	42,961	601	42,360	
BY 1985 total	Tahini River	1986	Fed fry	46,478	1,457	44,120	
BY 1987 total	Kelsall River	1988	Fingerling	4,553	0	4,553	
	1988	Chilkat River	1989	Fingerling	9,897	119	9,778
	1988	Chilkat River	1990	Smolt	2,220	29	2,191
	1988	Kelsall River	1989	Fingerling	20,199	120	20,079
	1988	Tahini River	1989	Fingerling	5,293	0	5,293
BY 1988 total				37,609	268	37,341	
	1989	Chilkat River	1990	Fingerling	2,230	0	2,230
	1989	Kelsall River	1990	Fingerling	10,242	82	10,160
	1989	Tahini River	1990	Fed fry	30,146	180	29,966
	1989	Tahini River	1990	Fingerling	1,403	0	1,403
BY 1989 total				44,021	262	43,759	
BY 1990 total	Tahini River	1991	Fed fry	36,316	796	35,520	
	1991	Big Boulder Creek	1992	Fed fry	44,820	1,470	43,018
	1991	Tahini River	1992	Fed fry	62,579	2,024	60,555
BY 1991 total				107,399	3,494	103,573	
BY 1992 total	Big Boulder Creek	1993	Fed fry	23,389	1,614	21,775	
	1993	Big Boulder Creek	1994	Emergent fry	24,324	243	24,081
	1993	Big Boulder Creek	1994	Fed fry	28,062	1,516	26,546
BY 1993 total				52,386	1,759	50,627	
BY 1994 total	Big Boulder Creek	1995	Emergent fry	45,060	2,569	42,491	
BY 1995 total	Big Boulder Creek	1996	Emergent fry	62,014	3,082	58,556	
BY 1997 total	Chilkat River	1999	Smolt	771	0	771	
	1998	Lower Chilkat	2000	Smolt	446	0	446
	1998	Upper Chilkat	2000	Smolt	1,550	0	1,550
BY 1998 total				1,996	0	1,996	
	1999	Chilkat River	2000	Fingerling	6,974	0	6,974
	1999	Kelsall River	2000	Fingerling	17,647	0	17,647
	1999	Klehini River	2000	Fingerling	173	0	173
	1999	Tahini	2000	Fingerling	5,310	0	5,310
	1999	Lower Chilkat	2001	Smolt	4,506	0	4,506
BY 1999 total				34,610	0	34,610	
	2000	Tahini River	2001	Fingerling	2,740	0	2,740
	2000	Kelsall River	2001	Fingerling	10,913	0	10,913
	2000	Lower Chilkat	2001	Fingerling	9,470	0	9,470
	2000	Lower Chilkat	2002	Smolt	4,714	5	4,709
BY 2000 total				27,837	5	27,832	
	2001	Tahini River	2002	Fingerling	6,519	0	6,519
	2001	Kelsall River	2002	Fingerling	18,251	0	18,251
	2001	Lower Chilkat	2002	Fingerling	6,620	0	6,620
	2001	Lower Chilkat	2003	Smolt	2,797	0	2,797
BY 2001 total				34,187	0	34,187	
	2002	Tahini River	2003	Fingerling	14,694	0	14,694
	2002	Kelsall River	2003	Fingerling	17,039	0	17,039
	2002	Lower Chilkat	2003	Fingerling	4,907	0	4,907
	2002	Lower Chilkat	2004	Smolt	5,707	0	5,707
BY 2002 total				42,347	0	42,347	

Source: Taken from Ericksen (2004).

**APPENDIX D: ESTIMATED MARINE HARVEST OF CHILKAT-BOUND
CHINOOK SALMON**

Appendix D1.—Estimated harvest of 1984 and 1985 brood year Tahini River Chinook salmon by fishery, age class, and year harvested.

Fishery	1984 Brood Year				1985 Brood Year				Average Percent
	Age	Year	Estimated		Year Harvested	Estimated		Percent	
		Harvested	harvest	SE		harvest	SE		
RECREATIONAL FISHERIES									
Haines Sport	1.2	1988			1989	22	22		
	1.3	1989	19	18	1990	48	35		
	1.4	1990	19	19	1991				
	Subtotal			38	26	12.3%	70	41	13.2%
Juneau Sport	1.2	1988	16	16	1989	80	54		
	Subtotal		16	16	5.2%	80	54	15.1%	10.1%
	Recreational Total		54	31	17.4%	150	68	28.3%	22.9%
GILL NET FISHERIES									
District 111 drift gill net	1.2	1988	13	9	1989				
	Subtotal		13	9	4.2%	0	0	0.0%	2.1%
District 115 drift gill net	1.1	1987			1988	23	16		
	1.2	1988	69	29	1989	139	86		
	1.3	1989	10	10	1990				
	1.4	1990	10	10	1991				
	Subtotal		89	32	28.7%	162	87	30.6%	29.6%
Gill net total		102	35	32.9%	162	87	30.6%	31.7%	
TROLL FISHERIES									
NE Quadrant troll	1.2	1988	9	9	1989	15	11		
	1.3	1989	29	17	1990	14	13		
	Subtotal		38	19.2	12.3%	29	17.0	5.5%	8.9%
NW Quadrant troll	1.2	1988	47	27	1989	111	46		
	1.3	1989	69	33	1990	54	32		
	1.4	1990			1991	24	17		
	Subtotal		116	43	37.4%	189	59	35.7%	36.5%
Troll total		154	47	49.7%	218	61	41.1%	45.4%	
TOTAL ALL FISHERIES			310	66		530	127		

Source: Taken from Johnson (et al. 1993).

Appendix D2.—Estimated harvest of 1988 and 1989 brood year Chilkat River Chinook salmon by fishery, age class, and year harvested.

Fishery	Age	1988 Brood Year				1989 Brood Year				Average %
		Year harvested	Estimated harvest	SE	%	Year harvested	Estimated harvest	SE	%	
SUBSISTENCE FISHERIES										
Chilkat Inlet	1.3	1993	1	0.1		1994	4	0.4		
	1.4	1994	6	0.4		1995	23	1.6		
	1.5	1995	2	0.7						
	Subtotal		9	1	0.6		27	2	3.9	2.2
Chilkat River	1.2					1993	1	0.3		
	1.3	1993	6	0.6		1994	1	0.1		
	1.4	1994	2	0.1		1995	13	0.8		
	1.5	1995	1	0.4						
	Subtotal		9	0.7	0.6		15	0.9	2.1	1.3
	Total subsistence		19	1	1.1		42	2	6.0	3.5
RECREATIONAL FISHERIES										
Haines sport	1.2	1992				1993	36	34		
	1.3	1993	216	142		1994	154	74		
	1.4	1994	260	161		1995	84	69		
	Subtotal		476	215	28.9		274	107	39.3	34.1
Juneau sport	1.3	1993				1994	99	78		
	1.4	1994	243	247		1995				
	Subtotal		243	247	14.7		99	78	14.2	14.5
	Total recreational		719	327	43.6		373	133	53.4	48.5
GILLNET FISHERIES										
District 115 drift gillnet	1.2	1992	145	87		1993	83	34		
	1.3	1993	82	57		1994	44	34		
	1.4	1994	96	66		1995				
	Subtotal		323	123	19.6		127	48	18.2	18.9
District 111 drift gillnet	1.2	1992	36	33		1993	15	12		
	1.3	1993	66	67		1994	14	14		
	Subtotal		102	75	6.2		29	18	4.2	5.2
District 183 gillnet	1.3				1994	55	38			
	Subtotal					55	38	7.9	3.9	
District 212 gillnet ^a	1.2				1993	14	14			
	Subtotal					14	14	2.0	1.0	
District 225 gillnet ^a	1.2	1992	54	53						
	Subtotal		54	53	3.3					1.6
	Total gillnet		479	154	29.1		225	65	32.3	30.7
TROLL FISHERIES										
NW quadrant troll	1.2	1992	163	119		1993				
	1.3	1993	207	124		1994	22	22		
	1.4	1994				1995	27	27		
	Subtotal		370	172	22.5		49	35	7.0	14.7
	Total troll		370	172	22.5		49	35	7.0	14.7
MISCELLANEOUS FISHERIES										
District 112 seine	1.2	1992	33	33						
	Subtotal		33	33	2.0					1.0
Hidden Falls PNP	1.2	1992	28	28						
	Subtotal		28	28	1.7					0.8
Valdez PNP	1.3					1994	9	9		
	Subtotal						9	9	1.3	0.6
	Total miscellaneous		61	43	3.7		9	9	1.3	1.9
TOTAL ALL FISHERIES			1,648	403	100.0		698	152	100.0	

Source: Taken from Ericksen (1996).

^a Districts 212 and 225 are located in Prince William Sound.

Appendix D3.—Estimated harvest of 1991 brood year Chilkat River Chinook salmon by fishery, age class, and year harvested.

Fishery	Age	Year of harvest	Estimated harvest	SE	%
SUBSISTENCE FISHERIES					
Chilkat	1.2	1995	8	1.4	
Inlet	1.3	1996	35	1.3	
	1.4	1997	14	0.6	
	1.5	1998	1	0.3	
	Subtotal		58	2.0	5.1
Chilkat	1.2	1995	4	0.7	
River	1.3	1996	14	0.5	
	1.4	1997	7	0.3	
	1.5	1998	0	0.0	
	Subtotal		25	0.9	2.2
	Subsistence total		84	2.2	7.4
RECREATIONAL FISHERIES					
Haines sport	1.2	1995	51	51	
	1.3	1996	93	55	
	1.4	1997	154	81	
	Subtotal		299	110	26.2
Juneau sport	1.3	1996	22	21	
	Subtotal		22	21	1.9
Anchor sport	1.4	1997	53	53	
	Subtotal		53	53	4.7
	Recreational total		374	124	32.8
GILLNET FISHERIES					
Dist. 115	1.2	1995	188	112	
drift gillnet	1.3	1996	60	42	
	Subtotal		248	120	21.8
Dist. 111					
drift gillnet	1.3	1996	53	52	
	Subtotal		53	52	4.6
	Gillnet total		301	131	26.4
TROLL FISHERIES					
NE Quad-	1.2	1995	39	39	
rant troll	1.3	1996	132	68	
	1.4	1997	39	39	
	Subtotal		210	88	18.5
NW Quad-					
rant troll	1.3	1996	64	64	
	Subtotal		64	64	
	Troll total		275	108	24.1
SEINE FISHERIES					
District					
112 seine	1.1	1994	85	41	
	Subtotal		85	41	7.5
District					
114 seine	1.1	1994	21	20	
	Subtotal		21	20	1.8
	Seine total		106	46	9.3
TOTAL ALL FISHERIES			1,139	215	

Source: Taken from Ericksen (1999).

**APPENDIX E: LYNN CANAL AND CHILKAT RIVER KING SALMON
FISHERY MANAGEMENT PLAN**

Appendix E1.—5 AAC 33.384. Lynn Canal and Chilkat River king salmon fishery management plan.

(a) The purpose of the management plan in this section is to provide for the biological spawning escapement requirements of king salmon to the Chilkat River. It is the intent of the Board of Fisheries (board) that Chilkat River king salmon be harvested in the fisheries that have historically harvested them. The board, through this management plan, recognizes that the commercial drift gillnet fishery in Chilkat Inlet, and the subsistence fisheries in Chilkat Inlet and the Chilkat River, are directed primarily toward sockeye salmon but incidentally catch king salmon. A secondary goal of this management plan is to provide a reasonable opportunity to harvest sockeye salmon in the Chilkat Inlet and Chilkat River subsistence fisheries while minimizing the incidental harvest of king salmon. This management plan provides the department guidelines to preclude allocation conflicts between the various user groups of this resource. The department shall manage the Chilkat River king salmon stocks in a conservative manner consistent with sustained yield principles.

(b) The subsistence net fisheries in Chilkat Inlet north of a line extending from an ADF&G regulatory marker located approximately one mile south of Anchorage Point to an ADF&G regulatory marker located directly north of the Letnikof Cove boat ramp are closed through July 15. The subsistence net fisheries in the Chilkat River, excluding that portion of the river from Haines Highway mile 19 upstream to Well's Bridge, are closed from the third week of June through the fourth week of July.

(c) The department shall manage the commercial and sport fisheries in Lynn Canal to achieve an inriver run goal of 1,850 - 3,600 king salmon in the Chilkat River upstream of the department fish wheels located approximately adjacent to Haines Highway mile 9. The inriver run goal includes the following:

- (1) a biological escapement goal of 1,750 - 3,500 three ocean age and older king salmon to the Chilkat River; and
- (2) the incidental harvest of king salmon in the Chilkat River subsistence sockeye fishery.

(d) The department will evaluate the inriver run of king salmon based on the following:

- (1) primarily, a pre-season projected run of Chilkat River king salmon to Lynn Canal; and
- (2) secondarily, inseason fisheries performance and inriver stock assessment programs.

(e) The department shall manage the commercial drift gillnet and troll fisheries in Lynn Canal and the sport king salmon fishery in Chilkat Inlet, as follows:

- (1) the commercial troll fishery in Chilkat Inlet north of an ADF&G regulatory marker immediately north of Seduction Point is closed through July 14;
- (2) if the projected inriver run of king salmon to the Chilkat River is less than 1,850 three ocean age and older fish, the commissioner shall, by emergency order,

(A) close the commercial drift gillnet fishery

- (i) in Chilkat Inlet north of an ADF&G regulatory marker immediately north of Seduction Point through the first two weeks of the season specified in 5 AAC 33.310(c);
- (ii) in Chilkat Inlet north of Glacier Point during the third and fourth week of the season specified in 5 AAC 33.310(c);
- (iii) in Chilkat Inlet north of Cannery Point during the fifth week of the season specified in 5 AAC 33.310(c); and

(B) close sport fishing for king salmon

- (i) in Chilkat Inlet north of an ADF&G regulatory marker immediately north of Seduction Point through June 30;
 - (ii) in Chilkat Inlet north of a line extending from an ADF&G regulatory marker located approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp, through July 15; and
 - (iii) in the remainder of Chilkat Inlet north of Seduction Point, from July 1 – July 15;
 - (C) establish a sport bag and possession limit of one king salmon, 28 inches or greater in length;
- (3) if the projected inriver run of king salmon to the Chilkat River is 1,850 - 3,600 fish, the commissioner shall, by emergency order,
- (A) close the commercial drift gillnet fishery
 - (i) in Chilkat Inlet north of an ADF&G regulatory marker immediately north of Seduction Point through the first two weeks of the season specified in 5 AAC 33.310(c);
 - (ii) in Chilkat Inlet north of Glacier Point during the third week of the season specified in 5 AAC 33.310(c);
 - (iii) in Chilkat Inlet north of Cannery Point during the fourth week of the season specified in 5 AAC 33.310(c); and
 - (B) close sport fishing for king salmon in Chilkat Inlet north of a line extending from an ADF&G regulatory marker located approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp from April 15 through July 15;
- (4) if the projected inriver run return of king salmon to the Chilkat River is greater than 3,600 fish,
- (A) the commissioner shall, by emergency order, close the commercial drift gillnet fishery
 - (i) in Chilkat Inlet north of an ADF&G regulatory marker immediately north of Seduction Point through the first week of the season specified in 5 AAC 33.310(c);
 - (ii) in Chilkat Inlet north of Glacier Point during the second week of the season specified in 5 AAC 33.310(c);
 - (iii) in Chilkat Inlet north of Cannery Point during the third week of the season specified in 5 AAC 33.310(c); and
 - (B) the commissioner shall, by emergency order, close sport fishing for king salmon in Chilkat Inlet north of a line extending from an ADF&G regulatory marker located approximately one mile south of Anchorage Point to an ADF&G regulatory marker directly north of the Letnikof Cove boat ramp from April 15 through July 15;
 - (C) the commissioner may, by emergency order, increase the bag and possession limits for king salmon in the waters of Chilkat Inlet north of Seduction Point. (Eff. 7/26/2003, Register 167)

Authority: AS 16.05.060 AS 16.05.251