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Stock Status and Escapement Goals for Chinook Salmon Stocks in Southeast Alaska

by

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

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition. All others must be defined in the text at first mention, as well as in the titles or footnotes of tables and in figures or figure captions.

Weights and measures (metric)

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

Weights and measures (English)

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

Spell out acre and ton.

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
hour (spell out for 24-hour clock)	h
minute	min
second	s

Spell out year, month, and week.

Physics and chemistry

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

General

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

Mathematics, statistics, fisheries

alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	F, t, χ^2, etc.
confidence interval	C.I.
correlation coefficient	R (multiple)
correlation coefficient	r (simple)
covariance	cov
degree (angular or temperature)	°
degrees of freedom	df
divided by	÷ or / (in equations)
equals	=
expected value	E
fork length	FL
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
standard length	SL
total length	TL
variance	var

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ABSTRACT

The status of chinook salmon *Oncorhynchus tshawytscha* stocks in Southeast Alaska and transboundary rivers is presented in this document, relying on results of the inriver stock assessment program by the Division of Sport Fish and Canada, and catch sampling programs by the Divisions of Sport and Commercial Fisheries. The stock assessment program for chinook salmon stocks is presented for each stock, along with primary results. Escapements in 11 drainages are evaluated for trends and tracking in relationship to biological escapement goals for each system. Escapement goals for chinook salmon stocks have been established for these 11 drainages in the Southeast region. Escapement goals were updated for two stocks in this document: the Situk and the Chilkat River stocks. Updated escapement goals for four other stocks are anticipated to be developed over the next few months. Methods for determining escapement goals currently in place are described briefly, and reports containing the detailed analyses are cited. Ten of the eleven regularly monitored systems are judged to be healthy. A potential management concern was identified for one of these stocks in October of 2002: the Blossom River, a relatively small stock originating on the mainland in Behm Canal near Ketchikan. Escapements for this stock have been slightly below the escapement goal developed for the stock in the early 1990s. Current available information indicates the Blossom River stock of chinook is lightly exploited and that the existing escapement goal is biased high. Stock-recruit information collected over the past decade needs to be evaluated and used in combination with historic data to update the biological escapement goal for this stock of chinook salmon. Stock status of the other three Behm Canal chinook stocks is judged healthy, and no directed fishing on any of these stocks occurs. Given these facts, adjustments to fisheries to increase Blossom River escapements at this time would not be prudent.

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 (SEAK) are harvested primarily by the commercial troll fleet and recreational anglers. Chinook salmon are also harvested incidentally 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.

Commercial and recreational fisheries are managed on an abundance-based approach, with an annual all-gear harvest target provided by the Pacific Salmon Commission (PSC) via its Chinook Technical Committee (CTC) prior to each fishing season. The annual PSC harvest target is based on a preseason forecast of the aggregate abundance of all chinook salmon stocks that are present in SEAK for the coming year (CTC 2002a). The preseason abundance is estimated from the PSC chinook model run 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 (ABF) between commercial and recreational users as follows: (1) 8,600 chinook salmon to the gillnet fleet; (2) 4.3% of the total to the purse seine fleet; (3) 80% of the remainder to the troll fleet; and (4) 20% of the remainder to the recreational fleet.

Management of commercial troll harvests is described in the other documents provided in February 2003, to the Alaska Board of Fisheries (ABF). An accounting year of October through the following September is used for the troll fleet. This accounting year is separated into winter (October through the following April 14th), spring (April 15 to June 30th), and summer (July 1 to September 30th) seasons. Inseason tracking of troll fishery harvests is accomplished by returns of fish tickets, inseason fishing effort counts, and fishery performance data as well as analysis of coded wire tag returns.

Management of the recreational fishery is covered in the management plan for this fishery in the other documents provided in February 2003 to the ABF. Inseason tracking of harvests is accomplished by on-site creel survey programs to estimate harvest and fishing effort, and analysis of coded wire tag returns.

Management of the gillnet and purse seine fleets is covered under management plans for those gear types. Harvests of chinook salmon in the net fisheries is largely incidental to harvest of sockeye, coho, pink and chum salmon.

Chinook salmon harvests in SEAK are known to be composed of stocks originating from the Yakutat area to the southern coast of Oregon. This includes local SEAK and transboundary wild stocks. Chinook salmon are known to occur in 34 rivers in, or draining into, the Southeast region of Alaska from British Columbia or Yukon Territory, Canada, (Kissner 1977). Local Alaska hatchery stocks contribute a sizeable portion of SEAK chinook harvests each year (Table 1). Non-local stocks are wild and hatchery chinook salmon that originate from waters south of Dixon Entrance.

STOCK STATUS

Stock status for chinook salmon stocks in the Southeast region was judged primarily by performance in meeting escapement requirements; these are local wild stocks that contribute to harvests in SEAK fisheries. Harvest levels are also addressed for many of the larger stocks. A description of the stock assessment program is presented 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 Sustainable Salmon Fisheries Policy (ADF&G/ABF 2000).

Non-local stocks that contribute to harvests in SEAK fisheries are wild and hatchery chinook salmon that originate from waters south of Dixon Entrance. Principal contributing stock groups include several large wild stocks in British Columbia (e.g., Nass, Skeena and Fraser rivers), hatchery stocks in British Columbia from the West Coast of Vancouver Island and Georgia Strait, the wild Upriver Bright stock from the Columbia River, hatchery stocks from the Columbia River, and wild stocks from the Oregon and Washington coastal rivers. A listing of recent escapements for non-local wild stocks which contribute to SEAK fisheries is provided in this section to provide a measure of the health of these stocks.

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 transboundary 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 spring troll fishery was also modified extensively by 1982 to reduce exploitation on local wild stocks and later to target Alaska hatchery stocks.

In 1981, this program was formalized and expanded into a 15-year (roughly 3 life-cycles) rebuilding program for eleven key streams: the transboundary Taku, Stikine, Alsek, Unuk, Chickamin, and Chilkat rivers and the non-transboundary Blossom, Keta, Situk, and King Salmon rivers and Andrew Creek (ADF&G 1981) (Figure 1). The program used region-wide, all-gear catch ceilings for chinook salmon, designed to rebuild spawning escapements by 1995. ADF&G established interim point escapement goals in 1981 for all 11 systems, based on the highest observed escapement count prior to 1981. In 1985, the Alaskan program was incorporated into a comprehensive, coastwide rebuilding program for all wild stocks of chinook salmon, under the auspices of the U.S./Canada Pacific Salmon Treaty (PST). In 1999, the U.S./Canada PST was re-signed after extensive negotiations. The chinook chapter of the new agreement specified coastwide, abundance-based management of chinook salmon stocks, and called for more comprehensive stock and fishery monitoring.

Table 1. **Southeast Alaska (SEAK) chinook salmon harvest levels and Alaska hatchery contributions in SEAK harvests, 1965–2002, in thousands of chinook salmon** (2002 data and some recent harvests subject to revision).

Year	Commercial harvest	Sport harvest	Total all gear SEAK harvest	Alaska hatchery contribution	SEAK harvest minus AK hatchery contribution
1965	337	13	350	0	350
1966	308	13	321	0	321
1967	301	13	314	0	314
1968	331	14	345	0	345
1969	314	14	328	0	328
1970	323	14	337	0	337
1971	334	15	349	0	349
1972	286	15	301	0	301
1973	344	16	360	0	360
1974	346	17	363	0	363
1975	300	17	317	0	317
1976	241	17	258	0	258
1977	285	17	302	0	302
1978	400	17	417	0	417
1979	366	17	383	0	383
1980	324	20	344	7	337
1981	268	21	289	2	287
1982	289	26	315	1	315
1983	289	22	311	2	309
1984	268	22	290	5	285
1985	250	25	275	13	262
1986	259	23	282	17	265
1987	258	24	282	24	258
1988	253	26	279	30	249
1989	260	31	291	29	262
1990	318	51	369	59	310
1991	299	60	359	66	293
1992	216	43	259	44	215
1993	254	49	304	41	263
1994	221	42	264	37	227
1995	186	50	236	67	169
1996	178	58	236	88	148
1997	272	71	343	62	281
1998	216	55	271	33	238
1999	179	72	251	58	163
2000	200	63	263	84	179
2001	192	72	264	79	185
2002	357	87	444	81	363

The major components of the stock assessment program in Southeast Alaska are listed in Table 2, and an explanation of the stock assessment program is provided in the following narrative. Further details for each stock are provided in the appendices to this chapter.

Escapement Estimation

To track the spawning escapement, the Alaska Department of Fish and Game (ADF&G), the Canadian Department of Fisheries and Oceans (DFO), the Taku River Tlingit First Nation (TRTFN), and the Tahltan First Nation (TFN)

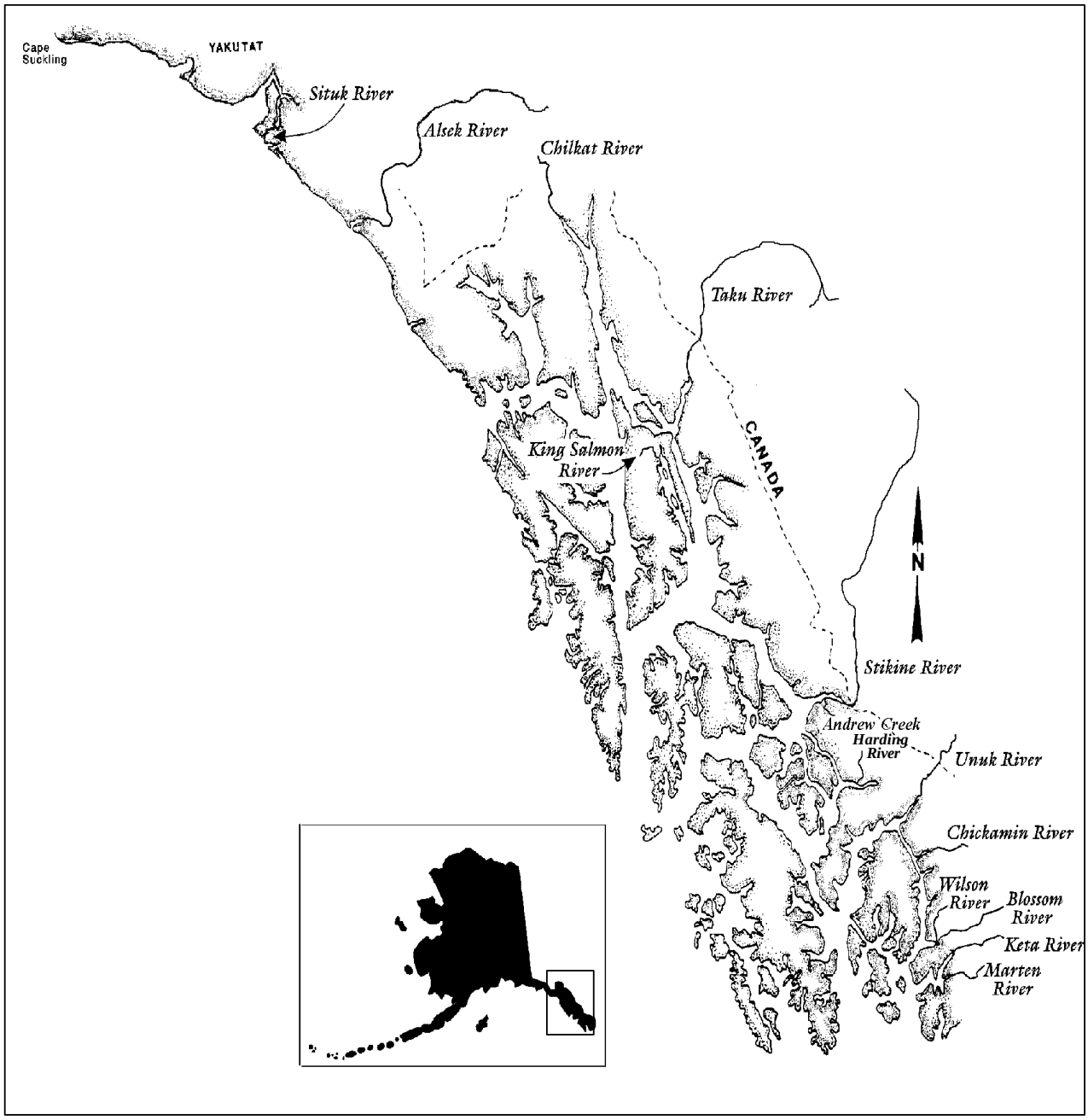

Figure 1. Location of selected chinook salmon systems in Southeast Alaska, Yakutat, and transboundary rivers.

count spawning chinook salmon in a designated set of eleven watersheds (Appendix A). These systems were selected on the basis of their historical importance to fisheries, size of the population, geographic distribution, extent of the historical database, and ease of data collection.

Initially, the escapement estimation program consisted of conducting aerial helicopter counts (peak single-day survey counts) annually in 10 of the 11 primary systems and a weir on one—the Situk River. The peak survey counts represented an unknown fraction of the total

escapement, which was adequate to track escapement trends, but inadequate for intensive fishery management and population assessment, such as that now in place in the PSC forum.

Over time, the chinook stock assessment program was expanded to estimate total escapement on all 11 of these streams (see Appendix A, Table 3). Long-term programs to estimate total escapement annually are in place on the six largest chinook-producing rivers in the region: the Situk (McPherson et al. *In Prep*), Alsek (Pahlke and Etherton 2001), Chilkat (Ericksen 2002), Taku (McPherson et al. 1999), Stikine (Der Hovanisian et al. 2001) and Unuk (Jones and McPherson 2002) rivers. A weir is operated on the Situk River, and mark-recapture tagging projects are used to estimate escapement in the five larger glacial systems. Short-term (1 to 10 years) projects were used to estimate expansion factors for the other five smaller systems: weirs on the King Salmon River and in Andrew Creek, and mark-recapture tagging studies on the Chickamin, Keta and Blossom rivers. These programs have allowed us to estimate expansion factors for past and future survey counts, when annual estimates of escapement are not possible because of budgetary constraints. 'Expansion factor' refers to the numeric multiplier that estimates total escapement from a survey count; e.g., for a survey count of 1,000 with an expansion factor of 5.0, the estimated total escapement is 5,000 spawners.

In addition to escapement estimation, biological sampling is conducted annually to collect samples to estimate age, sex and size structure of each population. These data are used to estimate brood-year production, survival, and to construct annual preseason forecasts of returning abundance. Escapement data are used annually by ADF&G for management purposes and are also provided annually to the Joint Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC), who use them to evaluate the status of escapement indicator stocks and fishery management regimes (CTC 2002a).

Radiotelemetry Studies

Many of our chinook salmon producing rivers are large and glacially occluded, and it is impossible to see fish unless they spawn in smaller clearwater tributaries. Radiotagging provides a tool to determine the distribution of spawning fish, to validate our aerial survey program, and to provide independent verification of our mark-recapture tagging studies to estimate escapement. The first radiotagging study on chinook salmon in Southeast Alaska was completed in 1989 and 1990 on the Taku River (Eiler et al., NMFS, Auke Bay Laboratory, unpublished data). Since then, we have used radiotelemetry to estimate the spawning distribution of chinook salmon in all of Southeast Alaska's major chinook-producing large glacial rivers, including the Alsek (Pahlke et al. 1999), Chilkat (Johnson et al. 1992), Stikine (Pahlke and Etherton 1999), Unuk (Pahlke et al. 1996), and Chickamin (Pahlke 1997) rivers. These studies have allowed us to validate our escapement surveys; i.e., to determine if we are surveying the areas where most of the fish spawn. On the Chilkat River, telemetry studies resulted in major changes in the escapement estimation methods for that river, and a revision of the Department's perception of the status of the Chilkat River stock from weak to healthy and stable. Telemetry results from the other rivers have supported the findings of the mark-recapture estimates and confirmed that the escapement surveys are valid indices of total escapement.

Harvest Estimation

Commercial harvests are reported on fish tickets, and sport harvests are estimated by creel surveys. These provide estimates of the total harvest in a fishery, but not the stock composition. Harvests of specific stocks, including hatchery fish, can be estimated using coded wire tags (CWT). These estimates have added value in Southeast because the PST provides Alaska fisheries a special add-on to the catch ceiling, allowing an additional harvest of local hatchery production. Currently, estimates of stock composition in SEAK fisheries that harvest chinook salmon has been somewhat limited and is being addressed by two programs, coded-wire-tagging of wild chinook stocks in the region and a genetic stock identification program. The combination of these two programs will significantly improve stock identification in SEAK chinook catches in the near future.

Table 2. Summary of key stock assessment components for Southeast Alaska chinook salmon stocks, through 2002.

	INSIDE REARING STOCKS							
	Chilkat	King SR	Andrew	Unuk	Chickamin	Blossom	Keta	Subtotal
1. 1997–2001 esc. average [a]	4,120	215	1,263	5,486	3,058	696	819	15,656
2. Years of index counts	NA	32	23	26	28	28	28	165
3. Years of total escapement	1991–2002	1983–1992	1976–1984	1994 and 1997–2002	1995–1996, 2001–2002	1998	1998–2000	
4. Total esc. methodology	mark-recap	weir	weir	mark-recap	mark-recap	mark-recap	mark-recap	
No. yrs. total esc. estimated	12	10	8	7	4	1	3	45
5. Radiotelemetry	1991–1992	NA	NA	1994	1996	None	None	
6. Expansion factor [b]	NA	1.5	2.0	5.0	5.17	4.0	3.0	
7. Years age/sex/size data	17	16	12	21	14	6	7	93
8. Broods coded-wire-tagged	7	None	None	15	6	None	None	28
9. Used for hatchery stock	Yes	Yes	Yes	Yes	Yes	No	No	

	OUTSIDE REARING STOCKS					TOTAL
	Situk	Alsek	Taku	Stikine	Subtotal	
1. 1997–2001 esc. average	1,341	10,157	47,543	33,005	92,045	**107,701**
2. Years of index counts	NA	27	30	28	85	**250**
3. Years of total escapement	1976–2002	1998–2002	1989–1990, 1995–2002	1996–2002		
4. Total esc. methodology	weir	mark-recap	mark-recap	mark-recap		
No. yrs. total esc. estimated	27	5	9	7	48	**93**
5. Radiotelemetry	NA	1998, 2002	1989–1990	1997		
6. Expansion factor	NA	~5.0	5.20	5.15		
7. Years age/sex/size data	21	27	30	22	100	**193**
8. Broods coded-wire-tagged	2	2	17	8	29	**57**
9. Used for hatchery stock	No	No	No	No	No	

[a] Estimates of large (3- to 5-ocean-age) fish only; does not include 1- and 2-ocean-age male jacks.

[b] The expansion factor is the multiplier to convert peak survey or weir index counts to total escapement of large spawners, based years when both survey/index counts and total escapement (mark-recapture or weir) projects were implemented.

Table 3. Estimated total escapements of chinook salmon to escapement indicator systems and to Southeast Alaska and transboundary rivers, 1975–2002. Numbers in **bold type** are weir counts or mark-recapture total estimates.

	MAJOR SYSTEMS			MEDIUM SYSTEMS							MINOR	
Year	Alsek (Klukshu) [a]	Taku	Stikine	Situk	Chilkat	Andrew	Unuk[a]	Chickamin[a]	Blossom[a]	Keta[a]	King Salmon	Total [b]
1975		12,920	7,571			520		1,914	584	609	63	NE
1976	5,320	24,582	5,723	**1,421**		**404**		810	272	252	98	43,584
1977	13,490	29,497	11,445	**1,732**		**456**	4,870	1,875	448	690	201	67,687
1978	12,650	17,124	6,835	**808**		**388**	5,530	1,594	572	1,176	86	48,886
1979	15,520	21,617	12,610	**1,284**		**327**	2,880	1,233	216	1,278	113	59,725
1980	12,435	39,239	30,573	**905**		**282**	5,080	2,299	356	576	104	96,113
1981	9,815	49,559	36,057	**702**		**536**	3,655	1,985	636	987	139	108,923
1982	9,845	23,848	40,488	**434**		**672**	6,755	2,952	1,380	2,262	354	93,065
1983	11,185	9,794	6,424	**592**		**366**	5,625	3,099	2,356	2,466	**245**	44,000
1984	7,860	20,778	13,995	**1,726**		**389**	9,185	5,697	2,032	1,830	**265**	66,577
1985	6,415	35,916	16,037	**1,521**		638	5,920	4,943	2,836	1,872	**175**	79,709
1986	13,035	38,111	14,889	**2,067**		1,414	10,630	9,022	5,112	2,070	**255**	100,874
1987	12,455	28,935	24,632	**1,379**		1,576	9,865	5,041	5,396	2,304	**196**	95,857
1988	9,970	44,524	37,554	**868**		1,128	8,730	4,064	1,536	1,725	**208**	115,360
1989	11,010	**40,329**	24,282	**637**		1,060	5,745	4,829	1,376	3,465	**240**	97,217
1990	8,490	**52,142**	22,619	**628**		1,328	2,955	2,916	1,028	1,818	**179**	98,468
1991	11,115	51,645	23,206	**889**	**5,897**	800	3,275	2,518	956	816	**134**	101,251
1992	6,215	55,889	34,129	**1,595**	**5,284**	1,556	4,370	1,789	600	651	**99**	112,177
1993	16,105	66,125	58,962	**952**	**4,472**	2,120	5,340	2,011	1,212	1,086	263	158,648
1994	18,100	48,368	33,094	**1,271**	**6,795**	1,144	**4,623**	2,006	644	918	210	117,173
1995	26,985	**33,805**	16,784	**4,330**	**3,790**	686	3,860	**2,309**	868	525	146	94,088
1996	17,995	**79,019**	**28,949**	**1,800**	**4,920**	670	5,835	**1,587**	880	891	288	142,834
1997	**15,250**	**114,938**	**26,996**	**1,878**	**8,100**	586	**2,970**	1,406	528	738	357	173,747
1998	**4,621**	31,039	**25,968**	**924**	**3,675**	974	**4,132**	2,021	**364**	**446**	132	74,296
1999	**11,597**	**20,545**	**19,947**	**1,461**	**2,271**	1,210	**3,914**	2,544	848	**968**	300	65,605
2000	**8,295**	**30,014**	**27,531**	**1,785**	**2,035**	1,380	**5,872**	4,141	924	**913**	137	83,027
2001	**11,022**	**41,179**	**63,523**	**656**	**4,517**	2,108	**10,541**	**5,177**	816	1,029	147	140,715
2002	**11,410**	**48,848**	**50,000**	**1,014**	**4,050**	1,752	**6,988**	**5,378**	896	1,233	153	131,722
Goals [b]												
Lower		30,000	14,000	450	1,750	650					120	NA
Point		36,000	17,500	734	2,200	800					150	NA
Upper		55,000	28,000	1,100	3,500	1,500					240	NA

[a] Escapements for the four Behm Canal systems are shown here for total escapement, to provide comparisons of magnitude across systems. Escapement goals for these four systems are for survey counts at present and are shown in Table 3 and Figure 4. Likewise, the escapement goal for the Alsek River is 1,100 to 2,300 chinook salmon past the Klukshu River weir, which represents approximately 20% of the chinook salmon production in the Alsek River.

[b] Total includes the estimated totals of large spawning chinook across all 11 systems. Escapements for the Chilkat River were approximated in 1976–1990 to make the totals comparable across years.

To maximize harvest of hatchery stocks and of wild stocks in excess of escapement requirements, information is needed on the distribution and harvest of individual stocks in various fisheries. For stocks such as the Situk and Alsek rivers, harvests of chinook salmon occur primarily within the river itself or in the lagoon where the river enters the ocean, and harvest estimation programs on those rivers can be used to estimate harvest and total production. For stocks where much of the harvest occurs in mixed-stock fisheries in the ocean, coded wire tagging projects can provide estimates of harvest for individual stocks, and genetic stock identification programs can provide estimates of harvest for individual stocks or stock groups.

Coded-wire-tagging of wild chinook salmon stocks was initiated in 1977 on the Taku River and continued until 1983 (McPherson et al. 2000). Stikine River juvenile salmon were tagged from 1978 to 1981. In 1983, tagging was started on the Unuk and Chickamin stocks and was continued through 1988. Situk River chinook smolt were tagged in 1984, and tagging occurred on the Alsek and Chilkat rivers from 1988 to 1990. Coded-wire-tagging was re-instituted in the Unuk and Taku rivers in 1993, and is continuing with increased effort compared to the earlier levels of tagging. Coded-wire-tagging was re-instituted on the Stikine and Chilkat rivers in spring 2000, and in the Chickamin River in fall 2001.

These programs, along with hatchery releases using local brood stocks, have documented the ocean migratory patterns of SEAK and transboundary chinook salmon stocks. Two major patterns are apparent: Outside Rearing Stocks (Taku, Stikine, Alsek, Situk) which rear as immature fish in waters outside (west and north) of Southeast Alaska, and Inside Rearing Stocks (all the rest) which generally rear in inside waters from Prince William Sound to Northern B.C. All releases of hatchery chinook salmon in SEAK are coded-wire-tagged at a rate of about 10% annually, a good mark rate for estimating harvests of these fish, most of which do not count toward the annual all-gear harvest limit in the region's fisheries.

The recovery of adult chinook salmon harvested in fisheries is dependent on sampling coverage in the various fisheries. Currently, about 40% of all commercial landings of chinook salmon are sampled for coded wire tags. Currently, about 20% of all recreational harvests of chinook salmon are sampled for coded wire tags.

In 1998, a pilot project was used to demonstrate that genetic-based sampling of chinook salmon from the summer troll fishery could be used to estimate the stock composition of harvests in that fishery, either to individual stocks or stock groups. In 1999 and 2000, both the summer and winter troll fishery were sampled for genetic electrophoretic analysis of stock composition. This genetic-based stock composition sampling and estimation program continued to make steady progress in the 2001 and 2002 seasons, and plans are underway to include the sport and net fisheries in the near future (2003 and 2004), using funding from the Southeast Alaska Sustainable Salmon Fund (SSSF).

STOCK STATUS ASSESSMENT

In this section, wild chinook stocks are evaluated for stock status through 2002. In the ADF&G/ABF Sustainable Salmon Fisheries Policy (SSFP —ADF&G/ABF 2000: 5AAC 39.222), some guidelines are provided to manage salmon stocks for sustainability. Our stock assessment and management program for chinook salmon in Southeast Alaska should provide a sustained resource; e.g., follow the SSFP. A brief excerpt from that policy is:

> *Management of salmon fisheries by the State of Alaska should be based on the following principles and criteria:*
>
> 1. *Wild salmon stocks and their habitats should be maintained at levels of resource productivity that assure sustained yields.*
> 2. *Fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning.*
> 3. *Effective salmon management systems should be established and applied to*

regulate human activities that affect salmon.

4. *Public support and involvement for sustained use and protection of salmon resources shall be sought and encouraged.*
5. *In the face of uncertainty, salmon stocks, fisheries, artificial propagation and essential habitats shall be managed conservatively.*

Escapement goals for the eleven key stocks of chinook salmon have been established (see Escapement Goal section below and associated references). These BEG ranges are designed to maintain wild stocks at high levels of productivity and to maintain yields near the theoretical or average maximum sustained level. Management plans and regimes are structured for SEAK fisheries to achieve escapements within the BEG ranges wherever possible, and are developed with significant input from the public and users. We evaluated escapements since 1975 in the 11 key stocks of chinook salmon against the BEG ranges established for each stock, to determine stock status. We assessed escapements retrospectively back to 1975, as if the BEGs currently being used had been in place since 1975.

Ten of the eleven chinook salmon stocks are judged to be healthy and achieving escapements which will produce returns near the theoretical maximum productivity (see Table 4 and Figures 2–4). The Alsek, Situk, Taku and Stikine rivers produce what are considered Outside Rearing chinook salmon. Of the escapements past Klukshu weir on the Alsek River since counts began in 1976, 14 have been within, 11 have been above, and one (1976) has been below the BEG range; since 1997, all five escapements have been within or above the BEG range. On the Situk River since 1976, 10 escapements have been within, 15 above, and one (1982) below the BEG range; since 1997, all five escapements have been within or above the BEG range. Escapements on the Taku and Stikine have rebounded since recruitment overfishing and poor survival reduced returns in the 1970s. Four of the five estimated escapements in the Taku River since 1997 have been within or above the BEG range, and the escapement in 1997 of about 115,000 was the highest on record since estimation began in 1973. All five escapements in the Stikine River since 1997 have been within or above the BEG range, and the 2001 escapement of about 63,000 large spawners was the highest on record.

The Chilkat and King Salmon rivers and Andrew Creek are considered Inside Rearing stocks, and stock status is judged healthy for all three systems. Escapement trends in the King Salmon River and Andrew Creek follow similar patterns to those seen on the Taku and Stikine rivers. Escapements have increased since the 1970s, to fall within or above the BEG ranges. All escapements in the King Salmon River since 1997 have been within or above the BEG range. All escapements in Andrew Creek since 1997 have been within or above the BEG range, and the 2001 escapement of 2,260 was the highest on record. A revised BEG was established for the Chilkat River stock in 2003; this stock has been within or exceeded this new range in each of the past five years.

The Unuk, Chickamin, Blossom and Keta rivers are all mainland stocks near Ketchikan and are considered Inside Rearing stocks. Peak survey goal ranges were developed for all four Behm Canal stocks in 1997. Stock status is judged to be healthy for three of the four systems (Unuk, Chickamin and Keta rivers). All five escapements in the Unuk River since 1998 have been within or above the 1997 BEG range, and the escapement in 2001 was near the highest on record. In the Chickamin River, escapements increased each year from 1998 to 2002, with the last four within or above the 1997 BEG range. Similarly, four of the last five escapements have been within the 1997 BEG range in the Keta River.

Escapements in the Blossom River have been below the 1997 BEG range all five years since 1998, averaging about 77% of the lower end of the 1997 BEG range. The escapements in 1998–2002 were 52%, 85%, 92%, 82% and 90%, respectively, of the lower end of the 1997 BEG range. Escapements did increase over the last five

Table 4. Estimated biological escapement goal (BEG) ranges for 11 chinook salmon stocks in Southeast Alaska. These BEGs include large spawners of approximate legal retention size (28 inches total length) and do not include smaller 1- and 2-ocean age males.

	Chinook salmon stock	BEG range for large spawners in survey count	1998–2002 survey count average	Present survey expansion factor	BEG range for large spawners estimated in total escapement	1998–2002 total escapement average
1	Chilkat River [a]	NA	NA	NA	1,750 to 3,500	3,310
2	King Salmon River [b]	80 to 160	116	1.50	120 to 240	174
3	Andrew Creek [b]	375 to 750	748	2.00	650 to 1,500	1,485
4	Blossom River [a, b]	250–500	192	4.00	NA	770
5	Keta River [a, b]	250 to 500	302	3.00		918
6	Unuk River [a, b]	650 to 1,400	1,155	5.00		6,289
7	Chickamin River [a, b]	450 to 900	741	5.17		3,852
8	Situk River [a]	NA	NA	NA	450 to 1,100	1,168
9	Klukshu (Alsek) River [c]	1,100 to 2,300	1,803	~5.0		9,389
10	Taku River [c]	5,800 to 10,600	5,837	5.20	30,000 to 55,000	34,325
11	Stikine River [c]	2,700 to 5,300	6,979	5.15	14,000 to 28,000	35,802

[a] The above biological escapement goal ranges have been approved by review teams from ADF&G as of February, 2003. The analysis and goals for these two systems along with an updated analysis for the four Behm Canal stocks will be presented to the Chinook Technical Committee of the Pacific Salmon Commission for review for PSC purposes by June 2003.

[b] 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. BEGs for the Blossom, Keta, Unuk and Chickamin rivers are expressed as survey count goals because expansion factors for these systems have just been developed. Analysis will be completed and presented to an ADF&G review team and the CTC, for total escapement goals for the Blossom, Unuk, Chickamin and Keta Rivers by June 2003.

[c] The above biological escapement goal ranges for the three 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.

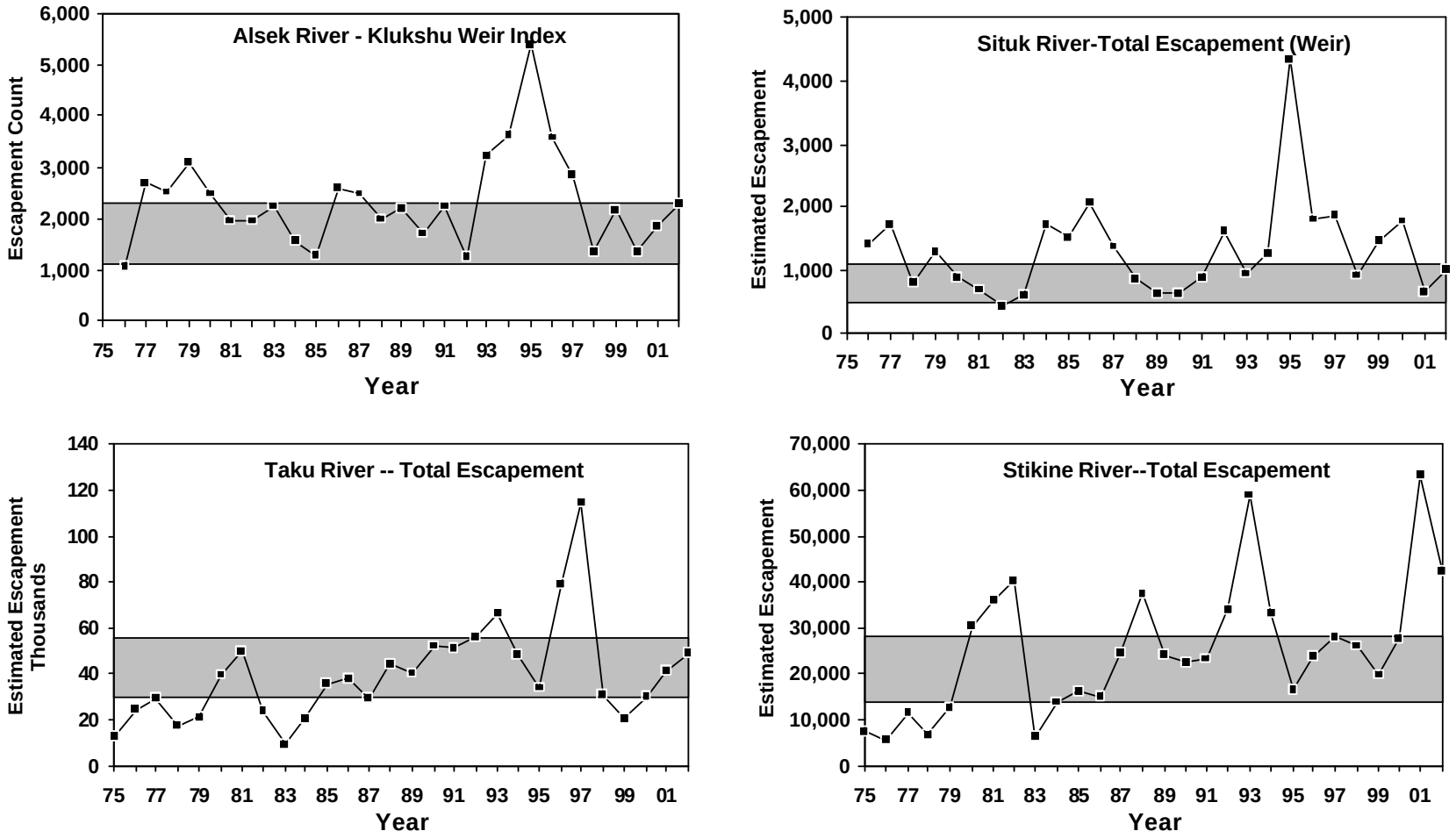

Figure 2. Estimated escapements of chinook salmon in the Alsek, Situk, Taku, and Stikine rivers from 1975 to 2002. All values represent the total escapement of large (3- to 5-ocean-age) chinook salmon except in the Alsek, which are total escapements past Klukshu weir, an index for the Alsek River.

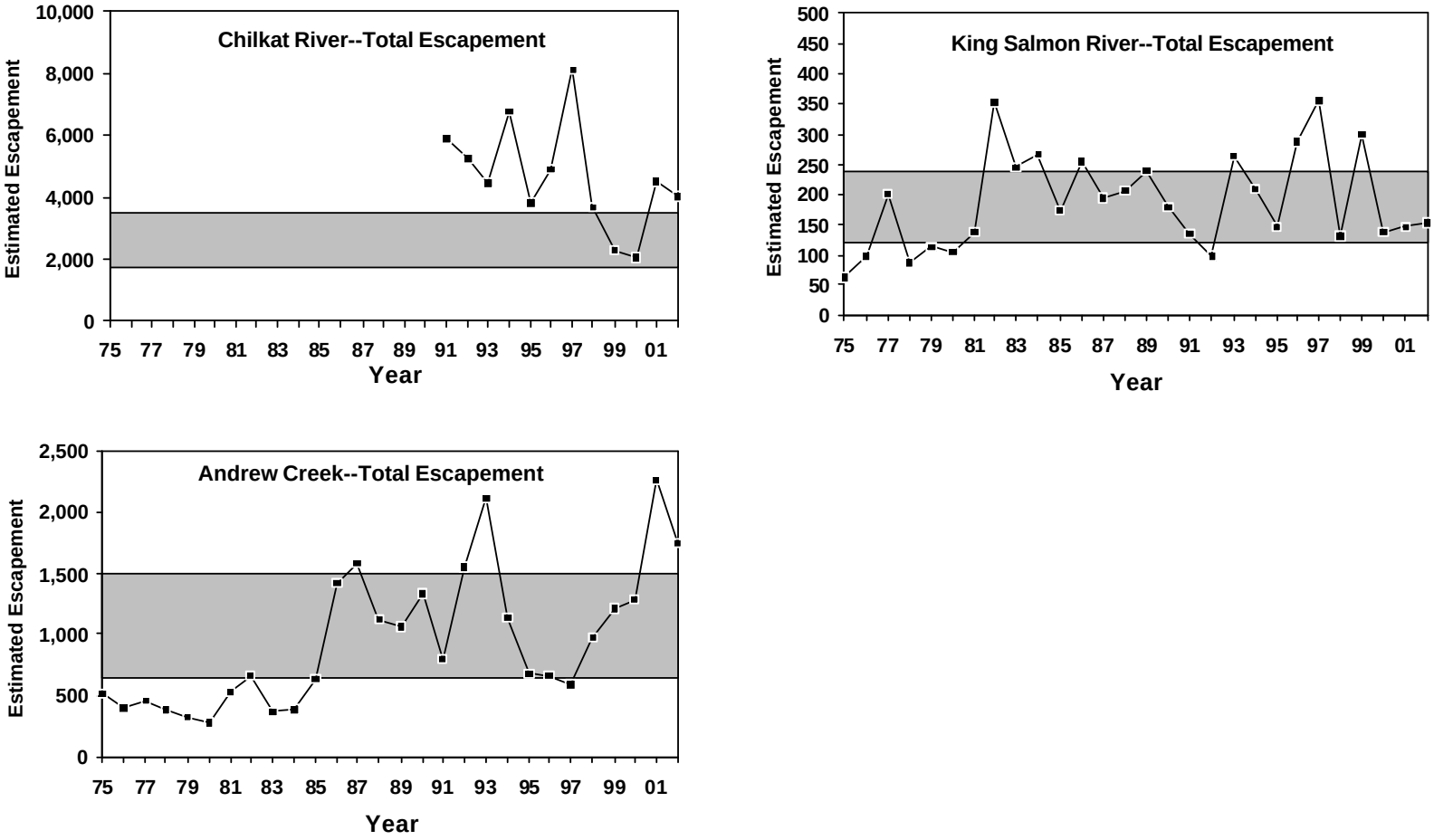

Figure 3. Estimated escapements of chinook salmon in the Chilkat and King Salmon rivers and in Andrew Creek from 1975 to 2002. All values represent the total escapement of large (3- to 5-ocean-age) chinook salmon.

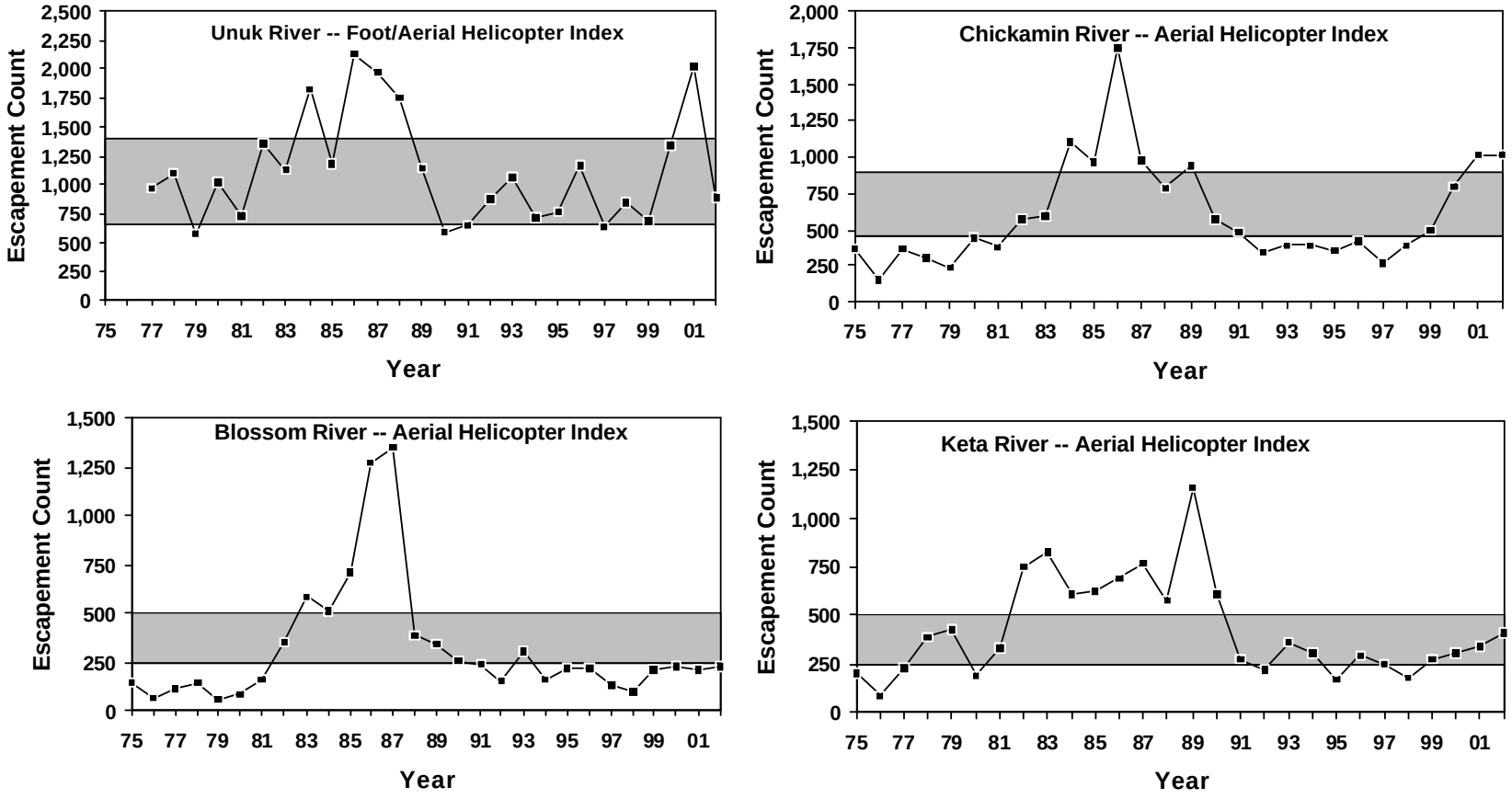

Figure 4. Peak survey counts of escapements of chinook salmon in the Unuk, Chickamin, Blossom, and Keta rivers from 1975 to 2002. All values represent the peak survey count of large (3- to 5-ocean-age; ≥ 660 mm MEF) chinook salmon.

years, but not into the 1997 BEG range. This led the Department to: (1) identify the Blossom River chinook salmon stock as a candidate stock of concern to the ABF, at the management concern level, in October 2002, and (2) to take a closer look at the Blossom River stock statistics, given its less-than-optimal performance and the good performance of the other three nearby chinook salmon stocks since 1998.

ADF&G has begun the process of analyzing the escapement survey data and age structure data for the Blossom River stock and the exploitation levels for the nearby Unuk River and Chickamin River stocks that are used as a surrogate for exploitation of the Blossom River stock. We anticipate being able to complete the analysis and thereby update the BEG for the Blossom River stock of chinook salmon over the next few months. Our initial review of these data leads us to believe that the existing goal of 250–500 large index spawners is an overestimate of the escapement level that will provide maximum sustained yield. This is because the harvest rate is relatively low, escapements over the past 10 years are stable under this relatively low exploitation rate, and, as a result, the maximum sustained yield escapement level is likely less than the prior analysis indicated. Given this preliminary analysis, we do not, at this time, consider the Blossom River to be a stock of concern. The Department does not consider that additional management action is needed to sustain the Blossom River chinook stock at this time. The 1998–2002 average survey count was 192 large chinook, which is about double the average escapement counts from 1975 to 1980 (102 large chinook), the base period used by the PSC. This stock has obviously sustained itself and is likely to do so in the future. The Department will continue the aerial survey program for this stock to maintain our ability to monitor escapement trends for this small stock. Additionally, results from the recently funded genetic stock identification program may assist the Department in identifying stock contributions of Behm Canal chinook salmon in key fisheries in the region. Fishery management actions have already been taken to provide additional escapement. No fisheries are open at present in terminal marine waters within 25 miles of the Blossom River. Spring troll and spring recreational fisheries are managed to reduce impacts on chinook salmon returning to spawn in the Blossom River. No fisheries are permitted for chinook salmon within the Blossom River drainage. We believe that these protective measures will maintain escapements and the sustainability of chinook salmon in the Blossom River in future years.

ESCAPEMENT GOALS

At the 2000 ABF meeting for Southeast Region finfish, it was reported that biological escapement goal (BEG) ranges had been established for ten of the eleven key chinook systems in Southeast Alaska. Since that time, we have established an escapement goal for the Chilkat River—the eleventh stock. In addition, BEG analyses for five of the ten other chinook salmon stocks were outdated; hence, efforts were initiated to update BEGs for this ABF cycle (i.e., for the Situk, Unuk, Chickamin, Blossom, and Keta rivers). We have not yet completed the required analysis for the four Behm Canal stocks of chinook salmon (Table 3). In this section, for each of the eleven systems, we provide a brief history of the escapement goals since interim goals were established in 1981, the current escapement goal range, and a reference for the detailed analysis used to develop each of the goals. In Appendix A, a section is included for each stock, which describes the stock and fisheries that harvest it, key numeric data, and graphs of the spawner-recruit relationship and the time series of escapements in relationship to the current goal range.

TAKU RIVER

In 1981, ADF&G set the index goal at 9,000 fish in the Nakina River (the largest chinook salmon producing tributary), based upon the count in 1952, the highest historical survey count for this tributary. The first system-wide goals were expressed in about 1985 as a range from 25,600 (U.S. estimate) to 30,000 (Canadian estimate), both estimates were based on professional judgment. In 1991, the Transboundary Technical

Committee (TTC), a subcommittee of the PSC for the Alsek, Taku and Stikine rivers, revisited the goal and agreed on an index goal of 13,200 counted in aerial surveys. This goal was implemented in 1992 (PSC 1991). All of these earlier goals were based on limited data. Staff of ADF&G and CDFO cooperatively developed a new escapement goal range of 30,000 to 55,000 large spawners (not an index) in an analysis of adult and smolt production, which was reviewed and accepted by the CTC (CTC 1999), ADF&G, CDFO, which included the Pacific Scientific Advice and Review Committee (PSARC), and the TTC, in 1999 (McPherson et al. 2000).

The current escapement goal range in McPherson et al. (2000) was based on a stock-recruit relationship, based on the number of smolt produced per female spawner (see graph in Appendix A1). In a nutshell, the highest number of smolt were produced from a range of approximately 15,000 to 27,500 females. Because the number of females to large males averages about 1:1 on the spawning grounds in the Taku River, this range was doubled to develop the current BEG range of 30,000 to 55,000 large spawners.

STIKINE RIVER

In 1981, ADF&G set an index escapement goal at 3,360 large fish, counted from the air over the Little Tahltan River, based upon an aerial count of 2,137 fish in 1980 expanded by a factor of 1.6. The first joint system-wide goal, developed by the TTC in about 1985, was expressed as a range from 19,800 (U.S. estimate) to 25,000 (Canadian estimate) and was in effect through 1991. In 1991, the TTC agreed on an index goal of 5,300 large spawners counted through the Little Tahltan River weir (PSC 1991). These earlier goals were all based on limited data. In a cooperative analysis by ADF&G and CDFO, recent results from mark-recapture experiments were used to expand aerial counts and weir counts into inriver returns to the watershed prior to 1996. In 1999, these data along with estimated harvests were used in a stock-recruit analysis to establish an escapement goal range for the Stikine River of 14,000 to 28,000 large chinook salmon (Bernard et al. 2000; Appendix A2). This biological escapement goal range has been reviewed and accepted by the CTC, ADF&G, and the joint TTC.

ALSEK RIVER

In 1981, ADF&G set the Alsek River goal at 5,000 chinook salmon, based on the 1979 Klukshu River weir count of 3,200 and a guessed expansion factor of 1.56 for the remainder of the drainage. The TTC developed an initial system-wide escapement goal range, developed circa 1985, which was 7,200 (U.S. estimate) to 12,500 (Canadian estimate). This goal was in effect through 1991. In 1991, the joint goal was revised to an index goal of 4,700 (Klukshu weir count of escapement; PSC 1991). A stock-recruit analysis was initially developed in 1996 but underwent review by the ADF&G, CDFO (including Pacific Scientific Advice Review Committee), TTC, and CTC, with subsequent revision through 1998. In the final technical report, McPherson, Etherton, and Clark (1998) recommended a revised Klukshu River chinook salmon escapement goal of 1,100 to 2,300 chinook salmon, and this revised goal was reviewed and accepted by ADF&G, the TTC, and the CTC in 1998 (Appendix A3).

The current escapement goal was based on an analysis of the stock-recruitment relationship of parent year spawners and returning adults, using a Ricker model to estimate stock-recruitment parameters. Note that the BEG range of 1,100 to 2,300 chinook salmon spawners counted past the Klukshu River weir is an index for the Alsek River drainage. Mark-recapture studies conducted jointly with Canada since 1997 indicate that the Klukshu River supports about one-fifth of the total spawners in the Alsek River drainage (Pahlke and Etherton 2001). It is anticipated that by 2006 a drainage-wide escapement goal for the Alsek River will be developed.

SITUK RIVER

The 1981 escapement goal was set at 5,100 fish. In 1982, the goal was revised to 2,000 large fish. In 1991, ADF&G revised the Situk River chinook salmon escapement goal to 600 large spawners based upon a spawner-recruit analysis (McPherson 1991), which was reviewed and

used by the CTC. The Alaska Board of Fisheries directed ADF&G to manage the stock for a range of 600 to 750 large spawners in 1991. In 1997, ADF&G revised the Situk River escapement goal range to 500–1,000 large spawners, to conform to the Department's escapement goal policy and to provide a more realistic maximum sustained yield range for management. The CTC reviewed and accepted this change in 1998.

Because the BEG analysis for the Situk River stock was done over 10 years ago and substantial new information has accumulated since that time, the BEG analysis was updated for this ABF cycle (see Appendix A4). We estimated parent spawners and subsequent recruitment for the 1977–1994 brood years. Statistical testing revealed that time series autocorrelation was present in the residuals output from a Ricker model. We corrected for the autocorrelation and estimated S_{MSY} (point estimate) to be 730 large spawners, and a range predicted to produce 90% of MSY of 450–1,050 large spawners (McPherson et al. *In Prep*). This range is not substantially different from the prior BEG range. This analysis will be presented to the CTC for review before June 2003.

CHILKAT RIVER

The 1981 escapement goal was set at 2,000 large fish, based on a guess of the fraction of the total escapement represented by the survey counts. ADF&G compiled available escapement, age, and harvest data for this stock, and a review team recommended a BEG range of 1,750–3,500 large spawners for the Chilkat River chinook salmon stock (Appendix A5) as measured in the annual mark-recapture program (Ericksen and McPherson *In prep*). This analysis has been accepted by ADF&G and will be presented to the CTC for review before June 2003.

KING SALMON RIVER

In 1981, ADF&G set the index goal at 200 large fish, based upon the prior highest survey counts of 200 spawners in 1957 and 211 spawners in 1973. In the mid-1980s, ADF&G revised the King Salmon River chinook escapement goal to 250 large spawners counted through the weir (total escapement). In 1997, ADF&G revised the goal to 120–240 total large fish, based upon a spawner-recruit analysis for the 1971–1991 brood years (McPherson and Clark 2001). This range is ADF&G's most current estimate of maximum sustained yield escapement and has been accepted by an ADF&G review team and the CTC as a biologically based escapement goal (Appendix A6).

ANDREW CREEK

In the early 1980s, ADF&G set the Andrew Creek chinook salmon escapement goal at 750 large fish total escapement. In 1997, an initial stock-recruit analysis was developed that underwent review by ADF&G and the CTC. This analysis was completed in 1998, and the technical report (Clark et al. 1998) recommended a revised biological escapement goal range of 650–1,500 large chinook salmon, which was accepted and adopted by the ADF&G and the CTC (Appendix A7).

UNUK RIVER

The 1981 ADF&G goal was 1,800 large index spawners. This goal was mistakenly based upon a 1978 count thought to be 1,765 fish, which was revised downward in 1985 to 1,106 fish upon discovery that some tributary counts were entered twice. The corrected count was still the largest pre-1981 index count. In 1994, ADF&G revised the goal to 875 large index spawners, based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted. In 1997, ADF&G revised the goal to a range of 650–1,400 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. The CTC reviewed and accepted this change in 1998 (Appendix A8). This stock is one of those that ADF&G anticipated being updated for the current ABF cycle. Analysis is currently under-way, and it is anticipated that revised escapement goals for the four Behm Canal stocks of chinook salmon will be complete in the next few months.

CHICKAMIN RIVER

In 1981, ADF&G set the escapement goal at 900 large index fish, based upon a count of 860 chinook salmon in 1972. In 1994, ADF&G

revised the goal to 525 large index spawners, based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted. In 1997, ADF&G revised the goal to 450–900 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. The CTC reviewed and accepted this change in 1998 (Appendix A9). This stock is one of those that ADF&G anticipated being updated for the current ABF cycle. Analysis is currently underway, and it is anticipated that revised escapement goals for the four Behm Canal stocks of chinook salmon will be complete in the next few months.

KETA RIVER

In 1981, ADF&G set the index goal at 500 large fish, based upon counts of 500 spawners in 1948 and 462 spawners in 1952 (ADF&G 1981). In 1994, ADF&G revised the escapement goal to 300 large index spawners, based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the escapement goal to a range of 250–500 large index spawners, in conformance with the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. The CTC reviewed and accepted this change in 1998 (Appendix A10). This stock is one of those that ADF&G anticipated being updated for the current ABF cycle. Analysis is currently underway, and it is anticipated that revised escapement goals for the four Behm Canal stocks of chinook salmon will be complete in the next few months.

BLOSSOM RIVER

In 1981, ADF&G set an index escapement goal, as a combined count of 800 large fish from the Blossom and Wilson rivers, based upon a 1963 count of 825 fish, 450 in the Blossom and 375 in the Wilson. In 1985, the Wilson surveys were dropped for budgetary reasons, but the goal of 800 continued to be applied to the Blossom. In 1994, ADF&G revised the Blossom goal to 300 large index spawners, based upon a spawner-recruit analysis (McPherson and Carlile 1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the goal to a range of 250–500 large index spawners in conformance with the McPherson and Carlile (1997) report and in compliance with the ADF&G Escapement Goal Policy. This stock is one of those that ADF&G anticipated being updated for the current ABF cycle. Analysis is currently underway, and it is anticipated that revised escapement goals for the four Behm Canal stocks of chinook salmon will be complete in the next few months.

NON-LOCAL STOCKS

Chinook salmon stocks originating from outside SEAK are harvested in SEAK fisheries. Here we provide a brief summary of the principal stocks or stock groups that are harvested, and escapement trends in recent years (Table 5).

The principal stock groups of chinook salmon, from Canada, Washington, Oregon and the Columbia River which contribute to SEAK fisheries are: (1) West Coast of Vancouver Island (WCVI), (2) North/Central British Columbia (NBC and CBC), (3) summer and fall stocks from the Columbia River (COL), (4) spring and summer stocks from the Fraser River, (5) Oregon coastal (OR) stocks from the north and mid-Oregon coasts), and (6) Washington coastal (WC) stocks. The remainder of the non-SEAK stocks listed in Table 5 cumulatively make up less than 10% of the SEAK harvests of chinook salmon. These six stock groups are all made up of both wild and hatchery stocks.

The escapements of these six stock groups were relatively high from 1999 to 2001, with the exception of WCVI hatchery and wild stocks. The WCVI stocks experienced a downturn in survival, especially in 2000 and 2001 returns. Preliminary estimates of 2002 returns for WCVI show an improvement. The 2000 and 2001 estimated escapements for the Nass and Skeena rivers (NBC) were high, 2002 being some of the highest on record. The Columbia River escapements of summer and fall chinook salmon have been high in recent years, with 2001 and 2002 returns the highest seen for several decades. Oregon coastal stocks have met or exceeded all existing escapement goals, with the exception of the Nehalem stock in 2000. Washington coastal stocks do not have agreed goals set, but escapements have been relatively stable for these stocks in recent years.

Table 5. Summary of CTC escapeme nt indicator stocks, those with CTC accepted biologically based goals as of December 2002, escapements from 1999–2001. Data source: CTC (2002b), CTC notes, and inter-net for 2001 Columbia spring and summer escapements.

Stock no.	Stock name	Area	CTC accepted goal	Goal	1999 Escapement	2000 Escapement	2001 Escapement
1.	Situk	SEAK	**Yes**	500–1,000	1,461	1,785	656
2.	K. Salmon	SEAK	**Yes**	120–140	300	137	147
3.	Andrew	SEAK	**Yes**	650–1,500	1,210	1,286	2,260
4.	Blossom [a]	SEAK	**Yes**	250–500	212	231	204
5.	Keta [a]	SEAK	**Yes**	250–500	276	300	343
6.	Klukshu	SEAK	**Yes**	1,100–2,300	2,166	1,363	1,843
7.	Taku	SEAK	**Yes**	30,000–55,000	20,545	30,014	41,179
8.	Stikine	SEAK	**Yes**	14,000–28,000	19,947	27,531	66,523
9.	Unuk [a]	SEAK	**Yes**	650–1,400	680	1,341	2,019
10.	Chickamin [a]	SEAK	**Yes**	450–900	492	801	1,010
11.	Chilkat	SEAK	No	–	2,271	2,035	4,517
12.	Yakoun	NBC	No	–	3,200	3,600	4,000
13.	Nass	NBC	No	–	11,538	20,406	34,315
14.	Skeena	NBC	No	–	43,775	51,720	84,642
15.	Dean	NBC	No	–	1,800	1,200	3,795
16.	Rivers Inlet	NBC	No	–	2,739	6,700	5,062
17.	Smith Inlet	NBC	No	–			
18.	WCVI	WCVI	No	–	12,256	5,175	3,041
19.	Up Georgia	GS	No	–	8,481	7,933	5,315
20.	Lw Georgia	GS	No	–	9,181	8,500	8,280
21.	Spr Fraser 1.3	Fraser	No	–	9,500	12,850	9,885
22.	Spr Fraser 1.2	Fraser	No	–	8,751	11,731	10,607
23.	Sum Fraser 1.3	Fraser	No	–	20,740	26,773	31,269
24.	Sum Fraser 0.3	Fraser	No	–	53,204	45,161	74,132
25.	Harrison	Fraser	**Yes**	75,100–98,500	107,016	77,035	78,098

-continued-

Table 5. (Page 2 of 2).

Stock no.	Stock name	Area	CTC accepted goal	Goal	1999 Escapement	2000 Escapement	2001 Escapement
26.	Skagit Spring	PS	No	–	471	1,021	1,856
27.	Skagit SU/Fall	PS	No	–	4,924	16,930	13,233
28.	Stillaguamish	PS	No	–	1,098	1,622	1,269
29.	Snohomish	PS	No	–	4,803	6,092	8,164
30.	Green	PS	No	–	11,025	6,170	7,975
31.	Nooksack SP	PS	No	–	213	432	2,185
32.	L Wash. Fall	PS	No	–	240	300	1,269
33.	Quillayute SU	WC	No	–	713	992	1,225
34.	Quillayute Fall	WC	No	–	3,334	3,730	3,800
35.	Queets SP/SU	WC	No	–	373	248	545
36.	Queets Fall	WC	No	–	1,933	3,572	2,106
37.	Grays Spring	WC	No	–	1,285	2,867	2,860
38.	Grays Fall	WC	No	–	9,196	9,260	9,483
39.	Hoh SP/SU	WC	No	–	1,027	492	1,200
40.	Hoh Fall	WC	No	–	1,924	1,748	1,870
41.	Hoko Fall	WC	No	–	1,550	730	838
42.	Col Upr SP	COL	No	–	10,682	51,308	about 100,000
43.	Col Upr.Sum	COL	**Interim**	17,857	23,057	27,073	about 75,000
44.	Col Upr Bright	COL	**Interim**	40,000	72,089	73,024	104,946
45.	Lewis	COL	**Yes**	5,700	3,184	9,820	13,900
46.	Deschutes	COL	No	–	3,641	3,728	11,057
47.	Nehalem	OR	**Yes**	6,989	8,063	5,257	9,459
48.	Siletz	OR	**Yes**	2,944	4,166	4,982	10,582
49.	Siuslaw	OR	**Yes**	12,925	29,610	12,999	29,748
50.	Umpqua	OR	No	–	1,804	3,140	6,510
51.	Mid S OR	OR	No	–	83	62	74

[a] Blossom, Keta, Unuk and Chickamin goals are for index surveys which represent one-third to one-fifth of total escapement.

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APPENDICES

APPENDIX A1: Taku River Chinook Salmon Stock
Stock Description

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). Prior to the mid 1970s (1880s to 1975), these fish were exploited in directed commercial (troll and gillnet) and recreational fisheries, with annual commercial harvests estimated in excess of 15,000 chinook salmon (Kissner 1976).

This stock underwent a downward trend in abundance and survival in the 1960s and 1970s. Various restrictions were placed on all SEAK fisheries (troll, gillnet and recreational) beginning in 1976, as part of a program to rebuild stocks of chinook salmon in SEAK by ADF&G. Presently, migrating chinook salmon from the Taku River are caught incidentally in the late winter and spring troll fisheries, a commercial gillnet fishery located in U.S. waters near the river, and in inriver commercial and aboriginal gillnet fisheries in Canada. Chinook salmon from the Taku River are also caught in directed recreational fisheries in Alaska and in northwestern British Columbia and constitute a large portion of the spring chinook harvest near Juneau (McPherson et al. 2000). Exploitation of the terminal run is jointly managed by the U.S. and Canada through the PSC process.

Chinook salmon from the Taku River are a "spring run" of salmon, with returning adults present in terminal marine areas from late April through early July. Spawning occurs from late July to mid-September, in clearwater tributaries. Yearling smolt are produced and migrate after a year in fresh water. After entering salt water, the juveniles spend anywhere from a couple of months to a year in nearshore waters of Southeast Alaska, and then migrate north and west into the Gulf of Alaska, out of reach of fisheries in Southeast Alaska and British Columbia; hence the classification as an Outside Rearing stock. Returning mature fish that are four to six years old dominate the annual spawning population.

The stock assessment program for Taku River chinook salmon consists of a smolt coded wire-tagging program, coded wire tag recovery on adults in marine fisheries and inriver, a mark-recapture tagging program to estimate escapement both inseason via a test fishery in the lower river and postseason via sampling upriver on the spawning grounds, and aerial survey counts to refine expansion factors (McPherson et al. 1999, 2000). This is a joint program that ADF&G runs in cooperation with CDFO and the Taku River Tlingit First Nation. This program produces annual estimates of smolt production, total adult production, exploitation rates and harvest rates, as well as age structure to evaluate brood year returns and escapement requirements. The coded wire tagging program for the Taku stock has marked fish from the 1975–1981 and 1991–2000 broods.

Escapements since 1990 have averaged over 50,000 large chinook and exploitation rates are estimated to have averaged less than 15%, ranging from about 12% to 22% (Table A1.1). The smolt and female spawner data used to develop the current BEG is shown in Table A1.2 and Figure A1.2. The estimated escapements of large spawners versus the current BEG is shown in Figure A1.1.

APPENDIX A1: Taku River Chinook Salmon Stock

System: Taku River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	Joint management ADF&G and CDFO through PSC
Fisheries:	U.S. recreational, gillnet, troll; Canadian gillnet, First Nations, recreational
Escapement Goal Type:	BEG
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: 1973–2002, conducted in six major tributaries—the Nahlin, Nakina, Dudidontu, Tatsamenie and Kowatua rivers, and Tseta Creek and standardized since 1973. Mark-recapture estimates: 1989, 1990, 1995–2002.
Index Count Expansion Factor:	5.20 (multiplier for cumulative helicopter peak survey count in five tributaries (Nahlin, Nakina, Dudidontu, Tatsamenie and Kowatua rivers)
Brood years in BEG analysis:	8
Data in BEG analysis:	Estimated total escapement of large female spawners and subsequent smolt production.
Data Quality:	Good.
Contrast in escapements:	NA
Model used for BEG:	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:	0.00001643
Document supporting BEG:	McPherson et al. (2000): SFD Fishery Manuscript No. 00-2

Table A1.1 Estimated harvests, escapements, and total runs by year of chinook salmon bound for the Taku River, 1973–2001.

Year	Escapement [a]	U.S. gillnet	U.S. sport	U.S. troll	U.S. PU	U.S. total	Canada GN	Canada FN	Total harvest	Total run size [b]	Expl. rate
1973	14,564	5,064	936	519		6,519		NE	6,519	21,083	30.9%
1974	16,015	2,381	885	526		3,792		NE	3,792	19,807	19.1%
1975	12,920	1,899	800	NE		2,699		NE	2,699	15,619	17.3%
1976	24,582	1,369	800	NE		2,169		NE	2,169	26,751	8.1%
1977	29,497	539	2,450	NE		2,989		NE	2,989	32,486	9.2%
1978	17,124	1,333	1,673	NE		3,006		NE	3,006	20,130	14.9%
1979	21,617	2,078	1,853	5,375		9,306	97		9,403	31,020	30.3%
1980	39,239	1,289	2,512	5,352		9,153	225	85	9,463	48,702	19.4%
1981	49,559	960	1,703	5,276		7,939	159		8,098	57,657	14.0%
1982	23,848	1,690	1,359	2,709		5,758	54		5,812	29,660	19.6%
1983	9,794	353	1,089	419		1,861	556	9	2,426	12,220	19.9%
1984	20,778	869	1,210	2,754		4,833	515	0	5,348	26,126	20.5%
1985	35,916	1,410	1,863	749		4,022	350	4	4,376	40,292	10.9%
1986	38,111	1,133	755	808		2,696	352	10	3,058	41,169	7.4%
1987	28,935	1,004	1,019	399		2,422	233	0	2,655	31,590	8.4%
1988	44,524	591	765	NE		1,356	741	27	2,124	46,648	4.6%
1989	40,329	1,278	1,857	NE	62	3,197	1,034	6	4,237	44,566	9.5%
1990	52,142	2,395	2,039	NE	57	4,491	1,386	0	5,877	58,019	10.1%
1991	51,645	2,330	4,199	NE	47	6,576	1,609	0	8,185	59,830	13.7%
1992	55,889	1,082	3,099	NE	34	4,215	1,592	121	5,928	61,817	9.6%
1993	66,125	3,567	5,860	NE	17	9,444	1,790	25	11,259	77,384	14.5%
1994	48,368	2,012	2,672	NE	36	4,720	2,300	119	7,139	55,507	12.9%
1995	33,805	3,056	1,920	NE	37	5,013	1,875	70	6,958	40,763	17.1%
1996	79,019	2,187	4,121	1,605	87	8,000	3,475	63	11,538	90,557	12.7%
1997	114,938	2,437	4,648	1,479	33	8,597	2,816	103	11,516	126,454	9.1%
1998	31,039	504	1,840	656	31	3,031	1,334	60	4,425	35,464	12.5%
1999	19,734	1,299	2,110	811	22	4,242	1,165	50	5,457	25,191	21.7%
2000	30,529	528	892	1,484	21	2,925	1,663	50	4,638	35,167	13.2%
2001	44,000	1,162	1,001	1,917		4,080	1,701	50	5,831	49,831	11.7%
Averages:											
1979-01	42,604	1,531	2,191	2,120	40	5,125	1,175	43	6,337	48,941	14.1%
1979-89	32,059	1,150	1,453	2,649	62	4,777	392	18	5,182	37,241	15.0%
1990-01	52,269	1,880	2,867	1,325	38	5,445	1,892	59	7,396	59,665	13.2%

[a] Escapement: Escapement estimates shown here are for large chinook (3- to 5-ocean age; 5- and 6-year total age), are from mark-recapture estimates in 1989–1990 and 1995–1997 (McPherson et al. 2000), are preliminary mark-recapture estimates for 1999–2001, and for 1973–1988, 1991–1994 and 1998 are expanded survey counts of large spawners. No estimates are available prior to 1973.

[b] Total run and exploitation rate estimates are underestimated for 1973–1978 because troll harvest estimates are lacking or incomplete. Exploitation rates were likely 30% or greater in these years. Exploitation rates are also underestimated from 1987–1996 because troll harvest estimates are lacking or incomplete, but likely averaged about 1,500 fish per year.

Table A1.2 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 (2,139)	1,189,118 (174,197)	79	258.9 (126)	87,450 (23,384)	0.074 (0.0224)
1976	15,165 (6,478)	1,549,052 (374,227)	71	102.1 (50)	65,457 (16,615)	0.042 (0.0148)
1979	10,997 (4,991)	661,150 (97,648)	74	60.1 (29)	39,833 (9,288)	0.060 (0.0166)
1991	27,435 (11,842)	2,098,862 (295,390)	80	76.5 (35)	196,114 (14,153)	0.093 (0.0148)
1992	22,935 (10,391)	1,968,167 (438,569)	73	85.8 (43)	79,307 [a]	0.0403
1993	29,976 (13,573)	1,267,907 (564,432)	78	42.3 (27)	19,114 [b]	0.0151
1994	31,553 (13,565)	1,328,553 (352,068)	76	42.1 (21)		
1995	19,705 (2,644)	1,898,233 (626,335)	77	96.3 (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 1973–1991 year classes.

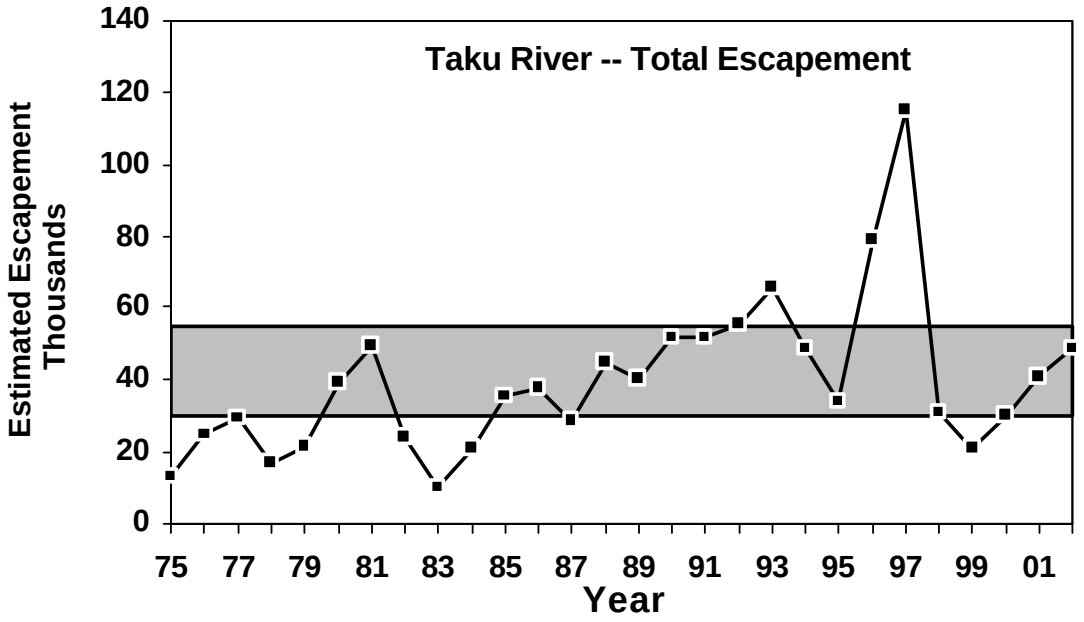

Figure A1.1 Estimated escapements of large spawners in the Taku River from 1975 to 2002, with the 1999 BEG range.

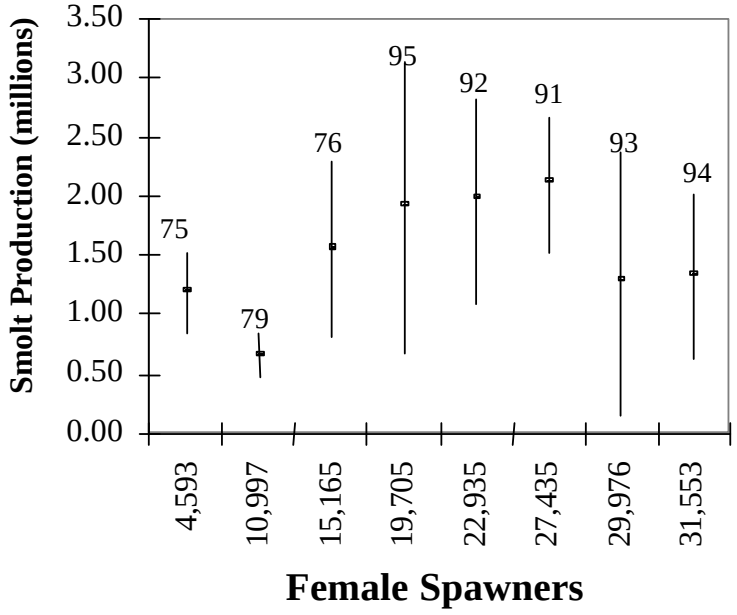

Figure A1.2 Estimated smolt production and estimated abundance of female parents for the 1975, 1976, 1979, and 1991–1995 year classes. Intervals on smolt production are approximate 95% confidence intervals (from McPherson et al. 2000).

APPENDIX A2: Stikine River Chinook Salmon Stock Stock Description

The Stikine River, which is a glacial transboundary river like the Taku, produces the second largest population of local chinook salmon, on average, in Southeast Alaska (Bernard et al. 2000). This stock underwent a downward trend in abundance and survival in the 1960s and 1970s. Various restrictions were placed on all intercepting fisheries (troll, gillnet and recreational) beginning in 1976, as part of a program to rebuild stocks of chinook salmon in SEAK by ADF&G. Presently, migrating chinook salmon from the Stikine River are caught incidentally in the troll fishery, a commercial gillnet fishery located in U.S. waters near the river, and in inriver commercial and aboriginal gillnet fisheries in Canada. Chinook salmon from the Stikine River are also caught in directed recreational fisheries near Wrangell and Petersburg in Alaska and on the Tahltan River in B.C. Exploitation of the terminal run is jointly managed by the U.S. and Canada through the Pacific Salmon Commission (PSC) process.

Chinook salmon from the Stikine River are a spring run and yearling smolt are produced. Ocean rearing patterns are similar to that of the Taku and, hence the classification as an Outside Rearing stock. Returning mature fish that are four to six years old dominate the annual spawning population, with 6-year-old fish being the most abundant age class.

The stock assessment program for Stikine River chinook salmon presently consists of a smolt coded wire tagging program, coded wire tag recovery on adults in fisheries and inriver, a mark-recapture tagging program to estimate escapement both inseason via a test fishery in the lower river and postseason via sampling upriver on the spawning grounds, and the index spawner counts at Little Tahltan River (Der Hovanisian et al. 2001). This is a joint program that ADF&G runs in cooperation with CDFO and the Tahltan First Nation. This program produces annual estimates of smolt production, total adult production, exploitation rates and harvest rates, as well as age structure to evaluate brood year returns and escapement requirements. The smolt coded wire tagging project was re-instituted in 2000 and the first returns of 5-year-old fish will occur in 2003; CWT coverage for this stock is much less extensive than that for the Taku and Unuk River stocks.

Escapements over the most recent five years of estimates (1997–2001) have averaged 33,000 large spawners (Figure A2.1). All of these five escapements and all estimated escapements since 1985 have been within or above the 1999 BEG. Exploitation rates are estimated to have averaged 18% for 1997–2001 and have ranged from about 10% to 40% since 1983 (Table A2.1). The adult spawner-recruit data used to develop the current BEG is shown in Table A2.2 and Figure A2.2.

APPENDIX A2: Stikine River Chinook Salmon Stock

System: Stikine River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	Joint management ADF&G and CDFO through PSC
Fisheries:	U.S. recreational, gillnet, troll; Canadian gillnet, First Nations, recreational
Escapement Goal Type:	BEG
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–present Index weir counts - Little Tahltan River: 1985–present Mark-recapture estimates: 1996–present
Index Count Expansion Factor:	5.15 (multiplier for weir count on Little Tahltan River)
Brood years in BEG analysis:	15 (1977–1991)
Data in BEG 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 BEG:	Ricker model incorporating measurement error in escapements and returns
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
Document supporting BEG:	Bernard et al. (2000): SFD Fishery Manuscript No. 00-1

Table A2.1 **Escapement index counts, spawning escapement estimates, harvests, run sizes, and exploitation rates for Stikine River chinook salmon, 1975–2001.** Escapement estimates in bold are from mark-recapture estimates (1996–2001), estimates in italics (1975–1984) are from expansions of aerial counts and estimates from 1985–1995 are from expansions of Little Tahltan River weir counts.

Year	Aerial counts	Little Tahltan weir count	Spawning escapement	U.S. sport harvest	U.S. gillnet harvest	Canadian harvest	Total harvest	Total run size	Expl. rate
1975	700		*7,571*		1,534	1,202	2,736	10,307	26.5%
1976	400		*5,723*		1,123	1,160	2,283	8,006	28.5%
1977	800		*11,445*	2,282	1,443	162	3,887	15,332	25.4%
1978	632		*6,835*	1,743	531	500	2,774	9,609	28.9%
1979	1,166		*12,610*	1,759	91	1,562	3,412	16,022	21.3%
1980	2,137		*30,573*	2,498	631	2,231	5,360	35,933	14.9%
1981	3,334		*36,057*	2,022	283	1,404	3,709	39,766	9.3%
1982	2,830		*40,488*	2,929	1,033	2,387	6,349	46,837	13.6%
1983	594		*6,424*	2,634	47	1,418	4,099	10,523	39.0%
1984	1,294		*13,995*	2,171	14	643	2,828	16,823	16.8%
1985	1,598	3,114	16,037	2,953	20	1,111	4,084	20,121	20.3%
1986	1,201	2,891	14,889	2,475	102	1,963	4,540	19,429	23.4%
1987	2,706	4,783	24,632	1,834	149	2,390	4,373	29,005	15.1%
1988	3,796	7,292	37,554	2,440	207	2,629	5,276	42,830	12.3%
1989	2,527	4,715	24,282	2,776	310	2,886	5,972	30,254	19.7%
1990	1,755	4,392	22,619	4,283	557	2,481	7,321	29,940	24.5%
1991	1,768	4,506	23,206	3,657	1,336	1,678	6,641	29,847	22.3%
1992	3,607	6,627	34,129	3,322	967	2,454	6,743	40,872	16.5%
1993	4,010	11,449	58,962	4,227	1,628	2,371	8,226	67,188	12.2%
1994	2,422	6,426	33,094	2,140	1,996	2,085	6,221	39,315	15.8%
1995	1,117	3,259	16,784	1,218	1,702	1,894	4,814	21,598	22.3%
1996	1,920	4,840	**28,949**	2,464	1,717	2,769	6,950	35,899	19.4%
1997	1,907	5,613	**26,996**	3,475	2,566	4,513	10,554	37,550	28.1%
1998	1,385	4,879	**25,968**	1,438	460	2,160	4,050	30,026	13.5%
1999	1,379	4,738	**19,947**	3,567	1,078	3,769	8,414	28,361	29.7%
2000	2,720	6,640	**27,531**	2,581	1,692	2,770	7,043	34,574	20.4%
2001	4,158	9,738	**63,523**	3,005	7	3,123	6,135	69,658	8.8%

Table A2.2. Estimated total returns of Stikine River chinook salmon for brood years 1977–1996.[a]

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*	866	8,254	6,000	102	15,222
1978	*6,835*	1,356	4,004	1,999	161	7,520
1979	*12,610*	3,981	14,809	16,006	311	35,107
1980	*30,573*	1,560	4,094	12,757	1,026	19,437
1981	*36,057*	963	6,289	21,225	768	29,245
1982	*40,488*	1,692	6,215	37,809	5,853	51,569
1983	*6,424*	1,657	3,914	13,415	1,588	20,574
1984	*13,995*	1,079	10,716	25,534	956	38,285
1985	16,037	828	2,264	16,832	76	20,000
1986	14,889	3,049	11,183	31,251	1,649	47,132
1987	24,632	2,440	8,517	57,900	3,135	71,992
1988	37,554	770	6,249	30,800	2,372	40,191
1989	24,282	644	4,324	13,268	116	18,352
1990	22,619	1,204	5,049	8,182	223	14,658
1991	23,206	4,859	21,264	28,700	641	55,464
1992	34,129	2,212	8,645	22,377	901	34,136
1993	58,962	1,315	7,185	15,905	556	24,961
1994	33,094	2,522	11,409	14,883	212	29,026
1995	16,784	5,731	18,663	16,109		40,503 [a]
1996	**28,949**	14,391	53,366			67,757 [a]

[a] Total returns for brood years 1995 and 1996 are incomplete.

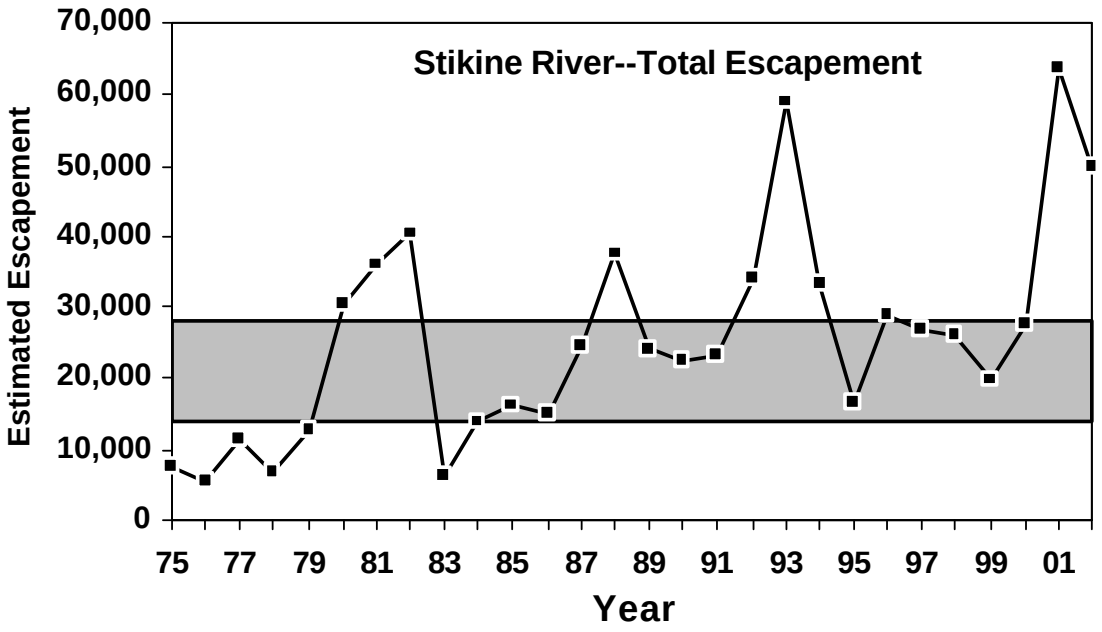

Figure A2.1 Estimated escapements of large spawners in the Stikine River from 1975 to 2002, with the 1999 BEG range.

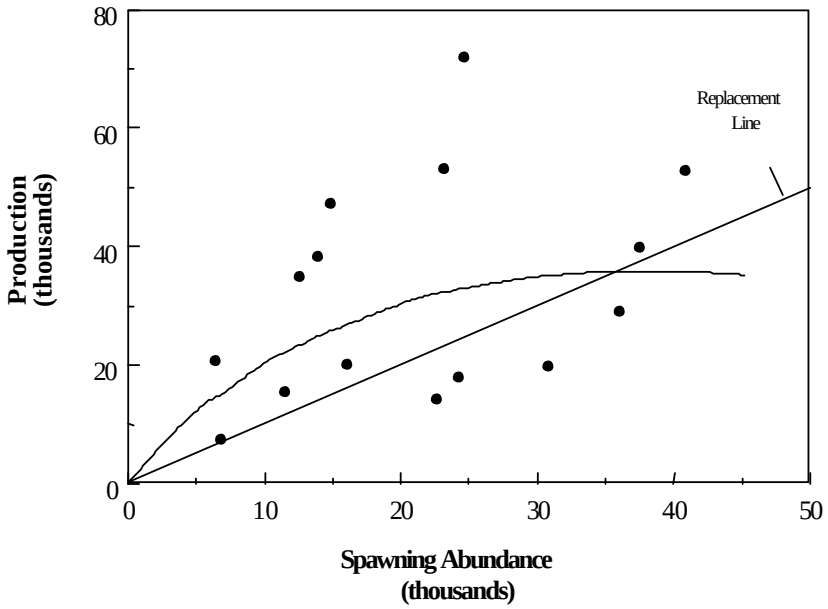

Figure A2.2 Estimated production of age 1.2–1.5 chinook salmon in year classes 1977–1991 against the estimated spawning abundance of their parents age 1.3 and older for the population in the Stikine River. (Extracted from Bernard et al. 2000. The curve represents production predicted with Ricker's model.)

APPENDIX A3: Alsek River Chinook Salmon Stock Stock Description

The Alsek River produces the third or fourth largest chinook run in Southeast Alaska (SEAK). The Alsek River originates in the Yukon Territory, Canada, and flows in a southerly direction into the Gulf of Alaska, southeast of Yakutat, Alaska. From 1941–1980 there were fishery openings directed at Alsek River chinook salmon with average catches of about 1,500 fish (McPherson et al. 1998). Chinook salmon returning to this river are caught primarily 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. Small harvests of this stock are also probably taken in marine recreational and commercial set gillnet and troll fisheries near Yakutat. Early season openings of the U.S. commercial fishery have been severely restricted since 1980, primarily in the attempt to reach the high escapement goals set in 1981 and 1991 for Klukshu River chinook, and in response to conservation concerns for the early sockeye run. The escapement goal was revised in 1998 to a range of 1,100 to 2,300 chinook through the Klukshu weir and that goal has been met or exceeded every year since 1976.

Chinook salmon from the Alsek are a "spring run" of salmon, with returning adults present in terminal marine areas from late April through early July. Spawning occurs from late July to late August. Yearling smolt are produced and migrate after a year in fresh water. Ocean migration patterns are similar to Taku and Stikine stocks, hence the classification as an Outside Rearing stock. Returning mature fish that are four to six years old dominate the annual spawning population.

Since 1976, the Canadian Department of Fisheries and Oceans (DFO) has operated a weir at the mouth of the Klukshu River to count chinook, sockeye, and coho salmon. The weir count is used as the index for the Alsek River. Prior to 1997, the proportion of the total chinook salmon escapement to the Alsek River drainage counted at the Klukshu River weir was unknown. Mark-recapture studies conducted annually since 1997 indicate that Klukshu River chinook salmon account for approximately 15–20% of the total run (Pahlke 2001; Pahlke and Etherton 2001). This is a cooperative program run by ADF&G and CDFO along with the Champagne-Aishihik First Nation that provides annual estimates of escapement as well as age structure to evaluate brood year returns and escapement requirements.

Klukshu River escapements averaged about 2,800 large chinook salmon in the 1990s and exploitation rates are estimated to have averaged 23%, ranging from about 12% to 45% (Table A3.1). The estimated escapements of large spawners versus the current BEG is shown in Figure A3.1. The adult spawner-recruit data used to develop the current BEG is shown in Table A3.2 and Figure A3.2 (McPherson et al 1998).

APPENDIX A3: Alsek River Chinook Salmon Stock

System: Alsek River and Klukshu River tributary
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	Joint management ADF&G and CDFO through PSC
Fisheries:	U.S. subsistence/personal use, gillnet, troll; First Nations, Canadian recreational
Escapement Goal Type:	BEG
Escapement Goal:	1,100 to 2,300 range; no point estimate.
Population for Goal:	Large spawners (3- to 5-ocean-age) counted past the Klukshu River Weir, a clearwater tributary of the Alsek.
Optimal Escapement Goal:	None
Inriver Goal:	None
Action Points:	None
Escapement Enumeration:	Aerial helicopter surveys: 1981–2002. Index weir counts Klukshu River: 1976–2002. Mark-recapture estimates for Alsek: 1998–2002.
Index Count Expansion Factor:	Approx. 5.0 (multiplier for weir count on Klukshu River)
Brood years in BEG analysis:	16 (1976–1991)
Data in BEG analysis:	Estimated total escapement of large spawners, all terminal, near terminal harvests, and age structure all years.
Data Quality:	Very good to excellent
Contrast in escapements:	2.9
Model used for BEG:	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
Document supporting BEG:	McPherson et al. (1998): SFD Fishery Manuscript No. 98-2

Table A3.1 Spawning escapement , estimated harvests, run size, and exploitation rates for chinook salmon in Klukshu River, a tributary of Alsek River, 1976–2002.

	Klukshu River						Alsek River total escapement[d]
Year	Spawning escape-ment [a]	Total Canada harvest [b]	Total U.S. harvest [c]	Total harvest	Total run size	Exploitation rate	
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	217	331	1,650	20%	8,295
2001	1,738	189	168	357	2,095	17%	11,022
2002	2,282	na	210	210	2,492		pending
Average	2,497	518	164	642	3,139	23%	8,884

[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 Food Fishery.

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

[d] Alsek River total escapement from mark-recapture estimates.

Table A3.2 Estimated brood year (BY) returns of Klukshu River chinook salmon by age, calculated by using the 30% assumption to apportion U.S. Alsek fishery harvests for BY 1971–1991 (per McPherson et al. 1998).

Brood year	Estimated escapement	Estimated returns by age					Estimated total return
		Age 3	Age 4	Age 5	Age 6	Age 7	
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]
Statistics for 1976–1990:							
Averages	2,127	20	312	1,454	1,109	16	2,911
Minimum	1,064	0	67	456	513	0	1,433
Maximum	3,104	155	1,279	5,095	1,791	87	8,320

[a] BY 1991 total return estimated as the average of 58% of total return at age 3–5 for BY 1976–1990.

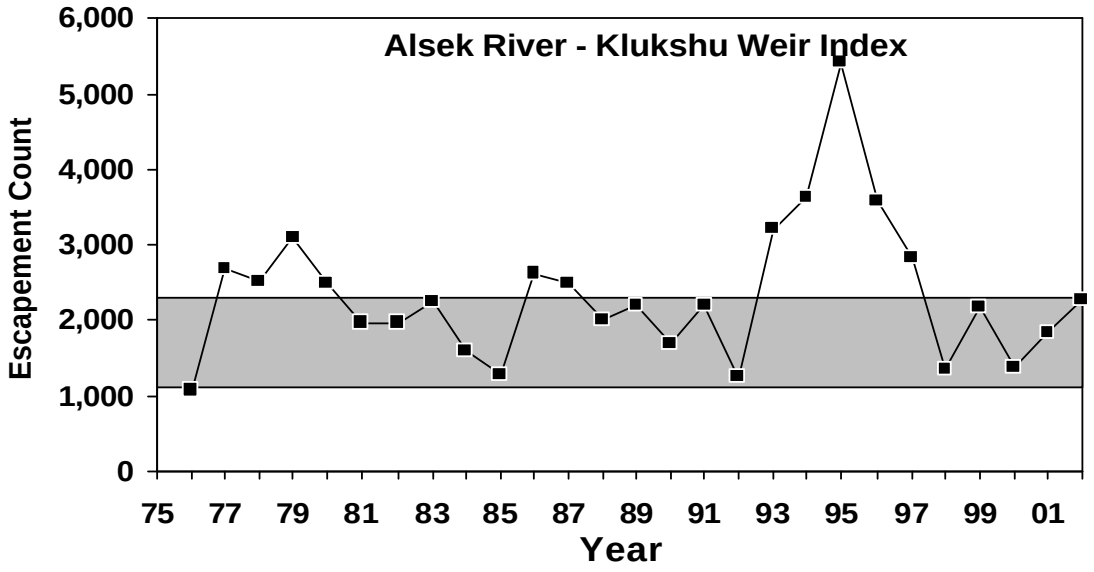

Figure A3.1 Estimated escapements of large spawners in the Klukshu River from 1976 to 2002, with the 1998 BEG range.

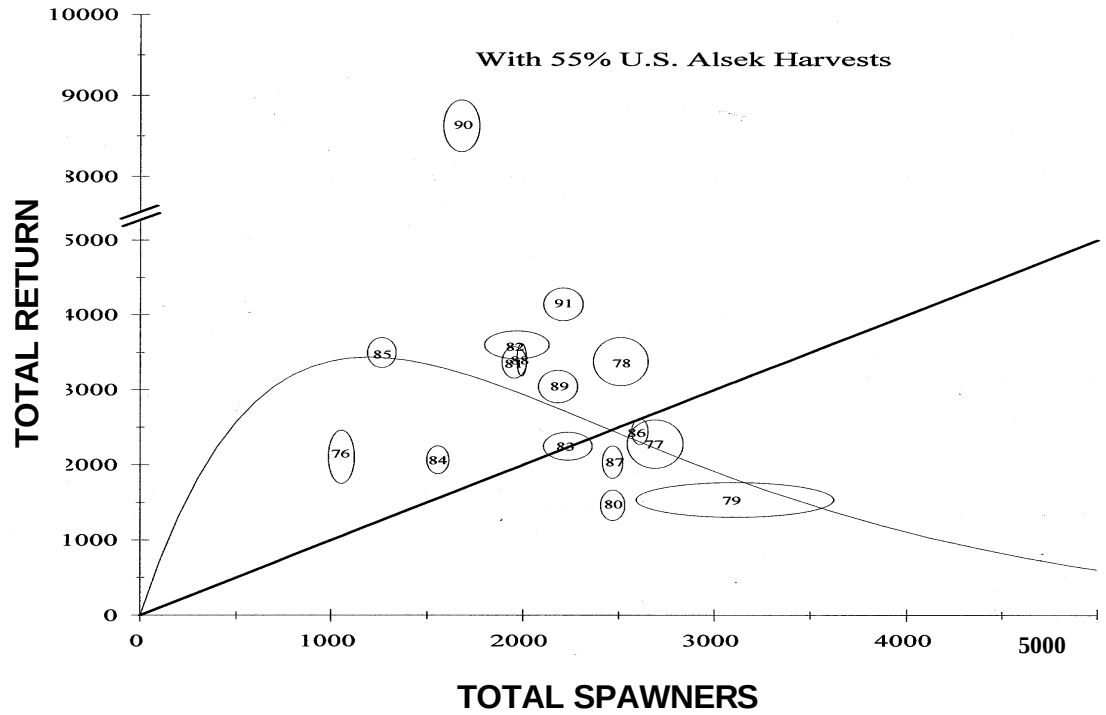

Figure A3.2 Estimated production of chinook salmon in year classes 1976–1991 against the estimated spawning abundance of their parents for the population in the Klukshu River (McPherson et al. 1998). The curve represents production predicted with Ricker's model. The ovals represent 95% confidence values for the point estimates.

APPENDIX A4: Situk River Chinook Salmon Stock Stock Description

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 (Table A4.1). These statistics do not include 1-ocean-age jack males, which generally number between 500 to 3,000 fish in a calendar year.

Chinook salmon from the Situk River are a "spring run" of salmon, with returning adults migrating into the lower Situk River from late May to early August. Spawning occurs from mid-August to early September, in the mainstem above Nine Mile Bridge. The Situk chinook population is very productive in that the number of adults produced per spawner is greater than the other SEAK chinook stocks. The majority (60–95%) of the smolt in most years are age-0., or subyearling smolt that emigrate to sea the year after spawning, verified by fry and coded wire tag studies. This bypasses mortality that would occur for most other stocks (Chilkat, Taku, Stikine, Unuk, etc.) during the year spent in freshwater as fry. Other Yakutat Forelands stocks like the Akwe and Italio produce a high percentage of subyearling smolt as well; this seems to be a function of the lagoons available for rearing in these systems. These are all clearwater systems as well. The only other location where we have observed subyearling smolt are the Keta and Blossom Rivers, two clearwater rivers in the far southern end of the region.

After entering saltwater, the juveniles appear to migrate west and north into the Gulf of Alaska, out of reach of fisheries in Southeast Alaska and British Columbia; hence the classification as an Outside Rearing stock. Two broods of chinook salmon were CWTd historically and no CWTs were recovered south of Yakutat; almost all CWT recoveries occurred in the Situk-Ahrnklin Lagoon and upstream in the Situk River. Returning mature fish that are four and five years old dominate the annual spawning population.

This stock is primarily exploited in or near the river. Commercial set gillnet, subsistence and recreational fishers target this stock. This stock can support a higher exploitation rate than other SEAK stocks because it is more productive per spawner. Exploitation rates have average 62% since the 1991 management plan was put into place (Table A4.1); the escapements since 1991 have all been within or above the escapement goal range during that period (Figure A4.1). Brood year returns have averaged about 4,000 fish for the 1977–1997 broods, and have been very productive recently, averaging 7,500 age-.2 to age-.5 fish for the 1990–1996 broods (Table A4.2). The stock-recruit relationship used to develop the 2003 BEG goal range is shown in Figure A4.2.

The stock assessment program for Situk River chinook salmon consists of 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. This information, along with the Situk River management plan, provide the tools for preseason forecasts, inseason run strength assessment and intensive inseason management.

APPENDIX A4: Situk River Chinook Salmon Stock

System: Situk River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, subsistence, troll
Escapement Goal Type:	BEG
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
Escapement Enumeration:	Weir counts: 1976–2002
Brood years in BEG analysis:	18 (1977–1994)
Data in BEG 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 BEG:	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
Value of beta parameter:	0.0011135
Document supporting BEG:	McPherson et al. (*In Prep*): SFD Fishery Manuscript No. 03-_

Table A4.1 Weir counts, harvests, run size and exploitation rates for Situk River chinook salmon, 1976–2001. The Situk weir count and spawning escapement includes large chinook (3-5-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 returns of these fish often number over 1,000 fish annually.

Year	Situk weir count	Spawning escapement	Sport harvest	Gillnet harvest	Subsistence harvest [a]	Total harvest	Total run size	Expl. rate
1976	1,421	1,421	200	1,002	41	1,243	3,184	39.0%
1977	1,732	1,732	244	833	24	1,101	2,981	36.9%
1978	808	808	210	382	50	642	1,745	36.8%
1979	1,284	1,284	282	1,028	25	1,335	3,089	43.2%
1980	905	905	353	969	57	1,379	2,504	55.1%
1981	702	702	130	858	62	1,050	1,857	56.5%
1982	434	434	63	248	27	338	949	35.6%
1983	592	592	42	349	50	441	1,290	34.2%
1984	1,726	1,726	146	512	89	747	2,948	25.3%
1985	1,521	1,521	294	484	156	934	2,916	32.0%
1986	2,067	2,067	0	202	99	301	2,873	10.5%
1987	1,379	1,379	75	891	24	990	2,874	34.4%
1988	885	868	185	299	90	574	1,596	36.0%
1989	637	637	0	1	496	497	1,377	36.1%
1990	628	628	0	0	516	516	1,643	31.4%
1991	897	889	88	784	220	1,092	2,095	52.1%
1992	1,618	1,595	172	1,504	341	2,017	3,819	52.8%
1993	980	952	137	790	202	1,129	2,558	44.1%
1994	1,311	1,271	400	2,656	367	3,423	6,085	56.3%
1995	4,700	4,330	1,407	8,107	578	10,092	14,987	67.3%
1996	2,175	1,800	1,529	3,717	559	5,805	8,100	71.7%
1997	2,690	1,878	1,598	2,339	352	4,289	6,601	65.0%
1998	1,353	924	1,156	2,101	594	3,851	5,420	71.1%
1999	1,947	1,461	1,160	3,810	588	5,558	7,208	77.1%
2000	2,518	1,785	1,143	1,318	594	3,055	4,941	61.8%
2001	696	656	75	1,087	375	1,537	2,290	67.1%
2002	1,024							

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

Table A4.2 Estimated total returns of Situk River chinook salmon for brood years 1977–1997.

Brood year	Parent escapement	Age-3 return	Age-4 return	Age-5 return	Age-6 return	Age-7 return	Total return	Return/ spawner
1977	1,421	399	801	199	6	0	1,405	0.8
1978	1,732	150	438	313	180	29	1,110	1.4
1979	808	156	703	1,289	606	0	2,755	2.1
1980	1,284	268	1,118	895	556	0	2,838	3.1
1981	905	137	1,068	1,019	315	0	2,539	3.6
1982	702	318	973	1,299	439	0	3,028	7.0
1983	434	324	1,181	836	93	0	2,434	4.1
1984	592	79	290	440	222	3	1,035	0.6
1985	1,726	35	619	488	67	0	1,208	0.8
1986	1,521	225	394	260	305	4	1,187	0.6
1987	2,067	540	1,267	1,963	314	0	4,084	3.0
1988	1,379	491	988	904	289	0	2,672	3.1
1989	868	544	821	1,314	79	0	2,758	4.3
1990	637	497	2,366	2,849	461	0	6,173	9.8
1991	628	2,103	11,104	3,090	197	0	16,493	18.6
1992	889	934	3,468	2,379	29	0	6,810	4.3
1993	1,595	1,071	2,793	893	60	0	4,816	5.1
1994	952	1,223	2,744	1,034	49	0	5,050	4.0
1995	1,271	1,674	4,569	906	67		7,217	1.7
1996	4,330	1,496	3,705	1,286	689		7,175	4.0
1997	1,800	281	563				*1,547*	0.8

[a] 1997 total return estimated from 56.4% of returns are complete, on average, through age-4.

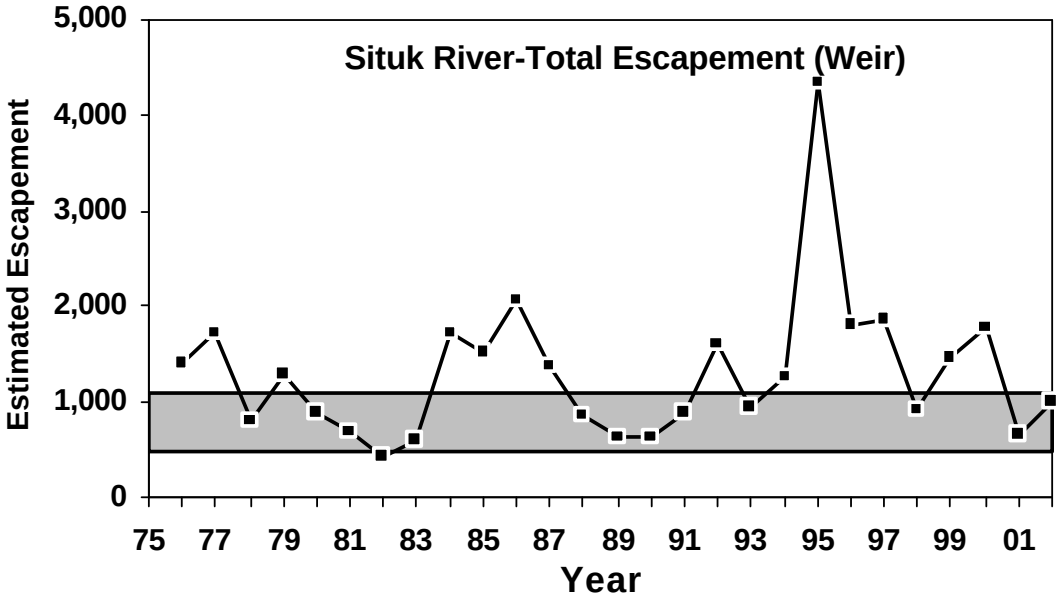

Figure A4.1 Escapements of large spawners in the Situk River from 1976 to 2002. Escapement goal shown reflects the revised range adopted in 2003.

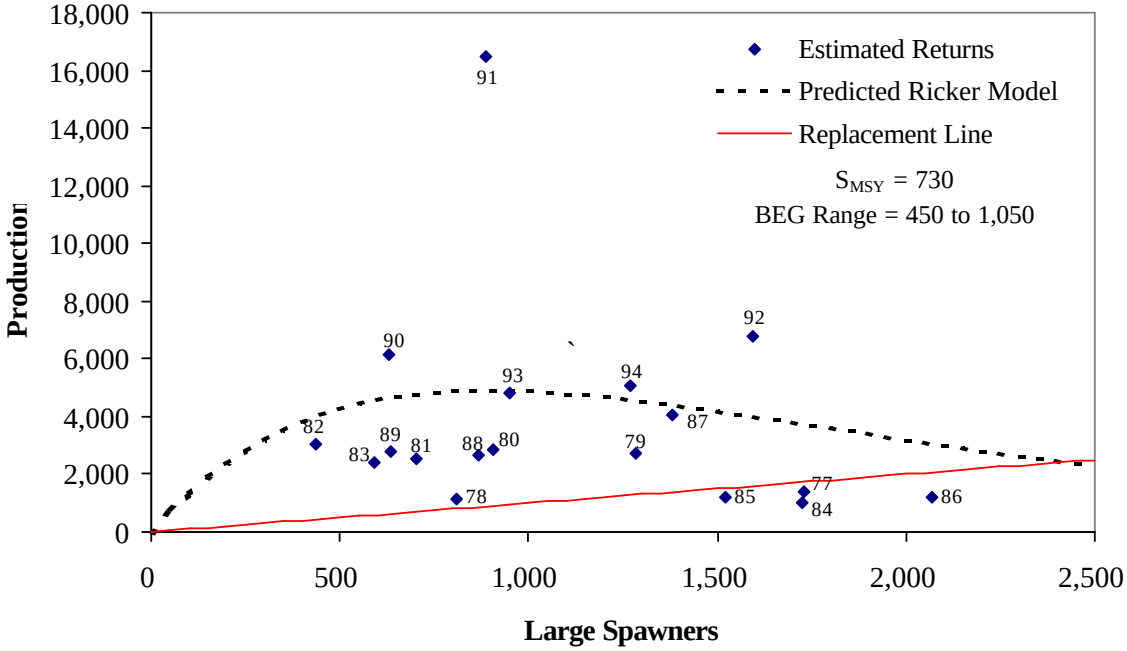

Figure A4.2 Estimated production of age-.2 to -.5 chinook salmon in year classes 1977–1994 against the estimated spawning abundance of their parents age-.3 and older for the population in the Situk River. The curve represents production predicted with Ricker's model, corrected for autocorrelation.

APPENDIX A5: Chilkat River Chinook Salmon Stock Stock Description

The Chilkat River is a large glacial system that originates in northwestern British Columbia, Canada, flows through rugged, dissected, mountainous terrain, and terminates in Chilkat Inlet near Haines, Alaska. The Chilkat River produces the third or fourth largest local population of chinook salmon in Southeast Alaska (Pahlke 2001). Prior to 1991, escapement was monitored through helicopter surveys of two clearwater tributaries, which were found to represent less than 5% of the escapement (Johnson et al. 1992).

Chinook salmon from the Chilkat River are a "spring run" of salmon, with returning adults present in terminal marine areas from late April through early July. Spawning occurs from late July to early-September. Yearling smolt are produced and migrate after a year in fresh water. After entering saltwater, the juveniles rear predominately in the inside waters of northern Southeast Alaska, hence the classification as an Inside Rearing stock. Returning mature fish that are four to six years old dominate the annual spawning population.

A spring marine boat sport fishery occurs annually in Chilkat Inlet and targets mature chinook salmon returning to the Chilkat River. A creel survey has been used to estimate harvest in this fishery since 1984. The harvest in this fishery peaked at over 1,600 chinook salmon in 1985 and 1986 (Ericksen 2002).

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

Because of these concerns, the Division of Sport Fish conducted a coded wire tagging program on wild juvenile chinook salmon in 1989 and 1990 to identify migratory patterns and to estimate contributions to sport and commercial fisheries. The Division of Sport Fish also conducted radiotelemetry experiments in 1991 and 1992 to estimate spawning distribution. Annual mark-recapture studies have been used to estimate escapement of large (age-1.3 and older) chinook salmon in the river since 1991. Results of this research indicate that escapements have ranged between 2,035 (SE = 334) and 8,100 (SE = 1,193) fish since 1991 (Ericksen 2002, Johnson et al. 1992), most of the chinook spawn in two major tributaries of the Chilkat River, the Kelsall and Tahini rivers, and immature fish are harvested as they rear primarily in the inside waters of Southeast Alaska (Johnson et al. 1992, Ericksen and McPherson *In Prep*).

The stock assessment program for Chilkat River chinook salmon consists of a juvenile coded wire tagging program, coded wire tag recovery on adults in fisheries and inriver, a mark-recapture tagging program to estimate escapement postseason via sampling upriver on the spawning grounds. This program will produce annual estimates of smolt production, total adult production, exploitation rates and harvest rates, as well as age structure to evaluate brood year returns and escapement requirements.

Escapements since 1991 have averaged over 4,000 large chinook and limited results indicate total exploitation rates average less than 15%, ranging from about 10% to 19% for the three years we have estimates. Exploitation by terminal fisheries is estimated annually and average less than 10%, ranging from about 2% to 19% (Table A5.1). The spawner-recruitment data used to develop the current BEG is shown in Table A5.2 and Figure A5.2. The estimated escapements of large spawners versus the current BEG is shown in Figure A5.1.

APPENDIX A5: Chilkat River Chinook Salmon Stock

System: Chilkat River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, subsistence, gillnet, troll
Escapement Goal Type:	BEG
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: 1981–1992 (not used and discontinued in 1992 because deemed not representative of population trends in escapement). Mark-recapture estimates: 1991–2002, annually.
Brood years in BEG analysis:	7 (1991–1997)
Data in BEG 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 CWT program will address this shortfall in the next 3–5 years.
Contrast in escapements:	2.1 (1991–1997)
Model used for BEG:	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 SEAK 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
Document supporting BEG:	Ericksen and McPherson (2003) *In Prep*.

Table A5.1 Spawning escapement estimates, terminal harvests[a], terminal run size and exploitation rates for Chilkat River chinook salmon, 1991–2002. Escapement estimates are from mark-recapture estimates (1991–2002).

Year	Spawning escapement	Subsistence harvest	Sport harvest	D115 Gillnet harvest	Terminal harvest	Terminal run size	Expl. rate
1991	5,897	0	0	262	262	6,159	0.04
1992	5,284	0	0	129	129	5,413	0.02
1993	4,472	2	314	232	548	5,020	0.11
1994	6,795	10	220	96	326	7,121	0.05
1995	3,790	38	228	41	307	4,097	0.07
1996	4,920	44	354	58	456	5,376	0.08
1997	8,100	18	381	167	566	8,666	0.07
1998	3,675	17	215	177	409	4,084	0.10
1999	2,271	31	184	301	516	2,787	0.19
2000	2,035	34	49	58	141	2,176	0.06
2001	4,517	60	185	71	316	4,833	0.07
2002	4,050	50	337	40	427	4,477	0.10

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

Table A5.2. Estimated total returns of Chilkat River chinook salmon for brood years 1991–1997.

Brood year	Parent escapement	Age-1.2 return	Age-1.3 return	Age-1.4 return	Age-1.5 return	Total return
1991	5,897	1,676	4,613	6,424	219	12,932
1992	5,284	552	2,281	2,628	81	5,542
1993	4,472	222	1,193	1,784	32	3,321
1994	6,795	314	627	704	0	1,645
1995	3,790	592	1,584	2,141	30	4,348
1996	4,920	872	2,969	1,795		5,637
1997	8,100	1,047	2,763	***3,271***[a]		7,081
1998	3,675	517				
1999	2,271					
2000	2,035					
2001	4,517					
2002	4,050					

[a] The return of age-1.4 fish from the 1997 brood is forecasted using a sibling regression.

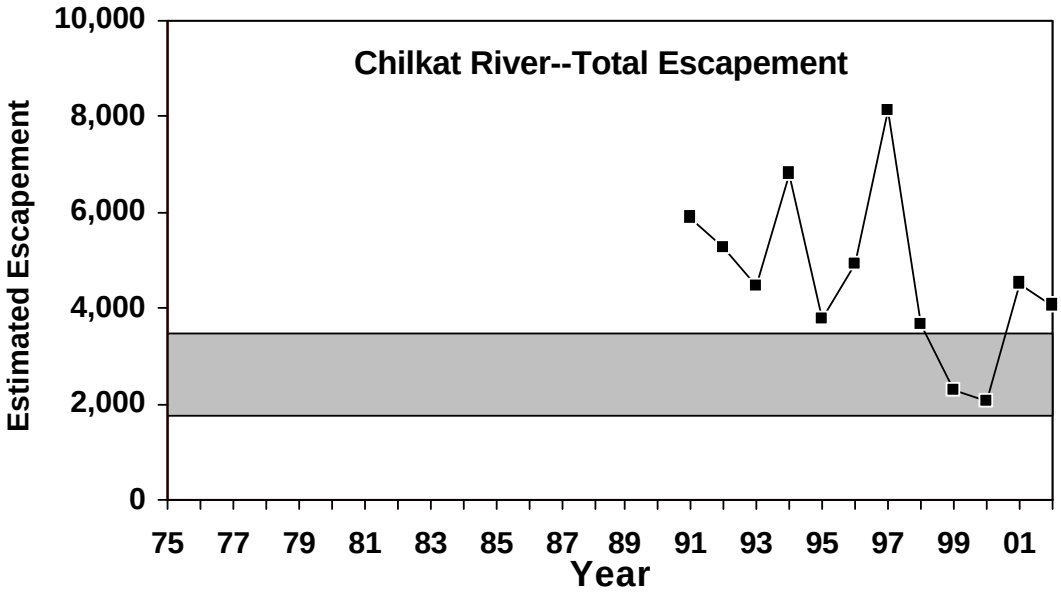

Figure A5.1 Escapements of large spawners in the Chilkat River from 1991 to 2002, with the recently adopted BEG range.

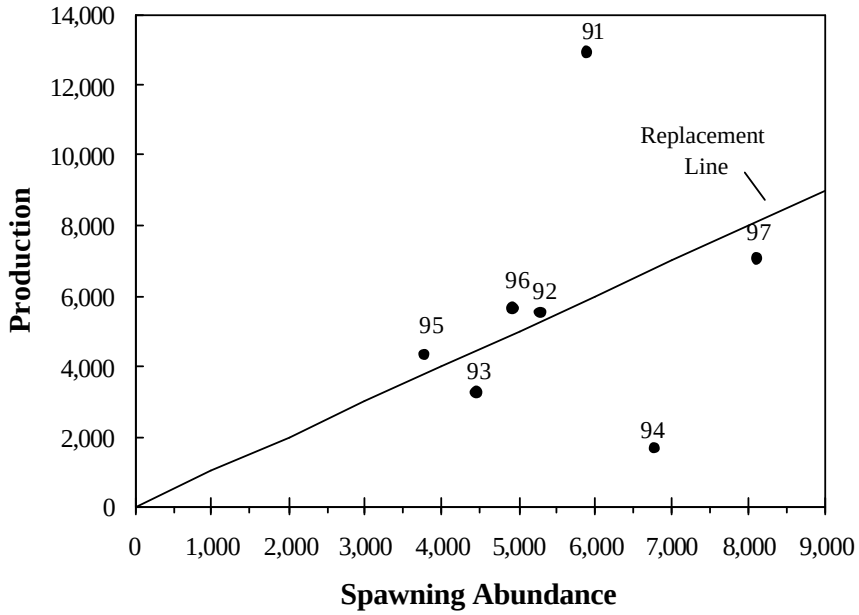

Figure A5.2 Estimated production of age-1.2 to -1.5 chinook salmon in year classes 1991–1997 against the estimated spawning abundance of their parents age-1.3 and older for the population in the Chilkat River.

APPENDIX A6: King Salmon River Chinook Salmon Stock Stock Description

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.

Chinook salmon from the King Salmon River are a spring run and yearling smolt are produced. Ocean rearing takes place primarily in Southeast Alaska, based on coded wire tag recoveries from hatchery releases of this stock (Josephson et al. 1993). Hence, this stock is classified as an Inside Rearing stock; distribution in the ocean appears to be primarily in northern and central Southeast Alaska. Returning mature fish are four to six years total age and most females are six years old.

The stock assessment program has consisted of peak survey counts, weir counts and age/sex/length data in the escapement. Helicopter and/or foot surveys to count peak spawning abundance has occurred annually since 1971. A weir was operated from 1983–1992 to collect viable gametes for use in hatchery production, collect age/sex/length data and to estimate the expansion factor that expands survey counts of large spawning chinook salmon to estimates of total abundance. At present, survey counts and age/sex/length sampling occurs on an annual basis.

Escapements since 1971 have averaged 190 large chinook salmon (Appendix Table A6.1). Lower escapements were seen in the late 1970s, but since 1981 have remained relatively consistent (Figure A6.1). The present BEG is 120 to 240 large spawners in total escapement; the adult spawner-recruit data used to develop the BEG is shown in Table A6.2 and Figure A6.2. Retrospectively, the 22 escapement counts since 1981 have been below the BEG range once, within the range 14 times and exceeded the range 7 times.

APPENDIX A6: King Salmon River Chinook Salmon Stock

System: King Salmon River
Species: Chinook salmon

Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, drift gillnet, and troll
Escapement Goal Type:	BEG
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 and/or foot surveys: 1971–2002, standardized over the duration. Weir counts: 1983–1992
Index Count Expansion Factor:	1.52 (SE=0.26; multiplier for peak survey count)
Brood years in BEG analysis:	21 (1971–1991)
Data in BEG analysis:	Estimated total escapement of large spawners, exploitation assumed similar to nearby hatchery stock, age structure 1982–1992 extrapolated to all years.
Data Quality:	Excellent
Contrast in escapements:	5.7:1
Model used for BEG:	Ricker model
Criteria for range:	S_{MSY} times 0.8 (lower) and 1.6 (upper)
Value of alpha parameter:	7.8
Value of beta parameter:	0.0054
Document supporting BEG:	McPherson and Clark (2001): Regional Information Report No. 1J01-40

Table A6.1 **Escapement index counts, spawning escapement estimates, and survey expansion factors for King Salmon River chinook salmon, 1971–2002.** Escapement estimates are from expansions of survey counts in 1971–1982 and 1993–2002, using an expansion factor of 1.52 (SE = 0.26).

Year	Survey counts	Spawning escapement [a]	Expansion factor
1971	94	141	
1972	90	135	
1973	211	317	
1974	104	156	
1975	42	63	
1976	65	98	
1977	134	201	
1978	57	86	
1979	71	113	
1980	70	104	
1981	90	139	
1982	229	354	
1983	183	**245**	1.17
1984	184	**265**	1.37
1985	105	**175**	1.57
1986	190	**255**	1.25
1987	128	**196**	1.38
1988	94	**208**	2.02
1989	133	**240**	1.59
1990	98	**179**	1.74
1991	91	**134**	1.38
1992	58	**99**	1.71
1993	175	259	
1994	140	207	
1995	97	144	
1996	192	284	
1997	238	353	
1998	88	130	
1999	200	296	
2000	92	136	
2001	98	145	
2002	102	141	

[a] Estimates in bold are years in which the weir was in place to count chinook salmon.

Table A6.2 Estimated total returns of King Salmon River chinook salmon for brood years 1971–1991 (from McPherson and Clark 2001).

	Estimated population statistics [a]				
Brood year	Parent escapement	Inriver return	Exploitation rate	Total return	Return/ spawner
1971	141	206	0.436	366	2.63
1972	135	159	0.436	281	2.11
1973	317	147	0.436	261	0.83
1974	156	149	0.436	264	1.71
1975	63	184	0.436	326	5.24
1976	98	431	0.436	765	7.94
1977	201	397	0.436	704	3.55
1978	86	396	0.436	702	8.32
1979	113	**166**	0.350	256	2.25
1980	104	**429**	0.515	885	8.53
1981	139	**255**	0.527	539	3.89
1982	354	**391**	0.696	1,285	3.63
1983	**245**	**266**	0.566	612	2.50
1984	**265**	**228**	0.580	543	2.05
1985	**175**	**317**	0.613	820	4.68
1986	**255**	**89**	0.580	212	0.83
1987	**196**	348	0.413	593	3.02
1988	**208**	251	0.427	437	2.10
1989	**240**	220	0.326	326	1.36
1990	**179**	308	0.436	546	3.05
1991	**134**	404	0.436	717	5.35

[a] Parent escapement is the estimated number of large spawners, total return is the estimated number of chinook salmon that returned in subsequent years in the escapement, were used for brood stock, or were fishing mortalities (landed catch or incidental mortalities) of age-.2 to -.5 fish. Estimates in bold are years in which the weir was in place to count chinook salmon.

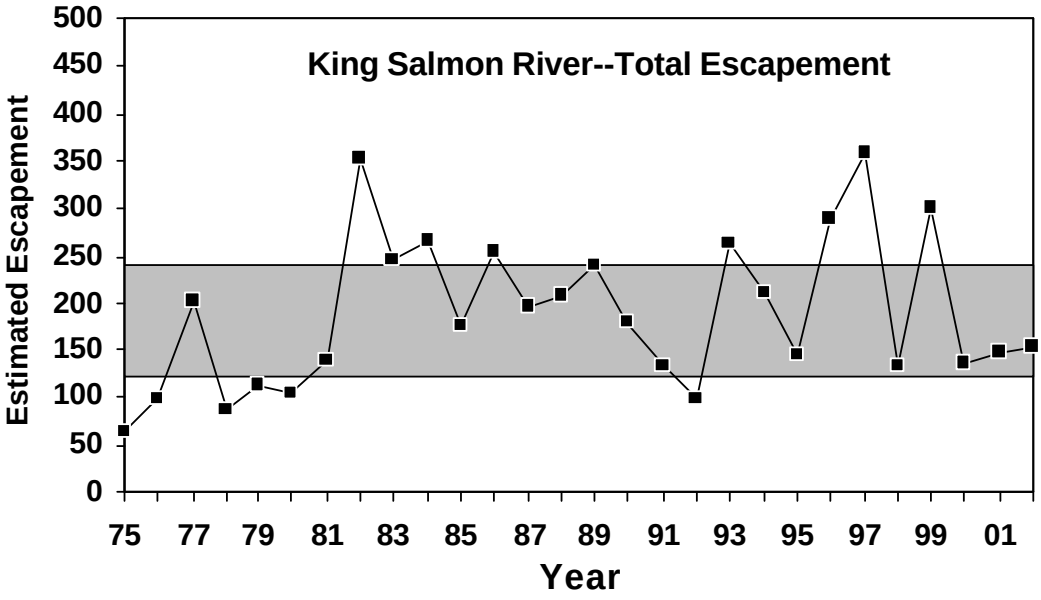

Figure A6.1 Estimated escapements of large spawners in the King Salmon River from 1975 to 2002, with the 1997 BEG range.

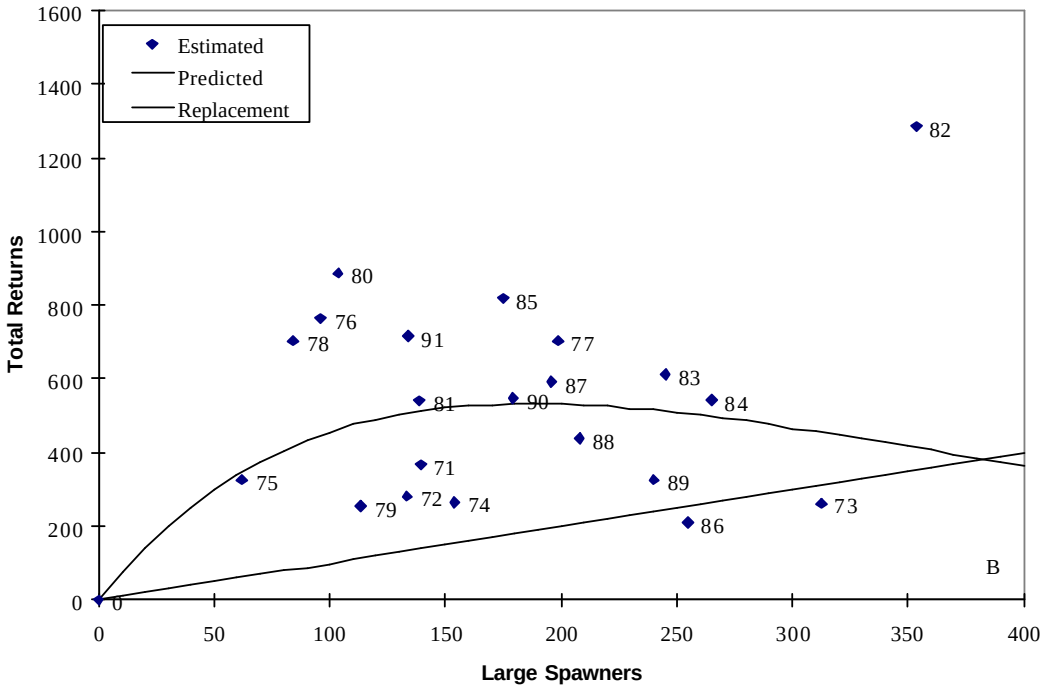

Figure A6.2 Estimated production of age-1.2 to age-1.5 chinook salmon in year classes 1971–1991 against the estimated spawning abundance of their parents age-1.3 and older for the population in the King Salmon River. The curve represents production predicted with Ricker's model (from McPherson and Clark 2001).

APPENDIX A7: Andrew Creek Chinook Salmon Stock
Stock Description

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). Prior to the mid 1970s, this stock was harvested in directed U.S. drift gillnet and recreational fisheries near the river mouth, near Petersburg and Wrangell, similar to the upper Stikine River stock. Significant, but not quantified, harvests likely occurred in the troll fishery during the same period. Presently, chinook salmon from Andrew Creek are harvested in a directed U.S. marine recreational fishery out of Petersburg and Wrangell and are caught incidentally in drift gillnet (primarily Districts 106 and 108) and troll fisheries (regionwide).

The stock assessment program for Andrew Creek chinook salmon has consisted of survey counts, weir counts and age/sex/length data in the escapement. Helicopter, fixed-wing and/or foot surveys to count peak spawning abundance has occurred most years since 1975, annually since 1984 and 1975, 1979, 1981 and 1982, prior to 1984. A weir was operated from 1976–1984 to take brood stock for initiating the hatchery program in the region, to collect age/sex/length data and to estimate the expansion factor for survey counts. The weir was also operated in 1997. At present, the survey count and age/sex/length programs occur on an annual basis.

Chinook salmon from Andrew Creek are a spring run and yearling smolt are produced. Ocean rearing takes place primarily in Southeast Alaska, based on coded wire tag recoveries from hatchery releases of this stock. Hence, this stock is classified as an Inside Rearing stock. Distribution of hatchery coded wire tag recoveries, from Crystal Lake Hatchery near Petersburg occur throughout the region, but are more concentrated in central Southeast Alaska. Returning mature fish are primarily four to six years total age; most females are five and six years old.

Like many other stocks in the region, escapements in Andrew Creek were lower in the late 1970s and early 1980s, and have rebounded since that time. Escapements since 1975 have averaged 950 large chinook salmon, in weir counts and survey counts expanded to be weir-count equivalents (Appendix Table A7.1). Escapements from 1975–1984 averaged 434 large spawners, and from 1985–2002 have averaged 1,233 or a threefold increase.

The present BEG is 650 to 1,500 large spawners; the adult spawner-recruit data used to develop the BEG is shown in Table A7.2 and Figure A7.2. Retrospectively, the escapement estimates from 1975 to 1986 were below the range 10 times and were within or above the BEG range 16 times since (Figure A7.1). Sporadic survey counts from 1959–1974 indicated that escapements of large spawners were 200 to 1,000 large spawners per year. Escapements in the last five years (1998–2002) have averaged about 1,500 large spawners.

APPENDIX A7: Andrew Creek Chinook Salmon Stock

System: Andrew Creek River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll
Escapement Goal Type:	BEG
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: 1975–2002, in standardized area and time.
Index Count Expansion Factor:	2.0 (multiplier for peak survey count).
Brood years in BEG analysis:	17 (1975–1991)
Data in BEG 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 eight years.
Data Quality:	Good
Contrast in escapements:	5.10
Model used for BEG:	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
Document supporting BEG:	Clark et al. (1998): CFD Regional Information Report No. 5J98-08

Table A7.1 Escapement peak survey counts, spawning escapement estimates, and expansion factors for Andrew Creek River chinook salmon, 1975–2002. Escapement estimates are from expansions of survey counts in 1975 and 1985–2002, using an expansion factor of 2.0.

Year	Survey counts	Spawning escapement [a]	Expansion factor
1975	260	520	
1976		**404**	
1977		**456**	
1978		**388**	
1979	221	**327**	1.48
1980		**282**	
1981	300	**536**	1.79
1982	332	**672**	2.02
1983		**366**	
1984	154	**389**	2.53
1985	319	638	
1986	707	1,414	
1987	788	1,576	
1988	564	1,128	
1989	530	1,060	
1990	664	1,328	
1991	400	800	
1992	778	1,556	
1993	1,060	2,120	
1994	572	1,144	
1995	343	686	
1996	335	670	
1997	293	586	
1998	487	974	
1999	605	1,210	
2000	690	1,380	
2001	1,054	2,108	
2002	876	1,752	

[a] Estimates in bold are from weir operations.

Table A7.2 Estimated total returns of Andrew Creek chinook salmon for brood years 1975–1991 (from Clark et al. 1998).

	Estimated population statistics				
Brood year	Parent escapement	Inriver return	Exploitation rate	Total return	Return/ spawner
1975	474	**575**	0.431	1,011	2.13
1976	**404**	**1,430**	0.431	2,513	6.22
1977	**456**	**375**	0.431	659	1.45
1978	**388**	**568**	0.431	998	2.57
1979	**327**	**641**	0.346	980	3.00
1980	**282**	**1,165**	0.510	2,378	8.43
1981	**536**	1,767	0.525	3,720	6.94
1982	**672**	1,492	0.697	4,924	7.33
1983	**366**	1,232	0.527	2,605	7.12
1984	**389**	1,346	0.502	2,703	6.95
1985	**584**	1,183	0.555	2,658	4.55
1986	1,292	1,379	0.564	3,163	2.45
1987	1,438	2,075	0.419	3,571	2.48
1988	1,029	1,769	0.427	3,087	3.00
1989	967	1,002	0.320	1,474	1.52
1990	1,212	752	0.603	1,894	1.56
1991	730	692	0.525	1,457	2.00

[a] Parent escapement is the estimated number of large spawners, total return is the estimated number of chinook salmon that returned in subsequent years in the escapement, were used for brood stock, or were fishing mortalities (landed catch or incidental mortalities) of age-.2 to -.5 fish. Numbers in bold are from years with weir operations.

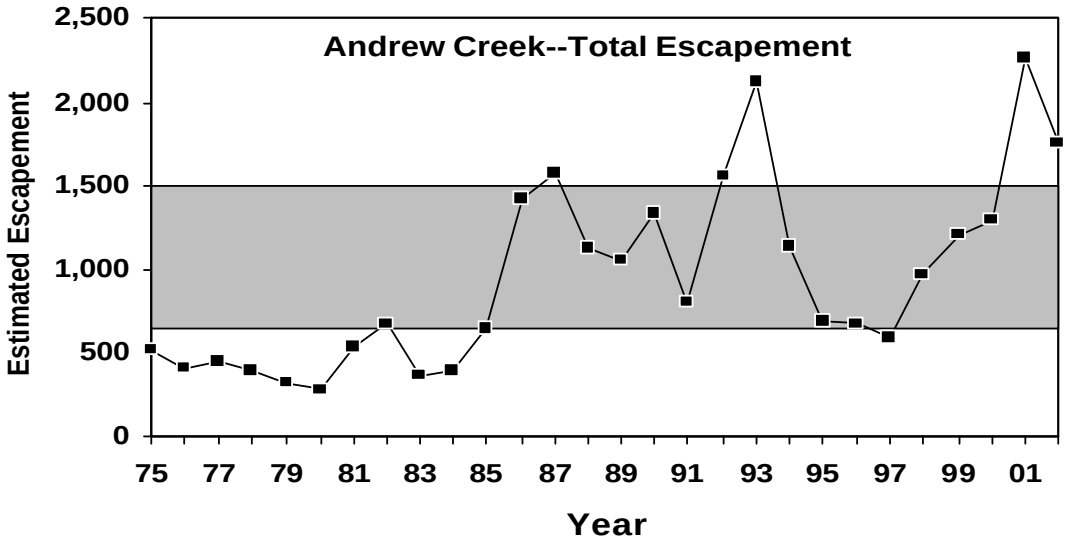

Figure A7.1 Estimated escapements of large spawners in the Andrew Creek from 1975 to 2002, with the 1998 BEG range.

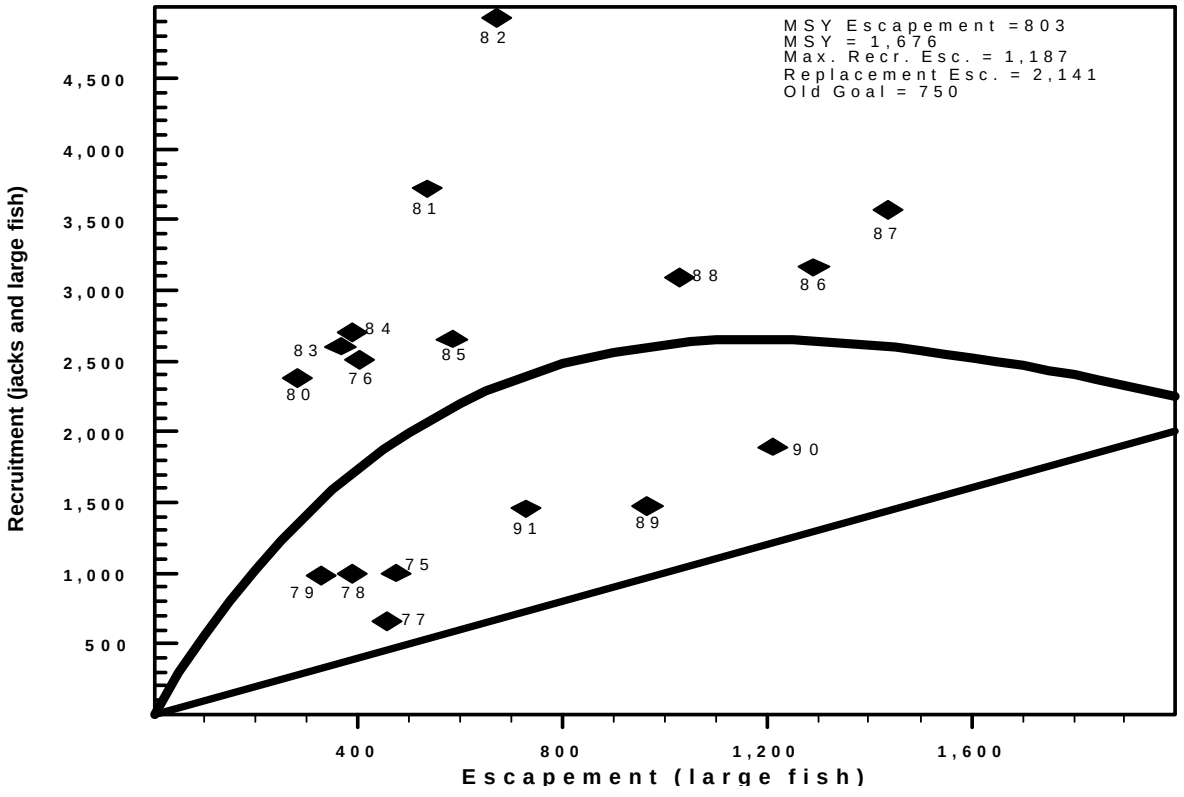

Figure A7.2 Estimated production of age-1.2 to age-1.5 chinook salmon in year classes 1975–1991 against the estimated spawning abundance of their parents age-1.3 and older for the population in the Andrew Creek. The curve represents production predicted with Ricker's model (from Clark et al. 1998).

APPENDIX A8: Unuk River Chinook Salmon Stock Stock Description

The Unuk River originates in a heavily glaciated area of northern British Columbia and flows for 129 km where it traverses Misty Fjords National Monument and empties into Burroughs Bay, 85 km northeast of Ketchikan, Alaska. The drainage encompasses an area of approximately 3,885 km^2 (Jones and McPherson 2002) with the lower 39 km flowing through Alaska. In most years, the Unuk River is the fourth or fifth largest producer of chinook salmon in Southeast Alaska.

Unuk River chinook salmon are a spring run that produces yearling (age-1.) fish nearly exclusively. Juvenile CWTing studies indicate that the majority of chinook salmon rear in the U.S. portion of the river. Survey counts of large chinook salmon have been made on the Unuk River since 1977. Indices of escapement on the Unuk River are determined annually by summing the peak observer aerial and foot survey counts of large spawners seen in six tributaries: Cripple, Gene's Lake, Kerr, Clear, and Lake creeks plus the Eulachon River (Pahlke 2001). When plotted over time, these indices are roughly dome-shaped with peak values occurring between 1987 and 1990 and since 2000.

Several consecutive years of low survey counts in the early 1990s generated concern for the health of the Unuk River chinook salmon stock. In response, the Division of Sport Fish began a full stock assessment program on the Unuk River to estimate smolt production, escapement, total run size, exploitation rates, harvest distribution, overwinter survival, and marine survival. In 1994, mark-recapture and radio telemetry studies were conducted and mark-recapture studies have occurred since 1997 (e.g., Jones and McPherson 2002) on Unuk River chinook salmon. The 1994 radio telemetry study indicated that 83% (SE = 9%) of all spawning occurred in the six tributaries surveyed.

Coded wire tagging studies on the 1982–1986 (Pahlke 1995) and on the 1992-present brood years indicate that harvest rates for Unuk River chinook salmon (age-1.1–1.5) average about 17% in landed catch. This information coupled with similar data on chinook salmon from the nearby Chickamin River provide strong evidence that Unuk River fish are mostly inside rearing in nature, but a few recoveries have been recorded as far north as Kodiak and several CWTs each year are recovered in northern British Columbia fisheries in Canada.

The current stock assessment program for adult chinook salmon returning to the Unuk River has three primary goals: (1) to estimate escapement; (2) to estimate age, sex, and length distribution in the escapement; and (3) to sample escapement for the fraction of fish possessing CWTs by brood year. The results are essential to estimate the marked fraction of each brood for CWTd fish and to estimate harvest of this stock in current and future sport and commercial fisheries. These harvest and escapement data will enable us to estimate total run size, exploitation rates, harvest distribution, and marine survival for this important chinook salmon indicator stock in southern Southeast Alaska.

Survey escapement counts for the Unuk stock show a relatively stable pattern over the duration of 1977 to 2002. Escapements over the most recent five years of estimates (1998–2002) have averaged 6,300 total large spawners, and 1,200 large spawners in peak survey counts (Table A8.1 and Figure A8.1). All five of these escapements were within or above the current (1997) goal range. The estimated escapements in survey counts of large spawners versus the 1997 BEG is shown in Figure A8.1. Our most current set of spawner-recruit estimates is summarized in Table A8.2. Exploitation rates for the 1982–1986 and 1992–1997 broods has averaged about 17%. The adult spawner-recruit data used to develop the 1997 BEG is shown in Figure A8.2.

APPENDIX A8: Unuk River Chinook Salmon

System: Unuk River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll
Escapement Goal Type:	BEG
Escapement Goal:	650 to 1,400; 800 point estimate
Population for Goal:	Large spawners (3- to 5-ocean-age) as counted in **peak survey counts** in the standardized survey areas on six clear water tributaries: Eulachon River and Clear, Lake, Kerr, Genes Lake and Cripple Creeks.
Optimal Escapement Goal:	None
Inriver Goal:	None
Action Points:	None
Escapement Enumeration:	Helicopter and foot peak survey counts: 1977–2002 in standard time and areas on: Eulachon River and Clear, Lake, Kerr, Genes Lake and Cripple Creeks. Mark-recapture estimates: 1994, 1997–2002
Index Count Expansion Factor:	5.0: multiplier for the sum of peak survey counts in a calendar year. Based on four years (1997–2001).
Brood years in BEG analysis:	13 (1977–1989), as in McPherson and Carlile (1997).
Data in BEG 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 sampled directly in most years, estimated for all broods.
Data Quality:	Fair, in McPherson and Carlile (1997)
Contrast in escapements:	2.9, in McPherson and Carlile (1997)
Model used for BEG:	Ricker model
Criteria for range:	Bootstrapping (simulation) of spawner-recruit data to estimate lower and upper levels of S_{MSY}
Value of alpha parameter:	6.36
Value of beta parameter:	0.0002148
Document supporting BEG:	McPherson and Carlile (1997): CFD RIR No. 1J97-06
Additional comments:	The ADF&G is in the process of analyzing the additional spawner-recruit data for this stock and plans to provide an escapement goal for total large spawners, as measured in the annual mark-recapture program, by July 2003.

Table A8.1 **Escapement survey counts, spawning escapement estimates of large chinook, expansion factors and available age/sex composition for Unuk River chinook salmon, 1977–2002.** Escapement estimates in bold are from mark-recapture studies, the remainder are from expanded survey counts.

Year	Survey count	Spawning escapement	Expansion factor [a]	Age 1.2	Age 1.3	Age 1.4	Age 1.5	Age-.2-.5 total	Large females
1977	974	4,870							
1978	1,106	5,530							
1979	576	2,880							
1980	1,016	5,080							
1981	731	3,655							
1982	1,351	6,755		233	1,067	5,688	0	6,988	NE
1983	1,125	5,625							
1984	1,837	9,185		1,077	6,236	3,020	0	10,333	NE
1985	1,184	5,920		2,505	4,987	683	0	8,175	NE
1986	2,126	10,630		5,341	5,557	4,704	100	15,702	NE
1987	1,973	9,865		4,952	4,577	4,907	52	14,488	NE
1988	1,746	8,730		3,102	3,112	5,225	66	11,505	NE
1989	1,149	5,745		1,676	2,331	3,158	163	7,328	NE
1990	591	2,955		1,023	646	1,903	150	3,722	NE
1991	655	3,275		872	2,420	638	52	3,982	1,528
1992	874	4,370		1,132	1,762	2,546	47	5,487	3,008
1993	1,068	5,340		586	2,297	2,917	101	5,901	2,928
1994	711	**4,623**	6.5	**432**	**1,343**	**3,082**	**154**	**5,011**	**3,359**
1995	772	3,860		1,673	1,029	2,445	0	5,147	2,059
1996	1,167	5,835		484	3,097	2,471	194	6,246	3,602
1997	636	**2,970**	**4.7**	**920**	**1,235**	**1,408**	**59**	**3,622**	**1,658**
1998	840	**4,132**	**4.9**	**1,275**	**2,589**	**1,207**	**35**	**5,106**	**2,087**
1999	680	**3,914**	**5.8**	**2,427**	**1,918**	**1,581**	**16**	**5,942**	**1,998**
2000	1,341	**5,872**	**4.4**	**3,140**	**3,499**	**1,447**	**50**	**8,136**	**2,506**
2001	2,019	**10,541**	**5.2**	**946**	**6,923**	**3,337**	**21**	**11,227**	**5,697**
2002	897	**6,988**	7.8	**2,485**	**2,887**	**3,199**	**55**	**8,626**	**3,330**

[a] The expansion factor is 5.0 (SE = 0.53) to convert peak survey counts to total escapement of large spawners, based on the 1997–2001 mark-recapture estimates.

Table A8.2 **Estimated parent escapements, harvests, total returns, exploitation rates and smolt production of Unuk River chinook salmon for brood years 1980–1997.** Estimates for escapement data in bold are from mark-recapture studies, the remainder are from expanded survey counts.

Brood year	Parent Escapement	Inriver total return [a]	Marine harvest [b]	Total return	Return/ spawner	Exploitation rate	Smolt production
1980	5,080	10,820					
1981	3,655	13,035					
1982	6,755	15,306	2,824	18,130	2.7	15.6%	510,516
1983	5,625	11,372	3,039	14,411	2.6	21.1%	425,577
1984	9,185	7,388	1,375	8,763	1.0	15.7%	344,772
1985	5,920	3,007	726	3,733	0.6	19.4%	300,767
1986	10,630	6,090	1,782	7,872	0.7	22.6%	174,173
1987	9,865	5,705					
1988	8,730	6,511					
1989	5,745	4,568					
1990	2,955	3,991					
1991	3,275	6,213					
1992	4,370	2,942	337	3,279	0.8	10.3%	384,702
1993	5,340	**5,140**	894	6,034	1.1	14.8%	197,052
1994	**4,623**	**4,661**	767	5,428	1.2	14.1%	250,370
1995	3,860	**9,318**	1,892	11,210	2.9	16.9%	321,961
1996	5,835	**13,262**	2,274	15,536	2.7	14.6%	478,914
1997	**2,970**	**5,587**	1,070	6,657	2.2	16.1%	283,718

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

[b] Marine harvest includes estimated landed catch; it does not include incidental mortality and is not converted to adult equivalents.

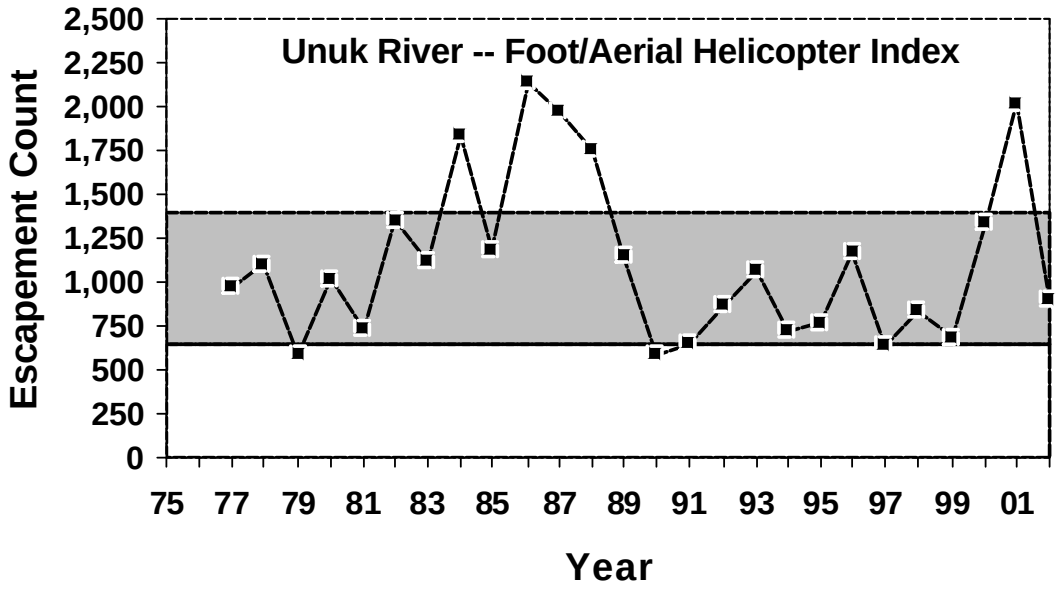

Figure A8.1. Estimated escapements of large spawners in the Unuk River from 1977 to 2002, with the 1997 survey goal BEG range.

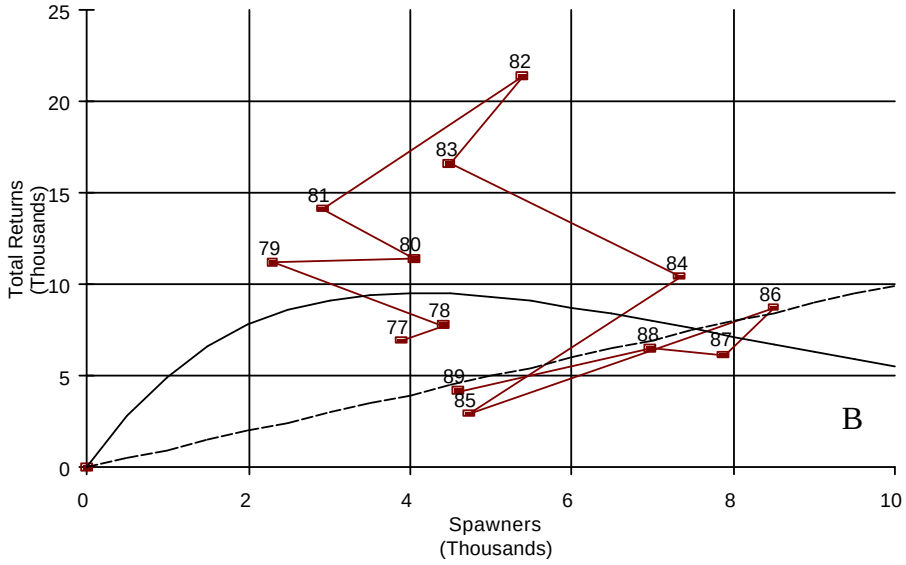

Figure A9.2. Estimated production of age-1.2 to age-1.5 chinook salmon in year classes 1977–1989 against the estimated spawning abundance of their large chinook parents for the population in the Unuk River. The curve represents production predicted with Ricker's model, from McPherson and Carlile (1997).

APPENDIX A9: Chickamin River Chinook Salmon Stock Stock Description

The Chickamin River is located on the mainland in southern Southeast Alaska, approximately 45 miles northeast of Ketchikan. Chinook from the Chickamin River, along with fish from the Keta, Unuk, Blossom and 7 other small stocks make up what are collectively known as the Behm Canal stocks, named for the long narrow body of water that they all flow into. The Unuk River is the largest stock, with peak annual production estimated at over 15,000 chinook. The Chickamin is next with production of between 5,000–10,000 fish, and the Keta and Blossom follow with estimated production of less than 5,000 fish. All of the Behm Canal stocks are small relative to the three major chinook stocks in Southeast Alaska: the transboundary Taku, Stikine and Alsek river stocks.

All of the Behm Canal chinook systems are located completely within the Misty Fiords National Monument Wilderness Area, and as such access is limited and habitat is essentially pristine. The Chickamin River is a muddy, glacial system and most chinook spawn in smaller clearwater tributaries. Chinook start to enter the river in June and complete spawning by early September.

Annual surveys of escapement have been conducted in a systematic manner since 1975. Mark-recapture tagging experiments were conducted in 1995, 1996, 2001 and 2002 (e.g. Freeman and McPherson *In press*) which provided alternative estimates of escapement and indicated that the aerial survey counted about 20% of the total escapement. In the 1997 BEG report we assumed the surveys counted between 15% and 25% of the total escapement. Since 1985 we have attempted to sample the escapement for age, sex and size data with mixed results due to the small stock spread over a large area and the difficulties of logistics in such a remote location.

Juvenile chinook salmon from the Chickamin River were marked with coded wire tags (CWT) from 1983 to 1988. Recoveries in 1986–1992 of returning adults with CWTs provided the first information on ocean migration patterns, fishery contributions and exploitation rates for this stock. Several hatcheries in southern Southeast release CWT tagged chinook salmon of Chickamin River origin. Recoveries of wild and hatchery fish released with coded wire tags have shown that Unuk and Chickamin River chinook are "inside rearing" stocks, with most fish rearing in the waters of Southeast Alaska. 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. Harvest is not concentrated in any particular fishery and exploitation rate does not appear excessive, rarely exceeding 50%. Results from the CWT tagging study in the 1980s indicated that the Chickamin stock was exploited at a slightly higher rate than the Unuk River stock. A new project tagging juvenile chinook on the Chickamin was started in 2001, and recoveries from that project along with the ongoing Unuk River tagging project will provide revised estimates of exploitation for both stocks.

Survey counts show low escapement in the 1970s, a high period in the 1980s, dropping to a low but stabile period through the 1990s with steady increases since 1998. Escapements over the most recent five years of estimates (1998–2002) have averaged 3,900 total large spawners, and 741 large spawners in peak survey counts (Table A9.1 and Figure A9.1). Of these five recent escapements, the first was below, the next two were within and the last two were above the goal range. The estimated escapements of survey counts of large spawners versus the 1997 BEG is shown in Figure A9.1. Our most current set of spawner-recruit estimates is summarized in Table A9.2. The adult spawner-recruit data used to develop the 1997 BEG is shown in Figure A9.2.

APPENDIX A9: Chickamin River Chinook Salmon Stock

System: Chickamin River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll
Escapement Goal Type:	BEG
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 eight 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: 1975–2002 in standard time and areas on: South Fork, Barrier, Butler, Leduc, Indian, Humpy, King and Clear Falls tributaries. Mark-recapture estimates: 1995–1996 and 2001–2002
Index Count Expansion Factor:	5.17: multiplier for the sum of peak survey counts in a calendar year. Based on four years (1995–1996 and 2001–2002).
Brood years in BEG analysis:	15 (1975–1989), as in McPherson and Carlile (1997).
Data in BEG 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, in McPherson and Carlile (1997)
Contrast in escapements:	11.1, in McPherson and Carlile (1997)
Model used for BEG:	Ricker model
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
Document supporting BEG:	McPherson and Carlile (1997): CFD RIR No. 1J97-06
Additional comments:	The ADF&G is in the process of analyzing the additional spawner-recruit data for this stock and plans to provide an escapement goal for total large spawners, as measured by mark-recapture, by July, 2003.

Table A9.1 **Escapement survey counts, spawning escapement estimates of large chinook, expansion factors and available age/sex composition for Chickamin River chinook salmon, 1975–2002.** Escapement estimates in bold are from mark-recapture studies, the remainder are from expanded survey counts.

Year	Survey count	Spawning escapement	Expansion factor [a]	Age 1.2	Age 1.3	Age 1.4	Age 1.5	Age-.2-.5 total	Large females
1975	370	1,914							
1976	157	810							
1977	363	1,875							
1978	308	1,594							
1979	239	1,233							
1980	445	2,299							
1981	384	1,985							
1982	571	2,952							
1983	599	3,099							
1984	1,102	5,697							
1985	956	4,943		287	2,914	1,845	0	5,046	NE
1986	1,745	9,022		1,301	6,354	2,762	0	10,417	NE
1987	975	5,041		2,099	3,095	1,660	61	6,915	NE
1988	786	4,064		601	2,432	1,724	49	4,807	NE
1989	934	4,829		335	1,853	2,720	278	5,185	NE
1990	564	2,916		745	659	1,936	114	3,454	NE
1991	487	2,518		1,013	2,057	595	48	3,714	NE
1992	346	1,789		392	795	1,044	19	2,250	NE
1993	389	2,011		400	813	1,227	42	2,483	NE
1994	388	2,006		272	552	1,431	72	2,327	NE
1995	356	**2,309**	6.5	**383**	**582**	**1,704**	**80**	**2,748**	**1,369**
1996	422	**1,587**	3.8	**342**	**1,015**	**527**	**46**	**1,930**	**890**
1997	272	1,406		334	808	562	35	1,740	791
1998	391	2,021		594	1,783	238	0	2,615	1,070
1999	492	2,544		669	1,219	868	15	2,771	1,234
2000	801	4,141		1,083	2,391	1,152	0	4,626	1,949
2001	1,010	**5,177**	5.1	**577**	**3,766**	**1,190**	**32**	**5,565**	**2,841**
2002	1,013	**5,378**	5.3	**1,818**	**2,411**	**1,865**	**27**	**6,121**	**2,448**

[a] The expansion factor is 5.17 (SE=1.12) to convert peak survey counts to total escapement of large spawners, based on the 1995–1996 and 2001–2002 mark-recapture estimates.

Table A9.2 Estimated parent escapements, harvests, total returns, exploitation rates and smolt production of Chickamin River chinook salmon for brood years 1980–1997. Estimates for escapement data in bold are from mark-recapture studies, the remainder are from expanded survey counts.

Brood year	Parent escapement	Inriver total return [a]	Inriver return/ spawner	Marine harvest [b]	Total return	Exploitation rate	Smolt production
1980	2,299	6,979	3.0				
1981	1,985	8,350	4.2				
1982	2,952	6,398	2.2	1,918	8,316	23.1%	182,727
1983	3,099	7,365	2.4	3,464	10,829	32.0%	320,068
1984	5,697	4,439	0.8	4,102	8,541	48.0%	261,723
1985	4,943	1,608	0.3	1,325	2,933	45.2%	
1986	9,022	3,888	0.4	2,291	6,179	37.1%	142,524
1987	5,041	3,107	0.6				
1988	4,064	2,715	0.7				
1989	4,829	2,702	0.6				
1990	2,916	1,416	0.5				
1991	2,518	1,960	0.8				
1992	1,789	1,403	0.8				
1993	2,011	2,985	1.5				
1994	2,006	2,996	1.5				
1995	**2,309**	4,277	1.9				
1996	**1,587**	6,714	4.2				
1997	1,406	4,185	3.0				

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

[b] Marine harvest includes estimated landed catch; it does not include incidental mortality and is not converted to adult equivalents.

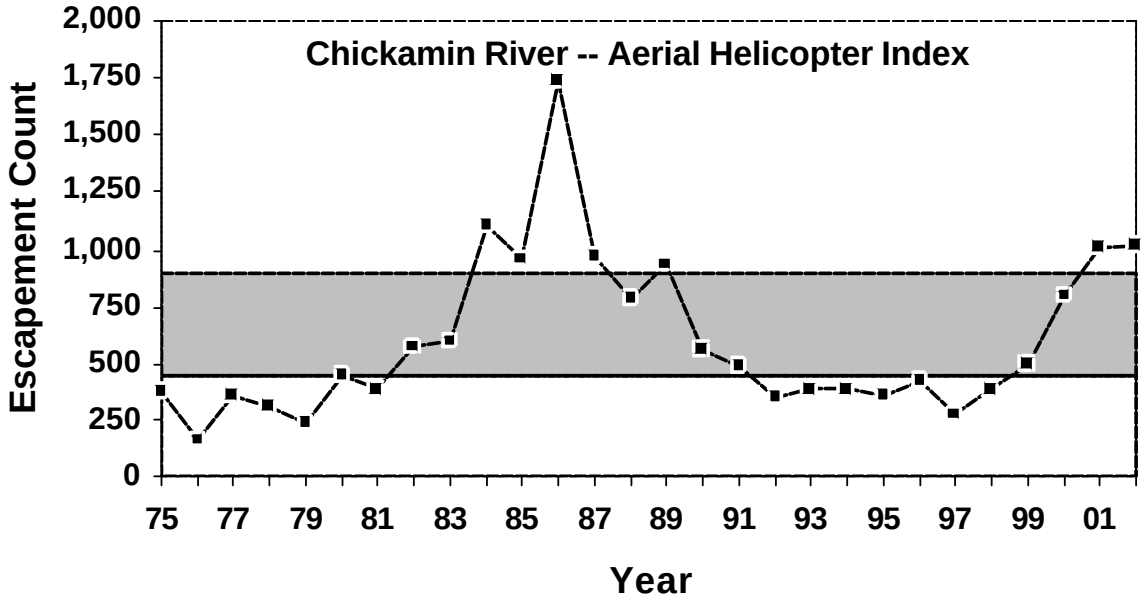

Figure A9.1. Estimated escapements of large spawners in the Chickamin River from 1975 to 2002, with the 1997 survey goal BEG range.

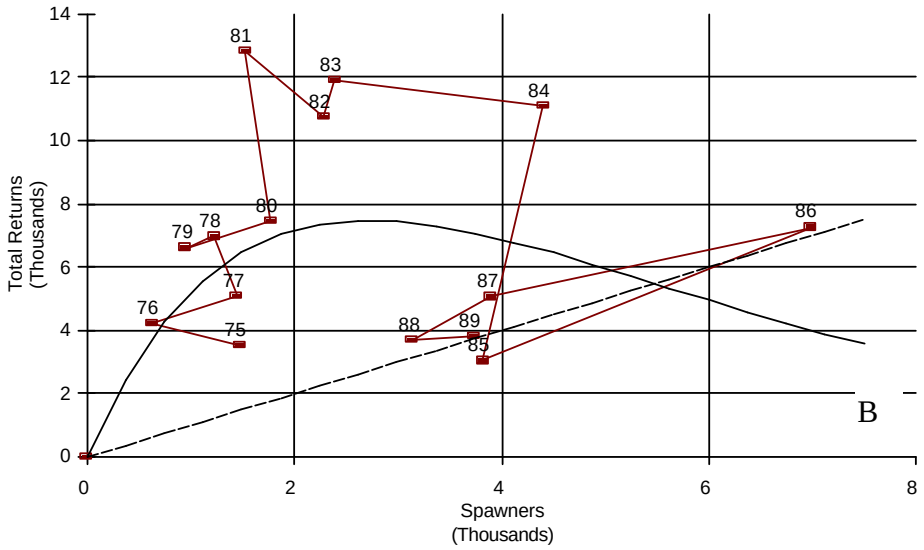

Figure A9.2. Estimated production of age-1.2 to age-1.5 chinook salmon in year classes 1975–1989 against the estimated spawning abundance of their large chinook parents for the population in the Chickamin River. The curve represents production predicted with Ricker's model, from McPherson and Carlile (1997).

APPENDIX A10: Keta River Chinook Salmon Stock
Stock Description

The Keta River enters Boca de Quadra Inlet in the Misty Fjords National Monument about 75 km east of Ketchikan, Alaska. The Keta River produces a small run of chinook salmon representing about 1% of the wild stock production in Southeast Alaska. Like other chinook salmon found in the region, these fish are a spring run that produces yearling (age-1.) smolt primarily with about 10% subyearling fish (age-0.). Information inferred from coded wire tagging studies in the nearby Chickamin and Unuk rivers suggests that Keta River chinook salmon are inside rearing in behavior spending most of their lives in Southeast Alaska and perhaps northern British Columbia. Keta River chinook salmon are very robust attaining lengths and weights rarely seen elsewhere in the region. The Keta River itself has many exposed gravel bars with intermittent large pools and logjams. This river is typified by large sediments probably the result of extremely high flows common to the system. Habitats of this nature are suited for the larger, more robust fish common to the Keta River.

Exploitation of Keta River chinook salmon is unknown but inferred from the Unuk River and Chickamin River projects. Although we have better stock assessment coverage in the nearby Chickamin and Unuk rivers, the stock assessment program on the Keta River has been greatly improved using monies attained in 1998–2002 from the U.S. Congress to support abundance-based management of chinook salmon. Since that time, three successful mark-recapture studies have been performed and sample sizes for age, sex, and length composition have been increased dramatically.

This river is one of four Behm Canal index systems in which chinook are counted annually (Pahlke 2001). Peak counts of chinook salmon in the Keta River have increased from the average seen during the base period (1975–1980), and in recent years have steadily increased towards the upper end of the biological escapement goal range. Temporal trends in chinook salmon abundance are reasonably consistent among the four Behm Canal index systems. In general, counts were at or above escapement goal ranges for most of the 1980s but a significant downward trend began for all four systems near the end of the decade. Although this decline is apparent for the Keta River, counts have been near or above the lower end of the range since 1990. In recent years, escapements have been about double the values seen during the base years (Figure A10.1).

The ADF&G Division of Sport Fish performed three mark-recapture studies to estimate chinook salmon escapement in the Keta River, 1998–2000 (Brownlee et al. 1999; Freeman et al. 2001). Escapement was estimated using a two-event mark-recapture experiment. Fish were captured with rod and reel gear, marked with uniquely numbered spaghetti tags and batch marked with two secondary marks. Spawning and pre-spawning fish were captured later with angling gear and dip nets, sampled for marks, age (scales), sex and length. The estimated escapement of large chinook salmon in 2000 was 914, about the same as the 968 estimated in 1999, and up from the 446 estimated in 1998. Expansion factors for the peak aerial survey counts were 3.0 in 2000, 2.5 in 1998 and 3.5 in 1999. The expansion factor used to expand index counts to estimates of total escapement is 3.0, the mean value seen during the three years of mark-recapture study (Table A10.1). Escapements from 1975–2000 averaged 1,282 large (Table A10.1) spawners. The estimated escapements of large spawners versus the 1997 BEG is shown in Figure A10.1. The adult spawner-recruit data used to develop the 1997 BEG is shown in Figure A10.2.

APPENDIX A10: Keta River Chinook Salmon Stock

System: Keta River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll; non directed
Escapement Goal Type:	BEG
Escapement Goal:	250–500 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: 1975–2002, standardized by time and area. Mark-recapture estimates: 1998–2000
Index Count Expansion Factor:	3.0: multiplier for helicopter peak survey count in the standardized survey area on the Keta River.
Brood years in BEG analysis:	15 (1975–1989), as in McPherson and Carlile (1997).
Data in BEG 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, in McPherson and Carlile (1997)
Contrast in escapements:	13.8, in McPherson and Carlile (1997)
Model used for BEG:	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
Document supporting BEG:	McPherson and Carlile (1997): CFD RIR No. 1J97-06
Additional comments:	The ADF&G is in the process of analyzing the additional spawner-recruit data for this stock and plans to provide a revised escapement goal by July, 2003.

Table A10.1 Escapement survey counts, spawning escapement estimates of large chinook, expansion factors and available age/sex composition for Keta River chinook salmon, 1975–2002. Escapement estimates in bold are from mark-recapture studies, the remainder are from expanded survey counts.

Year	Survey count	Spawning escapement	Expansion factor [a]	Total age 3	Total age 4	Total age 5	Total age 6	Age-.2-.5 total	Large females
1975	203	609							
1976	84	252							
1977	230	690							
1978	392	1,176							
1979	426	1,278							
1980	192	576							
1981	329	987							
1982	754	2,262							
1983	822	2,466							
1984	610	1,830							
1985	624	1,872							
1986	690	2,070							
1987	768	2,304							
1988	575	1,725							
1989	1,155	3,465							
1990	606	1,818							
1991	272	816							
1992	217	651							
1993	362	1,086							
1994	306	918							
1995	175	525							
1996	297	891							
1997	246	738							
1998	180	**446**	2.5	**54**	**110**	**153**	**231**	**503**	**240**
1999	276	**968**	3.5	**9**	**271**	**558**	**166**	**1,007**	**462**
2000	300	**914**	3.0	**62**	**643**	**377**	**206**	**1,289**	**377**
2001	343	1,029		214	339	721	77	1,177	464
2002	411	1,233		40	561	528	393	1,500	464

[a] The expansion factor is 3.00 (SE = 0.52) to convert peak survey counts to total escapement of large spawners, based on the 1998–2000 mark-recapture estimates.

Table A10.2 Estimated parent escapements and available inriver brood year return estimates of Keta River chinook salmon for brood years 1994–1998.

Brood year	Parent escapement	Inriver total return [a]	Inriver return/ spawner
1994	918	911	1.0
1995	525	779	1.5
1996	891	1,767	2.0
1997	738	*1,105*	*1.5*
1998	446	*1,987*	*4.5*

[a] Inriver total returns include 2 to 5-ocean-age fish. The 1997 inriver total return was estimated by assuming that the returns for this brood to date were 84% complete, and the 1998 inriver returns to date being 19% complete.

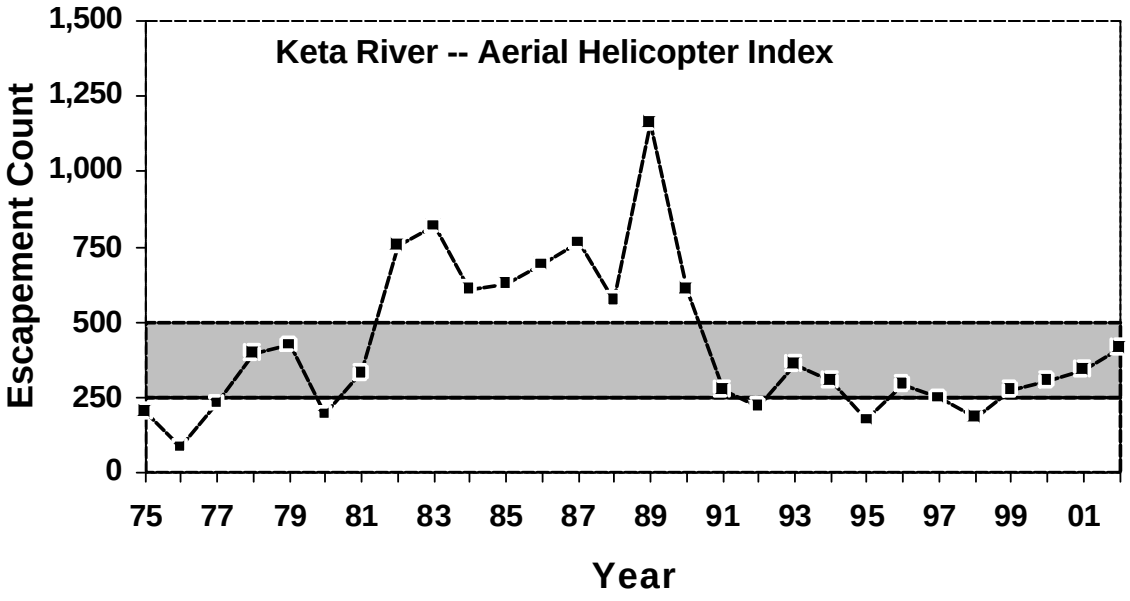

Figure A10.1 Estimated escapements of large spawners in the Keta River from 1975 to 2002 with the 1997 survey goal BEG range.

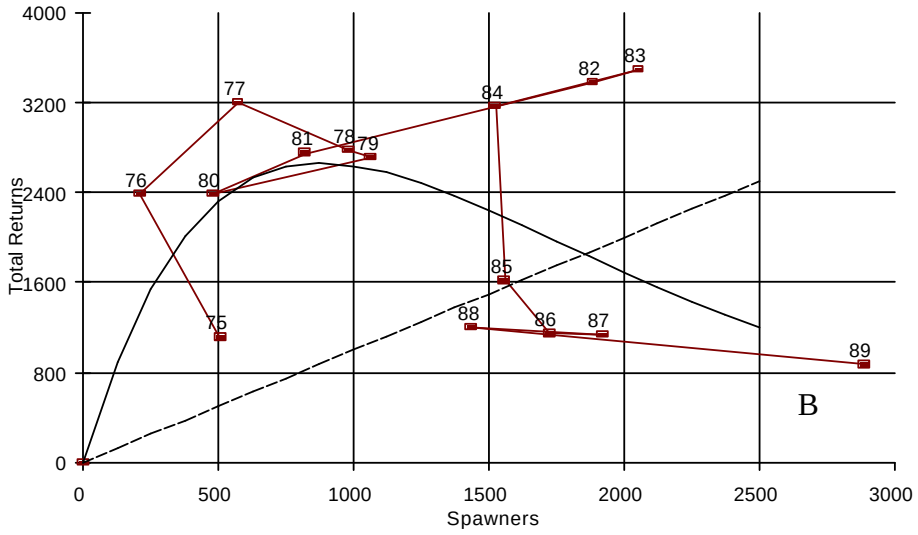

Figure A10.2 Estimated production of age-.2 to age-.5 chinook salmon in year classes 1975–1989 against the estimated spawning abundance of their large chinook parents for the population in the Keta River. The curve represents production predicted with Ricker's model, from McPherson and Carlile (1997).

APPENDIX A11: Blossom River Chinook Salmon Stock Stock Description

The Blossom River is a clearwater river on the mainland in southern Southeast Alaska, approximately 40 miles east of Ketchikan. Chinook from the Blossom River, along with fish from the Keta, Unuk, Chickamin and about 7 other small stocks make up what are collectively known as the Behm Canal stocks, named for the long narrow body of water that they all flow into. Although the Blossom and nearby Keta River are located within the Misty Fiords National Monument, they are both within an area of the Monument excluded from the Wilderness designation to allow the potential development of the Quartz Hill Molybdenum Project, located on a mountain between the two drainages; this development project is inactive at present and these drainages are pristine.

Chinook spawn in the main channel of the river. They start to enter the river in late June and complete spawning by early September. The stock produces primarily yearling smolt (age-1.), but returns have comprised as much as 15% subyearling fish (age-0.), which is unusual in Southeast Alaska (Pahlke 2001). The only other stocks which produce subyearling smolt, to any degree, are the Keta River stock and those in the Yakutat Forelands area, such as the Situk River. Based on coded wire tagging of Unuk and Chickamin chinook wild and hatchery stocks, we believe the ocean distribution of this stock is primarily in Southeast Alaska waters and to a lesser extent in northern British Columbia.

The stock assessment program for the Blossom River stock consisted solely of standardized helicopter surveys from 1975–1998 (Pahlke 2001). In 1998, ADF&G received special funding from the U.S. Congress to improve abundance-based management for chinook salmon in the PST area.. ADF&G directed a portion of the money received at improving stock assessment of SEAK chinook stocks that were lacking some basic information. Projects to collect age, sex and size information and to estimate total escapement have been implemented on the Blossom, Keta and Chickamin rivers in specific years since 1998. Annual surveys of escapement have continued in the Blossom River. A mark-recapture tagging experiment was conducted in 1998 which provided the expansion factor of 4.0, i.e. 25% of the total escapement of large spawners is counted in the helicopter surveys (Brownlee et al. 1999). Tagging studies were conducted in 1998–2000 on the Keta River, which indicated that about 1/3rd of the escapement in that river was counted in aerial surveys (Freeman et al. 2001).

Since 1998 we have sampled the escapement for age, sex and size data with adequate results in three of five years; the age data indicate that large chinook in this stock are composed of returns of three ocean ages (three different year classes) annually, fish that are two-, three- and four-ocean-age (Pahlke 2001). The two-ocean fish (primarily 4-year-old total age) are larger than in most other systems (but similar to the Chickamin and Keta), and about 75% of the two-ocean-age spawners in the Blossom River are of legal size. We have also found that the Chickamin, Keta and Blossom River stocks produce the largest chinook salmon at age in the region.

Survey counts have been relatively stable since 1975, with the exception of three years (Table A11.1 and Figure A11.1). Survey counts were the lowest in the period 1975–1980, rose for a few years to unprecedented levels, and then have been relatively stable since 1989. The high counts in 1985–1987 are the result of an exceptionally high survival from one particular brood, a phenomena that has occurred at least once in the last 28 years for most SEAK chinook stocks. The remainder of the survey counts have been relatively stable over the duration. The 1998–2002 average survey count was 192 large chinook, which is about double the average escapement counts (102 large chinook) from 1975–1980, the base period used by the PSC.

As mentioned in the body of the report above, a BEG range was established in 1997 for the Blossom River stock, based on limited data through the 1989 brood year (calendar year data through 1995), shown in Figure A11.2. That escapement goal range was a survey count of 250 to 500 large spawners. The escapements in the Blossom River have been below the 1997 BEG range in 1988–2002, or 52%, 85%,

92%, 82% and 90%, respectively, of the lower end of the 1997 BEG range. This led the Department to identify the Blossom River chinook as a candidate for stock of concern status to the ABF, at the management concern level, in October, 2002. ADF&G is partially through the spawner-recruit analysis update for the Blossom River and the other three Behm Canal chinook stocks. We will complete this analysis over the next two months, specifically for the Blossom stock, using all survey, age structure and the exploitation rate data available. This analysis has proven more cumbersome and complicated than originally anticipated because of time series effects in the data and workload on staff members. In addition, we need time to present any revisions to escapement goals to the Chinook Technical Committee.

Our initial review of these data suggest that the existing goal of 250–500 large spawners counted in helicopter surveys is an overestimate of the escapement level that will provide maximum sustained yield for this stock. **Given this preliminary analysis, we do not, at this time, consider the Blossom River to be a stock of concern nor in need of an action plan.** Our reasons for this conclusion and recommendation are:

1) Escapement levels have been very stable for this stock since 1988 (15 consecutive years). The stock has proven to sustain itself over a 28-year period.

2) The high escapements in 1985–1987 are unusual events from abnormally high survival of one or two broods.

3) Escapements in the most recent five years (1998–2002) have been double those seen in 1975–1980. Note in Figure A11.1 that escapements in the six years after the low counts from 1975–1980 were the highest in the time series.

4) Exploitation rates, inferred from the Unuk River wild stock nearby, and from time series analysis of the Blossom survey counts, are low. There are no directed fisheries on this stock. Except for a small spring fishery that targets Neets Bay hatchery returns, Behm Canal is closed to salmon fishing by regulation prior to July 13 and fishing in the Blossom River is closed year round to chinook salmon retention.

5) Low exploitation rates and relatively stable escapement counts are usually indicative of a stock at equilibrium, bouncing around replacement.

6) The three nearby stocks, the Unuk, Chickamin and Keta stocks, are performing well in recent years and it is therefore unlikely that an environmental or fisheries problem exists for the Blossom River stock.

7) The 1997 BEG for the Blossom River was based on the belief, in 1994, that the expansion factor for the Keta and Blossom River helicopter survey counts were the same. In fact, they are not and it is more difficult to count chinook salmon in the Blossom River because of deep pools, etc.

8) If the 1997 BEG range for the Blossom River is truly the escapement range that produces MSY, and fisheries were restricted in order to increase Blossom River escapements, the escapements in all other Behm Canal stocks would end up well above their BEG ranges, and substantial harvests for the combination of all chinook stocks would decrease.

APPENDIX A11: Blossom River Chinook Salmon Stock

System: Blossom River
Species: Chinook salmon

Outline of stock management, assessment and escapement goal analysis

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Management Division:	Sport and Commercial Fisheries Divisions
Management Jurisdictions:	ADF&G
Fisheries:	U.S. recreational, gillnet, and troll; non directed
Escapement Goal Type:	BEG
Escapement Goal:	250–500 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: 1975–2002, standardized by time and area. Mark-recapture estimate: 1998
Index Count Expansion Factor:	4.0: multiplier for helicopter peak survey count, based on one year (1998).
Brood years in BEG analysis:	15 (1975–1989), as in McPherson and Carlile (1997).
Data in BEG 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, in McPherson and Carlile (1997)
Contrast in escapements:	25.0, in McPherson and Carlile (1997)
Model used for BEG:	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
Document supporting BEG:	McPherson and Carlile (1997): CFD RIR No. 1J97-06
Additional comments:	The ADF&G is in the process of analyzing the additional spawner-recruit data for this stock and plans to provide a revised escapement goal by July, 2003.

Table A11.1 Escapement index counts and spawning escapement estimates for large spawners in the Blossom River chinook salmon population, 1975–2002. Escapement estimates are from expansions of aerial survey counts 1975–2002, except 1998, which is from a mark-recapture project.

Year	Survey counts	Spawning escapement [a]
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: mark recapture estimate**
1999	212	848
2000	231	924
2001	204	816
2002	224	896
Average	319	1,274

[a] Based on an expansion factor of 4.0 observed in 1998.

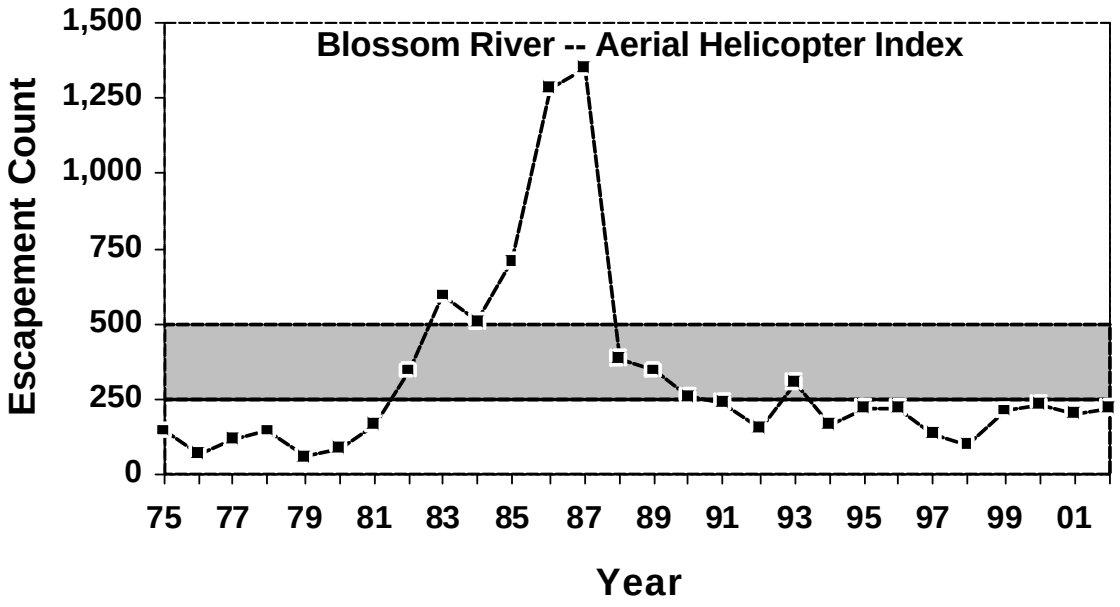

Figure A11.1 Estimated escapements of large spawners in the Blossom River from 1975 to 2002, with the 1997 survey goal BEG range.

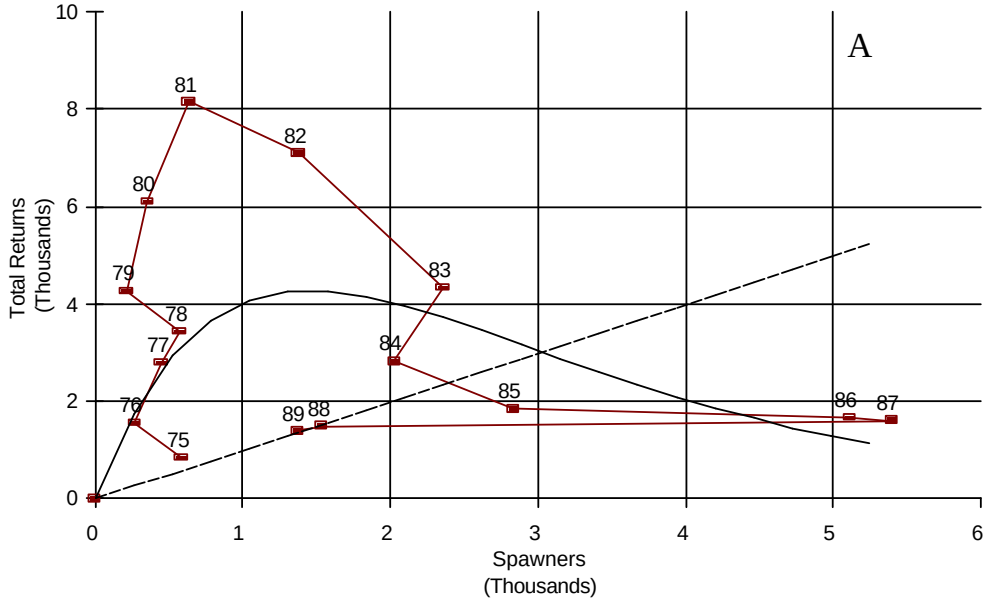

Figure A11.2 Estimated production of age-.2 to age-.5 chinook salmon in year classes 1975–1989 against the estimated spawning abundance of their large chinook parents for the population in the Blossom River. The curve represents production predicted with Ricker's model, from McPherson and Carlile (1997).