Fishery Data Series No. 95-2

Stock Assessment of the Return of Early-run Chinook Salmon to the Kenai River, 1994

by

S. L. Hammarstrom

July 1995

Alaska Department of Fish and Game Division of Sport Fish

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Spell out acre and ton.

Time and temperature

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

Spell out year, month, and week.

Physics and chemistry

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

General

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

Mathematics, statistics, fisheries

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

The Fishery Data Series No. 95-2 published in March contained an error.

The preliminary sonar count of early-run chinook salmon, rather than the final count after end-of-season adjustments, was reported. The preliminary count was 18,514 and the final count is 18,403.

The final count, or numbers derived from it, appear in many tables and many places in the report text. Therefore, please discard the March publication of FDS No. 95-2 and replace it with the enclosed corrected report published in July, 1995.

FISHERY DATA SERIES NO. 95-2

STOCK ASSESSMENT OF THE RETURN OF EARLY-RUN CHINOOK SALMON TO THE KENAI RIVER, 1994

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The Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Fishery Data Series reports are intended for fishery and other technical professionals. Distribution is to state and local publication distribution centers, libraries and individuals and, on request, to other libraries, agencies, and individuals. This publication has undergone editorial and peer review.

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ABSTRACT

The total inriver return of early-run chinook salmon *Oncorhynchus tshawytscha* as estimated through hydroacoustic techniques was 18,403. Angler effort and harvest as estimated by a creel survey during the early (May and June) chinook salmon run were 173,842 angler hours and 5,634 chinook salmon, respectively, approximately 7% greater than the 1974-1993 mean. Release mortality was estimated at 128 fish. Spawning escapement, estimated by subtracting total fishing mortality from total inriver return, was 12,641. This escapement was 3,641 (40%) greater than stipulated by the Kenai River Early King Salmon Management Plan. The predominant age class of both the inriver return and the recreational harvest of early-run chinook salmon was age-1.4 fish.

Migratory timing models were used to project spawning escapement during the 1994 fishery. No restrictions of the recreational fishery were required to achieve the escapement.

A model based on sibling ratios was used to forecast the 1995 return at 16,020 (SE = 5,170) chinook salmon.

Key words: Kenai River, chinook salmon, creel survey, effort, harvest, migratory timing, sibling ratios, brood tables, *Oncorhynchus tshawytscha*, forecast.

INTRODUCTION

The largest freshwater recreational fishery in Alaska occurs in the Kenai River with an average of nearly 350,000 angler-days of effort each year from 1983-1993 (Mills 1989-1994). This represents approximately 15% of the state's recreational fishing effort. The majority of the angler-effort occurs during May, June, and July, downstream of the outlet of Skilak Lake to Cook Inlet (river kilometer 13 to river kilometer 81) (Figure 1) during a fishery directed primarily at returning chinook salmon *Oncorhynchus tshawytscha*.

Two stocks of chinook salmon return to the Kenai River: an early run which enters the river from mid-May through June, and a late run which enters the river from late June through early August (Burger et al. 1985, Bendock and Alexandersdottir 1992). Early-run fish are destined primarily for tributary spawning locations (Bendock and Alexandersdottir 1992) and are the focus of this report. Late-run fish are destined almost exclusively for mainstem spawning locations.

Prior to 1970, the recreational fishery in the Kenai River was comprised of shorebased anglers targeting sockeye salmon *O. nerka* in July and coho salmon *O. kisutch* in August and early September. In 1973, large numbers of anglers began experimenting with a fishing method that involved bouncing brightly colored terminal gear along the river bottom from a drifting boat. This technique had been used effectively by anglers fishing for chinook salmon on rivers in the Pacific Northwest. It proved to be a very effective method for catching chinook salmon on the Kenai River, and the fishery expanded rapidly (Figure 2).

As fisheries targeting both the early and late runs of chinook salmon continued to grow during the early 1980s, agency and public concerns about overexploitation were heightened. In 1988, the Board of Fisheries (BOF) adopted management plans for the early- and late-run returns of chinook salmon to the Kenai River (McBride et al. 1989). These plans, in effect since 1989, stipulate specific escapement goals for which the fisheries will be managed, and

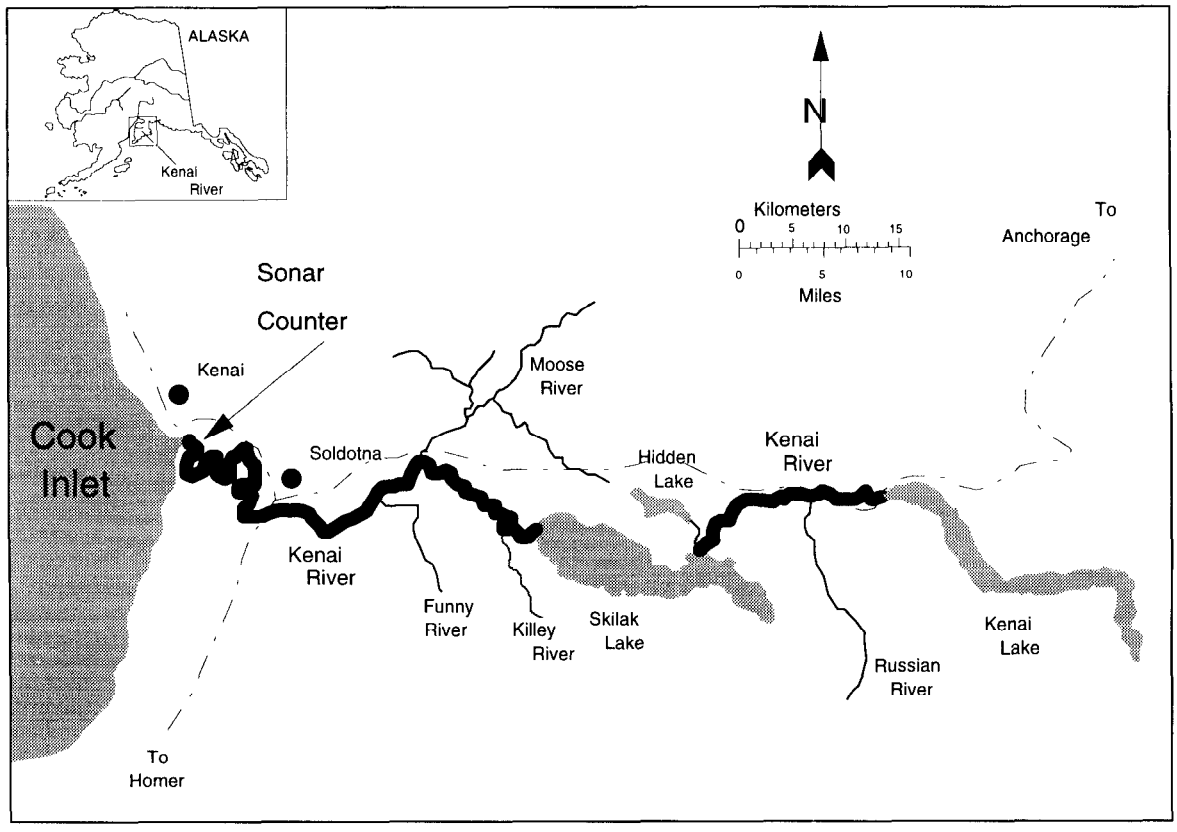

Figure 1.-Map of the Kenai River drainage.

how these fisheries will be managed in the event of conservation shortfall.

For management purposes, chinook salmon entering the Kenai River prior to 1 July are considered to be early-run fish; those entering after 30 June are late-run fish. The Kenai River Early King Salmon Management Plan stipulates that the use of bait is prohibited from 1 January until an estimated optimum spawning escapement level of 9,000 is projected. If the projected spawning escapement is between 5,300 and 9,000, the department shall, by emergency order, restrict the fishery through bag limit reduction and/or time/area closure to achieve 9,000 fish in the escapement. If the projected escapement is less than 5,300, chinook salmon fishing is to be prohibited until 1 July downstream of the Funny River and 10 July upstream of the Funny River (Figure 1 and Figure 3). A 1990 amendment to the plan, which was implemented in 1992, allowed retention of fish 132 cm (52 in) or larger if hook-and-release fishing was imposed (hereafter referred to as trophy fishing).

Sport fishing regulations for chinook salmon in the Kenai River are also detailed in the management plans, and are now among the most restrictive in Alaska. Only the mainstem Kenai River between the outlet of Skilak Lake and Cook Inlet (Figure 1) is open to fishing for chinook salmon. By regulation, the season for chinook salmon is from 1 January through 31 July, but it effectively begins in mid-May when the fish first begin entering the river. The daily bag and possession limits are one chinook

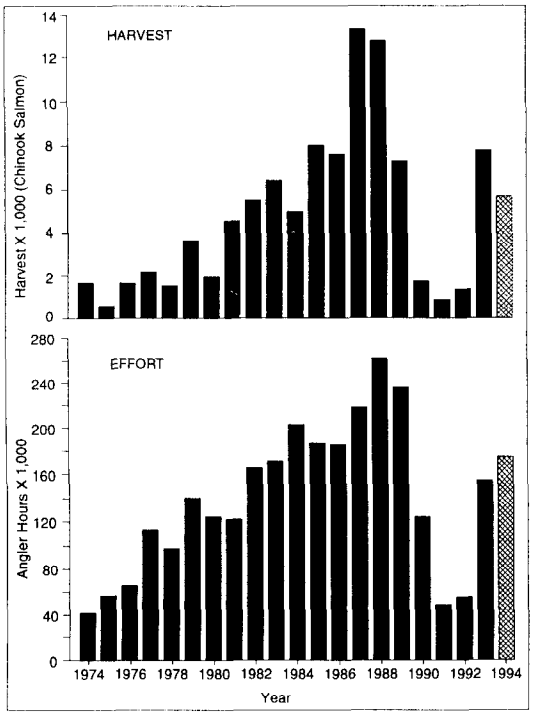

Figure 2.-Historical harvest and effort in the recreational fishery for early-run chinook salmon, Kenai River, 1974-1994.

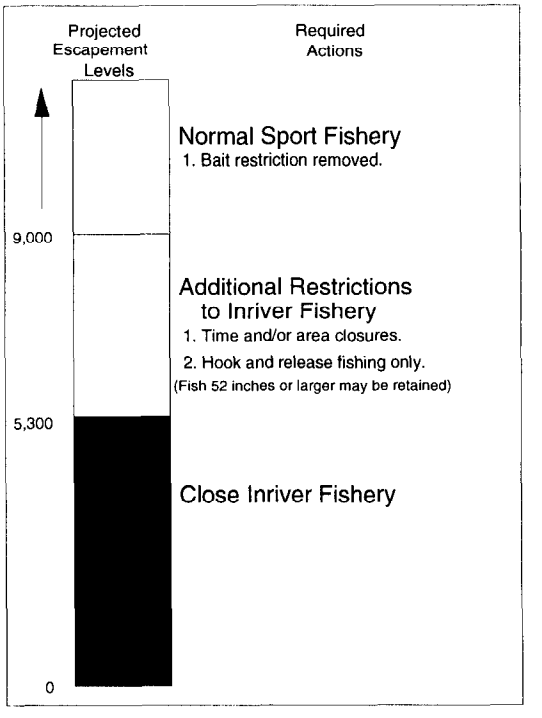

Figure 3.-Escapement levels and required actions according to the Kenai River Early Run Chinook Salmon Management Plan.

salmon per day greater than 41 cm (16 in) total length and a seasonal limit of two chinook salmon greater than 41 cm. In 1992, the BOF closed two areas on the Kenai River to fishing from a boat: the vicinity of the confluence with Slikok Creek, and the confluence with the Funny River. Fishing from boats is not allowed in these areas from 1 January to 15 July. Fishing from boats downstream from the outlet of Skilak Lake is prohibited on Mondays in May and June except Memorial Day. Anyone retaining a chinook salmon 41 cm in length or greater is prohibited from fishing from a boat in the Kenai River downstream of Skilak Lake for the remainder of that day. There are additional restrictions placed on anglers using professional guides: fishing from a guided boat is allowed only between 0600 and 1800 hours during June and July. Anglers using guides during May are not restricted.

Implementation of the management plan hinges upon the department's ability to project the strength of the current year's return early in the season. A comprehensive stock assessment program, initiated in the mid-1980s in response to the growing chinook salmon fisheries, and creel surveys, which have been conducted on the Kenai River since 1974, are the primary means of collecting the data necessary for implementing the plans. The objectives of these continuing studies are two-fold: to assess production by estimating harvest and abundance by age and inriver returns (Hammarstrom and Larson 1986)[1]; and to

[1] To clarify terms, inriver return refers to all fish that are counted by sonar in the Kenai River. Total return refers to all early-run Kenai River chinook salmon harvested in Upper Cook Inlet marine fisheries (recreational and educational) plus the inriver return.

model run timing, including migratory timing estimates of effort, harvest, and abundance. Because of the diversity and complexity of these studies, results of each study are published in separate reports.

This report compiles statistics for the 1994 early-run return, including estimates of inriver return, fishery parameters, and escapement. The estimates are compared to historic data and their application to the 1994 return are discussed. Finally a forecast of the 1995 return is presented.

Previous studies of the chinook salmon fisheries in the Kenai River include the following: Hammarstrom (1975-1981, 1988-1994), Hammarstrom and Larson (1982-1984, 1986), Hammarstrom et al. (1985), and Conrad and Hammarstrom (1987). Details of the 1994 creel survey of the recreational fishery are reported by King (*In prep*). Angler-effort and harvest by species for the recreational fishery have been estimated by Mills (1979-1994) via postal questionnaire. Rationale for the escapement goals and migratory timing data to implement the management plans are contained in McBride et al. (1989). Bendock and Alexandersdottir (1992) estimated hooking mortality for the Kenai River chinook salmon recreational fisheries. Estimates of total return by age have been summarized through 1990 by Sonnichsen and Alexandersdottir (1991).

SUMMARY OF HISTORICAL DATA

HARVEST AND ESCAPEMENT

Early-run Kenai River chinook salmon migrate, as adults, back to Cook Inlet with other stocks of chinook salmon from numerous natal streams of the Kenai Peninsula (Anchor River, Deep Creek, Ninilchik River, Stariski Creek, and Kasilof River) and the Susitna River drainage. Since the 1980s, Susitna River fish routinely outnumber the early-run Kenai River fish by an order of magnitude (McBride et al. 1985). During May and June, the recreational marine fishery along the eastern shore of Cook Inlet, near Ninilchik Village, accounts for the only significant marine harvest of these stocks. The harvest in this fishery during May and June has averaged approximately 2,500 fish from 1972-1990 (Hammarstrom and Larson 1986; Hammarstrom et al. 1987; Mills 1988-1991; Sonnichsen and Alexandersdottir 1991). An educational gillnet fishery operated in Cook Inlet by the Kenaitze Indian tribe has accounted for less than 120 fish annually. A subsistence gillnet fishery, established by the BOF in 1992, discontinued in 1993, and reinstituted in 1994, harvested 238 chinook salmon in 1992. Results of the 1994 fishery are currently unavailable. Based on available information, it is unlikely that other unknown harvests of early-run chinook salmon of Kenai River origin are large enough to alter conclusions regarding the status of this stock (McBride et al. 1989). However, the marine sport fishery has increased in recent years, and may thus increase in importance.

Inriver returns have been estimated annually since 1985 using two methods: a tag-recapture program from 1985-1990 (Hammarstrom and Larson 1986; Conrad and Larson 1987; Conrad 1988; Carlon and Alexandersdottir 1989; Alexandersdottir and Marsh 1990); and a hydroacoustic (sonar) program from 1984-1993 (Burwen and Skvorc *In prep a-d*; Burwen *In prep a-b*). Since 1988, sonar has provided the best estimate of the inriver return. The tag-recapture project was last conducted in 1990. Since 1985, the inriver return has averaged 17,770.

To estimate abundance by age, the age/sex composition of the inriver return is estimated. Prior to 1991, scale samples collected from chinook salmon captured with large mesh gillnets during tag-recapture studies provided the samples for this analysis. Although the tagging program was discontinued in 1991, age, sex, and length samples are still collected using gillnets. All fish captured with gillnets are sampled for age, sex, and size.

Harvest by age and sex, and catch of chinook salmon in the early-run fishery are estimated through a creel survey (Hammarstrom 1975-1981, 1988-1994; Hammarstrom and Larson 1982-1984, 1986; Hammarstrom et al. 1985; Conrad and Hammarstrom 1987; King *In prep*). Chinook salmon are sampled during angler interviews conducted in the creel survey (Hammarstrom 1992).

Mortality from hook-and-release fishing on early-run fish was an estimated 11.1% for small males (< 750 mm), 1.9% for large males (> 750 mm), and 6.8% for females (Bendock and Alexandersdottir 1992). Because it is not possible to measure the size or sex composition of the release component, a grand average of the estimated mortality rate on early-run fish (6.4%) was used as a reasonable estimate for this stock. This approach introduces an unknown bias because of the higher mortality for small males and the tendency of anglers to release smaller fish. To complete tabulations of return by age, I used the age and sex composition of the inriver return as an approximation of the chinook salmon released in the recreational fishery.

Escapement (fish that survive all fisheries and are potential spawners) is estimated by subtracting the inriver sport harvest plus the hook and release mortalities from the inriver return.

Brood and Sibling Ratios

Chinook salmon in the Kenai River are managed to achieve optimum sustained production. In 1988, spawning requirements were computed to sustain levels of production realized during the years 1984-1988. These escapement goals were based on limited information from the Kenai River and experiences of other researchers working with chinook salmon on the west coast of North America (McBride et al. 1989). Total return data are being compiled to assess production and refine these escapement goals. A good stock-recruit analysis requires data that span decades, since one year's return must be compared to returns from parent generations many years earlier.

A predictable relationship between consecutive-year returns of the same brood (i.e. sibling relationship) has been established for the early run (Sonnichsen and Alexandersdottir 1991). As a result, mean sibling ratios (the ratio of the returns of one age to the returns of one or more younger ages for a brood) for years with complete return data were used to predict returns for 1990-1994 (Sonnichsen and Alexandersdottir 1991; Hammarstrom 1992-1994). Sibling ratios were updated with the analysis of the 1994 return to forecast the 1995 return.

Migratory Timing

Inriver return (measured by tag-recapture experiments in 1985-1987 and by sonar in 1988-1994) and inriver recreational fishery statistics (effort, harvest per hour, catch per hour, harvest and catch) are used to estimate the migratory timing of the chinook salmon return into the Kenai River. Historic cumulative daily proportions of each of these statistics are used to provide estimates of each parameter that were applied to data from the year in question to predict

season-end values (McBride et al. 1989). Cumulative daily sonar counts were divided by average cumulative daily proportions of the inriver return for the years 1985-1993 to project the total inriver return for 1994 (Appendix A1). Similarly, the recreational effort, harvest and catch were projected using the inseason estimates of each parameter and average cumulative proportion data from 1986-1994 (Appendices A2-A7).

Escapement was projected by subtracting the projected fishing mortality (harvest + hook-and-release mortality) from the projected inriver return. Although projections are made from the commencement of the fishery, precision of the estimates is insufficient to detect significant deviations from the average historic migratory timing until early June.

ASSESSMENT OF THE 1994 EARLY RETURN

INRIVER RETURN

The sonar began counting fish 16 May 1994 and continued through the early run (Burwen *In prep b*). The 1994 inriver return through 30 June was 18,403 (Table 1). The 1994 return was the second largest return since 1988 and the fifth largest return since 1985.[2]

A total of 454 chinook salmon was captured in the gillnet test fishery during the early run (Table 2). There was a significant difference in age composition between the first half and second half of the run ($\chi^2 = 9.59$, df = 4, P = 0.04). The inriver return was predominantly age 1.4 (69.1%) followed by ages 1.3, 1.5, and 1.2, (19.9%, 4.4%, 3.6%) respectively. Total inriver return by age and historical age compositions (1986-1994) are presented in Table 3.

RECREATIONAL FISHERY

The 1994 creel survey commenced on 17 May (King *In prep*). A relatively strong return from the start of the sonar operation precluded any additional restrictive regulations on the recreational fishery. Effective 24 June, an emergency order removed the bait restriction because sufficient potential escapement had occurred by 23 June.

Angler effort for early-run chinook salmon in the downstream section (Cook Inlet to the Soldotna Bridge) was estimated at 134,199 angler-hours (SE = 3,791) (King *In prep*). Although no survey was conducted upstream of the Soldotna Bridge, observations indicated significant effort and therefore some harvest occurred in that area. Observers felt that effort had increased considerably from 1993 observations. To account for this apparent increase in effort and presumed increased harvest, the downstream estimates were expanded by the greatest proportion of harvest and effort that occurred above the downstream section during the years 1986-1989 when surveys were conducted and no additional restrictions were in effect. This increased the estimate of effort by 39,643 (22.8%) angler-hours resulting in a total estimated effort of 173,842 angler-hours. Estimated harvest in the downstream section was 4,722 fish (SE = 300) with an estimated catch of 6,399 fish (SE = 404). The estimate of harvest was increased by 912 (16.2%) fish to account for the harvest above the downstream section, resulting in a total

[2] Inriver return was estimated with tagging data in 1985 (15,972), 1986 (27,080) and 1987 (25,643). See Table 8 for a summary of all return data.

Table 1.-Historical sonar counts of chinook salmon in the Kenai River during the early run, 1987-1994.

	1987 Counts		1988 Counts		1989 Counts		1990 Counts		1991 Counts		1992 Counts		1993 Counts		1994 Counts	
Date	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
5/16			188	188	180	180	78	78	30	30	54	54	85	85	238	238
5/17			415	603	319	499	57	135	12	42	48	102	91	176	342	580
5/18			259	862	264	763	93	228	65	107	88	190	66	242	260	840
5/19			260	1,122	180	943	136	364	55	162	40	230	69	311	302	1,142
5/20			406	1,528	147	1,090	93	457	68	230	78	308	165	476	369	1,511
5/21			184	1,712	245	1,335	69	526	51	281	90	398	117	593	327	1,838
5/22			182	1,894	164	1,499	75	601	111	392	108	506	155	748	246	2,084
5/23			231	2,125	186	1,685	63	664	66	458	150	656	141	889	212	2,296
5/24			288	2,413	279	1,964	51	715	66	524	126	782	150	1,039	303	2,599
5/25			351	2,764	300	2,264	76	791	57	581	79	861	168	1,207	170	2,769
5/26			393	3,157	270	2,534	70	861	81	662	93	954	150	1,357	150	2,919
5/27			387	3,544	419	2,953	87	948	81	743	66	1,020	322	1,679	267	3,186
5/28			483	4,027	357	3,310	61	1,009	78	821	78	1,098	488	2,167	258	3,444
5/29			713	4,740	269	3,579	144	1,153	51	872	45	1,143	340	2,507	347	3,791
5/30			333	5,073	164	3,743	138	1,291	51	923	111	1,254	266	2,773	321	4,112
5/31			501	5,574	157	3,900	173	1,464	69	992	114	1,368	185	2,958	369	4,481
6/01			556	6,130	258	4,158	153	1,617	150	1,142	106	1,474	389	3,347	321	4,802
6/02			545	6,675	194	4,352	303	1,920	240	1,382	107	1,581	324	3,671	266	5,068
6/03			598	7,273	233	4,585	235	2,155	362	1,744	232	1,813	255	3,926	298	5,366
6/04	1,059	1,059	755	8,028	246	4,831	177	2,332	177	1,921	190	2,003	276	4,202	304	5,670
6/05	552	1,611	782	8,810	280	5,111	192	2,524	316	2,237	166	2,169	327	4,529	351	6,021
6/06	1,495	3,106	493	9,303	384	5,495	156	2,680	290	2,527	319	2,488	198	4,727	198	6,219
6/07	1,145	4,251	506	9,809	545	6,040	304	2,984	215	2,742	515	3,003	297	5,024	384	6,603
6/08	602	4,853	771	10,580	890	6,930	415	3,399	244	2,986	375	3,378	378	5,402	306	6,909
6/09	1,024	5,877	569	11,149	912	7,842	330	3,729	447	3,433	486	3,864	453	5,855	462	7,371
6/10	985	6,862	333	11,482	913	8,755	270	3,999	281	3,714	264	4,128	549	6,404	432	7,803
6/11	1,004	7,866	320	11,802	710	9,465	453	4,452	335	4,049	234	4,362	600	7,004	423	8,226
6/12	1,044	8,910	302	12,104	577	10,042	569	5,021	388	4,437	394	4,756	951	7,955	329	8,555
6/13	2,168	11,078	188	12,292	599	10,641	444	5,465	360	4,797	236	4,992	812	8,767	376	8,931
6/14	1,297	12,375	289	12,581	458	11,099	330	5,795	272	5,069	174	5,166	406	9,173	514	9,445
6/15	975	13,350	510	13,091	335	11,434	651	6,446	432	5,501	312	5,478	617	9,790	306	9,751
6/16	786	14,136	808	13,899	397	11,831	486	6,932	610	6,111	239	5,717	567	10,357	453	10,204
6/17	612	14,748	535	14,434	514	12,345	277	7,209	335	6,446	339	6,056	606	10,963	315	10,519
6/18	783	15,531	533	14,967	464	12,809	238	7,447	494	6,940	320	6,376	425	11,388	435	10,954
6/19	771	16,302	200	15,167	295	13,104	332	7,779	440	7,380	390	6,766	504	11,892	636	11,590
6/20	682	16,984	175	15,342	498	13,602	369	8,148	317	7,697	548	7,314	621	12,513	402	11,992
6/21	517	17,501	373	15,715	520	14,122	256	8,404	454	8,151	372	7,686	399	12,912	570	12,562
6/22	487	17,988	312	16,027	614	14,736	265	8,669	438	8,589	297	7,983	608	13,520	366	12,928
6/23	529	18,517	375	16,402	547	15,283	240	8,909	398	8,987	213	8,196	720	14,240	550	13,478
6/24	303	18,820	674	17,076	564	15,847	322	9,231	250	9,237	337	8,533	808	15,048	696	14,174
6/25	564	19,384	582	17,658	374	16,221	258	9,489	225	9,462	362	8,895	1,050	16,098	734	14,908
6/26	731	20,115	436	18,094	369	16,590	322	9,811	271	9,733	330	9,225	1,156	17,254	597	15,505
6/27	452	20,567	549	18,643	309	16,899	231	10,042	340	10,073	291	9,516	797	18,051	639	16,144
6/28	587	21,154	827	19,470	425	17,324	236	10,278	330	10,403	253	9,769	732	18,783	681	16,825
6/29	371	21,525	495	19,965	376	17,700	208	10,486	258	10,661	121	9,890	657	19,440	929	17,754
6/30	388	21,913	915	20,880	292	17,992	193	10,679	270	10,931	197	10,087	481	19,921	649	18,403
TOTAL		21,913		20,880		17,992		10,679		10,931		10,087		19,921		18,403

Table 2.-Estimates by age class of the number of early-run chinook salmon in the inriver return to the Kenai River.

	Age Class					
	1.2	1.3	1.4	1.5	Other	Total
(5/16 - 6/07)						
Males						
Sample Size	5	18	54	3	1	81
Percent	2.7	9.8	29.3	1.6	0.5	44.0
SE Percent	1.2	2.2	3.4	0.9	0.5	3.7
Return	179	646	1,938	108	36	2,907
SE Return	79	145	222	62	36	242
Females						
Sample Size	0	22	80	0	1	103
Percent	0.0	12.0	43.5	0.0	0.5	56.0
SE Percent	0.0	2.4	3.7	0.0	0.5	3.7
Return	0	789	2,871	0	36	3,696
SE Return	0	158	242	0	36	242
Combined						
Sample Size	5	40	134	3	2	184
Percent	2.7	21.7	72.8	1.6	1.1	100.0
SE Percent	1.2	3.0	3.3	0.9	0.8	
Return	179	1,435	4,809	108	72	6,603
SE Return	79	201	217	62	51	
(6/08 - 6/30)						
Males						
Sample Size	11	35	83	13	7	149
Percent	4.1	13.0	30.7	4.8	2.6	55.2
SE Percent	1.2	2.0	2.8	1.3	1.0	3.0
Return	481	1,530	3,627	568	306	6,512
SE Return	142	242	332	154	114	358
Females						
Sample Size	0	16	98	3	4	121
Percent	0.0	5.9	36.3	1.1	1.5	44.8
SE Percent	0.0	1.4	2.9	0.6	0.7	3.0
Return	0	699	4,283	131	175	5,288
SE Return	0	170	346	75	87	358
Combined						
Sample Size	11	51	181	16	11	270
Percent	4.1	18.9	67.0	5.9	4.1	100.0
SE Percent	1.2	2.4	2.9	1.4	1.2	
Return	481	2,229	7,910	699	481	11,800
SE Return	142	282	338	170	142	
Early Run Total						
Males						
Percent	3.6	11.8	30.2	3.7	1.9	51.2
Return	660	2,176	5,565	676	342	9,419
SE Return	163	282	400	166	120	432
Females						
Percent	0.0	8.1	38.9	0.7	1.1	48.8
Return	0	1,489	7,154	131	211	8,984
SE Return	0	232	422	75	94	432
Combined						
Percent	3.6	19.9	69.1	4.4	3.0	100.0
Return	660	3,664	12,719	807	553	18,403
SE Return	163	346	402	181	151	

Table 3.-Estimates by age class of the number of early-run chinook salmon in the total return to the Kenai River, 1986-1994.

	Age Class									
	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	Total
1986										
Percent	0.0	16.8	43.3	32.8	7.0	0.0	0.0	0.0	0.0	100.0
Return	0	4,554	11,731	8,880	1,908	0	0	0	7	27,080
SE Return	0	1,755	4,239	3,195	703	0	0	0	12	9,799
1987										
Percent	0.0	1.5	37.6	58.0	2.3	0.0	0.0	0.1	0.4	100.0
Return	0	386	9,653	14,883	589	0	0	31	101	25,643
SE Return	0	125	2,080	3,732	226	0	0	31	56	5,928
1988										
Percent	0.0	1.7	14.8	72.2	10.9	0.3	0.0	0.1	0.0	100.0
Return	0	358	3,088	15,077	2,279	57	0	21	0	20,880
SE Return	0	97	260	335	237	40	0	21	0	0
1989										
Percent	0.0	4.2	15.8	70.8	9.2	0.0	0.0	0.0	0.0	100.0
Return	0	759	2,853	12,788	1,665	0	0	0	0	18,065 [a]
SE Return	0	137	250	311	195	0	0	0	0	0
1990										
Percent	0.0	7.4	26.1	60.5	6.0	0.0	0.0	0.0	0.0	100.0
Return	0	793	2,796	6,487	643	0	0	0	0	10,719 [b]
SE Return	0	132	212	239	113	0	0	0	0	0
1991										
Percent	0.0	7.3	22.4	65.1	5.2	0.0	0.0	0.0	0.0	100.0
Return	0	801	2,450	7,117	565	0	0	0	0	10,933 [c]
SE Return	0	187	300	343	159	0	0	0	0	0
1992										
Percent	0.0	8.1	28.5	58.1	5.3	0.0	0.0	0.0	0.0	100.0
Return	0	826	2,891	5,906	537	0	0	0	0	10,160 [d]
SE Return	0	177	293	320	145	0	0	0	0	0
1993										
Percent	0.0	3.9	25.1	66.3	3.7	0.0	0.4	0.5	0.0	100.0
Return	0	784	5,039	13,281	750	0	83	102	0	20,039 [e]
SE Return	0	231	501	552	228	0	83	59	0	
1994										
Percent	0.0	3.6	19.9	69.1	4.4	0.0	0.2	0.7	2.1	100.0
Return	0	662	3,675	12,758	809	0	44	122	389	18,459 [f]
SE Return	0	163	346	402	181	0	44	72	129	

[a] Includes 73 fish harvested in the Kenaitze educational gillnet fishery.
[b] Includes 40 fish harvested in the Kenaitze educational gillnet fishery.
[c] Includes two fish harvested in the Kenaitze educational gillnet fishery.
[d] Includes 47 fish harvested in the Kenaitze educational gillnet fishery and 26 fish harvested in the subsistence dip net fishery.
[e] Includes 118 fish harvested in the Kenaitze educational gillnet fishery.
[f] Includes 56 fish harvested in the Kenaitze educational gillnet fishery.

estimated harvest of 5,634 (Table 4). Anglers employing professional guides accounted for 68% of the harvest and 46% of the effort.

Age composition of the recreational harvest was determined from 351 fish harvested during the early run. There was a significant difference (χ^2 = 24.55, df = 6, P < 0.01) in the age composition of the harvest among three temporal strata (Table 5). This was caused primarily by an increase in chinook salmon aged 1.3 during the first half of June and an increase in fish aged 1.2 during the latter half of June. Because there were significant differences in the age composition between late May and the first half of June (χ^2 = 15.65, df = 3, P < 0.01) and between the two temporal strata within June (χ^2 = 10.36, df = 3, P = 0.01), none of the strata were combined to estimate harvest by age and sex. The majority (82.9%) of the harvest was of fish aged 1.4. Chinook salmon aged 1.4 were the predominant year class in the harvest of the early-run for all but one year since 1976 (Table 6).

Release mortality by age was estimated to more accurately estimate spawning escapement. During 1990, 1991, and 1992, nearly two-thirds of the catch was released (Table 7) due to emergency orders restricting the fishery to hook-and-release or trophy fishing. In 1994, approximately one-quarter of the catch was released resulting in an estimated mortality of 128 (SE = 43) (Table 7).

ESCAPEMENT AND TOTAL RETURN

Spawning escapement is the harvest plus hook-and-release mortality subtracted from the inriver return. In 1994, an estimated 12,641 chinook salmon escaped all fisheries as potential spawners (Table 8). The majority of these spawners were age class 1.4 (Table 9). This age class has been the predominant spawning age class since 1987.

In 1994, a total harvest of 56 early-run chinook salmon was reported by the Kenaitze Indian Tribe. This compares to 73, 40, 2, 73, and 118 in 1989, 1990, 1991, 1992 and 1993, respectively.

BROOD RELATIONSHIPS

Returns at age were tabulated by sampling year (Table 10) and by brood year (Table 11). Total production from the first measured escapement (8,001 in 1985) was realized in 1993. Performance from the 1985 brood was better than replacement (1.40 to 1). The 1986 brood (19,227 escapement) did not replace itself as the return was only 0.51 to 1. Brood year 1987 (11,988 escapement), however, has already returned 1.52 adults per spawner, with only age-8 fish to return in 1995. Brood year 1988 (7,756 escapement) has shown the best total return of the measured escapements to date (18,828 fish and 2.43 adults per spawner) with two age classes still to return.

SIBLING RELATIONSHIPS

Sonnichsen and Alexandersdottir (1991) developed a sibling model to forecast future returns (Table 12). Total return for the 1990 early run was forecast at 14,919 fish; the observed value was 10,719 or 72% of the expected value (Table 13). Using similar techniques, but including values observed in 1990, they predicted a return of 14,290 for 1991. The observed value was 10,933, 77% of the expected value. Similarly the expected return for 1992 was 12,936; the observed return was 10,160, 79% of the expected value. In 1993, the observed return (20,039) exceeded the expected return (13,406) for the first time. The expected return for 1994 was 20,110; the observed return was 18,570, 92% of the expected value. Incorporating the observed 1994 values into the equations results in an expected return in 1995 of 16,020

Table 4.-Historical summary of harvest, angler effort and harvest rate in the recreational fishery for early-run chinook salmon, Kenai River, 1974-1994.

	Harvest			Effort in Angler Hours			Harvest per Hour		
Year	Unguided	Guided	Total	Unguided	Guided	Total	Unguided	Guided	Total
1974			1,685			41,098			0.041
1975			615			55,909			0.011
1976			1,665			64,750			0.026
1977			2,173			112,007			0.019
1978			1,542			96,624			0.016
1979			3,661			139,154			0.026
1980			1,946			123,019			0.016
1981	2,278	2,247	4,525	92,837	28,044	120,881	0.025	0.080	0.037
1982	3,002	2,464	5,466	136,560	27,774	164,334	0.022	0.089	0.033
1983	2,274	4,086	6,360	121,208	48,789	169,997	0.019	0.084	0.037
1984	2,396	2,560	4,956	153,586	48,235	201,821	0.016	0.053	0.025
1985	3,191	4,780	7,971	126,243	58,593	184,836	0.025	0.082	0.043
1986	3,575	3,986	7,561	134,868	49,033	183,901	0.027	0.081	0.041
1987	6,899	6,382	13,281	160,839	55,977	216,816	0.043	0.114	0.061
1988	5,791	6,956	12,747	181,436	78,465	259,901	0.032	0.089	0.049
1989	1,952	5,304	7,256	132,282	102,245	234,527	0.015	0.052	0.031
1990 [a]	367	1,368	1,735	57,189	65,960	123,149	0.010	0.038	0.024
1991 [a]	298	593	891	24,320	23,279	47,599	0.020	0.043	0.031
1992 [a]	653	712	1,365	28,217	26,113	54,330	0.036	0.052	0.043
1993	2,784 [b]	4,062 [b]	7,727	76,500 [b]	46,773 [b]	153,899	0.036 [b]	0.087 [b]	0.056 [b]
Mean	2,728	3,500	6,295	109,699	50,714	162,769	0.025	0.073	0.039
1994	1,524 [c]	3,198 [c]	5,634	72,433 [c]	61,766 [c]	173,842	0.021 [c]	0.052 [c]	0.035 [c]

[a] Harvest per hour only for periods open to retention of chinook salmon. Periods of trophy fishing (i.e. only fish greater than 52 inches may be retained) are excluded.

[b] Estimates presented are for the downstream section only. Total harvest was expanded by 881 fish to account for harvest upstream of the survey area. Total effort was expanded by 30,626 angler hours to account for effort upstream of the survey area. Expansion was based on the average proportion of harvest and effort occurring in the upstream section from 1986-1989.

[c] Estimates presented are for the downstream section only. Total harvest was expanded by 912 fish to account for harvest upstream of the survey area. Total effort was expanded by 39,643 angler hours to account for effort upstream of the survey area. Expansion was based on the average proportion of harvest and effort occurring in the upstream section from 1986-1989.

Table 5.-Estimates by age class of the number of early-run chinook salmon harvested in the recreational fishery on the downstream section of the Kenai River, 1994.

	Age Class					
	1.2	1.3	1.4	1.5	Other	Total
(5/17 - 5/31)						
Males						
Sample Size	1	6	83	4	0	94
Percent	0.6	3.6	50.3	2.4	0.0	57.0
SE Percent	0.6	1.5	3.9	1.2	0.0	3.9
Harvest	7	39	543	26	0	615
SE Harvest	7	16	79	13	0	87
Females						
Sample Size	0	3	66	2	0	71
Percent	0.0	1.8	40.0	1.2	0.0	43.0
SE Percent	0.0	1.0	3.8	0.9	0.0	3.9
Harvest	0	20	432	13	0	465
SE Harvest	0	11	67	9	0	71
Combined						
Sample Size	1	9	149	6	0	165
Percent	0.6	5.5	90.3	3.6	0.0	100.0
SE Percent	0.6	1.8	2.3	1.5	0.0	
Harvest	7	59	975	39	0	1,080
SE Harvest	7	20	124	16	0	134
(6/01 - 6/13)						
Males						
Sample Size	2	4	26	0	0	32
Percent	2.2	4.3	28.0	0.0	0.0	34.4
SE Percent	1.5	2.1	4.7	0.0	0.0	5.0
Harvest	37	75	487	0	0	600
SE Harvest	27	37	96	0	0	106
Females						
Sample Size	2	11	48	0	0	61
Percent	2.2	11.8	51.6	0.0	0.0	65.6
SE Percent	1.5	3.4	5.2	0.0	0.0	5.0
Harvest	37	206	900	0	0	1,143
SE Harvest	27	62	130	0	0	147
Combined						
Sample Size	4	15	74	0	0	93
Percent	4.3	16.1	79.6	0.0	0.0	100.0
SE Percent	2.1	3.8	4.2	0.0	0.0	
Harvest	75	281	1,387	0	0	1,743
SE Harvest	37	73	161	0	0	181

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Table 5.-Page 2 of 2.

	Age Class					
	1.2	1.3	1.4	1.5	Other	Total
(6/14 - 6/30)						
Males						
Sample Size	7	2	41	2	0	52
Percent	7.5	2.2	44.1	2.2	0.0	55.9
SE Percent	2.8	1.5	5.2	1.5	0.0	5.2
Harvest	143	41	837	41	0	1,062
SE Harvest	54	29	131	29	0	148
Females						
Sample Size	1	3	35	2	0	41
Percent	1.1	3.2	37.6	2.2	0.0	44.1
SE Percent	1.1	1.8	5.1	1.5	0.0	5.2
Harvest	20	61	715	41	0	837
SE Harvest	21	36	121	29	0	131
Combined						
Sample Size	8	5	76	4	0	93
Percent	8.6	5.4	81.7	4.3	0.0	100.0
SE Percent	2.9	2.4	4.0	2.1	0.0	
Harvest	163	102	1,552	82	0	1,899
SE Harvest	58	46	179	41	0	198
(Early Run Total)						
Males						
Percent	4.0	3.3	39.6	1.4	0.0	48.2
Harvest	187	155	1,868	67	0	2,277
SE Harvest	61	50	181	32	0	202
Females						
Percent	1.2	6.1	43.3	1.1	0.0	51.8
Harvest	58	287	2,046	54	0	2,445
SE Harvest	34	73	190	30	0	209
Combined						
Percent	5.2	9.4	82.9	2.6	0.0	100.0
Harvest	245	442	3,914	121	0	4,722
SE Harvest	69	88	263	44	0	300

Table 6.-Estimates by age class of the number of early-run chinook salmon harvested in the recreational fishery on the Kenai River, 1976-1994.

	Age Class										
	1.1	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	Other	Total
1976											
Percent	3.9	26.4	24.0	42.2	2.4	0.0	1.0	0.0	0.0		100.0
Harvest	61	411	373	656	38	0	15	0	0		1,554
SE Harvest	21	48	47	54	17	0	11	0	0		NA
1977											
Percent	0.0	14.1	29.6	52.4	1.5	0.0	0.5	1.5	0.5		100.0
Harvest	0	306	643	1,138	32	0	11	32	11		2,173
SE Harvest	0	53	69	76	18	0	11	18	11		NA
1978											
Percent	0.0	16.0	18.9	65.2	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Harvest	0	246	291	1,005	0	0	0	0	0	0	1,542
SE Harvest	0	68	73	89	0	0	0	0	0	0	NA
1979											
Percent	5.8	30.8	51.9	11.5	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Harvest	154	819	1,381	307	0	0	0	0	0	0	2,661
SE Harvest	0	61	121	131	84	0	0	0	0	0	NA
1980											
Percent	0.0	9.0	14.9	69.8	6.3	0.0	0.0	0.0	0.0	0.0	100.0
Harvest	0	175	289	1,359	123	0	0	0	0	0	1,946
SE Harvest	0	37	47	60	32	0	0	0	0	0	NA
1981											
Percent		14.2	31.0	49.5	3.1					2.2	100.0
Harvest		641	1,402	2,242	140					100	4,525
SE Harvest		105	139	151	52					44	NA
1982											
Percent		6.3	23.3	62.3	4.4					3.8	100.0
Harvest		344	1,272	3,403	241					206	5,466
SE Harvest		106	184	211	89					83	NA
1983											
Percent		7.1	14.3	62.9	4.3					11.4	100.0
Harvest		454	909	3,998	273					726	6,360
SE Harvest		197	268	370	155					244	NA
1984											
Percent	0.0	3.4	27.8	61.8	6.9	0.0	0.0	0.0	0.0		100.0
Harvest	0	170	1,380	3,065	341	0	0	0	0		4,956
SE Harvest	0	53	130	141	74	0	0	0	0		NA
1985											
Percent	0.0	6.1	13.3	76.5	4.1	0.0	0.0	0.0	0.0		100.0
Harvest	0	488	1,058	6,100	325	0	0	0	0		7,971
SE Harvest	0	112	158	197	92	0	0	0	0		NA

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Table 6.-Page 2 of 2.

	Age Class										
	1.1	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	Other	Total
1986											
Percent	0.2	7.1	36.3	47.5	8.9	0.0	0.0	0.0	0.0		100.0
Harvest	14	540	2,741	3,591	675	0	0	0	0		7,561
SE Harvest	14	89	229	274	100	0	0	0	0		470
1987											
Percent	0.0	0.9	31.1	62.7	4.7	0.0	0.0	0.6	0.0		100.0
Harvest	0	113	4,134	8,326	623	0	0	85	0		13,281
SE Harvest	0	57	392	621	136	0	0	49	0		871
1988											
Percent	0.2	1.9	12.2	78.6	6.8	0.0	0.0	0.3	0.0		100.0
Harvest	22	244	1,555	10,016	866	0	0	44	0		12,747
SE Harvest	22	74	195	608	143	0	0	31	0		722
1989											
Percent	1.1	3.3	26.2	62.8	6.6	0.0	0.0	0.0	0.0		100.0
Harvest	79	238	1,903	4,560	476	0	0	0	0		7,256
SE Harvest	56	97	272	416	137	0	0	0	0		517
1990											
Percent	0.0	5.6	5.6	74.6	14.1	0.0	0.0	0.0	0.0		100.0
Harvest	0	98	98	1,295	244	0	0	0	0		1,735
SE Harvest	0	50	50	225	81	0	0	0	0		277
1991											
Percent	0.0	0.0	8.5	80.9	10.7	0.0	0.0	0.0	0.0		100.1
Harvest	0	0	76	720	95	0	0	0	0		891
SE Harvest	0	0	39	146	44	0	0	0	0		169
1992											
Percent	0.0	4.2	16.8	75.8	3.2	0.0	0.0	0.0	0.0		100.0
Harvest	0	58	229	1,035	43	0	0	0	0		1,365
SE Harvest	0	29	58	129	25	0	0	0	0		151
1993											
Percent	0.2	4.0	14.3	74.8	5.6	0.0	0.2	0.6	0.2		100.0
Harvest[a]	18	310	1,107	5,779	431	0	18	46	18		7,727
SE Harvest	16	60	118	319	75	0	16	24	16		383
1994											
Percent	0.0	5.2	9.4	82.9	2.6	0.0	0.0	0.0	0.0		100.0
Harvest[b]	0	292	528	4,670	144	0	0	0	0		5,634
SE Harvest	0	69	87	250	42	0	0	0	0		300

[a] Includes 881 fish estimated harvested in unsurveyed areas of the Kenai River based on the mean proportion of harvest occurring in those areas during the years 1986-1989 when the areas were surveyed. Age composition in unsurveyed area assumed equal to the total age composition estimated for the harvest in the downstream section.

[b] Includes 912 fish estimated harvested in unsurveyed areas of the Kenai River based on the highest proportion of harvest occurring in those areas during the years 1986-1989 when the areas were surveyed. Age composition in unsurveyed area assumed equal to the total age composition estimated for the harvest in the downstream section.

Table 7.-Estimates of the number of early-run chinook salmon mortalities attributable to hook-and-release fishing, Kenai River, 1986-1994.

Year	Sport Catch	Sport Harvest	Number Released	SE Released	Percent Mortality[a]	SE Percent	Hook and Release Mortality	SE Mortality
1986	12,117	7,561	4,556	845	6.4 (E)	3.39	292	161
1987	19,119	13,281	5,838	1,492	6.4 (E)	3.39	374	214
1988	18,643	12,747	5,896	1,129	6.4 (E)	3.39	377	209
1989	9,901	7,256	2,645	831	6.4 (E)	3.39	169	100
1990	4,973	1,735	3,238	630	8.8 (M)	2.50	285	97
1991	3,716	891	2,825	391	4.1 (M)	1.98	116	58
1992	3,901	1,365	2,536	219	6.4 (E)	3.39	164	87
1993	11,153	7,727	3,454	523	6.4 (E)	3.39	219	106
1994	7,635	5,634	2,001	271	6.4 (E)	3.39	128	43

[a] (E) Estimated as the mean of the 1990 and 1991 mortality rates (Bendock and Alexandersdottir 1992).
(M) Measured.

Table 8.-Summary of early-run Kenai River chinook salmon population data, 1985-1994.

Year	Deep Creek Marine Harvest	Eastside Set Net Harvest	Drift Gill Net Harvest	Subsistence[a]	Inriver Return	Total Return	Kenai River Sport Harvest	Hook and Release Mortality	Spawning Escapement
1985	Unknown	Closed	Closed		15,972	15,972	7,971	Unknown	8,001
1986	Unknown	Closed	Closed		27,080	27,080	7,561	292	19,227
1987	Unknown	Closed	Closed		25,643	25,643	13,281	374	11,988
1988	Unknown	Closed	Closed		20,880	20,880	12,747	377	7,756
1989	Unknown	Closed	Closed	73	17,992	18,065	7,256	169	10,567
1990	Unknown	Closed	Closed	40	10,679	10,719	1,735	285	8,659
1991	Unknown	Closed	Closed	2	10,931	10,933	891	116	9,924
1992	Unknown	Closed	Closed	73	10,087	10,160	1,365	164	8,558
1993	Unknown	Closed	Closed	118	19,921	20,039	7,727	219	11,975
1994	Unknown	Closed	Closed	56	18,403	18,459	5,634	128	12,641

[a] Includes fish harvested in Kenaitze educational gillnet fishery and in the subsistence dip net fishery.

Table 9.-Estimates by age class of the number of early-run chinook salmon in the spawning escapement to the Kenai River, 1986-1994.

	Age Class										
	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	2.5	Total
1986											
Inriver Return[a]	0	4,554	11,731	8,880	1,908	0	0	0	7	0	27,080
SE Return	0	1,755	4,239	3,195	703	0	0	0	12	0	9,799
Harvest	14	540	2,741	3,591	675	0	0	0	0	0	7,561
SE Harvest	14	89	229	274	100	0	0	0	0	0	470
H&R[b] Mortality	0	45	121	102	24	0	0	0	0	0	292
SE H&R	0	23	49	40	9	0	0	0	0	0	161
Escapement[c]	0	3,969	8,869	5,187	1,209	0	0	0	7	0	19,227
SE Escapement	14	1,757	4,245	3,207	710	0	0	0	12	0	9,812
1987											
Inriver Return[a]	0	386	9,653	14,883	589	0	0	31	101	0	25,643
SE Return	0	125	2,080	3,732	226	0	0	31	56	0	5,928
Harvest	0	113	4,134	8,326	623	0	0	0	85	0	13,281
SE Harvest	0	57	392	621	136	0	0	0	49	0	871
H&R[b] Mortality	0	6	145	214	9	0	0	0	0	0	374
SE H&R	0	3	59	88	4	0	0	0	0	0	214
Escapement[c]	0	267	5,374	6,343	0	0	0	31	16	0	11,988
SE Escapement	0	137	2,117	3,784	264	0	0	31	74	0	5,995
1988											
Inriver Return[a]	0	358	3,088	15,077	2,279	57	0	21	0	0	20,880
SE Return	0	97	260	335	237	40	0	21	0	0	0
Harvest	22	244	1,555	10,016	866	0	0	44	0	0	12,747
SE Harvest	22	74	195	608	143	0	0	31	0	0	722
H&R[b] Mortality	0	7	59	268	41	0	0	2	0	0	377
SE H&R	0	23	49	40	9	0	0	0	0	0	209
Escapement[c]	0	107	1,474	4,793	1,372	57	0	0	0	0	7,756
SE Escapement	22	124	329	695	277	40	0	37	0	0	752
1989											
Inriver Return[a]	0	756	2,841	12,737	1,658	0	0	0	0	0	17,992
SE Return	0	137	250	311	195	0	0	0	0	0	0
Harvest	79	238	1903	4560	476	0	0	0	0	0	7,256
SE Harvest	56	97	272	416	137	0	0	0	0	0	517
H&R[b] Mortality	0	7	25	122	15	0	0	0	0	0	169
SE H&R	0	4	11	51	7	0	0	0	0	0	100
Escapement[c]	0	511	913	8,055	1,167	0	0	0	0	0	10,567
SE Escapement	56	168	370	522	238	0	0	0	0	0	527
1990											
Inriver Return[a]	0	792	2,794	6,460	633	0	0	0	0	0	10,679
SE Return	0	132	214	240	113	0	0	0	0	0	0
Harvest	0	98	98	1295	244	0	0	0	0	0	1,735
SE Harvest	0	50	50	225	81	0	0	0	0	0	277
H&R[b] Mortality	0	20	76	171	18	0	0	0	0	0	285
SE H&R	0	6	19	42	5	0	0	0	0	0	97
Escapement[c]	0	674	2,620	4,994	371	0	0	0	0	0	8,659
SE Escapement	0	141	221	332	139	0	0	0	0	0	293

-continued-

Table 9.-Page 2 of 2.

	Age Class										
	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	2.5	Total
1991											
Inriver Return[a]	0	801	2,449	7,116	565	0	0	0	0	0	10,931
SE Return	0	187	300	343	159	0	0	0	0	0	0
Harvest	0	0	76	720	95	0	0	0	0	0	891
SE Harvest	0	0	39	146	44	0	0	0	0	0	169
H&R[b] Mortality	0	8	26	76	6	0	0	0	0	0	116
SE H&R	0	5	10	28	3	0	0	0	0	0	58
Escapement[c]	0	793	2,347	6,320	464	0	0	0	0	0	9,924
SE Escapement	0	187	303	374	165	0	0	0	0	0	179
1992											
Inriver Return[a]	0	820	2,870	5,864	533	0	0	0	0	0	10,087
SE Return	0	176	291	318	144	0	0	0	0	0	0
Harvest	0	58	229	1035	43	0	0	0	0	0	1,365
SE Harvest	0	29	58	129	25	0	0	0	0	0	151
H&R[b] Mortality	0	13	47	95	9	0	0	0	0	0	164
SE H&R	0	7	25	51	4	0	0	0	0	0	87
Escapement[c]	0	749	2,594	4,734	481	0	0	0	0	0	8,558
SE Escapement	0	179	298	347	146	0	0	0	0	0	174
1993											
Inriver Return[a]	0	780	5,009	13,202	746	0	82	102	0	0	19,921
SE Return	0	231	501	552	228	0	82	58	0	0	0
Harvest	18	310	1,107	5,779	431	0	0	18	46	18	7,727
SE Harvest	0	29	58	129	25	0	0	16	24	16	383
H&R[b] Mortality	0	8	45	155	10	0	0	1	0	0	219
SE H&R	0	2	4	5	2	0	0	1	0	0	118
Escapement[c]	0	462	3,857	7,268	305	0	82	83	0	0	11,975
SE Escapement	0	233	504	567	229	0	82	60	24	16	401
1994											
Inriver Return[a]	0	660	3,664	12,719	809	0	44	121	386	0	18,403
SE Return	0	163	346	402	181	0	44	72	129	0	0
Harvest	0	279	517	4,691	147	0	0	0	0	0	5,634
SE Harvest	0	69	87	250	42	0	0	0	0	0	387
H&R[b] Mortality	0	4	23	92	6	0	0	1	2	0	128
SE H&R	0	2	8	31	3	0	0	1	2	0	43
Escapement[c]	0	377	3,124	7,936	656	0	44	120	384	0	12,641
SE Escapement	0	177	357	474	186	0	44	72	129	0	389

[a] Inriver return estimated from tag to untag ratio from 1986-1987; by sonar counter from 1988-1994.

[b] Hook-and-Release.

[c] For some age classes in some years the estimate of the number harvested in the sport fishery is greater than the estimate of the number in the inriver return. The spawning escapement for the age class was set to zero. When this occurred, the total spawning escapement (calculated by subtracting the total sport harvest plus the hook-and-release mortality from the inriver return) is not the sum of the escapement across age classes.

Table 10.-Age composition of measured returns of Kenai River early-run chinook salmon, 1986-1994.

Year	(0.2, 1.1) Age 3	(0.3, 1.2, 2.1) Age 4	(0.4, 1.3, 2.2) Age 5	(0.5, 1.4, 2.3) Age 6	(1.5, 2.4) Age 7	(1.6, 2.5) Age 8	Total Return
1986		4,554	11,731	8,880	1,915	0	27,080
1987		386	9,653	14,914	690	0	25,643
1988		358	3,088	15,098	2,279	57	20,880
1989		759	2,853	12,788	1,665	0	18,065
1990		793	2,796	6,487	643	0	10,719
1991		801	2,450	7,117	565	0	10,933
1992		826	2,891	5,906	537	0	10,160
1993		784	5,122	13,383	750	0	20,039
1994		662	3,719	12,880	1,198	0	18,459

Table 11.-Summary of returns from each brood year, early-run Kenai River chinook salmon, 1979-1994.

Year	Spawning Escapement	Return (0.3,1.2,2.1) Age 4	(0.4,1.3,2.2) Age 5	(0.5,1.4,2.3) Age 6	(1.5,2.4) Age 7	(1.6,2.5) Age 8	Measured Return To Date	Return Per Spawner
1979	Unknown				(1986) 1,915		1,915	
1980	Unknown			(1986) 8,880	(1987) 690	(1988) 57	9,627	
1981	Unknown		(1986) 11,731	(1987) 14,914	(1988) 2,279		28,924	
1982	Unknown	(1986) 4,554	(1987) 9,653	(1988) 15,098	(1989) 1,665		30,970	
1983	Unknown	(1987) 386	(1988) 3,088	(1989) 12,788	(1990) 643		16,905	
1984	Unknown	(1988) 358	(1989) 2,853	(1990) 6,487	(1991) 565		10,263	
1985	8,001	(1989) 759	(1990) 2,796	(1991) 7,117	(1992) 537		11,209	1.40
1986	19,227	(1990) 793	(1991) 2,450	(1992) 5,906	(1993) 750		9,899	0.51
1987	11,988	(1991) 801	(1992) 2,891	(1993) 13,383	(1994) 1,198		18,273	1.52
1988	7,756	(1992) 826	(1993) 5,122	(1994) 12,880			18,828	2.43
1989	10,567	(1993) 784	(1994) 3,719				4,503	0.43
1990	8,659	(1994) 662					662	0.08
1991	9,924							
1992	8,558							
1993	11,975							
1994	12,641							

Table 12.-Sibling return ratios from early-run Kenai River chinook salmon, brood years 1980-1989.

Brood Year	Age 5/ Age4	Age 6/ Age 5	Age 6/ Age4+5	Age 7/ Age 6	Age 7/ Age 5+6	Age 7/ Age4+5+6
1980				0.08		
1981		1.27		0.15	0.09	
1982	2.12	1.56	1.06	0.11	0.07	0.06
1983	8.00	4.14	3.68	0.05	0.04	0.04
1984	7.97	2.27	2.02	0.09	0.06	0.06
1985	3.68	2.55	2.00	0.08	0.05	0.05
1986	3.09	2.41	1.82	0.13	0.09	0.08
1987	3.61	4.63	3.62	0.09	0.07	0.07
1988	6.20	2.51	2.17			
1989	4.74					
Mean	4.93	2.67	2.34	0.10	0.07	0.06
Std. Dev.	2.23	1.16	0.97	0.03	0.02	0.01
% Coeff. Var.	45	44	41	34	26	25
Maximum	8.00	4.63	3.68	0.15	0.09	0.08
Minimum	2.12	1.27	1.06	0.05	0.04	0.04

Table 13.-Summary of expected returns based on sibling ratios versus observed returns, early-run Kenai River chinook salmon, 1990-1994, and 1995 projections. Numbers in parentheses denote negative numbers.

	Return				
	Age 4	Age 5	Age 6	Age 7	Total
1990					
Projected	1,514	4,576	7,616	1,213	14,919
Observed	775	2,851	6,409	684	10,719
Difference	(739)	(1,758)	(1,076)	(565)	(4,113)
% of Expected	51.2	62.3	84.2	56.4	71.8
1991					
Projected	1,371	4,363	8,085	471	14,290
Observed	801	2,450	7,117	565	10,933
Difference	(573)	(1,915)	(970)	97	(3,361)
% of Expected	58.4	56.2	88.0	120.0	76.5
1992					
Projected	1,276	3,983	7,126	551	12,936
Observed	826	2,891	5,906	537	10,160
Difference	(450)	(1,092)	(1,220)	(14)	(2,776)
% of Expected	64.7	72.6	82.9	97.5	78.5
1993					
Projected	1,208	3,939	7,785	474	13,406
Observed	784	5,122	13,383	750	20,039
Difference	(424)	1,183	5,598	276	6,633
% of Expected	64.9	130.0	171.9	158.2	149.5
1994					
Projected	1,158	3,883	14,089	980	20,110
Observed	662	3,719	12,880	1,198	18,459
Difference	(496)	(164)	(1,209)	218	(1,651)
% of Expected	57.2	95.8	91.4	122.2	91.8
1995					
Projection	1,103	3,262	10,535	1,120	16,020
Standard Error	436	1,957	4,584	423	5,170

(SE = 5,170) chinook salmon to the Kenai River during the early run (Table 13).

MIGRATORY TIMING

In 1994, daily sonar counts of chinook salmon exceeded 150 from the first day the sonar was in operation (16 May). No daily count exceeded 1,000. The largest count (929) occurred on 29 June (Table 1).

Daily projections of the inriver return remained within 11% of the final return from 5 June through 30 June (Figure 4). Cumulative proportions of the 1994 inriver return remained within the 95% confidence interval of the historical model (Figure 5) beginning May 26. The estimated total return throughout the season was large enough to preclude any restrictive management actions. On 24 June the bait restriction was removed.

DISCUSSION

Real-time estimates of the inriver return provided by the sonar project have greatly improved the department's ability to compensate for changing situations on relatively short notice. For example, data collected through the sonar project make it possible to implement trophy fishing, rather than a total fishery closure, in response to weak returns. Regulations can be liberalized in response to exceptionally strong returns. During 1990, 1991 and 1992, the spawning

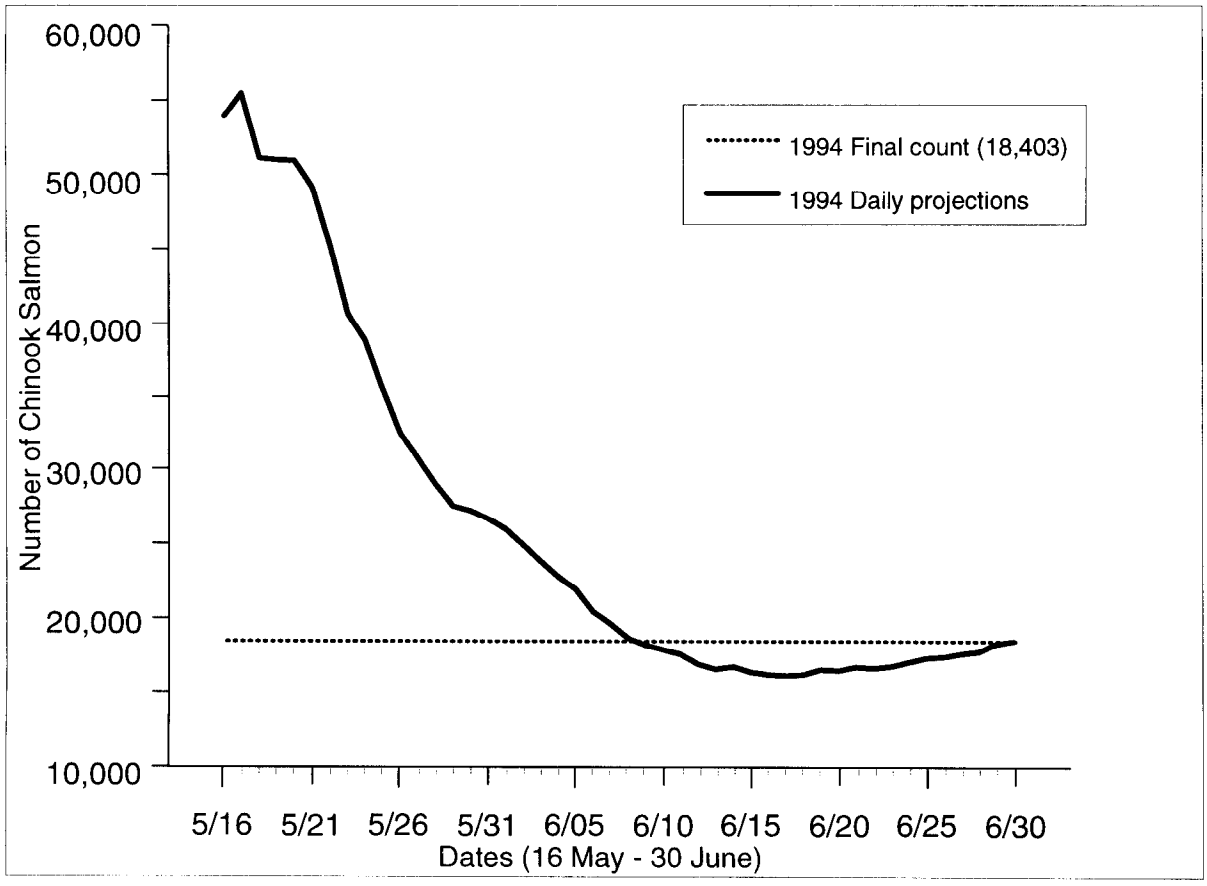

Figure 4.-Daily projections of total inriver return vs. the actual inriver return of early-run chinook salmon, Kenai River, 1994.

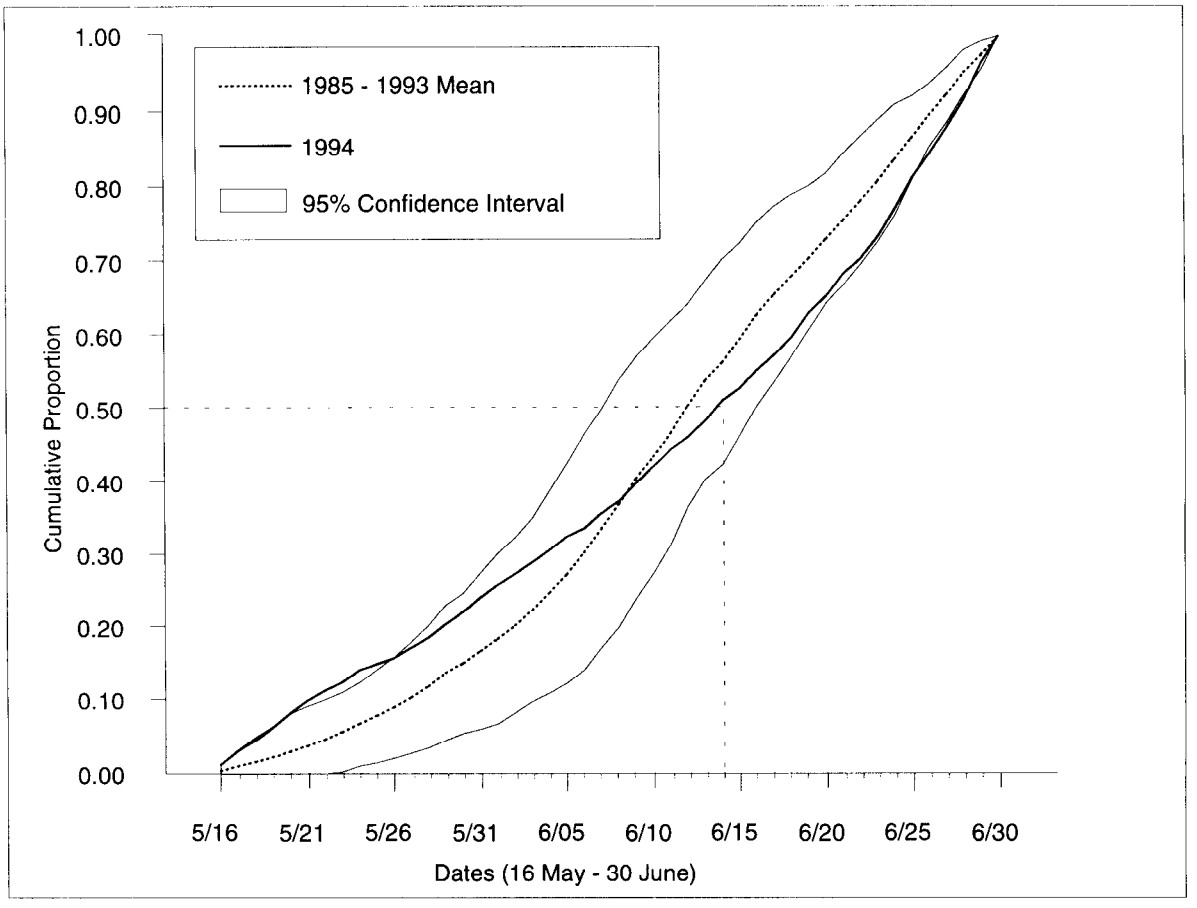

Figure 5.-Cumulative proportions by date for the inriver return of early-run chinook salmon to the Kenai River, 1985-1993 mean vs. 1994.

escapement goal for early-run chinook salmon was almost met due to inseason restrictions placed on the recreational fishery. In 1993 and again in 1994, regulations were liberalized to permit the use of bait in response to a relatively strong return without compromising the escapement goal.

The two closures adopted by the BOF for the 1993 season, one near the mouth of Slikok Creek and one near the mouth of the Funny River, both significant spawning streams for early-run fish, undoubtedly impacted the recreational fishery's overall harvest potential. These are primary holding areas for early-run chinook salmon in their migration routes and fish remain vulnerable to harvest for longer periods of time in these areas. Cursory staff observations during spawning indicated significant numbers of spawning chinook salmon in both streams.

Preseason forecasts for early-run chinook salmon to the Kenai River have been reported beginning with the 1990 return. The projected returns for the years 1990-1994 have ranged from 12,936 to 20,110. The realized returns have ranged from 10,160 to 20,039. Forecasts have been greater than the observed returns for all but one year. Observed returns have ranged

from 71.8% to 149.5% of the expected return with the 1994 forecast being the closest to the realized return (92.3%). Although the fishery is managed based on the inseason return, the forecasts have been beneficial in preparing the fishing public, in a general sense, for the type of fishery to expect. Returns during recent years in the magnitude of 10,000 to 11,000 fish (1990-1992) required inseason restrictions to achieve the desired escapement. Returns in the magnitude of 18,000 to 20,000 fish (1993-1994) allowed for the fishery to be liberalized and still exceed the escapement goal. The anticipated return of approximately 16,000 fish in 1995 would allow for a harvest of 7,000 fish. Should the forecast be realized and normal timing occur, no inseason restrictions should be required.

The largest potential problem in the stock assessment program is the inability to estimate harvest of early-run Kenai River chinook salmon in the marine fishery. While not believed to be a problem to date, this fishery is growing and harvest of Kenai River chinook salmon could become significant.

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LITERATURE CITED

Alexandersdottir, M. and L. Marsh. 1990. Abundance estimates of the escapement of chinook salmon into the Kenai River, Alaska, by analysis of tagging data, 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-55.

Bendock, T. and M. Alexandersdottir. 1992. Mortality and movement behavior of hooked and released chinook salmon in the Kenai River recreational fishery, 1988-1991. Alaska Department of Fish and Game, Fishery Manuscript No. 92-2.

Burger, C. V., R. L. Wilmot, and D. B. Wangaard. 1985. Comparison of spawning areas and times for two runs of chinook salmon (*Oncorhynchus tshawytscha*) in the Kenai River, Alaska. Canadian Journal of Fisheries and aquatic Sciences 42(4):693-700.

Burwen, D. *In prep a.* Riverine abundance estimates of chinook salmon in the Kenai River using dual-beam sonar, 1993. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Burwen, D. *In prep b.* Riverine abundance estimates of chinook salmon in the Kenai River using dual-beam sonar, 1994. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Burwen, D. and P. Skvorc. *In prep a.* Riverine abundance estimates of chinook salmon in the Kenai River using dual-beam sonar, 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report, Juneau.

LITERATURE CITED (Continued)

Burwen, D. and P. Skvorc. *In prep b.* Riverine abundance estimates of chinook salmon in the Kenai River using dual-beam sonar, 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report, Juneau.

Burwen, D. and P. Skvorc. *In prep c.* Riverine abundance estimates of chinook salmon in the Kenai River using dual-beam sonar, 1991. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report, Juneau.

Burwen, D. and P. Skvorc. *In prep d.* Riverine abundance estimates of chinook salmon in the Kenai River using dual-beam sonar, 1992. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report, Juneau.

Carlon, J. and M. Alexandersdottir. 1989. Abundance estimates of the escapement of chinook salmon into the Kenai River, Alaska, by analysis of tagging data, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 107, Juneau.

Conrad, R. H. 1988. Abundance estimates of the escapement of chinook salmon into the Kenai River, Alaska, by analysis of tagging data, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 67, Juneau.

Conrad, R. H. and S. L. Hammarstrom. 1987. Harvest of chinook salmon *Oncorhynchus tshawytscha* and coho salmon *O. kisutch* and angler effort by the lower Kenai River recreational fisheries, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 6, Juneau.

Conrad, R. H. and L. L. Larson. 1987. Abundance estimates for chinook salmon (*Oncorhynchus tshawytscha*) into the Kenai River, Alaska, by analysis of tagging data, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 34, Juneau.

Hammarstrom, S. L. 1975. Inventory and cataloging of Kenai Peninsula, Cook Inlet drainages and fish stocks. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1974-1975, Project F-9-7, 16 (G-I-C), Juneau.

Hammarstrom, S. L. 1976. Inventory and cataloging of Kenai Peninsula, Cook Inlet drainages and fish stocks. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1975-1976, Project F-9-8, 17 (G-I-C), Juneau.

Hammarstrom, S. L. 1977. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1976-1977, Project F-9-9, 18 (G-II-L), Juneau.

Hammarstrom, S. L. 1978. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1977-1978, Project F-9-10, 19 (G-II-L), Juneau.

Hammarstrom, S. L. 1979. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20 (G-II-L), Juneau.

Hammarstrom, S. L. 1980. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (G-II-L), Juneau.

Hammarstrom, S. L. 1981. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (G-II-L), Juneau.

Hammarstrom, S. L. 1988. Angler effort and harvest of chinook salmon *Oncorhynchus tshawytscha* and coho salmon *O. kisutch* by the recreational fisheries in the lower Kenai River, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 50, Juneau.

Hammarstrom, S. L. 1989. Angler effort and harvest of chinook salmon and coho salmon by the recreational fisheries in the lower Kenai River, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 100, Juneau.

Hammarstrom, S. L. 1990. Angler effort and harvest of chinook salmon and coho salmon by the recreational fisheries in the lower Kenai River, 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-22, Anchorage.

LITERATURE CITED (Continued)

Hammarstrom, S. L. 1991. Angler effort and harvest of chinook salmon and coho salmon by the recreational fisheries in the lower Kenai River, 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-44, Anchorage.

Hammarstrom, S. L. 1992. Angler effort and harvest of chinook salmon and by the recreational fisheries in the lower Kenai River, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-25, Anchorage.

Hammarstrom, S. L. 1993. Angler effort and harvest of chinook salmon by the recreational fisheries in the lower Kenai River, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-40, Anchorage.

Hammarstrom, S. L. 1994. Angler effort and harvest of chinook salmon by the recreational fisheries in the lower Kenai River, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-7, Anchorage.

Hammarstrom, S. L. and L. L. Larson. 1982. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23 (G-II-L), Juneau.

Hammarstrom, S. L. and L. L. Larson. 1983. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (G-II-L), Juneau.

Hammarstrom, S. L. and L. L. Larson. 1984. Evaluation of chinook salmon fisheries of the Kenai Peninsula. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25 (G-II-L), Juneau.

Hammarstrom, S. L. and L. L. Larson. 1986. Cook Inlet chinook and coho salmon studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-9-18, 27 (G-32-1,2,4,5), Juneau.

Hammarstrom, S. L., L. L. Larson, and D. T. Balland. 1987. Fisheries statistics for selected sport fisheries on the lower Kenai Peninsula, Alaska, 1986, with emphasis on chinook salmon. Alaska Department of Fish and Game, Fishery Data Series No. 36, Juneau.

Hammarstrom, S. L., L. L. Larson, M. Wenger, and J. Carlon. 1985. Kenai River chinook and coho salmon studies/Kenai River chinook salmon hook and release study. Alaska Department of Fish and Game. Federal Aid in Fish Restoration/ Anadromous Fish Study, Annual Performance Report, 1984-1985, Project F-9-17/AFS-50, 26 (G-II-L), Juneau.

King, M. *In prep*. Angler effort and harvest of chinook salmon by the recreational fisheries in the lower Kenai River, 1994. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

McBride, D. N., R. D. Harding, B. A. Cross, and R. H. Conrad. 1985. Origins of chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), in the commercial catches from the central district eastside set gillnet fishery in Upper Cook Inlet, 1984. Alaska Department of Fish and Game, Informational Leaflet No. 251.

McBride, D. N., M. Alexandersdottir, S. Hammarstrom, and D. Vincent-Lang. 1989. Development and implementation of an escapement goal policy for the return of chinook salmon to the Kenai River. Alaska Department of Fish and Game, Fishery Manuscript Series No. 8, Anchorage.

Mills, M. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20 (SW-1), Juneau.

Mills, M. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (SW-1), Juneau.

Mills, M. 1981*a*. Alaska statewide sport fish harvest studies (1979). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau.

LITERATURE CITED (Continued)

Mills, M. 1981*b*. Alaska statewide sport fish harvest studies (1980). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau.

Mills, M. 1982. Alaska statewide sport fish harvest studies (1981). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23 (SW-1), Juneau.

Mills, M. 1983. Alaska statewide sport fish harvest studies (1982). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (SW-1), Juneau.

Mills, M. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984. Project F-9-16, 25 (SW-1-A), Juneau.

Mills, M. 1985. Alaska statewide sport fish harvest studies (1984). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26 (SW-1-A), Juneau.

Mills, M. 1986. Alaska statewide sport fish harvest studies (1985). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (RT-2), Juneau.

Mills, M. 1987. Alaska statewide sport fisheries harvest report 1986. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau.

Mills, M. 1988. Alaska statewide sport fisheries harvest report 1987. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau.

Mills, M. 1989. Alaska statewide sport fisheries harvest report 1988. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau.

Mills, M. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage.

Mills, M. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage.

Mills, M. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage.

Mills, M. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage.

Mills, M. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage.

Sonnichsen, S. and M. Alexandersdottir. 1991. Estimates of total return by age for Kenai River chinook salmon, 1986-1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-69, Anchorage.

APPENDIX A. SUPPORTING STATISTICS

Appendix A1.-Historical daily cumulative proportions of the inriver return of early-run chinook salmon to the Kenai River, 1985-1994.

	Daily cumulative proportions [P(t)] by year of inriver return											95% Confidence Interval		Rel[a]	
Date	1985	1986	1987	1988	1989	1990	1991	1992	1993	Mean	SE	Low	High	Prec	1994
5/16	0.000	0.000	0.000	0.009	0.010	0.007	0.003	0.005	0.004	0.004	0.001	0.001	0.007	70.0%	0.013
5/17	0.000	0.001	0.000	0.029	0.028	0.013	0.004	0.010	0.009	0.010	0.004	0.002	0.019	83.0%	0.032
5/18	0.000	0.001	0.000	0.041	0.042	0.021	0.010	0.019	0.012	0.016	0.005	0.004	0.029	77.5%	0.046
5/19	0.000	0.007	0.000	0.054	0.052	0.034	0.015	0.023	0.016	0.022	0.007	0.007	0.038	70.8%	0.062
5/20	0.000	0.009	0.005	0.073	0.061	0.043	0.021	0.031	0.024	0.030	0.008	0.010	0.049	65.3%	0.082
5/21	0.009	0.011	0.015	0.082	0.074	0.049	0.026	0.039	0.030	0.037	0.009	0.017	0.058	55.0%	0.100
5/22	0.019	0.013	0.027	0.091	0.083	0.056	0.036	0.050	0.038	0.046	0.009	0.025	0.067	45.4%	0.113
5/23	0.036	0.023	0.038	0.102	0.094	0.062	0.042	0.065	0.045	0.056	0.009	0.036	0.077	36.7%	0.124
5/24	0.047	0.041	0.044	0.116	0.109	0.067	0.048	0.078	0.052	0.067	0.009	0.045	0.089	32.6%	0.141
5/25	0.067	0.056	0.044	0.132	0.126	0.074	0.053	0.085	0.061	0.078	0.011	0.053	0.102	31.3%	0.150
5/26	0.086	0.068	0.056	0.151	0.141	0.081	0.061	0.095	0.068	0.090	0.011	0.063	0.116	29.5%	0.159
5/27	0.104	0.079	0.072	0.170	0.164	0.089	0.068	0.101	0.084	0.103	0.013	0.074	0.133	28.2%	0.173
5/28	0.124	0.089	0.090	0.193	0.184	0.094	0.075	0.109	0.109	0.119	0.014	0.086	0.151	27.3%	0.187
5/29	0.136	0.116	0.132	0.227	0.199	0.108	0.080	0.113	0.126	0.137	0.015	0.102	0.173	25.9%	0.206
5/30	0.153	0.125	0.159	0.243	0.208	0.121	0.084	0.124	0.139	0.151	0.016	0.114	0.188	24.6%	0.223
5/31	0.159	0.142	0.213	0.267	0.217	0.137	0.091	0.136	0.148	0.168	0.018	0.126	0.209	24.7%	0.243
6/01	0.167	0.155	0.242	0.294	0.231	0.151	0.104	0.146	0.168	0.184	0.020	0.139	0.230	24.6%	0.261
6/02	0.178	0.173	0.265	0.320	0.242	0.180	0.126	0.157	0.184	0.203	0.020	0.156	0.249	23.0%	0.275
6/03	0.201	0.178	0.298	0.348	0.255	0.202	0.160	0.180	0.197	0.224	0.021	0.176	0.273	21.6%	0.292
6/04	0.237	0.205	0.335	0.384	0.269	0.218	0.176	0.199	0.211	0.248	0.023	0.195	0.302	21.5%	0.308
6/05	0.274	0.227	0.371	0.422	0.284	0.236	0.205	0.215	0.227	0.273	0.025	0.216	0.331	21.2%	0.327
6/06	0.318	0.267	0.427	0.446	0.305	0.251	0.231	0.247	0.237	0.303	0.027	0.241	0.366	20.6%	0.338
6/07	0.359	0.314	0.461	0.470	0.336	0.279	0.251	0.298	0.252	0.336	0.027	0.273	0.398	18.7%	0.359
6/08	0.402	0.349	0.487	0.507	0.385	0.318	0.273	0.335	0.271	0.370	0.028	0.305	0.435	17.6%	0.375
6/09	0.444	0.382	0.507	0.534	0.436	0.349	0.314	0.383	0.294	0.405	0.027	0.341	0.468	15.6%	0.401
6/10	0.481	0.434	0.521	0.550	0.487	0.374	0.340	0.409	0.321	0.435	0.027	0.374	0.497	14.2%	0.424
6/11	0.513	0.490	0.536	0.565	0.526	0.417	0.370	0.432	0.352	0.467	0.026	0.408	0.526	12.6%	0.447
6/12	0.552	0.545	0.558	0.580	0.558	0.470	0.406	0.471	0.399	0.504	0.023	0.451	0.558	10.5%	0.465
6/13	0.591	0.594	0.596	0.589	0.591	0.512	0.439	0.495	0.440	0.539	0.023	0.486	0.591	9.7%	0.485
6/14	0.611	0.629	0.631	0.603	0.617	0.543	0.464	0.512	0.460	0.563	0.023	0.510	0.617	9.5%	0.513
6/15	0.633	0.656	0.660	0.627	0.636	0.604	0.503	0.543	0.491	0.595	0.022	0.545	0.645	8.4%	0.530
6/16	0.666	0.682	0.690	0.666	0.658	0.649	0.559	0.567	0.520	0.628	0.021	0.581	0.676	7.6%	0.554
6/17	0.694	0.703	0.714	0.691	0.686	0.675	0.590	0.600	0.550	0.656	0.020	0.610	0.702	7.0%	0.572
6/18	0.716	0.717	0.728	0.717	0.712	0.697	0.635	0.632	0.572	0.681	0.018	0.639	0.722	6.1%	0.595
6/19	0.744	0.735	0.736	0.726	0.728	0.728	0.675	0.671	0.597	0.705	0.016	0.667	0.742	5.3%	0.630
6/20	0.764	0.745	0.758	0.735	0.756	0.763	0.704	0.725	0.628	0.731	0.014	0.698	0.764	4.6%	0.652
6/21	0.786	0.759	0.778	0.753	0.785	0.787	0.746	0.762	0.648	0.756	0.014	0.723	0.789	4.4%	0.683
6/22	0.811	0.775	0.791	0.768	0.819	0.812	0.786	0.791	0.679	0.781	0.014	0.749	0.814	4.1%	0.702
6/23	0.839	0.798	0.809	0.786	0.849	0.834	0.822	0.813	0.715	0.807	0.013	0.776	0.838	3.8%	0.732
6/24	0.857	0.818	0.833	0.818	0.881	0.864	0.845	0.846	0.755	0.835	0.012	0.807	0.863	3.3%	0.770
6/25	0.872	0.852	0.859	0.846	0.902	0.889	0.866	0.882	0.808	0.864	0.009	0.843	0.885	2.4%	0.810
6/26	0.887	0.881	0.898	0.867	0.922	0.919	0.890	0.915	0.866	0.894	0.007	0.878	0.910	1.8%	0.843
6/27	0.899	0.921	0.925	0.893	0.939	0.940	0.922	0.943	0.906	0.921	0.006	0.907	0.935	1.5%	0.877
6/28	0.924	0.963	0.952	0.932	0.963	0.962	0.952	0.968	0.943	0.951	0.005	0.939	0.963	1.2%	0.914
6/29	0.962	0.983	0.973	0.956	0.984	0.982	0.975	0.980	0.976	0.975	0.003	0.967	0.982	0.8%	0.965
6/30	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%	1.000

[a] Relative precision.

Appendix A2.-Historical daily cumulative proportions of the effort by unguided anglers during the return of early-run chinook salmon to the Kenai River, 1986-1994.

	Daily cumulative proportions [P(t)] by year of unguided angler effort											95% Confidence Interval		Rel[a]
Date	1986	1987	1988	1989	1990	1991	1992	1993	1994	Mean	SE	Low	High	Prec
5/16	0.000	0.005	0.000	0.003	0.006	0.006	0.004	0.000	0.000	0.003	0.001	0.001	0.005	76.3%
5/17	0.005	0.011	0.005	0.006	0.011	0.011	0.008	0.000	0.000	0.006	0.001	0.003	0.010	53.7%
5/18	0.010	0.011	0.009	0.010	0.018	0.017	0.008	0.000	0.000	0.009	0.002	0.005	0.014	51.5%
5/19	0.010	0.016	0.014	0.015	0.052	0.022	0.011	0.000	0.021	0.018	0.005	0.007	0.029	61.5%
5/20	0.015	0.019	0.027	0.034	0.075	0.022	0.016	0.000	0.027	0.026	0.007	0.010	0.042	60.5%
5/21	0.020	0.024	0.064	0.041	0.075	0.028	0.020	0.000	0.052	0.036	0.008	0.018	0.054	50.9%
5/22	0.023	0.029	0.089	0.041	0.087	0.034	0.024	0.007	0.057	0.043	0.010	0.021	0.066	50.8%
5/23	0.027	0.055	0.089	0.048	0.103	0.039	0.054	0.018	0.057	0.054	0.009	0.034	0.075	38.3%
5/24	0.042	0.080	0.100	0.054	0.119	0.061	0.158	0.018	0.069	0.078	0.014	0.045	0.110	41.8%
5/25	0.072	0.087	0.108	0.058	0.141	0.068	0.204	0.023	0.078	0.093	0.018	0.053	0.134	43.5%
5/26	0.083	0.095	0.115	0.067	0.231	0.136	0.212	0.029	0.086	0.117	0.022	0.066	0.168	43.7%
5/27	0.084	0.101	0.130	0.104	0.318	0.149	0.229	0.041	0.099	0.139	0.028	0.075	0.204	46.5%
5/28	0.085	0.109	0.150	0.158	0.371	0.156	0.251	0.057	0.135	0.164	0.032	0.091	0.236	44.6%
5/29	0.089	0.118	0.207	0.175	0.388	0.166	0.259	0.086	0.183	0.186	0.031	0.113	0.258	39.1%
5/30	0.094	0.180	0.222	0.183	0.413	0.178	0.308	0.134	0.222	0.215	0.032	0.142	0.288	34.1%
5/31	0.110	0.218	0.247	0.192	0.432	0.192	0.372	0.159	0.234	0.239	0.034	0.161	0.318	32.7%
6/01	0.121	0.218	0.267	0.200	0.453	0.246	0.372	0.168	0.253	0.255	0.034	0.177	0.334	30.7%
6/02	0.121	0.238	0.304	0.209	0.506	0.297	0.414	0.177	0.272	0.282	0.040	0.191	0.373	32.3%
6/03	0.129	0.259	0.329	0.276	0.584	0.297	0.438	0.195	0.285	0.310	0.044	0.208	0.413	33.1%
6/04	0.140	0.279	0.416	0.309	0.584	0.324	0.468	0.216	0.336	0.341	0.044	0.239	0.444	30.0%
6/05	0.157	0.310	0.433	0.309	0.617	0.401	0.498	0.275	0.375	0.375	0.045	0.272	0.478	27.4%
6/06	0.177	0.396	0.433	0.332	0.655	0.404	0.586	0.308	0.375	0.407	0.048	0.297	0.517	27.0%
6/07	0.267	0.438	0.466	0.360	0.656	0.416	0.628	0.308	0.403	0.438	0.044	0.337	0.539	23.1%
6/08	0.325	0.438	0.486	0.387	0.664	0.437	0.628	0.327	0.425	0.457	0.040	0.366	0.549	20.1%
6/09	0.325	0.474	0.496	0.421	0.686	0.452	0.676	0.345	0.447	0.480	0.042	0.383	0.578	20.3%
6/10	0.358	0.502	0.509	0.471	0.694	0.452	0.685	0.366	0.475	0.501	0.040	0.410	0.593	18.3%
6/11	0.386	0.530	0.569	0.510	0.694	0.465	0.695	0.396	0.518	0.529	0.037	0.444	0.615	16.2%
6/12	0.415	0.564	0.593	0.510	0.703	0.485	0.710	0.458	0.556	0.555	0.034	0.476	0.633	14.2%
6/13	0.487	0.630	0.593	0.537	0.705	0.495	0.737	0.510	0.556	0.583	0.030	0.513	0.653	12.0%
6/14	0.566	0.658	0.625	0.551	0.714	0.510	0.760	0.510	0.586	0.609	0.029	0.541	0.677	11.1%
6/15	0.640	0.658	0.648	0.575	0.727	0.524	0.760	0.556	0.598	0.632	0.026	0.572	0.692	9.4%
6/16	0.640	0.674	0.678	0.598	0.746	0.553	0.782	0.567	0.624	0.651	0.026	0.592	0.711	9.1%
6/17	0.677	0.702	0.707	0.642	0.766	0.553	0.794	0.591	0.650	0.676	0.026	0.616	0.735	8.8%
6/18	0.699	0.726	0.741	0.668	0.766	0.569	0.806	0.614	0.687	0.697	0.025	0.640	0.754	8.1%
6/19	0.720	0.749	0.763	0.668	0.785	0.577	0.824	0.681	0.701	0.719	0.024	0.663	0.775	7.8%
6/20	0.746	0.798	0.763	0.694	0.800	0.602	0.861	0.718	0.701	0.743	0.025	0.685	0.800	7.8%
6/21	0.791	0.834	0.790	0.726	0.813	0.617	0.876	0.718	0.726	0.766	0.026	0.706	0.825	7.8%
6/22	0.815	0.834	0.812	0.750	0.829	0.675	0.876	0.749	0.741	0.787	0.021	0.739	0.834	6.1%
6/23	0.815	0.847	0.832	0.779	0.869	0.697	0.898	0.771	0.757	0.807	0.021	0.759	0.855	5.9%
6/24	0.833	0.864	0.849	0.827	0.907	0.697	0.909	0.794	0.779	0.829	0.022	0.778	0.880	6.2%
6/25	0.858	0.888	0.898	0.883	0.907	0.707	0.922	0.810	0.808	0.854	0.023	0.801	0.906	6.1%
6/26	0.888	0.920	0.931	0.883	0.925	0.722	0.932	0.863	0.891	0.884	0.022	0.834	0.934	5.7%
6/27	0.913	0.943	0.931	0.923	0.943	0.736	0.950	0.929	0.891	0.907	0.022	0.856	0.958	5.6%
6/28	0.960	0.980	0.959	0.953	0.956	0.811	0.984	0.929	0.927	0.940	0.017	0.900	0.980	4.3%
6/29	1.000	0.980	0.984	0.980	0.972	0.918	0.984	0.975	0.973	0.974	0.008	0.957	0.991	1.8%
6/30	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

[a] Relative precision.

Appendix A3.-Historical daily cumulative proportions of the harvest of chinook salmon by unguided anglers during the return of early-run chinook salmon to the Kenai River, 1986-1994.

	Daily cumulative proportions [P(t)] by year of harvest by unguided anglers											95% Confidence Interval		Rel[a]
Date	1986	1987	1988	1989	1990	1991	1992	1993	1994	Mean	SE	Low	High	Prec
5/16	0.000	0.030	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.005	0.004	0.000	0.013	160.8%
5/17	0.000	0.030	0.000	0.030	0.000	0.000	0.000	0.000	0.000	0.007	0.004	0.000	0.017	152.5%
5/18	0.001	0.030	0.002	0.030	0.000	0.000	0.000	0.000	0.000	0.007	0.004	0.000	0.017	142.7%
5/19	0.001	0.031	0.020	0.030	0.000	0.000	0.000	0.000	0.038	0.013	0.005	0.001	0.026	93.6%
5/20	0.001	0.035	0.070	0.030	0.000	0.000	0.000	0.000	0.047	0.020	0.009	0.000	0.040	99.5%
5/21	0.001	0.038	0.119	0.038	0.000	0.000	0.000	0.000	0.080	0.031	0.014	0.000	0.064	108.3%
5/22	0.005	0.038	0.132	0.038	0.000	0.000	0.004	0.000	0.082	0.033	0.015	0.000	0.069	107.0%
5/23	0.005	0.052	0.132	0.045	0.000	0.000	0.051	0.011	0.082	0.042	0.015	0.008	0.076	81.1%
5/24	0.010	0.060	0.146	0.050	0.020	0.000	0.104	0.011	0.098	0.055	0.017	0.016	0.095	70.8%
5/25	0.021	0.062	0.146	0.050	0.020	0.019	0.173	0.030	0.106	0.070	0.020	0.025	0.115	64.7%
5/26	0.021	0.064	0.152	0.059	0.020	0.105	0.179	0.037	0.119	0.084	0.019	0.040	0.128	52.8%
5/27	0.021	0.064	0.162	0.059	0.222	0.105	0.179	0.059	0.131	0.111	0.022	0.060	0.163	46.1%
5/28	0.022	0.064	0.183	0.111	0.222	0.159	0.235	0.085	0.182	0.140	0.025	0.084	0.197	40.3%
5/29	0.022	0.080	0.213	0.118	0.284	0.214	0.250	0.139	0.240	0.173	0.029	0.106	0.241	38.9%
5/30	0.024	0.144	0.223	0.118	0.284	0.214	0.306	0.179	0.307	0.200	0.032	0.127	0.273	36.4%
5/31	0.026	0.193	0.244	0.118	0.284	0.214	0.376	0.204	0.329	0.221	0.035	0.139	0.302	36.9%
6/01	0.031	0.193	0.324	0.122	0.716	0.303	0.376	0.216	0.346	0.292	0.065	0.142	0.441	51.3%
6/02	0.031	0.256	0.362	0.129	0.863	0.341	0.407	0.236	0.369	0.332	0.078	0.153	0.512	54.0%
6/03	0.031	0.281	0.376	0.232	0.974	0.341	0.456	0.250	0.387	0.370	0.086	0.172	0.568	53.5%
6/04	0.031	0.312	0.428	0.250	0.974	0.495	0.581	0.250	0.454	0.419	0.088	0.216	0.623	48.5%
6/05	0.055	0.349	0.442	0.250	1.000	0.646	0.640	0.339	0.501	0.469	0.091	0.259	0.679	44.7%
6/06	0.080	0.390	0.442	0.260	1.000	0.646	0.754	0.354	0.501	0.492	0.092	0.280	0.703	43.0%
6/07	0.196	0.420	0.446	0.517	1.000	0.646	0.838	0.354	0.534	0.550	0.082	0.361	0.740	34.5%
6/08	0.266	0.420	0.468	0.535	1.000	0.646	0.838	0.393	0.554	0.569	0.076	0.393	0.745	31.0%
6/09	0.266	0.440	0.482	0.551	1.000	0.646	0.966	0.399	0.568	0.591	0.083	0.401	0.781	32.2%
6/10	0.312	0.475	0.496	0.590	1.000	0.646	0.966	0.436	0.598	0.613	0.077	0.435	0.792	29.1%
6/11	0.351	0.596	0.528	0.621	1.000	0.646	0.966	0.476	0.624	0.645	0.071	0.482	0.809	25.3%
6/12	0.397	0.610	0.544	0.621	1.000	0.646	0.966	0.519	0.634	0.660	0.066	0.507	0.813	23.2%
6/13	0.491	0.638	0.544	0.621	1.000	0.646	0.966	0.540	0.634	0.676	0.061	0.535	0.816	20.8%
6/14	0.552	0.665	0.581	0.621	1.000	0.646	1.000	0.540	0.658	0.696	0.059	0.559	0.833	19.7%
6/15	0.648	0.665	0.621	0.621	1.000	0.646	1.000	0.540	0.658	0.711	0.056	0.582	0.840	18.2%
6/16	0.648	0.699	0.655	0.621	1.000	0.646	1.000	0.548	0.667	0.720	0.055	0.595	0.846	17.5%
6/17	0.660	0.722	0.712	0.632	1.000	0.646	1.000	0.567	0.700	0.738	0.052	0.618	0.858	16.3%
6/18	0.665	0.742	0.731	0.672	1.000	0.646	1.000	0.580	0.706	0.749	0.050	0.634	0.864	15.4%
6/19	0.696	0.828	0.761	0.672	1.000	0.646	1.000	0.620	0.715	0.771	0.048	0.660	0.881	14.3%
6/20	0.739	0.867	0.761	0.733	1.000	0.646	1.000	0.628	0.715	0.788	0.046	0.681	0.894	13.5%
6/21	0.760	0.911	0.789	0.764	1.000	0.646	1.000	0.628	0.731	0.803	0.046	0.697	0.910	13.3%
6/22	0.787	0.911	0.806	0.781	1.000	0.646	1.000	0.645	0.735	0.812	0.045	0.709	0.915	12.7%
6/23	0.787	0.915	0.818	0.866	1.000	0.646	1.000	0.650	0.735	0.824	0.045	0.721	0.927	12.5%
6/24	0.819	0.927	0.843	0.915	1.000	0.646	1.000	0.662	0.749	0.840	0.044	0.738	0.943	12.2%
6/25	0.853	0.946	0.872	0.941	1.000	0.646	1.000	0.688	0.770	0.857	0.044	0.757	0.958	11.7%
6/26	0.883	0.964	0.895	0.941	1.000	0.646	1.000	0.752	0.832	0.879	0.040	0.788	0.971	10.4%
6/27	0.951	0.978	0.895	0.983	1.000	0.646	1.000	0.835	0.832	0.902	0.039	0.812	0.992	9.9%
6/28	0.991	1.000	0.957	1.000	1.000	0.792	1.000	0.835	0.885	0.940	0.027	0.877	1.003	6.7%
6/29	1.000	1.000	0.983	1.000	1.000	0.938	1.000	0.955	0.936	0.979	0.009	0.957	1.001	2.2%
6/30	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

[a] Relative precision.

Appendix A4.-Historical daily cumulative proportions of the catch of chinook salmon by unguided anglers during the return of early-run chinook salmon to the Kenai River, 1986-1994.

	Daily cumulative proportions [P(t)] by year of catch by unguided anglers											95% Confidence Interval		Rel[a]
Date	1986	1987	1988	1989	1990	1991	1992	1993	1994	Mean	SE	Low	High	Prec
5/16	0.000	0.023	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.004	0.003	0.000	0.010	161.7%
5/17	0.000	0.024	0.000	0.022	0.000	0.000	0.000	0.000	0.000	0.005	0.003	0.000	0.013	152.7%
5/18	0.001	0.024	0.003	0.022	0.000	0.000	0.000	0.000	0.000	0.006	0.003	0.000	0.013	137.4%
5/19	0.001	0.025	0.015	0.022	0.000	0.000	0.000	0.000	0.052	0.013	0.006	0.000	0.027	107.5%
5/20	0.001	0.036	0.048	0.022	0.000	0.000	0.000	0.000	0.061	0.019	0.008	0.000	0.037	99.2%
5/21	0.001	0.039	0.111	0.029	0.000	0.000	0.000	0.000	0.086	0.030	0.014	0.000	0.062	109.7%
5/22	0.003	0.039	0.121	0.029	0.000	0.000	0.004	0.005	0.088	0.032	0.015	0.000	0.066	105.5%
5/23	0.004	0.053	0.121	0.034	0.000	0.000	0.026	0.016	0.088	0.038	0.014	0.005	0.071	85.7%
5/24	0.010	0.060	0.147	0.038	0.007	0.000	0.048	0.016	0.101	0.047	0.016	0.010	0.085	79.7%
5/25	0.026	0.064	0.147	0.038	0.007	0.004	0.133	0.027	0.112	0.062	0.018	0.020	0.104	68.0%
5/26	0.026	0.072	0.152	0.045	0.007	0.024	0.135	0.034	0.124	0.069	0.018	0.027	0.111	60.9%
5/27	0.026	0.072	0.159	0.045	0.082	0.024	0.135	0.049	0.138	0.081	0.017	0.042	0.120	48.4%
5/28	0.027	0.072	0.175	0.084	0.100	0.037	0.158	0.079	0.175	0.101	0.019	0.057	0.144	43.0%
5/29	0.028	0.098	0.200	0.105	0.122	0.049	0.169	0.122	0.234	0.125	0.022	0.074	0.177	41.0%
5/30	0.029	0.165	0.209	0.105	0.122	0.062	0.200	0.177	0.292	0.151	0.027	0.089	0.213	41.0%
5/31	0.031	0.220	0.223	0.105	0.122	0.062	0.236	0.208	0.310	0.169	0.031	0.098	0.240	42.1%
6/01	0.035	0.220	0.280	0.108	0.281	0.094	0.236	0.223	0.333	0.201	0.033	0.125	0.278	38.1%
6/02	0.035	0.246	0.331	0.114	0.420	0.103	0.283	0.243	0.360	0.237	0.043	0.138	0.337	41.9%
6/03	0.035	0.288	0.346	0.207	0.484	0.103	0.309	0.297	0.377	0.272	0.046	0.166	0.378	39.1%
6/04	0.035	0.306	0.390	0.227	0.484	0.174	0.386	0.297	0.435	0.304	0.047	0.195	0.412	35.6%
6/05	0.055	0.335	0.403	0.227	0.484	0.222	0.411	0.384	0.473	0.333	0.047	0.225	0.440	32.4%
6/06	0.090	0.373	0.403	0.256	0.484	0.225	0.458	0.411	0.473	0.352	0.045	0.249	0.455	29.2%
6/07	0.194	0.398	0.406	0.481	0.484	0.234	0.510	0.411	0.508	0.403	0.039	0.314	0.492	22.1%
6/08	0.257	0.398	0.422	0.519	0.484	0.255	0.510	0.441	0.524	0.423	0.035	0.343	0.504	19.0%
6/09	0.257	0.418	0.436	0.531	0.528	0.272	0.589	0.453	0.545	0.448	0.039	0.357	0.538	20.2%
6/10	0.357	0.460	0.447	0.566	0.538	0.272	0.594	0.483	0.566	0.476	0.036	0.394	0.558	17.2%
6/11	0.398	0.554	0.485	0.590	0.538	0.289	0.597	0.528	0.600	0.509	0.035	0.429	0.589	15.8%
6/12	0.446	0.570	0.497	0.590	0.549	0.343	0.597	0.562	0.610	0.529	0.029	0.463	0.596	12.6%
6/13	0.530	0.597	0.497	0.590	0.550	0.357	0.610	0.586	0.610	0.547	0.027	0.485	0.610	11.4%
6/14	0.594	0.626	0.544	0.590	0.550	0.357	0.637	0.586	0.631	0.568	0.029	0.502	0.634	11.6%
6/15	0.668	0.626	0.579	0.612	0.550	0.368	0.637	0.600	0.631	0.586	0.030	0.518	0.654	11.6%
6/16	0.668	0.647	0.622	0.618	0.550	0.368	0.651	0.607	0.643	0.597	0.031	0.526	0.668	11.9%
6/17	0.676	0.683	0.660	0.635	0.667	0.368	0.651	0.631	0.673	0.627	0.033	0.551	0.703	12.1%
6/18	0.680	0.702	0.696	0.676	0.667	0.396	0.651	0.642	0.678	0.643	0.032	0.570	0.716	11.3%
6/19	0.699	0.786	0.729	0.676	0.724	0.427	0.651	0.667	0.684	0.671	0.033	0.594	0.748	11.5%
6/20	0.725	0.839	0.729	0.752	0.742	0.572	0.719	0.672	0.684	0.715	0.024	0.660	0.770	7.7%
6/21	0.746	0.881	0.756	0.785	0.821	0.572	0.729	0.672	0.694	0.740	0.030	0.671	0.808	9.3%
6/22	0.764	0.881	0.767	0.810	0.821	0.885	0.729	0.691	0.697	0.783	0.024	0.727	0.838	7.1%
6/23	0.764	0.885	0.778	0.883	0.821	0.895	0.729	0.694	0.699	0.794	0.027	0.733	0.856	7.8%
6/24	0.789	0.894	0.827	0.936	0.905	0.895	0.768	0.710	0.709	0.826	0.029	0.759	0.892	8.0%
6/25	0.824	0.917	0.856	0.955	0.905	0.895	0.768	0.726	0.733	0.842	0.028	0.778	0.907	7.7%
6/26	0.844	0.955	0.880	0.955	0.958	0.895	0.778	0.789	0.827	0.876	0.024	0.821	0.930	6.2%
6/27	0.920	0.976	0.880	0.987	0.977	0.895	0.797	0.869	0.827	0.903	0.023	0.851	0.955	5.8%
6/28	0.980	1.000	0.952	1.000	0.977	0.928	0.824	0.869	0.863	0.933	0.022	0.882	0.983	5.4%
6/29	1.000	1.000	0.969	1.000	1.000	0.973	0.824	0.944	0.927	0.960	0.019	0.915	1.004	4.6%
6/30	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

[a] Relative precision.

Appendix A5.-Historical daily cumulative proportions of the effort by guided anglers during the return of early-run chinook salmon to the Kenai River, 1986-1994.

	Daily cumulative proportions [P(t)] by year of guided angler effort											95% Confidence Interval		Rel[a]
Date	1986	1987	1988	1989	1990	1991	1992	1993	1994	Mean	SE	Low	High	Prec
5/16	0.000	0.005	0.000	0.003	0.006	0.006	0.000	0.000	0.000	0.002	0.001	0.000	0.004	94.7%
5/17	0.005	0.011	0.005	0.006	0.011	0.011	0.000	0.000	0.002	0.006	0.002	0.002	0.009	62.4%
5/18	0.010	0.011	0.009	0.010	0.018	0.017	0.000	0.000	0.004	0.009	0.002	0.004	0.014	56.4%
5/19	0.010	0.016	0.014	0.015	0.052	0.022	0.015	0.000	0.022	0.018	0.005	0.007	0.029	59.2%
5/20	0.015	0.019	0.027	0.034	0.075	0.022	0.030	0.000	0.031	0.028	0.007	0.012	0.044	55.5%
5/21	0.020	0.024	0.064	0.041	0.075	0.028	0.037	0.000	0.052	0.038	0.008	0.020	0.056	46.8%
5/22	0.023	0.029	0.089	0.041	0.087	0.034	0.045	0.026	0.058	0.048	0.008	0.029	0.067	40.4%
5/23	0.027	0.055	0.089	0.048	0.103	0.039	0.053	0.034	0.058	0.056	0.008	0.037	0.075	34.0%
5/24	0.042	0.080	0.100	0.054	0.119	0.061	0.083	0.034	0.065	0.071	0.009	0.050	0.092	29.6%
5/25	0.072	0.087	0.108	0.058	0.141	0.068	0.162	0.036	0.088	0.091	0.013	0.060	0.122	33.9%
5/26	0.083	0.095	0.115	0.067	0.231	0.136	0.158	0.061	0.103	0.116	0.018	0.076	0.157	35.0%
5/27	0.084	0.101	0.130	0.104	0.318	0.149	0.183	0.079	0.127	0.142	0.025	0.085	0.198	39.9%
5/28	0.085	0.109	0.150	0.158	0.371	0.156	0.197	0.103	0.148	0.164	0.028	0.099	0.229	39.7%
5/29	0.089	0.118	0.207	0.175	0.388	0.166	0.202	0.135	0.172	0.184	0.029	0.118	0.250	36.0%
5/30	0.094	0.180	0.222	0.183	0.413	0.178	0.237	0.174	0.198	0.209	0.029	0.142	0.275	31.8%
5/31	0.110	0.218	0.247	0.192	0.432	0.192	0.243	0.198	0.217	0.228	0.029	0.161	0.294	29.2%
6/01	0.121	0.218	0.267	0.200	0.453	0.246	0.243	0.217	0.233	0.244	0.030	0.176	0.313	27.9%
6/02	0.121	0.238	0.304	0.209	0.506	0.297	0.298	0.236	0.248	0.273	0.035	0.193	0.353	29.3%
6/03	0.129	0.259	0.329	0.276	0.584	0.297	0.321	0.250	0.262	0.301	0.040	0.208	0.394	31.0%
6/04	0.140	0.279	0.416	0.309	0.584	0.324	0.345	0.259	0.294	0.328	0.040	0.234	0.421	28.4%
6/05	0.157	0.310	0.433	0.309	0.617	0.401	0.363	0.293	0.316	0.355	0.042	0.259	0.452	27.1%
6/06	0.177	0.396	0.433	0.332	0.655	0.404	0.412	0.317	0.316	0.382	0.043	0.284	0.481	25.8%
6/07	0.267	0.438	0.466	0.360	0.656	0.416	0.457	0.317	0.357	0.415	0.037	0.328	0.501	20.8%
6/08	0.325	0.438	0.486	0.387	0.664	0.437	0.457	0.347	0.390	0.437	0.033	0.360	0.513	17.6%
6/09	0.325	0.474	0.496	0.421	0.686	0.452	0.518	0.377	0.423	0.463	0.034	0.385	0.542	17.0%
6/10	0.358	0.502	0.509	0.471	0.694	0.452	0.556	0.442	0.546	0.503	0.031	0.432	0.575	14.2%
6/11	0.386	0.530	0.569	0.510	0.694	0.465	0.595	0.482	0.597	0.537	0.030	0.467	0.606	12.9%
6/12	0.415	0.564	0.593	0.510	0.703	0.485	0.617	0.527	0.604	0.557	0.028	0.493	0.622	11.6%
6/13	0.487	0.630	0.593	0.537	0.705	0.495	0.639	0.555	0.604	0.583	0.024	0.528	0.638	9.4%
6/14	0.566	0.658	0.625	0.551	0.714	0.510	0.659	0.555	0.648	0.610	0.022	0.558	0.661	8.4%
6/15	0.640	0.658	0.648	0.575	0.727	0.524	0.659	0.587	0.675	0.633	0.020	0.586	0.679	7.4%
6/16	0.640	0.674	0.678	0.598	0.746	0.553	0.689	0.617	0.686	0.653	0.019	0.609	0.698	6.8%
6/17	0.677	0.702	0.707	0.642	0.766	0.553	0.712	0.646	0.697	0.678	0.020	0.632	0.724	6.8%
6/18	0.699	0.726	0.741	0.668	0.766	0.569	0.737	0.678	0.719	0.700	0.019	0.655	0.745	6.4%
6/19	0.720	0.749	0.763	0.668	0.785	0.577	0.759	0.710	0.740	0.719	0.021	0.671	0.768	6.8%
6/20	0.746	0.798	0.763	0.694	0.800	0.602	0.781	0.740	0.740	0.741	0.021	0.693	0.788	6.4%
6/21	0.791	0.834	0.790	0.726	0.813	0.617	0.804	0.740	0.770	0.765	0.022	0.715	0.815	6.5%
6/22	0.815	0.834	0.812	0.750	0.829	0.675	0.804	0.777	0.792	0.787	0.017	0.749	0.825	4.8%
6/23	0.815	0.847	0.832	0.779	0.869	0.697	0.841	0.807	0.814	0.811	0.017	0.773	0.850	4.8%
6/24	0.833	0.864	0.849	0.827	0.907	0.697	0.861	0.838	0.844	0.836	0.019	0.792	0.879	5.3%
6/25	0.858	0.888	0.898	0.883	0.907	0.707	0.884	0.872	0.872	0.863	0.020	0.817	0.910	5.4%
6/26	0.888	0.920	0.931	0.883	0.925	0.722	0.921	0.904	0.897	0.888	0.021	0.839	0.938	5.6%
6/27	0.913	0.943	0.931	0.923	0.943	0.736	0.958	0.936	0.897	0.909	0.022	0.857	0.960	5.7%
6/28	0.960	0.980	0.959	0.953	0.956	0.811	0.975	0.936	0.940	0.941	0.017	0.902	0.980	4.2%
6/29	1.000	0.980	0.984	0.980	0.972	0.918	0.975	0.968	0.968	0.972	0.007	0.955	0.989	1.8%
6/30	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

[a] Relative precision.

Appendix A6.-Historical daily cumulative proportions of the harvest of chinook salmon by guided anglers during the return of early-run chinook salmon to the Kenai River, 1986-1994.

	Daily cumulative proportions [P(t)] by year of harvest by guided anglers											95% Confidence Interval		Rel[a]
Date	1986	1987	1988	1989	1990	1991	1992	1993	1994	Mean	SE	Low	High	Prec
5/16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
5/17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
5/18	0.000	0.000	0.008	0.007	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.004	152.9%
5/19	0.000	0.000	0.016	0.018	0.000	0.000	0.000	0.000	0.030	0.007	0.004	0.000	0.016	122.3%
5/20	0.000	0.000	0.025	0.025	0.025	0.000	0.049	0.000	0.040	0.018	0.006	0.003	0.033	80.0%
5/21	0.000	0.003	0.025	0.029	0.025	0.000	0.049	0.000	0.050	0.020	0.007	0.004	0.036	77.9%
5/22	0.009	0.003	0.069	0.029	0.064	0.000	0.049	0.009	0.053	0.032	0.009	0.010	0.053	66.5%
5/23	0.015	0.012	0.069	0.035	0.098	0.000	0.076	0.013	0.053	0.041	0.011	0.014	0.068	64.1%
5/24	0.020	0.022	0.097	0.042	0.112	0.000	0.076	0.013	0.061	0.049	0.013	0.018	0.080	61.4%
5/25	0.027	0.028	0.121	0.042	0.203	0.000	0.269	0.015	0.105	0.090	0.031	0.016	0.164	79.7%
5/26	0.031	0.047	0.131	0.042	0.241	0.017	0.264	0.045	0.114	0.104	0.031	0.031	0.177	68.8%
5/27	0.054	0.047	0.164	0.042	0.280	0.066	0.341	0.084	0.142	0.135	0.036	0.050	0.221	61.8%
5/28	0.060	0.049	0.175	0.054	0.280	0.066	0.380	0.124	0.150	0.149	0.038	0.058	0.239	59.6%
5/29	0.070	0.061	0.195	0.057	0.334	0.145	0.406	0.152	0.159	0.176	0.041	0.080	0.272	53.3%
5/30	0.080	0.125	0.195	0.072	0.571	0.186	0.474	0.192	0.175	0.230	0.058	0.093	0.367	58.1%
5/31	0.095	0.180	0.195	0.110	0.669	0.186	0.496	0.226	0.221	0.264	0.064	0.114	0.415	55.5%
6/01	0.135	0.180	0.246	0.166	0.762	0.224	0.496	0.303	0.245	0.306	0.067	0.148	0.465	50.3%
6/02	0.135	0.206	0.280	0.252	0.782	0.584	0.651	0.319	0.258	0.385	0.076	0.206	0.564	45.3%
6/03	0.135	0.297	0.298	0.294	0.890	0.584	0.694	0.335	0.279	0.423	0.081	0.230	0.615	44.4%
6/04	0.135	0.329	0.338	0.322	0.890	0.685	0.743	0.341	0.311	0.455	0.084	0.256	0.654	42.6%
6/05	0.185	0.403	0.366	0.322	0.936	0.765	0.780	0.375	0.333	0.496	0.087	0.291	0.701	40.3%
6/06	0.235	0.428	0.366	0.362	1.000	0.765	0.925	0.380	0.333	0.533	0.095	0.309	0.757	41.0%
6/07	0.312	0.455	0.374	0.419	1.000	0.765	0.992	0.380	0.367	0.563	0.093	0.343	0.782	38.0%
6/08	0.355	0.455	0.393	0.475	1.000	0.765	0.992	0.418	0.399	0.583	0.088	0.376	0.790	34.6%
6/09	0.355	0.490	0.423	0.551	1.000	0.765	0.992	0.444	0.417	0.604	0.084	0.406	0.802	32.0%
6/10	0.404	0.539	0.450	0.568	1.000	0.765	0.992	0.514	0.588	0.647	0.074	0.472	0.822	26.4%
6/11	0.463	0.580	0.481	0.589	1.000	0.765	0.992	0.535	0.627	0.670	0.068	0.509	0.832	23.5%
6/12	0.480	0.593	0.494	0.589	1.000	0.765	0.992	0.570	0.633	0.680	0.066	0.524	0.835	22.3%
6/13	0.539	0.617	0.494	0.614	1.000	0.765	0.992	0.587	0.633	0.693	0.062	0.546	0.841	20.7%
6/14	0.576	0.648	0.556	0.642	1.000	0.765	0.992	0.587	0.716	0.720	0.057	0.586	0.854	18.1%
6/15	0.612	0.648	0.596	0.665	1.000	0.765	0.992	0.600	0.730	0.734	0.053	0.609	0.860	16.7%
6/16	0.612	0.692	0.644	0.685	1.000	0.765	0.992	0.625	0.737	0.750	0.049	0.634	0.867	15.2%
6/17	0.635	0.770	0.675	0.691	1.000	0.765	0.992	0.674	0.747	0.772	0.045	0.666	0.878	13.4%
6/18	0.653	0.797	0.709	0.707	1.000	0.765	1.000	0.695	0.751	0.786	0.043	0.685	0.887	12.5%
6/19	0.692	0.833	0.747	0.707	1.000	0.765	1.000	0.709	0.753	0.801	0.040	0.706	0.896	11.6%
6/20	0.743	0.857	0.747	0.750	1.000	0.765	1.000	0.733	0.753	0.816	0.037	0.729	0.903	10.4%
6/21	0.758	0.863	0.792	0.807	1.000	0.765	1.000	0.733	0.773	0.832	0.034	0.752	0.912	9.4%
6/22	0.788	0.863	0.818	0.815	1.000	0.765	1.000	0.752	0.783	0.843	0.032	0.768	0.917	8.7%
6/23	0.788	0.872	0.837	0.832	1.000	0.765	1.000	0.768	0.791	0.850	0.031	0.778	0.923	8.3%
6/24	0.805	0.885	0.853	0.858	1.000	0.765	1.000	0.784	0.820	0.863	0.029	0.795	0.931	7.7%
6/25	0.845	0.919	0.869	0.903	1.000	0.765	1.000	0.819	0.858	0.886	0.026	0.825	0.948	6.8%
6/26	0.872	0.951	0.884	0.903	1.000	0.765	1.000	0.868	0.878	0.902	0.024	0.845	0.960	6.3%
6/27	0.911	0.972	0.884	0.979	1.000	0.765	1.000	0.917	0.878	0.923	0.025	0.863	0.983	6.3%
6/28	0.982	0.998	0.934	0.991	1.000	0.817	1.000	0.917	0.918	0.951	0.020	0.902	0.999	5.0%
6/29	1.000	0.998	0.973	1.000	1.000	0.900	1.000	0.932	0.954	0.973	0.012	0.944	1.002	2.9%
6/30	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

[a] Relative precision.

Appendix A7.-Historical daily cumulative proportions of the catch of chinook salmon by guided anglers during the return of early-run chinook salmon to the Kenai River, 1986-1994.

	Daily cumulative proportions [P(t)] by year of catch by guided anglers											95% Confidence Interval		Rel[a]
Date	1986	1987	1988	1989	1990	1991	1992	1993	1994	Mean	SE	Low	High	Prec
5/16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
5/17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
5/18	0.000	0.000	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.003	152.6%
5/19	0.000	0.000	0.011	0.014	0.000	0.000	0.000	0.000	0.033	0.006	0.004	0.000	0.015	136.0%
5/20	0.000	0.000	0.017	0.020	0.007	0.000	0.004	0.000	0.041	0.010	0.005	0.000	0.021	108.6%
5/21	0.000	0.004	0.017	0.024	0.007	0.000	0.004	0.000	0.050	0.012	0.006	0.000	0.025	109.3%
5/22	0.009	0.004	0.055	0.024	0.018	0.000	0.006	0.010	0.054	0.020	0.007	0.004	0.036	80.8%
5/23	0.014	0.011	0.055	0.028	0.027	0.000	0.008	0.015	0.054	0.024	0.007	0.009	0.039	63.4%
5/24	0.018	0.019	0.080	0.034	0.031	0.000	0.013	0.015	0.060	0.030	0.008	0.011	0.049	64.7%
5/25	0.025	0.023	0.105	0.034	0.069	0.000	0.097	0.017	0.094	0.052	0.013	0.021	0.082	59.6%
5/26	0.027	0.045	0.116	0.034	0.079	0.014	0.096	0.042	0.104	0.062	0.012	0.033	0.091	46.4%
5/27	0.042	0.045	0.148	0.034	0.090	0.046	0.101	0.079	0.135	0.080	0.014	0.048	0.112	40.4%
5/28	0.049	0.048	0.157	0.043	0.090	0.046	0.101	0.110	0.143	0.087	0.015	0.054	0.121	38.3%
5/29	0.057	0.060	0.174	0.046	0.105	0.082	0.104	0.141	0.158	0.103	0.015	0.067	0.139	34.6%
5/30	0.065	0.115	0.174	0.058	0.171	0.101	0.156	0.179	0.193	0.135	0.017	0.095	0.174	29.2%
5/31	0.082	0.161	0.209	0.088	0.198	0.101	0.162	0.212	0.234	0.161	0.019	0.116	0.205	27.6%
6/01	0.117	0.161	0.252	0.133	0.224	0.114	0.162	0.270	0.268	0.189	0.022	0.139	0.239	26.3%
6/02	0.117	0.199	0.293	0.202	0.235	0.235	0.241	0.282	0.307	0.235	0.019	0.190	0.279	19.1%
6/03	0.117	0.259	0.307	0.241	0.288	0.235	0.263	0.298	0.330	0.260	0.021	0.212	0.307	18.4%
6/04	0.117	0.297	0.352	0.271	0.288	0.287	0.263	0.309	0.370	0.284	0.024	0.228	0.339	19.5%
6/05	0.175	0.357	0.380	0.271	0.308	0.323	0.274	0.335	0.388	0.312	0.022	0.262	0.363	16.3%
6/06	0.232	0.388	0.380	0.309	0.326	0.335	0.283	0.342	0.388	0.332	0.017	0.292	0.371	12.0%
6/07	0.302	0.413	0.389	0.368	0.339	0.341	0.354	0.342	0.429	0.364	0.013	0.333	0.395	8.5%
6/08	0.342	0.413	0.409	0.421	0.353	0.375	0.354	0.378	0.456	0.389	0.013	0.360	0.418	7.5%
6/09	0.342	0.450	0.442	0.516	0.384	0.395	0.563	0.398	0.470	0.440	0.023	0.387	0.493	12.1%
6/10	0.384	0.501	0.470	0.530	0.439	0.395	0.659	0.465	0.618	0.496	0.031	0.424	0.568	14.5%
6/11	0.450	0.541	0.509	0.553	0.439	0.411	0.659	0.508	0.654	0.525	0.029	0.457	0.593	12.9%
6/12	0.471	0.555	0.518	0.553	0.481	0.458	0.692	0.542	0.658	0.548	0.027	0.485	0.610	11.4%
6/13	0.543	0.579	0.518	0.576	0.524	0.483	0.726	0.558	0.658	0.574	0.025	0.516	0.632	10.1%
6/14	0.574	0.609	0.569	0.603	0.572	0.553	0.758	0.558	0.721	0.613	0.025	0.556	0.670	9.4%
6/15	0.605	0.609	0.603	0.628	0.610	0.589	0.758	0.574	0.738	0.635	0.022	0.584	0.685	8.0%
6/16	0.605	0.661	0.651	0.646	0.648	0.671	0.804	0.603	0.745	0.670	0.022	0.621	0.720	7.5%
6/17	0.620	0.745	0.682	0.657	0.674	0.671	0.826	0.654	0.752	0.698	0.021	0.649	0.747	7.0%
6/18	0.638	0.784	0.722	0.683	0.674	0.689	0.826	0.685	0.755	0.717	0.020	0.671	0.764	6.4%
6/19	0.673	0.841	0.759	0.683	0.694	0.724	0.834	0.697	0.758	0.740	0.021	0.692	0.789	6.5%
6/20	0.714	0.868	0.759	0.746	0.762	0.734	0.866	0.729	0.758	0.771	0.019	0.727	0.814	5.7%
6/21	0.729	0.876	0.799	0.801	0.803	0.812	0.890	0.729	0.773	0.801	0.019	0.758	0.844	5.4%
6/22	0.753	0.876	0.824	0.819	0.819	0.869	0.890	0.745	0.782	0.820	0.018	0.779	0.860	4.9%
6/23	0.753	0.885	0.837	0.840	0.844	0.889	0.912	0.762	0.788	0.834	0.019	0.791	0.878	5.2%
6/24	0.774	0.899	0.863	0.870	0.868	0.889	0.927	0.779	0.814	0.854	0.018	0.813	0.895	4.8%
6/25	0.827	0.928	0.879	0.911	0.868	0.896	0.927	0.819	0.854	0.879	0.013	0.848	0.910	3.5%
6/26	0.850	0.956	0.892	0.911	0.925	0.903	0.962	0.878	0.873	0.905	0.012	0.877	0.934	3.2%
6/27	0.919	0.975	0.892	0.980	0.949	0.914	0.981	0.919	0.873	0.934	0.013	0.903	0.964	3.3%
6/28	0.984	0.999	0.937	0.990	0.968	0.931	0.990	0.919	0.928	0.961	0.011	0.937	0.985	2.5%
6/29	1.000	0.999	0.973	1.000	0.982	0.966	0.990	0.942	0.960	0.979	0.007	0.963	0.995	1.6%
6/30	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

[a] Relative precision.