Fishery Data Series No. 96-6

Age Composition and Spawning Escapement of Chinook Salmon in the Karluk, Ayakulik, and Chignik Rivers, Alaska, 1993 and 1994

by

Len Schwarz

March 1996

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

FISHERY DATA SERIES NO. 96-6

AGE COMPOSITION AND SPAWNING ESCAPEMENT OF CHINOOK SALMON IN THE KARLUK, AYAKULIK, AND CHIGNIK RIVERS, ALASKA, 1993 AND 1994

by

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ABSTRACT

A project was initiated in June 1993 to monitor the status of the chinook salmon stocks of the Karluk, Ayakulik and Chignik rivers. These stocks were selected for study because they are the largest and most heavily utilized stocks in the Kodiak Management Area. This report presents data collected in 1993 and 1994. Weirs are located on all three rivers to monitor inriver returns. Sport harvest and catch on the Karluk and Ayakulik rivers were monitored in 1993 and 1994. Escapements at the weir and sport harvests in the Karluk and Ayakulik rivers were sampled for age, sex and length. In Chignik, chinook salmon harvested in the commercial purse seine fishery in Chignik Lagoon were sampled for age, sex and length.

In 1993 the onsite creel survey estimated 569 (SE = 48) chinook salmon harvested and 2,566 (SE = 82) released in the Karluk River sport fishery. Total sport fishing effort was estimated to be 1,572 angler-days. The 1993 estimates do not include anglers who exited at the Portage. The onsite creel census in 1994 counted 896 chinook salmon harvested, with a release of 4,339. Effort in 1994 was 2,359 angler-days in the sport fishery above the weir. Estimates for 1994 included anglers exiting at the Portage, but not those fishing downstream of the weir.

In the Karluk River, the spawning escapement (inriver return minus known sport harvest above the weir) was 13,575 chinook salmon in 1993, and 11,153 in 1994. The escapement was predominantly ages 1.4 and 1.3 in both years. The male/female sex ratio was 0.9:1.0 in 1993, and 1.1:1.0 in 1994.

The sport fishery on the Ayakulik River was censused in 1993 and 1994 by the United States Fish and Wildlife Service. Harvest in 1993 was 808 chinook salmon with 2,878 released. The 1994 harvest was 739 chinook salmon; 2,733 were released. Total fishing effort was 1,133 angler-days in 1993; 1,533 angler-days in 1994.

The spawning escapement to the Ayakulik River was 7,011 chinook salmon in 1993; 8,399 in 1994. In 1993 the spawning escapement was predominantly ages 1.4 and 1.2. In 1994, ages 1.4 and 1.3 were most abundant. The male/female sex ratio was 2.3 in 1993, and 1.6 in 1994.

In 1993, 4,938 chinook salmon were harvested in the commercial purse seine fishery in Chignik Lagoon, through July 31. In 1994, the commercial harvest through July 31 was 1,773 chinook salmon. The commercial harvest was dominated by 1.4- and 1.3-age fish in both years. The male/female sex ratio was 0.34 in 1993; 0.96 in 1994.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, escapement, Karluk River, Ayakulik River, Chignik Lagoon, Chignik River, age, length, sex compositions, sport harvest and release, sport effort.

INTRODUCTION

The largest chinook salmon *Oncorhynchus tshawytscha* populations in the Kodiak Management Area (the Kodiak Island Archipelago, Alaska Peninsula waters west of Cape Douglas on the Pacific side and Cape Mensikof on the Bering side, and the Aleutian Islands) are from the Karluk, Ayakulik (Red), and Chignik rivers. All three populations are harvested incidentally by commercial fisheries targeting sockeye salmon *Oncorhynchus nerka* and also support sport fisheries. Chinook salmon in the Karluk River are also harvested in a subsistence fishery. As these chinook salmon returns receive more harvest from the commercial and sport fisheries it is essential that escapement goals are established that will result in optimum returns and harvests. The purpose of this study is to document the age, sex, and length compositions of the inriver return and the number of fish in the sport harvest and spawning escapement. These data are needed to construct brood tables that will be used to refine escapement goals and harvest guidelines for management of these chinook salmon fisheries.

THE KARLUK RIVER

The Karluk and Ayakulik rivers contain the only native populations of chinook salmon on Kodiak Island. Both rivers are located on the southwest end of Kodiak Island (Figure 1). From

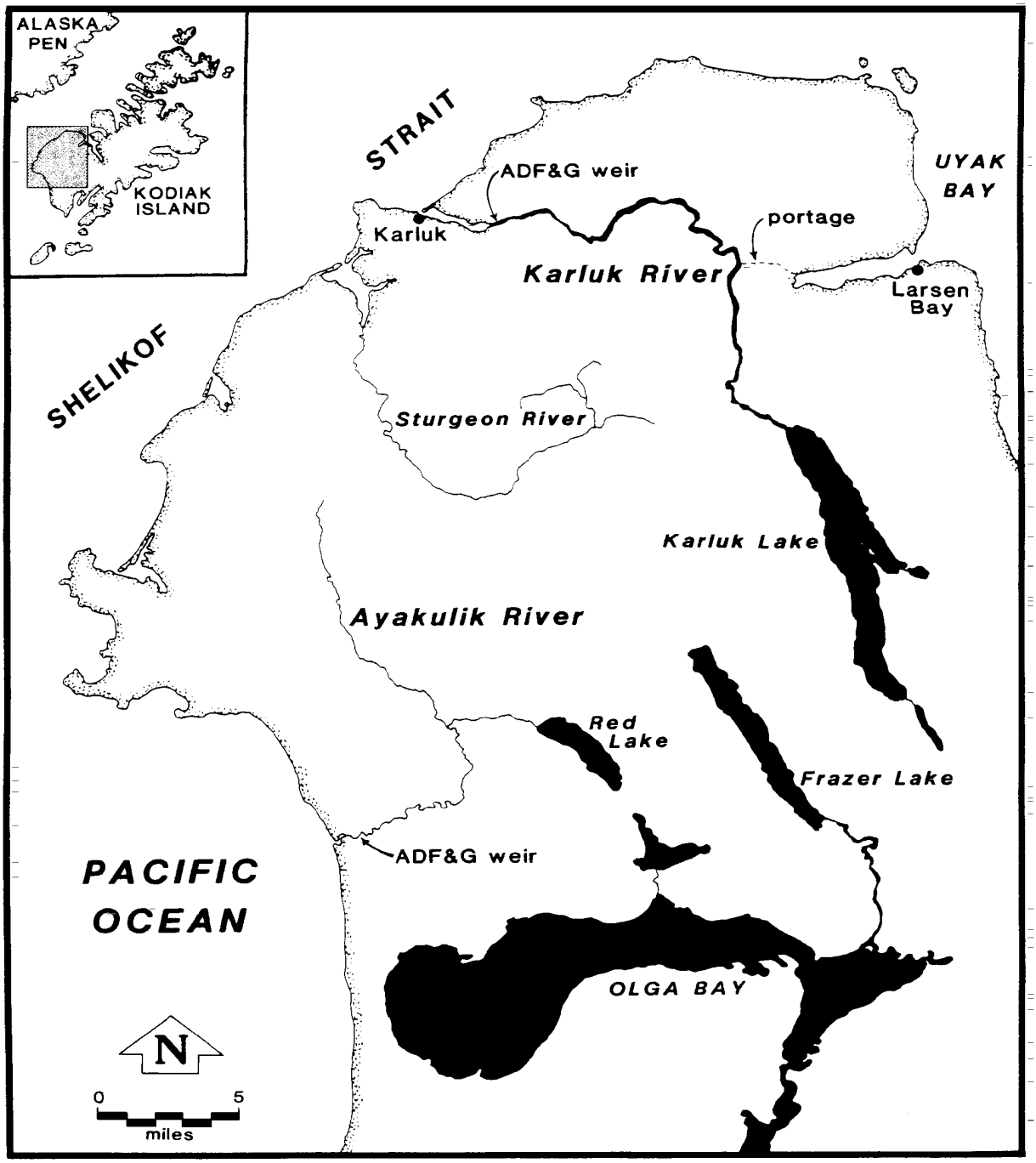


Figure 1.-Map of Karluk and Ayakulik rivers.

its source at the outlet of Karluk Lake, the Karluk River flows 35.2 km (22 mi) to its terminus at Karluk Lagoon. Virtually all the land surrounding the Karluk River is owned by native corporations. Chinook salmon of Karluk River origin are harvested in sport, commercial, and subsistence fisheries.

The primary commercial harvest of Karluk and Ayakulik river chinook salmon occurs in a mixed-stock fishery along the west side of Kodiak Island (Appendix A1). Chinook salmon harvested in the commercial fishery are of Karluk and Ayakulik stocks, as well as other stocks of unknown origin. This fishery usually begins on 9 June. Because over 97% of the escapement in both the Karluk and Ayakulik rivers generally occurs by 15 July, these stocks are considered to be commercially exploited from 9 June through 15 July. The Commercial Fisheries Management and Development Division (CFMD) of the Alaska Department of Fish and Game (ADF&G) documents commercial harvests of chinook salmon through fish ticket reports returned by fish processors.

The subsistence harvest of chinook salmon on the Karluk River is primarily conducted by residents of Karluk Village. Harvest in this fishery is documented by returned subsistence permits and household surveys. During complete village surveys conducted in 1986, 1989 and 1990, harvests ranged from 34 to 232 chinook salmon (Table 1).

The Karluk River sport fishery is spread out over the entire river and lagoon system. Anglers fishing the Karluk River typically gain access to the river in one of three fashions. Anglers fly into the village of Karluk via either float or wheel plane and fish Karluk Lagoon and the lower Karluk River. Others fly into Karluk Lake and float the Karluk River downstream either to the reach near the Portage that leads to Larsen Bay or all the way downstream to Karluk Lagoon. Finally, access may be gained by flying into the Portage reach via float plane. Anglers accessing the river in this manner either fish just this reach or float down to the Lagoon. Anglers may fish at the Lagoon near the river mouth and from a spit at the mouth of the Lagoon. There is a lodge commonly called “French Camp” located at the Portage, which caters to European anglers. These anglers often stay at the lodge and fish the area for a week or more.

Sport fishing effort for all species at the Karluk River has increased steadily since 1988; harvest of chinook salmon also has generally increased (Mills 1986-1994, Howe et al. 1995) (Table 1, Figure 2). Prior to this study, sport harvest of chinook salmon and fishing effort at the Karluk River were estimated solely by the Statewide Harvest Survey (SWHS) (Mills 1986-1994, Howe et al. 1995). Estimates of fishing effort from the SWHS are for effort directed toward all species, not chinook salmon alone, however the chinook salmon fishery is the major sport fishery on the Karluk River.

CFMD operates a weir on the Karluk River located about 400 m upriver of Karluk Lagoon. Counts of chinook salmon migrating through the weir ranged from 4,429 to 14,442 chinook salmon from 1985-1994, averaging 10,560 (Table 1, Figure 2, Appendix B1). Returns of chinook salmon to the Karluk River greatly increased starting in 1988. The average inriver return measured at the weir was 12,400 chinook salmon in the Karluk River from 1988 through 1992, compared to the previous 10-year average of 7,500. These record inriver returns, increasing interest in chinook salmon fishing, and poor chinook salmon returns in other areas of the state contributed to an increase in sport fishing effort on both the Karluk and Ayakulik rivers.

Table 1.-Total commercial harvest of chinook salmon from the west side of Kodiak Island, and subsistence and sport harvests from the Karluk River, along with Karluk River inriver returns at the weir, 1985-1994.

				Sport Harvest[c]		
	Total West Side Kodiak Commercial Harvest[a]	Karluk Village Subsistence Harvest[b]	Inriver Return at Weir	Harvest	Release	Effort (angler-days)[d]
1985	3,406		5,362	472 [e]		2,520
1986	2,735		4,429	122 [f]		657 [f]
1987	1,554	97	7,930	199 [f]		3,459 [f]
1988	4,794		13,337	819		2,128
1989	0	34	10,484	559		2,420
1990	6,533	232	14,442	700 [g]	2,262	2,969
1991	6,060		14,022	1,599	3,119	4,547
1992	8,677		9,601	856	2,754	5,430
1993	11,675		13,944	1,634	6,735	6,894
1994	9,967		12,049	1,483	2,174	10,948
Mean	5,540	121	10,560	844	3,409	4,197

[a] Source: Commercial catch numbers extracted from ADF&G, CFMD Statewide Harvest Receipt (fish ticket) database. Includes harvest of Karluk and Ayakulik stocks, as well as other stocks of unknown origin. There was no commercial harvest in 1989 due to the *Exxon Valdez* oil spill.

[b] Estimated from household surveys.

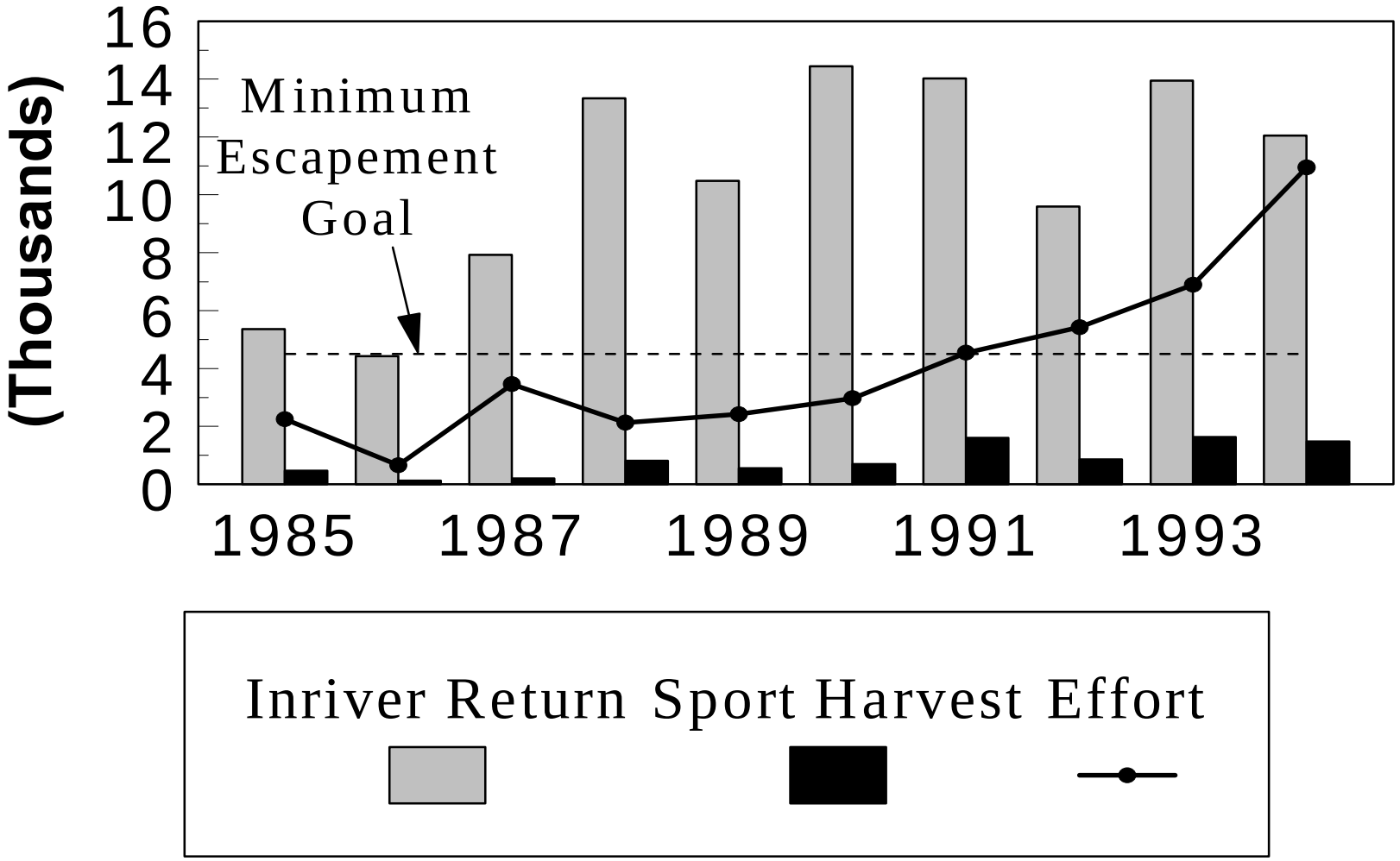
[c] Source Mills (1986-1994), Howe et. al (1995), and K. Sundet, Alaska Department of Fish and Game, Sport Fish Division, RTS, Anchorage, personal communication.

[d] Includes effort directed toward all species, not chinook salmon alone.

[e] Includes 25 chinook salmon harvested from Karluk Lake that were not included in the original postal survey report (Mills 1986).

[f] Estimates for these years are based on fewer than 12 returned surveys and are, therefore, extremely imprecise.

[g] Includes 11 chinook salmon harvested from Karluk Lake that were not included in the original postal survey report (Mills 1991).



Sport harvest and effort estimates from Mills (1986-1994) and Howe et al. (1995).

Figure 2.-Karluk River chinook salmon inriver return at the weir, sport harvest of chinook salmon, and sport effort (angler-days) directed toward all species, 1985-1994.

ADF&G has set a biological escapement goal of 4,500 to 8,000 chinook salmon in the Karluk River. The sport fishery is allowed to proceed without restriction (other than the normal regulatory bag limits) if it appears that the final weir count will reach 6,000 fish. This management approach assumes that the sport fishery harvest above the weir (including hook-and-release mortality) is approximately 1,500 fish, leaving 4,500 fish to spawn, These goals were set qualitatively based on average historical escapements that were continuing to provide harvestable surpluses.

THE AYAKULIK RIVER

The Ayakulik River lies approximately 25 miles south of the Karluk River (Figure 1). Most of the land surrounding the Ayakulik River is within the Kodiak National Wildlife Refuge. Chinook salmon of Ayakulik River origin are harvested in sport and commercial fisheries.

Chinook salmon of Ayakulik River origin are harvested in the mixed-stock commercial fishery along the west side of Kodiak Island, along with Karluk River stocks (Table 2). Subsistence harvests did not occur in the Ayakulik River from 1985 to 1994.

Sport anglers fishing the Ayakulik River typically gain access to the fishery by float plane. The major access location on the upper Ayakulik River is at the confluence of the Ayakulik and Bare Creek. Anglers either fish and camp at the landing sites or raft downstream and fish along the way. Wheel planes can land on the beach near the river mouth to pick up rafters. There is a lodge near the mouth of the river where anglers often stay for extended visits.

Sport harvest of chinook salmon from the Ayakulik River has increased since 1991 (Table 2, Figure 3). Sport fishing effort for all species at the Ayakulik River nearly tripled, from 1,780 angler-days in 1991 to 5,473 angler-days in 1994 (Mills 1992, Howe et al. 1995) (Table 2, Figure 3).

CFMD operates a weir near the mouth of Ayakulik River. Record inriver returns of chinook salmon occurred from 1987 through 1991 in the Ayakulik River (Table 2, Figure 3, Appendix C1). The average inriver return was 15,000 chinook salmon during these record years, compared to the previous 10-year average of 7,000. In 1992, the inriver return of 9,100 to the Ayakulik River was closer to the historical average than the recent record escapements, but the decline in escapement did not reduce sport harvest (Table 2).

ADF&G has set a biological escapement goal of 6,500 to 10,000 chinook salmon in the Ayakulik River. Similarly to management of the Karluk River, the sport fishery is allowed to proceed under the normal regulatory restrictions if it appears at least 7,500 chinook salmon will be counted through the weir. This management approach assumes that harvest above the weir (including hook-and-release mortality) is approximately 1,000 fish. As with the Karluk River, these goals were set qualitatively based on average historical escapements that were continuing to provide harvestable surpluses.

In addition to annual weir counts, the United States Fish and Wildlife Service (USFWS) conducted a spawning habitat study of the Ayakulik River in 1989 (Handler and Chatto *Unpublished*). They estimated that the available spawning habitat could accommodate 5,213 spawning beds for chinook salmon. If jacks are not included and a sex ratio of 1:1 is observed, then 10,426 adult chinook salmon could utilize the available spawning habitat. This study did

Table 2.-Total commercial harvest of chinook salmon from the west side of Kodiak Island, and sport harvest from the Ayakulik River, along with Ayakulik River inriver returns at the weir, 1985-1994.

			Sport Harvest[b]		
	Total West Side Kodiak Commercial Harvest[a]	Inriver Return at Weir	Harvest	Release	Effort (angler-days)[c]
1985	3,406	8,151	76 [d]		91 [d]
1986	2,735	6,371	76 [d,e]		229 [d,h]
1987	1,554	15,636	126 [d]		638 [d]
1988	4,794	21,370	600 [d]		377 [d]
1989	0	15,432	390 [d]		1,135 [d]
1990	6,533	11,251	252 [f]	2,109 [g]	759 [i]
1991	6,060	12,988	563	2,191	1,780
1992	8,677	9,135	776	3,199	3,340
1993	11,675	7,819	1,004	4,347	4,566
1994	9,967	9,138	948	1,020	5,473
Mean	5,540	12,127	526	2,573	2,033

[a] Source: Commercial catch numbers extracted from ADF&G, CFMD Statewide Harvest Receipt (fish ticket) database. Includes harvest of Karluk and Ayakulik stocks, as well as other stocks of unknown origin. There was no commercial harvest in 1989 due to the *Exxon Valdez* oil spill.

[b] Source: Mills (1986-1994), Howe et. al (1995), and K. Sundet, Alaska Department of Fish and Game, Sport Fish Division, RTS, Anchorage, personal communication.

[c] Includes effort directed toward all species, not chinook salmon alone.

[d] Estimates for these years are based on fewer than 12 returned surveys and are, therefore, extremely imprecise.

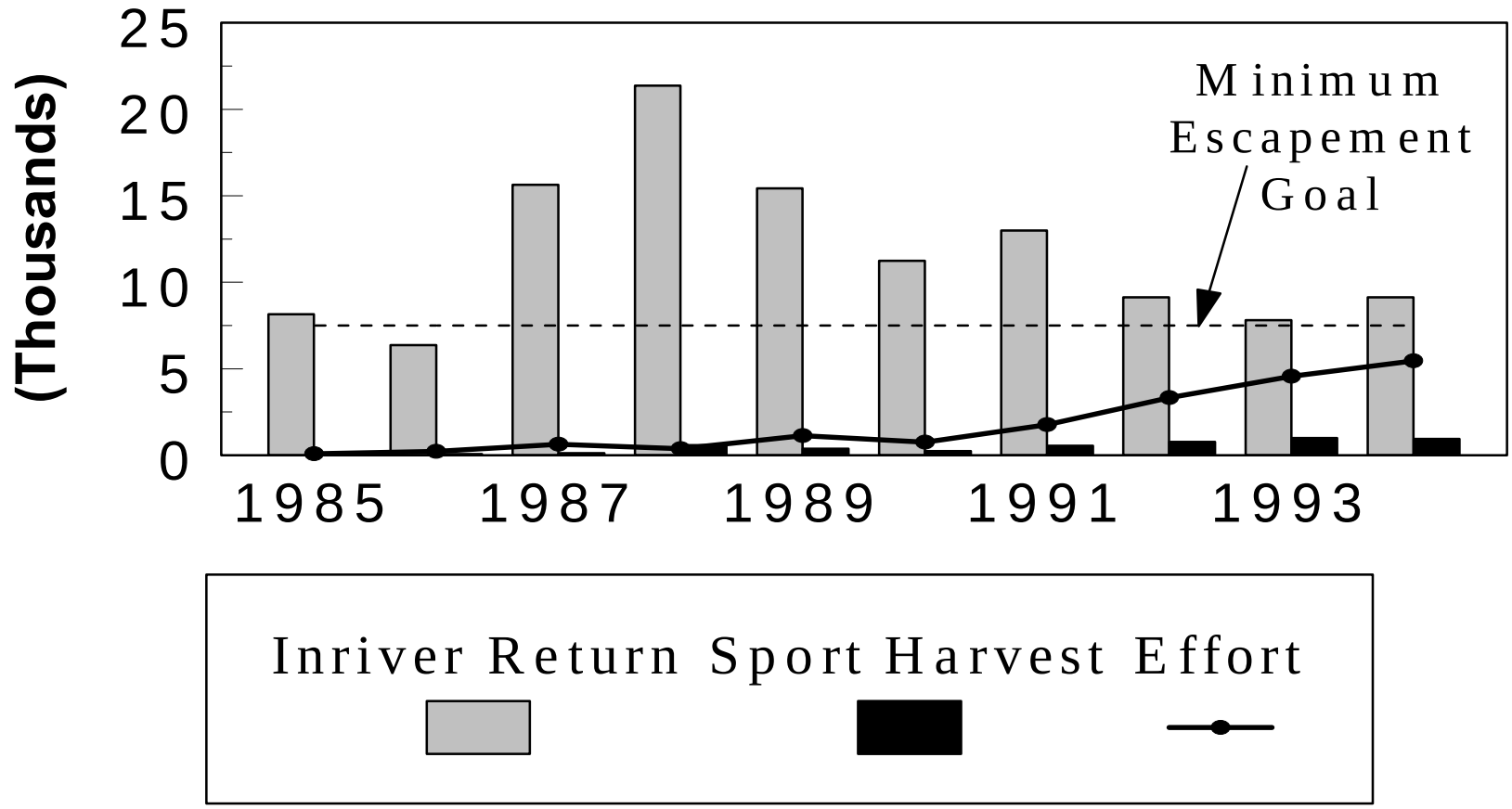
[e] These fish were harvested from Red Lake.

[f] Includes 219 chinook salmon harvested from the Ayakulik River that were coded to the wrong site number and therefore not included in the postal survey report (Mills 1991).

[g] Includes catch of 1,388 chinook salmon from the Ayakulik River that were coded to the wrong site number and therefore not included in the postal survey report (Mills 1991).

[h] This is effort by anglers fishing at Red Lake.

[i] Includes 420 days of effort from the Ayakulik River that were coded to the wrong site number and therefore not included in the postal survey report (Mills 1991).



Sport harvest and effort estimates from Mills (1986-1994) and Howe et al. (1995).

Figure 3.-Ayakulik River chinook salmon inriver return at the weir, sport harvest of chinook salmon, and sport effort (angler-days) directed toward all species, 1985-1994.

not evaluate the amount of available rearing habitat, an essential parameter in determining spawning goals.

THE CHIGNIK RIVER

The Chignik River is remotely located on the Alaska Peninsula near the village of Chignik (Figure 4). It is the largest chinook salmon-producing system on the south side of the Alaska Peninsula. Sport, commercial and subsistence fisheries harvest chinook salmon of Chignik River origin. Sport harvests of Chignik River chinook salmon have been relatively low compared to Karluk and Ayakulik rivers (Schwarz 1990), however there has been concern that in years of weak returns adequate escapements would not be achieved.

Chinook salmon bound for the Chignik River are harvested in a commercial fishery in the Chignik area, particularly in Chignik Lagoon, directed at sockeye salmon. Peak harvests are usually in July. Commercial chinook salmon harvest within Chignik Lagoon ranged from 1,810 to 5,240 chinook salmon, averaging 3,014 from 1985 to 1994 (Table 3).

Chignik River chinook salmon are also harvested in a subsistence fishery. Estimated subsistence harvest for the Chignik Management Area ranged from 1 to 165 chinook salmon from 1985-1994 (Owen *In prep.*).

The sport fishery for chinook salmon primarily occurs in the reach between the weir and the outlet of Chignik Lake. Sport fishing effort and harvest have been relatively low at the Chignik River, compared to the Karluk and Ayakulik rivers. Creel surveys were conducted by the Division of Sport Fish in 1988 and 1989, with estimated harvests of 233 and 181 chinook salmon, respectively (Figure 5, Schwarz 1990).

CFMD operates a weir on the Chignik River located midway between Chignik Lagoon and Chignik Lake (Appendix D1). Until 1993, chinook salmon were visually counted through the weir during scheduled 10-minute counting periods. These counts were expanded to include time when counts did not take place. In 1993, chinook salmon were counted for the first 30 minutes of daily weir operation, and for 10 minutes during each hour thereafter (Owen 1993). Also until 1994, weir counts of chinook salmon did not include fish less than approximately 650 mm (those which had spent only 1 or 2 years at sea). Chinook salmon less than 650 mm were counted as sockeye salmon due to similarity in length. Counts of chinook salmon were expanded to include small fish based on estimates of the actual age composition of the run. Starting in 1994 an underwater video camera was used to count fish, so all chinook salmon, regardless of size and time of passage, were counted. Between 1985 and 1994, estimates of immigrating chinook salmon (including small fish) ranged from 2,337 to 6,123 chinook salmon, averaging 4,257 (Table 3).

In 1993 a Ricker recruitment curve (Ricker 1978) was constructed using the very limited data that were available to provide the Board of Fisheries information needed to respond to a public proposal to lower the sport fishing bag limit from three chinook salmon per day to two per year. The Ricker curve estimated maximum sustained yield at an escapement level of 3,000 fish. A minimum escapement level of 1,750 was selected because this level of escapement would still provide a large harvestable surplus, while allowing a fishery to proceed during lower escapement years. The following year, weir staff recognized an error in the methodology used to estimate escapements through the weir (Owen 1993). Owen (1993) calculated an 18% overestimation of

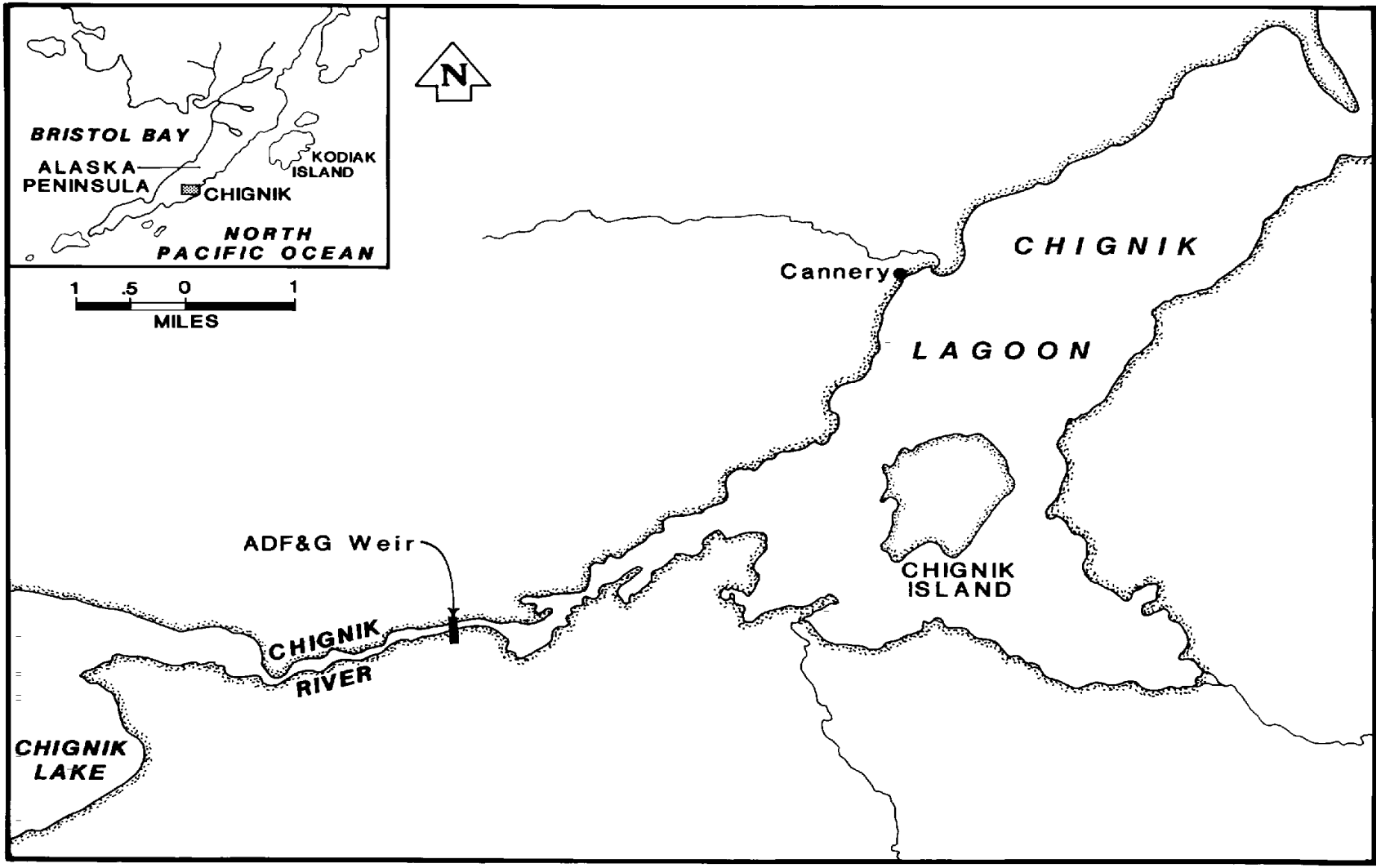


Figure 4.-Map of Chignik River on the Alaska Peninsula.

Table 3.-Commercial, subsistence, and sport harvest of Chignik River chinook salmon, along with inriver returns at the weir, 1985-1994.

	Total Chignik Area Commercial Harvest[a]	Chignik Lagoon Commercial Harvest[b]	Inriver Return at Weir[c]	Subsistence Harvest[d]	Sport Harvest[e]
1985	1,919	1,810	3,738	1	
1986	3,037	2,592	3,896	4	
1987	2,651	1,931	3,301	10	
1988	7,296	4,331	6,123	9	233
1989	3,545	3,532	4,171	11	181
1990	9,901	3,719	5,489	147	
1991	3,288	1,996	5,716	42	
1992	11,381	3,181	4,787	55	
1993	19,515	5,240	2,337	115	
1994	3,919	1,808	3,016	165	
Mean	6,645	3,014	4,257	56	207

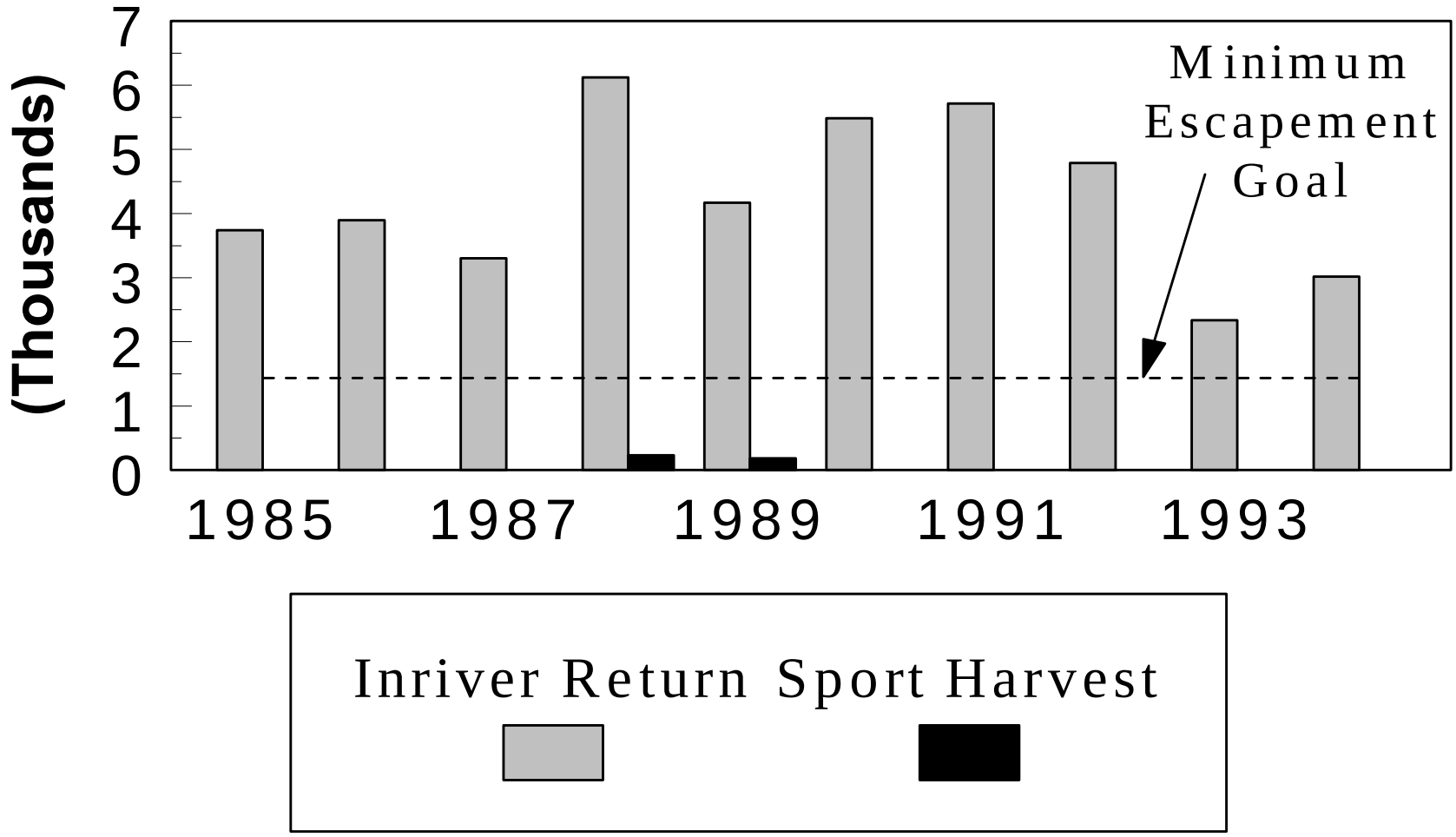
[a] Harvest from the entire Chignik Management Area (between Kilokak Rocks and Kupreanof Point on the Alaska Peninsula). Source: Owen (*In prep*).

[b] Commercial harvest for the entire season. Source: Owen (*In prep*).

[c] For 1985-1992 these are estimated returns based on expanded 10 minute per hour counts. In 1993 estimated returns were based on 30-minute counts during the first hour of daily operation and 10-minute counts made each following hour, all counts expanded to include time not counted (Owen 1993). One- and 2-ocean-year fish were not counted at the weir for 1985-1993 due to their small size. Estimates of the proportion of 1- and 2-ocean fish were used to expand the weir estimates to yield the numbers shown above. The 1985, 1986, and 1993 estimates were adjusted by the actual percent of 1- and 2-ocean fish found in the commercial purse seine catch (15.9% and 7.3% for 1985 and 1986, respectively; and 8.1% for the early run, 26.8% for the late run in 1993). Estimates for other years prior to 1994 were adjusted by 20.5%. In 1994 a video camera was installed to continuously count all fish passing the weir (including 1- and 2- ocean chinook salmon).

[d] Source: Owen (*In prep*).

[e] Sport harvest was estimated only in 1988 and 1989 (Schwarz 1990).



Sport harvest estimates from Mills (1986-1994) and Howe et al. (1995).

Figure 5.-Chignik River chinook salmon inriver return at the weir 1985-1994, and sport harvest 1988 and 1989.

escapement. Because of this error, the escapement goal range of 1,750-3,000 was lowered by 18%. The current escapement goal for the Chignik River is 1,435-2,460. The sport fishery is managed so that a minimum of 1,435 chinook salmon will be allowed to spawn. The Chignik River chinook salmon escapement goal will benefit greatly from refinements that can be made by developing brood tables based on accurate age class classification of the return data.

STUDY OBJECTIVES

In June 1993, ADF&G initiated this study to estimate sport fishing effort, harvest and catch, and age, length and sex compositions of the chinook salmon populations of the Karluk, Ayakulik, and Chignik rivers. This report presents results from 1993 and 1994.

CFMD operates weirs on Karluk and Chignik rivers. Their counts of chinook salmon passing through these weirs were an essential component of this study.

The objectives of this study for the Karluk River were to:

1. estimate the sport fishing effort in the Karluk River above and below the Karluk River weir;
2. estimate the sport harvest and catch of chinook salmon in the Karluk River above and below the Karluk River weir;
3. estimate the age, sex, and length composition of the chinook salmon migration through the weir in two 3-week strata; and
4. estimate the age, sex and length composition of chinook salmon harvested by anglers exiting the fishery at the Portage, passing the weir, and fishing or exiting the fishery below the weir.

Objectives for the Chignik River portion of the study were to:

5. Estimate the age, sex and length composition of the commercial harvest of chinook salmon in the Chignik River Lagoon in two 2-week time strata.

In addition to the information collected for the Karluk River and Chignik River portions of this study, the USFWS collected information on the chinook salmon population of the Ayakulik River. This information is included in this report so that data on Kodiak area chinook salmon will be available in a single report. Objectives for the Ayakulik River study conducted by the USFWS were to:

1. document the sport fishing effort on the Ayakulik River through a complete census of anglers;
2. document the sport harvest and catch of chinook salmon on the Ayakulik River;
3. estimate the age, sex, and length compositions of the chinook salmon migration through the weir in two 3-week strata; and
4. estimate the age, sex, and length compositions of the sport harvest of chinook salmon in the Ayakulik River.

METHODS

DATA COLLECTION

Karluk River Sport Fishing Effort, Harvest, and Catch

Anglers were interviewed at four locations on the Karluk River: the Portage, the weir, the river and Lagoon below the weir, and the spit at the mouth of the Lagoon. At the Portage, the weir,

and the spit, all anglers were interviewed as they exited the fishery. At the river below the weir and the Lagoon, interviewing all anglers was not possible.

Creel Survey Below the Weir, 1993

In 1993, a creel survey of the Karluk River below the weir and the Lagoon was conducted from 1 June through 10 July to estimate sport fishing effort, and harvest and catch of chinook salmon. The survey was a two-stage roving survey (Bernard et al. *In prep*), stratified into mornings and afternoons and further into two seasonal time intervals: 1 June-21 June, and 22 June-10 July. The break between the seasonal time intervals was chosen to coincide with the date when Karluk village began charging access fees to anglers at the Lagoon.

Periods were the first stage, completed-trip anglers and angler counts the second. For each day the morning stratum was from 0600-1359 hours, and the afternoon stratum was from 1400-2200 hours. Observations from previous years indicated that effort was minimal from 2200 to 0600 hours. Four sampled periods were chosen randomly each week from all possible periods. Six angler counts were conducted at times chosen systematically in each period sampled.

Only anglers engaged in fishing were counted, and only anglers who had completed that day's fishing trip to the Lagoon were interviewed. Care was taken to record each angler's effort only once. Therefore, anglers who rafted through the weir or fished at the spit and were later interviewed while fishing the Lagoon were questioned only for the time spent fishing at the Lagoon, assuming their effort elsewhere was already recorded in the weir or spit census.

The creel technician collected the following information from each interviewed angler:

1. number of hours fished;
2. number, by species, of chinook and sockeye salmon, steelhead, and Dolly Varden kept;
3. number, by species, of chinook and sockeye salmon, steelhead, and Dolly Varden released;
4. type of resident: non-Alaskan resident (nonresident), Alaskan resident from outside the Kodiak Borough (other Alaskan resident), or Kodiak Island Borough resident (local resident);
5. guided or nonguided; and
6. whether or not the angler was interviewed at the weir or the Lagoon spit that day.

On 22 June 1993, Karluk Village began charging anglers for access to Karluk Lagoon and spit, causing a substantial decrease in sport fishing effort and harvest at those sites. The Village continued to charge access fees during 1994; therefore, sampling of the river below the weir, at the Lagoon, and at the spit was discontinued in 1994 because few anglers were anticipated at those sites.

Creel Census at the Portage, Weir, and Spit; 1993 and 1994

In 1993, the sport fishery was censused at the weir and spit sites. All anglers rafting through the weir or fishing on the spit at the mouth of the Lagoon were interviewed. At the Portage, the private landowner did not allow the department to establish a fisheries monitoring camp there. Therefore, the Portage was not sampled in 1993.

A technician stationed at the Karluk River weir interviewed all anglers rafting downstream through the weir. Interviewing all anglers was possible because the technician had to remove

weir panels to allow passage through the weir. Anglers walking downstream past the weir were also interviewed. Each angler was interviewed individually. Anglers were asked the same questions as in the section above, except that they were asked the number of days fished, not hours fished. Any part of a day spent fishing counted as a full day. Anglers were asked number of fish caught and kept for their entire trip. Anglers walking downstream were also asked if they were interviewed at any other location during that day.

In 1994, the spit and river and Lagoon below the weir were not sampled because effort was expected to be very low there as it was in 1993. However, the landowner at the Portage allowed establishment of a research camp, so the fishery was censused at the Portage and the weir. Methods for interviewing anglers at the weir in 1994 were identical to methods for 1993.

At the Portage in 1994, a technician contacted the lodge manager daily to collect summaries of lodge clients' fishing activity. Lodge clients were not interviewed directly because they generally stayed at the lodge for 2 weeks. We felt that interviewing the same 10-15 anglers each day could have annoyed the anglers, compromising the quality of the data.

Each day, the lodge manager recorded the number of anglers who fished and the number, by species, of chinook and sockeye salmon, steelhead, and char kept and released by lodge clients. The lodge manager recorded these data separately for guided and unguided anglers. Guided anglers were defined as anglers who were accompanied and assisted by a guide while fishing. Anglers merely residing at the lodge and those who used air taxis as a mode of transportation were not considered guided unless accompanied by a guide while fishing.

All anglers not associated with the lodge were interviewed as they exited the Portage area. Interview questions were the same as at the weir.

Ayakulik River Sport Fishing Effort, Harvest, and Catch

During 1993 and 1994 the sport fishery on the Ayakulik River was censused by USFWS. All anglers exiting the fishery at Bare Creek or floating past the weir were interviewed. Interview questions were the same as for the interviews collected at the Karluk River weir. Daily catch reports of anglers fishing at the lodge located on the ocean beach were also collected. This coverage accounted for all exit locations.

Age, Sex, and Length Compositions

Escapement 1993 and 1994

During 1993 and 1994, the chinook salmon escapements of the Karluk and Ayakulik rivers were sampled at weir traps. Sampling was stratified into two 3-week intervals at each system. Sampling goals were established at 150 fish for 1-20 June and 150 fish for 21 June-10 July. At least 50 fish were to be sampled each week. During 1 or 2 days each week, all chinook salmon passing the weir were stopped in the weir trap and sampled for length, sex, and age.

At the Chignik River a weir trap is not available so the commercial purse seine harvest from inside Chignik Lagoon was sampled. Purse seine gear is fairly nonselective with regard to size, so samples from the purse seine harvest in this terminal fishery were assumed to be indicative of the Chignik River escapement. Sampling was stratified into two 2-week intervals with sample goals of 150 fish from 1 July-15 July and 150 fish between 16 July and 31 July.

Length from mid-eye to fork-of-tail was recorded to the nearest millimeter. Sex was identified based on external sexual characteristics. Three scales were removed from each chinook salmon from the left side of the body, at a point on a diagonal line from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, two rows above the lateral line (Welander 1940). Scales were mounted on a gum card. If the preferred scales could not be obtained, scales were taken from as close to the preferred scales as possible. However, scales were only taken from the area bounded dorsally by the fourth row of scales above the lateral line, ventrally by the lateral line, and between lines drawn vertically from the posterior insertion of the dorsal fin and the anterior insertion of the anal fin. If no scales were available in the preferred area on the left side of the fish, scales were collected from the preferred area on the right side of the fish. Ages of sampled chinook salmon were determined from scales using criteria described in Mosher (1969).

Sport Harvest 1993 and 1994

The sport harvest of chinook salmon from the Karluk River was sampled for age, length, and sex at the Portage (1994), the weir (1993 and 1994), the river below the weir and the Lagoon (1993), and the spit (1993). All available chinook salmon were sampled. Harvests by anglers in rafts and on foot were sampled. At the Portage, chinook salmon were sampled both from harvests of anglers at the lodge and those not associated with the lodge. Data collection was as described above, except that only scale samples were collected from cleaned and beheaded fish.

In 1993 and 1994, the Ayakulik River sport fishery was sampled at Bare Creek and the weir by USFWS. Samples were collected in the same way as at the Karluk River.

DATA ANALYSIS

Effort, Catch and Harvest of Chinook Salmon

Effort, catch, and harvest from the river and Lagoon below the weir on the Karluk River in 1993 were estimated from the stratified roving two-stage creel survey following the methods of Bernard et al. (*In prep*).

The mean number of anglers counted during period i in stratum h was estimated by:

$$\bar{x}_{hi} = \frac{\sum_{g=1}^{r_{hi}} x_{hig}}{r_{hi}}, \qquad (1)$$

where:

x_{hig} = the number of anglers observed in the gth count during period i in stratum h, and

r_{hi} = the number of counts during period i in stratum h, which was six in each stratum.

Angler counts were taken systematically within each sample period. The variance of the mean angler count was estimated by:

$$\mathrm{Var}(\bar{x}_{hi}) = \frac{\sum_{g=2}^{r_{hi}} \left(x_{hig} - x_{hi(g-1)}\right)^2}{2r_{hi}(r_{hi}-1)}. \quad (2)$$

Effort (angler-hours) during period i in stratum h was estimated by:

$$\hat{E}_{hi} = L_{hi}\bar{x}_{hi}, \quad (3)$$

where:

L_{hi} = length of the sample period (= 8 hours) in each stratum.

The within period variance was estimated by:

$$\mathrm{Var}(\hat{E}_{hi}) = L_{hi}^2 \mathrm{Var}(\bar{x}_{hi}). \quad (4)$$

The mean effort of stratum h was estimated by:

$$\bar{E}_h = \frac{\sum_{i=1}^{d_h} \hat{E}_{hi}}{d_h}, \quad (5)$$

where:

d_h = number of periods sampled in stratum h.

Periods sampled were chosen at random in each stratum. The variance of mean effort among periods was estimated by:

$$\mathrm{Var}(\bar{E}_h) = \frac{\sum_{i=1}^{d_h} \left(\hat{E}_{hi} - \bar{E}_h\right)^2}{(d_h - 1)}. \quad (6)$$

Total effort of stratum h was estimated by:

$$\hat{E}_h = D_h \bar{E}_h, \quad (7)$$

where:

D_h = total number of periods in each stratum.

The variance of total effort of each stratum in a two-stage design, omitting the finite population correction factor for the second stage, was estimated by (Cochran 1977):

$$\mathrm{Var}(\hat{E}_h) = (1-f)D_h^2 \frac{\mathrm{Var}(\bar{E}_h)}{d_h} + fD_h^2 \frac{\sum_{i=1}^{d_h} \mathrm{Var}(\hat{E}_{hi})}{d_h^2}, \quad (8)$$

where:

f = finite population correction factor for periods sampled (= d_h/D_h).

Catch and harvest per unit of effort of each period sampled were estimated from angler interviews using the jackknife method to minimize the bias of these ratio estimators (Efron 1982). A jackknife estimate of CPUE (similarly HPUE) was made for each angler by:

$$\mathrm{CPUE}^{*}_{hij} = \frac{\sum_{\substack{p=1 \\ p \neq j}}^{m_{hi}} c_{hip}}{\sum_{\substack{p=1 \\ p \neq j}}^{m_{hi}} e_{hip}}, \tag{9}$$

where:

c_{hip} = catch of angler p interviewed in stratum h during period i,

e_{hip} = effort (hours fished) of angler p interviewed in stratum h during period i,

m_{hi} = number of anglers interviewed in stratum h during period i.

The jackknife estimate of mean CPUE of period i was the mean of the angler estimates:

$$\overline{\mathrm{CPUE}}^{*}_{hi} = \frac{\sum_{j=1}^{m_{hi}} \mathrm{CPUE}^{*}_{hij}}{m_{hi}}, \tag{10}$$

and the bias corrected mean was:

$$\overline{\mathrm{CPUE}}^{**}_{hi} = m_{hi}\left(\overline{\mathrm{CPUE}}_{hi} - \overline{\mathrm{CPUE}}^{*}_{hi}\right) + \overline{\mathrm{CPUE}}^{*}_{hi}, \tag{11}$$

where:

$\overline{\mathrm{CPUE}}_{hi}$ = the standard estimate of CPUE, or the sum of all catches over the sum of all hours fished in a period.

The variance of the jackknife estimate of CPUE was estimated by:

$$\mathrm{Var}\left(\overline{\mathrm{CPUE}}^{**}_{hi}\right) = \frac{m_{hi}-1}{m_{hi}} \sum_{j=1}^{m_{hi}} \left(\mathrm{CPUE}^{*}_{hij} - \overline{\mathrm{CPUE}}^{*}_{hi}\right)^2. \tag{12}$$

Catch during each sample period was then estimated as the product of effort and CPUE by:

$$\hat{C}_{hi} = \hat{E}_{hi}\overline{\mathrm{CPUE}}^{**}_{hi}, \tag{13}$$

and the variance by:

$$\mathrm{Var}\left(\hat{C}_{hi}\right) = \mathrm{Var}\left(\hat{E}_{hi}\right)\left(\overline{\mathrm{CPUE}}^{**}_{hi}\right)^2 + \mathrm{Var}\left(\overline{\mathrm{CPUE}}^{**}_{hi}\right)\hat{E}^2_{hi} - \mathrm{Var}\left(\hat{E}_{hi}\right)\mathrm{Var}\left(\overline{\mathrm{CPUE}}^{**}_{hi}\right). \tag{14}$$

HPUE was estimated by substituting harvest for angler catch in equations (9) through (12). Harvest during sample period i was estimated by substituting the appropriate $HPUE_{hi}$ statistics into equations (13) and (14). Total catch and harvest during stratum h was estimated using equations (5) through (8), substituting estimated catch (C_{hi}) and harvest (H_{hi}) during sample period i for the estimated effort (E_{hi}) during period i.

The estimates of total effort, catch, and harvest, and their variances were summed across strata as these estimates were considered independent.

Effort at all other locations was in units of angler-days, so effort from the survey was converted from angler-hours to angler-days by dividing the estimated effort (in angler-hours) for each period by the mean trip length for that period:

$$\hat{F}_{hi} = \frac{\hat{E}_{hi}}{\bar{e}_{hi}}, \tag{15}$$

where:

$\hat{F}_{hi}$ = the estimated effort in angler-days for period i in stratum h.

$\hat{E}_{hi}$ = the estimated effort in angler hours calculated from angler counts for period i in stratum h, and

$\bar{e}_{hi}$ = the mean trip length calculated from angler interviews for period i in stratum h.

The variance of angler-days was calculated using the equation for variance of the quotient of two random variables (Lindgren 1976):

$$\mathrm{Var}\left(\hat{F}_{hi}\right) = \hat{F}_{hi}^2\left[\frac{\mathrm{Var}\left(\hat{E}_{hi}\right)}{\hat{E}_{hi}^2} + \frac{\mathrm{Var}\left(\bar{e}_{hi}^2\right)}{\bar{e}_{hi}^2}\right]. \tag{16}$$

Mean angler-days of effort and its variance during each weekly stratum was estimated and expanded for periods not sampled. The stratum estimates were summed to estimated total effort in angler-days and variance of total effort. The estimate of angler-days from the creel survey was summed with creel census values from the Lagoon spit to estimate total effort, catch (all fish caught, including those released), and harvest (fish caught and kept) below the weir. This, combined with the weir count provided an estimate of total inriver return of chinook salmon to the Karluk River in 1993.

Effort, catch, and harvest from the Karluk River in 1994 and for the Ayakulik River in 1993 and 1994 was simply the sum of values from anglers interviewed during the complete census.

Age, Sex, and Length Compositions

The proportion of chinook salmon in each age and sex class j sampled from the escapement or sport harvest and its variance was estimated as a binomial proportion (Cochran 1977) by:

$$\hat{p}_j = \frac{n_j}{n}, \tag{17}$$

where:

n_j = the number of chinook salmon in age and sex class j, and

n = the total number of chinook salmon sampled.

The finite population correction factor was added to the estimate of variance:

$$\hat{Var}(\hat{p}_j) = \left(\frac{N-n}{N}\right)\left(\frac{\hat{p}_j(1-\hat{p}_j)}{n-1}\right), \quad (18)$$

where:

N = the total number of chinook salmon in the population of interest.

The abundance or harvest of chinook salmon by age and sex class was estimated as the product of the harvest or escapement count (N) and the proportion:

$$\hat{N}_j = N\hat{p}_j\,, \quad (19)$$

and its variance estimated by (Goodman 1960):

$$\hat{Var}(\hat{N}_j) = \hat{N}^2\hat{Var}(\hat{p}_j) + p_j^2\hat{Var}(\hat{N}) - \hat{Var}(\hat{p}_j)\hat{Var}(\hat{N})\,. \quad (20)$$

When N was known (as for the escapement counts or for the sums of harvest from the creel censuses), then the above formula reduced to:

$$\hat{Var}(\hat{N}_j) = N^2\hat{Var}(\hat{p}_j)\,. \quad (21)$$

Chi-square tests were used to test the null hypothesis that the age and sex composition did not change between strata in the escapement or the harvest. Differences in length compositions between strata were tested using a Kolmogorov-Smirnov test. When we failed to detect differences, the data were pooled across strata. When differences were detected we calculated estimates for each strata and summed those estimates to get the season total.

RESULTS

KARLUK RIVER

Effort, and Catch and Harvest of Chinook Salmon in 1993

Anglers interviewed at the weir in 1993 harvested 369 chinook salmon out of a catch of 2,853. These anglers expended 1,088 angler-days of effort (Table 4). Eighty-seven percent of chinook salmon caught were released. At the spit, anglers expended 91 angler-days to catch 20 chinook salmon and harvest 14 (Table 4). Thirty percent of the chinook salmon caught at the spit were released.

During the 1993 creel survey at the Lagoon and lower river, the maximum number of anglers counted during a sampling period was 25 (on 13 June). Usually, less than 10 anglers were counted. During the entire season, 80 anglers were interviewed. No anglers were interviewed during ten sampled periods; during two of these periods no anglers were counted.

Table 4.-Sport fishing effort, and catch and harvest of chinook salmon from the Karluk River, 1993 and 1994.

Location	Effort (Angler Days)[a]		Catch[a]		Harvest[a]	
1993						
Spit	91		20		14	
Lagoon	393	(91)	262	(67)	186	(48)
Weir	1,088		2,853		369	
Total	1,572	(91)	3,135	(67)	569	(48)
1994						
Weir	1,650		3,878		493	
Portage	725		1,357		403	
Total	2,375		5,235		896	

[a] SE in parentheses

Sport fishing effort at the Lagoon (Table 4, Appendix E1) was 393 angler-days (SE = 91). Anglers caught 262 (SE = 67) and harvested 186 (SE = 48) chinook salmon (Table 4, Appendix E1). Anglers retained 71% of the catch of chinook salmon.

Total catch at the Karluk River in 1993, excluding the Portage, was 3,135 (SE = 67), with a harvest of 569 (SE = 48) chinook salmon (Table 4). Overall, 82% of the chinook salmon caught were released. Fishing effort was estimated to be 1,572 angler-days (SE = 91). Anglers also caught sockeye salmon, steelhead and rainbow trout *O. mykiss*, and Dolly Varden *Salvelinus malma* (Table 5). Most anglers interviewed at the Karluk River were unguided and were nonresidents (Table 6). Very few anglers reported harvesting more than the possession limit of three fish during their trip (Table 7).

Effort, and Catch and Harvest of Chinook Salmon in 1994

At the weir in 1994, anglers harvested 493 chinook salmon out of a catch of 3,878. Anglers expended 1,650 angler-days of effort (Table 4). Anglers exiting the Karluk River at Portage caught 1,357 chinook salmon and harvested 403 in 725 angler-days (Table 4). Anglers interviewed at the weir tended to be unguided nonresidents; anglers interviewed at the Portage were generally guided nonresidents (Table 8).

The total chinook salmon harvest on the Karluk River above the weir in 1994 was 896 fish out of a catch of 5,235 fish (Table 4). Overall release was 83%. Total fishing effort was 2,375 angler-days. Anglers also caught sockeye salmon, steelhead and rainbow trout, and Dolly Varden (Table 5). Most anglers interviewed at the Portage in 1994 were guided, most at the weir were unguided (Table 8). In both locations most anglers were nonresidents (Table 8).

Table 5.-Catch and harvest of sockeye salmon, steelhead and rainbow trout, and Dolly Varden from the Karluk River, 1993 and 1994.

	Sockeye Salmon		Steelhead & Rainbow Trout		Dolly Varden	
Location	Catch[a]	Harvest[a]	Catch[a]	Harvest[a]	Catch[a]	Harvest[a]
1993						
Spit	119	68	3	0	2	2
Lagoon	301 (93)	218 (86)	25 (14)	0	7 (6)	0
Weir	377	51	120	7	1,229	28
Total	797 (93)	337 (86)	148 (14)	7	1,238 (6)	30
1994						
Weir	712	111	204	5	465	7
Portage	102	16	64	0	437	44
Total	814	127	268	5	902	51

[a] SE in parentheses.

As in 1993, very few anglers at the Karluk River reported harvesting more than the possession limit of three fish during their trip (Table 9). Fish that are frozen or consumed are not considered part of the angler's possession limit, but freezers are not readily available on the Karluk River, so few anglers keep more than three fish.

Age, Length and Sex Compositions in 1993

Ages were determined for 295 chinook salmon sampled from the weir trap on the Karluk River in 1993. To stratify by time, data were classified into early (20 May through 20 June) and late (21 June through 2 September) time periods. For statistical tests, some ages were dropped due to small sample sizes.

The age composition (proportion of ages 1.3 and 1.4) of females was significantly different between the early and late groups ($\chi^2 = 7.66$, df = 1, $P < 0.01$). The age composition (proportion of ages 1.2, 1.3 and 1.4) of males was also significantly different between the two groups ($\chi^2 = 9.52$, df = 2, $P = 0.01$). Therefore data from the inriver return for the two time strata were not pooled.

In the inriver return at the weir, ages 1.4 and 1.3 were predominant among females in both time strata and among males in the early strata (Appendix F1 and F2). Male chinook salmon aged 1.2 appeared during the late strata. The mean length for all chinook salmon in the inriver return sampled at the weir early in the season was 807 mm (Appendix F1). Mean length of chinook salmon in the inriver return at the weir late in the season was 745 mm (Appendix F2).

Table 6.-Catch, harvest, and days fished by angler type and residency of anglers interviewed at the Spit, Lagoon, and weir on the Karluk River, 1993.

	Angler Type		Residency			
	Guided	Unguided	Local	Other AK	Nonresident	Total
Spit						
Number of Anglers	36	55	8	1	81	91 [a]
Effort (Angler days)	36	55	8	1	81	91
Catch	11	9	1	3	16	20
Harvest	7	7	1	3	10	14
Lagoon [b]						
Number of Interviews	30	50	20	7	52	80 [a]
Effort (Angler days)	156	237	92	38	264	393
SE	49	62	26	17	68	91
Catch						262
SE						67
Harvest						186
SE						48
Weir						
Number of Anglers	81	163	27	33	183	244 [a]
Effort (Angler days)	238	850	65	87	923	1,088
Catch	835	2,018	191	153	2,482	2,853
Harvest	108	261	29	26	312	369
Total all sites						
Effort (Angler days)	430	1,142	165	126	1,268	1,572 [a]
SE	49	62	26	17	68	91

[a] Rows may not sum across because angler type and residency were not documented for some anglers.

[b] A roving creel survey was conducted at the Lagoon, therefore some anglers may have been interviewed more than once during their stay at the Lagoon. Catch and harvest were not estimated by angler type for the Lagoon in 1993.

The age compositions (proportion of ages 1.3 and 1.4) of the harvest of anglers interviewed at the river, Lagoon and spit below the weir (Appendix F3) and those interviewed at the weir (Appendix F4) were not significantly different for chinook salmon of either sex ($\chi^2 = 0.03$, df =1, P = 0.86 for females; $\chi^2 = 0.05$, df =1, P = 0.83 for males).

The age composition of the inriver return at the weir was significantly different from the age composition of the sport harvest for both females (ages 1.3 and 1.4, $\chi^2 = 4.37$, df = 1, P = 0.04) and males (ages 1.3 and 1.4, $\chi^2 = 3.99$, df = 1, P = 0.05) for the entire season.

The estimated spawning escapement was 13,575 chinook salmon. This is an overestimate because harvest by anglers who exited at the Portage in 1993 is unknown, as is the number of fish lost due to hook-and-release mortality. The estimated spawning escapement consisted of 6,296 males and 7,278 females for a male/female ratio of 0.9:1.0 (Table 10).

Age, Length and Sex Compositions in 1994

In 1994, age was determined for 258 of 301 chinook salmon sampled from the weir trap at the Karluk River weir. To stratify by time, data were classified into early (10 May through 20 June) and late (21 June through 26 August) time periods.

Age composition (sexes combined, ages 1.1 through 1.5) differed between time strata ($\chi^2 = 16.8$, df = 4, P < 0.01). During both time strata, most females were age 1.4. Most males were age 1.3 and 1.4 during the early stratum, and age 1.2, 1.3, and 1.4 during the late stratum (Appendix G1 and G2). Therefore data from the two time strata were not pooled to estimate age composition. The inriver return at the weir consisted primarily of age 1.4 and 1.3 fish (Table 11).

Table 7.-Distribution of harvest for anglers fishing at the Karluk River, 1993.

	Number of Chinook Salmon Kept During Trip								
	0	1	2	3	4	5	6	>6	Total Anglers
Anglers at the Weir									
Guided Anglers									
Number	13	37	23	7	1	0	0	0	81
Percent	16	46	28	9	1	0	0	0	
Unguided Anglers									
Number	43	25	64	26	0	4	0	1	163
Percent	26	15	39	16	0	2	0	1	
All Anglers									
Number	56	62	87	33	1	4	0	1	244
Percent	23	25	36	14	0	2	0	0	

Mean length of males was 754 mm (SE = 14) during the early stratum and 693 mm (SE = 14) during the late stratum (Appendix G1 and G2). Mean length of females was 805 mm (SE = 5) during the early stratum and 786 mm (SE = 6) during the late stratum (Appendix G1 and G2). Based on a two-way ANOVA, mean length at age did not differ between time strata for age-1.3 fish (F = 1.39; df = 1.48; P = 0.24) or for age-1.4 fish (F = 0.16; df = 1.43; P = 0.69).

Age was determined for 125 of 155 chinook salmon sampled from the sport harvest. Age distribution did not differ between fish sampled from anglers at the Karluk River weir versus those sampled from anglers at the Portage (sexes combined, ages 1.2 through 1.4 only, χ^2 =3.5, df = 2, P=0.18). Therefore data from both locations were pooled to estimate age composition of the harvest. Most harvested females were age-1.4 fish; most males, age-1.3 and 1.4-fish (Appendix G3).

Table 8.-Catch, harvest, and days fished by angler type and residency of anglers interviewed at the weir and Portage on the Karluk River, 1994.

	Angler Type		Residency			
	Guided	Unguided	Local	Other AK	Nonresident	Total[a]
Weir						
Number of Anglers	129	371	61	68	368	506
Effort (Angler days)	222	1,411	131	197	1,299	1,650
Catch	400	3,470	262	375	3,199	3,878
Harvest	107	386	39	68	384	493
Portage						
Number of Anglers	263	98	41	12	309	365
Effort (Angler days)	455	257	70	26	627	725
Catch	1,014	327	69	24	1,255	1,357
Harvest	241	161	52	18	331	403
Total all sites						
Number of Anglers	392	469	102	80	677	871
Effort (Angler days)	677	1,668	201	223	1,926	2,375
Catch	1,409	3,795	331	399	4,454	5,235
Harvest	348	547	91	86	715	896

[a] Rows do not sum across because angler type was unknown for four anglers at the Portage and six anglers at the weir, and residency was unknown for three anglers at the Portage and nine at the weir.

Table 9.-Distribution of harvest for anglers fishing at the Karluk River, 1994.

	Number of Chinook Salmon Kept During Trip								Total
	0	1	2	3	4	5	6	>6	Anglers[a]
Guided Anglers									
Number	181	88	111	11	0	1	0	0	392
Percent	46	22	28	3	0	0	0	0	
Unguided Anglers									
Number	205	91	125	32	7	2	2	5	469
Percent	44	19	27	7	1	0	0	1	
Anglers at the Weir									
Number	238	90	139	33	4	2	0	0	506
Percent	47	18	27	7	1	0	0	0	
Anglers at the Portage									
Number	157	90	97	10	3	1	2	5	365
Percent	43	25	27	3	1	0	1	1	
All Anglers									
Number	395	180	236	43	7	3	2	5	871
Percent	45	21	27	5	1	0	0	1	

[a] Angler type (guided or unguided) was unknown for 10 anglers.

Age composition of the harvest did not differ from that of the inriver return at the weir for the entire season (sexes combined, ages 1.2, 1.3, and 1.4 only, $\chi^2 = 3.78$, df = 2, P = 0.15), however during the late time strata the age composition of males did differ between the harvest and the inriver return (ages 1.2, 1.3, and 1.4: $\chi^2 = 7.06$, df = 2, P=0.03). Estimates of age composition from the sport harvest were subtracted from those for the inriver return to give estimates of spawning escapement by age.

Spawning escapement to the Karluk River was 11,153 chinook salmon. This is a slight overestimate because the number of fish lost due to hook-and-release mortality is unknown. The estimated spawning escapement consisted of 5,812 males and 5,341 females for a male/female ratio of 1.1:1.0 (Table 11).

AYAKULIK RIVER

Effort, and Catch and Harvest of Chinook Salmon in 1993

In 1993, anglers interviewed at the weir on the Ayakulik River harvested 433 chinook salmon out of a catch of 2,394, resulting in a release rate of 82% (Table 12). Anglers expended 598 angler-days of effort. Anglers passing the weir tended to be unguided nonresidents (Table 13).

Table 10.-Estimated inriver return and spawning escapement by age and sex for Karluk River chinook salmon, 1993.

	Age								
	0.4	1.1	1.2	1.3	1.4	1.5	2.3	2.4	Total
Return to Karluk Lagoon									
Females	0	0	101	1,874	5,610	0	0	0	7,585
SE	0	0	70	278	413	0	0	0	420
Males	63	63	1,018	2,388	2,900	63	63	0	6,558
SE	62	44	193	318	343	44	62	0	420
Total	63	63	1,118	4,262	8,511	63	63	0	14,144
SE	62	44	203	385	404	44	62	0	48
Sport Harvest Below Weir									
Females	0	0	6	11	94	0	0	0	111
SE			5	7	15				15
Males	0	0	6	22	61	0	0	0	89
SE			5	9	14				15
Total	0	0	11	33	156	0	0	0	200
SE			7	11	13				48
Inriver Return at Weir									
Females	0	0	95	1,863	5,516	0	0	0	7,474
SE			70	278	413				420
Males	63	63	1,012	2,366	2,839	63	63	0	6,469
SE	62	44	193	318	343	44	62		420
Total	63	63	1,107	4,229	8,355	63	63	0	13,944
SE	62	44	203	385	404	44	62		
Sport Harvest above Weir[a]									
Females	0	0	12	23	161	0	0	0	196
SE			11	15	31				32
Males	0	0	0	35	115	0	0	23	173
SE				18	29			15	32
Total	0	0	12	58	277	0	0	23	369
SE			11	23	27			15	
Spawning Escapement[b]									
Females	0	0	83	1,840	5,355	0	0	0	7,278
SE			71	278	414				421
Males	63	63	1,012	2,331	2,724	63	63	0	6,296
SE	62	44	193	319	344	44	62		421
Total	63	63	1,095	4,171	8,078	63	63	0	13,575
SE	62	44	203	386	405	44	62		

[a] Does not include harvest by anglers who exited the fishery at the Portage.

[b] Slightly overestimated because chinook salmon harvested by anglers who exited at the Portage were not subtracted from the weir escapement, and because loss due to hook-and-release mortality is unknown.

[c] Rows may not sum across because ages that appear only in the harvest above the weir are included only in the total spawning escapement.

Table 11.-Estimated inriver return and spawning escapement by sex and age for Karluk River chinook salmon, 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Inriver Return at Weir										
Females	0	0	58	538	4,729	267	0	36	129	5,756
SE			57.1	154.7	371.1	118.2		34.9	75.4	377.3
Males	0	458	1,129	1,801	2,415	338	58	58	36	6,293
SE		137.3	203.0	267.9	307.0	127.9	57.1	57.1	34.9	377.3
Total	0	458	1,187	2,339	7,144	605	58	93	164	12,049
SE		137.3	210.2	297.2	365.8	171.6	57.1	67.0	82.8	
Sport Harvest above Weir										
Females	0	0	7	36	280	14	7	14	57	416
SE			6.6	14.6	34.4	9.3	6.6	9.3	18.2	37.1
Males	0	14	36	143	251	0	0	14	22	480
SE		9.3	14.6	27.3	33.4			9.3	11.4	37.1
Total	0	14	43	179	530	14	7	29	79	896
SE		9.3	15.9	29.7	36.5	9.3	6.6	13.1	21.1	
Spawning Escapement[a,b]										
Females	0	0	51	502	4,449	253	0	21	72	5,341
SE			57.5	155.4	372.7	118.6		36.1	77.5	379.1
Males	0	444	1,093	1,658	2,164	338	58	44	14	5,812
SE		137.6	203.6	269.3	308.8	127.9	57.1	57.9	36.7	379.1
Total	0	444	1,144	2,160	6,614	591	51	65	86	11,153
SE		137.6	210.8	298.6	367.6	171.9	57.5	68.2	85.5	

[a] Slightly overestimated because loss due to hook-and-release mortality is unknown.

[b] Rows may not sum across because ages that appear in the harvest above the weir but not in the inriver return at the weir are included only in the total for spawning escapement.

Anglers exiting the Ayakulik River at Bare Creek harvested 375 chinook salmon and released 917 (Table 12); effort was 535 angler-days. Nonresidents were predominant at Bare Creek (Table 13).

The total harvest on the Ayakulik River in 1993 was 808 chinook salmon. The release rate of chinook salmon was 78% (Table 12). Anglers expended a total of 1,133 angler-days of effort. Fifteen percent of anglers reported harvesting more than three fish (Table 14). More than three fish can be legally harvested if they are less than 20 inches in length, or if the fish are frozen or consumed (and therefore no longer in possession). Freezers are present at the lodge located at the river mouth, making it possible for anglers at the Ayakulik to increase their harvest. In addition to chinook salmon, anglers caught sockeye salmon, steelhead and rainbow trout, and Dolly Varden from the Ayakulik River in 1993 (Table 15).

Table 12.-Sport fishing effort, and catch and harvest of chinook salmon from the Ayakulik River, 1993 and 1994.

Location	Effort (Angler Days)	Catch	Harvest
1993			
Weir	598	2,394	433
Bare Creek	535	1,292	375
Total	1,133	3,686	808
1994			
Weir	926	2,375	477
Bare Creek	607	1,116	262
Total	1,533	3,491	739

Table 13.-Catch, harvest, and days fished by angler type and residency of anglers interviewed at the Ayakulik River, 1993.

	Angler Type		Residency			
	Guided	Unguided	Local	Other AK	Nonresident	Total[a]
Weir						
Number of Anglers	50	100	34	17	86	150
Effort (Angler days)	249	349	71	99	387	598
Catch	1,436	958	273	221	1,741	2,394
Harvest	318	115	33	32	335	433
Bare Creek						
Number of Anglers	141	120	60	22	177	261
Effort (Angler days)	143	392	131	78	322	535
Catch	455	837	314	136	839	1,292
Harvest	160	215	91	42	240	375
Total all sites						
Number of Anglers	191	220	94	39	263	411
Effort (Angler days)	392	741	202	177	709	1,133
Catch	1,891	1,795	587	357	2,580	3,686
Harvest	478	330	124	74	575	808

[a] Rows may not sum across because angler type and residency were not documented for some anglers.

Table 14.-Distribution of harvest for anglers fishing at the Ayakulik River, 1993.

	Number of Chinook Salmon Kept During Trip								Total
	0	1	2	3	4	5	6	>6	Anglers
Guided Anglers									
Number	55	19	73	5	2	2	6	29	191
Percent	29	10	38	3	1	1	3	15	
Unguided Anglers									
Number	75	46	52	27	13	2	2	3	220
Percent	34	21	24	12	6	1	1	1	
Anglers at the Weir									
Number	47	24	20	12	8	3	7	29	150
Percent	31	16	13	8	5	2	5	19	
Anglers at Bare Cr.									
Number	83	41	105	20	7	1	1	3	261
Percent	32	16	40	8	3	0	0	1	
All Anglers									
Number	130	65	125	32	15	4	8	32	411
Percent	32	16	30	8	4	1	2	8	

Table 15.-Catch and harvest of sockeye salmon, steelhead and rainbow trout, and Dolly Varden from the Ayakulik River, 1993 and 1994.

	Sockeye Salmon		Steelhead/Rainbow Trout		Dolly Varden	
Location	Catch	Harvest	Catch	Harvest	Catch	Harvest
1993						
Weir	549	154	200	0	82	2
Bare Creek	368	168	92	0	73	6
Total	917	322	292	0	155	8
1994						
Weir	1,117	351	178	3	59	4
Bare Creek	645	207	222	2	122	2
Total	1,762	558	400	5	181	6

Effort, and Catch and Harvest of Chinook Salmon in 1994

In 1994, anglers passing the Ayakulik River weir and those at the lodge harvested 477 chinook salmon out of a catch of 2,375 (Table 12). These anglers expended 926 angler-days of effort. As in 1993, anglers passing the weir in 1994 tended to be unguided nonresidents (Table 16).

Anglers exiting the fishery at Bare Creek harvested 262 chinook salmon out of a catch of 1,116 (Table 12). These anglers expended 607 angler-days of fishing effort. As in 1993, most anglers at Bare Creek were nonresidents (Table 16).

Total harvest on the Ayakulik River was 739 chinook salmon, with a release rate of 79%. Anglers expended 1,533 angler-days of effort (Table 12). Eleven percent of anglers reported harvesting more than the possession limit (Table 17). Anglers caught sockeye salmon, steelhead, rainbow trout, and Dolly Varden in addition to chinook salmon in 1994 (Table 15).

Age, Length and Sex Compositions in 1993

Ages were determined for 245 chinook salmon in the Ayakulik River inriver return sampled from the weir trap. The age composition of fish sampled early in the season (15 May through 20 June)

Table 16.-Catch, harvest, and days fished by angler type and residency of anglers interviewed at the Ayakulik River, 1994.

	Angler Type		Residency			
	Guided	Unguided	Local	Other AK	Nonresident	Total[a]
Weir						
Number of Anglers	50	153	43	39	119	203
Effort (Angler days)	246	680	196	175	551	926
Catch	1,105	1,270	407	183	1,782	2,375
Harvest	242	235	63	50	361	477
Bare Creek						
Number of Anglers	133	140	49	24	198	273
Effort (Angler days)	197	410	88	69	443	607
Catch	694	422	58	54	996	1,116
Harvest	124	138	27	19	216	262
Total both sites						
Number of Anglers	183	293	92	63	317	476
Effort (Angler days)	443	1,090	284	244	994	1,533
Catch	1,799	1,692	465	237	2,778	3,491
Harvest	366	373	90	69	577	739

[a] Rows may not sum across because angler type and residency were not documented for some anglers.

Table 17.-Distribution of harvest for anglers fishing at the Ayakulik River, 1994.

	Number of Chinook Salmon Kept During Trip								Total
	0	1	2	3	4	5	6	>6	Anglers
Guided Anglers									
Number	66	44	23	15	9	1	10	15	183
Percent	36	24	13	8	5	1	5	8	
Unguided Anglers									
Number	114	58	72	35	8	2	4	0	293
Percent	39	20	25	12	3	1	1	0	
Anglers at the Weir									
Number	50	43	40	27	11	3	14	15	203
Percent	25	21	20	13	5	1	7	7	
Anglers at Bare Cr.									
Number	130	59	55	23	6	0	0	0	273
Percent	48	22	20	8	2	0	0	0	
All Anglers									
Number	180	102	95	50	17	3	14	15	476
Percent	38	21	20	11	4	1	3	3	

was significantly different from the age composition of fish sampled late in the season (21 June through 6 July) for males ages 1.3, 1.4 and 1.5 ($\chi^2 = 14.22$, df = 2, $P < 0.01$), but not for females ages 1.4 and 1.5, ($\chi^2 = 0.95$, df = 1, P = 0.33). Therefore data from the two time strata were not pooled to estimate age composition. Age 1.4 was the predominant age for females in the inriver return during both time strata. Ages 1.2 and 1.4 were the predominant ages for males early in the season; ages 1.2 and 1.3 late in the season (Appendix H1 and H2). Mean length of all fish during the early strata was 746 mm, during the late strata was 646 mm (Appendix H1 and H2).

Ages were determined for 260 chinook salmon from the Ayakulik River sport harvest. The age composition of fish harvested by anglers at the weir was not significantly different from the age composition of fish harvested by anglers at Bare Creek for either males or females (females ages 1.4 and 1.5: $\chi^2 = 0.16$, df = 1, P = 0.69; males ages 1.3, 1.4, and 1.5: $\chi^2 = 0.71$, df = 2, P = 0.70). Therefore, data from the entire sport fishery was pooled to estimate age composition of the sport harvest. The chinook salmon harvested in the sport fishery were ages 1.4 for females, and ages 1.2, 1.3, and 1.4 for males (Appendix H3).

The age composition of the sport harvest was significantly different from the age composition of the inriver return at the weir for late season males (ages 1.2, 1.3, and 1.4; $\chi^2 = 9.18$; df = 2; P = 0.01) and for late season sexes combined (ages 1.2-1.5, $\chi^2 = 16.43$, df = 3, P < 0.01).

Estimates of age composition from the sport harvest were subtracted from those for the inriver return to give estimates of spawning escapement by age. Spawning escapement for Ayakulik River chinook salmon in 1993 was 7,011, with ages 1.4 and 1.2 the most abundant age classes, followed by ages 1.5 and 1.3 (Table 18). The estimated spawning escapement consisted of 4,857 males and 2,155 females for a male/female sex ratio of 2.3:1.0.

Table 18.-Estimated inriver return at the weir, sport harvest, and spawning escapement by age and sex for Ayakulik River chinook salmon, 1993.

	Age										
	0.4	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	Total
Inriver Return at Weir											
Females	0	0	0	133	1,712	691	0	0	0	0	2,536
SE				75	226	159					254
Males	0	51	2,122	1,215	1,327	568	0	0	0	0	5,283
SE		28	227	185	207	147					254
Total	0	51	2,122	1,348	3,039	1,259	0	0	0	0	7,819
SE		28	227	196	262	205					
Sport Harvest above Weir											
Females	0	0	0	25	270	87	0	0	0	0	382
SE				7	19	13					21
Males	0	6	140	99	131	40	9	0	0	0	426
SE		4	16	14	15	9	4				21
Total	0	6	140	124	401	127	9	0	0	0	808
SE		4	16	15	21	15	4				
Spawning Escapement[a,b]											
Females	0	0	0	108	1,442	604	0	0	0	0	2,154
SE			0	75	227	160					255
Males	0	45	1,982	1,116	1,196	528	0	0	0	0	4,857
SE		28	228	186	208	147					255
Total	0	45	1,982	1,224	2,638	1,132	0	0	0	0	7,011
SE		29	231	200	267	298					

[a] Slightly overestimated because loss due to hook-and-release mortality is unknown.

[b] Rows may not sum across because ages that appear only in the harvest above the weir are included only in the totals.

Age, Length and Sex Compositions in 1994

Age was determined for 258 of 331 chinook salmon sampled from the inriver return at the Ayakulik River weir in 1994. To stratify by time, the data were classified into early (21 May through 20 June) and late (21 June through 24 August) time periods. Age composition differed between time strata for ages 1.1 through 1.5 (χ^2 = 37.0, df = 4, P < 0.01). Most females were age 1.4 during both strata. Males were mostly ages 1.3 and 1.4 during the early stratum, but ages 1.1, 1.2, 1.3, and 1.4 during the late stratum (Appendix I1 and I2). Therefore data from the two time strata were not pooled to estimate age composition.

Mean length of males was 718 mm (SE = 15) during the early stratum and 601 mm (SE = 16) during the late stratum (Appendix I1 and I2). Mean length of females was 789 mm (SE = 5) during the early stratum and 768 mm (SE = 6) during the late stratum (Appendix I1 and I2). Based on a two-way ANOVA, mean length at age did not differ between time strata for age-1.3 fish (F = 1.57; df = 1,59; P = 0.22) or for age-1.4 fish (F = 1.29; df = 1,12; P = 0.26).

Age was determined for 326 of 426 chinook salmon sampled from the sport harvest. Age distribution did not differ between fish sampled from anglers interviewed at the weir versus those interviewed at Bare Creek (sexes combined, ages 1.2 through 1.4 only, χ^2 = 1.8, df = 2, P = 0.40). Sex composition did differ by location (χ^2 = 27.6, df = 1, P < 0.01), with approximately 60% of the harvest being females at Bare Creek versus only 34% females at the weir. However, the age samples were almost perfectly weighted to the harvest. Bare Creek accounted for 35.5% of the harvest and 35.6% of the fish sampled. Therefore data from both locations were pooled to estimate age composition of the harvest. Harvested females were primarily age 1.4 and harvested males primarily ages 1.3 and 1.4 (Appendix I3).

Age composition of the harvest did not differ from that of the inriver return (sexes combined, ages 1.2, 1.3, and 1.4 only, χ^2 = 1.89, df = 2, P=0.39). However, there was a difference in sex composition, with females comprising approximately 44% of the harvest, versus 34% of the inriver return (χ^2 = 8.3, df = 1, P=0.004). Estimates of age composition from the sport harvest were subtracted from those for the inriver return to give estimates of spawning escapement by age.

Of the 9,138 chinook salmon that migrated through the weir 52% were age 1.4, 25% were age 1.3, 11% were age 1.1 and 11% were age 1.2. After subtracting the sport harvest, 8,399 fish were left in the river to spawn. The estimated spawning escapement consisted of 5,219 males and 3,180 females (Table 19) for a male/female sex ratio of 1.6:1.0.

CHIGNIK RIVER

Age, Length and Sex Compositions in 1993

The commercial purse seine catch in Chignik Lagoon was sampled and assumed to be representative of the river escapement. Age composition changed significantly over time (sexes combined; ages 1.2, 1.3, and 1.4 only; χ^2 = 10.14; df = 2; P < 0.01) with the age composition of both sexes shifting towards younger fish late in the season (Appendix J1 and J2). Based on the age composition of scales collected in the commercial fishery from 20 June through 7 July, the age composition of the entire return through 7 July was estimated (Appendix J1). The escapement at the weir for the early run includes the counted weir escapement (724) plus an

Table 19.-Estimated inriver return at the weir, sport harvest, and spawning escapement by age and sex for Ayakulik River chinook salmon, 1994.

	Age										
	0.4	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	Total
Inriver Return at Weir											
Females	0	0	28	515	2,809	143	0	0	0	0	3,494
SE			27.0	134.9	263.3	71.56					274.5
Males	0	988	946	1,724	1,958	28	0	0	0	0	5,644
SE		151.6	167.6	224.5	237.7	27.04					274.5
Total	0	988	974	2,239	4,767	170	0	0	0	0	9,138
SE		151.6	169.1	247.7	275.5	76.36					
Sport Harvest above Weir											
Females	0	0	2	39	231	25	0	0	2	16	315
SE			1.7	6.8	13.8	5.517			1.7	4.4	14.6
Males	2	16	64	163	172	2	0	0	2	2	424
SE	1.7	4.4	8.5	12.7	12.7	1.695			0.0	1.7	14.6
Total	2	16	66	202	403	27	0	0	5	18	739
SE	1.7	4.4	8.7	13.6	15.2	5.757			2.4	4.6	
Spawning Escapement[a,b]											
Females	0	0	25	477	2,578	118	0	0	0	0	3,180
SE			27.1	135.0	263.7	71.8					274.9
Males	0	972	883	1,560	1,786	25	0	0	0	0	5,219
SE		151.6	167.8	224.9	238.0	27.1					274.9
Total	0	972	908	2,037	4,363	143	0	0	0	0	8,399
SE		29.3	230.7	199.7	267.0	298.1					

[a] Slightly overestimated because loss due to hook-and-release mortality is unknown.

[b] Rows may not sum across because ages that appear only in the harvest above the weir are included only in the totals.

estimate of 1.1- and 1.2-age chinook salmon which were too small to be counted as chinook salmon at the weir. Age 1.1 and 1.2 comprised 8.1% of the sampled fish in the commercial harvest. Increasing the weir escapement by 8.1% (64) results in an estimated escapement at the weir of 788. The commercial harvest from the Lagoon through 7 July (2,092) was also added to calculate the entire early return (2,880).

The age composition of the entire return after 7 July was estimated based on scales collected from the commercial fishery 8 July through 4 August (Appendix J2). The escapement at the weir for the late run includes the counted weir escapement (1,222) plus a 26.3% adjustment for uncounted age 1.1 and 1.2 chinook salmon (436), to give a total estimated escapement at the weir

of 1,658. The commercial harvest from the Lagoon after 7 July (3,148) was also added to calculate the entire late return (4,806).

The entire return for the season was estimated to be 7,577 chinook salmon (Table 20). The male/female sex ratio was 0.54:1.0. The dominant age class was 1.4 (50%) followed by ages 1.3 (26%), 1.2 (18%), 1.5 (4%) and 1.1 (2%).

Age, Length and Sex Compositions in 1994

Age and sex were determined for 139 of 174 chinook salmon sampled from the Chignik Lagoon commercial fishery. Age composition did not differ between fish sampled 26 June through 7 July versus fish sampled 10 July through 10 August (ages 1.2, 1.3 and 1.4 only, $\chi^2 = 0.57$, df = 2, P = 0.75). Therefore the return was not stratified by time to estimate overall age composition. Most female chinook salmon were ages 1.3 and 1.4; most males were also ages 1.3 and 1.4, with some ages 1.1 and 1.2 (Appendix K1). Mean length of female chinook salmon (Appendix K1) was 780 mm (SE = 10); males, 760 mm (SE = 16).

In 1994, all chinook salmon passing the weir were counted. Total return to the Chignik River was 4,824 chinook salmon (commercial harvest from Chignik Lagoon was 1,808 chinook salmon; escapement through the weir was 3,016 chinook salmon). Age composition of the escapement was assumed to be the same as that of the commercial harvest. Approximately 50% of the total return was age 1.3 and 36% was age 1.4 (Table 21). The male/female sex ratio was 0.96:1.0.

Table 20.-Estimated total return of chinook salmon to Chignik River and Lagoon by age and sex, 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Total Return	0	0	537	1,375	2,715	285	0	0	0	4,911
SE Total Return			163	235	283	108				289
Males:										
Total Return	0	117	813	645	1,089	0	0	0	0	2,666
SE Total Return			193	169	208		0	0		289
All:										
Total Return	0	117	1,350	2,020	3,805	285	0	0	0	7,577
SE Total Return			253	290	351					

Table 21.-Estimated total return of chinook salmon to Chignik River and Lagoon by age and sex, 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Total Return	0	0	69	1,284	1,006	0	0	69	35	2,464
SE Total Return			48	178	164			48	34	202
Males:										
Total Return	0	139	243	1,111	729	69	0	35	35	2,360
SE Total Return		67	88	170	144	48		34	34	202
All:										
Total Return	0	139	312	2,395	1,735	69	0	104	69	4,824
SE Total Return			100	246	218			59	48	

DISCUSSION

The primary objective of this project is to estimate the age and sex composition of the chinook salmon returns to the Karluk, Ayakulik, and Chignik rivers to refine escapement goals through the construction of brood tables. To accomplish this goal, we need to sample chinook salmon returning to each river for age and sex and estimate the number of spawners in each river each year.

Weir counts on the Karluk and Ayakulik rivers are obtained by visually counting all fish, and represent the actual number of fish which migrated upstream (unlike estimates made using other enumeration methods such as aerial surveys or sonar counts). Having an actual number for a major component of the return will help in achieving an accurate estimate of the total return. However, weir escapements represent only a portion of the Karluk and Ayakulik returns as a mixed-stock commercial fishery harvests Karluk- and Ayakulik-bound chinook salmon. Chinook salmon harvested in this fishery are bound for the Karluk and Ayakulik rivers and probably streams outside of the Kodiak area as well. Immature or feeder chinook salmon are also harvested. The unknown contribution of Karluk- and Ayakulik-bound chinook salmon to the commercial harvest, in numbers of fish and by age and sex, adds a source of error in determining the size and biological characteristics of the total returns.

On the Karluk River, weir escapements of 13,944 and 12,049 (Table 1) were sampled in 1993 and 1994, respectively. Table 2 shows that the commercial harvest of chinook salmon along the west side of Kodiak Island (Uganik Bay to Tanner Head) from 1 June through 15 July was 11,675 and 9,967 in 1993 and 1994, respectively. It is clear that the Karluk weir escapement represents the largest component of the total Karluk return as the escapement through the Karluk River weir was larger than the entire mixed-stock fishery both in 1993 and 1994. This is also true for the Ayakulik River, where over the past 10 years river escapements have exceeded the entire mixed-stock commercial harvest eight times. We need to determine whether sampling the largest component of the return without sampling minor components will allow construction of brood tables that will be accurate enough to develop effective escapement goals.

If arbitrarily dividing the mixed-stock harvest between the Karluk and Ayakulik rivers based on geographic proximity, and assuming the age composition of the harvest is the same as the escapement, introduces too large an error into estimating the total return, then the mixed-stock commercial harvest should be sampled. This effort should include sampling the harvest both for the presence of coded wire tags (CWTs) and for age, sex, and size information. The commercial harvest in the entire Kodiak area was monitored for CWTs in 1994. Hatchery contribution (mainly from British Columbia) accounted for approximately 30% of the commercial chinook salmon harvest. Subtracting fish of known origin from the mixed-stock fishery harvest will reduce bias in estimating the commercial harvest of chinook salmon returning to the Karluk and Ayakulik rivers. Knowing the age, sex, and size characteristics of the harvest may also allow for more accurate estimation of the return to each river.

In addition to establishing a sampling program to define the age and brood-year composition of the return, we also need to determine the number of fish that actually spawn. This is a crucial element because the main goal of this project is to evaluate the returns produced by different spawning escapements. Spawning escapement is calculated by subtracting the sport harvest and hook-and-release mortality above the weir from the inriver return at the weir.

In 1993 and 1994 complete censuses were performed on the Ayakulik River by the USFWS, and harvests were documented at 808 and 739 fish, respectively. This compares with estimated harvests from the statewide postal survey of 1,004 and 948, respectively, for the same years (Mills 1994, Howe et al. 1995). The difference between the creel census and postal survey was approximately 200 fish in each year. The difference between these two estimates is so small (the estimates in 1993 are not statistically different and are within one standard error of each other), and the sport harvest is so small relative to escapements that have averaged about 12,000 chinook salmon over the past 10 years, that it is not necessary to continue a creel census on this fishery.

On the Karluk River, the most complete creel estimate was obtained in 1994, when the Portage exit area was censused as well as rafters at the weir. The documented harvest of 896 compares to a postal estimate of 1,483 (Howe et al. 1995), a difference of 587 fish. The postal survey included chinook salmon that were harvested in the Lagoon, so this harvest estimate should be greater than the creel census which did not include harvest in the Lagoon. Again, the estimated sport harvest and the difference between the two sport harvest estimates is small compared to inriver returns which have averaged 10,500 fish over the past 10 years (Table 1.)

Virtually all of the sport harvest at the Ayakulik River and most of the sport harvest at the Karluk River occurs above the weir. Therefore, spawning escapements in the future should be estimated by subtracting postal survey estimates from the weir counts. There are two problems associated with this method: mortality associated with released fish, and the postal survey estimate for the Karluk River includes harvest which occurs in the Lagoon before these fish are counted through the weir.

The postal survey estimated 6,700 and 2,200 sport-caught chinook salmon were released in the Karluk River in 1993 and 1994, respectively (Mills 1994, Howe et al. 1995). Some of these fish died due to wounds received from hooks or from handling. Research done on the Kenai River indicated that approximately 7% of released chinook salmon died due to hooking or handling after being released (Bendock and Alexandersdottir 1992). If a 7% mortality rate is applied to the release estimates for the Karluk River, then 470 and 150 less fish would have spawned in 1993 and 1994, respectively. The loss to hook-and-release mortality is probably very small relative to the total return. Research to define the specific mortality rate in the Karluk River is not warranted. Applying existing estimates from the Kenai River to spawning escapement estimates for the Karluk River would adequately address this mortality factor.

Subtracting the postal survey harvest estimates for Karluk River and Lagoon from the weir count to estimate spawning escapement also introduces some bias because some of the sport harvest occurs in the Lagoon before the fish are counted at the weir. In 1993 the postal survey estimated a sport fish harvest of 1,634 from the Karluk River and Lagoon. The creel survey that was conducted that year estimated 186 fish were harvested from the Lagoon. It is not cost effective to continue doing creel surveys in the Lagoon to adjust the spawning escapement by as little as 100 to 200 fish. Bias introduced by such a small harvest is insignificant in comparison to the size of the inriver return.

For Chignik River chinook salmon, the return is calculated by adding the Chignik River weir count to the commercial chinook salmon harvest from Chignik Lagoon. Chignik Lagoon is considered a terminal harvest area because of its geographical features, and the problems associated with estimating a harvest in a mixed-stock fishery do not occur here. However, at least two problems are associated with calculating the total return. Some of the chinook salmon entering the Chignik River hold in the lower river and are never counted at the weir, and there is a mixed-stock commercial fishery that occurs in fishing districts outside of Chignik Lagoon which may harvest chinook salmon of Chignik River origin.

The Chignik River weir is located approximately 3 miles upriver from the bay. The entire river is approximately 7 miles long. Some chinook salmon never go through the weir and hold and spawn in the lower river. These fish cannot be counted from the air because the water is too deep and murky. The intuitive feeling of the area manager who lives at the weir site is that about 75% of chinook salmon that enter the river pass through the weir and are counted (Dave Owen, Chignik Area Management Biologist, ADF&G, Kodiak, personal communication). This guess is based on sport fishing success and the number of chinook salmon that can be seen when skiffing over certain sections of the lower river. The manager also feels that the number of chinook salmon that hold in the lower river changes greatly from year to year. Similar to the discussion for the Karluk and Ayakulik rivers, we need to evaluate if the weir count and the terminal harvest in Chignik Lagoon represent a large enough percentage of the total return to develop accurate

brood tables. If we determine that it is advantageous to increase the accuracy of our total return estimate then we should consider attempting to estimate the number of chinook salmon that do not pass through the weir.

The commercial harvest of chinook salmon that occurs in the districts outside of Chignik Lagoon must also be addressed. These fisheries harvest fish of mixed origin. The only chinook salmon return on the Alaska Peninsula from Unimak Island to Cape Douglas, a distance of over 500 miles, is the return to the Chignik River, which has averaged a weir count of 4,000 fish since 1990. The commercial harvest of chinook salmon for this same area and time period averaged 23,000. These geographic areas are known migratory routes for salmon and it is quite likely that the percentage of Chignik-bound chinook salmon harvested in these areas is small. If it is necessary to research the stock composition of this harvest further several things can be done. Simply comparing average weights of chinook salmon from Chignik Lagoon with the outside districts may show that the outside harvest is made up predominantly of immature or feeder chinook salmon and are not of local origin. A sampling program to look for CWTs and document age composition, as described for the west side of Kodiak Island, could also be conducted.

Finally, a factor to consider for all locations when evaluating size of returns is the quality of the escapement in terms of egg deposition. For example, the 1993 spawning escapement in the Ayakulik River was estimated to be 7,011 chinook salmon (Table 18). However, there were only an estimated 2,154 spawning females present. The type of return that this escapement generates will probably be different than the same size escapement with a one to one sex ratio. An escapement of 7,011 fish with a one-to-one sex ratio would have 3,500 spawning females, a 62% increase in the number of spawning females from that actually observed.

RECOMMENDATIONS

To construct brood tables and evaluate returns produced by spawning escapements, it will be necessary to continue to sample inriver returns for size, sex, and age composition.

We must decide if additional research to determine stock composition and biological characteristics of the mixed-stock commercial harvest is needed to produce accurate total return brood tables.

Estimates of harvest from the onsite creel surveys and census conducted in 1993 and 1994 and the statewide postal harvest survey were in close agreement. It is not necessary to continue creel surveys to accurately estimate spawning escapement size, and these surveys should be discontinued due to their cost. Spawning escapement can be estimated by subtracting the statewide postal harvest survey estimate of harvest from the weir counts.

It is not necessary to continue sampling the sport harvest for age composition. The only age sampling needed is at the weir so that the contribution of each brood year to the inriver return can be determined. The age composition of the sport harvest is not needed for the construction of total return brood tables. The sport harvest should, however, be sampled for sex composition. This information is needed to define the quality of each spawning escapement in terms of egg deposition.

Finally, quality control during sampling should be maintained so that accurate data can be obtained. It is especially important that technicians sampling inriver returns at the weir traps are trained to accurately identify the sex of sampled fish. Additionally, crews sampling the commercial purse seine catch from Chignik Lagoon should work closely with cannery personnel to insure that no chinook salmon caught outside of Chignik Lagoon are sampled.

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APPENDIX A. COMMERCIAL HARVEST OF CHINOOK SALMON FROM THE WEST SIDE OF KODIAK ISLAND BY STATISTICAL AREA, 1985-1994

Appendix A1.-Commercial harvests of chinook salmon (numbers of fish) from the west side of Kodiak Island by statistical area, 1 June through 15 July, 1985-1994.

Statistical Area	1985	1986	1987	1988	1989[a]	1990	1991	1992	1993	1994
253-11 (Uganik)	22	26	14	97	0	147	34	756	592	565
254-40 (Spiridon)	19	25	20	173	0	120	94	556	929	902
254-30 (Zachar)	147	51	24	173	0	299	57	61	749	143
254-10 (Rocky Point)	36	172	325	429	0	160	331	1,011	1,587	1,767
255-20	5	69	122	3	0	0	0	207	1,957	1,482
255-10 (Karluk)		473	192	0	0	0	0	57	1,125	3,632
256-40 (Sturgeon)	8	28	28	74	0	22	1	39	0	0
256-30 (Halibut Bay)	46	29	22	838	0	0	22	155	348	0
256-25 (Gurney Bay)		13	60	92	0	15	206	261	283	0
256-20 (N. Ayakulik)	3,043	1,785	729	2,257	0	5,332	4,685	4,909	2,715	0
256-10 (S. Ayakulik)	2	23	0	300	0	72	103	5	24	0
257-10 (Sukhoi)	10	2	0	0	0	4	1	1	1	43
257-20 (Tannerhead)	68	39	18	357	0	362	526	659	1,365	1,433
Total number of fish	3,406	2,735	1,554	4,794	0	6,533	6,060	8,677	11,675	9,967
Average Weight (lbs)	20	15	16	17		15	17	16	13	15

Source: Commercial catch numbers extracted from ADF&G, CFMD Statewide Harvest Receipt (fish ticket) database.

[a] There was no commercial harvest in 1989 due to the *Exxon Valdez* oil spill.

APPENDIX B. KARLUK RIVER CHINOOK SALMON WEIR COUNTS, 1984-1994

Appendix B1.-Daily immigration of chinook salmon through the Karluk River weir, 1984-1994.

	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
20-May	0	0.0	0	0.0	0	0.0	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	33	0.3	0.0
21-May	0	0.0	0	0.0	0	0.0	13	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	45	0.4	0.0
22-May	0	0.0	0	0.0	0	0.0	21	0.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	65	0.5	0.1
23-May	12	0.2	1	0.0	0	0.0	31	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	128	1.1	0.1
24-May	83	1.1	3	0.1	3	0.1	74	0.9	0	0.0	4	0.0	0	0.0	0	0.0	0	0.0	0	0.0	142	1.2	0.3
25-May	186	2.4	7	0.1	5	0.1	122	1.5	0	0.0	12	0.1	0	0.0	0	0.0	0	0.0	56	0.4	223	1.9	0.6
26-May	205	2.6	17	0.3	8	0.2	145	1.8	5	0.0	30	0.3	0	0.0	5	0.0	0	0.0	96	0.7	267	2.2	0.7
27-May	332	4.3	17	0.3	10	0.2	181	2.3	26	0.2	62	0.6	0	0.0	126	0.9	1	0.0	212	1.5	331	2.7	1.2
28-May	551	7.1	65	1.2	13	0.3	258	3.3	27	0.2	87	0.8	0	0.0	202	1.4	28	0.3	320	2.3	405	3.4	1.8
29-May	745	9.6	120	2.2	19	0.4	287	3.6	41	0.3	130	1.2	42	0.3	301	2.1	63	0.7	438	3.1	489	4.1	2.5
30-May	907	11.7	156	2.9	38	0.9	347	4.4	89	0.7	165	1.6	278	1.9	386	2.8	89	0.9	714	5.1	540	4.5	3.4
31-May	1,123	14.5	173	3.2	53	1.2	394	5.0	105	0.8	210	2.0	537	3.7	478	3.4	183	1.9	971	7.0	635	5.3	4.4
1-Jun	1,345	17.4	216	4.0	99	2.2	419	5.3	157	1.2	305	2.9	646	4.5	570	4.1	270	2.8	1,517	10.9	743	6.2	5.6
2-Jun	1,534	19.8	258	4.8	152	3.4	515	6.5	276	2.1	451	4.3	1,090	7.5	700	5.0	405	4.2	1,943	13.9	855	7.1	7.2
3-Jun	1,933	25.0	322	6.0	202	4.6	638	8.0	319	2.4	524	5.0	1,311	9.1	1,310	9.3	529	5.5	2,233	16.0	1,204	10.0	9.2
4-Jun	2,126	27.4	362	6.8	319	7.2	730	9.2	409	3.1	580	5.5	1,586	11.0	1,545	11.0	601	6.3	2,559	18.4	1,459	12.1	10.7
5-Jun	2,352	30.4	439	8.2	430	9.7	813	10.3	521	3.9	824	7.9	1,943	13.5	1,879	13.4	818	8.5	3,206	23.0	1,835	15.2	13.1
6-Jun	2,628	33.9	515	9.6	479	10.8	1,075	13.6	641	4.8	978	9.3	2,429	16.8	2,199	15.7	985	10.3	3,405	24.4	2,000	16.6	15.1
7-Jun	2,875	37.1	605	11.3	606	13.7	1,186	15.0	761	5.7	1,241	11.8	2,969	20.6	2,675	19.1	1,148	12.0	3,852	27.6	2,206	18.3	17.5
8-Jun	3,073	39.7	648	12.1	659	14.9	1,259	15.9	818	6.1	1,419	13.5	3,433	23.8	3,119	22.2	1,365	14.2	4,453	31.9	2,614	21.7	19.6
9-Jun	3,606	46.5	864	16.1	724	16.3	1,432	18.1	1,107	8.3	1,705	16.3	4,456	30.9	3,744	26.7	1,699	17.7	4,917	35.3	2,869	23.8	23.3
10-Jun	4,144	53.5	968	18.1	828	18.7	1,476	18.6	1,655	12.4	1,976	18.8	5,432	37.6	3,967	28.3	1,947	20.3	5,399	38.7	3,114	25.8	26.4
11-Jun	4,386	56.6	1,105	20.6	951	21.5	1,660	20.9	2,139	16.0	2,299	21.9	5,810	40.2	4,318	30.8	2,329	24.3	5,833	41.8	3,467	28.8	29.4
12-Jun	4,592	59.3	1,308	24.4	1,209	27.3	1,841	23.2	2,369	17.8	2,555	24.4	6,631	45.9	5,160	36.8	2,857	29.8	6,187	44.4	4,198	34.8	33.5
13-Jun	4,800	62.0	1,452	27.1	1,291	29.1	1,963	24.8	3,106	23.3	2,954	28.2	6,825	47.3	5,627	40.1	3,259	33.9	6,705	48.1	4,709	39.1	36.6
14-Jun	4,913	63.4	1,806	33.7	1,347	30.4	2,402	30.3	3,608	27.1	3,277	31.3	7,321	50.7	5,935	42.3	3,705	38.6	7,161	51.4	5,245	43.5	40.2
15-Jun	5,193	67.0	1,989	37.1	1,628	36.8	2,581	32.5	4,141	31.0	3,591	34.3	7,598	52.6	6,350	45.3	4,093	42.6	7,411	53.1	5,774	47.9	43.7
16-Jun	5,410	69.8	2,091	39.0	1,869	42.2	2,749	34.7	5,158	38.7	4,058	38.7	7,919	54.8	6,893	49.2	4,527	47.2	7,542	54.1	6,304	52.3	47.3
17-Jun	5,643	72.8	2,336	43.6	2,082	47.0	2,832	35.7	5,663	42.5	4,471	42.6	8,070	55.9	7,187	51.3	4,893	51.0	7,995	57.3	6,645	55.1	50.4
18-Jun	5,938	76.6	2,503	46.7	2,255	50.9	3,110	39.2	6,277	47.1	5,071	48.4	8,361	57.9	7,916	56.5	5,233	54.5	8,290	59.5	6,971	57.9	54.1

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Appendix B1.-Page 2 of 4.

	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
19-Jun	6,051	78.1	2,618	48.8	2,537	57.3	3,674	46.3	6,869	51.5	5,477	52.2	8,949	62.0	8,449	60.3	5,609	58.4	8,935	64.1	7,143	59.3	58.0
20-Jun	6,125	79.1	2,773	51.7	2,764	62.4	3,882	49.0	7,434	55.7	5,649	53.9	9,576	66.3	8,769	62.5	5,988	62.4	9,250	66.3	7,464	61.9	61.0
21-Jun	6,212	80.2	2,911	54.3	2,867	64.7	4,285	54.0	7,743	58.1	6,145	58.6	10,183	70.5	9,313	66.4	5,274	54.9	9,568	68.6	7,816	64.9	63.2
22-Jun	6,366	82.2	3,099	57.8	2,993	67.6	4,511	56.9	8,210	61.6	6,749	64.4	10,820	74.9	9,753	69.6	6,542	68.1	9,965	71.5	8,194	68.0	67.5
23-Jun	6,508	84.0	3,284	61.2	3,186	71.9	4,724	59.6	8,854	66.4	7,022	67.0	11,383	78.8	10,145	72.4	6,803	70.9	10,526	75.5	8,373	69.5	70.6
24-Jun	6,655	85.9	3,398	63.4	3,444	77.8	4,838	61.0	9,317	69.9	7,486	71.4	11,845	82.0	10,596	75.6	6,991	72.8	10,721	76.9	8,645	71.7	73.5
25-Jun	6,796	87.7	3,501	65.3	3,669	82.8	5,155	65.0	10,220	76.6	7,799	74.4	12,210	84.5	11,001	78.5	7,184	74.8	11,008	78.9	9,014	74.8	76.7
26-Jun	6,905	89.1	3,716	69.3	3,898	88.0	5,592	70.5	10,593	79.4	8,049	76.8	12,570	87.0	11,380	81.2	7,487	78.0	11,325	81.2	9,205	76.4	79.7
27-Jun	6,978	90.1	3,902	72.8	3,977	89.8	5,950	75.0	11,157	83.7	8,303	79.2	12,876	89.2	11,638	83.0	7,779	81.0	11,505	82.5	9,648	80.1	82.4
28-Jun	7,078	91.4	4,016	74.9	4,036	91.1	6,057	76.4	11,511	86.3	8,477	80.9	13,075	90.5	11,892	84.8	7,968	83.0	11,668	83.7	9,835	81.6	84.1
29-Jun	7,153	92.3	4,137	77.2	4,112	92.8	6,200	78.2	11,718	87.9	8,708	83.1	13,246	91.7	12,139	86.6	8,159	85.0	11,793	84.6	10,107	83.9	85.7
30-Jun	7,220	93.2	4,340	80.9	4,183	94.4	6,396	80.7	11,908	89.3	9,061	86.4	13,399	92.8	12,370	88.2	8,332	86.8	11,978	85.9	10,344	85.8	87.7
1-Jul	7,278	93.9	4,448	83.0	4,200	94.8	6,549	82.6	12,063	90.4	9,260	88.3	13,579	94.0	12,560	89.6	8,475	88.3	12,184	87.4	10,427	86.5	89.0
2-Jul	7,322	94.5	4,538	84.6	4,222	95.3	6,759	85.2	12,219	91.6	9,293	88.6	13,651	94.5	12,743	90.9	8,583	89.4	12,569	90.1	10,533	87.4	90.2
3-Jul	7,361	95.0	4,598	85.8	4,223	95.3	6,876	86.7	12,284	92.1	9,420	89.9	13,743	95.2	12,860	91.7	8,658	90.2	12,708	91.1	10,631	88.2	91.0
4-Jul	7,393	95.4	4,666	87.0	4,224	95.4	7,006	88.3	12,321	92.4	9,511	90.7	13,808	95.6	12,962	92.4	8,744	91.1	12,845	92.1	10,767	89.4	91.8
5-Jul	7,451	96.2	4,705	87.7	4,246	95.9	7,088	89.4	12,466	93.5	9,616	91.7	13,867	96.0	13,127	93.6	8,810	91.8	12,925	92.7	10,829	89.9	92.6
6-Jul	7,473	96.5	4,865	90.7	4,285	96.7	7,172	90.4	12,590	94.4	9,764	93.1	13,934	96.5	13,267	94.6	8,853	92.2	13,039	93.5	10,876	90.3	93.5
7-Jul	7,490	96.7	4,938	92.1	4,330	97.8	7,258	91.5	12,668	95.0	9,818	93.6	13,966	96.7	13,323	95.0	8,929	93.0	13,146	94.3	10,923	90.7	94.2
8-Jul	7,513	97.0	4,974	92.8	4,336	97.9	7,345	92.6	12,686	95.1	9,838	93.8	14,025	97.1	13,390	95.5	8,977	93.5	13,191	94.6	11,046	91.7	94.7
9-Jul	7,529	97.2	5,021	93.6	4,337	97.9	7,434	93.7	12,762	95.7	9,872	94.2	14,033	97.2	13,434	95.8	8,996	93.7	13,248	95.0	11,078	91.9	95.1
10-Jul	7,541	97.3	5,051	94.2	4,342	98.0	7,499	94.6	12,841	96.3	9,904	94.5	14,044	97.2	13,484	96.2	9,023	94.0	13,302	95.4	11,138	92.4	95.5
11-Jul	7,553	97.5	5,099	95.1	4,349	98.2	7,547	95.2	12,873	96.5	9,955	95.0	14,069	97.4	13,546	96.6	9,094	94.7	13,359	95.8	11,189	92.9	95.9
12-Jul	7,574	97.8	5,142	95.9	4,368	98.6	7,570	95.5	12,875	96.5	10,023	95.6	14,074	97.5	13,619	97.1	9,129	95.1	13,385	96.0	11,230	93.2	96.2
13-Jul	7,588	97.9	5,157	96.2	4,374	98.8	7,609	96.0	12,933	97.0	10,045	95.8	14,081	97.5	13,646	97.3	9,141	95.2	13,408	96.2	11,276	93.6	96.5
14-Jul	7,594	98.0	5,167	96.4	4,374	98.8	7,632	96.2	12,969	97.2	10,081	96.2	14,107	97.7	13,692	97.6	9,181	95.6	13,470	96.6	11,301	93.8	96.7
15-Jul	7,614	98.3	5,190	96.8	4,374	98.8	7,650	96.5	13,004	97.5	10,113	96.5	14,112	97.7	13,714	97.8	9,201	95.8	13,495	96.8	11,327	94.0	96.9
16-Jul	7,626	98.4	5,212	97.2	4,374	98.8	7,691	97.0	13,040	97.8	10,145	96.8	14,130	97.8	13,733	97.9	9,215	96.0	13,532	97.0	11,347	94.2	97.2
17-Jul	7,637	98.6	5,221	97.4	4,374	98.8	7,706	97.2	13,061	97.9	10,168	97.0	14,145	97.9	13,746	98.0	9,241	96.3	13,547	97.2	11,355	94.2	97.3
18-Jul	7,656	98.8	5,228	97.5	4,374	98.8	7,723	97.4	13,078	98.1	10,185	97.1	14,158	98.0	13,765	98.2	9,275	96.6	13,589	97.5	11,357	94.3	97.5

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	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
19-Jul	7,660	98.9	5,234	97.6	4,375	98.8	7,739	97.6	13,104	98.3	10,207	97.4	14,175	98.2	13,775	98.2	9,294	96.8	13,607	97.6	11,365	94.3	97.6
20-Jul	7,670	99.0	5,236	97.7	4,375	98.8	7,755	97.8	13,123	98.4	10,215	97.4	14,203	98.3	13,785	98.3	9,309	97.0	13,623	97.7	11,367	94.3	97.7
21-Jul	7,674	99.1	5,240	97.7	4,375	98.8	7,773	98.0	13,135	98.5	10,236	97.6	14,212	98.4	13,800	98.4	9,318	97.1	13,648	97.9	11,420	94.8	97.8
22-Jul	7,676	99.1	5,252	97.9	4,375	98.8	7,787	98.2	13,154	98.6	10,242	97.7	14,222	98.5	13,810	98.5	9,335	97.2	13,694	98.2	11,472	95.2	98.0
23-Jul	7,680	99.1	5,261	98.1	4,377	98.8	7,799	98.3	13,160	98.7	10,261	97.9	14,240	98.6	13,820	98.6	9,341	97.3	13,728	98.5	11,538	95.8	98.1
24-Jul	7,684	99.2	5,262	98.1	4,377	98.8	7,810	98.5	13,167	98.7	10,278	98.0	14,253	98.7	13,825	98.6	9,350	97.4	13,736	98.5	11,623	96.5	98.3
25-Jul	7,688	99.2	5,268	98.2	4,380	98.9	7,819	98.6	13,175	98.8	10,280	98.1	14,263	98.8	13,837	98.7	9,360	97.5	13,759	98.7	11,687	97.0	98.4
26-Jul	7,694	99.3	5,268	98.2	4,383	99.0	7,826	98.7	13,185	98.9	10,280	98.1	14,281	98.9	13,849	98.8	9,371	97.6	13,765	98.7	11,697	97.1	98.5
27-Jul	7,704	99.4	5,269	98.3	4,386	99.0	7,837	98.8	13,193	98.9	10,288	98.1	14,291	99.0	13,870	98.9	9,394	97.8	13,768	98.7	11,728	97.3	98.6
28-Jul	7,719	99.6	5,276	98.4	4,387	99.1	7,844	98.9	13,197	99.0	10,292	98.2	14,297	99.0	13,879	99.0	9,404	97.9	13,776	98.8	11,770	97.7	98.7
29-Jul	7,723	99.7	5,284	98.5	4,391	99.1	7,848	99.0	13,219	99.1	10,298	98.2	14,305	99.1	13,889	99.1	9,433	98.3	13,788	98.9	11,777	97.7	98.8
30-Jul	7,729	99.8	5,289	98.6	4,393	99.2	7,862	99.1	13,223	99.1	10,309	98.3	14,309	99.1	13,899	99.1	9,450	98.4	13,789	98.9	11,797	97.9	98.9
31-Jul	7,733	99.8	5,290	98.7	4,396	99.3	7,865	99.2	13,228	99.2	10,315	98.4	14,312	99.1	13,919	99.3	9,480	98.7	13,803	99.0	11,814	98.0	99.0
1-Aug	7,736	99.9	5,292	98.7	4,397	99.3	7,871	99.3	13,241	99.3	10,329	98.5	14,316	99.1	13,920	99.3	9,499	98.9	13,827	99.2	11,823	98.1	99.0
2-Aug	7,740	99.9	5,294	98.7	4,399	99.3	7,873	99.3	13,247	99.3	10,336	98.6	14,323	99.2	13,935	99.4	9,510	99.1	13,830	99.2	11,826	98.1	99.1
3-Aug	7,742	99.9	5,295	98.8	4,405	99.5	7,878	99.3	13,266	99.5	10,341	98.6	14,330	99.2	13,941	99.4	9,524	99.2	13,832	99.2	11,838	98.2	99.2
4-Aug	7,742	99.9	5,296	98.8	4,407	99.5	7,884	99.4	13,267	99.5	10,351	98.7	14,348	99.3	13,947	99.5	9,528	99.2	13,838	99.2	11,862	98.4	99.2
5-Aug	7,742	99.9	5,299	98.8	4,409	99.5	7,890	99.5	13,272	99.5	10,360	98.8	14,352	99.4	13,950	99.5	9,535	99.3	13,847	99.3	11,893	98.7	99.3
6-Aug	7,744	100.0	5,314	99.1	4,413	99.6	7,894	99.5	13,273	99.5	10,372	98.9	14,364	99.5	13,957	99.5	9,542	99.4	13,860	99.4	11,901	98.8	99.4
7-Aug	7,744	100.0	5,315	99.1	4,413	99.6	7,896	99.6	13,274	99.5	10,375	99.0	14,366	99.5	13,963	99.6	9,545	99.4	13,869	99.5	11,929	99.0	99.4
8-Aug	7,744	100.0	5,319	99.2	4,422	99.8	7,900	99.6	13,279	99.6	10,378	99.0	14,372	99.5	13,969	99.6	9,545	99.4	13,871	99.5	11,979	99.4	99.5
9-Aug	7,745	100.0	5,319	99.2	4,423	99.9	7,902	99.6	13,287	99.6	10,381	99.0	14,379	99.6	13,976	99.7	9,547	99.4	13,872	99.5	11,995	99.6	99.5
10-Aug	7,745	100.0	5,319	99.2	4,423	99.9	7,908	99.7	13,293	99.7	10,393	99.1	14,383	99.6	13,983	99.7	9,549	99.5	13,878	99.5	12,007	99.7	99.6
11-Aug	7,745	100.0	5,322	99.3	4,423	99.9	7,912	99.8	13,299	99.7	10,402	99.2	14,389	99.6	13,989	99.8	9,552	99.5	13,892	99.6	12,009	99.7	99.6
12-Aug	7,745	100.0	5,335	99.5	4,426	99.9	7,915	99.8	13,303	99.7	10,403	99.2	14,396	99.7	13,991	99.8	9,556	99.5	13,896	99.7	12,017	99.7	99.7
13-Aug	7,745	100.0	5,342	99.6	4,426	99.9	7,916	99.8	13,304	99.8	10,404	99.2	14,398	99.7	13,992	99.8	9,557	99.5	13,898	99.7	12,020	99.8	99.7
14-Aug	7,745	100.0	5,347	99.7	4,426	99.9	7,918	99.8	13,308	99.8	10,407	99.3	14,398	99.7	13,995	99.8	9,559	99.6	13,902	99.7	12,023	99.8	99.7
15-Aug	7,746	100.0	5,348	99.7	4,426	99.9	7,920	99.9	13,311	99.8	10,411	99.3	14,398	99.7	13,999	99.8	9,563	99.6	13,903	99.7	12,025	99.8	99.8
16-Aug	7,746	100.0	5,350	99.8	4,426	99.9	7,923	99.9	13,312	99.8	10,413	99.3	14,399	99.7	14,000	99.8	9,575	99.7	13,911	99.8	12,027	99.8	99.8
17-Aug	7,746	100.0	5,351	99.8	4,427	100.0	7,924	99.9	13,316	99.8	10,418	99.4	14,400	99.7	14,001	99.9	9,578	99.8	13,913	99.8	12,030	99.8	99.8

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	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
18-Aug	7,746	100.0	5,351	99.8	4,427	100.0	7,924	99.9	13,317	99.9	10,429	99.5	14,400	99.7	14,002	99.9	9,578	99.8	13,919	99.8	12,032	99.9	99.8
19-Aug	7,746	100.0	5,351	99.8	4,427	100.0	7,925	99.9	13,320	99.9	10,432	99.5	14,401	99.7	14,006	99.9	9,578	99.8	13,923	99.8	12,035	99.9	99.8
20-Aug	7,746	100.0	5,352	99.8	4,427	100.0	7,925	99.9	13,324	99.9	10,436	99.5	14,403	99.7	14,008	99.9	9,580	99.8	13,928	99.9	12,036	99.9	99.8
21-Aug	7,747	100.0	5,353	99.8	4,428	100.0	7,927	100.0	13,328	99.9	10,438	99.6	14,405	99.7	14,008	99.9	9,584	99.8	13,932	99.9	12,042	99.9	99.9
22-Aug	7,747	100.0	5,354	99.9	4,428	100.0	7,927	100.0	13,329	99.9	10,446	99.6	14,409	99.8	14,008	99.9	9,585	99.8	13,934	99.9	12,042	99.9	99.9
23-Aug	7,747	100.0	5,354	99.9	4,428	100.0	7,928	100.0	13,330	99.9	10,454	99.7	14,413	99.8	14,009	99.9	9,591	99.9	13,936	99.9	12,045	100.0	99.9
24-Aug	7,747	100.0	5,355	99.9	4,428	100.0	7,929	100.0	13,331	100.0	10,458	99.8	14,415	99.8	14,010	99.9	9,594	99.9	13,938	100.0	12,046	100.0	99.9
25-Aug	7,747	100.0	5,357	99.9	4,428	100.0	7,929	100.0	13,332	100.0	10,463	99.8	14,417	99.8	14,011	99.9	9,595	99.9	13,940	100.0	12,047	100.0	99.9
26-Aug	7,747	100.0	5,358	99.9	4,429	100.0	7,929	100.0	13,332	100.0	10,464	99.8	14,422	99.9	14,013	99.9	9,596	99.9	13,940	100.0	12,049	100.0	99.9
27-Aug	7,747	100.0	5,360	100.0	4,429	100.0	7,930	100.0	13,332	100.0	10,465	99.8	14,427	99.9	14,014	99.9	9,596	99.9	13,942	100.0	12,049	100.0	100.0
28-Aug	7,747	100.0	5,360	100.0	4,429	100.0	7,930	100.0	13,332	100.0	10,468	99.8	14,428	99.9	14,015	100.0	9,596	99.9	13,943	100.0	12,049	100.0	100.0
29-Aug	7,747	100.0	5,362	100.0	4,429	100.0	7,930	100.0	13,334	100.0	10,472	99.9	14,432	99.9	14,016	100.0	9,596	99.9	13,943	100.0	12,049	100.0	100.0
30-Aug	7,747	100.0	5,362	100.0	4,429	100.0	7,930	100.0	13,336	100.0	10,473	99.9	14,432	99.9	14,016	100.0	9,596	99.9	13,943	100.0	12,049	100.0	100.0
31-Aug	7,747	100.0	5,362	100.0	4,429	100.0	7,930	100.0	13,337	100.0	10,473	99.9	14,433	99.9	14,016	100.0	9,596	99.9	13,943	100.0	12,049	100.0	100.0
1-Sep	7,747	100.0	5,362	100.0	4,429	100.0	7,930	100.0	13,337	100.0	10,475	99.9	14,436	100.0	14,020	100.0	9,596	99.9	13,943	100.0	12,049	100.0	100.0
2-Sep	7,747	100.0	5,362	100.0	4,429	100.0	7,930	100.0	13,337	100.0	10,476	99.9	14,441	100.0	14,020	100.0	9,596	99.9	13,944	100.0	12,049	100.0	100.0
Season Total	7,747		5,362		4,429		7,930		13,337		10,484		14,442		14,022		9,601		13,944		12,049		

APPENDIX C. AYAKULIK RIVER CHINOOK SALMON WEIR COUNTS, 1984-1994

Appendix C1.-Daily counts of chinook salmon through the Ayakulik River weir, 1984-1994.

	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
20-May	0	0.0	0	0.0	77	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	4	0.0	0.1
21-May	19	0.3	0	0.0	83	1.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	15	0.2	0.2
22-May	62	1.0	0	0.0	90	1.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	205	2.2	0	0.0	39	0.4	0.5
23-May	692	10.6	0	0.0	104	1.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	361	4.0	21	0.3	63	0.7	1.6
24-May	806	12.4	0	0.0	117	1.8	30	0.2	0	0.0	0	0.0	0	0.0	0	0.0	800	8.8	28	0.4	88	1.0	2.2
25-May	989	15.2	0	0.0	144	2.3	36	0.2	15	0.1	0	0.0	0	0.0	20	0.2	885	9.7	37	0.5	100	1.1	2.7
26-May	1,226	18.9	0	0.0	156	2.4	85	0.5	284	1.3	0	0.0	0	0.0	78	0.6	1,042	11.4	44	0.6	129	1.4	3.4
27-May	1,556	23.9	0	0.0	309	4.9	167	1.1	401	1.9	0	0.0	800	7.1	113	0.9	1,351	14.8	103	1.3	158	1.7	5.2
28-May	1,840	28.3	0	0.0	319	5.0	225	1.4	560	2.6	0	0.0	1,318	11.7	380	2.9	1,588	17.4	241	3.1	204	2.2	6.8
29-May	1,989	30.6	0	0.0	337	5.3	270	1.7	714	3.3	0	0.0	1,709	15.2	566	4.4	1,699	18.6	326	4.2	210	2.3	7.8
30-May	2,086	32.1	0	0.0	407	6.4	361	2.3	892	4.2	0	0.0	2,137	19.0	603	4.6	1,836	20.1	370	4.7	265	2.9	8.8
31-May	2,191	33.7	0	0.0	499	7.8	415	2.7	1,021	4.8	7	0.0	2,409	21.4	655	5.0	2,012	22.0	821	10.5	294	3.2	10.1
1-Jun	2,229	34.3	0	0.0	647	10.2	491	3.1	1,106	5.2	58	0.4	3,100	27.6	671	5.2	2,045	22.4	1,927	24.6	328	3.6	12.4
2-Jun	2,329	35.8	0	0.0	726	11.4	526	3.4	1,176	5.5	202	1.3	3,797	33.7	697	5.4	2,385	26.1	3,118	39.9	568	6.2	15.3
3-Jun	2,416	37.2	328	4.0	763	12.0	538	3.4	1,400	6.6	255	1.7	4,144	36.8	711	5.5	2,879	31.5	3,225	41.2	694	7.6	17.0
4-Jun	2,584	39.7	445	5.5	864	13.6	913	5.8	1,634	7.6	387	2.5	4,393	39.0	772	5.9	2,957	32.4	3,352	42.9	1,304	14.3	19.0
5-Jun	2,644	40.7	612	7.5	892	14.0	1,285	8.2	1,872	8.8	494	3.2	4,988	44.3	961	7.4	3,030	33.2	3,585	45.8	1,565	17.1	20.9
6-Jun	2,809	43.2	1,109	13.6	936	14.7	2,071	13.2	2,086	9.8	804	5.2	5,708	50.7	1,544	11.9	3,384	37.0	3,623	46.3	1,636	17.9	24.0
7-Jun	3,089	47.5	1,498	18.4	1,023	16.1	2,442	15.6	2,278	10.7	1,272	8.2	5,787	51.4	3,068	23.6	4,073	44.6	3,686	47.1	1,860	20.4	27.6
8-Jun	3,238	49.8	2,614	32.1	1,165	18.3	2,611	16.7	2,426	11.4	1,408	9.1	6,659	59.2	4,164	32.1	4,273	46.8	3,708	47.4	2,731	29.9	32.1
9-Jun	3,480	53.5	3,707	45.5	1,483	23.3	2,743	17.5	2,590	12.1	1,520	9.8	6,893	61.3	5,852	45.1	4,414	48.3	3,861	49.4	3,257	35.6	36.5
10-Jun	3,846	59.2	4,518	55.4	1,576	24.7	3,157	20.2	2,857	13.4	2,134	13.8	7,005	62.3	7,116	54.8	4,480	49.0	4,154	53.1	3,641	39.8	40.5
11-Jun	4,006	61.6	4,753	58.3	1,686	26.5	3,580	22.9	3,975	18.6	2,967	19.2	7,157	63.6	7,714	59.4	4,624	50.6	4,537	58.0	3,797	41.6	43.7
12-Jun	4,159	64.0	4,909	60.2	1,812	28.4	3,671	23.5	5,045	23.6	4,073	26.4	7,216	64.1	8,268	63.7	4,848	53.1	4,807	61.5	4,293	47.0	46.9
13-Jun	4,225	65.0	5,033	61.7	2,037	32.0	3,804	24.3	7,117	33.3	4,966	32.2	7,427	66.0	8,311	64.0	5,115	56.0	5,041	64.5	4,321	47.3	49.7
14-Jun	4,396	67.6	5,087	62.4	2,816	44.2	4,044	25.9	7,586	35.5	5,580	36.2	7,433	66.1	8,728	67.2	5,261	57.6	5,160	66.0	4,544	49.7	52.6
15-Jun	4,498	69.2	5,217	64.0	3,194	50.1	4,158	26.6	7,897	37.0	6,732	43.6	7,448	66.2	8,858	68.2	5,435	59.5	5,255	67.2	4,825	52.8	54.9
16-Jun	4,599	70.7	5,340	65.5	3,407	53.5	4,432	28.3	8,979	42.0	7,357	47.7	7,698	68.4	8,884	68.4	5,626	61.6	5,437	69.5	4,933	54.0	57.2
17-Jun	4,655	71.6	5,583	68.5	3,718	58.4	5,006	32.0	10,020	46.9	8,238	53.4	7,948	70.6	9,001	69.3	5,807	63.6	5,553	71.0	5,155	56.4	60.2
18-Jun	4,796	73.8	5,750	70.5	3,923	61.6	5,411	34.6	10,268	48.0	9,192	59.6	8,198	72.9	9,168	70.6	5,901	64.6	5,664	72.4	5,347	58.5	62.5

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	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
19-Jun	5,068	77.9	5,789	71.0	3,988	62.6	5,714	36.5	12,263	57.4	9,218	59.7	8,448	75.1	9,259	71.3	6,085	66.6	5,834	74.6	5,461	59.8	64.8
20-Jun	5,133	78.9	5,963	73.2	4,053	63.6	5,971	38.2	12,340	57.7	10,032	65.0	8,578	76.2	9,295	71.6	6,116	67.0	5,917	75.7	5,536	60.6	66.2
21-Jun	5,183	79.7	6,092	74.7	4,124	64.7	7,037	45.0	13,453	63.0	10,259	66.5	8,983	79.8	9,317	71.7	6,520	71.4	5,936	75.9	5,771	63.2	68.7
22-Jun	5,333	82.0	6,173	75.7	4,225	66.3	7,689	49.2	14,292	66.9	10,440	67.7	9,242	82.1	9,482	73.0	6,672	73.0	6,041	77.3	5,931	64.9	70.7
23-Jun	5,490	84.4	6,259	76.8	4,245	66.6	8,669	55.4	14,676	68.7	10,587	68.6	9,605	85.4	9,698	74.7	7,189	78.7	6,075	77.7	6,190	67.7	73.2
24-Jun	5,560	85.5	6,436	79.0	4,301	67.5	9,419	60.2	15,276	71.5	10,865	70.4	9,890	87.9	10,274	79.1	7,430	81.3	6,118	78.2	6,789	74.3	75.9
25-Jun	5,597	86.1	6,678	81.9	4,382	68.8	9,644	61.7	15,967	74.7	11,077	71.8	10,095	89.7	10,614	81.7	7,527	82.4	6,490	83.0	7,229	79.1	78.3
26-Jun	5,734	88.2	7,060	86.6	4,411	69.2	10,019	64.1	16,323	76.4	11,836	76.7	10,137	90.1	10,754	82.8	7,667	83.9	6,732	86.1	7,724	84.5	80.8
27-Jun	5,909	90.9	7,168	87.9	4,460	70.0	11,071	70.8	17,161	80.3	12,084	78.3	10,180	90.5	10,815	83.3	7,800	85.4	6,778	86.7	7,906	86.5	82.8
28-Jun	6,009	92.4	7,253	89.0	4,506	70.7	11,441	73.2	17,640	82.5	12,347	80.0	10,202	90.7	11,419	87.9	7,933	86.8	6,872	87.9	7,990	87.4	84.4
29-Jun	6,018	92.6	7,331	89.9	4,808	75.5	11,674	74.7	18,038	84.4	13,192	85.5	10,400	92.4	11,916	91.7	8,067	88.3	6,908	88.3	8,093	88.6	86.5
30-Jun	6,040	92.9	7,387	90.6	4,960	77.9	12,071	77.2	18,522	86.7	13,312	86.3	10,561	93.9	12,039	92.7	8,153	89.3	6,947	88.8	8,261	90.4	87.9
1-Jul	6,144	94.5	7,519	92.2	5,231	82.1	12,409	79.4	18,886	88.4	13,396	86.8	10,656	94.7	12,122	93.3	8,221	90.0	6,960	89.0	8,443	92.4	89.3
2-Jul	6,192	95.2	7,533	92.4	5,410	84.9	12,769	81.7	19,212	89.9	13,430	87.0	10,739	95.4	12,338	95.0	8,285	90.7	7,186	91.9	8,522	93.3	90.7
3-Jul	6,238	95.9	7,626	93.6	5,488	86.1	13,695	87.6	19,277	90.2	13,651	88.5	10,809	96.1	12,370	95.2	8,395	91.9	7,234	92.5	8,619	94.3	92.0
4-Jul	6,263	96.3	7,626	93.6	5,610	88.1	14,375	91.9	19,370	90.6	13,815	89.5	10,821	96.2	12,465	96.0	8,474	92.8	7,266	92.9	8,661	94.8	93.0
5-Jul	6,270	96.4	7,631	93.6	5,710	89.6	14,592	93.3	19,398	90.8	14,148	91.7	10,834	96.3	12,514	96.4	8,503	93.1	7,288	93.2	8,691	95.1	93.6
6-Jul	6,299	96.9	7,634	93.7	5,747	90.2	14,732	94.2	19,664	92.0	14,251	92.3	10,877	96.7	12,549	96.6	8,581	93.9	7,368	94.2	8,740	95.6	94.2
7-Jul	6,308	97.0	7,742	95.0	5,839	91.6	14,770	94.5	19,883	93.0	14,543	94.2	10,894	96.8	12,572	96.8	8,660	94.8	7,408	94.7	8,806	96.4	95.0
8-Jul	6,312	97.1	7,793	95.6	5,855	91.9	14,931	95.5	20,211	94.6	14,667	95.0	10,948	97.3	12,589	96.9	8,750	95.8	7,438	95.1	8,832	96.7	95.6
9-Jul	6,342	97.5	7,806	95.8	5,994	94.1	14,692	94.0	20,410	95.5	14,668	95.0	10,953	97.4	12,610	97.1	8,755	95.8	7,471	95.5	8,873	97.1	95.9
10-Jul	6,361	97.8	7,829	96.0	6,031	94.7	15,071	96.4	20,416	95.5	14,669	95.1	10,970	97.5	12,636	97.3	8,768	96.0	7,530	96.3	8,942	97.9	96.4
11-Jul	6,371	98.0	7,863	96.5	6,040	94.8	15,176	97.1	20,449	95.7	14,721	95.4	10,970	97.5	12,638	97.3	8,840	96.8	7,547	96.5	8,973	98.2	96.7
12-Jul	6,384	98.2	7,897	96.9	6,119	96.0	15,270	97.7	20,493	95.9	14,862	96.3	10,971	97.5	12,640	97.3	8,891	97.3	7,573	96.9	8,990	98.4	97.1
13-Jul	6,417	98.7	7,935	97.4	6,180	97.0	15,289	97.8	20,562	96.2	14,943	96.8	10,973	97.5	12,691	97.7	8,916	97.6	7,587	97.0	9,008	98.6	97.5
14-Jul	6,432	98.9	7,962	97.7	6,194	97.2	15,350	98.2	20,836	97.5	14,962	97.0	10,999	97.8	12,709	97.9	8,958	98.1	7,615	97.4	9,025	98.8	97.8
15-Jul	6,438	99.0	7,974	97.8	6,197	97.3	15,362	98.2	20,881	97.7	14,991	97.1	11,025	98.0	12,711	97.9	8,967	98.2	7,649	97.8	9,036	98.9	98.0
16-Jul	6,438	99.0	7,983	97.9	6,222	97.7	15,376	98.3	20,948	98.0	14,998	97.2	11,042	98.1	12,715	97.9	8,984	98.3	7,659	98.0	9,054	99.1	98.1
17-Jul	6,444	99.1	7,986	98.0	6,259	98.2	15,406	98.5	20,949	98.0	15,013	97.3	11,042	98.1	12,721	97.9	9,003	98.6	7,682	98.2	9,069	99.2	98.3
18-Jul	6,448	99.2	7,993	98.1	6,283	98.6	15,423	98.6	20,963	98.1	15,019	97.3	11,042	98.1	12,728	98.0	9,018	98.7	7,704	98.5	9,082	99.4	98.4

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	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
19-Jul	6,449	99.2	7,994	98.1	6,289	98.7	15,440	98.7	20,965	98.1	15,077	97.7	11,042	98.1	12,728	98.0	9,020	98.7	7,704	98.5	9,088	99.5	98.5
20-Jul	6,458	99.3	8,001	98.2	6,296	98.8	15,456	98.8	21,033	98.4	15,092	97.8	11,051	98.2	12,733	98.0	9,030	98.9	7,706	98.6	9,094	99.5	98.6
21-Jul	6,465	99.4	8,003	98.2	6,299	98.9	15,471	98.9	21,058	98.5	15,127	98.0	11,076	98.4	12,749	98.2	9,054	99.1	7,708	98.6	9,099	99.6	98.7
22-Jul	6,465	99.4	8,004	98.2	6,312	99.1	15,475	99.0	21,065	98.6	15,160	98.2	11,087	98.5	12,795	98.5	9,060	99.2	7,713	98.6	9,104	99.6	98.8
23-Jul	6,465	99.4	8,018	98.4	6,312	99.1	15,485	99.0	21,085	98.7	15,192	98.4	11,093	98.6	12,809	98.6	9,060	99.2	7,716	98.7	9,105	99.6	98.9
24-Jul	6,467	99.5	8,020	98.4	6,312	99.1	15,489	99.1	21,093	98.7	15,209	98.6	11,105	98.7	12,835	98.8	9,069	99.3	7,749	99.1	9,108	99.7	99.0
25-Jul	6,468	99.5	8,023	98.4	6,312	99.1	15,514	99.2	21,113	98.8	15,210	98.6	11,107	98.7	12,835	98.8	9,076	99.4	7,749	99.1	9,111	99.7	99.0
26-Jul	6,470	99.5	8,048	98.7	6,312	99.1	15,532	99.3	21,123	98.8	15,241	98.8	11,115	98.8	12,836	98.8	9,080	99.4	7,757	99.2	9,111	99.7	99.1
27-Jul	6,473	99.6	8,049	98.7	6,312	99.1	15,541	99.4	21,135	98.9	15,257	98.9	11,118	98.8	12,881	99.2	9,081	99.4	7,758	99.2	9,113	99.7	99.2
28-Jul	6,476	99.6	8,056	98.8	6,312	99.1	15,547	99.4	21,173	99.1	15,258	98.9	11,133	99.0	12,886	99.2	9,086	99.5	7,771	99.4	9,115	99.7	99.2
29-Jul	6,476	99.6	8,063	98.9	6,312	99.1	15,553	99.5	21,184	99.1	15,268	98.9	11,158	99.2	12,892	99.3	9,088	99.5	7,778	99.5	9,116	99.8	99.3
30-Jul	6,477	99.6	8,064	98.9	6,312	99.1	15,555	99.5	21,204	99.2	15,310	99.2	11,169	99.3	12,897	99.3	9,091	99.5	7,781	99.5	9,118	99.8	99.4
31-Jul	6,477	99.6	8,064	98.9	6,325	99.3	15,567	99.6	21,206	99.2	15,318	99.3	11,180	99.4	12,901	99.3	9,094	99.6	7,781	99.5	9,118	99.8	99.4
1-Aug	6,478	99.6	8,067	99.0	6,333	99.4	15,573	99.6	21,210	99.3	15,323	99.3	11,192	99.5	12,901	99.3	9,098	99.6	7,788	99.6	9,120	99.8	99.5
2-Aug	6,478	99.6	8,073	99.0	6,336	99.5	15,575	99.6	21,212	99.3	15,341	99.4	11,200	99.5	12,906	99.4	9,100	99.6	7,788	99.6	9,125	99.9	99.5
3-Aug	6,481	99.7	8,081	99.1	6,339	99.5	15,577	99.6	21,225	99.3	15,354	99.5	11,209	99.6	12,915	99.4	9,105	99.7	7,789	99.6	9,127	99.9	99.5
4-Aug	6,482	99.7	8,085	99.2	6,342	99.5	15,581	99.6	21,236	99.4	15,360	99.5	11,216	99.7	12,922	99.5	9,108	99.7	7,795	99.7	9,127	99.9	99.6
5-Aug	6,482	99.7	8,092	99.3	6,344	99.6	15,585	99.7	21,250	99.4	15,367	99.6	11,218	99.7	12,926	99.5	9,111	99.7	7,795	99.7	9,127	99.9	99.6
6-Aug	6,483	99.7	8,097	99.3	6,345	99.6	15,587	99.7	21,272	99.5	15,375	99.6	11,222	99.7	12,936	99.6	9,115	99.8	7,796	99.7	9,127	99.9	99.7
7-Aug	6,484	99.7	8,115	99.6	6,346	99.6	15,594	99.7	21,289	99.6	15,378	99.7	11,228	99.8	12,938	99.6	9,119	99.8	7,797	99.7	9,127	99.9	99.7
8-Aug	6,486	99.8	8,115	99.6	6,350	99.7	15,597	99.8	21,291	99.6	15,383	99.7	11,233	99.8	12,942	99.6	9,122	99.9	7,798	99.7	9,127	99.9	99.7
9-Aug	6,488	99.8	8,115	99.6	6,350	99.7	15,598	99.8	21,301	99.7	15,388	99.7	11,233	99.8	12,947	99.7	9,125	99.9	7,799	99.7	9,127	99.9	99.7
10-Aug	6,488	99.8	8,129	99.7	6,354	99.7	15,602	99.8	21,311	99.7	15,396	99.8	11,237	99.9	12,954	99.7	9,126	99.9	7,808	99.9	9,128	99.9	99.8
11-Aug	6,490	99.8	8,132	99.8	6,357	99.8	15,603	99.8	21,330	99.8	15,398	99.8	11,238	99.9	12,972	99.9	9,130	99.9	7,808	99.9	9,129	99.9	99.8
12-Aug	6,490	99.8	8,132	99.8	6,360	99.8	15,606	99.8	21,334	99.8	15,406	99.8	11,239	99.9	12,978	99.9	9,130	99.9	7,809	99.9	9,131	99.9	99.9
13-Aug	6,490	99.8	8,133	99.8	6,360	99.8	15,608	99.8	21,336	99.8	15,408	99.8	11,239	99.9	12,988	100.0	9,131	100.0	7,809	99.9	9,133	99.9	99.9
14-Aug	6,491	99.8	8,134	99.8	6,360	99.8	15,611	99.8	21,340	99.9	15,414	99.9	11,242	99.9	12,988	100.0	9,131	100.0	7,809	99.9	9,135	100.0	99.9
15-Aug	6,492	99.8	8,135	99.8	6,361	99.8	15,613	99.9	21,344	99.9	15,421	99.9	11,242	99.9	12,988	100.0	9,131	100.0	7,813	99.9	9,137	100.0	99.9
16-Aug	6,493	99.9	8,136	99.8	6,362	99.9	15,616	99.9	21,347	99.9	15,421	99.9	11,245	99.9	12,988	100.0	9,133	100.0	7,817	100.0	9,137	100.0	99.9
17-Aug	6,496	99.9	8,137	99.8	6,365	99.9	15,618	99.9	21,356	99.9	15,425	100.0	11,246	100.0	12,988	100.0	9,134	100.0	7,818	100.0	9,137	100.0	99.9

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	1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Avg %
18-Aug	6,499	100.0	8,138	99.8	6,368	100.0	15,619	99.9	21,360	100.0	15,428	100.0	11,246	100.0	12,988	100.0	9,134	100.0	7,818	100.0	9,137	100.0	100.0
19-Aug	6,500	100.0	8,139	99.9	6,369	100.0	15,626	99.9	21,364	100.0	15,429	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,818	100.0	9,137	100.0	100.0
20-Aug	6,501	100.0	8,140	99.9	6,369	100.0	15,629	100.0	21,367	100.0	15,429	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,818	100.0	9,137	100.0	100.0
21-Aug	6,502	100.0	8,141	99.9	6,370	100.0	15,629	100.0	21,368	100.0	15,430	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,818	100.0	9,137	100.0	100.0
22-Aug	6,502	100.0	8,142	99.9	6,371	100.0	15,630	100.0	21,369	100.0	15,431	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,137	100.0	100.0
23-Aug	6,502	100.0	8,144	99.9	6,371	100.0	15,631	100.0	21,369	100.0	15,431	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
24-Aug	6,502	100.0	8,144	99.9	6,371	100.0	15,632	100.0	21,370	100.0	15,431	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
25-Aug	6,502	100.0	8,146	99.9	6,371	100.0	15,633	100.0	21,370	100.0	15,431	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
26-Aug	6,502	100.0	8,148	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,431	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
27-Aug	6,502	100.0	8,149	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,431	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
28-Aug	6,502	100.0	8,151	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,431	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
29-Aug	6,502	100.0	8,151	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,432	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
30-Aug	6,502	100.0	8,151	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,432	100.0	11,249	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
31-Aug	6,502	100.0	8,151	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,432	100.0	11,250	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
1-Sep	6,502	100.0	8,151	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,432	100.0	11,250	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
2-Sep	6,502	100.0	8,151	100.0	6,371	100.0	15,636	100.0	21,370	100.0	15,432	100.0	11,251	100.0	12,988	100.0	9,135	100.0	7,819	100.0	9,138	100.0	100.0
Season Total	6,502		8,151		6,371		15,636		21,370		15,432		11,251		12,988		9,135		7,819		9,138		

APPENDIX D. CHIGNIK RIVER CHINOOK SALMON WEIR COUNTS AND CHIGNIK LAGOON COMMERCIAL HARVESTS, 1982-1994

Appendix D1.-Daily counts of chinook salmon through the Chignik River weir and daily harvests in the Chignik Lagoon commercial fishery, 1982-1994.

	1982[a,b]				1983[a,b]				1984[a,b]				1985[a,b]				1986[a,b]			
Date	Weir	Harvest	Total	%	Weir	Harvest	Total	%	Weir	Harvest	Total	%	Weir	Harvest	Total	%	Weir	Harvest	Total	%
20-Jun	12	16	28	0.5	0	70	70	1.3	0	177	177	2.0	0	28	28	0.7	72	13	85	1.4
21-Jun	18	21	39	0.7	12	102	114	2.1	0	245	245	2.7	6	41	47	1.1	144	13	157	2.6
22-Jun	24	32	56	1.0	18	138	156	2.9	0	284	284	3.2	6	41	47	1.1	216	26	242	4.0
23-Jun	24	50	74	1.3	18	162	180	3.3	6	301	307	3.4	6	41	47	1.1	288	34	322	5.4
24-Jun	36	60	96	1.7	18	187	205	3.8	19	314	333	3.7	6	41	47	1.1	360	38	398	6.6
25-Jun	48	84	132	2.4	19	213	232	4.3	47	314	361	4.0	6	41	47	1.1	432	38	470	7.8
26-Jun	48	115	163	3.0	43	269	312	5.8	62	314	376	4.2	6	41	47	1.1	504	71	575	9.6
27-Jun	48	1,607	1,655	30.0	43	269	312	5.8	80	314	394	4.4	18	41	59	1.4	576	105	681	11.4
28-Jun	48	1,656	1,704	30.8	43	269	312	5.8	86	995	1,081	12.1	30	41	71	1.7	648	133	781	13.0
29-Jun	48	1,723	1,771	32.1	49	377	426	7.9	86	1,173	1,259	14.1	60	41	101	2.4	720	133	853	14.2
30-Jun	48	1,743	1,791	32.4	49	486	535	9.9	110	1,323	1,433	16.1	108	41	149	3.5	792	133	925	15.4
1-Jul	48	1,817	1,865	33.8	55	571	626	11.6	152	1,404	1,556	17.4	144	290	434	10.3	864	133	997	16.6
2-Jul	60	1,882	1,942	35.1	193	706	899	16.7	258	1,404	1,662	18.6	222	290	512	12.1	936	133	1,069	17.8
3-Jul	108	1,967	2,075	37.6	242	920	1,162	21.6	812	1,404	2,216	24.8	276	290	566	13.4	1,008	198	1,206	20.1
4-Jul	120	1,967	2,087	37.8	256	1,164	1,420	26.3	1,064	1,404	2,468	27.7	276	290	566	13.4	1,080	557	1,637	27.3
5-Jul	204	1,967	2,171	39.3	376	1,458	1,834	34.0	1,184	1,404	2,588	29.0	282	290	572	13.6	1,152	743	1,895	31.6
6-Jul	276	1,972	2,248	40.7	671	1,831	2,502	46.4	1,658	1,469	3,127	35.0	288	543	831	19.7	1,224	900	2,124	35.4
7-Jul	312	1,980	2,292	41.5	765	2,047	2,812	52.2	1,910	2,570	4,480	50.2	300	916	1,216	28.8	1,296	1,003	2,299	38.3
8-Jul	330	1,980	2,310	41.8	802	2,268	3,070	56.9	2,072	2,749	4,821	54.0	360	979	1,339	31.8	1,356	1,072	2,428	40.5
9-Jul	372	1,980	2,352	42.6	974	2,268	3,242	60.1	2,150	3,064	5,214	58.4	384	979	1,363	32.3	1,716	1,156	2,872	47.9
10-Jul	462	2,235	2,697	48.8	1,053	2,268	3,321	61.6	2,388	3,153	5,541	62.1	402	979	1,381	32.8	1,878	1,164	3,042	50.7
11-Jul	540	2,449	2,989	54.1	1,151	2,268	3,419	63.4	2,646	3,153	5,799	65.0	516	979	1,495	35.5	1,938	1,174	3,112	51.9
12-Jul	618	2,601	3,219	58.3	1,205	2,268	3,473	64.4	2,832	3,153	5,985	67.1	666	988	1,654	39.2	2,088	1,486	3,574	59.6
13-Jul	666	2,779	3,445	62.4	1,288	2,319	3,607	66.9	3,014	3,153	6,167	69.1	936	988	1,924	45.6	2,166	1,678	3,844	64.1
14-Jul	684	2,779	3,463	62.7	1,336	2,621	3,957	73.4	3,566	3,153	6,719	75.3	1,032	988	2,020	47.9	2,274	1,847	4,121	68.7
15-Jul	714	2,779	3,493	63.2	1,372	2,954	4,326	80.2	3,788	3,153	6,941	77.8	1,314	988	2,302	54.6	2,400	1,982	4,382	73.1
16-Jul	768	2,779	3,547	64.2	1,402	2,954	4,356	80.8	3,974	3,153	7,127	79.9	1,536	988	2,524	59.9	2,478	2,086	4,564	76.1
17-Jul	798	2,779	3,577	64.7	1,444	2,990	4,434	82.2	4,172	3,374	7,546	84.6	1,602	988	2,590	61.4	2,556	2,140	4,696	78.3
18-Jul	1,128	2,779	3,907	70.7	1,456	3,105	4,561	84.6	4,263	3,464	7,727	86.6	1,788	988	2,776	65.9	2,640	2,214	4,854	80.9
19-Jul	1,398	2,779	4,177	75.6	1,492	3,166	4,658	86.4	4,438	3,464	7,902	88.5	1,860	989	2,849	67.6	2,730	2,214	4,944	82.4
20-Jul	1,530	2,779	4,309	78.0	1,528	3,166	4,694	87.1	4,492	3,464	7,956	89.2	1,962	989	2,951	70.0	2,988	2,214	5,202	86.7
21-Jul	1,644	2,779	4,423	80.1	1,582	3,237	4,819	89.4	4,600	3,464	8,064	90.4	2,106	989	3,095	73.4	3,114	2,214	5,328	88.8
22-Jul	1,806	2,779	4,585	83.0	1,618	3,274	4,892	90.7	4,702	3,464	8,166	91.5	2,286	989	3,275	77.7	3,210	2,214	5,424	90.4
23-Jul	1,914	2,783	4,697	85.0	1,648	3,322	4,970	92.2	4,888	3,464	8,352	93.6	2,388	989	3,377	80.1	3,318	2,302	5,620	93.7
24-Jul	2,046	2,783	4,829	87.4	1,684	3,351	5,035	93.4	4,966	3,464	8,430	94.5	2,466	989	3,455	82.0	3,390	2,338	5,728	95.5
25-Jul	2,124	2,783	4,907	88.8	1,769	3,373	5,142	95.4	5,057	3,464	8,521	95.5	2,574	989	3,563	84.5	3,414	2,347	5,761	96.1
26-Jul	2,136	2,783	4,919	89.0	1,823	3,403	5,226	96.9	5,111	3,464	8,575	96.1	2,646	1,051	3,697	87.7	3,456	2,362	5,818	97.0
27-Jul	2,196	2,783	4,979	90.1	1,853	3,403	5,256	97.5	5,183	3,464	8,647	96.9	2,694	1,168	3,862	91.6	3,468	2,389	5,857	97.7
28-Jul	2,274	2,968	5,242	94.9	1,865	3,403	5,268	97.7	5,327	3,464	8,791	98.5	2,784	1,239	4,023	95.4	3,492	2,410	5,902	98.4
29-Jul	2,376	3,050	5,426	98.2	1,913	3,433	5,346	99.1	5,405	3,464	8,869	99.4	2,814	1,275	4,089	97.0	3,498	2,410	5,908	98.5
30-Jul	2,388	3,113	5,501	99.6	1,913	3,448	5,361	99.4	5,447	3,464	8,911	99.9	2,862	1,275	4,137	98.1	3,504	2,410	5,914	98.6
31-Jul[d]	2,412	3,113	5,525	100.0	1,925	3,467	5,392	100.0	5,460	3,464	8,924	100.0	2,940	1,275	4,215	100.0	3,552	2,445	5,997	100.0

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	1987[a,b]				1988[a,b]				1989[a,b]				1990[a,b]				1991[a,b]			
Date	Weir	Harvest	Total	%	Weir	Harvest	Total	%	Weir	Harvest	Total	%	Weir	Harvest	Total	%	Weir	Harvest	Total	%
20-Jun	6	22	28	0.7	0	0	0	0.0	24	26	50	0.8	0	27	27	0.3	6	69	75	1.2
21-Jun	6	27	33	0.8	0	0	0	0.0	24	26	50	0.8	0	27	27	0.3	6	91	97	1.5
22-Jun	18	27	45	1.1	12	0	12	0.1	24	26	50	0.8	0	27	27	0.3	6	110	116	1.8
23-Jun	18	27	45	1.1	30	0	30	0.3	54	26	80	1.2	6	27	33	0.4	18	110	128	2.0
24-Jun	18	48	66	1.5	30	0	30	0.3	60	26	86	1.3	30	27	57	0.7	42	110	152	2.4
25-Jun	18	60	78	1.8	54	0	54	0.6	63	26	89	1.4	80	149	229	2.9	54	110	164	2.6
26-Jun	36	65	101	2.4	210	0	210	2.4	68	26	94	1.5	170	210	380	4.9	84	110	194	3.0
27-Jun	162	65	227	5.3	276	0	276	3.2	74	26	100	1.6	182	210	392	5.0	156	128	284	4.5
28-Jun	198	65	263	6.2	300	0	300	3.4	99	26	125	2.0	230	210	440	5.7	234	137	371	5.8
29-Jun	228	65	293	6.9	414	0	414	4.8	183	480	663	10.4	332	210	542	7.0	272	141	413	6.5
30-Jun	228	106	334	7.8	510	0	510	5.9	189	480	669	10.4	386	379	765	9.8	320	143	463	7.3
1-Jul	252	146	398	9.3	528	0	528	6.1	260	480	740	11.6	416	540	956	12.3	410	157	567	8.9
2-Jul	312	226	538	12.6	570	0	570	6.5	384	480	864	13.5	434	659	1,093	14.1	554	175	729	11.5
3-Jul	330	264	594	13.9	600	507	1,107	12.7	576	872	1,448	22.6	456	812	1,268	16.3	638	181	819	12.9
4-Jul	330	292	622	14.6	690	925	1,615	18.6	612	1,198	1,810	28.3	600	908	1,508	19.4	752	194	946	14.9
5-Jul	348	324	672	15.8	888	1,334	2,222	25.5	654	1,198	1,852	28.9	708	1,068	1,776	22.8	998	201	1,199	18.8
6-Jul	348	383	731	17.1	1,056	1,334	2,390	27.5	714	1,198	1,912	29.9	852	1,182	2,034	26.1	1,166	231	1,397	21.9
7-Jul	354	477	831	19.5	1,320	1,334	2,654	30.5	763	1,504	2,267	35.4	1,008	1,324	2,332	30.0	1,232	257	1,489	23.4
8-Jul	450	571	1,021	23.9	1,544	1,334	2,878	33.1	781	1,654	2,435	38.0	1,302	1,480	2,782	35.8	1,304	1,010	2,314	36.4
9-Jul	510	710	1,220	28.6	2,030	1,508	3,538	40.6	877	1,654	2,531	39.5	1,980	1,607	3,587	46.1	1,472	1,183	2,655	41.7
10-Jul	780	888	1,668	39.1	2,168	2,751	4,919	56.5	1,225	1,654	2,879	44.9	2,130	1,607	3,737	48.0	1,652	1,243	2,895	45.5
11-Jul	888	888	1,776	41.6	2,474	3,260	5,734	65.9	1,297	1,654	2,951	46.1	2,274	1,607	3,881	49.9	1,832	1,366	3,198	50.2
12-Jul	1,050	888	1,938	45.4	2,648	3,537	6,185	71.1	1,399	1,654	3,053	47.7	2,502	1,607	4,109	52.8	1,886	1,413	3,299	51.8
13-Jul	1,092	1,107	2,199	51.6	2,708	3,537	6,245	71.7	1,453	2,280	3,733	58.3	2,670	1,607	4,277	55.0	2,054	1,498	3,552	55.8
14-Jul	1,188	1,115	2,303	54.0	2,870	3,537	6,407	73.6	1,609	2,280	3,889	60.7	2,808	1,937	4,745	61.0	2,205	1,614	3,819	60.0
15-Jul	1,224	1,461	2,685	63.0	3,140	3,537	6,677	76.7	1,717	2,570	4,287	66.9	2,826	2,281	5,107	65.7	2,271	1,749	4,020	63.2
16-Jul	1,248	1,637	2,885	67.6	3,200	3,556	6,756	77.6	1,813	2,570	4,383	68.4	2,886	2,393	5,279	67.9	2,415	1,904	4,319	67.9
17-Jul	1,266	1,708	2,974	69.7	3,368	3,717	7,085	81.4	1,837	2,570	4,407	68.8	2,964	2,556	5,520	71.0	2,481	1,904	4,385	68.9
18-Jul	1,309	1,792	3,101	72.7	3,488	3,801	7,289	83.7	1,921	2,570	4,491	70.1	3,162	2,692	5,854	75.3	2,481	1,904	4,385	68.9
19-Jul	1,383	1,792	3,175	74.4	3,566	3,908	7,474	85.9	2,071	2,570	4,641	72.5	3,234	2,865	6,099	78.4	2,649	1,904	4,553	71.5
20-Jul	1,569	1,792	3,361	78.8	3,680	3,985	7,665	88.1	2,199	2,570	4,769	74.5	3,324	2,978	6,302	81.0	3,147	1,904	5,051	79.4
21-Jul	1,791	1,792	3,583	84.0	3,854	4,018	7,872	90.4	2,229	2,570	4,799	74.9	3,576	3,128	6,704	86.2	3,213	1,904	5,117	80.4
22-Jul	1,935	1,792	3,727	87.4	3,956	4,018	7,974	91.6	2,291	3,018	5,309	82.9	3,876	3,128	7,004	90.0	3,609	1,907	5,516	86.7
23-Jul	2,049	1,792	3,841	90.1	4,004	4,018	8,022	92.2	2,458	3,137	5,595	87.4	3,954	3,128	7,082	91.0	3,819	1,907	5,726	90.0
24-Jul	2,151	1,792	3,943	92.5	4,040	4,060	8,100	93.1	2,542	3,137	5,679	88.7	3,996	3,128	7,124	91.6	4,011	1,907	5,918	93.0
25-Jul	2,288	1,792	4,080	95.7	4,070	4,126	8,196	94.2	2,644	3,137	5,781	90.3	4,050	3,183	7,233	93.0	4,167	1,907	6,074	95.4
26-Jul	2,324	1,792	4,116	96.5	4,112	4,200	8,312	95.5	2,746	3,137	5,883	91.9	4,086	3,278	7,364	94.7	4,221	1,907	6,128	96.3
27-Jul	2,354	1,792	4,146	97.2	4,148	4,220	8,368	96.1	2,782	3,194	5,976	93.3	4,172	3,342	7,514	96.6	4,269	1,907	6,176	97.0
28-Jul	2,378	1,792	4,170	97.8	4,256	4,250	8,506	97.7	2,908	3,194	6,102	95.3	4,244	3,411	7,655	98.4	4,311	1,907	6,218	97.7
29-Jul	2,396	1,812	4,208	98.7	4,376	4,250	8,626	99.1	3,040	3,269	6,309	98.5	4,262	3,453	7,715	99.2	4,371	1,907	6,278	98.6
30-Jul	2,408	1,828	4,236	99.3	4,442	4,250	8,692	99.9	3,094	3,269	6,363	99.3	4,268	3,490	7,758	99.7	4,401	1,907	6,308	99.1
31-Jul[d]	2,420	1,845	4,265	100.0	4,454	4,250	8,704	100.0	3,136	3,269	6,405	100.0	4,268	3,511	7,779	100.0	4,455	1,910	6,365	100.0

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Date	1992[a,b] Weir	Harvest	Total	%	1993[a,b] Weir	Harvest	Total	%	1994[c] Weir	Harvest	Total	%	10 YEAR AVERAGE % 1985 - 1994
20-Jun	0	7	7	0.1	23	0	23	0.3	24	3	27	0.6	0.6
21-Jun	0	32	32	0.5	47	0	47	0.7	30	3	33	0.7	0.9
22-Jun	6	32	38	0.6	59	23	82	1.2	50	3	53	1.2	1.2
23-Jun	18	32	50	0.8	59	90	149	2.2	56	3	59	1.3	1.6
24-Jun	90	32	122	1.9	86	159	245	3.6	74	3	77	1.7	2.1
25-Jun	216	32	248	3.9	92	250	342	5.1	88	3	91	2.0	2.9
26-Jun	226	32	258	4.0	138	359	497	7.4	88	3	91	2.0	3.8
27-Jun	268	61	329	5.1	156	432	588	8.7	94	3	97	2.1	4.8
28-Jun	308	255	563	8.7	185	547	732	10.8	108	77	185	4.1	6.1
29-Jun	320	383	703	10.9	207	719	926	13.7	140	134	274	6.0	8.3
30-Jun	456	486	942	14.6	231	815	1,046	15.5	147	212	359	7.9	9.8
1-Jul	524	625	1,149	17.9	240	916	1,156	17.1	167	274	441	9.7	12.0
2-Jul	651	724	1,375	21.4	341	916	1,257	18.6	167	338	505	11.1	13.9
3-Jul	691	814	1,505	23.4	462	1,100	1,562	23.1	205	452	657	14.4	17.3
4-Jul	843	973	1,816	28.2	503	1,449	1,952	28.9	318	553	871	19.1	21.3
5-Jul	915	1,261	2,176	33.8	550	1,673	2,223	32.9	444	719	1,163	25.5	24.9
6-Jul	963	1,421	2,384	37.0	634	1,936	2,570	38.0	514	832	1,346	29.5	28.2
7-Jul	997	1,660	2,657	41.3	724	2,092	2,816	41.7	583	878	1,461	32.0	32.1
8-Jul	1,207	1,871	3,078	47.8	829	2,092	2,921	43.2	752	977	1,729	37.9	36.8
9-Jul	1,277	2,105	3,382	52.5	896	2,092	2,988	44.2	863	1,084	1,947	42.7	41.6
10-Jul	1,385	2,326	3,711	57.7	963	2,331	3,294	48.7	1,025	1,198	2,223	48.7	47.3
11-Jul	1,663	2,476	4,139	64.3	1,114	2,668	3,782	56.0	1,096	1,341	2,437	53.4	51.5
12-Jul	1,819	2,623	4,442	69.0	1,210	2,924	4,134	61.2	1,212	1,419	2,631	57.7	55.6
13-Jul	1,990	2,673	4,663	72.5	1,218	3,390	4,608	68.2	1,315	1,475	2,790	61.2	60.4
14-Jul	2,168	2,673	4,841	75.2	1,224	3,776	5,000	74.0	1,330	1,526	2,856	62.6	63.8
15-Jul	2,514	2,673	5,187	80.6	1,258	3,969	5,227	77.3	1,435	1,556	2,991	65.6	68.7
16-Jul	2,605	2,673	5,278	82.0	1,345	4,173	5,518	81.7	1,703	1,629	3,332	73.1	72.2
17-Jul	2,744	2,673	5,417	84.2	1,374	4,384	5,758	85.2	1,899	1,639	3,538	77.6	74.6
18-Jul	2,876	2,673	5,549	86.2	1,439	4,521	5,960	88.2	2,122	1,639	3,761	82.5	77.4
19-Jul	3,022	2,673	5,695	88.5	1,537	4,746	6,283	93.0	2,204	1,639	3,843	84.3	79.8
20-Jul	3,102	2,673	5,775	89.7	1,646	4,746	6,392	94.6	2,393	1,640	4,033	88.4	83.1
21-Jul	3,202	2,673	5,875	91.3	1,670	4,746	6,416	94.9	2,431	1,640	4,071	89.3	85.4
22-Jul	3,247	2,673	5,920	92.0	1,694	4,746	6,440	95.3	2,485	1,678	4,163	91.3	88.5
23-Jul	3,293	2,673	5,966	92.7	1,746	4,754	6,500	96.2	2,547	1,710	4,257	93.3	90.7
24-Jul	3,375	2,673	6,048	94.0	1,763	4,775	6,538	96.7	2,623	1,710	4,333	95.0	92.2
25-Jul	3,425	2,673	6,098	94.7	1,777	4,801	6,578	97.3	2,663	1,710	4,373	95.9	93.7
26-Jul	3,531	2,673	6,204	96.4	1,779	4,852	6,631	98.1	2,716	1,729	4,445	97.5	95.1
27-Jul	3,556	2,673	6,229	96.8	1,780	4,871	6,651	98.4	2,732	1,746	4,478	98.2	96.3
28-Jul	3,599	2,673	6,272	97.5	1,780	4,911	6,691	99.0	2,753	1,757	4,510	98.9	97.6
29-Jul	3,669	2,673	6,342	98.5	1,789	4,938	6,727	99.5	2,760	1,757	4,517	99.0	98.7
30-Jul	3,720	2,673	6,393	99.3	1,798	4,938	6,736	99.7	2,773	1,757	4,530	99.3	99.2
31-Jul[d]	3,750	2,686	6,436	100.0	1,820	4,938	6,758	100.0	2,788	1,773	4,561	100.0	100.0

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[a] Percentages are based on weir passage estimates and a 3-day lag time applied to catches made in Chignik Lagoon (statistical area 271-10), to approximate arrival at the weir.

[b] Weir counts for 1982-1993 do not include 1- and 2-ocean chinook salmon, which could not be distinguished from sockeye salmon at the weir. Weir counts for 1982-1992 are based on 10-minute counts made each hour and expanded to include time not counted. In 1993, fish were counted for the first 30 minutes of daily weir operation, and for 10 minutes each hour thereafter.

[c] Starting in 1994, underwater video cameras were used to continuously count fish. One- and 2-ocean chinook salmon were counted and are included in these figures.

[d] This table uses data from a consistent time frame for all years. Counts on 31 July are not always the total count past the weir for the season. The total weir counts (not expanded to include 1- and 2-ocean fish) for chinook salmon each year are as follows:

1982	2,412	1989	3,316
1983	1,943	1990	4,364
1984	5,548	1991	4,545
1985	3,144	1992	3,806
1986	3,612	1993	1,946
1987	2,624	1994	3,016
1988	4,868		

10 year average = 3,524.

APPENDIX E. KARLUK LAGOON 1993 CREEL SURVEY ESTIMATES BY STRATA AND PERIOD

Appendix E1.-Estimates of angler effort (angler hours and angler-days), and chinook salmon catch and harvest by temporal strata and period from the Karluk Lagoon creel survey, 1993.

		Days[c]			Effort (Hours)				Angler Days				Catch				Harvest			
Strata[a]	Period[b]	D	d_e	d_h	Mean	S^2	Total	Variance	Mean	S^2	Total	Variance	Mean	S^2	Total	Variance	Mean	S^2	Total	Variance
01	A	21	5	2	39.20	676.98	823.2	47,715.0	4.02	11.73	84	2,351.5	5.4	2.08	114	444.9	4.6	6.64	97	1,340.6
01	B	21	7	5	56.57	1,677.54	1,188.0	71,826.5	6.93	20.69	145	1,613.9	4.5	36.54	95	3,411.8	1.8	4.05	39	390.2
02	A	19	3	1	9.33	76.44	177.3	7,888.2	0.00	0.00	0	0.0	0.0	0.00	0	0.0	0.0	0.00	0	0.0
02	B	19	8	7	19.33	275.81	367.3	7,735.0	8.64	122.54	164	4,235.3	2.8	13.75	53	603.0	2.6	13.52	50	594.3
Total							2,555.8	135,164.7			393	8,200.7			262	4,459.7			186	2,325.1

[a] Strata: 01 = 01 June-21 June, 02 = 22 June-10 July.

[b] Periods: A = 0600-1359, B = 1400-2200.

[c] D = total number of days available to sample, d_e = number of days sampled for effort, d_h = number of days sampled for catch and harvest.

APPENDIX F. KARLUK RIVER CHINOOK SALMON AGE COMPOSITION, 1993

Appendix F1.-Age composition, inriver return at the weir by age, and mean length at age for Karluk River chinook salmon sampled from the weir trap, 20 May-20 June 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	16	67	0	0	0	0	84
Percent			0.7	10.9	45.6					57.1
SE Percent			0.7	2.5	4.1					4.0
Inriver Return at Weir	0	0	63	1,007	4,216	0	0	0	0	5,286
SE Return			62	236	377					375
Mean Length			585	786	825					815
SE Mean Length				14	5					6
Minimum Length			585	700	740					585
Maximum Length			585	870	910					910
Males:										
Sample Size	1	0	5	25	31	0	0	1	0	63
Percent	0.7		3.4	17.0	21.1			0.7		42.9
SE Percent	0.7		1.5	3.1	3.3			0.7		4.0
Inriver Return at Weir	63	0	315	1,573	1,951	0	0	63	0	3,964
SE Return	62		137	284	309					375
Mean Length		785	576	779	846			815		754
SE Mean Length			23	6	6					10
Minimum Length		785	500	735	790			815		500
Maximum Length		785	640	835	930			815		930
All:										
Sample Size	1	0	6	41	98	0	0	1	0	147
Percent	0.7		4.1	27.9	66.7			0.7		100.0
SE Percent	0.7		1.6	3.7	3.9			0.7		0.0
Inriver Return at Weir	63	0	378	2,580	6,167	0	0	63	0	9,250
SE Return	62		150	339	357			62		0
Mean Length	785		578	782	832			815		807
SE Mean Length			19	6	4					5
Minimum Length	785		500	700	740			815		500
Maximum Length	785		640	870	930			815		930

Appendix F2.-Age composition, inriver return at the weir by age, and mean length at age for Karluk River chinook salmon sampled from the weir trap, 21 June-2 September 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	27	41	0	0	0	0	69
Percent			0.7	18.2	27.7					46.6
SE Percent			0.7	3.1	3.6					4.0
Inriver Return at Weir	0	0	32	856	1,300	0	0	0	0	2,188
SE Return			31	147	170					189
Mean Length				640	728	810				776
SE Mean Length					11	7				8
Minimum Length				640	540	700				540
Maximum Length				640	844	880				880
Males:										
Sample Size	0	2	22	25	28	2	0	0	0	79
Percent		1.4	14.9	16.9	18.9	1.4				53.4
SE Percent		0.9	2.9	3.0	3.2	0.9				4.0
Inriver Return at Weir	0	63	698	793	888	63	0	0	0	2,506
SE Return		44	135	142	149	44				189
Mean Length		375	604	717	824	833				718
SE Mean Length		20	6	13	9	13				13
Minimum Length		355	565	600	665	820				355
Maximum Length		395	675	840	890	845				890
All:										
Sample Size	0	2	23	52	69	2	0	0	0	148
Percent		1.4	15.5	35.1	46.6	1.4				100.0
SE Percent		0.9	2.9	3.9	4.0	0.9				0.0
Inriver Return at Weir	0	63	729	1,649	2,188	63	0	0	0	4,694
SE Return		44	138	181	189	44				0
Mean Length		375	605	723	816	833				745
SE Mean Length		13	10	8	4	32				8
Minimum Length		355	565	540	665	820				355
Maximum Length		395	675	844	890	845				890

Appendix F3.-Age composition, sport harvest by age, and mean length at age for Karluk River chinook salmon harvested by anglers fishing below the Karluk River weir at Karluk Lagoon, and Spit, 01 June-10 July 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	2	17	0	0	0	0	20
Percent			2.8	5.6	47.2					55.6
SE Percent			2.5	3.5	7.5					7.5
Harvest			6	11	94					111
SE Harvest			5	7	15					15
Mean Length			638	739	852					828
SE Mean Length			113	29	6					12
Minimum Length			525	680	775					525
Maximum Length			750	810	930					930
Males:										
Sample Size	0	0	1	4	11	0	0	0	0	16
Percent			2.8	11.1	30.6					44.4
SE Percent			2.5	4.7	7.0					7.5
Harvest			6	22	61					89
SE Harvest			5	9	14					15
Mean Length			625	762	833				920	816
SE Mean Length				15	11				60	13
Minimum Length			625	685	740				860	625
Maximum Length			625	800	935				980	980
All:										
Sample Size	0	0	2	6	28	0	0	0	0	36
Percent			5.6	16.7	77.8					100.0
SE Percent			3.5	5.6	6.3					0.0
Harvest			11	33	156					200
SE Harvest			7	11	13					48
Mean Length			633	754	845				920	782
SE Mean Length			65	14	6				60	7
Minimum Length			625	705	740				860	625
Maximum Length			750	810	930				980	980

Appendix F4.-Age composition, sport harvest by age, and mean length at age for Karluk River chinook salmon harvested by anglers who fished the Karluk River above the weir and were interviewed at the weir 01 June-10 July 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	2	14	0	0	0	0	17
Percent			3.1	6.3	43.8					53.1
SE Percent			2.9	4.1	8.4					8.4
Harvest	0	0	12	23	161	0	0	0	0	196
SE Harvest			11	15	31					31
Mean Length			638	739	852					828
SE Mean Length			113	29	6					12
Minimum Length			525	680	775					525
Maximum Length			750	810	930					930
Males:										
Sample Size	0	0	0	3	10	0	0	0	2	15
Percent				9.4	31.3				6.3	46.9
SE Percent				4.9	7.8				4.1	8.4
Harvest	0	0	0	35	115	0	0	0	23	173
SE Harvest				18	29				15	31
Mean Length			625	762	833				920	816
SE Mean Length				15	11				60	13
Minimum Length			625	685	740				860	625
Maximum Length			625	800	935				980	980
All:										
Sample Size	0	0	1	5	24	0	0	0	2	32
Percent			3.1	15.6	75.0				6.3	100.0
SE Percent			2.9	6.1	7.3				4.1	0.0
Harvest	0	0	12	58	277	0	0	0	23	369
SE Harvest			11	23	27				15	
Mean Length			633	754	845				920	782
SE Mean Length			65	14	6				60	7
Minimum Length			625	705	740				860	625
Maximum Length			750	810	930				980	980

APPENDIX G. KARLUK RIVER CHINOOK SALMON AGE COMPOSITION, 1994

Appendix G1.-Age composition, inriver return at the weir by age, and mean length at age for Karluk River chinook salmon sampled from the weir trap, 10 May-20 June 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	5	59	4	0	0	1	70
Percent			0.8	3.9	45.7	3.1			0.8	54.3
SE Percent			0.8	1.7	4.3	1.5			0.8	4.3
Inriver Return at Weir	0	0	58	289	3,414	231	0	0	58	4,050
SE Return			57	126	325	113			57	325
Mean Length			830	762	803	869			885	805 [a]
SE Mean Length				12	6	22				5
Minimum Length			830	740	575	825			885	575
Maximum Length			830	790	875	930			885	930
Males:										
Sample Size	0	3	6	17	27	4	1	1	0	59
Percent		2.3	4.7	13.2	20.9	3.1	0.8	0.8		45.7
SE Percent		1.3	1.8	3.0	3.6	1.5	0.8	0.8		4.3
Inriver Return at Weir	0	174	347	984	1,562	231	58	58	0	3,414
SE Return		98	137	220	265	113				325
Mean Length		406	596	750	812	763	630	765		754 [b]
SE Mean Length		14	64	8	10	73				14
Minimum Length		385	495	700	670	550	630	765		385
Maximum Length		434	905	810	935	885	630	765		950
All:										
Sample Size	0	3	7	22	86	8	1	1	1	129
Percent		2.3	5.4	17.1	66.7	6.2	0.8	0.8	0.8	100.0
SE Percent		1.3	2.0	3.3	4.1	2.1	0.8	0.8	0.8	0.0
Inriver Return at Weir	0	174	405	1,273	4,976	463	58	58	58	7,464
SE Return		98	148	245	307	157	57	57	57	0
Mean Length		406	629	753	806	816	630	765	885	781 [c]
SE Mean Length		14	64	7	5	41				7
Minimum Length		385	495	700	575	550	630	765	885	385
Maximum Length		434	905	810	935	930	630	765	885	950

[a] Includes 10 fish that were not aged.

[b] Includes 11 fish that were not aged.

[c] Includes 21 fish that were not aged.

Appendix G2.-Age composition, inriver return at the weir by age, and mean length at age for Karluk River chinook salmon sampled from the weir trap, 21 June-26 August 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	0	7	37	1	0	1	2	48
Percent				5.4	28.7	0.8		0.8	1.6	37.2
SE Percent				2.0	3.9	0.8		0.8	1.1	4.2
Inriver Return at Weir	0	0	0	249	1,315	36	0	36	71	1,706
SE Return				90	180	35		35	49	192
Mean Length				749	796	875		725	710	786 [a]
SE Mean Length				15	5				5	6
Minimum Length				690	735	875		725	705	650
Maximum Length				810	855	875		725	715	905
Males:										
Sample Size	0	8	22	23	24	3	0	0	1	81
Percent		6.2	17.1	17.8	18.6	2.3			0.8	62.8
SE Percent		2.1	3.3	3.3	3.4	1.3			0.8	4.2
Inriver Return at Weir	0	284	782	817	853	107	0	0	36	2,879
SE Return		96	150	152	155	60			35	192
Mean Length		414	597	731	813	832			770	693 [b]
SE Mean Length		13	10	10	7	43				14
Minimum Length		335	465	645	740	770			770	335
Maximum Length		460	675	800	875	915			770	915
All:										
Sample Size	0	8	22	30	61	4	0	1	3	129
Percent		6.2	17.1	23.3	47.3	3.1		0.8	2.3	100.0
SE Percent		2.1	3.3	3.7	4.3	1.5		0.8	1.3	0.0
Inriver Return at Weir	0	284	782	1,066	2,168	142	0	36	107	4,585
SE Return		96	150	168	199	69		35	60	0
Mean Length		414	597	735	803	843		725	730	730 [c]
SE Mean Length		13	10	8	4	32			20	10
Minimum Length		335	465	645	735	770		725	705	335
Maximum Length		460	675	810	875	915		725	770	915

[a] Includes 13 fish that were not aged.

[b] Includes 9 fish that were not aged.

[c] Includes 22 fish that were not aged.

Appendix G3.-Age composition, sport harvest by age, and mean length at age for Karluk River chinook salmon harvested by anglers fishing the Karluk River, 10 May-24 July 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	5	39	2	1	2	8	58
Percent			0.8	4.0	31.2	1.6	0.8	1.6	6.4	46.4
SE Percent			0.7	1.6	3.8	1.0	0.7	1.0	2.0	4.1
Harvest	0	0	7	36	280	14	7	14	57	416
SE Harvest			7	15	34	9	7	9	18	37
Mean Length			695	780	814	780	735	758	810	803 [a]
SE Mean Length				19	7	5		15	15	7
Minimum Length			695	730	700	775	735	743	748	570
Maximum Length			695	840	920	785	735	772	870	920
Males:										
Sample Size	0	2	5	20	35	0	0	2	3	67
Percent		1.6	4.0	16.0	28.0			1.6	2.4	53.6
SE Percent		1.0	1.6	3.0	3.7			1.0	1.3	4.1
Harvest	0	14	36	143	251	0	0	14	22	480
SE Harvest		9	15	27	33				11	37
Mean Length		408	590	741	826			729	775	765 [b]
SE Mean Length		23	21	17	9			69	14	12
Minimum Length		385	545	580	710			660	748	385
Maximum Length		430	670	875	942			798	792	942
All:										
Sample Size	0	2	6	25	74	2	1	4	11	125
Percent		1.6	4.8	20.0	59.2	1.6	0.8	3.2	8.8	100.0
SE Percent		1.0	1.8	3.3	4.1	1.0	0.7	1.5	2.4	0.0
Harvest	0	14	43	179	530	14	7	29	79	896
SE Harvest		9	16	30	37	9	7	13	21	0
Mean Length		408	608	749	819	780	735	743	800	782 [c]
SE Mean Length		23	25	14	6	5		30	12	7
Minimum Length		385	545	580	700	775	735	660	748	385
Maximum Length		430	695	875	942	785	735	798	870	942

[a] Includes 12 fish that were not aged.

[b] Includes 18 fish that were not aged.

[c] Includes 30 fish that were not aged.

APPENDIX H. AYAKULIK RIVER CHINOOK SALMON AGE COMPOSITION, 1993

Appendix H1.-Age composition, inriver return at the weir by age, and mean length at age for Ayakulik River chinook salmon sampled from the weir trap, 15 May-20 June 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	0	3	32	14	0	0	0	49
Percent				2.3	24.1	10.5				36.8
SE Percent				1.3	3.7	2.6				4.1
Inriver Return at Weir	0	0	0	133	1,424	623	0	0	0	2,180
SE Return				75	217	156				245
Mean Length				772	829	842				823
SE Mean Length				20	10	15				8
Minimum Length				732	670	723				670
Maximum Length				795	942	950				950
Males:										
Sample Size	0	0	29	17	26	12	0	0	0	84
Percent			21.8	12.8	19.5	9.0				63.2
SE Percent			3.5	2.9	3.4	2.5				4.1
Inriver Return at Weir	0	0	1,290	756	1,157	534	0	0	0	3,737
SE Return			209	169	201	145				245
Mean Length			548	686	824	885				702
SE Mean Length			12	23	14	22				17
Minimum Length			449	523	660	745				449
Maximum Length			803	858	957	956				957
All:										
Sample Size	0	0	29	20	58	26	0	0	0	133
Percent			21.8	15.0	43.6	19.5				100.0
SE Percent			3.5	3.1	4.3	3.4				0.0
Inriver Return at Weir	0	0	1,290	890	2,580	1,157	0	0	0	5,917
SE Return			209	181	252	201				0
Mean Length			548	699	821	859				746
SE Mean Length			12	21	8	13				12
Minimum Length			449	523	660	723				449
Maximum Length			803	858	957	956				957

Appendix H2.-Age composition, inriver return at the weir by age, and mean length at age for Ayakulik River chinook salmon sampled from the weir trap, 21 June-22 August 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	0	0	17	4	0	0	0	21
Percent					15.2	3.6				18.8
SE Percent					3.3	1.7				3.6
Inriver Return at Weir	0	0	0	0	289	68	0	0	0	357
SE Return					63	32				68
Mean Length					802	834				808
SE Mean Length					11	22				10
Minimum Length					715	771				715
Maximum Length					868	869				869
Males:										
Sample Size	0	3	49	27	10	2	0	0	0	91
Percent		2.7	43.8	24.1	8.9	1.8				81.3
SE Percent		1.5	4.5	3.9	2.6	1.2				3.6
Inriver Return at Weir	0	51	832	459	170	34	0	0	0	1,545
SE Return		28	86	75	50	23				68
Mean Length		320	537	677	799	903				608
SE Mean Length		22	6	16	16	8				13
Minimum Length		295	416	536	713	895				295
Maximum Length		363	643	896	890	910				910
All:										
Sample Size	0	3	49	27	27	6	0	0	0	112
Percent		2.7	43.8	24.1	24.1	5.4				100.0
SE Percent		1.5	4.5	3.9	3.9	2.1				0.0
Inriver Return at Weir	0	51	832	459	459	102	0	0	0	1,902
SE Return		28	86	75	75	39				0
Mean Length		320	537	677	801	857				646
SE Mean Length		22	6	16	9	20				13
Minimum Length		295	416	536	713	771				295
Maximum Length		363	643	896	910	910				910

Appendix H3.-Age composition, harvest estimates by age, and mean length at age for Ayakulik River and Bare Creek chinook salmon harvested by sport anglers, 29 May through 9 July 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	1.6	2.3	2.4	Total
Females:										
Sample Size	0	0	0	8	87	28	0	0	0	123
Percent				3.1	33.5	10.8				47.3
SE Percent				0.9	2.4	1.6				2.5
Harvest	0	0	0	25	270	87	0	0	0	382
SE Harvest				7	19	13				21
Mean Length				783	844	870				846
SE Mean Length				17	5	9				4
Minimum Length				700	709	790				700
Maximum Length				864	945	950				950
Males:										
Sample Size	0	2	45	32	42	13	3	0	0	137
Percent		0.8	17.3	12.3	16.2	5.0	1.2			52.7
SE Percent		0.4	1.9	1.7	1.9	1.1	0.5			2.5
Harvest	0	6	140	99	131	40	9	0	0	426
SE Harvest		4	16	14	15	9	4			21
Mean Length		326	560	735	859	907	974			729
SE Mean Length		26	8	18	11	11	13			14
Minimum Length		300	475	535	699	835	961			300
Maximum Length		351	843	895	970	970	987			987
All:										
Sample Size	0	2	45	40	129	41	3	0	0	260
Percent		0.8	17.3	15.4	49.6	15.8	1.2			100.0
SE Percent		0.4	1.9	1.8	2.6	1.9	0.5			0.0
Harvest	0	6	140	124	401	127	9	0	0	808
SE Harvest		4	16	15	21	15	4			0
Mean Length		326	560	744	849	882	974			784
SE Mean Length		26	8	15	5	7	13			8
Minimum Length		300	475	535	699	790	961			300
Maximum Length		351	843	895	970	970	987			987

APPENDIX I. AYAKULIK RIVER CHINOOK SALMON AGE COMPOSITION, 1994

Appendix I1.-Age composition, inriver return at the weir by age, and mean length at age for Ayakulik River chinook salmon sampled from the weir trap, 21 May-20 June 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	0	8	51	2	0	0	0	61
Percent				6.4	40.8	1.6				48.8
SE Percent				2.2	4.3	1.1				4.4
Inriver Return at Weir	0	0	0	350	2,228	87	0	0	0	2,665
SE Return				118	237	61				241
Mean Length				749	792	876				789 [a]
SE Mean Length				11	6	3				5
Minimum Length				702	620	873				620
Maximum Length				805	856	878				878
Males:										
Sample Size	0	3	9	23	29	0	0	0	0	64
Percent		2.4	7.2	18.4	23.2					51.2
SE Percent		1.4	2.3	3.4	3.7					4.4
Inriver Return at Weir	0	131	393	1,005	1,267	0	0	0	0	2,796
SE Return		74	125	187	204					241
Mean Length		323	555	725	833					718 [b]
SE Mean Length		17	12	9	10					15
Minimum Length		291	500	637	692					291
Maximum Length		348	611	813	914					926
All:										
Sample Size	0	3	9	31	80	2	0	0	0	125
Percent		2.4	7.2	24.8	64.0	1.6				100.0
SE Percent		1.4	2.3	3.8	4.2	1.1				0.0
Inriver Return at Weir	0	131	393	1,354	3,495	87	0	0	0	5,461
SE Return		74	125	209	232	61				0
Mean Length		323	555	732	807	876				751 [c]
SE Mean Length		17	12	7	5	3				9
Minimum Length		291	500	637	620	873				291
Maximum Length		348	611	813	914	878				926

[a] Includes 16 fish that were not aged.

[b] Includes 25 fish that were not aged.

[c] Includes 41 fish that were not aged.

Appendix I2.-Age composition, inriver return at the weir by age, and mean length at age for Ayakulik River chinook salmon sampled from the weir trap, 21 June-24 August 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	6	21	2	0	0	0	30
Percent			0.8	4.5	15.8	1.5				22.6
SE Percent			0.7	1.8	3.1	1.0				3.6
Inriver Return at Weir	0	0	28	166	581	55	0	0	0	829
SE Return			27	65	114	38				131
Mean Length			490	732	790	790				768 [a]
SE Mean Length				11	10	24				11
Minimum Length			490	685	683	766				490
Maximum Length			490	762	863	814				863
Males:										
Sample Size	0	31	20	26	25	1	0	0	0	103
Percent		23.3	15.0	19.5	18.8	0.8				77.4
SE Percent		3.6	3.0	3.4	3.3	0.7				3.6
Inriver Return at Weir	0	857	553	719	691	28	0	0	0	2,848
SE Return		132	112	124	122	27				131
Mean Length		347	554	712	815	730				601 [b]
SE Mean Length		5	13	9	12					16
Minimum Length		294	445	615	728	730				294
Maximum Length		432	661	774	910	730				910
All:										
Sample Size	0	31	21	32	46	3	0	0	0	133
Percent		23.3	15.8	24.1	34.6	2.3				100.0
SE Percent		3.6	3.1	3.6	4.0	1.3				0.0
Inriver Return at Weir	0	857	581	885	1,272	83	0	0	0	3,677
SE Return		132	114	134	149	46				0
Mean Length		347	551	715	803	770				636 [c]
SE Mean Length		5	13	7	8	24				14
Minimum Length		294	445	615	683	730				294
Maximum Length		432	661	774	910	814				910

[a] Includes 5 fish that were not aged.

[b] Includes 27 fish that were not aged.

[c] Includes 32 fish that were not aged.

Appendix I3.-Age composition, harvest estimates by age, and mean length at age for Ayakulik River and Bare Creek chinook salmon harvested by sport anglers, 30 May through 10 July 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	1	17	102	11	0	1	7	139
Percent			0.3	5.2	31.3	3.4		0.3	2.1	42.6
SE Percent			0.2	0.9	1.9	0.7		0.2	0.6	2.0
Harvest	0	0	2	39	231	25	0	2	16	315
SE Harvest			2	7	14	6		2	4	15
Mean Length			835	758	823	856		834	831	817 [a]
SE Mean Length				11	4	21			13	4
Minimum Length			835	666	706	710		834	792	666
Maximum Length			835	831	949	930		834	889	949
Males:										
Sample Size	1	7	28	72	76	1	0	1	1	187
Percent	0.3	2.1	8.6	22.1	23.3	0.3		0.3	0.3	57.4
SE Percent	0.2	0.6	1.2	1.7	1.8	0.2		0.2	0.2	2.0
Harvest	2	16	63	163	172	2	0	2	2	424
SE Harvest	2	4	9	13	13	2			2	15
Mean Length	826	340	552	723	823	902		792	801	731 [b]
SE Mean Length		10	11	8	7					9
Minimum Length	826	305	405	350	619	902		792	801	305
Maximum Length	826	368	678	860	940	902		792	801	990
All:										
Sample Size	1	7	29	89	178	12	0	2	8	326
Percent	0.3	2.1	8.9	27.3	54.6	3.7		0.6	2.5	100.0
SE Percent	0.2	0.6	1.2	1.8	2.1	0.8		0.3	0.6	0.0
Harvest	2	16	66	202	404	27	0	5	18	739
SE Harvest	2	4	9	14	15	6		2	5	0
Mean Length	826	340	561	729	823	860		813	827	769 [c]
SE Mean Length		10	14	7	4	20		21	12	6
Minimum Length	826	305	405	350	619	710		792	792	305
Maximum Length	826	368	835	860	949	930		834	889	990

[a] Includes 49 fish that were not aged.

[b] Includes 51 fish that were not aged.

[c] Includes 100 fish that were not aged.

APPENDIX J. CHIGNIK RIVER CHINOOK SALMON AGE COMPOSITION, 1993

Appendix J1.-Age composition, total return by age, and mean length at age for chinook salmon returning to the Chignik River, 20 June through 7 July 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	2	13	39	5	0	0	0	59
Percent			2.3	15.1	45.3	5.8				68.6
SE Percent			1.6	3.8	5.3	2.5				4.9
Total Return	0	0	67	435	1,306	167	0	0	0	1,976
SE Total Return			46	110	152	72				142
Mean Length			620	803	888	925				863
SE Mean Length			7	12	8	16				10
Minimum Length			613	740	765	880				613
Maximum Length			626	865	970	960				970
Males:										
Sample Size	0	0	5	7	15	0	0	0	0	27
Percent			5.8	8.1	17.4					31.4
SE Percent			2.5	2.9	4.0					4.9
Total Return	0	0	167	234	502	0	0	0	0	904
SE Total Return			72	84	116					142
Mean Length			578	730	935					816
SE Mean Length			37	37	11					31
Minimum Length			510	610	860					510
Maximum Length			695	900	981					981
All:										
Sample Size	0	0	7	20	54	5	0	0	0	86
Percent			8.1	23.3	62.8	5.8				100.0
SE Percent			2.9	4.5	5.1	2.5				0.0
Total Return[a]	0	0	234	670	1,808	167	0	0	0	2,880
SE Total Return			84	129	148	72				0
Mean Length			590	777	901	925				848
SE Mean Length			27	17	7	16				12
Minimum Length			510	610	765	880				510
Maximum Length			695	900	981	960				981

[a] Represents the sum of the purse seine harvest in Chignik Lagoon (2,092), and weir escapement estimate (724) through 7 July with an 8.1% adjustment to the weir escapement estimate (64) to include uncounted 1- and 2-ocean age chinook salmon.

Appendix J2.-Age composition, total return by age, and mean length at age for chinook salmon returning to the Chignik River, 8 July through 4 August 1993.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	8	16	24	2	0	0	0	50
Percent			10.0	20.0	30.0	2.5				62.5
SE Percent			3.3	4.4	5.1	1.7				5.4
Total Return	0	0	470	939	1,409	117	0	0	0	2,936
SE Total Return			156	208	239	81				252
Mean Length			619	751	887	896				801
SE Mean Length			35	17	6	1				16
Minimum Length			484	641	840	895				484
Maximum Length			766	879	950	896				950
Males:										
Sample Size	0	2	11	7	10	0	0	0	0	30
Percent		2.5	13.8	8.8	12.5					37.5
SE Percent		1.7	3.8	3.1	3.7					5.4
Total Return	0	117	646	411	587	0	0	0	0	1,761
SE Total Return		81	179	147	172					252
Mean Length		401	639	789	856					730
SE Mean Length		11	30	50	35					30
Minimum Length		390	484	514	623					390
Maximum Length		411	815	890	980					980
All:										
Sample Size	0	2	19	23	34	2	0	0	0	80
Percent		2.5	23.8	28.8	42.5	2.5				100.0
SE Percent		1.7	4.7	5.0	5.5	1.7				0.0
Total Return[a]	0	117	1,116	1,350	1,996	117	0	0	0	4,697
SE Total Return		81	222	236	257	81				0
Mean Length		401	631	762	878	896				774
SE Mean Length		11	22	19	11	1				16
Minimum Length		390	484	514	623	895				390
Maximum Length		411	815	890	980	896				980

[a] Represents the sum of the purse seine harvest in Chignik Lagoon (3,148), and weir escapement estimate (1,222) from 8 July through 15 September, with a 26.8% adjustment to the weir escapement estimate (327) to include uncounted 1- and 2-ocean age chinook salmon.

APPENDIX K. CHIGNIK RIVER CHINOOK SALMON AGE COMPOSITION, 1994

Appendix K1.-Age composition, total return by age, and mean length at age for chinook salmon returning to the Chignik River, 12 June through 26 August 1994.

	Age									
	0.4	1.1	1.2	1.3	1.4	1.5	2.2	2.3	2.4	Total
Females:										
Sample Size	0	0	2	37	29	0	0	2	1	71
Percent			1.4	26.6	20.9			1.4	0.7	51.1
SE Percent			1.0	3.7	3.4			1.0	0.7	4.2
Total Return	0	0	69	1,284	1,006	0	0	69	35	2,464
SE Total Return			48	178	164			48	34	202
Mean Length			608	745	833			842	840	780 [a]
SE Mean Length			13	11	14			52		10
Minimum Length			595	650	673			790	840	595
Maximum Length			620	887	1,000			893	840	1,090
Males:										
Sample Size	0	4	7	32	21	2	0	1	1	68
Percent		2.9	5.0	23.0	15.1	1.4		0.7	0.7	48.9
SE Percent		1.4	1.8	3.5	3.0	1.0		0.7	0.7	4.2
Total Return	0	139	243	1,111	729	69	0	35	35	2,360
SE Total Return		67	88	170	144	48		34	34	202
Mean Length		405	602	766	877	967		758	880	760 [b]
SE Mean Length		23	18	12	16	43				16
Minimum Length		338	518	654	730	924		758	880	338
Maximum Length		434	675	910	1,034	1,010		758	880	1,034
All:										
Sample Size	0	4	9	69	50	2	0	3	2	139
Percent		2.9	6.5	49.6	36.0	1.4		2.2	1.4	100.0
SE Percent		1.4	2.1	4.2	4.0	1.0		1.2	1.0	0.0
Total Return [c]	0	139	312	2,395	1,735	69	0	104	69	4,824
SE Total Return		67	99	202	194	48		59	48	0
Mean Length		405	604	755	848	967		814	860	770 [d]
SE Mean Length		23	14	8	10	43		41	20	9
Minimum Length		338	518	650	673	924		758	840	338
Maximum Length		434	675	910	1,034	1,010		893	860	1,090

[a] Includes 16 fish that were not aged.

[b] Includes 14 fish that were not aged.

[c] Represents sum of the purse seine harvest in Chignik Lagoon (1,808) and weir escapement estimate (3,016).

[d] Includes 30 fish that were not aged and 5 fish of unknown sex.