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Chinook Salmon Status and Escapement Goals for Stocks in Southeast Alaska

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

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Measures (fisheries)

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

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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ABSTRACT

The status of Chinook salmon *Oncorhynchus tshawytscha* stocks in Southeast Alaska and transboundary rivers is presented in this document, based on results of the inriver stock assessment program in Southeast Alaska and Canada, and catch sampling programs of the Divisions of Sport and Commercial Fisheries. Chinook escapements in 11 drainages were evaluated relative to *biological escapement goals* that have been developed for each system. A revised escapement goal has been recommended for the Unuk River and awaits adoption by the Alaska Department of Fish and Game; goals for the Alsek, Taku, Blossom, and Keta river stocks are being revised. Reports detailing the methods for determining the Unuk River escapement goal and the analyses for the remaining 10 stocks are cited. Ten of the 11 regularly-monitored systems are judged to be healthy. Escapements of Alsek River Chinook salmon have been below the escapement goal for 4 consecutive years (2005–2008), but because the goal is being revised and assessment and management of U.S. and Canadian fisheries is coordinated and conducted under the auspices of the Pacific Salmon Treaty, the Department does not recommend Alsek Chinook salmon as a stock of concern.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, escapement, escapement goals, escapement goal ranges, stock status, Taku River, Stikine River, Alsek River, Chilkat River, Unuk River, Chickamin River, Blossom River, Keta River, King Salmon River, Situk River, Andrew Creek, U.S./Canada Pacific Salmon Treaty, transboundary rivers

INTRODUCTION

Chinook salmon (*Oncorhynchus tshawytscha*) in Southeast Alaska are harvested primarily by the commercial troll fleet and recreational anglers. Chinook salmon are also harvested in U.S. commercial set gillnet, drift gillnet, and purse seine fisheries, and in subsistence fisheries in the region. In addition, Chinook salmon are harvested in Canada in the transboundary Alsek, Taku and Stikine rivers. Management of Chinook fisheries in Southeast Alaska are covered in other Alaska Board of Fisheries documents, presentations, and regional management plans.

Harvests of Chinook salmon in Southeast Alaska commercial and recreational fisheries are managed on an abundance-based approach, with an annual all-gear harvest target provided by the Pacific Salmon Commission, via its Chinook Technical Committee, prior to each fishing season. The annual Pacific Salmon Commission harvest target is based on a preseason forecast of the relative aggregate abundance of most Chinook salmon stocks that are present in Southeast Alaska for the coming year (CTC 2002). The relative preseason abundance is estimated from 30 stock groups in the Pacific Salmon Commission Chinook Model completed each spring by the Chinook Technical Committee, with membership from Alaska, British Columbia, Washington, Oregon, and Idaho. Presently, the all-gear quota is allocated by the Alaska Board of Fisheries between commercial and recreational users as follows: (1) 4.3% of the total to the purse seine fleet; (2) 2.9% of the total to the drift gillnet fleet; (3) 1,000 Chinook salmon to the set gillnet fishery; (4) 80% of the remainder to the troll fleet; and (5) 20% of the remainder to the recreational fleet (5 AAC 29.060). Additionally, in February 2005, the U.S. and Canada reached a bilateral terminal harvest sharing agreement for directed Taku and Stikine river Chinook fisheries. Annex IV, Chapter 1 of the 2008 Pacific Salmon Treaty (approved by the Pacific Salmon Commission in May 2008, but pending approval by the U.S. and Canadian governments) includes directives for the conduct of those fisheries. The 2008 Pacific Salmon Treaty agreement (Annex IV, Chapter 3) also recognizes that Chinook stocks in the entire area covered by the treaty vary in status, with many healthy and abundant, while others are considered stocks of concern (some of which are listed under the U.S. Endangered Species Act).

After lengthy negotiations, the allowable Chinook catch levels in fisheries off the west coast of Vancouver Island in British Columbia were reduced by 30%, where Endangered Species Act-listed stocks account for a large portion of the harvest, and by 15% in Southeast Alaska, where Endangered Species Act-listed stocks account for a very small portion of the harvest. Reductions in these two fisheries will be in place from 2009 to 2014, when a 5-year review will be used to evaluate whether these are to continue.

Chinook salmon harvests in Southeast Alaska are known to be composed of stocks originating from

as far north as the Yakutat area to the southern coast of Oregon. This includes local Southeast Alaska and transboundary wild stocks. Chinook salmon are known to occur in 34 rivers in, or draining into, the southeast region of Alaska, including those with headwaters in British Columbia or the Yukon Territory, Canada (Kissner 1977). Local Alaska hatchery stocks contribute a sizeable portion of Southeast Alaska Chinook harvests each year (Table 1).

STOCK STATUS

Stock status for Chinook salmon stocks in Southeast Alaska was judged primarily by performance in meeting escapement requirements; these are local wild stocks that contribute to harvests in Southeast Alaska fisheries. Harvest estimates are also presented for selected stocks. A detailed description of the stock assessment program was presented in the 2003 stock status report (Geiger and McPherson 2004) to provide an understanding of the tools that are available for management of these stocks, and performance in relationship to the principles and criteria in the state's Sustainable Salmon Fisheries Policy (ADF&G and BOF 2001; 5 AAC 39.222). We briefly summarize the assessment program below.

STOCK ASSESSMENT PROGRAM

In the mid-1970s it became apparent that many of the local Chinook salmon stocks in this region were depressed relative to historical levels of production (Kissner 1974). A fisheries management program was implemented to rebuild stocks in Southeast Alaska streams and in trans-boundary rivers (rivers that originate in Canada and flow into Southeast Alaska coastal waters; ADF&G 1981). Initially, under this management program, commercial and recreational fisheries in terminal and near-terminal areas in U.S. waters were closed. The troll fishery was also modified extensively by 1982 to reduce exploitation on local wild stocks and later to target Alaska hatchery stocks. In 1985 the Alaskan program was incorporated into a comprehensive, coastwide rebuilding program to represent all wild stocks of Chinook salmon under the auspices of the U.S./Canada Pacific Salmon Treaty. In May 2008, the Pacific Salmon Treaty was re-negotiated and approved by the Pacific Salmon Commission (approval by the U.S. and Canadian governments is pending). The Chinook chapter continues the coastwide, abundance-based management regime for Chinook salmon stocks, and as noted above, calls for reduced harvests in Southeast Alaska and off the west coast of Vancouver Island to help address conservation concerns for depressed stocks.

In the 1970s, a stock assessment program was developed to provide information for tools to manage Chinook stocks in the region, to judge stock status and develop sound escapement goals. This program has evolved and expanded over the past few decades, concurrent with increasing information needs. The major components of the stock assessment program in Southeast Alaska include estimation of escapement, survival, harvest, exploitation rates, and distribution. Programs are in place in 11 rivers (Figure 1) to sample, enumerate and collect biological data from the escapements. These rivers represent all of the region's major producers (production greater than 10,000 fish), seven medium producers (production of 1,500 to 10,000 fish), and one minor producer (production less than 1,500 fish). Separate programs are in place to sample, enumerate, and collect biological data from the fisheries that harvest Chinook salmon.

ESCAPEMENT PROGRAMS

Initially, the escapement estimation program consisted of peak survey counts (peak single-day aerial helicopter or foot counts) annually in 10 of the 11 index systems and a weir on the Situk River. This was inadequate for intensive fishery management and population assessment, such as that now in place in the Pacific Salmon Commission forum. Over time the program was modified to estimate total escapement to all 11 systems (Table 2), including development of expansion factors relating survey counts to total escapement. Presently, total escapement programs are operated on many of the larger rivers, including the weirs on the Situk and Klukshu rivers, and mark–recapture tagging projects on the Chilkat, Taku, Stikine, and Unuk rivers. Helicopter survey counts are used to monitor escapements to other systems. Radiotelemetry projects have been conducted

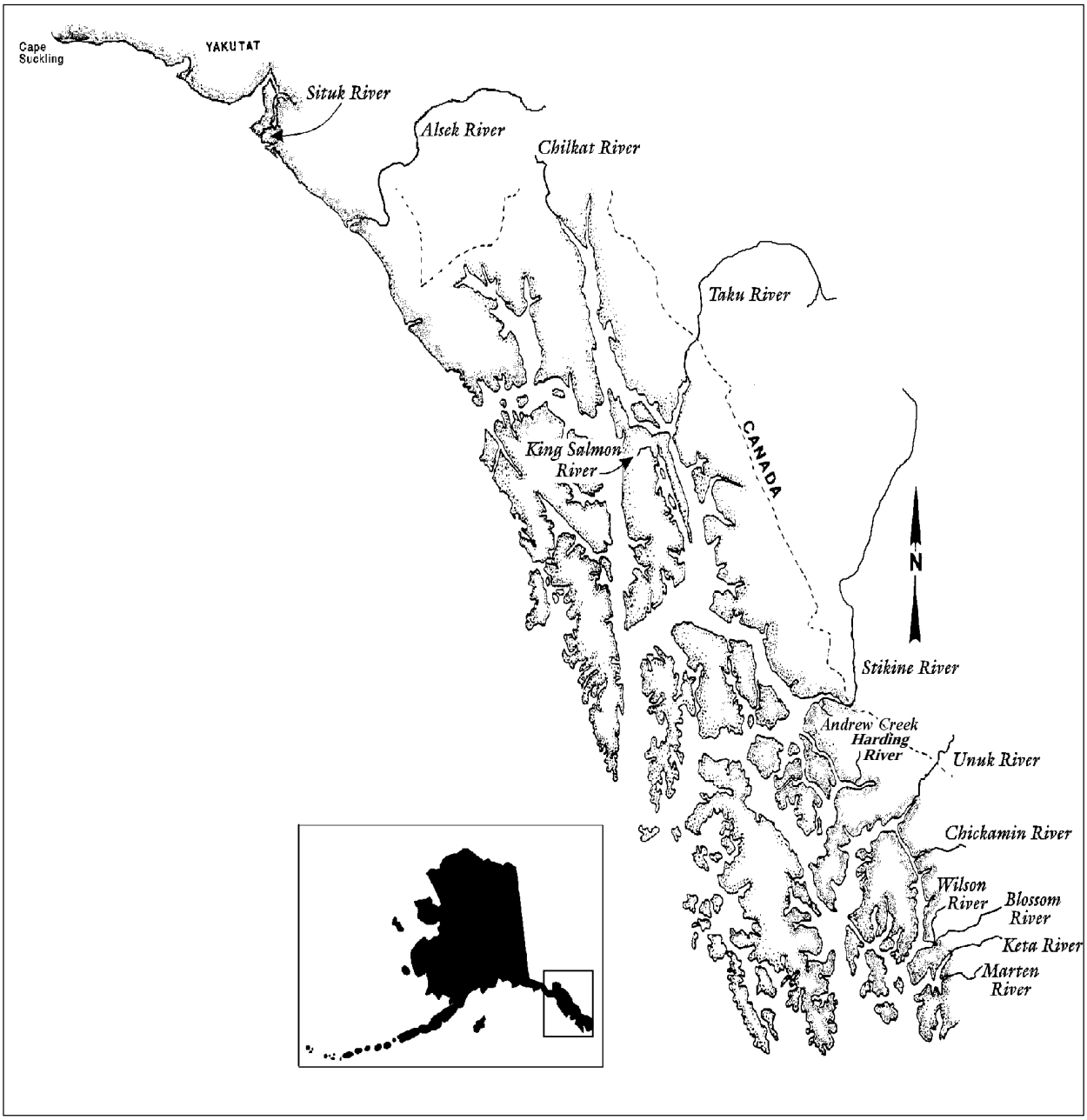

Figure 1.–Location of selected Chinook salmon systems in Southeast Alaska, Yakutat, and transboundary rivers.

once or twice on all major systems to determine spawning distribution and verify that survey counts were being conducted over the major spawning areas, and to validate assumptions of the mark–recapture studies. Biological data collected has included age, sex, length, and tag recovery to estimate escapement in total and by sex and age, as well as the fraction of fish that were coded wire tagged in selected systems. Selected descriptions and results of the inriver stock assessment programs are contained in Appendix 1.

Table 1.–Southeast Alaska Chinook salmon harvests, 1975–2007, in thousands of Chinook salmon (2007 data and some recent harvests subject to revision).[a]

Year	Troll	Net	Sport	Total all gear Southeast Alaska harvest	Hatchery add-on	Terminal exclusion	Treaty catch
975	287	13	17	318	-	-	-
1976	231	11	17	259	-	-	-
1977	272	13	17	302	-	-	-
1978	376	25	17	418	-	-	-
1979	338	28	17	383	-	-	-
1980	304	20	20	344	-	-	-
1981	249	19	21	289	-	-	-
1982	242	47	26	315	-	-	-
1983	270	20	22	312	-	-	-
1984	236	32	22	290	-	-	-
1985	216	34	25	275	6	-	268
1986	238	22	23	282	11	-	271
1987	243	16	24	282	17	-	265
1988	231	22	26	279	23	-	257
1989	236	24	31	291	22	-	270
1990	288	28	51	367	46	-	321
1991	264	35	60	359	61	-	298
1992	184	32	43	259	37	-	222
1993	227	28	49	304	33	-	271
1994	186	36	42	264	29	-	235
1995	138	48	50	236	59	-	177
1996	141	37	58	236	73	9	155
1997	246	25	72	343	46	10	287
1998	192	24	55	271	25	2	243
1999	146	33	72	251	48	4	199
2000	159	41	63	263	74	2	186
2001	153	40	72	266	77	2	187
2002	325	32	70	427	68	1	357
2003	331	39	69	439	57	2	380
2004	355	64	88	506	72	5	429
2005	338	73	84	496	64	45	387
2006	282	73	86	441	50	31	359
2007	268	58	72	398	67	9	322

[a] Harvests statistics from PSC (2008)

HARVEST PROGRAMS

Commercial harvests are reported on fish tickets, and sport harvests are estimated by creel and postal surveys. These provide estimates of the total harvest in a fishery, but not the stock composition. Harvests of specific stocks, including Alaskan hatchery fish, can be estimated using coded wire tags. Pacific Salmon Treaty agreements provide Alaska fisheries a special add-on of Alaskan hatchery Chinook salmon to the annual catch ceiling. Estimates of stock composition in Southeast Alaska fisheries that harvest Chinook salmon have been somewhat limited and at present, the five largest stocks in Southeast Alaska are not included in the Pacific Salmon Commission Chinook Model because stock data were limited and the Chinook Technical Committee has not progressed to that point in the model improvement process. This is being addressed by two programs: coded wire tagging of wild Chinook stocks in the region and a genetic stock identification program. Fishery sampling of coded wire tags and genetic sampling has been increased in the past few years to improve our estimates of stock composition. Four wild stocks of Chinook salmon are being coded wire tagged at present in

Table 2.–Estimated total escapements of large Chinook salmon to escapement indicator systems in Southeast Alaska and transboundary rivers, from 1975 to 2008 (2008 data and some recent estimates based on expanded survey or weir counts are subject to revision). Numbers in bold type are weir counts or mark–recapture total estimates.

	MAJOR SYSTEMS			MEDIUM SYSTEMS							MINOR
Year	Alsek (Klukshu)[a]	Taku	Stikine	Situk[b]	Chilkat	Andrew	Unuk[a]	Chickamin[a]	Blossom[a]	Keta[a]	King Salmon
1975		12,917	7,571			507		1,758	584	611	64
1976	5,765	24,575	5,723	**1,421**		**404**		746	272	253	99
1977	10,496	29,489	11,445	**1,732**		**456**	4,706	1,724	448	692	204
1978	11,754	17,118	6,835	**808**		**388**	5,344	1,463	572	1,180	87
1979	18,670	21,611	12,610	**1,284**		**327**	2,783	1,135	216	1,282	134
1980	8,077	39,229	30,573	**905**		**282**	4,909	2,114	356	578	106
1981	8,327	49,546	36,057	**702**		**536**	3,532	1,824	636	990	154
1982	9,174	23,842	40,488	**434**		**672**	6,528	2,712	1,380	2,270	394
1983	11,028	9,792	6,424	**592**		**366**	5,436	2,845	2,356	2,474	**245**
1984	7,494	20,774	13,995	**1,726**		**389**	8,876	5,235	2,032	1,836	**265**
1985	5,758	35,906	16,037	**1,521**		624	5,721	4,541	2,836	1,878	**175**
1986	9,981	38,100	14,889	**2,067**		1,381	10,273	8,289	5,112	2,077	**255**
1987	11,395	28,928	24,632	**1,379**		1,537	9,533	4,631	5,396	2,312	**196**
1988	8,227	44,512	37,554	**868**		1,100	8,437	3,734	1,536	1,731	**208**
1989	9,105	**40,329**	24,282	**637**		1,034	5,552	4,437	1,376	3,477	**240**
1990	8,794	**52,142**	22,619	**628**		1,295	2,856	2,679	1,028	1,824	**179**
1991	12,722	51,645	23,206	**889**	**5,897**	780	3,165	2,313	956	819	**134**
1992	5,519	55,889	34,129	**1,595**	**5,284**	1,517	4,223	1,644	600	653	**99**
1993	12,688	66,125	58,962	**952**	**4,472**	2,067	5,160	1,848	1,212	1,090	266
1994	12,312	48,368	33,094	**1,271**	**6,795**	1,115	3,435	1,843	644	921	213
1995	25,322	**33,805**	16,784	**4,330**	**3,790**	669	3,730	**2,309**	868	527	147
1996	14,443	**79,019**	**28,949**	**1,800**	**4,920**	653	5,639	**1,587**	880	894	292
1997	12,697	**114,938**	**26,996**	**1,878**	**8,100**	571	**2,970**	1,292	528	740	362
1998	**4,621**	31,039	**25,968**	**924**	**3,675**	950	**4,132**	1,857	**364**	**446**	134
1999	**11,597**	**16,786**	**19,947**	**1,461**	**2,271**	1,180	**3,914**	2,337	848	**968**	304
2000	**8,295**	**34,997**	**27,531**	**1,785**	**2,035**	1,346	**5,872**	3,805	924	**914**	138
2001	**11,022**	**46,644**	**63,523**	**562**	**4,517**	2,055	**10,541**	**5,177**	816	1,032	149
2002	**8,504**	**55,044**	**50,875**	**1,000**	**4,051**	1,708	**6,988**	**5,007**	896	1,237	155
2003	**4,932**	**36,435**	**46,824**	**2,163**	**5,657**	1,160	**5,546**	**4,579**	812	969	119
2004	**7,343**	**75,032**	**48,900**	**698**	**3,422**	2,991	**3,963**	**4,268**	**734**	1,132	135
2005	4,462	**38,725**	**40,501**	**595**	**3,366**	1,979	**4,742**	**4,257**	**926**	1,496	143
2006	1,881	**42,296**	**24,400**	**695**	**3,039**	2,124	**5,645**	6,318	**1,270**	2,248	150
2007	2,811	**14,854**	**16,442**	**677**	**1,442**	1,736	**5,718**	4,242	540	936	181
2008	1,939	**21,450**	**21,900**	**413**	**3,233**	981	**3,109**	5,159	1,028	1,093	90

[a] Escapements for the 4 Behm Canal systems are shown here for total escapement, to provide comparisons of magnitude across systems. Escapement goals for the Chickamin, Blossom, and Keta systems are for survey counts at present and are shown in Table 1.3 and Figure 1.4. The escapement goal for the Alsek River is 1,100 to 2,300 Chinook salmon of all sizes past the Klukshu River weir, minus above-weir harvest.

[b] Escapement equals weir count minus above-weir harvest.

the region: the Chilkat, Taku, Stikine, and Unuk river stocks. The combination of these two programs has improved, and will continue to further improve stock identification information available for Southeast Alaska Chinook catches in the near future.

STOCK STATUS ASSESSMENT

In this section, the status of wild Chinook stocks is evaluated through 2008. The Sustainable Salmon Fisheries Policy (ADF&G and BOF 2001; 5 AAC 39.222) specifies guidelines to manage salmon stocks for sustainability. Our stock assessment and management program for Chinook salmon in Southeast Alaska is designed to provide a sustained resource, i.e., follow the Sustainable Salmon Fisheries Policy.

Escapement goals for the 11 index stocks of Chinook salmon have been established. These *biological escapement goal* ranges are designed to maintain wild stocks at high levels of productivity and yields near the theoretical average maximum sustained level. Management plans and regimes are structured for Southeast Alaska fisheries to achieve escapements within the *biological escapement goal* ranges wherever possible, and are developed with significant input from the public and users. Escapements have been evaluated in the 11 index stocks against the *biological escapement goal* ranges established for each stock to determine stock status. Escapements were assessed retrospectively back to 1975 as if the current *biological escapement goal* had been in place.

Ten of the 11 regularly-monitored systems are judged to be healthy. Escapements of Alsek River Chinook salmon have been below the escapement goal for 4 consecutive years (2005–2008), but because the goal is being revised and assessment and management of U.S. and Canadian fisheries is coordinated and conducted under the auspices of the Pacific Salmon Treaty (5 AAC 33.361), the Department does not recommend Alsek Chinook salmon as a stock of concern. (Table 3 and Figures 2, 3, and 4).

ESCAPEMENT GOALS

The escapement goal for the Unuk River was updated and has undergone internal review, but has not been adopted by the Alaska Department of Fish and Game; goals for the Alsek, Taku, Blossom, and Keta river stocks are being revised. Taku River Chinook salmon are a transboundary river stock and language in the 2008 Pacific Salmon Treaty (Annex IV, Chapter 1) states:

"By January 15, 2009, the Parties agree to jointly review the currently agreed escapement goal and pass a jointly prepared technical report through accelerated domestic review processes in time for a revised goal to be applied in the 2009 season. Formal review processes will proceed as required."

To that end, ADF&G will forward a draft report to the Canadian Department of Fisheries and Oceans for review. Once a bilateral report is prepared, it will undergo an accelerated review process by Canadian and U.S. reviewers. That review is required by January 15th. Those review comments then need to be addressed and the product accepted by the end of the February Pacific Salmon Commission meeting such that the new goal can be fully implemented in the 2009 season.

Reports detailing the methods for determining the Unuk River escapement goal and the analyses for the current goals of the remaining 10 stocks are cited. In the Appendix, a section is included for each of the 11 stocks which briefly describes the stock and fisheries that harvest it, key stock assessment data, and the current escapement goal.

Table 3.–Estimated biological escapement goal ranges for 11 Chinook salmon stocks in Southeast Alaska. These biological escapement goals include large spawners[a] of approximate legal retention size (28 inches total length) and do not include smaller 1- and 2-ocean age males.

	Chinook salmon stock	Biological escapement goal range for large[a] spawners in survey count	2004–2008 survey count average	Present survey expansion factor	Biological escapement goals range for large spawners estimated in total escapement	2004–2008 total escapement average
1	Chilkat River[b]	NA	NA	NA	1,750–3,500	2,900
2	King Salmon River[c]	80–160	92	1.52	120–240	140
3	Andrew Creek[c]	325–750	1,006	1.95	650–1,500	1,962
4	Blossom River[c]	250–500	302	4.00	NA	900
5	Keta River[c]	250–500	459	3.01	NA	1,381
6	Unuk River[c]	375–800	740[d]	4.83	1,800–3,800	4,635
7	Chickamin River[c]	450–900	1,007	4.75	NA	4,849
8	Situk River[e]	NA	NA	NA	450–1,050	616
9	Klukshu (Alsek) River[f]	1,100–2,300	1,040	4.17[g]	NA	3,687
10	Taku River[f]	5,800–10,600	4,797[d]	5.20	30,000–55,000	38,471
11	Stikine River[f]	2,700–5,300	6,169	5.15	14,000–28,000	30,429

[a] The Klukshu River goal is germane to Chinook salmon of all sizes.

[b] The above *biological escapement goal* range has been approved by review teams from ADF&G and the Chinook Technical Committee of the Pacific Salmon Commission.

[c] The above *biological escapement goal* ranges have been approved by review teams from ADF&G and the Chinook Technical Committee of the Pacific Salmon Commission. *Biological escapement goals* for the Blossom, Keta, and Chickamin rivers are expressed as survey count goals. The escapement goal for the Unuk River has undergone internal review, but has not been adopted by ADF&G. The escapement goals for the Blossom and Keta rivers are being revised.

[d] Only partial counts were made in the Unuk and Taku river systems in 2008.

[e] The above *biological escapement goal range* has been approved by review teams from ADF&G.

[f] The above *biological escapement goal* ranges for the 3 transboundary rivers have been approved by review teams from ADF&G, the Department of Fisheries and Oceans Canada, and the Chinook and Transboundary Technical Committees of the Pacific Salmon Commission. The goals for the Taku and Alsek rivers are being revised; the goal for the Taku and Alsek rivers are being revised; the revised goal for the Alsek River will be germane to escapement to the entire system.

[g] The expansion factor is used to expand the number of large fish at the Klukshu weir and in the below-weir harvest.

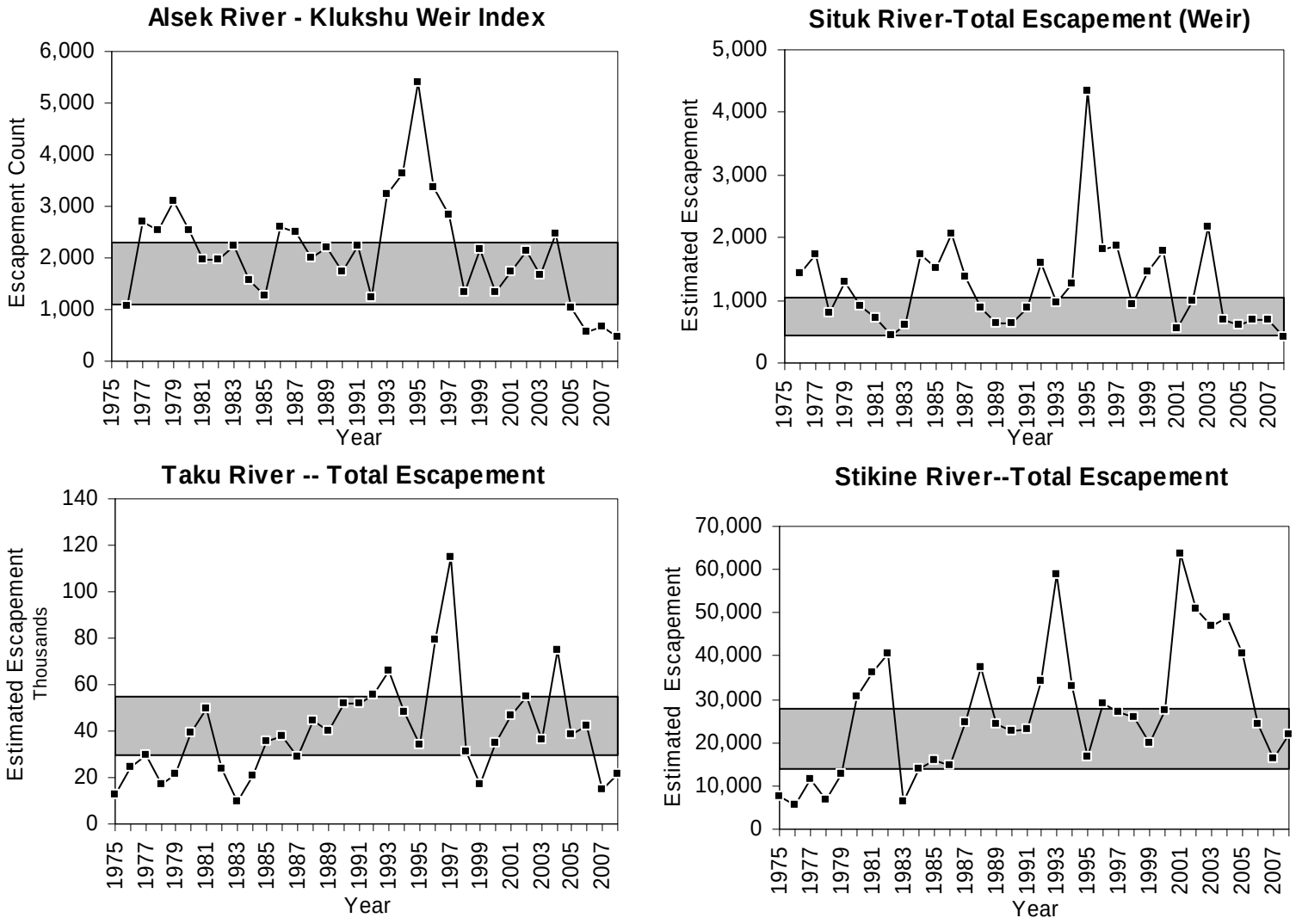

Figure 2.–Estimated escapements of Chinook salmon in the Alsek, Situk, Taku, and Stikine rivers from 1975 to 2008. All values represent the total escapement of large (3- to 5-ocean-age) Chinook salmon except in the Alsek, which are total escapements past Klukshu weir, an index for the Alsek River.

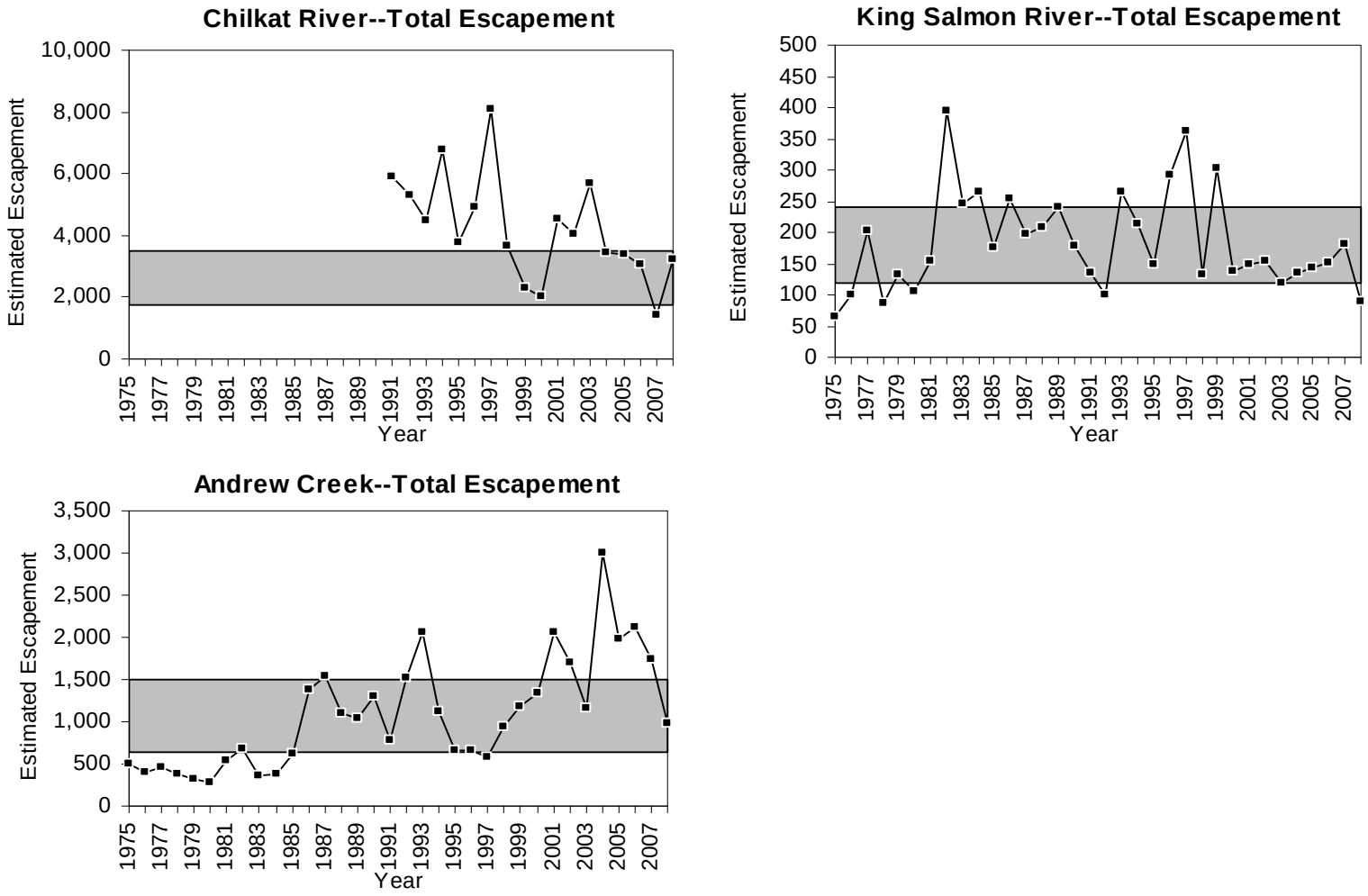

Figure 3.–Estimated escapements of Chinook salmon in the Chilkat and King Salmon rivers and in Andrew Creek from 1975 to 2008. All values represent the total escapement of large (3- to 5-ocean-age) Chinook salmon.

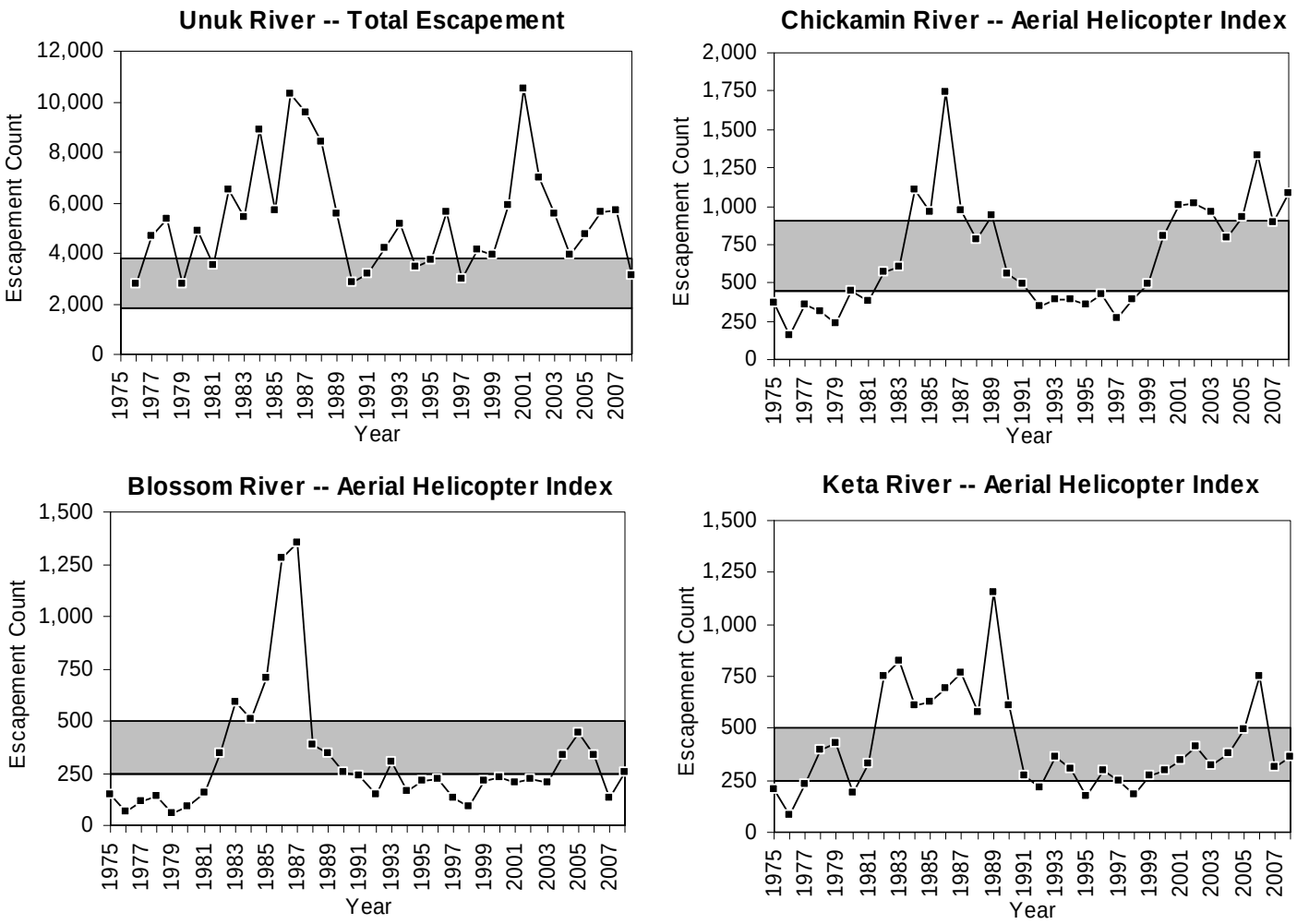

Figure 4.–Peak survey counts of escapements of Chinook salmon in the Unuk, Chickamin, Blossom, and Keta rivers from 1975 to 2008. All values represent the peak survey count of large (3- to 5-ocean-age; ≥ 660 mm MEF) Chinook salmon.

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APPENDIX

Appendix 1.–Taku River Chinook Salmon Stock.

The Taku River, which originates in northwestern British Columbia, produces the largest local population of Chinook salmon on average in Southeast Alaska (McPherson et al. 2000). This spring run is harvested primarily as mature adults from late April to early July; immature fish rear primarily outside of the region. Stock assessment includes: coded wire tagging of smolt, estimation of adult escapement (inseason and postseason), harvest, exploitation, smolt abundance, and survival.

Outline of stock management, assessment, and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G; joint management ADF&G and CDFO through Pacific Salmon Commission of terminal run
Fisheries:	U.S. recreational, gillnet, troll; Canadian gillnet, First Nations, recreational
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	30,000 to 55,000 range; 35,938 point estimate
Population for goal:	Large spawners (3- to 5-ocean-age) in entire drainage
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial helicopter surveys: 1973 to present, conducted in 6 major tributaries—the Nahlin, Nakina, Dudidontu, Tatsamenie, and Kowatua rivers, and Tseta Creek and standardized since 1973 Mark–recapture estimates: 1989, 1990, 1995 to present
Index count expansion factor:	5.20 (SE = 1.78); multiplier for cumulative helicopter peak survey count in 5 tributaries—Nahlin, Nakina, Dudidontu, Tatsamenie, and Kowatua rivers
Brood years in analysis:	8
Data in analysis:	Estimated total escapement of large female spawners and subsequent smolt production
Data quality:	Good
Contrast in escapements:	6.87
Model used for escapement goal:	Empirical observation of optimal smolt production range and associated number of female spawners
Criteria for range:	Highest smolt production
Value of alpha parameter:	4.406
Value of beta parameter:	0.00001635
Value of $sigma^2$ parameter:	Not available
Document supporting goal:	McPherson, S. A., D. R. Bernard, and J. H. Clark. 2000. Optimal production of Chinook salmon from the Taku River. Alaska Department of Fish and Game, Division of Sport Fish, Fisheries Manuscript No. 00-2, Anchorage. Additional comments: ADF&G is in the process of revising this goal.

Table 1.1.–Estimated harvests, escapements, and total runs by year of large Chinook salmon (3- to 5-ocean-age; 5- to 6-year total age) bound for the Taku River from 1979 to 2008. Escapement estimates in bold are from mark–recapture estimates and estimates in italics are from expanded survey counts (2008 data, some recent estimates, and estimates based on expanded survey counts are subject to revision).

		U.S.					Test	Canada				Total		
Year	Escapement[a]	Gillnet	Sport	Troll[b]	P.U.	Total	fishery	Gillnet	Sport[c]	Abor.	Total	Harvest	Run	Exp.
1979	*21,611*	217	1,853	4,544		6,614		73	300		373	6,987	28,598	24.4%
1980	*39,229*	696	2,512	3,813		7,021		169	300	64	533	7,554	46,783	16.4%
1981	*49,546*	611	1,703	5,276		7,590		119	300		419	8,009	57,555	13.9%
1982	*23,842*	847	1,359	2,709		4,915		41	300		341	5,256	29,098	18.1%
1983	*9,792*	106	1,089	419		1,614		418	300	7	725	2,339	12,131	19.3%
1984	*20,774*	399	1,210	2,754		4,363		387	300		687	5,050	25,824	19.6%
1985	*35,906*	802	1,863	750		3,415		263	300	3	566	3,981	39,887	10.0%
1986	*38,100*	849	755	808		2,412		264	300	8	572	2,984	41,084	7.3%
1987	*28,928*	557	1,019	399		1,975		175	300		475	2,450	31,378	7.8%
1988	*44,512*	240	765	2,034		3,039	54	557	300	20	877	3,970	48,482	8.2%
1989	**40,329**	933	1,857	2,034	62	4,886	23	777	300	5	1,082	5,991	46,320	12.9%
1990	**52,142**	960	2,085	2,034	57	5,136	36	1,041	300		1,341	6,513	58,655	11.1%
1991	*51,645*	1,150	4,199	2,034	47	7,430		1,208	300		1,508	8,938	60,583	14.8%
1992	*55,889*	869	3,334	2,034	34	6,271		1,196	300	91	1,587	7,858	63,747	12.3%
1993	*66,125*	1,823	6,273	2,034	17	10,147		1,344	300	19	1,663	11,810	77,935	15.2%
1994	*48,368*	1,426	3,213	2,034	36	6,709		1,727	300	89	2,116	8,825	57,193	15.4%
1995	**33,805**	608	2,225	2,034	37	4,904		1,408	300	53	1,761	6,665	40,470	16.5%
1996	**79,019**	1,814	4,602	1,605	87	8,108		2,610	300	47	2,957	11,065	90,084	12.3%
1997	**114,938**	2,197	5,017	1,478	33	8,725		2,114	300	77	2,491	11,216	12,615	8.9%
1998	*31,039*	278	2,088	656	31	3,053		1,002	300	45	1,347	4,400	35,439	12.4%
1999	**16,786**	785	2,408	811	22	4,026	311	781	300	38	1,119	5,456	22,242	24.5%
2000	**34,997**	426	1,553	1,390	22	3,391	1,312	1,341	300	38	1,679	6,382	41,379	15.4%
2001	**46,644**	538	1,437	2,324	8	4,307	1,175	1,324	300	94	1,718	7,200	53,844	13.4%
2002	**55,044**	869	2,399	2,658	14	5,940	1,311	1,444	300	37	1,781	9,032	64,076	14.1%
2003	**36,435**	738	2,017	1,930	13	4,698	1,401	1,350	300	259	1,909	8,008	44,443	18.0%
2004	**75,032**	971	2,700	3,916	25	7,612	1,410	1,777	300	277	2,354	11,376	86,408	13.2%
2005	**38,725**	18,962	3,053	1,625	32	23,672		7,399	300	13	7,712	31,384	70,109	44.8%
2006	**42,296**	10,525	2,385	2,021	16	14,947	630	7,377	300	222	7,899	23,476	65,772	35.7%
2007	**14,854**	910	1,416	1,763	22	4,111	1,396	874	300	167	1,341	6,848	21,702	31.6%
2008	**21,450**	850	1,255	1,216	34	3,355	1,399	913	300	774	1,074	6,741	28,191	23.9%

-continued-

Table 1.1.–Page 2 of 2.

		U.S.					Test	Canada				Total		
Year	Escapement[a]	Gillnet	Sport	Troll[b]	P.U.	Total	fishery	Gillnet	Sport[c]	Abor.	Total	Harvest	Run	Exp.
Averages:														
79–08	42,260	1,765	2,321	2,038	32	6,146	872	1,382	300	106	1,764	8,259	50,519	17.0%
04–08	38,471	6,444	2,162	2,108	26	10,739	1,209	3,668	300	291	4,259	15,965	54,436	29.8%

[a] Escapement: escapement estimates shown here are from mark–recapture estimates in 1989 to 1990 and 1995 to 1997 (McPherson et al. 2000), and preliminary mark–recapture estimates for 1999 to 2008. Estimates for 1979 to 1988, 1991 to 1994, and 1998 are expanded survey counts of large spawners. No estimates are available prior to 1973.

[b] Troll harvest estimates for 1988 to 1995 were estimated using averages for 1996–2008 and all other years are estimates from coded wire tag recoveries.

[c] The sport harvest in Canada is unknown yet assumed to average 300 fish per year.

Table 1.2.–Estimated abundance of females, smolts, subsequent production of adult salmon, and estimated mean fork length for smolts for several year classes of Chinook salmon in the Taku River. Standard errors for ratios (in parentheses) were approximated with the delta method (Seber 1982:7–9).

Year class	Females	Smolts	Mean smolt FL (mm)	Smolts / female	Recruits	Adult / smolt
1975	4,593	1,189,118	79	258.9	87,450	0.074
	(2,139)	(174,197)		(126)	(23,384)	(0.0224)
1976	15,165	1,549,052	71	102.1	65,457	0.042
	(6,478)	(374,227)		(50)	(16,615)	(0.0148)
1979	10,997	661,150	74	60.1	39,833	0.060
	(4,991)	(97,648)		(29)	(9,288)	(0.0166)
1991	27,435	2,098,862	80	76.5	196,114	0.093
	(11,842)	(295,390)		(35)	(14,153)	(0.0148)
1992	22,935	1,968,167	73	85.8	79,307[a]	0.0403
	(10,391)	(438,569)		(43)		
1993	29,976	1,267,907	78	42.3	19,114[b]	0.0151
	(13,573)	(564,432)		(27)		
1994	31,553	1,328,553	76	42.1		
	(13,565)	(352,068)		(21)		
1995	19,705	1,898,233	77	96.3		
	(2,644)	(626,335)		(34)		

[a] Estimate is based on final estimate of spawning abundance and preliminary statistics on harvest.

[b] Estimate is based on inputting production of age-1.4 and -1.5 salmon as the average (34% of production) over all age groups for the 1973 to 1991 year classes.

Appendix 2.–Stikine River Chinook Salmon Stock.

The Stikine River is a glacial transboundary river that produces the second largest population of Chinook salmon, on average, in Southeast Alaska (Bernard et al. 2000). These fish are caught in the troll fishery, a commercial gillnet fishery in U.S. waters near the river, recreational fisheries near Wrangell and Petersburg, and in inriver commercial, aboriginal gillnet, and recreational fisheries in Canada. Stock assessment includes: coded wire tagging of smolt, estimation of adult escapement (inseason and postseason), harvest, exploitation, smolt abundance, and survival.

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G, joint management ADF&G and CDFO through Pacific Salmon Commission of terminal run
Fisheries:	U.S. recreational, gillnet, troll; Canadian gillnet, First Nations, recreational
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	14,000 to 28,000 range; 17,368 point estimate
Population for goal:	Large spawners (3- to 5-ocean-age) in entire drainage
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial helicopter surveys: 1975 to present Index weir counts, Little Tahltan River: 1985 to present Mark–recapture estimates: 1996 to present
Index count expansion factor:	5.15 (SE = 0.77); multiplier for weir count on Little Tahltan River
Brood years in analysis:	15 (1977 to 1991)
Data in analysis:	Estimated total escapement of large spawners, all terminal and near terminal harvests, age structure all years
Data quality:	Excellent
Contrast in escapements:	6.3
Model used for escapement goal: and returns	Ricker model incorporating measurement error in escapements
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper), per Eggers (1993)
Value of alpha parameter:	2.61
Value of beta parameter:	0.000026592
Value of sigma^2 parameter:	0.2613
Document supporting goal:	Bernard, D. R., S. A. McPherson, K. A. Pahlke, and P. Etherton. 2000. Optimal production of Chinook salmon from the Stikine River. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Manuscript No. 00-1, Anchorage.

Table 2.1.–Escapement index counts, spawning escapement estimates, harvests, run sizes, and exploitation rates for large Stikine River Chinook salmon, from 1975 to 2008. Escapement estimates in bold are from mark–recapture estimates, estimates in italics are from expanded survey counts, and the remainder are from expansions of Little Tahltan River weir counts (2008 data, some recent estimates, and estimates based on expanded weir counts are subject to revision).

Year	Aerial counts	Little Tahltan weir count	Spawning escapement	U.S. sport harvest	U.S. gillnet/troll harvest	U.S. subsistence harvest	Canadian harvest	Total harvest	Total run size	Exploitation rate
1975	700		*7,571*		1,529		1,202	2,731	10,302	26.5%
1976	400		*5,723*		1,101		1,160	2,261	7,984	28.3%
1977	800		*11,445*		1,378		162	1,540	12,985	11.9%
1978	632		*6,835*	2,282			500	2,782	9,617	28.9%
1979	1,166		*12,610*	1,759	432		1,262	3,453	16,063	21.5%
1980	2,137		*30,573*	2,498	926		2,655	6,079	36,652	16.6%
1981	3,334		*36,057*	2,022	823		1,650	4,495	40,552	11.1%
1982	2,830		*40,488*	2,929	1,753		2,597	7,279	47,767	15.2%
1983	594		*6,424*	2,634	1,024		2,106	5,764	12,188	47.3%
1984	1,294		*13,995*	2,171	1,039		796	4,006	18,001	22.3%
1985	1,598	3,114	16,037	2,953	2,823		1,491	7,267	23,304	31.2%
1986	1,201	2,891	14,889	2,475	2,510		3,473	8,458	23,347	36.2%
1987	2,706	4,783	24,632	2,834	2,404		3,020	8,258	32,890	25.1%
1988	3,796	7,292	37,554	2,440	1,299		3,333	7,072	44,626	15.8%
1989	2,527	4,715	24,282	2,776	1,887		3,349	8,012	32,294	24.8%
1990	1,755	4,392	22,619	4,283	1,912		3,604	9,799	32,418	30.2%
1991	1,768	4,506	23,206	3,657	2,080		3,258	8,995	32,201	27.9%
1992	3,607	6,627	34,129	3,322	752		3,080	7,154	41,283	17.3%
1993	4,010	11,449	58,962	4,227	1,201		3,204	8,632	67,594	12.8%
1994	2,422	6,426	33,094	2,140	1,777		2,760	6,677	39,771	16.8%
1995	1,117	3,259	16,784	1,218	1,291		3,059	5,568	22,352	24.9%
1996	1,920	4,821	**28,949**	2,464	1,161		3,450	7,075	36,024	19.6%
1997	1,907	5,557	**26,996**	3,475	2,146		5,019	10,640	37,636	28.3%
1998	1,385	4,879	**25,968**	1,438	276		2,812	4,526	30,494	14.8%
1999	1,379	4,738	**19,947**	3,668	1,125		5,318	10,111	30,058	33.6%
2000	2,720	6,640	**27,531**	2,581	1,262		4,684	8,527	36,058	23.6%
2001	4,158	9,738	**63,523**	2,263	687		3,297	6,247	69,770	9.0%
2002	1,131	7,490	**50,875**	3,077	1,009		4,007	8,093	58,968	13.7%
2003	1,903	6,492	**46,824**	3,252	1,529		4,739	9,520	56,344	16.9%
2004	6,014	16,381	**48,900**	2,939	8,282	31	6,712	17,964	66,864	26.9%
2005	1,997	7,387	**40,501**	3,002	29,131	23	21,346	53,502	94,003	56.9%
2006	1,372	3,860	**24,400**	2,944	25,194	17	15,776	43,931	68,330	64.3%
2007	213	562	**16,442**	3,273	10,413	30	10,581	24,297	40,739	59.6%
2008	600	2,657	**21,900**	1,692	8,424	25	8,012	18,153	40,053	45.3%
Averages:										
75–08	1,973	5,861	27,078	2,732	3,654	25	4,220	10,261	37,339	26.6%
04–08	2,039	6,169	30,429	2,770	16,289	25	12,485	31,569	61,998	50.6%

Table 2.2.–Estimated total returns of Stikine River Chinook salmon for brood years 1977 to 2003. Escapement estimates in bold are from mark–recapture estimates, estimates in italics are from expanded survey counts, and estimates from 1985 to 1995 are from expansions of Little Tahltan River weir counts. (2003 data, some recent estimates, and estimates based on expanded weir counts are subject to revision).

Brood year	Parent escapement	Age-1.2 return	Age-1.3 return	Age-1.4 return	Age-1.5 return	Total return
1977	*11,445*	881	8,340	6,105	227	15,554
1978	*6,835*	1,386	4,117	2,562	151	8,217
1979	*12,610*	4,754	14,687	17,589	337	37,368
1980	*30,573*	2,021	4,484	14,200	1,099	21,804
1981	*36,057*	1,849	6,933	23,594	788	33,164
1982	*40,488*	2,562	7,044	38,996	6,189	54,791
1983	*6,424*	2,310	4,040	14,207	1,654	22,211
1984	*13,995*	1,366	11,384	26,720	1,005	40,475
1985	16,037	1,000	2,373	17,681	80	21,134
1986	14,889	3,662	11,748	32,127	1,681	49,218
1987	24,632	3,252	8,756	58,838	3,208	74,053
1988	37,554	832	6,349	31,531	2,374	41,087
1989	24,282	903	4,422	13,326	135	18,786
1990	22,619	1,273	5,101	9,852	168	16,395
1991	23,206	5,226	26,869	28,361	696	61,151
1992	34,129	1,957	9,162	22,353	1,002	34,474
1993	58,962	1,340	7,227	15,207	550	24,324
1994	33,094	2,452	11,231	13,882	208	27,773
1995	16,784	6,842	19,227	16,235	485	42,788
1996	28,949	14,660	53,215	43,475	182	111,532
1997	26,996	800	14,844	15,988	142	31,774
1998	25,968	5,611	36,659	21,057	547	63,874
1999	19,947	11,823	37,577	31,758	623	81,781
2000	27,531	18,651	60,480	55,913	1,161	136,205
2001	63,523	2,085	11,653	11,826		
2002	50,875	4,660	29,016			
2003	46,824	4,038				

Appendix 3.–Alsek River Chinook Salmon Stock.

The Alsek River produces the third or fourth largest Chinook run in Southeast Alaska. Harvest of this stock primarily occurs in U.S. commercial and subsistence set gillnet fisheries in the lower Alsek River in Dry Bay, and in recreational and aboriginal fisheries on the upper Tatshenshini River in Canada. Stock assessment includes: weir counts, direct fishery enumeration, and age, sex, and size sampling.

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	Joint management ADF&G and CDFO through Pacific Salmon Commission
Fisheries:	U.S. subsistence/personal use, gillnet, troll; First Nations, Canadian recreational
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	1,100 to 2,300 range; no point estimate
Population for goal:	All spawners counted past the Klukshu River (a clearwater tributary of the Alsek) weir, minus above-weir harvest,
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial helicopter surveys: 1981 to present Index weir counts Klukshu River: 1976 to present Mark–recapture estimates for Alsek: 1998 to 2004
Index count expansion factor:	4.17 (SE = 1.71); multiplier for below-weir harvest and weir count of large fish on the Klukshu River
Brood years in analysis:	16 (1976 to 1991)
Data in analysis:	Estimated total escapement, all terminal, near terminal harvests, and age structure all years.
Data quality:	Very good to excellent
Contrast in escapements:	2.9
Model used for escapement goal:	Ricker model and empirical inspection of the spawner-recruit relationship
Criteria for range:	Range producing largest total returns
Value of alpha parameter:	7.44
Value of beta parameter:	0.00081
Value of $sigma^2$ parameter:	Not available
Document supporting goal:	McPherson, S. A., P. Etherton, and J. H. Clark. 1998b. Biological escapement goal for Klukshu River Chinook salmon. Alaska Department of Fish and Game, Division of Sport Fish, Fisheries Manuscript 98-2, Anchorage. Additional comments: ADF&G is in the process of revising this goal.

Table 3.1.–Spawning escapement, estimated harvests, run size, and exploitation rates for Chinook salmon in Klukshu River, a tributary of Alsek River, from 1976 to 2008 (2008 data and some recent estimates are subject to revision).

	Klukshu River						Alsek River
Year	Spawning escapement[a]	Total Canada harvest[b]	Total U.S. harvest[c]	Total harvest	Total run size	Exploitation rate	total escapement[d]
1976	1,064	354	154	508	1,572	32%	
1977	2,698	656	421	1,077	3,775	29%	
1978	2,530	656	732	1,388	3,918	35%	
1979	3,104	1,755	758	2,513	5,617	45%	
1980	2,487	290	415	705	3,192	22%	
1981	1,963	430	234	664	2,627	25%	
1982	1,969	633	160	793	2,762	29%	
1983	2,237	518	28	546	2,783	20%	
1984	1,572	415	14	429	2,001	21%	
1985	1,283	322	64	386	1,669	23%	
1986	2,607	218	151	368	2,975	12%	
1987	2,491	476	112	589	3,080	19%	
1988	1,994	312	71	383	2,377	16%	
1989	2,202	486	74	560	2,762	20%	
1990	1,698	722	49	771	2,469	31%	
1991	2,223	822	42	864	3,087	28%	
1992	1,243	253	95	348	1,591	22%	
1993	3,221	332	101	433	3,654	12%	
1994	3,620	500	260	760	4,380	17%	
1995	5,397	1,316	216	1,532	6,929	22%	
1996	3,382	893	249	1,143	4,525	25%	
1997	2,829	437	182	619	3,448	18%	
1998	1,347	286	184	470	1,817	26%	**4,621**
1999	2,166	349	158	507	2,673	19%	**11,597**
2000	1,319	114	225	339	1,658	20%	**8,295**
2001	1,738	189	168	357	2,095	17%	**11,022**
2002	2,141	235	228	463	2,604	18%	**8,504**
2003	1,661	175	288	463	2,124	22%	**4,932**
2004	2,455	165	208	373	2,828	13%	**7,343**
2005	1,034	96	208	304	1,338	23%	
2006	568	12	214	226	794	28%	
2007	677	41	224	265	942	28%	
2008	465	0	178	178	643	28%	
Averages:							
76–08	2,103	438	208	649	2,749	23%	
04–08	1,040	63	206	269	1,309	24%	

[a] Klukshu River spawning escapement = weir count minus above-weir harvest.

[b] Total Canada harvest Klukshu stock = above weir harvest plus 70% Dalton Post sport and 95% Aboriginal Fishery.

[c] Total U.S. harvest of Klukshu stock = 30% Dry Bay commercial, subsistence, and personal use gillnet harvest.

[d] Alsek River total escapement of large fish from mark–recapture estimates.

Table 3.2.–Estimated brood year returns of Klukshu River Chinook salmon by age, calculated by using the 30% assumption to apportion U.S. Alsek fishery harvests for brood year 1971 to 1991 (per McPherson et al. 1998a).

		Estimated returns by age					Estimated
Brood year	Estimated escapement	Age 3	*Age 4*	Age 5	Age 6	Age 7	total return
1971	unknown			498	1,153	0	1,651
1972	unknown		122	1,357	1,235	0	2,714
1973	unknown	0	1,068	2,121	2,414	0	5,603
1974	unknown	43	421	2,655	2,008	73	5,199
1975	unknown	0	412	1,085	1,299	2	2,799
1976	1,064	0	67	813	1,125	0	2,005
1977	2,698	0	276	1,156	696	28	2,156
1978	2,530	0	371	1,941	991	0	3,302
1979	3,104	29	77	739	661	0	1,506
1980	2,487	1	91	812	513	16	1,433
1981	1,963	30	156	1,955	1,086	10	3,238
1982	1,969	16	479	1,656	1,293	6	3,450
1983	2,237	1	196	674	1,329	9	2,209
1984	1,572	2	295	853	768	87	2,006
1985	1,283	10	493	1,265	1,645	2	3,415
1986	2,607	0	246	1,242	871	17	2,376
1987	2,491	4	73	456	1,412	49	1,994
1988	1,994	7	197	1,635	1,461	1	3,301
1989	2,202	47	387	1,514	992	5	2,945
1990	1,698	155	1,279	5,095	1,791		8,320
1991	2,223	11	511	1,773			3,958[a]

[a] Brood year 1991 total return estimated as the average of 58% of total return at age 3 to 5 for brood years 1976 to 1990.

Appendix 4.–Situk River Chinook Salmon Stock.

The Situk River is a relatively small but productive drainage located near Yakutat. It usually produces runs of Chinook salmon in the 2,000 to 5,000 fish range, but runs have been as large as 15,000. This stock is primarily exploited in or near the river by commercial set gillnet, subsistence, and recreational fishers. Stock assessment includes: weir counts, direct fishery enumeration for the commercial, subsistence and recreational fisheries, and age, sex, and size sampling in the commercial gillnet and recreational fisheries and in the escapement.

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, subsistence, troll
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	450 to 1,050 range; 730 point estimate
Population for goal:	Large spawners (3- to 5-ocean-age) in entire drainage
Optimal escapement goal:	None
Inriver goal:	None
Action points:	See Situk River management plan (5 AAC 30.365)
Escapement enumeration:	Weir counts: 1976 to present
Brood years in analysis:	18 (1977 to 1994)
Data in analysis:	Escapement of large spawners, all terminal and near terminal harvests, age structure all years.
Data quality:	Excellent
Contrast in escapements:	4.8
Model used for escapement goal:	Ricker model incorporating correction for autocorrelation seen in the spawner-recruit relationship
Criteria for range:	Range predicted to produce 90% of *MSY*
Value of alpha parameter:	14.806, corrected for autocorrelation
Value of beta parameter:	0.0011135
Value of $sigma^2$ parameter:	Not available
Document supporting goal:	McPherson, S. A., R. E. Johnson and G. F. Woods. 2005. Optimal Production of Chinook salmon from the Situk River. Alaska Department of Fish and Game, Division of Sport Fisheries, Fishery Manuscript No. 05-04, Anchorage.

Table 4.1.–Weir counts, harvests, run size, and exploitation rates for Situk River Chinook salmon, 1976 to 2008 (2008 data and some recent estimates are subject to revision). The Situk weir count and spawning escapement includes large Chinook (3- to 5-ocean-age), whereas the remainder of the statistics include 2-ocean-age fish as well as large Chinook salmon. One-ocean-age jack males are not included in this table, but annual returns of these fish often number over 1,000.

Year	Situk weir count	Spawning escapement	Sport harvest	Gillnet harvest	Subsistence harvest[a]	Total harvest	Total run size	Exploitation rate
1976	1,421	1,421	200	1,002	41	1,243	2,664	46.7%
1977	1,732	1,732	244	833	24	1,101	2,833	38.9%
1978	808	808	210	382	50	642	1,450	44.3%
1979	1,284	1,284	282	1,028	25	1,335	2,619	51.0%
1980	905	905	353	969	57	1,379	2,284	60.4%
1981	702	702	130	858	62	1,050	1,752	59.9%
1982	434	434	63	248	27	338	772	43.8%
1983	592	592	42	349	50	441	1,033	42.7%
1984	1,726	1,726	146	512	89	747	2,473	30.2%
1985	1,521	1,521	294	484	156	934	2,455	38.0%
1986	2,067	2,067	0	202	99	301	2,368	12.7%
1987	1,379	1,379	75	891	24	990	2,369	41.8%
1988	885	868	185	299	90	574	1,442	39.8%
1989	637	637	0	1	496	497	1,134	43.8%
1990	628	628	0	0	516	516	1,144	45.1%
1991	897	889	88	784	220	1,092	1,981	55.1%
1992	1,618	1,595	172	1,504	341	2,017	3,612	55.8%
1993	980	952	137	790	202	1,129	2,081	54.3%
1994	1,311	1,271	400	2,656	367	3,423	4,694	72.9%
1995	4,700	4,330	1,407	8,107	578	10,092	14,422	70.0%
1996	2,175	1,800	1,529	3,717	559	5,805	7,605	76.3%
1997	2,690	1,878	1,598	2,339	352	4,289	6,167	69.5%
1998	1,353	924	1,156	2,101	594	3,851	4,775	80.6%
1999	1,947	1,461	1,160	3,810	588	5,558	7,019	79.2%
2000	2,518	1,785	1,143	1,318	594	3,055	4,840	63.1%
2001	696	562	235	1,087	402	1,724	2,286	75.4%
2002	1,024	1,000	72	1,078	416	1,566	2,566	61.0%
2003	2,615	2,163	826	2,342	613	3,781	5,944	63.6%
2004	798	698	454	1,222	396	2,072	2,770	74.8%
2005	613	599	255	1	140	396	995	39.8%
2006	749	695	64	19	192	275	970	28.4%
2007	677	677	65	83	158	306	983	31.1%
2008	413	413	0[b]	91				
Averages:								
76–08	1,348	1,224	406	1,246				
04–08	650	616	210	283				

[a] Subsistence harvests include 400 fish in 1989, 415 in 1990, and 109 in 1991 taken home during commercial openings in those years with non-retention for Chinook salmon.

[b] Preliminary data from Situk River creel survey.

Table 4.2.–Estimated total returns of Situk River Chinook salmon for brood years 1977 to 2004 (2004 data and some recent estimates are subject to revision).

Brood year	Parent escapement	Age-3 return	Age-4 return	Age-5 return	Age-6 return	Age-7 return	Total return	Return/ spawner
1977	1,732	399	802	199	6	0	1,406	0.81
1978	808	150	438	313	180	29	1,110	1.37
1979	1,284	156	704	1,289	606	0	2,755	2.15
1980	905	268	1,118	895	556	0	2,837	3.13
1981	702	137	1,068	1,019	315	0	2,539	3.62
1982	434	318	973	1,299	439	0	3,029	6.98
1983	592	324	1,181	835	93	0	2,433	4.11
1984	1,726	79	290	441	222	3	1,035	0.60
1985	1,521	35	618	488	68	0	1,209	0.79
1986	2,067	225	393	259	305	4	1,186	0.57
1987	1,379	540	1,267	1,964	314	0	4,085	2.96
1988	868	491	988	904	289	0	2,672	3.08
1989	637	544	821	1,314	79	0	2,758	4.33
1990	628	497	2,366	2,849	461	9	6,182	9.84
1991	889	2,103	11,104	3,089	124	0	16,420	18.47
1992	1,595	934	3,468	2,076	29	0	6,507	4.08
1993	952	1,071	3,014	893	60	0	5,038	5.29
1994	1,271	1,346	2,744	1,034	50	0	5,174	4.07
1995	4,330	1,674	4,570	902	67	0	7,213	1.67
1996	1,800	1,496	3,704	1,238	26	0	6,464	3.59
1997	1,878	284	546	209	41	0	1,080	0.57
1998	924	383	1,217	681	238	0	2,519	2.73
1999	1,461	1,571	5,137	1,379	10	0	8,097	5.54
2000	1,785	451	1,190	483	0	0	2,124	1.19
2001	562	631	595	390	25			
2002	1,000	271	781	173				
2003	2,163	195	678					
2004	698	281						

Appendix 5.–Chilkat River Chinook Salmon Stock.

The Chilkat River produces the fifth or sixth largest population of Chinook salmon in Southeast Alaska (Pahlke 2008). Returning adults are present in terminal marine areas from late April through early July. A spring sport fishery occurs annually in Chilkat Inlet and targets mature Chilkat River Chinook salmon. Stock assessment includes: juvenile coded wire tagging, estimation of adult escapement, harvest, exploitation, smolt abundance, and survival.

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, subsistence, gillnet, troll
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	1,750 to 3,500 range; point estimate 2,200
Population for goal:	Large spawners (3- to 5-ocean-age)
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial helicopter surveys: 1981 to 1992 (not used; discontinued in 1992, deemed not representative). Mark–recapture estimates: 1991 to present
Brood years in analysis:	7 (1991 to 1997)
Data in analysis:	Estimated total escapement of large spawners, all terminal and near terminal harvests, age structure all years.
Data quality:	Very good escapement data, but limited to a short time series and low contrast; harvest and exploitation rate data limited, but current coded wire tag program will address this shortfall.
Contrast in escapements:	2.1 (1991 to 1997)
Model used for escapement goal:	Empirical inspection to determine replacement level and appropriate escapement goal range, supported with Ricker model to estimate replacement level. The optimal escapement level (S_{MSY}) was estimated from the relationship between spawners at replacement and S_{MSY} in 10 other Southeast Alaska Chinook stocks.
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper), per Eggers (1993)
Value of alpha parameter:	NA
Value of beta parameter:	NA
Value of sigma^2 parameter:	NA
Document supporting goal:	Ericksen, R.P., and S.A. McPherson. 2004. Optimal production of Chinook salmon from the Chilkat River. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Manuscript No. 04-01, Anchorage.

Table 5.1.–Spawning escapement estimates, terminal harvests, terminal run size, and exploitation rates for Chilkat River Chinook salmon, from 1991 to 2008. Escapement estimates are from mark–recapture estimates (2008 data and some recent estimates are subject to revision).

Year	Spawning escapement	Subsistence harvest	Sport harvest	D115 Gillnet Harvest[a]	Terminal Harvest[b]	Terminal run size	Exploitation rate
1991	5,897	0	0	233	233	6,130	3.8%
1992	5,284	0	0	124	124	5,408	2.3%
1993	4,472	2	314	220	536	5,008	10.7%
1994	6,795	10	220	68	298	7,093	4.2%
1995	3,790	38	228	38	304	4,094	7.4%
1996	4,920	44	354	45	443	5,363	8.3%
1997	8,100	18	381	165	564	8,664	6.5%
1998	3,675	17	215	113	345	4,020	8.6%
1999	2,271	31	184	279	494	2,765	17.9%
2000	2,035	34	49	45	128	2,163	5.9%
2001	4,517	60	185	38	283	4,800	5.9%
2002	4,051	60	337	32	429	4,480	9.6%
2003	5,657	46	404	27	477	6,134	7.8%
2004	3,422	146	403	108	657	4,079	16.1%
2005	3,366	78	252	165	495	3,861	12.8%
2006	3,039	86	116	16	218	3,245	6.7%
2007	1,442	90	285	16	391	1,833	21.3%
2008	3,233	0	0	2	2	3,235	0.06%
Averages:							
91–08	4,220	42	218	96	357	4,576	8.7%
04–08	2,900	80	211	61	353	3,251	11.4%

[a] 1991–2004 harvests in subdistricts 31 and 34 through statweek 28, 2005–2008 harvests in subdistricts 31 and 32 through statweek 29.

[b] Chilkat Inlet was closed to all fishing during the springs of 1991, 1992, and 2008 because of conservation concerns.

Table 5.2.–Estimated total returns of Chilkat River Chinook salmon for brood years 1991 to 2003 (2003 data and some recent estimates are subject to revision).

Brood year	Parent escapement	Age-1.2 return	Age-1.3 return	Age-1.4 return	Age-1.5 return	Total return	Return/ spawner
1991	5,897	1,295	4,567	6,565	232	12,659	2.15
1992	5,284	413	2,066	2,646	84	5,209	0.99
1993	4,472	216	1,108	1,822	32	3,178	0.71
1994	6,795	260	662	690	0	1,612	0.24
1995	3,790	624	1,391	2,037	33	4,085	1.08
1996	4,920	679	2,717	1,923	41	5,360	1.09
1997	8,100	801	2,500	3,986	33	7,320	0.90
1998	3,675	397	2,036	1,604	14	4,051	1.10
1999	2,271	1,084	2,330	1,646	0	5,060	2.23
2000	2,035	1,208	2,077	952	0	4,233	2.08
2001	4,517	1,721	2,250	1,012			
2002	4,051	875	775				
2003	5,657	653					

Appendix 6.–King Salmon River Chinook Salmon Stock.

The King Salmon River, located on Admiralty Island in northern Southeast Alaska, produces a small run of Chinook salmon (McPherson and Clark 2001). This stock supports no directed fisheries, but is taken incidentally in recreational, drift gillnet, and troll fisheries in marine waters in the region. Stock assessment includes peak survey counts and age/sex/length escapement sampling.

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, drift gillnet, and troll
Escapement goal type:	*Biological Escapement Goal*
Escapement Goal:	Weir count: 120 to 240 range; 150 point estimate
	Survey count: 80 to 160 range; 100 point estimate
Population for goal:	Large spawners (3- to 5-ocean-age)
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial helicopter or foot surveys: 1971 to present, standardized over the duration.
	Weir counts: 1983 to 1992
Index count expansion factor:	1.52 (SE = 0.27); multiplier for peak survey count)
Brood years in analysis:	21 (1971 to 1991
Data in analysis:	Estimated total escapement of large spawners, exploitation assumed similar to nearby hatchery stock, age structure 1982 to 1992 extrapolated to all years.
Data quality:	Excellent
Contrast in escapements:	5.7
Model used for escapement goal:	Ricker
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper), per Eggers (1993)
Value of alpha parameter:	7.8
Value of beta parameter:	0.0054
Value of sigma^2 parameter:	Not available
Document supporting goal:	McPherson, S. and J. H. Clark. 2001. Biological escapement goal for King Salmon River Chinook salmon. Alaska Department of Fish and Game, Regional Information Report No. 1J-0140, Juneau.

Table 6.1.–Escapement index counts, spawning escapement estimates of large spawners, expansion factors, and available age/sex composition for King Salmon River Chinook salmon from 1971 to 2008. Escapements in bold are weir counts and estimates in italics are from expanded survey counts. (2008 data, some recent estimates, and estimates based on expanded survey counts are subject to revision).

Year	Survey counts	Spawning escapement	Expansion factor	Age 1.2	Age 1.3	Age 1.4	Age 1.5	Age-.2-.5 total	Large females
1971	94	*141*							
1972	90	*135*							
1973	211	*317*							
1974	104	*156*							
1975	42	64							
1976	65	99							
1977	134	204							
1978	57	87							
1979	88	134							
1980	70	106							
1981	101	154							
1982	259	394		*16*	*49*	*340*	*0*	*405*	*275*
1983	183	**245**	1.17	**39**	**64**	**142**	**39**	**284**	**172**
1984	184	**265**	1.37	**94**	**47**	**200**	**18**	**359**	**194**
1985	105	**175**	1.57	**32**	**97**	**78**	**0**	**207**	**91**
1986	190	**255**	1.25	**95**	**51**	**204**	**0**	**350**	**175**
1987	128	**196**	1.38	**16**	**78**	**110**	**8**	**212**	**118**
1988	94	**208**	2.02	**14**	**21**	**174**	**7**	**216**	**153**
1989	133	**240**	1.59	**14**	**67**	**156**	**15**	**251**	**156**
1990	98	**179**	1.74	**12**	**87**	**87**	**6**	**191**	**104**
1991	91	**134**	1.38	**0**	**10**	**124**	**0**	**134**	**96**
1992	58	**99**	1.71	**25**	**72**	**27**	**0**	**124**	**44**
1993	175	266							
1994	140	213							
1995	97	147							
1996	192	292							
1997	238	362							
1998	88	134							
1999	200	304		*47*	*125*	*172*	*0*	*344*	*165*
2000	91	138		*36*	*65*	*57*	*4*	*162*	*81*
2001	98	149		*51*	*56*	*65*	*0*	*172*	*65*
2002	102	155		*14*	*96*	*56*	*0*	*166*	*58*
2003	78	119		*62*	*34*	*74*	*0*	*170*	*74*
2004	89	135		*10*	*111*	*12*	*6*	*139*	*49*
2005	94	143		*71*	*52*	*91*	*0*	*214*	*104*
2006	99	150		*20*	*113*	*38*	*0*	*171*	*42*
2007	119	181		*30*	*68*	*117*	*0*	*215*	*133*
2008	59	90							
Averages:									
71–08	119	183							
04–08	92	140							

Appendix 7.–Andrew Creek Chinook Salmon Stock.

Andrew Creek is a lower drainage and U. S. tributary to the transboundary Stikine River that supports a moderate-sized run of Chinook salmon (Clark et al. 1998). Chinook salmon from Andrew Creek are harvested in the U.S. marine recreational fishery out of Petersburg and Wrangell, and in drift gillnet (primarily Districts 106 and 108) and troll fisheries (regionwide). Stock assessment includes: peak survey counts and age/sex/length escapement sampling.

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	650 to 1,500 range; 800 point estimate
Population for goal:	Large spawners (3- to 5-ocean-age); total escapement or expanded survey count.
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial, foot, and/or fixed-wing helicopter surveys: 1975 to present, in standardized area and time
Index count expansion factor:	1.95 (SE = 0.45); multiplier for peak survey count
Brood years in analysis:	17 (1975 to 1991)
Data in analysis:	Estimated total escapement of large spawners, assumed annual harvest rates from nearby hatchery stock, age structure measured or inferred from sampled age structure data in 8 years
Data quality:	Good
Contrast in escapements:	5.10
Model used for escapement goal:	Ricker
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper), per Eggers (1993)
Value of alpha parameter:	6.07
Value of beta parameter:	0.0008426
Value of sigma^2 parameter:	Not available
Document supporting goal:	Clark, J. H., S. A. McPherson, and D. M. Gaudet. 1998. Biological escapement goal for Andrew Creek Chinook salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 5J98-08, Juneau.

Table 7.1.–Escapement peak survey counts, spawning escapement estimates of large spawners, expansion factors, and available age/sex composition for Andrew Creek River Chinook salmon, from 1975 to 2008. Escapements in bold are weir counts and estimates in italics are from expanded survey counts (2008 data, some recent estimates, and estimates based on expanded survey counts are subject to revision).

Year	Survey counts	Spawning escapement	Expansion factor	Age 1.2	Age 1.3	Age 1.4	Age 1.5	Age-.2-.5 total	Large females
1975	260	*507*							
1976		**404**							
1977		**456**							
1978		**388**							
1979	221	**327**	1.48	**74**	**186**	**133**	**11**	**404**	**170**
1980		**282**		**183**	**146**	**136**	**0**	**465**	**146**
1981	300	**536**	1.79	**69**	**314**	**220**	**4**	**607**	**274**
1982	332	**672**	2.02	**49**	**102**	**550**	**18**	**718**	**422**
1983		**366**		**110**	**279**	**81**	**3**	**473**	**168**
1984	154	**389**	2.53	**985**	**242**	**104**	**17**	**1,349**	**182**
1985	320	624							
1986	708	1,381							
1987	788	1,537							
1988	564	1,100							
1989	530	1,034							
1990	664	1,295							
1991	400	780							
1992	778	1,517							
1993	1,060	2,067							
1994	572	1,115							
1995	343	669							
1996	335	653							
1997	293	571		**61**	**253**	**371**	**4**	**690**	**347**
1998	487	950		*329*	*271*	*712*	*22*	*1,334*	*564*
1999	605	1,180		*576*	*503*	*543*	*80*	*1,702*	*557*
2000	690	1,346		*193*	*889*	*457*	*12*	*1,551*	*1,551*
2001	1,054	2,055		*56*	*915*	*1,191*	*12*	*2,174*	*2,174*
2002	876	1,708		*161*	*474*	*1,200*	*35*	*1,870*	*1,027*
2003	595	1,160		*207*	*647*	*449*	*43*	*1,346*	*535*
2004	1,534	2,991		*688*	*1,537*	*1,328*	*53*	*3,606*	*1,487*
2005	1,015	1,979		*136*	*1,423*	*650*	*0*	*2,209*	*802*
2006	1,089	2,124		*121*	*309*	*1,788*	*27*	*2,245*	*1,250*
2007	890	1,736		*78*	*1,056*	*637*	*77*	*1,848*	*945*
2008	503	981							
Averages:									
75–08	619	1,085							
04–08	1,006	1,962							

The Unuk River is a transboundary river that is the third or fourth largest producer of Chinook salmon in Southeast Alaska (Pahlke 2008). Coded wire tagging studies indicate that the majority of Unuk River Chinook salmon rear in the U.S. portion of the river and spend their marine residence in *inside* waters, but a few recoveries have been recorded as far as Kodiak and northern British Columbia. Stock assessment includes: coded wire tagging of smolt, estimation of adult escapement, harvest, exploitation, smolt abundance, and survival.

Optimal production of adult Unuk River Chinook salmon was estimated using information from the stock assessment program (1981–2005) and catch sampling programs of the U.S. and Canadian troll, gillnet, and recreational fisheries. Spawning abundance of large (≥660 mm MEF, primarily age-1.3 and older) fish was estimated from mark–recapture experiments (1997–2005), and from peak aerial and foot survey counts (1981–1996) expanded by a factor of 4.83. Spawning abundance of small (<660 mm MEF) fish was estimated either from mark–recapture experiments or their proportion seen in biological samples from the spawning tributaries. Age and sex composition for all years were also estimated from these samples. Bias in relative age and sex composition in escapements due to gear selectivity in years 1987 to 1990, 1994, and 1996 was corrected using sampling information from years with mark–recapture studies. Measurement error of spawning abundance was relatively low in all years (CV < 15%). For brood years with coded wire tag (CWT) data (1982–1986 and 1992–1998), total fishing mortality, including incidental mortality and landed catch, was estimated from CWT recoveries by age. Abundance of harvested fish was estimated from expansions of CWT recoveries using the estimated marked fraction (θ) of CWTs in escapement samples. For brood years 1981 and 1987–1991, estimates of fishing mortality were estimated from averages in years with CWT data. Ricker spawner-recruit models were fit to four datasets: large adult spawners to age-.2 to -.5 returns, large adult spawners to age-.2 to -.5 returns with a marine survival covariate, and two large adult spawner to smolt datasets incorporating different time series. Point estimates of spawning abundance (S_{MSY}) that would on average produce maximum sustained yield (MSY) of age-1.2-1.5 returns ranged from 2,764 to 3,068 large spawners. Tests for autocorrelation in the fitted adult spawner to adult return model without the marine survival covariate were not significant.

The Department recommends a biological escapement goal range of 1,800 to 3,800 large spawners (Hendrich et al. 2008). This recommendation comes from the spawner-recruit model with a marine survival covariate because it provided the best fit and did not require transformation of smolt numbers into adult returns. The corresponding range in index survey equivalents is 375–800 spawners. This replaces the goal of 650–1,400 large spawners (McPherson and Carlile 1997), as counted in index escapement surveys. The goal has undergone internal review, but it has not been adopted by the Alaska Department of Fish and Game.

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll
Escapement goal type:	*Biological Escapement Goal*
Revised escapement goal:	1,800 to 3,800; 2,764 point estimate
Population for goal:	Large spawners (3- to 5-ocean-age) to the entire drainage
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Helicopter and foot peak survey counts: 1977 to present in standard time and areas on: Eulachon River and Clear, Lake, Kerr, Genes Lake, and Cripple Creeks. Mark–recapture estimates: 1994, 1997 to present
Index count expansion factor:	4.83 (SE = 0.59); multiplier for the sum of peak survey counts in revision analysis
Brood years in revision analysis:	12 (1982 to 1986, and 1992 to 1998)
Data in revision analysis:	Survey counts, expanded by 4.83:1, and mark–recapture estimates of the total escapement of large spawners, marine harvest by age for 12 wild broods with average harvest data for the remainder, age structure sampled directly in most years, estimated for all broods.
Data quality:	Good to excellent
Contrast in escapements:	3.7
Model used for escapement goal:	Ricker model using a marine survival covariate
Criteria for range:	Range predicted to produce 90% of *MSY*
Value of alpha parameter:	4.61
Value of beta parameter:	0.0001849
Value of $sigma^2$ parameter:	0.1136
Document supporting goal:	Hendrich et al. 2008. Optimal production of Chinook salmon from the Unuk River. Alaska Department of Fish and Game, Fishery Manuscript 08-03, Anchorage.

Table 8.1.–Estimated parent escapements, harvests, total returns, and exploitation rates of Unuk River Chinook salmon for brood years 1981 to 2000. Estimates for escapement data in bold are from mark–recapture studies, and estimates in italics are from expanded survey counts.

Brood year	Parent escapement	Inriver total return[a]	Marine harvest (landed catch)	Incidental mortality	Total return[b]	Return/ spawner[b,c]	Exploitation rate[b]
1981[d]	3,532	12,552	2,885	1,055	16,493	3.5	23.9%
1982	6,528	16,223	2,816	1,408	20,447	2.9	20.7%
1983	5,436	8,235	2,165	767	11,167	1.5	26.3%
1984	8,876	5,401	1,054	505	6,960	0.7	22.4%
1985	5,721	1,626	638	334	2,598	0.3	37.4%
1986	10,273	6,254	2,073	830	9,157	0.5	31.7%
1987[d]	9,533	5,619	1,292	472	7,383	0.5	23.9%
1988[d]	8,437	5,684	1,307	478	7,468	0.7	23.9%
1989[d]	5,552	4,500	1,035	378	5,913	0.7	23.9%
1990[d]	2,856	4,417	1,015	371	5,804	1.6	23.9%
1991[d]	3,165	6,121	1,407	515	8,043	2.1	23.9%
1992	4,223	3,199	493	151	3,842	0.7	16.7%
1993	5,160	5,142	1,240	386	6,769	1.2	24.0%
1994[e]	3,435	4,655	1,041	307	6,002	1.6	22.4%
1995	3,730	**9,329**	2,154	822	12,306	2.5	24.2%
1996	5,639	**13,297**	2,357	770	16,424	2.7	19.0%
1997	**2,970**	**5,326**	1,266	247	6,839	1.9	22.1%
1998	**4,132**	**8,196**	1,467	418	10,081	1.9	18.7%
1999	**3,914**	**2,723**	1,287	311	4,344	1.1	36.8%
2000	**5,872**	**8,884**	3,333	330	12,896	2.1	28.4%

[a] Inriver total returns include 2- to 5-ocean-age fish (total age 4 to 7 years).

[b] Total returns, return per spawner, and exploitation rate all include incidental mortalities.

[c] Expressed in terms of the number of large fish per 2- to 5-ocean-age spawner.

[d] No wild stock CWT data for years 1981 and 1987–1991. Marine harvest and incidental mortality were calculated using the average brood year exploitation and incidental mortality rates from years 1993–1998.

[e] A mark–recapture experiment was conducted in 1994 to estimate escapement, but the data were biased. The expanded survey count was used for the revised goal analysis.

Table 8.2.–Escapement survey counts, spawning escapement estimates of large spawners, and available age/sex composition for Unuk River Chinook salmon from 1977 to 2008. Escapement estimates in bold are from mark–recapture studies and estimates in italics are from expanded survey counts (2008 data, some recent estimates, and estimates based on expanded survey counts are subject to revision).

Year	Survey count	Spawning escapement[a]	Age 1.2	Age 1.3	Age 1.4	Age 1.5	Age-.2-.5 total	Large females
1977	974	*4,706*						
1978	1,106	*5,344*						
1979	576	*2,783*						
1980	1,016	*4,909*						
1981	731	*3,532*						
1982	1,351	*6,528*	*225*	*1,031*	*5,497*	*0*	*6,753*	*3,779*
1983	1,125	*5,436*						
1984	1,837	*8,876*	*1,041*	*6,026*	*2,918*	*0*	*9,986*	*4,985*
1985	1,184	*5,721*	*2,421*	*4,819*	*660*	*0*	*7,900*	*4,181*
1986	2,126	*10,273*	*7,132*	*5,123*	*4,800*	*92*	*17,147*	*6,757*
1987	1,973	*9,533*	*2,011*	*4,578*	*4,261*	*50*	*10,900*	*5,741*
1988	1,746	*8,437*	*1,293*	*3,358*	*4,433*	*64*	*9,148*	*3,856*
1989	1,149	*5,552*	*337*	*2,544*	*2,721*	*80*	*5,682*	*3,393*
1990	591	*2,856*	*1,509*	*707*	*1,526*	*145*	*3,887*	*1,624*
1991	655	*3,165*	*786*	*2,414*	*551*	*38*	*3,789*	*1,369*
1992	874	*4,233*	*1,319*	*1,914*	*2,232*	*30*	*5,496*	*2,836*
1993	1,068	*5,160*	*568*	*2,241*	*2,797*	*99*	*5,704*	*2,818*
1994[b]	711	*3,435*	*1,044*	*1,382*	*2,124*	*122*	*4,673*	*2,039*
1995	772	*3,730*	*1,616*	*995*	*2,362*	*0*	*4,973*	*1,989*
1996	1,167	*5,639*	*736*	*3,061*	*2,319*	*187*	*6,303*	*2,661*
1997	636	**2,970**	**916**	**1,240**	**1,408**	**59**	**3,623**	**1,658**
1998	840	**4,132**	**1,269**	**2,595**	**1,207**	**35**	**5,106**	**2,087**
1999	680	**3,914**	**2,427**	**1,918**	**1,581**	**16**	**5,942**	**1,998**
2000	1,341	**5,872**	**3,140**	**3,499**	**1,447**	**50**	**8,136**	**2,506**
2001	2,019	**10,541**	**946**	**6,923**	**3,337**	**21**	**11,227**	**5,697**
2002	897	**6,988**	**2,485**	**2,887**	**3,188**	**66**	**8,626**	**3,330**
2003	1,121	**5,546**	**592**	**3,941**	**1,474**	**46**	**6,053**	**2,873**
2004	1,008	**3,963**	**2,937**	**1,289**	**1,756**	**19**	**6,001**	**1,645**
2005	929	**4,742**	**521**	**3,808**	**842**	**13**	**5,184**	**1,947**
2006	940	**5,645**	**3,248**	**2,146**	**2,108**	**0**	**7,502**	**2,466**
2007	720	**5,718**	**856**	**4,562**	**1,054**	**31**	**6,503**	**2,672**
2008	103[c]	**3,109**						
Averages:								
77–08	1,061	5,406						
04–08	740	4,635						

[a] The expansion factor 4.83 (SE = 0.59), based on the 1997–2001 and 2003–2004 mark–recapture estimates, was used to convert survey counts to total escapement of large spawners for years prior to 1997.

[b] A mark–recapture experiment was conducted in 1994 to estimate escapement, but the data were biased. The expanded survey count was used for the revised goal analysis.

[c] Partial count. Three tributaries that on average account for 80% of the count were not surveyed.

Appendix 9.–Chickamin River Chinook Salmon Stock.

The Chickamin River produces between 5,000 to 10,000 Chinook salmon annually. Harvest is spread throughout the fisheries of southern and central Southeast Alaska, with occasional recoveries in outside waters as far north as Prince William Sound and as far south as northern British Columbia. Stock assessment includes peak survey counts and age/sex/length data escapement sampling

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	450 to 900 range; 525 point estimate
Population for goal:	Large spawners (3- to 5-ocean-age) as counted in **peak survey counts** in the standardized survey areas on 8 clearwater tributaries: South Fork, Barrier, Butler, Leduc, Indian, Humpy, King, and Clear Falls.
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Helicopter and foot peak survey counts: 1975 to present in standard time and areas on: South Fork, Barrier, Butler, Leduc, Indian, Humpy, King, and Clear Falls tributaries. Mark–recapture estimates: 1995 to 1996, and 2001 to 2003
Index count expansion factor:	4.75 (SE = 0.77); multiplier for the sum of peak survey counts
Brood years in analysis:	15 (1975 to 1989), as in McPherson and Carlile (1997).
Data in analysis:	Survey counts, expanded by 4:1 and 6.7:1 to estimate total escapement of large spawners, marine harvest by age for 5 wild broods with adjusted hatchery harvest data for the remainder, age structure estimated directly in about half of the years, estimated for all broods.
Data quality:	Fair, McPherson and Carlile (1997)
Contrast in escapements:	11.1, McPherson and Carlile (1997)
Model used for escapement goal:	Ricker
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper), per Eggers (1993)
Value of alpha parameter:	7.46
Value of beta parameter:	0.0003446
Value of sigma^2 parameter:	Not available
Document supporting goal:	McPherson, S. A. and J. Carlile. 1997. Spawner-recruit analysis of Behm Canal Chinook salmon stocks. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 1J97-06, Juneau.

Table 9.1.–Escapement survey counts, spawning escapement estimates of large spawners, expansion factors, and available age/sex composition for Chickamin River Chinook salmon from 1975 to 2008. Escapement estimates in bold are from mark–recapture studies and estimates in italics are from expanded survey counts. (2008 data, some recent estimates, and estimates based on expanded survey counts are subject to revision).

Year	Survey count	Spawning escapement	Expansion factor	Age 1.2	Age 1.3	Age 1.4	Age 1.5	Age-.2-.5 total	Large females
1975	370	*1,758*							
1976	157	*746*							
1977	363	*1,724*							
1978	308	*1,463*							
1979	239	*1,135*							
1980	445	*2,114*							
1981	384	*1,824*							
1982	571	*2,712*							
1983	599	*2,845*							
1984	1,102	*5,235*							
1985	956	*4,541*		*1,170*	*2,975*	*1,253*	*0*	*5,398*	*2,401*
1986	1,745	*8,289*		*1,232*	*5,872*	*2,454*	*0*	*9,558*	*4,576*
1987	975	*4,631*		*1,938*	*2,844*	*1,525*	*56*	*6,363*	*2,909*
1988	786	*3,734*		*552*	*2,235*	*1,584*	*45*	*4,416*	*1,810*
1989	934	*4,437*		*307*	*1,702*	*2,499*	*255*	*4,763*	*3,085*
1990	564	*2,679*		*704*	*607*	*1,779*	*105*	*3,195*	*2,679*
1991	487	*2,313*							
1992	346	*1,644*							
1993	389	*1,848*							
1994	388	*1,843*							
1995	356	**2,309**	6.5	**383**	**581**	**1,704**	**80**	**2,748**	**1,369**
1996	422	**1,587**	3.8	**214**	**992**	**527**	**46**	**1,779**	**890**
1997	272	*1,292*							
1998	391	*1,857*							
1999	492	*2,337*							
2000	801	*3,805*							
2001	1,010	**5,177**	5.1	**1,080**	**3,778**	**1,190**	**32**	**6,080**	**2,841**
2002	1,013	**5,007**	4.9	**1,648**	**2,214**	**1,722**	**25**	**5,610**	**2,285**
2003	964	**4,579**	4.8	**506**	**3,369**	**1,145**	**21**	**5,041**	**2,550**
2004	798	**4,268**	5.3	**1,689**	**1,239**	**1,827**	**20**	**4,775**	**1,756**
2005	926	**4,257**	4.6	**1,020**	**3,260**	**556**	**44**	**4,881**	**1,834**
2006	1,330	*6,318*		*1,958*	*3,293*	*1,744*	*0*	*6,995*	*2,695*
2007	893	*4,242*		*945*	*3,062*	*818*	*20*	*4,845*	*1,961*
2008	1,086	*5,159*							
Averages:									
75–08	672	3,227							
04–08	1,007	4,848							

Appendix 10.–Keta River Chinook Salmon Stock.

The Keta River produces a small run of Chinook salmon representing about 3% of the wild stock production in Southeast Alaska (Pahlke 2008). This stock primarily produces yearling (age-1.) smolt, but about 10% are sub-yearling fish (age-0.). The only other stocks that produce sub-yearling smolt, to any degree, are the Blossom River stock and those in the Yakutat Forelands area, such as the Situk River. Information inferred from coded wire tagging studies in the nearby Chickamin and Unuk rivers suggests that Keta River Chinook salmon are *inside rearing*, spending most of their lives in Southeast Alaska and perhaps northern British Columbia. Stock assessment includes peak survey counts and age/sex/length data escapement sampling

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll; non directed
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	250 to 500 range; 300 point estimate
Population for goal:	Large spawners (≥660 mm MEF, or 2- to 5-ocean-age) as counted in **peak survey counts** under standardized survey conditions (time and area).
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial helicopter surveys: 1975 to present, standardized by time and area. Mark–recapture estimates: 1998 to 2000
Index count expansion factor:	3.01 (SE = 0.56); multiplier for helicopter peak survey standardized survey area on the Keta River.
Brood years in analysis:	15 (1975 to 1998), as in McPherson and Carlile (1997)
Data in analysis:	Survey counts, expanded by 2.5:1 to 4.0:1 estimate total escapement of large spawners, harvest rates assumed from Unuk and Chickamin, age structure limited, but estimated for all broods.
Data quality:	Fair, as in McPherson and Carlile (1997)
Contrast in escapements:	13.8, as in McPherson and Carlile (1997)
Model used for escapement goal:	Ricker model
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper) per Eggers (1993)
Value of alpha parameter:	8.23
Value of beta parameter:	0.0009923
Value of sigma^2 parameter:	Not available
Document supporting current goal:	McPherson, S.A., and J. Carlile. 1997. Spawner-recruit analysis of Behm Canal Chinook salmon stocks. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 1J97-06, Juneau. Additional comments: ADF&G is in the process of revising this goal.

Table 10.1.–Escapement survey counts, spawning escapement estimates of large spawners, expansion factors, and available age/sex composition for Keta River Chinook salmon from 1975 to 2008. Escapement estimates in bold are from mark–recapture studies and estimates in italics are from expanded survey counts (2008 data, some recent estimates, and estimates based on expanded survey counts are subject to revision).

Year	Survey count	Spawning escapement	Expansion factor	Total age 3	Total age 4	Total age 5	Total age 6	Total age 7	Age-3 to 7 total	Large females
1975	203	611								
1976	84	253								
1977	230	692								
1978	392	1,180								
1979	426	1,282								
1980	192	578								
1981	329	990								
1982	754	2,270		*0*	*119*	*1,672*	*478*	*0*	*2,269*	*1,672*
1983	822	2,474								
1984	610	1,836		*0*	*0*	*1,101*	*734*	*0*	*1,835*	*1,193*
1985	624	1,878								
1986	690	2,077								
1987	768	2,312								
1988	575	1,731								
1989	1,155	3,477								
1990	606	1,824								
1991	272	819								
1992	217	653								
1993	362	1,090								
1994	306	921								
1995	175	527								
1996	297	894								
1997	246	740								
1998	180	**446**	2.5	**0**	**55**	**151**	**234**	**6**	**446**	**240**
1999	276	**968**	3.5	**13**	**320**	**509**	**126**	**0**	**968**	**390**
2000	300	**914**	3.0	**12**	**318**	**378**	**206**	**0**	**914**	**377**
2001	343	1,032		*31*	*217*	*706*	*78*	*0*	*1,032*	*466*
2002	411	1,237		*0*	*318*	*524*	*395*	*0*	*1,237*	*465*
2003	322	969		*0*	*188*	*613*	*170*	*0*	*971*	*391*
2004	376	1,132		*27*	*386*	*360*	*359*	*0*	*1,132*	*466*
2005	497	1,496		*69*	*516*	*757*	*120*	*34*	*1,496*	*602*
2006	747	2,248		*23*	*371*	*1,623*	*232*	*0*	*2,249*	*1,089*
2007	311	936		*15*	*136*	*483*	*302*	*0*	*936*	*453*
2008	363	1,093								
Averages:										
75–08	425	1,282								
04–08	459	1,381								

Appendix 11.–Blossom River Chinook Salmon Stock.

The Blossom River produces less than 1% of the wild stock production in Southeast Alaska (Pahlke 2008). The stock produces primarily yearling smolt (age-1.), but returns have comprised as much as 15% sub yearling fish (age-0.). Coded wire tagging of Unuk and Chickamin Chinook wild and hatchery stocks suggest that Blossom River Chinook salmon are *inside rearing*, spending most of their lives in Southeast Alaska waters and to a lesser extent, in northern British Columbia. About 75% of the 2-ocean-age spawners in the Blossom River are of legal size. Stock assessment includes peak survey counts and age/sex/length data escapement sampling

Outline of stock management, assessment and escapement goal analysis

Management division:	Sport and Commercial Fisheries Divisions
Management jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll; non directed
Escapement goal type:	*Biological Escapement Goal*
Escapement goal:	250 to 500 range; 300 point estimate
Population for goal:	Large spawners (≥660 mm MEF, or 2- to 5-ocean-age) as counted in **peak survey counts** under standardized survey conditions (time and area).
Optimal escapement goal:	None
Inriver goal:	None
Action points:	None
Escapement enumeration:	Aerial helicopter surveys: 1975 to present, standardized by time and area. Mark–recapture estimate: 1998 and 2003–2006
Index count expansion factor:	4.00 (SE = 0.85): multiplier for helicopter peak survey count, based on 1 year (1998).
Brood years in analysis:	15 (1975 to 1989), as in McPherson and Carlile (1997)
Data in analysis:	Survey counts, expanded by 2.5:1 and 4.0:1 to estimate total escapement of large spawners, harvest rates assumed from Unuk and Chickamin, age structure limited, but estimated for all broods.
Data quality:	Fair, as in McPherson and Carlile (1997)
Contrast in escapements:	25.0, as in McPherson and Carlile (1997)
Model used for escapement goal:	Ricker model
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper) per Eggers (1993)
Value of alpha parameter:	9.207
Value of beta parameter:	0.0010217
Value of $sigma^2$ parameter:	Not available
Document supporting current goal:	McPherson, S.A., and J. Carlile. 1997. Spawner-recruit analysis of Behm Canal Chinook salmon stocks. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 1J97-06, Juneau. Additional comments: ADF&G is in the process of revising this goal.

Table 11.1.–Escapement index counts, spawning escapement estimates of large spawners, expansion factors, and available age/sex composition for Blossom River Chinook salmon population from 1975 to 2008. Escapement estimates in bold are from mark–recapture studies and estimates in italics are from expanded survey counts. (2008 data, some recent estimates, and estimates based on expanded survey counts are subject to revision).

Year	Survey counts	Spawning escapement	Expansion factor	Total age 3	Total age 4	Total age 5	Total age 6	Total age 7	Age-3 to 7 total	Large females
1975	146	*584*								
1976	68	*272*								
1977	112	*448*								
1978	143	*572*								
1979	54	*216*								
1980	89	*356*								
1981	159	*636*								
1982	345	*1,380*								
1983	589	*2,356*								
1984	508	*2,032*								
1985	709	*2,836*								
1986	1,278	*5,112*								
1987	1,349	*5,396*								
1988	384	*1,536*								
1989	344	*1,376*								
1990	257	*1,028*								
1991	239	*956*								
1992	150	*600*								
1993	303	*1,212*								
1994	161	*644*								
1995	217	*868*								
1996	220	*880*								
1997	132	*528*								
1998	**91**	**364**	4.0	**0**	**70**	**143**	**144**	**7**	**364**	**180**
1999	212	*848*		*71*	*353*	*354*	*71*	*0*	*848*	*283*
2000	231	*924*		*0*	*250*	*450*	*225*	*0*	*924*	*377*
2001	204	*816*		*0*	*272*	*317*	*227*	*0*	*816*	*544*
2002	224	*896*		*0*	*151*	*477*	*268*	*0*	*896*	*500*
2003	203	*812*		*0*	*90*	*451*	*271*	*0*	*812*	*511*
2004	333	**734**	2.2	**18**	**257**	**295**	**164**	**0**	**734**	**247**
2005	445	**926**	2.0	**6**	**202**	**570**	**143**	**6**	**926**	**376**
2006	339	**1,270**	3.8	**0**	**251**	**784**	**220**	**16**	**1,270**	**604**
2007	135	*540*		*15*	*161*	*292*	*73*	*0*	*540*	*248*
Averages:										
2008	257	*1,028*								
75–08	313	1,205								
04–08	302	900								