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Escapements of Chinook Salmon in Southeast Alaska and Transboundary Rivers in 1994

by

Keith A. Pahlke

November 1995

Alaska Department of Fish and Game

Division of Sport Fish

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
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

As part of a continuing stock assessment program for chinook salmon *Oncorhynchus tshawytscha* in Southeast Alaska, the Division of Sport Fish obtained indices of their escapement in designated streams and transboundary rivers. The estimated total escapement in 1994 was 77,156 large (age .3+) chinook, a 27% decrease from the record high of 106,286 fish in 1993. The 1994 estimate was more than twice the 1975–1980 base period average of 32,701 chinook salmon, 163% of the 1981–1985 average of 47,187, and 121% of the 1986–1990 average of 63,606.

Escapement indices exceeded management goals in the Stikine River (though down 44% from 1993), the Situk River (up 57% from 1993), and in Andrew Creek (down 46% from 1993). Indices were below goal in the Alsek River (though up 15% from 1993). The King Salmon River index count decreased from 280 fish in 1993 to 224 in 1994 (down 20%). Indices in three of the Behm Canal systems remained below management goals: Unuk: (down 38% from 1993), Chickamin (no change), and Blossom rivers (down 47%), while the Keta River (down 15%) was at goal.

Key words: Chinook, *Oncorhynchus tshawytscha*, escapement, Taku River, Stikine River, Alsek River, Chilkat River, Unuk River, Chickamin River, Blossom River, Keta River, Marten River, Wilson River, King Salmon River, Situk River, Andrew Creek, Behm Canal, Southeast Alaska, U.S./Canada Treaty, transboundary rivers.

INTRODUCTION

Chinook salmon *Oncorhynchus tshawytscha* are known to occur in 34 rivers in or draining into the Southeast region of Alaska from British Columbia or Yukon Territory, Canada. In the mid-1970s it became apparent that the majority of chinook salmon stocks in this region were depressed relative to historical levels of production (Kissner 1974), and 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, this management program closed commercial and recreational fisheries in terminal and near-terminal areas. In 1981, the program was formalized and expanded to a 15-year (roughly three life-cycles) rebuilding program for the transboundary Taku, Stikine, Alsek, Unuk, Chickamin, and Chilkat rivers and the non-transboundary Blossom, Keta, Situk, and King Salmon rivers (ADF&G 1981). The program used regionwide, all-gear catch ceilings for chinook salmon designed to rebuild spawning escapements by 1995 (ADF&G 1981).

Then, in 1985, the Alaskan program was incorporated into comprehensive coastwide rebuilding program for all wild stocks of chinook salmon under the auspices of the U.S./Canada Pacific Salmon Treaty (PST).

To track the rate of rebuilding, the Alaska Department of Fish and Game (ADF&G) and the Canadian Department of Fisheries and Oceans (DFO) count spawning chinook salmon in a designated set of watersheds (Appendix A1). These streams 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. Counts from each of these streams are considered to be indicators of relative abundance based on the assumption that counts are a constant proportion of the escapement in an index area or watershed. The data are provided annually to the Joint Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC) who use the data to evaluate rebuilding progress relative to the implementation of conservation actions (PSC 1991a). Evaluation focuses on changes in escapement relative to base period years, comparison of current escapement with a linear trend-line extending from the base period escapement to the

goal at the rebuilding target date, and trends in escapement since implementation of the PST. Judgments about rebuilding progress provide the basis for regulations which restrict or expand fisheries to achieve rebuilding goals.

As part of a continuing program by the Division of Sport Fish to improve wild chinook stocks, this project obtained indices of spawner abundance for major chinook salmon stocks in Southeast Alaska. Objectives for 1994 were to count large (age 1.3, 1.4 and 1.5) spawning chinook salmon during the time of peak abundance in tributaries and mainstem areas of the Taku, Stikine, Alsek, Situk, Unuk, Chickamin, Blossom, Keta, King Salmon rivers and Andrew Creek and to compile and compare the indices to those from past years.

DESCRIPTION OF STUDY SITES

There are 34 river systems in Southeast Alaska with populations of wild chinook salmon (Figure 1). Many individual spawning areas within these systems are surveyed annually in a designated set of watersheds. Detailed descriptions and locations of these areas are found in Mecum and Kissner (1989); general descriptions of the watersheds follow.

The Taku River originates in northern British Columbia and flows into the ocean 48 km east of Juneau, Alaska. The Taku River drainage covers over 16,000 km^2; maximum flows range from 787 to 2,489 m^3/sec. Principal tributaries include the Sloko, Nakina, Sheslay, Inklin, and Nahlin rivers. The clearwater Nakina and Nahlin rivers contribute less than 25% of the total drainage discharge; most is from glacier-fed streams on the eastern slope of the Coast Range in British Columbia. Upstream of the abandoned mining community of Tulsequah, British Columbia, the drainage remains in pristine condition, with very little mining, logging, or other development activities. The upper Taku River area is extremely remote, with no road access and few year-round residents.

All of the important chinook salmon spawning areas are in tributaries in the upper drainage in British Columbia—the Nakina, Nahlin, Dudidontu, Tatsamenie, Hackett, and Kowatua rivers and Tseta Creek.

Stock assessment of chinook salmon has been conducted intermittently on the Taku River since the 1950s, and helicopter surveys of the index areas have been conducted annually since 1973. In addition the DFO has operated a carcass collection weir below the major spawning area on the Nakina river since 1973. The carcass weir provides age composition of the escapement.

The Stikine River originates in British Columbia and flows to the sea approximately 32 km south of Petersburg, Alaska. The drainage covers about 52,000 km^2, about 90% of which is inaccessible to anadromous fish because of natural barriers and velocity blocks. Principal tributaries include the Tahltan, Chutine, Scud, Iskut, and Tuya rivers. The lower river and most tributaries are glacially occluded (e.g., Chutine, Scud, and Iskut rivers). Only 2% of the Stikine River drainage is in Alaska (Beak Consultants Limited 1981), and the majority of chinook salmon spawning areas in the Stikine River are located in British Columbia, in the mainstem Tahltan and Little Tahltan rivers (including Beatty Creek), but Andrew Creek, in the lower Stikine River, supports a significant run of chinook salmon. The upper drainage of the Stikine is accessible via Telegraph Creek Road. Development includes several active mines in the Canadian section of the Stikine drainage and proposals for major hydroelectric projects.

Helicopter surveys of the Little Tahltan River index area have been conducted annually since 1975 and the DFO has operated a fish-counting weir at the mouth of the Little Tahltan River since 1985. Since all fish spawning in the Little Tahltan River spawn above the weir, counts from the weir represent the total escapement to that tributary.

The Alsek River originates in the Yukon Territory, Canada and flows in a southerly direction into the Gulf of Alaska about 75 km southeast of Yakutat, Alaska. The Dezadeash and Tatshenshini rivers are the largest tributaries to the Alsek River. Velocity barriers and blockages prohibit migration of anadromous salmonids to most of the Alsek.

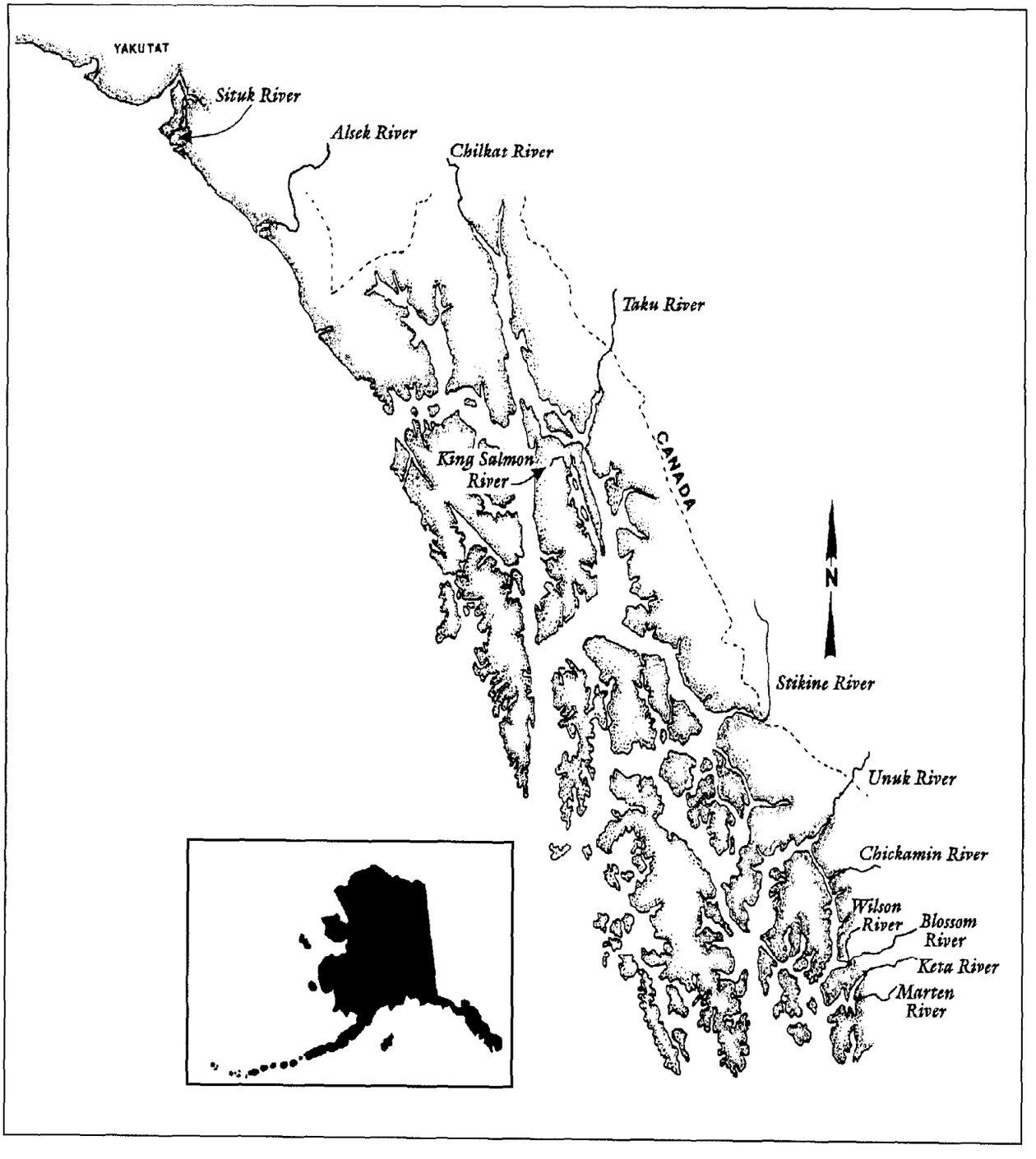

Figure 1.–Location of chinook salmon systems in Southeast Alaska.

River drainage. Most of the significant chinook salmon spawning areas are found in tributaries of the Tatshenshini River—the Klukshu, Blanchard, and Takhanne rivers and Village and Goat creeks. The Klukshu and upper Tatshenshini rivers are accessible by road near Dalton Post, Yukon Territory.

Counts of chinook salmon have been collected on the Alsek River since 1962. Beginning in 1976, the DFO operated a weir at the mouth of the Klukshu to count chinook, sockeye, and coho salmon O. *kisutch*. Aerial surveys to count spawning chinook salmon have been conducted by ADF&G with a helicopter since 1981. Prior to 1981, counts were obtained from fixed-wing aircraft. The escapement to the Klukshu River is difficult to count by aerial, boat or foot surveys because of deep pools and overhanging vegetation. However, surveys are conducted annually to provide some continuity in estimates, in case the weir is not funded.

The Unuk, Chickamin, Blossom, and Keta river drainages all feed into Behm Canal—a narrow passage of water east of Ketchikan, Alaska. Misty Fiords National Monument/Wilderness Area surrounds the eastern or "back" Behm Canal and includes the Boca de Quadra fjords. Many of the mainland rivers in the area support chinook salmon; the Unuk, Chickamin, Blossom and Keta rivers are designated chinook salmon escapement index systems.

The Unuk River originates in a glaciated area of British Columbia and flows 129 km to Burroughs Bay 85 km northeast of Ketchikan, Alaska; only the lower 39 km of the river are in Alaska. The Unuk is a large braided, glacially occluded river with a drainage of approximately 3,885 km^2. Most spawning occurs in tributaries of the Alaska portion of the river (Pahlke *In press*). The escapement index areas are all small clearwater tributaries: Eulachon River and Cripple, Genes Lake, Clear, Lake, and Kerr creeks. Cripple Creek and Genes Lake Creek cannot be surveyed from the air because of heavy vegetation, and fish are counted by foot surveys. Chinook salmon have been counted by foot or helicopter surveys in these areas annually since 1977.

The Chickamin River is a large, glacial river that originates in British Columbia, and flows into Behm Canal approximately 32 km southeast of Burroughs Bay and 65 km northeast of Ketchikan. Although it is technically a transboundary river, there are no known chinook spawning areas upstream from the Canadian border on the Chickamin River. The important spawning tributaries are the South Fork of the Chickamin and Barrier, Butler, Indian, Leduc, Humpy, King, and Clear Falls creeks. Chinook salmon have been counted by foot or helicopter surveys in index areas of the Chickamin River each year since 1975.

The Blossom, Keta, Wilson, and Marten rivers are non-transboundary rivers that flow into Behm Canal approximately 45 km east of Ketchikan. These rivers lie inside the boundaries of the Misty Fiords National Monument in southern Behm Canal but are within an area that has been specifically excluded from Wilderness designation, because of the potential development of a large-scale molybdenum mine (Quartz Hill) near the divide of the Blossom and Keta rivers. The mine is presently undeveloped, but an access road has been completed; it terminates at salt water near the mouth of the Blossom River. Chinook salmon escapements to the Wilson and Marten rivers have been monitored on an intermittent basis in recent years. The Marten River, the most southern of the four rivers, flows into Marten Arm near Boca de Quadra.

The King Salmon River drains an area of approximately 100 km^2 on Admiralty Island, flowing into King Salmon Bay in the eastern portion of Stephens Passage about 48 km south of Juneau. The King Salmon River is the only island river system in Southeast Alaska to support a significant population of spawning chinook salmon. The only other island system with a documented run of chinook salmon is Wheeler Creek, also on Admiralty Island. The Alaska Department of Fish and Game (ADF&G) operated an upstream weir on the King Salmon River from 1983 through 1992 to count chinook salmon and collect their eggs for Snettisham Hatchery.

The Chilkat River is a large glacial river which originates in the Yukon Territory and flows into Chilkat Inlet at the head of northern Lynn Canal near Haines, Alaska. Helicopter surveys were conducted on two index areas, Big Boulder Creek and Stonehouse Creek of the Chilkat River from 1981 to 1992 (Pahlke 1993). Counts from these streams were shown by Johnson et al. (1992) to be an ineffective index of abundance and they greatly underestimated the escapement to Chilkat River. Because all other streams in the Chilkat drainage are glacially occluded or not suitable for other reasons, the aerial indices were suspended in favor of annual abundance estimates of escapement using mark-recapture experiments.

The Situk River is located about 16 km east of Yakutat, Alaska. The Situk supports a large run of sockeye salmon *O. nerka* which is harvested in commercial and subsistence set gill net fisheries concentrated at the mouth of the Situk River. Situk River chinook salmon have been harvested incidentally in the set gill net fishery and a recreational fishery in the lower river. A weir was operated on the Situk River at the upper limit of the intertidal area from 1928 to 1955 to count all five species of Pacific salmon spawning in the river. From 1976 to 1988, a weir was operated further upstream near the Ninemile Road bridge, primarily to count chinook and sockeye salmon. In 1988, the weir was returned to a location near tidewater and operated jointly by the Division of Sport Fish and Commercial Fisheries Management and Development Division (CFMD).

METHODS

Of the 34 river systems in the region that contain populations of wild chinook salmon, three trans-boundary rivers, the Taku, Stikine, and Alsek, are classed as major producers, each with potential production (harvest plus escapement) greater than 10,000 fish. Nine rivers are classed as medium producers, each with production of 1,500 to 10,000 fish, and the remaining 22 rivers are minor producers, with production less than 1,500 fish. Small numbers of chinook salmon occur in other streams of the region, but they are not included in the above because successful spawning has not been documented. Chinook salmon are counted via aerial surveys or at weirs each year in all three major systems, six of the medium systems, and the one minor producing system (Appendix A1).

INDICES OF ESCAPEMENT

Spawning chinook salmon are counted at 26 designated index areas in nine of the systems; complete counts of chinook salmon are obtained at the Situk River weir. Counts are made during aerial or foot surveys or at weirs. Aerial surveys are conducted from a Bell 206 or Hughes 500D helicopter during periods of peak spawning. Peak spawning times, defined as the period when the largest number of adult chinook salmon actively spawn in a particular stream or river, are well documented from surveys of these index areas conducted over the past 15 years (Kissner 1982). The proportion of fish in pre-spawning, spawning and post-spawning condition is used to judge whether the survey timing is correct to encompass peak spawning. Index areas are surveyed at least twice unless turbid water or unsafe flying conditions precluded the second survey. Pilots are directed to fly the helicopter from 6 m to 15 m above the river bed at a speed of 6–16 km/h. The helicopter door on the side of the observer is removed, and the helicopter is flown sideways while observations of spawning chinook salmon are made from the open space. Foot surveys are conducted by at least two people walking in the creek bed or on the riverbank.

Only large, (typically age-.3, -.4, and -.5) chinook salmon ≥660 mm mideye-to-fork length (MEF), are counted during aerial or foot surveys. No attempt is made to accurately count small (typically age-.1 and -.2) chinook salmon <660 mm (MEF) (Mecum 1990). These small chinook salmon, also called jacks, are early maturing, precocious males that are considered to be surplus to spawning escapement needs. They are easy to separate visually from their older age counterparts under most conditions, because of their short, compact bodies and lighter color. They are, however, difficult to distinguish from other smaller species such as pink O. *gorbuscha* and

sockeye salmon. Counts and other observations from the 1994 surveys (Appendix A3) are entered into the CFMD Integrated Fisheries Database (IFDB), where they are accessible to any interested party.

Escapement counts are also obtained from fish-counting weirs operated by the DFO on the Little Tahltan (Stikine), Tatsamenie (Taku), and Klukshu (Alsek) rivers, and by ADF&G on the Situk River. Except for the Situk River, where aerial surveys were not practical because of overhanging vegetation, weir counts were compared with aerial or foot surveys to determine the relative accuracy of surveys of peak escapement in predicting total escapements. Since 1991, escapement to the Chilkat River has been estimated annually by mark-recapture experiments (Ericksen 1995).

To estimate escapement (since indices are only a measure of relative abundance), counts from index areas are expanded by a 'survey expansion factor' and/or a 'tributary expansion factor,' formulae that are found in Mecum (1990) and Appendix A1.

A survey expansion factor is a judgment as to the proportion of the total season's escapement counted in the specific area observed during the peak spawning period. Survey expansion factors are based on professional judgment and vary among index areas according to the difficulties encountered in observing spawners, such as overhanging vegetation, turbid water conditions, presence of other salmon species (i.e., pink and chum O. *keta* salmon), or protraction of run timing. Survey expansion factors range from 1/0.75 for the Nakina and Nahlin Rivers to 1/0.625 for most other index areas (Appendix A1). Survey expansions are not necessary for those streams where weirs or other estimation programs are used to count all migrating chinook salmon.

Peak aerial, foot, or weir counts are also expanded by a 'tributary expansion factor,' a judgment as to the proportion of spawners observed in index areas relative to escapement to the entire drainage (i.e., not all tributaries or spawning areas were surveyed). Tributary expansion factors range from 1/0.25 for the Stikine River to 1/0.64 for the Klukshu River (Appendix A1).

Finally, to estimate total regional escapement, counts are additionally expanded by a 'category expansion factor' which weights expanded counts from major, medium, and minor producers by the number of streams in each category in the region.

From 1989 to 1991, counts from surveyed watersheds were expanded by the survey and tributary expansion factors, and judgments as to the rebuilding rate of stocks were made on expanded data (Mecum 1990, Pahlke 1991, 1992). However, Johnson et al. (1992) demonstrated that expansion factors used on the Chilkat River system were highly inaccurate. The resulting uncertainty as to the accuracy of expansion factors prompted removal of expanded counts from analysis of rebuilding rates beginning in 1991 (Pahlke 1992), in favor of displaying the actual survey count or sum of counts.

Nevertheless, estimates of escapement from expanded counts are included in this narrative to provide gross figures of spawner abundance, with the caveat that expansion factors may produce incorrect estimates.

RESULTS

Of the 42 locations surveyed in 1994 specifically for chinook salmon escapement, 26 were designated index areas (Appendix A3). Surveys generally progressed as planned, but poor water conditions prevented a second aerial survey of the Little Tahltan River; total counts in that system are obtained at a weir, however, and the surveys are primarily for calibration of survey technique.

The estimated escapement of chinook salmon for all Southeast Alaska and transboundary rivers was 77,156 (Table 1) a 27% decrease from the estimate of 106,286 fish in 1993. This was mostly due to decreases in spawner counts in the Taku and Stikine rivers, the largest stocks in the region. The 1994 escapement is more than twice the 1975–1980 base period average of 32,701 chinook salmon, 163% of the 1981–1985 average of

47,187, and 121% of the 1986–1990 average of 63,606 fish (Appendix A2).

Estimated escapements of chinook salmon in Southeast Alaska have increased steadily since 1984, and they exceeded the management escapement goal for combined systems for the first time in 1993 (Figure 2). This is due primarily to strong returns to the Taku, Stikine, and Chilkat rivers, which together make up 76% of the regional escapement goal and 76% of the 1994 escapement.

Through 1993, the Taku, Stikine, Situk, Unuk, Chickamin, and Keta rivers and Andrew Creek index systems were classified by the CTC as above goal or rebuilding (CTC 1994). In a departure from these trends, counts and the estimated escapement for the Alsek River have not paced the linear rebuilding schedule, and counts in four Behm Canal systems have declined.

Taku River

The count of 9,913 large chinook salmon in the six index areas of the Taku River was the lowest since 1989 (Table 2). Counts were similar to 1984–1993 average in all areas except Tseta Creek and Nahlin River, where counts were above average (Table 3). Counts have increased steadily since 1983 (Figure 3) but were below the newly revised six-tributary goal of 13,200 fish (PSC 1991b).

Counts were expanded by survey expansion factors (1/0.75 for Nakina/Nahlin and 1/.625 for the other four tributaries) and by the tributary expansion factor (1/0.52) to produce an estimated escapement of 26,804 large chinook salmon in the Taku River. The estimated escapement for the Taku River in 1993 was 99% of the revised escapement goal of 36,500 large chinook salmon; the 1994 estimate was 73% of the goal.

Expansion factors for the Taku River were modified based results of a two-year tagging study which produced new information on the distribution of spawners in the drainage (PSC 1991b). These changes had the effect of increasing in the escapement goal from 25,500 to 36,500 large chinook salmon. However, these changes were not adopted by the Transboundary River Technical Committee (TBTC) of the PSC, who further revised the escapement goal to be composed of the sum of counts from all six index tributaries (PSC 1991b).

The new goal uses no expansion factors and refers to chinook actually counted during surveys. Because terminal catches at this time are small relative to the escapement, the TBTC recommends that only escapement counts for the six index tributaries be used in assessing rebuilding status.

Stikine River

We counted 6,450 chinook salmon at the Little Tahltan River weir in 1994. This number was later reduced to 6,361 by an egg take of 26 fish. The 1994 weir count was 44% lower than the record count of 11,449 in 1993 (Table 4). An aerial survey of Beatty Creek counted 184 large chinook salmon, considerably fewer than the record count of 757 in 1993 (Table 4). The glacially occluded mainstem Tahltan River was not surveyed.

One aerial survey was flown in 1994, and 2,422 large chinook salmon were counted above the weir (a second survey was canceled when a beaver dam washed out and increased the turbidity in the index area). The survey was conducted before the peak of spawning (about 1,000 fish immigrated through the weir after the survey), and the count was only 37.9% of the season's escapement.

From 1985 to 1993, the proportion of the total escapement of chinook salmon counted during peak aerial surveys has ranged from 32.9% to56.6% and averaged 46.5% (Table 5). The proportion of total escapement observed in a single survey often declined after the peak of spawning as fish died or were removed by predators. The low proportion of total escapement observed in 1986 was caused by poor survey conditions after a mudslide. Low counts in 1990 and 1991 were attributed in part to the formation of

Table 1.–Estimated escapement of chinook salmon to Southeast Alaska and transboundary rivers in 1994.

	Survey area	Number counted	Survey expansion factor	Tributary expansion factor	Estimated inriver escapement	Category expansion factor	Final estimated escapement
Major producers							
Alsek River	Klukshu	3,735	1/1	1/0.64	5,836		5,532 [a]
Taku River	4 tributaries[b]	2,703	1/0.625	1/0.52	8,317		8,317
Taku River	Nakina/Nahlin	7,210	1/0.75	1/0.52	18,487		18,487
Subtotal		9,913			26,804		26,804
Stikine River	Little Tahltan	6,450	1/1	1/0.25	25,800		25,774 [c]
Category subtotal					58,440	3/3	58,110
Medium producers							
Situk River	all	1,241	–	1/1	1,241		
Chilkat River	all	6,319	–	1/1	6,319		
Andrew Creek	all	572	1/0.625	1/1	915		
Unuk River	all	711	1/0.625	1/1	1,138		
Chickamin River	all	388	1/0.625	1/1	621		
Blossom River	all	161	1/0.625	1/1	258		
Keta River	all	306	1/0.625	1/1	490		
Category subtotal					10,981	9/7	14,118
Minor producers							
King Salmon R.	all	140	1/0.625	1/1	224		
Category subtotal					224	22/1	4,928
Total							77,156

[a] Estimated escapement reduced by 304.

[b] Kowatua, Tatsamenie, and Dudidontu rivers and Tseta Creek.

[c] Estimated escapement reduced by 26 fish taken for broodstock.

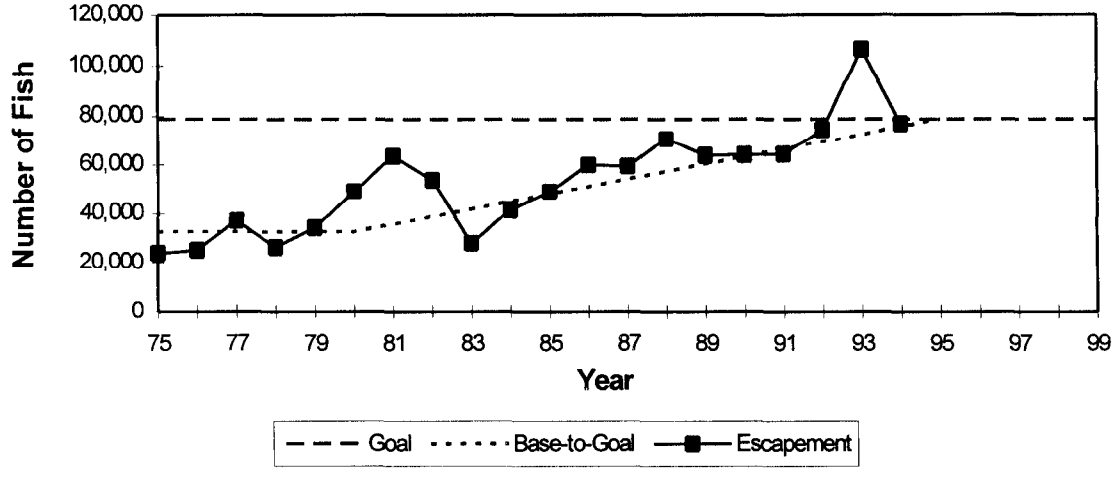

Figure 2.–Estimated total escapement of large chinook salmon to transboundary Southeast Alaska rivers, 1975–1994. Counts of spawners are expanded by survey, tributary, and category expansion factors. Base-to-goal line represents the desired rebuilding rate, starting in 1981 at the average escapement during base period (1975–1980) and ending at a management escapement goal of 78,940 large chinook salmon in 1995 (final year of the three-cycle rebuilding program)

Table 2.–Counts of spawning chinook salmon in index areas of the Taku River, 1951–1994.

Year[a]	Nakina River		Nahlin River		Kowatua River		Tatsamenie River		Dudidontu River		Tseta Creek		Total	
1951	5,000	(F)[b]	1,000		– [c]				400	(F)	100	(F)	6,500	
1952	9,000	(F)	–		–		–		–		–		9,000	
1953	7,500	(F)	–		–		–		–		–		7,500	
1954	6,000	(F)	–	(F)	–		–		–		–		6,000	
1955	3,000	(F)	–		–		–		–		–		3,000	
1956	1,380	(F)	–		–		–		–		–		1,380	
1957	1,500	(F,W)	–		–		–		–		–		1,500	[d]
1958	2,500	(F,W)	2,500	(A)	–		–		4,500	(A)	–		9,500	[d]
1959	4,000	(F,W)	–		–		–		–		–		4,000	[d]
1962	–		216	(A)	–		–		25	(A)	81	(A)	322	
1965	3,050	(H)	35	(A)	200	P(A)	50	P(A)	110	(A)	18	(A)	3,463	
1966	3,700	P(A)	300	(A)	14	P(A)	100	P(A)	252	(A)	150	(A)	4,516	
1967	700	(A)	300	P(A)	250	P(A)	–		600	(A)	350	(A)	2,200	
1968	300	P(A)	450	(A)	1,100	(A)	800	E(A)	590	(A)	230	(A)	3,470	
1969	3,500	(A)	–		3,300	(A)	800	E(A)	–		–		7,600	
1970	–		26	(A)	1,200	P(A)	530	E(A)	10	(A)	25	(A)	1,791	
1971	500	(A)	473		1,400		360	E(A)	165	(A)	–		2,898	
1972	1,000	(F)	280		170		132	E(A)	102	(A)	80		1,764	
1971	500	(A)	473	(A)	1,400	E(A)	360	E(A)	165	(A)	–	(A)	2,898	
1972	1,000	(F)	280	(A)	170	(A)	132	(A)	102	(A)	80	P(A)	1,764	
1973	2,000	N(H)	300	E(H)	100	N(H)	200	E(H)	200	E(H)	4	(A)	2,804	
1974	1,800	E(H)	900	E(H)	235	(A)	120	(A)	24	(A)	4	(A)	3,083	
1975	1,800	E(H)	274	E(H)	–		–		15	N(H)	–		2,089	
1976	3,000	E(H)	725	E(H)	341	P(A)	620	E(H)	40	(H)	–		4,726	
1977	3,850	E(H)	650	E(H)	580	E(A)	573	E(H)	18	(H)	–		5,671	
1978	1,620	E(H)	624	E(H)	490	N(H)	550	E(H)	–		21	E(H)	3,305	
1979	2,110	E(H)	857	E(H)	430	N(H)	750	E(H)	9	E(H)	–		4,156	
1980	4,500	E(H)	1,531	E(H)	450	N(H)	905	E(H)	158	E(H)	–		7,544	
1981	5,110	E(H)	2,945	E(H)	560	N(H)	839	E(H)	74	N(H)	258	N(H)	9,786	
1982	2,533	E(H)	1,246	E(H)	289	N(H)	387	N(H)	130	N(H)	228	N(H)	4,813	
1983	968	E(H)	391	N(H)	171	E(H)	236	E(H)	117	E(H)	179	N(H)	2,062	
1984	1,887	(H)	951	(H)	279	E(H)	616	E(H)	–		176	(H)	3,909	[e]
1985	2,647	N(H)	2,236	E(H)	699	E(H)	848	E(H)	475	(H)	303	E(H)	7,208	
1986	3,868	(H)	1,612	E(H)	548	E(H)	886	E(H)	413	E(H)	193	E(H)	7,520	
1987	2,906	E(H)	1,122	E(H)	570	E(H)	678	E(H)	287	E(H)	180	E(H)	5,743	
1988	4,500	E(H)	1,535	E(H)	1,010	E(H)	1,272	E(H)	243	E(H)	66	E(H)	8,626	
1989	5,141	E(H)	1,812	E(H)	601	(W)	1,228	E(H)	204	E(H)	494	E(H)	9,480	[f]
1990	7,917	E(H)	1,658	E(H)	614	(W)	1,068	N(H)		E(H)	172	N(H)	12,249	[f]
1991	5,610	E(H)	1,781	E(H)	570	N(H)	1,164	E(H)	804	E(H)	224	N(H)	10,153	
1992	5,750	E(H)	1,821	E(H)	782	E(H)	1,624	N(H)	768	N(H)	313	N(H)	11,058	
1993	6,490	E(H)	2,128	N(H)	1,584	E(H)	1,491	E(H)	1,020	E(H)	491	N(H)	13,204	
1994	4,792	N(H)	2,418	E(H)	410	P(H)	1,106	N(H)	573	N(H)	614	E(H)	9,913	

[a] Counts before 1975 may not be comparable due to changes in survey dates and methods. Early foot surveys may have included jacks.

[b] (F) = foot survey; (A) = fixed-wing aircraft; (H) = helicopter; N = normal water flows and turbidity, average survey conditions; P = survey conditions hampered by glacial or turbid waters; E = survey conditions excellent.

[c] No survey conducted.

[d] Partial survey of Nakina River in 1957-59; comparisons made from carcass weir counts.

[e] Surveys in 1984 conducted by DFO; partial survey of Tseta Creek and Nahlin.

[f] Carcass weir at Kowatua River used to partially count escapement due to unfavorable water conditions.

Table 3.–Distribution of spawning chinook salmon among index areas of the Taku River during years when all index areas were surveyed.

Year	Nakina River	%	Nahlin River	%	Kowatua River	%	Tatsamenie River	%	Dudidontu River	%	Tseta Creek	%	Total
1981	5,110	52	2,945	30	560	6	839	9	74	1	258	3	9,786
1982	2,533	53	1,246	26	289	6	387	8	130	3	228	5	4,813
1983	968	47	391	19	171	8	236	11	117	6	179	9	2,062
1985	2,647	37	2,239	31	699	10	848	12	475	7	303	4	7,211
1986	3,868	51	1,612	21	548	7	886	12	413	5	193	3	7,520
1987	2,906	51	1,122	20	570	10	678	12	287	5	180	3	5,743
1988	4,500	52	1,535	18	1,010	12	1,272	15	243	3	66	1	8,626
1989	5,141	54	1,812	19	601	6	1,228	13	204	2	494	5	9,480
1990	7,917	65	1,658	14	614	5	1,068	9	820	7	172	1	12,249
1991	5,610	55	1,781	18	570	6	1,164	11	804	8	224	2	10,153
1992	5,750	52	1,821	16	782	7	1,624	15	768	7	313	3	11,058
1993	6,490	49	2,128	16	1,584	12	1,491	11	1,020	8	497	4	13,210
Avg.	4,453	52	1,691	21	667	8	977	12	446	5	259	4	8,493
1994	4,792	48	2,418	24	410	4	1,106	11	573	6	614	6	9,913

a new river channel through a heavily wooded area which was difficult to survey. The low proportion counted in 1993 was a result of the extremely large escapement.

The revised escapement goal (PSC 1991b) for the Little Tahltan River weir is 5,300 fish, and the 1994 weir count exceeded that goal for the eighth year in a row; it exceeded as well the rebuilding rate required to achieve the escapement goal by 1995 (Figure 4). Expansion of the 1994 Little Tahltan weir count of 6,450 large chinook salmon by the tributary expansion factor (1/0.25) produced a total Stikine River escapement estimate of 25,774 large chinook salmon (= 25,800 – 26 fish taken for broodstock).

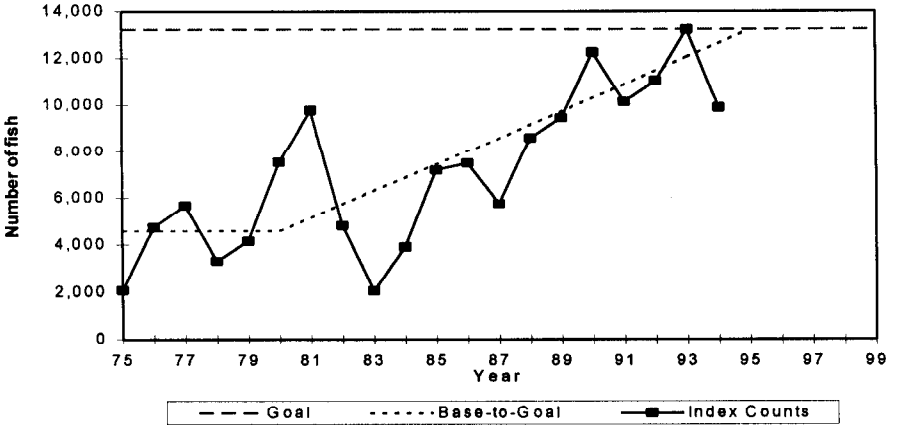

Figure 3.–Counts of chinook salmon in index areas of the Taku River, 1975–1994. Base-to-goal line indicates linear rebuilding schedule, starting in 1981 at average escapement level during base period (1975–1980) and ending at revised escapement goal of 13,200 large chinook salmon in 1995 (final year of the three-cycle rebuilding program.)

Table 4.–Counts of spawning chinook salmon in index areas of the Stikine River, 1956–1994.

Year[a]	Little Tahltan River				Mainstem Tahltan River		Beatty Creek		Total	
	Survey count		Weir count							
1956	493	(F)[b]	–		–		–		493	
1957	199	(F)	–		–		–		199	
1958	790	(F)	–		–		–		790	
1959	198	(F)	–		–		–		198	
1960	346	(F)	–		–		–		346	
1961	–		–		–		–		–	
1962	–		–		–		–		–	
1963	–		–		–		–		–	
1964	–		–		–		–		–	
1965	–		–		85		–		85	[c]
1966	–		–		318		–		318	[c]
1967	800	N(H)	–		–		–		800	
1968	–		–		–		–		–	
1969	–		–		–		–		–	
1970	–		–		–		–		–	
1971	–		–		–		–		–	
1972	–		–		–		–		–	
1973	–		–		–		–		–	
1974	–		–		–		–		–	
1975	700	E(H)	–		2,908	E(H)	–		3,608	
1976	400	N(H)	–		120	(H)	–		520	[d]
1977	800	P(H)	–		25	(A)	–		825	
1978	632	E(H)	–		756	P(H)	–		1,388	
1979	1,166	E(H)	–		2,118	N(H)	–		3,284	
1980	2,137	N(H)	–		960	P(H)	122	E(H)	3,219	
1981	3,334	E(H)	–		1,852	P(H)	558	E(H)	5,744	
1982	2,830	N(H)	–		1,690	N(F)	567	E(H)	5,087	
1983	594	E(H)	–		453	N(H)	83	E(H)	1,130	
1984	1,294	(H)	–		–		126	(H)	1,420	[e]
1985	1,598	E(H)	3,114		1,490	N(H)	147	N(H)	4,751	[f]
1986	1,201	E(H)	2,891		1,400	P(H)	183	N(H)	4,474	
1987	2,706	E(H)	4,783		1,390	P(H)	312	E(H)	6,485	
1988	3,796	E(H)	7,292		4,384	N(H)	593	E(H)	12,269	
1989	2,527	E(H)	4,715		–		362	E(H)	5,077	
1990	1,755	E(H)	4,392		2,134	N(H)	271	E(H)	6,797	
1991	1,768	E(H)	4,506		2,445	N(H)	193	N(H)	7,144	[g]
1992	3,607	E(H)	6,627		1,891	N(H)	362	N(H)	8,880	
1993	4,010	P(H)	11,449		2,249	P(H)	757	E(H)	14,455	
1994	2,422	N(H)	6, 450[h]		–		184	N(H)	6,545	

[a] Counts prior to 1975 may not be comparable because of differences in survey dates and counting methods.

[b] (F) = survey conducted by walking; (A) = survey conducted by fixed-wing aircraft; (H) = survey conducted by helicopter; (W) = weir count; (F/A) = combined foot and aerial count; N = normal survey conditions; P = survey conditions hampered by glacial or turbid waters; E = excellent survey conditions; – = no survey conducted or data not comparable.

[c] Chinook lifted over barrier on mainstem Tahltan, 1965 and 1966.

[d] Late count on mainstem Tahltan, minimal estimate.

[e] Surveys were done by DFO in 1984.

[f] Total = Little Tahltan weir count plus aerial or weir counts on other systems.

[h] Total count of 6,450 was reduced to 6,426 actual spawners by an egg take of 26 fish.

Table 5.–Comparison of aerial survey counts of chinook salmon to counts at the Little Tahltan River weir on the same date, and final count of escapement through the weir, 1985–1994.

Date	Weir count	Count from aerial survey[a]	Percent counted in survey
8/2/85	2,379	1,262	53.0
8/6/85	2,864	1,598	55.8
Final	3,114		51.3
8/1/86	2,323	1,101	47.4
8/5/86	2,646	1,143	43.2
Final	2,891	1,201	41.5
7/31/87	3,903	2,446	62.7
8/3/87	4,456	2,706	60.7
Final	4,783		56.6
7/30/88	5,573	3,484	62.5
8/5/88	6,822	3,796	55.6
Final	7,292		52.1
7/29/89	3,772	2,515	66.7
8/4/89	4,394	2,527	57.5
Final	4,715		53.6
7/31/90	3,780	1,658	43.9
8/7/90	4,232	1,576	37.2
Final	4,392	1,755	40.0
7/31/91	3,649	1,768	48.5
8/6/91	4,141	1,549	37.5
Final	4,506		39.2
7/31/92	6,070	3,419	56.3
8/6/92	6,587	2,702	41.0
Final	6,627	3,607	54.4
8/4/93	11,247	3,770	33.5
Final	11,449	4,010	35.0
Average final 1985-1993	5,529	2,504	46.5
7/30/94	5,301	2,422	45.7
Final	6,450		37.9

[a] Final count = peak survey above weir plus count below weir on that date.

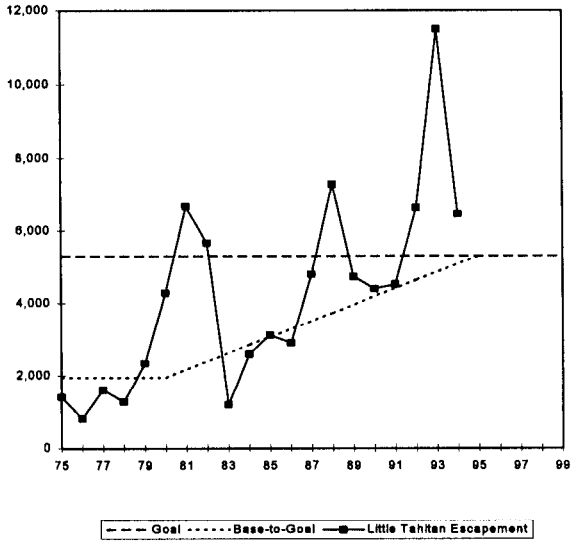

Figure 4.–Counts of chinook salmon at the Little Tahltan River weir, Stikine River, 1975–1994. Base-to-goal line shows linear rebuilding schedule, starting in 1981 at average escapement level during base period (1975–1980) and ending at escapement goal of 5,300 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Andrew Creek

The count of chinook salmon in Andrew Creek was 572 fish, a 46% decrease from 1,060 in 1993 (Table 6). This was the eighth year since 1985 that the Andrew Creek escapement exceeded the goal of 470 fish (Figure 5). The stream channel changed significantly in 1987, and previous years' counts were revised in 1991 to be consistent with present methods. Changes were small (<40 fish except in 1987 when 137 fish were added to the count). From 1976 to 1984, some adult chinook from Andrew Creek were used to provide brood stock for hatcheries. Total spawners removed from the creek ranged from 12 in 1978 to 275 in 1982 (Table 6).

Alsek River

In 1994, 3,735 large chinook salmon were counted at the Klukshu River weir, the highest count since 1979 (Table 7). The escapement to the Klukshu, estimated by subtracting the Indian Food Fishery (IFF) harvest and brood stock

Table 6.–Counts of spawning chinook salmon in Andrew Creek, 1956–1994.

Year	Index counts: South fork A		Index counts: North fork B	Total egg take C	Total weir count (adults) D	Total weir count (jacks) E	Spawners below weir (foot) F	Total return[a] [B+C+D+F]	Total large natural spawning [D+F+B] or [A+B] (if no weir)
1956	4,500	(A)[b]	–	–	–	–	–	–	4,500
1957	3,000	(F/A)	–	–	–	–	–	–	3,000
1958	2,500	(F/A)	–	–	–	–	–	–	2,500
1959	150	(F/A)	–	–	–	–	–	–	150
1960	287	(F)	–	–	–	–	–	–	287
1961	103	(F)	–	–	–	–	–	–	103
1962	300	(A)	–	–	–	–	–	–	300
1963	500	(A/H)	–	–	–	–	–	–	500
1964	400	(H)	–	–	–	–	–	–	400
1965	100	(A)	–	–	–	–	–	–	100
1966	75	(A)	–	–	–	–	–	–	75
1967	30	(A)	–	–	–	–	–	–	30
1968	15	–	–	–	–	–	–	–	15
1969	12	(A)	–	–	–	–	–	–	12
1970	–	–	–	–	–	–	–	–	0
1971	305	(A)	–	–	–	–	–	–	305
1972	–	–	–	–	–	–	–	–	0
1973	40	(A)	–	–	–	–	–	–	40
1974	129	(A)	–	–	–	–	–	–	129
1975	260	(F)	–	–	–	–	–	–	260
1976	–	–	–	64	351	50	53	468	404
1977	–	–	–	78	396	36	60	534	456
1978	–	–	–	12	343	75	45	400	388
1979	221	(F)	–	55	289	89	38	382	327
1980	–	–	1	81	240	272	41	363	282
1981	275	N(F)	25	118	440	119	71	654	536
1982	295	N(A)	37	275	524	124	111	947	672
1983	–	–	–	78	316	38	50	444	366
1984	120	N(A)	34	0	315	200	40	389	389
1985	320	E(F)							320
1986	708	N(F)	–	–	–	–	–	–	708
1987	651	E(H)	137	–	–	–	–	–	788
1988	470	N(F)	94	–	–	–	–	–	564
1989	530	E(F)		–	–	–	–	–	530
1990	664	E(F)	–	–	–	–	–	–	664
1991	400	N(A)	–	–	–	–	–	–	400
1992	778	E(H)	–	–	–	–	–	–	778
1993	1,060	E(F)	–	–	–	–	–	–	1,060
1994	572	E(H)	–	–	–	–	–	–	572

[a] Total return equals sum of egg take , weir count, below weir, and north fork.

[b] (A) = survey conducted by fixed -wing aircraft; (F) = survey conducted by walking; (H) = survey conducted by helicopter; (F/A) = combined foot and aerial count; N = normal survey conditions; E = excellent survey conditions; – = no survey conducted or data not comparable.

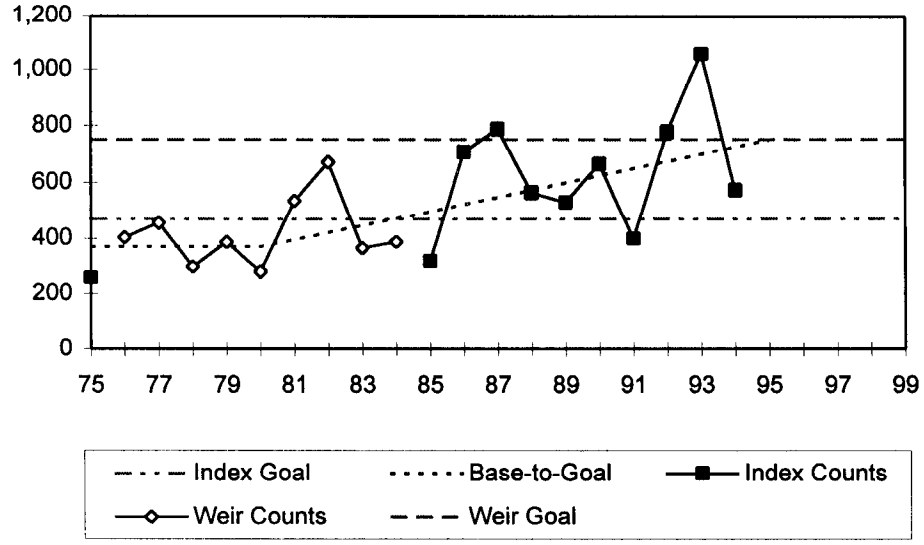

Figure 5.–Counts of chinook salmon at the Andrew Creek weir and in aerial surveys, 1975–1994.

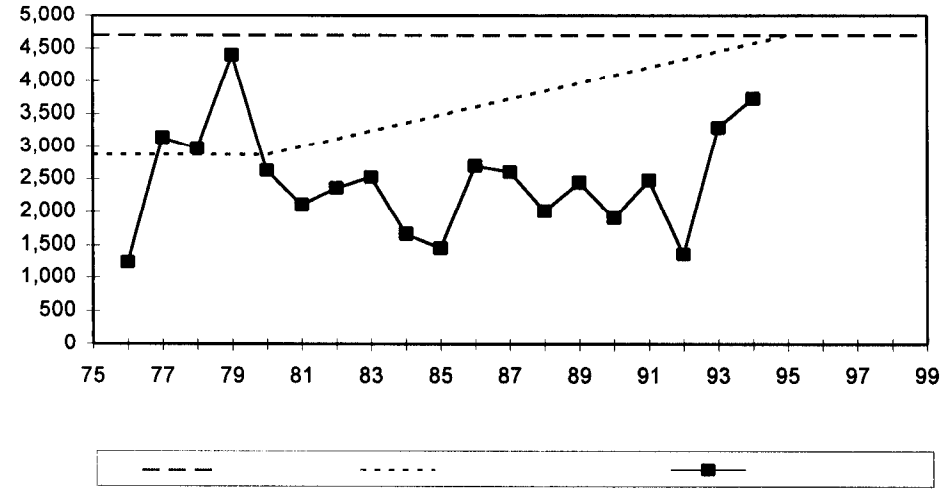

Figure 6.–Escapement of chinook salmon to the Klukshu River tributary of the Alsek River, 1975–1994. Base-to-goal line indicates linear rebuilding trend, starting in 1981 at average escapement level during base period (1975–1980) and ending at the escapement goal of 4,700 large chinook salmon in 1995 (final year of three-cycle rebuilding program).

Table 7.–Escapement of chinook salmon to the Klukshu River and counts of spawning adults in other tributaries of the Alsek River, 1962–1994.

	Klukshu River								
			Canadian inriver harvest						
Year[a]	Aerial count	Weir count	IFF	Sport	Escapement[b]	Blanchard River	Takhanne River	Goat Creek	Total[c]
1962	86	–	–	–	86	–[d]	–	–	86
1963	–	–	–	–	–	–	–	–	0
1964	20	–	–	–	20	–	–	–	20
1965	100	–	–	–	100	100	250	–	450
1966	1,000	–	–	–	1,000	100	200	–	1,300
1967	1,500	–	–	–	1,500	200	275	–	1,975
1968	1,700	–	–	–	1,700	425	225	–	2,350
1969	700	–	–	–	700	250	250	–	1,200
1970	500	–	–	–	500	100	100	–	700
1971	300	–	–	–	300	–	–	–	300
1972	1,100	–	–	–	1,100	12 (A)	250	–	1,362
1973	–	–	–	–	–	–	49 (A)	–	49
1974	62	–	–	–	62	52 (A)	132	–	246
1975	58	–	–	–	58	81 (A)	177 (A)	–	316
1976	–	1,278	125	200	1,153	–	–	–	1,153
1977	–	3,144	250	300	2,894	–	–	–	2,894
1978	–	2,976	300	300	2,676	–	–	–	2,676
1979	–	4,404	130	650	4,274	–	–	–	4,274
1980	–	2,673	150	200	2,487	–	–	–	2,487
1981	–	2,113	150	315	1,963	35 (H)	11 (H)	–	2,009
1982	633	2,369	400	224	1,969	59 (H)	241 (H)	13 (H)	2,282
1983	917	2,537	300	312	2,237	108 (H)	185 (H)	–	2,530
1984	–	1,672	100	475	1,572	304 (H)	158 (H)	28 (H)	2,062
1985	–	1,458	175	250	1,283	232 (H)	184 (H)	–	1,699
1986	738	2,709	102	165	2,607	556 (H)	358 (H)	142 (H)	3,663
1987	933	2,616	125	367	2,491	624 (H)	395 (H)	85 (H)	3,595
1988	–	2,037	43	249	1,994	437 E(H)	169 E(H)	54 E(H)	2,654
1989	893	2,456	167	272	2,289	–	158 E(H)	34 E(H)	2,481
1990	1,381	1,915	173	555	1,742	–	325 E(H)	32 E(H)	2,099
1991	–	2,489	336	388	2,153	121 N(H)	86 E(H)	63 E(H)	2,423
1992	261	1,367	84	102	1,283	86 P(H)	77 N(H)	16 N(H)	1,462
1993	1,058	3,302	152	171	3,125[e]	326 N(H)	351 E(H)	50 N(H)	3,852
82-93 average	711	2,418	181	305	1,577	210	200	52	1,770
1994	1,558	3,735	99	197	3,628[f]	349 N(H)	342 E(H)	67 N(H)	4,386

[a] Escapement counts prior to 1975 may not be comparable due to differences in survey dates and counting methods.

[b] Klukshu River escapement = weir count minus Indian Food Fishery (IFF) and broodstock.

[c] Total escapement = Klukshu escapement plus aerial counts of other systems.

[d] (A) = aerial survey from fixed wing aircraft; (H) = helicopter survey; E = excellent survey conditions; N = normal conditions; P = poor conditions; (–) = no survey.

[e] Reduced by 25 fish killed for brood stock.

[f] Reduced by 8 fish killed for brood stock.

removal from the weir count, was 3,628, an increase of 503 fish from 1993. Most of the sport harvest is below the weir. The 1994 peak aerial counts of 342 large chinook salmon in the Takhanne River and 349 in the Blanchard River were similar to the 1993 counts of 351 and 326 fish. The aerial count of large chinook salmon escapement to Goat Creek in 1994 was 67 fish, up from 50 fish in 1993.

The estimated escapement for the entire Alsek River drainage, obtained by expanding the count from the Klukshu River weir by 1/0.64 (tributary expansion factor) and subtracting sport (197) and IFF harvest (99) and removal for broodstock (8), was 5,532 large chinook salmon. This was an increase of 15% over the estimated 1993 escapement of 4,811 and above the pre-1991 escapement goal of 5,000 large chinook salmon. Escapements of chinook salmon to the Alsek River have exceeded the escapement goal only in 1979, and average escapements during the first two cycles of the rebuilding program (1981–1985 and 1986–1990) have actually declined relative to the 1975–1980 base period (Figure 6). In 1991, the TBTC revised the Alsek River chinook escapement goal to 4,700 large fish through the Klukshu River weir (PSC 1991b). There has no agreement on use of new expansion factors therefore the total escapement was estimated using the above methods.

Unuk River

In 1994, 711 large chinook salmon were counted in index areas of the Unuk River (Table 8) a count that was below average in 4 out of 6 index areas (Table 9). The total count was 19% below the survey goal (revised in 1994) of 875 fish. Boundary Creek was also surveyed in 1994. A recent change in the river has revealed more spawning area in that tributary than previously observed. However, these data were not included in summed counts for the watershed nor in the expanded count. Expansion of the summed counts for 1994 by a survey expansion factor of 1/0.625 produced an estimated escapement of 1,138 large chinook salmon to the Unuk River, a 33% decrease from 1,709 fish in 1993. Additionally, the 1994 estimated was 57% below the average escapements observed during the first rebuilding cycle (1981-1985) but 77% above the 1975–1980 average of 1,469 chinook salmon. Escapements of chinook salmon to the Unuk River have been below the escapement goal four of the last five years (Figure 7).

Table 8.–Peak escapement counts of chinook salmon to index areas of the Unuk River, 1960–1994.

Year[a]	Cripple Creek		Lake Creek		Genes Eulachon Creek		Clear Creek		Lake Creek		Kerr Creek		Total	
1960	–	[b]			250	(A)	–		–		–		250	
1961	3	(F)	200	(F)	270	(F)	65	(F)	–		53	(F)	591	
1962	–		150	(A)	145	(A)	100	(A)	30	(A)			425	
1963	100	(A)	750	(A)	150	(A)	25	(A)					1,025	
1964	–				25	(A)	–						25	
1965	–				–		–						0	
1966	–				–		–						0	
1967	–				60	(H)	–						60	
1968	–				75	(H)	–						75	
1969	–				150	(H)	–						150	
1970	–				–		–						0	
1971	–				30	(A)	–						30	
1972	95	(A)	35	(A)	450	(A)	90	(A)	55	(A)			725	
1973	–				64	(H)	–						64	
1974	–				68	(H)	–						68	
1975	–				17	(H)	–						17	
1976	–	[f]			3	(A)	–						3	
1977	529	[f] (F)	339	(F)	57	(H)	34	(H)			15	(H)	974	
1978	394	[f] (F)	374	(F)	218	(H)	85	(H)	20	(H)	15	(H)	1,106	
1979	363	(F)	101	(F)	48	(H)	14	(H)	30	(H)	20	(H)	576	
1980	748	(F)	122	(F)	95	(H)	28	(H)	5	(H)	18	(H)	1,016	
1981	324	(F)	112	(F)	196	(H)	54	(H)	20	(H)	25	(H)	731	
1982	538	(F)	329	(F)	384	(H)	24	(H)	48	(H)	28	(H)	1,351	
1983	459	(F)	338	(F)	288	(H)	24	(H)	12	(H)	4	(H)	1,125	
1984	644	(F)	647	(F)	350	(H)	113	(H)	32	(H)	51	(H)	1,837	
1985	284	(F)	553	(F)	275	(H)	37	(H)	22	(H)	13	(H)	1,184	
1986	532	(F)	838	(F)	486	(H)	183	(F)	25	(H)	62	(H)	2,126	
1987	860	(F)	398	(F)	520	(H)	107	(H)	37	(H)	51	(H)	1,973	
1988	1,068	(F)	154	(F)	146	(F)	292	(H)	60	(H)	26	(H)	1,746	
1989	351	(F)	302	(F)	298	(H)	128	(H)	27	(F)	43	(H)	1,149	
1990	86	(F)	284	(F)	81	(H)	103	(F)	26	(F)	11	(H)	591	
1991	358	(W/F)	123	(F)	43	(H)	96	(F)	23	(F)	12	(H)	655	[c]
1992	327	(W/F)	360	(F)	57	(F)	69	(F)	31	(H)	30	(H)	874	[d]
1993	448	(W/F)	330	N(F)	132	E(F)	137	N(F)	8	N(F)	13	P(H)	1,068	[e]
82-93 Average	496		388	N(F)	255		109		29		29		1,307	
1994	161	P(F)	300	N(F)	52	N(H)	128	E(F)	18	N(F)	52	N(F)	711	[g]

[a] Counts prior to 1975 may not be comparable due to differences in survey dates and counting methods.

[b] (F) = escapement survey conducted by walking river; (A) = escapement survey conducted from fixed-wing aircraft; (H) = escapement survey conducted from helicopter; – = no survey conducted or data not comparable. N = normal; E = excellent; P = poor.

[c] Total does not include 108 from Boundary Creek; Cripple Creek weir count reduced by /0.625 to be comparable with foot surveys.

[d] Total does not include 123 from Boundary Creek; Cripple Creek weir count reduced by /0.625 to be comparable with foot surveys.

[e] Total does not include 143 from Boundary Creek.

[f] Not including 35 fish for egg take in 1976, 132 in 1977, and 85 in 1978.

[g] Total does not include 42 fish from Boundary Creek.

Table 9.–Distribution of spawning chinook salmon among index areas of the Unuk River for years when all index areas were surveyed.

Year	Cripple Creek	%	Genes Lake Creek	%	Eula-chon Creek	%	Clear Creek	%	Lake Creek	%	Kerr Creek	%	Total
1978	394	36	374	34	218	20	85	8	20	2	15	1	1,106
1979	363	63	101	18	48	8	14	2	30	5	20	3	576
1980	748	74	122	12	95	9	28	3	5	0	18	2	1,016
1981	324	44	112	15	196	27	54	7	20	3	25	3	731
1982	538	40	329	24	384	28	24	2	48	4	28	2	1,351
1983	459	41	338	30	288	26	24	2	12	1	4	0	1,125
1984	644	35	647	35	350	19	113	6	32	2	51	3	1,837
1985	284	24	553	47	275	23	37	3	22	2	13	1	1,184
1986	532	25	838	39	486	23	183	9	25	1	62	3	2,126
1987	860	44	398	20	520	26	107	5	37	2	51	3	1,973
1988	1,068	61	154	9	146	8	292	17	60	3	26	1	1,746
1989	351	31	302	26	298	26	128	11	27	2	43	4	1,149
1990	86	15	284	48	81	14	103	17	26	4	11	2	591
1991	358	55	123	19	43	7	96	15	23	4	12	2	655
1992	327	37	360	41	57	7	69	8	31	4	30	3	874
1993	448	42	330	31	132	12	137	13	8	0	13	1	1,068
Ave.	487	41	335	28	226	19	93	8	27	2	26	2	1,194
1994	161	23	300	42	52	7	128	18	18	3	52	7	711

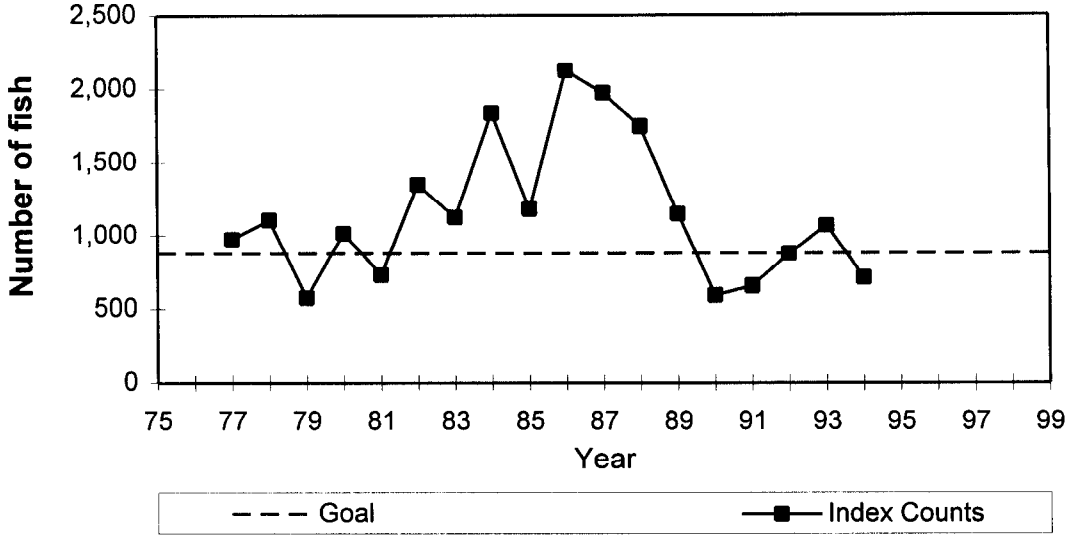

Figure 7.–Counts of large chinook salmon in index areas of the Unuk River, 1975–1994.

Chickamin River

In 1994, 388 large chinook salmon were counted in index areas on eight tributaries of the Chickamin River, compared to 389 counted in 1993 (Table 10). Counts in 1994 were below average in all but two Chickamin River tributaries (Table 11). The 1994 count was 26% below the survey escapement goal (revised in 1994 to 525 fish)

The summed counts for 1994 were expanded by a survey expansion factor of 1/0.625 to produce a total escapement estimate of 621 fish to the watershed, a value that is 26% below the watershed escapement goal of 840 fish. The 1994 total escapement was similar to 1993 but lower than the 1981–1985 and 1986–1990 average escapements and 84% higher than the 1975–1980 average of 338 fish (Figure 8). The 1994 escapement level has fallen below both the

Table 10.–Counts of chinook salmon in index areas of the Chickamin River, 1960–1994.

Year[a]	South Fork Creek	Barrier Creek	Butler Creek	Leduc Creek	Indian Creek	Humpy Creek	King Creek	Clear Falls Creek	Total[c]
1960	– [b]	–	–	–	–	3 (A)	–	–	3
1961	–	36 (A)	77 (A)	42 (A)	5 (A)	120 (A)	48 (A)	–	328
1962	400 (A)	35 (A)	–	–	–	150 (A)	–	–	585
1963	350 (A)	115 (A)	–	–	–	3 (A)	200 (A)	–	668
1964		–	–	–	–	–	–	–	–
1965		–	–	–	–	–	75 (A)	–	75
1966		–	–	–	–	50 (F)	–	–	50
1967		–	–	–	–	-	45 (H)	–	45
1968		–	–	–	–	30 (H)	20 (H)	–	50
1969		–	–	–	–	10 (H)	45 (H)	–	55
1970		–	–	–	–	–	–	–	–
1971		–	–	–	–	–	–	–	–
1972	350 (A)	25 (A)	–	85 (A)	–	65 (A)	510 (A)	–	1,035
1973	–	–	–	–	–	14 (A)	65 (A)	–	79
1974	144 (H)	–	–	–	–	–	11 (H)	–	155
1975	141 (H)	9 (H)	66 (H)	6 (H)	90 (H)	7 (H)	30 (H)	–	349
1976	46 (H)	10 (H)	15 (H)	12 (H)	9 (H)	–	–	–	92
1977	52 (H)	66 (H)	30 (H)	26 (H)	53 (H)	0 (H)	–	–	227
1978	21 (H)	94 (H)	4 (H)	42 (H)	20 (H)	–	–	–	181
1979	63 (H)	17 (H)	29 (H)	0 (H)	31 (H)	–	–	–	140
1980	56 (H)	62 (H)	104 (H)	17 (H)	22 (H)	–	–	–	261
1981	51 (H)	105 (H)	51 (H)	25 (H)	12 (H)	4 (F)	105 (F)	31 (H)	384
1982	84 (H)	149 (H)	37 (H)	36 (H)	30 (F)	37 (F)	165 (F)	33 (H)	571
1983	28 (H)	138 (H)	91 (H)	30 (H)	47 (H)	–	212 (F)	30 (H)	576
1984	185 (H)	171 (H)	124 (H)	15 (H)	103 (H)	88 (F)	388 (F)	28 (H)	1,102
1985	163 (H)	129 (H)	92 (H)	8 (H)	125 (H)	50 (H)	377 (H)	12 (H)	956
1986	562 (H)	168 (H)	203 (H)	20 (H)	120 (H)	–	564 (H)	40 (H)	1,677
1987	261 (H)	76 (H)	120 (H)	19 (H)	115 (H)	26 (H)	310 (H)	48 (H)	975
1988	280 (H/F)	82 (H/F)	159 (H)	25 (H/F)	32 (H)	19 (H/F)	164 (H)	25 (H/F)	786
1989	226 (H/F)	90 (H)	137 (H)	57 (H)	84 (H)	22 (H/F)	224 (H)	94 (H)	934
1990	135 (F)	107 (H)	27 (H)	20 (H)	24 (H)	35 (H)	163 (H)	53 (H)	564
1991	125 (H)	18 (H)	49 (H)	14 (H)	38 (H)	13 (H)	185 (H)	45 (H)	487
1992	87 (H)	4 (H)	68 (H)	4 (H)	20 (H)	8 (H)	131 (H)	24 (H)	346
1993	67 N(H)	46 E(H)	68 N(H)	11 N(H)	29 N(H)	13 N(H)	80 N(H)	75 N(H)	389
1994	31 N(H)	29 E(H)	64 E(H)	18 E(H)	16 N(H)	44 N(H)	129 E(H)	57 E(H)	388

[a] Escapement counts conducted prior to 1975 may not be comparable due to differences in survey dates and counting methods.

[b] (F) = escapement surveyed by walking stream. (H) = escapement surveyed by helicopter. (A) = escapement surveyed by fixed-wing aircraft. (H/F) = escapement surveyed by combination of walking and helicopter. – = no survey conducted or data not comparable.

[c] Totals for 1975-1980, 1983 and 1986 expanded for unsurveyed index areas by 1981-1992 average % observed to those indices.

Table 11.–Distribution of spawning chinook salmon into index areas of the Chickamin River for years when all index areas were surveyed.

Year	South Fork Creek	%	Barrier Creek	%	Butler Creek	%	Leduc Creek	%	Indian Creek	%	Humpy Creek	%	King Creek	%	Clear Falls Creek	%	Total
1981	51	13	105	27	51	13	25	7	12	3	4	1	105	27	31	8	384
1982	84	15	149	26	37	6	36	6	30	5	37	6	165	29	33	6	571
1984	185	17	171	16	124	11	15	1	103	9	88	8	388	35	28	3	1,102
1985	136	14	156	16	93	10	8	0	125	13	50	5	377	39	12	1	957
1987	261	27	76	8	120	12	19	2	115	12	26	3	310	32	48	5	975
1988	280	36	82	10	159	20	25	3	32	4	19	2	164	21	25	3	786
1989	226	24	90	10	137	15	57	6	84	9	22	2	224	24	94	10	934
1990	135	24	107	19	27	5	20	4	24	4	35	6	163	29	53	9	564
1991	125	26	18	4	49	10	14	3	38	8	13	3	185	38	45	9	487
1992	87	25	4	1	68	20	4	1	20	6	8	2	131	38	24	7	346
1993	67	17	46	12	68	17	11	3	29	7	13	3	80	21	75	19	389
Avg.	149	22	91	13	85	12	21	3	56	8	29	4	208	31	43	6	681
1994	31	8	29	7	64	16	18	5	16	4	44	11	129	33	57	15	388

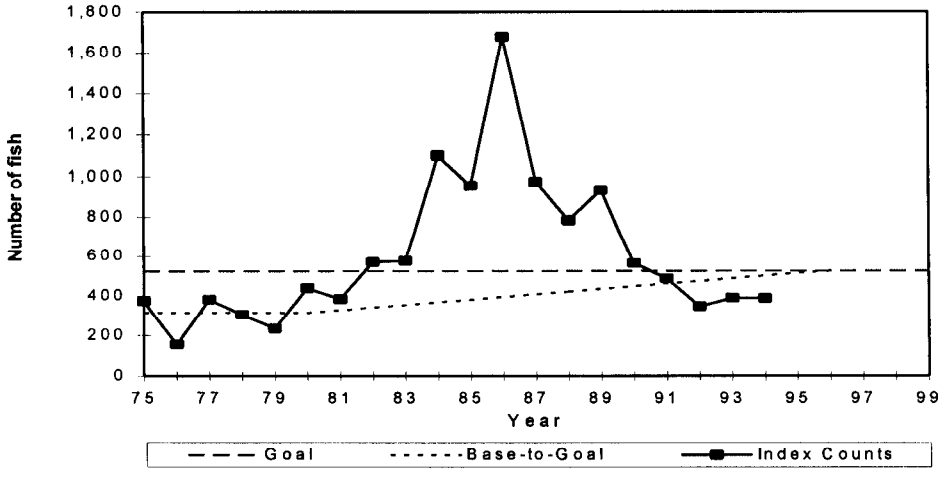

Figure 8.–Counts of chinook salmon in the Chickamin River, 1975–1994. Base-to-goal line indicates linear rebuilding schedule, starting in 1981 at average escapement level during the base period (1975–1980) and ending at escapement goal of 525 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

escapement goal and the rebuilding schedule. Total escapements had been above the linear rebuilding schedule from 1980 to 1991 and has been close near the management escapement goal since 1982 (Figure 8).

Blossom River

One hundred and sixty one (161) large chinook salmon were counted in index areas of the Blossom River in 1994. This was a decrease of about 50% from the 303 fish counted in 1993 (Table 12). The 1994 count was approximately 46% below the revised escapement goal of 300 observed fish. Counts were above the escapement goal of 300 from 1983–1987, but since 1988, they have fallen below the linear rebuilding schedule (Figure 9).

Keta River

In 1994, 306 chinook salmon were counted in the Keta River, down from 362 counted in 1993 (Table 12) but slightly above the 1994 revised goal of 300. Prior to 1990, counts of chinook salmon in the Keta River increased steadily since implementation of the 1980 rebuilding program, and had exceeded every year since 1981 (Figure 10).

Marten and Wilson Rivers

Counts of chinook salmon in the Marten River are not included in the regional index program and no official escapement goals have been set for this system. However, regular counts have been made in the Marten River since 1982 because of its proximity to other surveyed systems In 1994, 178 large chinook salmon were counted during aerial surveys of the Marten River, 28% less than the count of 229 in 1993. In 1988, the U.S. Forest Service modified a barrier on Dicks Creek, a major tributary of the Marten River, with the objective of opening access to new spawning areas. Since then, aerial surveys have documented chinook salmon above the barrier site indicating some success.

The Wilson River was not surveyed in 1994.

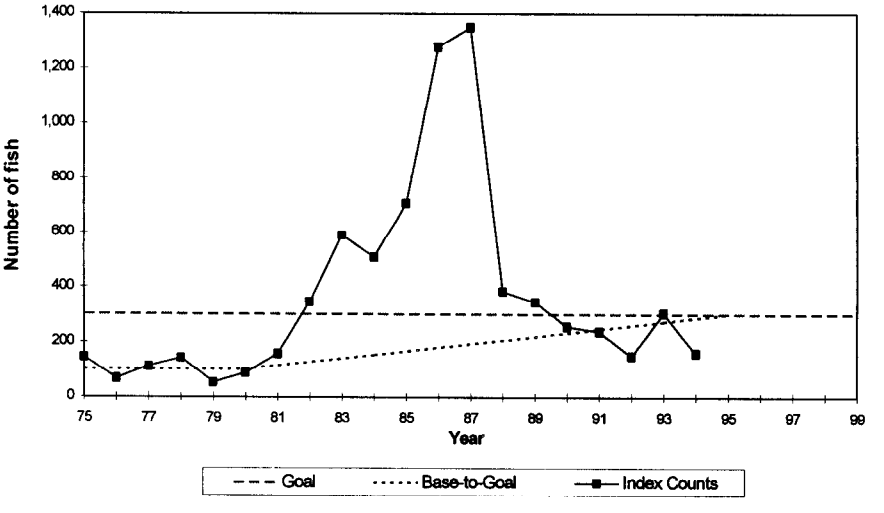

Figure 9.–Counts of chinook salmon into the Blossom River, 1975–1994. Base-to-goal line shows linear rebuilding schedule, starting in 1981 at average escapement level during the base period (1975–1980) and ending at escapement goal of 300 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Table 12.–Counts of chinook salmon for selected rivers in Behm Canal, 1948–1994.

Year	Keta River		Blossom River		Wilson River		Marten River		Grant River		Klahini River		Total
1948	500	(F)	-		-		-		-		-		500
1949	-		-		-		-		-		-		-
1950	210	(F)	-		-		-		-		-		210
1951	120	(F)	-		-		-		-		-		120
1952	462	(F)	-		-		-		-		-		462
1953	156	(F)	-		-		-		-		-		156
1954	300	(A)	-		-		-		-		-		300
1955	1,000	(A)	-		-		-		-		-		1,000
1956	1,500	(A)	-		-		-		-		-		1,500
1957	500	(A)	-		-		-		-		-		500
1958	-		-		-		-		-		-		-
1959	-		-		-		-		-		-		-
1960	-		-		-		-		-		-		-
1961	44	(F)	68	(F)	-		22	(F)	40	(A)	-		174
1962	-		-		-		-		6	(A)	100	(A)	106
1963	-		450	(A)	375	(A)	-		15	(A)	-		840
1964	-		-		-		-		-		-		-
1965	-		-		50	(A)	43	(H)	-		-		93
1966	75	(A)	200	(A)	60	(A)	10	(A)	100	(A)	3	(A)	448
1967	86	(H)	-		8	(H)	7	(H)	15	(H)	-		116
1968	-		-		-		-		4	(H)	-		4
1969	200	(A)	-		10	(A)	10	(A)	69	(H)	3	(H)	292
1970	-		100	(H)	-		-		-		-		100
1971	-				-		-		-		-		-
1972	255	(A)	225	(A)	275	(A)	-		25	(A)	150	(A)	930
1973	-		-		30	(A)	-		38	(A)	7	(H)	75
1974	25	(H)	166	(H)	-		-		-		-		191
1975	203	(H)	146	(H)	7	(H)	15	(H)	-		-		371
1976	84	(H)	68	(H)	-		-		-		-		152
1977	230	(H)	112	(H)	-		-		-		-		342
1978	392	(H)	143	(H)	-		2	(A)	-		-		537
1979	426	(H)	54	(H)	36	(H)	-		-		-		516
1980	192	(H)	89	(H)	-		-		-		-		281
1981	329	(H)	159	(H)	76	(F)	-		25	(H)	42	(F)	631
1982	754	(H)	345	(H)	300	(B)	75	(F)	33	(F)	79	(F)	1,586
1983	822	(H)	589	(H)	178	(B)	138	(B)	8	(A)	10	(H)	1,745
1984	610	(H)	508	(H)	133	(F)	12	(B)	124	(F)	54	(F)	1,441
1985	624	(H)	709	(H)	420	(H)	69	(F)	55	(F)	20	(F)	1,897
1986	690	(H)	1,278	(H)	-		-		-		-		1,968
1987	768	(H)	1,349	(H)	-		270	(H)	33	(A)			2,420
1988	575	(H)	384	(H)	-		543	(H)	-		40	(H)	1,542
1989	1,155	(H)	344	(H)	-		133	(H)	-		-		1,632
1990	606	(H)	257	(H)	-		283	(H)	-		-		1,146
1991	272	(H)	239	(H)	-		135	(H)	-		-		646
1992	217	(H)	150	(H)	109	(H)	76	(H)	25	(H)	19	(H)	596
1993	362	E(H)	303	N(H)	63	P(H)	229	E(H)	-		-		957
1994	306	E(H)	161	N(H)	-		178	E(H)	-		-		645

[a] Escapement counts prior to 1975 may not be comparable due to differences in survey dates or methods.

[b] (F) = escapement surveyed by walking stream; (A) = escapement surveyed from fixed-wing aircraft; (H) = escapement surveyed from helicopter; (B) = escapement surveyed from boat.

– = no survey conducted or data not comparable.

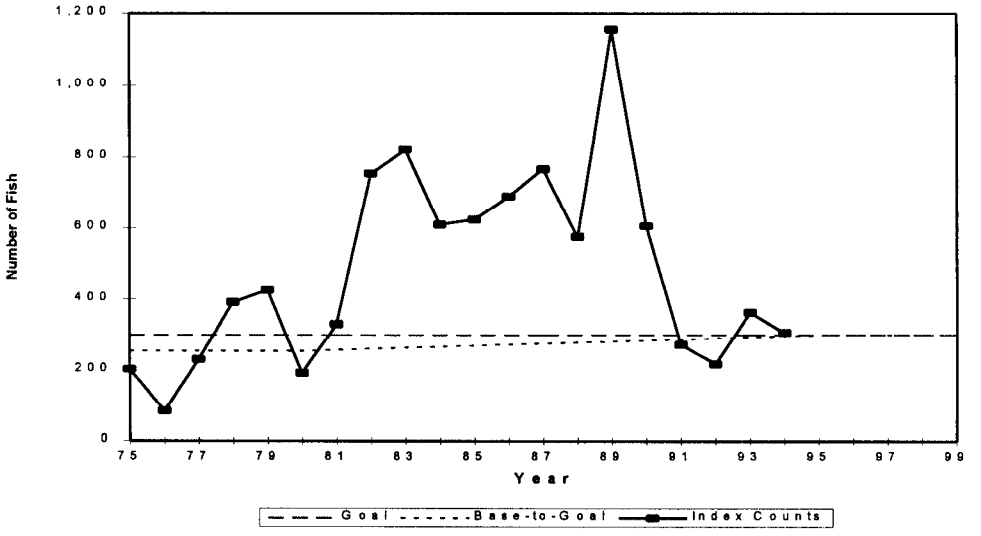

Figure 10.–Escapement counts of chinook salmon to the Keta River, 1975–1994. Base-to goal line shows linear rebuilding schedule, starting in 1981 at average escapement level during the base period (1975–1980) and ending at escapement goal of 300 large chinook salmon in 1995, (final year of the three-cycle rebuilding program).

King Salmon River

Both foot and helicopter surveys were conducted on King Salmon River in 1994. One hundred and thirty four large chinook salmon were counted during the aerial survey and 140 were counted during a foot survey conducted on the same day (Table 13). Since 1983, counts have been slightly below the goal of 140 fish, and have been below the linear rebuilding schedule three out of five years since 1990 (Figure 11).

Situk River

Escapement of chinook salmon to the Situk River in 1994 was 1,241 fish, a 57% increase over the escapement of 790 fish in 1993 (Table 14). Based on spawner-recruit analysis, ADF&G in 1991 revised the management escapement goal from 2,000 chinook salmon in the Situk River to 600 large fish, with a range of 450 to 900 (ADF&G 1991). This revised goal has been adopted by the PSC and the Alaska Board of Fisheries as part of a management plan for the Situk River. Escapements have exceeded the revised escapement goal since 1984 (Figure 12). The 1994 commercial harvest of 2,656 (Table 13) is the highest recorded.

Chilkat River

The 1994 escapement to the Chilkat River was estimated by mark-recapture experiment to be 6,319 large chinook salmon (Ericksen *In prep*). Since Johnson et al. (1992) demonstrated that expansion factors used on the Chilkat River system were inaccurate, the management escapement goal of 2,000 large fish is now obsolete. A new index method and management escapement goal will be developed when a sufficient number of abundance estimates have been conducted.

DISCUSSION

The utility of the index method as a measure of escapement is based on the assumption that the number of fish counted in an index area is a constant proportion of the escapement in the index area or watershed. Therefore, a change in the escapement causes a proportional change in the index count.

Table 13.–Peak escapement counts and weir counts of spawning chinook salmon in the King Salmon River, 1957–1994.

	Survey count			Survey as	Total				Adults	Total	Total
	Below	Above		% of weir	Snettisham	Total weir count			below weir	return	natural
	weir	weir[a]		count	egg take	(adults)	(jacks)[b]		(foot ct)	(adults)	spawning
Year	A	B		B/(D-C)	C	D	E		F	D+F	D+F-C
1957	–	200	(F)	–	–	–	–		–		200
1960	–	20	(F)	–	–	–	–		–		20
1961	–	117	(F)	–	–	–	–		–		117
1971	–	94	(F)	–	–	–	–		–		94
1972	–	90	(F)	–	–	–	–		–		90
1973	–	211	(F)	–	–	–	–		–		211
1974	–	104	(F)	–	–	–	–		–		104
1975	–	42	(H)	–	–	–	–		–		42
1976	–	65	(H)	–	–	–	–		–		65
1977	–	134	(H)	–	–	–	–		–		134
1978	–	57	(H)	–	–	–	–		–		57
1979	–	88	(H)	–	17	–	–		–		71
1980	–	70	(H)	–	–	–	–		–		70
1981	–	101	(H)	–	11	–	–		–	101	90
1982	–	259	(H)	–	30	–	–		–	259	229
1983	25	183	(H)	0.85	37	252	20		30	282	245
1984	14	184	(H)	0.77	61	299	82		12	311	250
1985	12	105	(H)	0.65	33	194	45		10	204	171
1986	9	190	(H)	0.83	36	264	72		17	281	245
1987	19	128	(H)	0.74	34	207	62		20	227	193
1988	5	94	(H)	0.50 [d]	37	231	54		12	243	206
1989	34	133	(H)	0.64	40 [e]	249	71		29	278	238
1990	34	98	(H)	0.61	30	190	32		8	198	168
1991	6	91	(H)	0.72	20	146	89		8	154	134
1992	–	58	(H)	0.59 [f]	18	47	16		70	117	99
1993	–	175	E(H)	----------no weir or egg take----------						147	175
84-93 Avg.	17	126		0.67	34	203	54		21	201	188
1994	–	140	N(F)	----------no weir or egg take----------							140

[a] (F) = escapement surveyed by walking stream; (H) = escapement surveyed from helicopter; – = no survey conducted or data not comparable.

[b] Minimum count as jacks could pass through weir.

[c] Natural spawning (adults) = (weir count - egg take & mortality) + spawners below weir (83-89).

[d] Four females and two males were held but not spawned for egg take; % = 94/(231-37-6) = 50%.

[e] Includes holding mortality of 4 males and 6 females for egg take.

[f] Peak survey was after weir was removed 58/99 = 0.59.

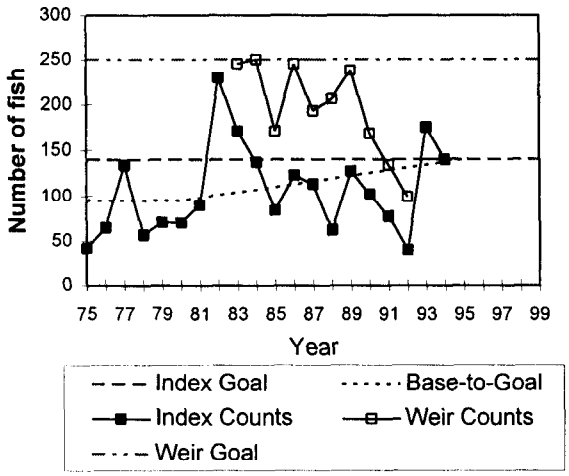

Figure 11.–Escapement counts and weir counts of chinook salmon to the King Salmon River, 1975–1994. Base-to-goal line shows linear rebuilding schedule, starting in 1981 at average escapement level during base period (1975–1980) and ending at index escapement goal of 140 large chinook salmon in 1995 (final year of the three-cycle rebuilding program).

Implicit in this method are sources of error that fall into two categories:

- Factors that are constant sources of error:

  (1) interference with the ability to count fish, conditions such as heavily shaded areas or topography that prevents close approach with a helicopter, presence of other species that could be confused with chinook salmon, overhanging brush, or deep or normally occluded water (accounted for by a survey expansion factor); and (2) inaccurate estimates of distribution among tributaries (faulty tributary expansion factors).

- Factors that are not constants:

  (1) changes in migratory timing will produce a reduced count; (2) a very large number of spawners may cause reduced counts relative to the number of fish in the index area; (3) changes in the distribution of spawners among tributaries of a watershed among years; and (4) inclement weather, turbidity events, or changes in pilot and/or observer experience.

Consequently, multi-year trends in escapement are correct, even though estimates of escapement may be incorrect.

To judge rebuilding progress, the Pacific Salmon Commission focuses on whether trends in counts are above or below a linear rebuilding schedule (Figures 2-11). This method will correctly reflect the rate of rebuilding, providing the ratio of the count to escapement and the effect of 'constant factors' do not change among years and that 'non-constant factors' are infrequent events.

Expanded counts are needed when comparing indices among watersheds or for estimating exploitation rates and spawner/recruit relationships. Though survey and tributary expansion factors have been endorsed by the Pacific Salmon Commission (PSC) since 1981, expansion factors were developed on the basis of judgment rather than on empirical data, and error associated with these expansions could be large. Johnson et al. (1992) showed that expansion factors for the Chilkat River greatly underestimated the escapement to that watershed.

Recognizing the need to develop better expansions in other watersheds, ADF&G has estimated distribution and escapement for chinook salmon in the Unuk River (Pahlke 1995 *In prep*) and begun projects on the Taku, Stikine, and Chickamin rivers. These data will be used to estimate more accurate expansion factors for those stocks.

Changing expansion factors, however, would require a formal review by ADF&G, the Canadian Department of Fisheries and Oceans and the CTC and Transboundary Technical Committees of the PSC. All current expansions and goals are scheduled for review following the 1995 field season. Any change in survey methods must take into account the comparability of historical data with new data. Year to year consistency and repeatability of index counts may be more important than their absolute accuracy to agencies that compare escapement estimates between years.

Table 14.–Harvest, escapement, and minimum total run of Situk River chinook salmon, 1984–1994.

Year	Commercial chinook harvests: Yakutat Bay	Commercial chinook harvests: Situk River Commercial	Commercial chinook harvests: Situk River Subsistence	Recreational[a]: Large chinook	Recreational[a]: Small chinook	Escapement: Large chinook	Escapement: Small chinook	Total escapement	Total run size[b]: Large only	Total run size[b]: All chinook
1984	145	512	50	146	5	1,726	475	2,201	2,434	2,914
1985	240	484	81	294	217	1,521	461	1,982	2,380	3,058
1986	211	202	87	0	37	2,067	505	2,572	2,356	2,898
1987	329	891	22	76	319	1,884	494	2,378	2,873	3,686
1988	196	299	81	185	3	885	193	1,078	1,450	1,646
1989	297	1	29	0	0	652	1,217	1,869	682	1,899
1990	304	0 [c]	80	0	0	676	687 [d]	1,363	756	1,443
1991	392	786	110	88	8	878	706 [e]	1,584	1,862	2,576
1992	147	1,504	150	172	9	1,580	351 [f]	1,931	3,406	3,766
1993	148	790	217	137	115	899	3,099 [g]	3,998	2,043	5,257
84–93 Avg.	241	547	91	110	71	1,277	819	2,096	2,024	2,914
1994	258	2,656	339	208	167	1,270	2,922 [h]	4,192	4,473	7,562

[a] Some harvest (≈30%) occurs above weir and was subtracted from escapements.

[b] Total run = chinook escapement + Situk commercial, sport, and subsistence harvests. An unknown portion of the Yakutat Bay catch is Situk fish.

[c] Non-retention regulation in effect for commercial fisheries in 1989 and 1990; estimated harvest of 223 large chinook in 1990.

[d] Small chinook included 532 medium fish (>450mm <660mm MEF) in 1990.

[e] Small chinook included 125 medium fish in 1991.

[f] Small chinook included 224 medium fish in 1992.

[g] Small chinook included 461 medium fish in 1993.

[h] Small chinook included 1,424 medium fish in 1994.

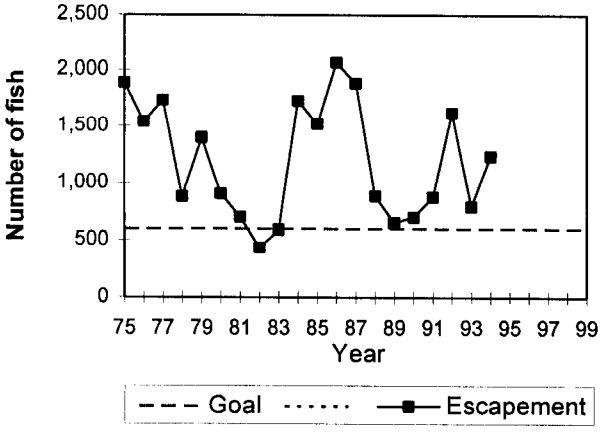

Figure 12.–Escapement of chinook salmon to the Situk River, 1975–1994.

Currently, only one of the 22 minor producers in the region and six of 9 medium producing watersheds are included in the index survey program. Expansion of counts from these streams to represent the escapement of all streams in minor and medium producing categories most likely produces inaccurate estimates of total escapement. In 1994, surveys were flown on the Harding and Bradfield rivers and Aaron Creek to determine the feasibility of adding these medium and small systems to the program. The remaining systems are too remote and funds are not currently available for these surveys.

The failure of Alsek River stock to respond to the rebuilding program is perplexing, particularly since harvests of this stock in terminal net and

recreational fisheries has been greatly reduced in recent years. Possible factors include:

1. The management escapement goal for the Alsek River is higher than it should be to achieve optimum sustained production.
2. Alsek River chinook salmon may be harvested to a greater extent in mixed stock domestic or high seas fisheries than previously believed.
3. Increased siltation and changes in channel morphology in Dry Bay may inhibit rebuilding (Gmelch 1982).
4. A combination of the above (Mecum and Kissner 1989). Coded-wire tagging studies on the Alsek (Mecum 1989) and Situk rivers have not documented any mixed stock harvest of these stocks.

Chinook salmon escapements to the Unuk, Chickamin, Blossom, and Keta rivers have declined substantially since 1987. Before 1987, the four stocks had been rebuilding and were above the linear rebuilding schedules for each river. The cause of the recent decline in these stocks may be a result of poor marine survival and density-dependent mortality (McPherson and Carlile *In prep*). These four rivers make up the major wild stocks of chinook salmon in southern Southeast Alaska. Several large Ketchikan area hatcheries use brood stock from the Unuk and Chickamin Rivers. These hatcheries provide significant returns of adult salmon which rear and migrate in similar areas to wild donor stocks (Mecum and Kissner 1989). Recent analysis of spawner-recruit relationships indicated that the escapement goals to these systems were too high, and the goals were revised in 1994 (McPherson and Carlile *In prep*).

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LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1981. Proposed management plan for Southeast Alaska chinook salmon runs in 1981. Southeast Region, Alaska Department of Fish and Game. January, 1981. Unpublished Report, RUR 1J81-3.

ADF&G (Alaska Department of Fish and Game). 1991. Regulations of the Alaska Board of Fisheries for commercial fishing Alaska. 1991-1993 Southeast-Yakutat commercial fishing regulations. Juneau.

Beak Consultants, Limited. 1981. Preliminary analysis of the potential impact of hydro-electric development of the Stikine River system on biological resources of the Stikine River estuary. Report for the British Columbia Hydro and Power Authority. Richmond, British Columbia.

CTC 1994. Pacific Salmon Commission, Joint Chinook Technical Committee 1993 Annual Report, TCCHINOOK(94)-1 Vancouver, British Columbia.

Ericksen, R. 1995. Sport fishing effort, catch, and harvest and inriver abundance of Chilkat River shinook salmon near Haines, Alaska, in 1994. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 94-36.

Gmelch, G. 1982. Resource use of Glacier Bay National Preserve. National Park Service, Alaska Region. Research/Resources Management Report, AR-6.

Johnson, R. J., R. P. Marshall, and S. E. Elliott. 1992. Chilkat River chinook salmon studies, 1991. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 92-49.

Kissner, P. D., Jr. 1974. A study of chinook salmon in Southeast Alaska. Alaska Department of Fish and Game. Annual report 1973-1974, Project F-9-7, 16 (AFS-41).

McPherson, S. and J. Carlile. *In prep.* Spawner-recruit analysis of Behm Canal chinook salmon stocks. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report, Juneau.

McPherson, S. and J. Carlile. 1982. A study of chinook salmon in Southeast Alaska. Alaska Department of Fish and Game. Annual report 1981-1982, Project F-9-14, 24 (AFS-41).

Mecum, R. D. 1989. Alsek River chinook salmon stock assessment. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 1J89-42.

Mecum, R. D. 1990. Escapements of chinook salmon in Southeast Alaska and transboundary rivers in 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-52.

Mecum, R. D., and P. D. Kissner, Jr. 1989. A study of chinook salmon in Southeast Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 117.

PSC (Pacific Salmon Commission). 1991a. Joint Chinook Technical Committee, 1990 Annual Report, TCCHINOOK (91)-3.

PSC (Pacific Salmon Commission). 1991b. Escapement goals for chinook salmon in the Alsek, Taku, and Stikine Rivers. Transboundary River Technical Report, TCTR (91)-4.

Pahlke, K. A. 1991. Escapements of chinook salmon in Southeast Alaska and transboundary rivers in 1990. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 91-36.

Pahlke, K. A. *In press.* Coded-wire tagging studies of chinook salmon on the Unuk and Chickamin rivers, 1983-1993. Alaska Department of Fish and Game, Alaska Fishery Research Bulletin Series.

Pahlke, K. A. *In prep.* Abundance and distribution of chinook salmon in the Unuk River, 1994. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series.

Sands, N. J., K. A. Pahlke, S. McPherson, J. Carlile, and D. Gaudet. *In prep.* The chinook salmon rebuilding program in Southeast Alaska. Alaska Department of Fish and Game, Fishery Research Bulletin.

APPENDIX A

Appendix A1.–Management escapement goals and survey and tributary expansion factors for Southeast Alaska and transboundary rivers. Category escapement goal is equal to the sum of the survey escapement goal times survey and tributary expansion factors times the category expansion factor.

River system	Index tributaries surveyed	Survey escapement goal[a]	Survey expansion factor	Trib. expansion factor	System escapement goal	Category expan. factor	Category escape. goal
		Major production systems (total of 3)					
Alsek	Klukshu	4,700 (W)	1	0.64	7,344		
Taku	4 tributaries	5,155 (H)	0.625	0.52	15,862		
Taku	Nakina/Nahlin	8,055 (H)	0.75	0.52	20,654		
Stikine	Little Tahltan	5,300 (W)	1	0.25	21,200		
Major category subtotal		23,210			65,060	3/3	65,060
		Medium production systems (total of 9)					
Situk	all	600 (W)		1/1	600		
Chilkat	all	2,000 (M)		1/1	2,000		
Andrew Cr.	all	470 (A)	0.625	1/1	752		
Unuk	all	875 (A)	0.625	1/1	1,400		
Chickamin	all	525 (A)	0.625	1/1	840		
Blossom	all	300 (A)	0.625	1/1	480		
Keta	all	300 (A)	0.625	1/1	480		
Medium category subtotal		5,070			6,552	9/7	8,424
		Minor production systems (total of 22)					
King Salmon	all	156 (F/H	0.62	1/	25		
Minor category subtotal		156			250	22/1	5,500
All systems total		28,436			71,861		78,974

[a] Survey escapement goal = number of fish actually counted on survey, or through weir.
(W) = weir count; (A) = aerial survey peak escapement estimate; (M) = mark/recapture estimate.

Appendix A2.–Estimated total escapements of chinook salmon to escapement indicator systems and to Southeast Alaska and transboundary (T) rivers, 1975–1994. Index escapements are expanded for survey counting rates and unsurveyed tributaries, using 1993 expansions and escapement goals.

	MAJOR SYSTEMS				MEDIUM SYSTEMS										MINOR SYSTEMS			Total
Year	Alsek (T)	Taku (T)	Stikine (T)	Major Subtotal	Situk	Chil-kat	Andrew	Unuk (T)	Chicka-min (T)	Blos-som	Keta	Behm Subtotal	Medium Unsurv.	Medium Subtotal	King Salmon	Minor Unsurv.	Minor Subtotal	all systems
1975	4,214	5,854	5,800	15,868	1,510		416	1,469	592	234	325	2,620	2,273	6,819	53	1,113	1,166	23,853
1976	1,672	12,729	3,300	17,701	1,433		404	1,469	251	109	134	1,963	1,900	5,700	81	1,701	1,782	25,183
1977	4,363	15,259	6,600	26,222	1,732		456	1,558	581	179	368	2,686	2,437	7,311	168	3,528	3,696	37,229
1978	4,050	9,168	5,200	18,418	814		388	1,770	493	229	627	3,119	2,161	6,482	71	1,491	1,562	26,462
1979	6,101	11,353	9,328	26,782	1,400		327	922	382	86	682	2,072	1,900	5,699	89	1,869	1,958	34,439
1980	3,770	20,275	17,096	41,141	905		282	1,626	712	142	307	2,787	1,987	5,961	88	1,848	1,936	49,038
Avg.	4,028	12,440	7,887	24,355	1,299		379	1,469	502	163	407	2,541	2,110	6,329	92	1,925	2,017	32,701
1981	2,837	25,856	26,672	55,365	702		536	1,170	614	254	526	2,564	1,901	5,703	113	2,373	2,486	63,554
1982	3,078	12,810	22,640	38,528	434		672	2,162	914	552	1,206	4,834	2,970	8,910	286	6,006	6,292	53,730
1983	3,352	5,621	4,752	13,725	592		366	1,800	958	942	1,315	5,015	2,987	8,960	245	5,145	5,390	28,075
1984	2,038	10,748	10,352	23,138	1,726		389	2,939	1,763	813	976	6,491	4,303	12,909	250	5,250	5,500	41,547
1985	1,853	19,580	12,456	33,889	1,521		510	1,894	1,530	1,134	998	5,556	3,794	11,381	171	3,591	3,762	49,032
Avg.	2,632	14,923	15,374	32,929	995		495	1,993	1,156	739	1,004	4,892	3,191	9,572	213	4,473	4,686	47,187
1986	3,966	20,231	11,564	35,761	2,067		1,131	3,402	2,792	2,045	1,104	9,343	6,271	18,812	245	5,145	5,390	59,963
1987	3,598	15,530	19,132	38,260	1,884		1,261	3,157	1,560	2,158	1,229	8,104	5,625	16,874	193	4,053	4,246	59,380
1988	2,891	23,334	29,168	55,393	885		760	2,794	1,258	614	920	5,586	3,616	10,847	206	4,326	4,532	70,772
1989	3,399	25,481	18,860	47,740	652		848	1,838	1,494	550	1,848	5,730	3,615	10,845	238	4,998	5,236	63,821
1990	2,722	32,622	17,568	52,912	700		1,062	946	902	411	970	3,229	2,496	7,487	168	3,528	3,696	64,095
Avg.	3,315	23,440	19,258	46,013	1,238		1,012	2,427	1,601	1,156	1,214	6,398	4,324	12,973	210	4,410	4,620	63,606
1991	3,165	27,318	18,024	48,507	875	5,897	640	1,048	779	382	435	2,644	2,873	12,929	134	2,814	2,948	64,384
1992	1,950	30,142	26,508	58,600	1,400	5,287	1,245	1,400	554	240	347	2,541	2,992	13,465	117	2,457	2,574	74,639
1993	4,811	36,208	45,796	86,815	790	4,472	1,696	1,709	622	485	579	3,395	2,958	13,311	280	5,880	6,160	106,286
1994	5,532	26,804	25,774	58,136	1,241	6,319	915	1,138	621	258	490	2,507	3,138	14,118	224	4,704	4,928	77,156
Avg.	3,865	30,118	29,032	63,015	1,077	5,494	1,124	1,324	644	341	463	2,772	2,990	13,456	189	3,964	4,153	80,623
1994 CHANGE FROM 1993																		
Number	721	(9,404)	(19,996)	(28,679)	451	1,847	(781)	(571)	(1)	(227)	(89)	(888)	(180)	809	(56)	(1,176)	(1,232)	(29,102)
Percent	15%	-26%	-44%	-33%	57%	41%	-46%	-33%	-0%	-47%	-15%	-26%	6%	6	-20%	-20%	-20%	-27%
Goals	7,300	36,515	21,200	65,015	600		750	1,400	840	480	480	3,200	1,871	8,421	250	5,250	5,500	78,936
AVERAGE PERCENT OF GOAL																		
1975-80	55%	34%	37%	37%	217%		51%	105%	60%	34%	85%	79%	113%	75%	37%	37%	37%	41%
1981-85	36%	41%	73%	51%	166%		66%	142%	138%	154%	209%	153%	171%	114%	85%	85%	85%	60%
1986-90	45%	64%	91%	71%	206%		135%	173%	191%	241%	253%	200%	231%	154%	84%	84%	84%	81%
1991-95	53%	82%	137%	97%	179%		150%	95%	77%	71%	96%	87%	160%	162%	76%	76%	76%	102

1/ Prior to Little Tahltan weir in 1985, Stikine estimate is 8 times aerial survey.

2/ Using CTC calculations of Alsek Escapement: Escapement = (weir count/0.64)-sport and IFF harvest.

3/ Andrew Creek revised to include North Fork counts, egg takes excluded, weir counts not expanded.

4/ Situk escapement goal revised downward from 2,100 to 600 in 1991.

5/ Chilkat escapements based on mark recapture estimates; goal under revision

6/ Taku counts expanded for missing tributaries when all six not surveyed.

Appendix A3. Detailed 1994 Southeast Alaska chinook salmon escapement surveys as entered into Commercial Fisheries Division Integrated Fisheries Database (IFDB).

DETAILED ESCAPEMENT SURVEYS, 1994

IFDB-SET-01 on 2/24/95 at

Number	Stream name	Date	Type	Dist.	Species	Mouth	Tidal	Live	Dead	Total	Obs.	Visib.	Water	Tide	Remarks
101-30-030	Keta River	8/19/94	H	L	chinook	0	0	306	0	306	KAP	E	L		
101-30-030	Keta River	8/29/94	H	L	chinook	0	0	282	5	287	KAP	E	L		
101-30-060	Marten River	8/29/94	H	L	chinook	0	0	178	0	178	KAP	E	L		COHOS ALREADY IN
101-45-078	Carroll Creek	7/11/94	A	I	chinook	0	0	30	0	30	PD	E	N	I	
101-45-078	Carroll Creek	7/21/94	A	L	chinook	25	0	80	0	105	PD	N	N	I	
101-45-078	Carroll Creek	7/27/94	A	L	chinook	0	150	0	0	150	PD	P	N	I	
101-45-078	Carroll Creek	8/12/94	A	L	chinook	0	0	80	1	81	SBW	E	L	I	
101-45-081	Falls Creek	7/21/94	A	I	chinook	0	20	0	0	20	PD	N	N	I	
101-45-081	Falls Creek	7/27/94	A	L	chinook	0	0	0	0	0	PD	N	N	I	2 jumps - kings
101-45-081	Falls Creek	8/5/94	A	I	chinook	0	0	260	0	260	PD	P	H	I	
101-45-081	Falls Creek	8/17/94	A	I	chinook	0	0	50	0	50	PD	N	N	I	
101-55-040	Blossom River	8/19/94	H	L	chinook	0	0	133	0	133	KAP	N	L		
101-55-040	Blossom River	8/29/94	H	L	chinook	0	0	161	0	161	KAP	N	L		
101-71-004	Chickamin River	8/29/94	H	L	chinook	0	0	388	0	388	KAP	E	L		PEAK TOTAL
101-71-04A	Barrier Creek	8/5/94	H	L	chinook	0	0	2	0	2	KAP	P	H		
101-71-04A	Barrier Creek	8/12/94	H	L	chinook	0	0	17	0	17	KAP	E	L		
101-71-04A	Barrier Creek	8/19/94	H	L	chinook	0	0	29	0	29	KAP	E	L		
101-71-04B	Butler Creek	8/5/94	H	L	chinook	0	0	57	0	57	KAP	N	N		
101-71-04B	Butler Creek	8/11/94	H	L	chinook	0	0	64	0	64	KAP	E	L		
101-71-04C	Clear Creek	8/5/94	H	L	chinook	0	0	41	0	41	KAP	N	N		
101-71-04C	Clear Creek	8/11/94	H	L	chinook	0	0	57	0	57	KAP	E	L		
101-71-04C	Clear Creek	8/19/94	H	L	chinook	0	0	31	0	31	KAP	N	N		
101-71-04H	Humpy Creek	8/18/94	H	L	chinook	0	0	44	0	44	KAP	N	L		
101-71-04I	Indian Creek	8/5/94	H	L	chinook	0	0	1	4	5	KAP	N	H		
101-71-04I	Indian Creek	8/12/94	H	L	chinook	0	0	16	0	16	KAP	N	L		
101-71-04I	Indian Creek	8/19/94	H	L	chinook	0	0	5	0	5	KAP	N	N		LATE?
101-71-04K	King Creek	8/12/94	H	L	chinook	0	0	84	0	84	KAP	E	L		
101-71-04K	King Creek	8/18/94	H	L	chinook	0	0	129	0	129	KAP	E	L		
101-71-04L	Leduc River	8/5/94	H	L	chinook	0	0	1	0	1	KAP	E	L		
101-71-04L	Leduc River	8/12/94	H	L	chinook	0	0	18	0	18	KAP	E	L		
101-71-04L	Leduc River	8/18/94	H	L	chinook	0	0	15	0	15	KAP	N	L		
101-71-04S	South Fork Chickamin	8/5/94	H	L	chinook	0	0	0	0	0	KAP	P	H		TOO MUDDY
101-71-04S	South Fork Chickamin	8/12/94	H	L	chinook	0	0	11	1	12	KAP	N	N		
101-71-04S	South Fork Chickamin	8/19/94	H	L	chinook	0	0	31	0	31	KAP	N	L		
101-75-015	Eulachon River	8/18/94	F	L	chinook	0	0	50	0	50	DM	N	N		9 LEFT FORK
101-75-015	Eulachon River	8/19/94	H	L	chinook	0	0	52	0	52	KAP	N	N		3 LEFT FORK
101-75-030	Unuk River	8/29/94	F	L	chinook	0	0	711	0	711	KAP	E	L		PEAK TOTAL
101-75-03B	Boundary Creek	8/6/94	F	L	chinook	0	0	38	3	41	DLM				
101-75-03B	Boundary Creek	8/8/94	F	L	chinook	0	0	38	4	42	DLM				
101-75-30C	Clear Creek-Unuk River	8/5/94	H	L	chinook	0	0	33	0	33	KAP	N	H		

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Number	Stream name	Date	Type	Dist.	Species	Mouth	Tidal	Live	Dead	Total	Obs.	Visib.	Water	Tide	Remarks
101-75-30C	Clear Creek-Unuk River	8/6/94	F	L	chinook	0	0	93	1	94	DD	N	H		
101-75-30C	Clear Creek-Unuk River	8/8/94	F	L	chinook	0	0	100	4	104	DD	N	N		
101-75-30C	Clear Creek-Unuk River	8/11/94	F	L	chinook	0	0	121	7	128	DD	E	N		
101-75-30G	Genes Lake Creek	8/5/94	F	L	chinook	0	0	77	0	77	DD	P	L		
101-75-30G	Genes Lake Creek	8/11/94	F	L	chinook	0	0	156	5	161	DM	N	N		WEAK RUN
101-75-30G	Genes Lake Creek	8/12/94	F	L	chinook	223	0	56	0	279	KAP	N	N		223 AT MOUTH
101-75-30K	Kerr Creek-Unuk River	8/11/94	F	L	chinook	0	0	25	0	25	DD	N	N		
101-75-30K	Kerr Creek-Unuk River	8/12/94	H	L	chinook	0	0	38	0	38	KAP	N	N		
101-75-30K	Kerr Creek-Unuk River	8/18/94	F	L	chinook	0	0	32	20	52	KAP	N	N		
101-75-30L	Lake Creek-Unuk River	8/5/94	H	L	chinook	0	0	3	0	3	KAP	P	H		3 AT FALLS
101-75-30L	Lake Creek-Unuk River	8/11/94	F	L	chinook	0	0	14	0	14	DD	N	N		8 AT FALLS
101-75-30L	Lake Creek-Unuk River	8/17/94	F	L	chinook	0	0	19	0	19	DD	N	L		10 AT FALLS
101-75-30Q	Cripple Ck-Unuk River	8/2/94	F	L	chinook	0	0	63	0	63	DM	P	N		
101-80-070	Hatchery Ck-Yes Bay	8/22/94	F	L	chinook	0	0	3	0	3	TPZ	E	L		
101-80-070	Hatchery Ck-Yes Bay	8/31/94	F	L	chinook	0	0	12	4	16	MHH	E	L		
101-80-070	Hatchery Ck-Yes Bay	9/9/94	F	L	chinook	0	0	0	6	6	MHH	E	L		
106-22-015	Burnett Hatchery	7/15/94	A	M	chinook	200	0	0	0	200	WB	P	N	I	MIXED W/ CHUMS
106-44-031	Crystal Creek	6/20/94	A	L	chinook	0	50	250	0	300	BLL	N	N	I	250 ABV RAPIDS
106-44-031	Crystal Creek	6/27/94	A	L	chinook	0	50	200	0	250	BLL	N	N	L	200 ABV RAPIDS
106-44-031	Crystal Creek	7/2/94	A	L	chinook	0	70	70	0	140	BLL	N	L	I	70 ABV RAPIDS; NO KING G.N. OPENINGS
106-44-031	Crystal Creek	7/3/94	A	I	chinook	0	500	0	0	500	WB	N	N	I	400 ABV RAPIDS, 100 BLW
106-44-031	Crystal Creek	7/11/94	A	L	chinook	0	450	700	0	1150	WB	N	N	H	100 BLW, 250 ABV RAPIDS, 100 ROCKS
106-44-031	Crystal Creek	7/21/94	A	L	chinook	0	2050	50	0	2100	WB	N	N	H	850 abv rapids, 100 blw hatchery
106-44-031	Crystal Creek	7/27/94	A	L	chinook	0	300	500	0	800	BLL	N	N	L	500 HATCH., 200 ABV RAPIDS, 100 BLW
106-44-031	Crystal Creek	8/1/94	A	L	chinook	0	1650	200	0	1850	WB	N	L	I	1300 BLW CR, 50 RCKS, 300 ABV RAPIDS
106-44-031	Crystal Creek	8/13/94	A	L	chinook	0	1000	400	30	1430	WB	N	L	I	
107-40-024	Aaron Creek	8/11/94	H	L	chinook	0	0	27	0	27	KAP	P			GLACIAL
107-40-024	Aaron Creek	8/13/94	A	L	chinook	0	0	15	0	15	WB	P	L	L	GLACIAL
107-40-049	Harding River	7/21/94	A	L	chinook	0	0	23	0	23	WB	N	N	L	tough to count, mixed with chums
107-40-049	Harding River	8/4/94	H	L	chinook	0	0	35	0	35	KAP	N			
107-40-049	Harding River	8/19/94	H	L	chinook	0	0	77	10	87	KAP	N			
107-40-049	Harding River	8/31/94	A	L	chinook	0	0	23	0	23	WB	P	N	H	
107-40-052	Bradfield River-N. Fork	8/19/94	H	L	chinook	0	0	15	0	15	KAP	P			ALL FISH IN UPPER TRIB.
108-40-010	North Arm Creek	8/11/94	F	L	chinook	0	0	57	1	58	RT	E	N		
108-40-010	North Arm Creek	8/13/94	A	L	chinook	0	0	35	0	35	WB	N	L		too many pinks for good king count
108-40-020	Andrews Creek	8/11/94	F	L	chinook	0	0	325	15	340	TWR	E	N		15 OF COUNT ARE JACKS
108-40-020	Andrews Creek	8/11/94	H	L	chinook	0	0	552	20	572	KAP	E	L		300 IN MOUTH & N. FORK
108-40-020	Andrews Creek	8/13/94	A	L	chinook	150	0	195	10	355	WB	N	L		40 left fork, 155 RT, still coming
108-40-020	Andrews Creek	8/31/94	A	L	chinook	0	0	27	0	27	WB	N	N		
108-40-050	Ohmer Creek	7/15/94	A	I	chinook	0	55	0	2	57	WB	N	L	I	
108-40-050	Ohmer Creek	7/21/94	A	0.1	chinook	0	130	0	0	130	WB	N	N	H	SCHLED IN 4 SPOTS

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Number	Stream name	Date	Type	Dist.	Species	Mouth	Tidal	Live	Dead	Total	Obs.	Visib.	Water	Tide	Remarks
108-40-13A	W of Hot Springs	8/31/94	A	L	chinook	0	0	10	0	10	WB	N	N		
108-80-100	Tahltan River	8/3/94	H	L	chinook	0	0	0	0	0	KAP	P	H		TOO MURKY TO SURVEY
108-80-100	Tahltan River	8/16/94	W	L	chinook	0	0	6478	0	6478	DFO	E	L		WEIR, 121 JACKS
108-80-115	Beatty Ck Tahltan River	7/30/94	H	L	chinook	0	0	174	10	184	KAP	N	N		
108-80-120	Little Talhtan River	7/30/94	H	L	chinook	0	0	2182	240	2422	KAP	N	L		
110-14-007	Farragut River	8/29/94	A	L	chinook	0	0	6	0	6	WB	P	L	I	1 mi.up left fk, very glacial
110-32-009	Chuck R Windham Bay	7/21/94	A	3	chinook	0	0	2	0	2	WB	N	N	H	
110-32-009	Chuck R Windham Bay	7/28/94	A	L	chinook	0	0	8	0	8	WB	N	N	L	
110-32-009	Chuck R Windham Bay	7/31/94	A	L	chinook	0	0	20	0	20	WB	E	L	H	
110-32-009	Chuck R Windham Bay	8/4/94	A	L	chinook	0	0	35	0	35	WB	P	N	I	
111-17-010	King Salmon River	7/23/94	H	L	chinook	0	0	126	0	126	KAP	E	L		
111-17-010	King Salmon River	7/27/94	F	L	chinook	0	0	138	2	140	KAP	N	N		27 JACKS
111-17-010	King Salmon River	7/27/94	H	L	chinook	0	0	134	0	134	KAP	N	N		
111-32-220	Nakina River	7/30/94	H	L	chinook	0	0	2030	0	2030	KAP	N	N		IAI
111-32-220	Nakina River	7/30/94	H	L	chinook	0	0	2345	0	2345	KAP	N	N		IAII, III, WEIR NOT IN YET
111-32-220	Nakina River	8/3/94	H	L	chinook	0	0	4792	0	4792	KAP	E	L		PEAK TOTAL
111-32-220	Nakina River	8/3/94	H	L	chinook	0	0	1392	0	1392	KAP	N	N		IAI, GLARE BAD
111-32-220	Nakina River	8/3/94	H	L	chinook	0	0	450	0	450	KAP	N	N		IAII
111-32-220	Nakina River	8/3/94	H	L	chinook	0	0	2350	0	2350	KAP	N	N		IAIII
111-32-220	Nakina River	8/3/94	H	L	chinook	0	0	600	0	600	KAP	N	N		
111-32-240	Kowatua Creek	8/22/94	H	L	chinook	0	0	221	0	221	KAP	P	H		GLACIAL
111-32-240	Kowatua Creek	8/29/94	H	L	chinook	0	0	390	20	410	KAP	P	N		STILL GLACIAL
111-32-255	Tatsamenie River	8/22/94	H	L	chinook	0	0	572	0	572	KAP	P	H		poor surveys, no sockeye
111-32-255	Tatsamenie River	8/29/94	H	L	chinook	0	0	1106	0	1106	KAP	N	N		700 blw weir, few sockeye
111-32-270	Nahlin River	7/22/94	H	L	chinook	0	0	2418	0	2418	KAP	E	L		PEAK TOTAL
111-32-270	Nahlin River	7/22/94	H	L	chinook	0	0	1749	0	1749	KAP	E	L		I A 1, 1280 AT WEIR
111-32-270	Nahlin River	7/22/94	H	L	chinook	0	0	655	4	659	KAP	E	L		IAII, IAIII
111-32-270	Nahlin River	7/29/94	H	L	chinook	0	0	865	21	886	KAP	N	N		IAII
111-32-270	Nahlin River	7/29/94	H	L	chinook	0	0	92	0	92	KAP	N	N		IAII
111-32-270	Nahlin River	7/29/94	H	L	chinook	0	0	914	100	1014	KAP	N	N		IA1
111-32-275	Tseta Creek	7/29/94	H	L	chinook	0	0	614	0	614	KAP	N	H		300 AT TOP END
111-32-280	Dudidontu River	7/29/94	H	L	chinook	0	0	517	0	517	KAP	N	H		40 ABOVE BEAVER DAMS
111-32-280	Dudidontu River	8/3/94	H	L	chinook	0	0	533	40	573	KAP	N			
111-50-069	Fish Creek-Douglas I.	9/1/94	F	1.5	chinook	0	14	182	0	196	WL				
113-41-043	REDOUBT LK OU	9/1/94	W	L	chinook	0	0	0	0	0	RDJ				
182-20-010	EAST ALSEK RI	6/4/94	A	4M	chinook	0	40	0	0	40	GFW	N	N	I	Wind on water
182-30-020	KLUKSHU RIVE	8/1/94	H	L	chinook	0	0	1458	100	1558	KAP	N	N		20 SWANS
182-30-020	KLUKSHU RIVE	8/30/94	W	L	chinook	0	0	3875	0	3875	DFO				weir count
182-30-043	TAKHANNI RIVE	8/1/94	H	L	chinook	0	0	205	137	342	KAP	E	L		EXCELLENT VIS
182-30-045	GOAT CREEK	8/1/94	H	L	chinook	0	0	47	20	67	KAP	N	N		
182-30-051	BLANCHARD LAK	8/1/94	H	L	chinook	0	0	314	35	349	KAP	N			
182-40-010	AKWE RIVER	6/4/94	A	L	chinook	1	0	0	0	1	GFW	E	N	I	
182-40-010	AKWE RIVER	6/7/94	A	L	chinook	0	0	12	0	12	GFW	E	N	I	
182-40-010	AKWE RIVER	6/13/94	A	L	chinook	0	0	12	0	12	KW	E	N	I	
182-70-010	SITUK RIVER	6/10/94	B	1.5	chinook	0	11	0	0	11	GFW	E	N	H	