Fishery Data Series No. 95-12

Angler Effort and Harvest of Chinook Salmon by the Recreational Fisheries in the Lower Kenai River, 1994

by

Mary A. Schwager King

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

FISHERY DATA SERIES NO. 95-12

ANGLER EFFORT AND HARVEST OF CHINOOK SALMON BY THE RECREATIONAL FISHERIES IN THE LOWER KENAI RIVER, 1994

By

Mary A. Schwager King
Division of Sport Fish, Soldotna

Alaska Department of Fish and Game
Division of Sport Fish
333 Raspberry Road, Anchorage, Alaska, 99518-1599

July 1995

Development and publication of this manuscript were partially financed by the Federal Aid in Sport Fish restoration Act (16 U.S.C. 777-777K) under project F-10-10, Job No. S-2-5a.

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.

Mary A. Schwager King
Alaska Department of Fish and Game, Division of Sport Fish
34828 Kalifornsky Beach Road, Suite B, Soldotna, AK 99669-8367, USA

This document should be cited as:
Schwager King, Mary A.. 1995. 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 No. 95-12, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES ii

LIST OF FIGURES ii

LIST OF APPENDICES iii

ABSTRACT 1

INTRODUCTION 1

Fishing Regulations 5

METHODS 6

Creel Survey 6
- Angler Counts 8
- Angler Interviews 9

Age/Sex Composition 10
- Harvest 10
- Inriver Return 10

Data Analyses 10
- Effort 10
- Harvest Rates and Catch Rates 11
- Harvest and Catch 12
- Biological Data 12

RESULTS 12

Effort 12
Harvest Rates and Catch Rates 19
Harvest and Catch 19
Inriver Return 19
Biological Data 19
- Recreational Fishery 19
- Inriver Return 27

DISCUSSION 27

RECOMMENDATIONS 27

ACKNOWLEDGMENTS 27

LITERATURE CITED 34

APPENDIX A. COUNTS OF BOAT ANGLERS DURING THE CREEL SURVEY OF THE FISHERY FOR CHINOOK SALMON ON THE KENAI RIVER, ALASKA, 1994 37

APPENDIX B. DAILY SUMMARY STATISTICS FOR FISHING EFFORT, HARVEST RATE, AND CATCH RATE FOR ANGLERS INTERVIEWED DURING THE FISHERY FOR CHINOOK SALMON IN THE KENAI RIVER, ALASKA, 1994 41

LIST OF TABLES

Table **Page**

1. Mean counts of boat anglers by period for each of the strata of the creel survey of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994. 14
2. Mean counts of boat anglers by period for each of the strata of the creel survey of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994. 16
3. Estimated number of angler-hours of fishing effort by boat anglers during each of the strata of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994. 17
4. Estimated number of angler-hours of fishing effort by boat anglers during each of the strata of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994. 18
5. Estimated harvest per unit effort (HPUE) and catch per unit of effort (CPUE) of chinook salmon by boat anglers during each stratum of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994. 20
6. Estimated harvest per unit effort (HPUE) and catch per unit of effort (CPUE) of chinook salmon by boat anglers during each stratum of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994. 21
7. Estimated number of chinook salmon harvested and number caught by boat anglers during each stratum of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994. 22
8. Estimated number of chinook salmon harvested and number caught by boat anglers during each stratum of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994. 23
9. Daily counts of chinook salmon-sized targets during the early run as determined by dual-beam sonar, Kenai River, 1994. 24
10. Daily counts of chinook salmon-sized targets during the late run as determined by dual-beam sonar, Kenai River, 1994. 25
11. Age composition and mean length-at-age of chinook salmon sampled from the recreational harvest during the fishery for early-run chinook salmon in the Kenai River, 1994. 26
12. Age composition and mean length-at-age of chinook salmon sampled from the recreational harvest during the fishery for late-run chinook salmon in the Kenai River, 1994. 28
13. Age composition and mean length-at-age of chinook salmon sampled with large mesh gill nets during the fishery for early-run chinook salmon in the Kenai River, 1994. 30
14. Age composition and mean length-at-age of chinook salmon sampled with large mesh gill nets during the fishery for late-run chinook salmon in the Kenai River, 1994. 31

LIST OF FIGURES

Figure **Page**

1. Map of the Kenai River drainage. 2
2. Historical harvest and effort in the recreational fishery for early-run chinook salmon, Kenai River, 1974-1994. 3
3. Historical harvest and effort in the recreational fishery for late-run chinook salmon, Kenai River, 1974-1994. 4
4. Map of the Kenai River study area. 7
5. Daily sonar counts of chinook salmon, recreational catch of chinook salmon and angler effort during the early run, Kenai River, 1994. 32
6. Daily sonar counts of chinook salmon, recreational catch of chinook salmon and angler effort during the late run, Kenai River, 1994. 33

LIST OF APPENDICES

Appendix **Page**

A1. Counts of unguided and guided boat anglers during the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994. 38

A2. Counts of unguided and guided boat anglers during the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994. 39

B1. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for unguided anglers interviewed during the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only). 42

B2. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only). 43

B3. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only). 44

B4. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only). 45

ABSTRACT

A creel survey was conducted on the Kenai River between the Soldotna Bridge and Cook Inlet from 17 May through 7 August, 1994. The recreational fishery in this section of the Kenai River primarily targets chinook salmon *Oncorhynchus tshawytscha*. The estimated angler-effort and harvest during the early (May and June) chinook salmon run were 134,199 angler-hours and 4,722 chinook salmon, respectively. The estimated angler-effort and harvest during the late (July) chinook salmon run were 354,778 angler-hours and 14,388 chinook salmon, respectively. During the early run, the recreational fishery was liberalized allowing the use of bait, and during the late run the fishery was liberalized to allow fishing from a boat on the last Monday of July (normally closed to boat fishing) and the season was extended until 7 August in response to a large return. Unguided anglers exerted 64.8% of the total effort and took 48.6% of the chinook salmon harvest while guided anglers exerted 35.2% of the effort and harvested 51.4% of the chinook salmon.

Age and sex compositions of the recreational harvest and inriver return, and the inriver return as estimated by sonar are also presented.

Key words: Kenai River, chinook salmon, creel survey, effort, harvest, *Oncorhynchus tshawytscha*.

INTRODUCTION

The Kenai River supports the largest freshwater recreational fishery in Alaska with an average annual effort of nearly 350,000 angler-days over the last 6 years (Mills 1989-1994). This represents approximately 15% of the state's recreational fishing effort. The majority of the angler-effort occurs in the section of the river between the outlet of Skilak Lake and Cook Inlet (Figure 1) during a fishery directed primarily at returning chinook salmon *Oncorhynchus tshawytscha* during May, June, and July. With the exception of 1990, 1991 and 1992, angler effort in the chinook salmon fishery has generally been increasing (Figures 2 and 3). Decreased effort in these years was related to decreased run size resulting in restrictions to the fisheries. Although coho salmon *O. kisutch*, sockeye salmon *O. nerka*, pink salmon *O. gorbuscha*, Dolly Varden *Salvelinus malma*, and rainbow trout *O. mykiss* are also harvested by anglers in the Kenai River, this report focuses on the chinook salmon fisheries.

Prior to 1970, the recreational fishery in the Kenai River was comprised of shore-based anglers targeting on sockeye salmon in July and coho salmon in August and early September. In 1973, large numbers of anglers began experimenting with a new 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 began to expand rapidly (Figures 2 and 3).

Chinook salmon return to the Kenai River in two distinct temporal components: an early run which typically enters the river from mid-May until late June; and a late run which typically enters the river from late June through early August. Fish from both runs are prized by recreational anglers due to their large size, especially those from the late run which average about 18 kg (40 lbs) and may exceed 36 kg (80 lbs). The world record sport-caught chinook salmon, which weighed 44.1 kg (97 lb), was taken from the Kenai River in May of 1985.

Management of the late-run recreational fishery in the Kenai River is further complicated by the relatively large commercial harvest of returning chinook salmon. Chinook salmon are commercially

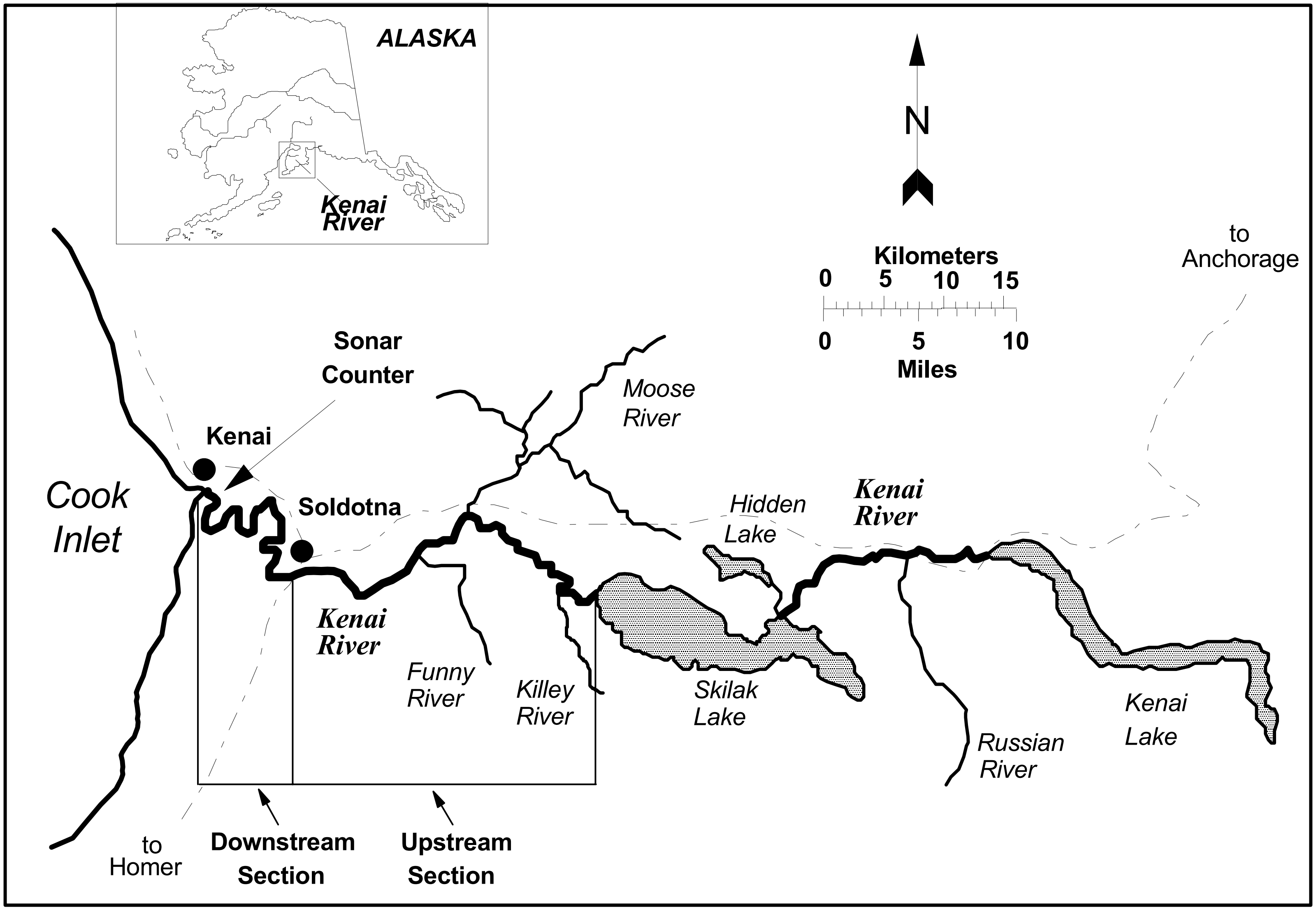

Figure 1.-Map of the Kenai River drainage.

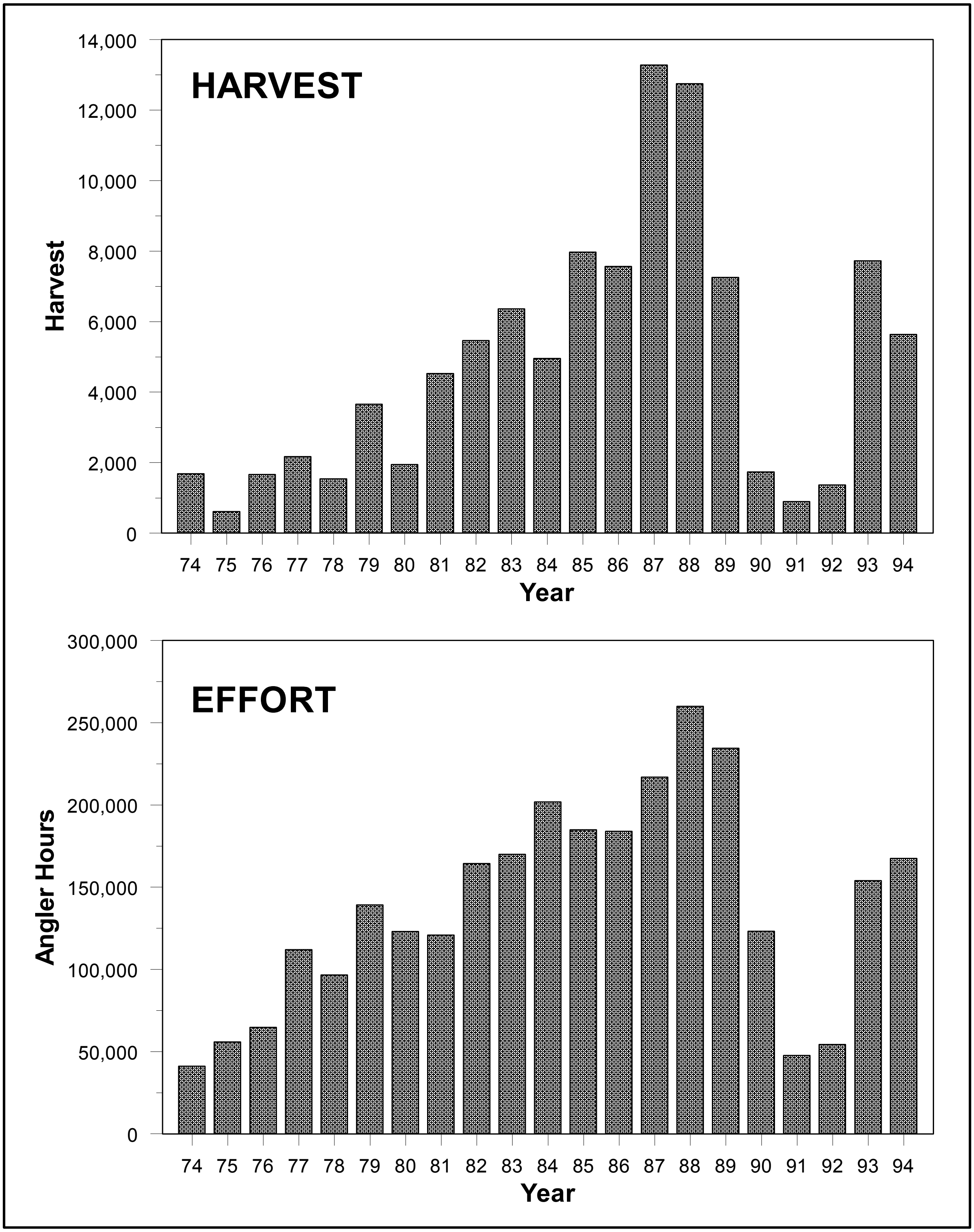

Figure 2.-Historical harvest and effort in the recreational fishery for early-run chinook salmon, Kenai River, 1974-1994.

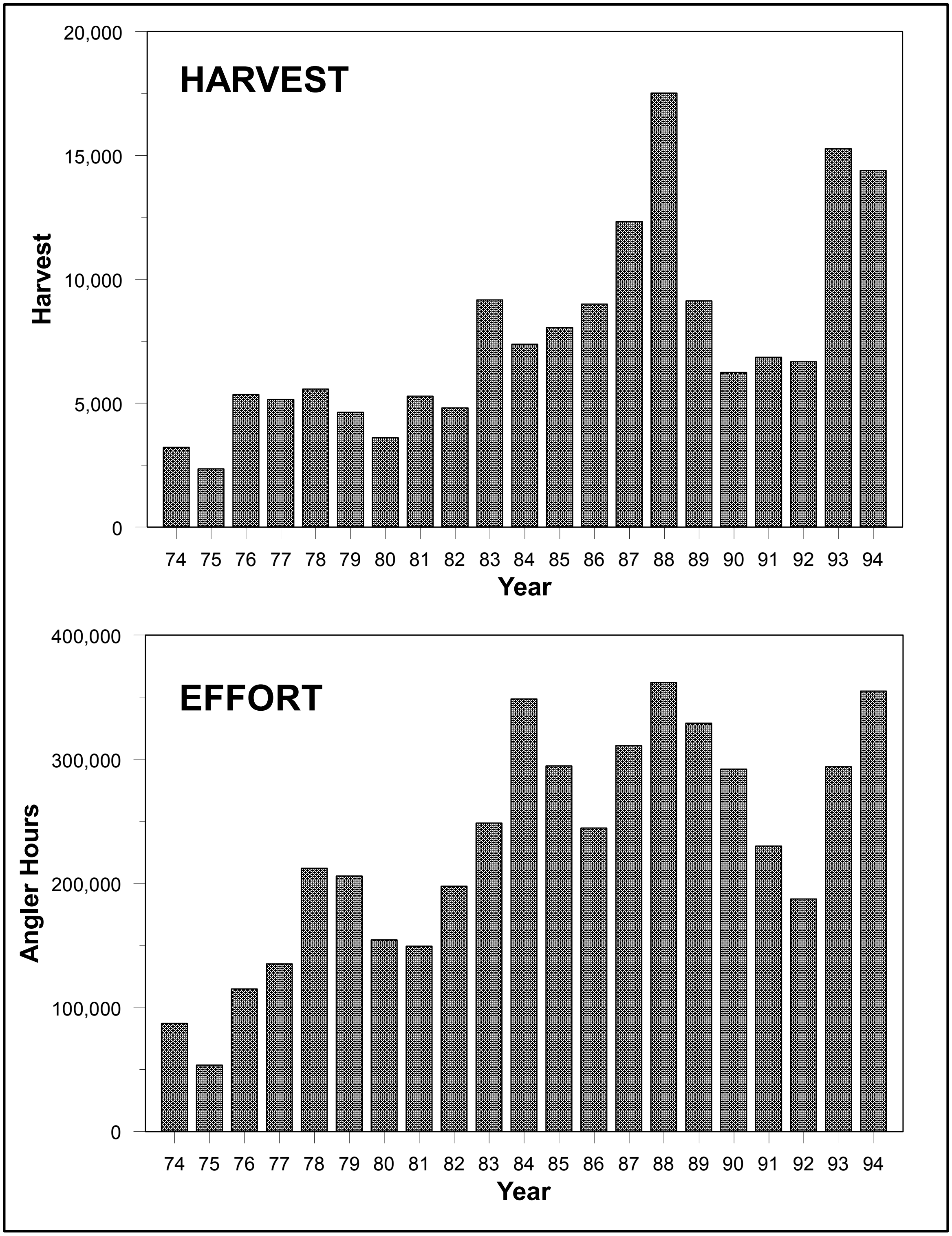

Figure 3.-Historical harvest and effort in the recreational fishery for late-run chinook salmon, Kenai River, 1974-1994.

harvested primarily by the set net fishery along the eastern shore of Cook Inlet (McBride et al. 1985). User-group conflicts have required the Department of Fish and Game to manage the salmon resources of the Kenai River with increasing precision. During the winter of 1988, the Alaska Board of Fisheries adopted management plans for both the early and late chinook salmon runs. These plans define escapement goals and mechanisms by which the various fisheries are to be regulated to achieve the stated goals. Another component of these plans defines the separation date between the two runs as 1 July. Both management plans were reviewed by the Alaska Board of Fisheries in late 1990. Minor changes were made which were to be implemented for the entire 1991 fisheries, however, legal complications delayed the implementation until 21 July, 1991. The modifications have been in place since 1992.

Previous information on the chinook salmon fisheries in the Kenai River has been presented by Hammarstrom (1975-1981, 1988-1994), Hammarstrom and Larson (1982-1984, 1986), Hammarstrom et al. (1985), and Conrad and Hammarstrom (1987). In addition, angler-effort and harvest by species for the recreational fishery have been estimated by Mills (1979-1994) in the Alaska Statewide Sport Fish Harvest Survey.

The current creel survey program in the Kenai River provides data that are used for inseason management decisions for the recreational fishery, evaluated to refine long-term management objectives, and used by the Alaska Board of Fisheries to allocate salmon resources. The objective of this report is to present detailed information from the creel survey of the recreational fishery for chinook salmon conducted in 1994.

FISHING REGULATIONS

The regulations for the chinook salmon fishery in the Kenai River are among the most restrictive of any open waters in Alaska. Only the section of the river between the outlet of Skilak Lake and Cook Inlet is open to fishing for chinook salmon, with the exception of the restricted waters at the confluences of the Funny River and Slikok Creek with the Kenai River. These waters are closed to fishing for chinook salmon until July 15 to protect early-run chinook salmon which are staging in these areas prior to entering their natal streams. 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 salmon per day greater than 41 cm (16 in) in length and a seasonal limit of two chinook salmon greater than 41 cm. In 1994, fishing from boats downstream from the outlet of Skilak Lake was prohibited on Mondays in May, June, and July, except Monday of Memorial Day. Anyone retaining a chinook salmon that was 41 cm in length or greater was prohibited from fishing from a boat in the Kenai River downstream of Skilak Lake for the remainder of that day. Additionally, the early-run fishery was further restricted in that the use of bait was prohibited until the department was able to project an escapement of at least 9,000 fish or 1 July, whichever occurred first.

There are further restrictions for guided anglers. In addition to the regulation prohibiting fishing from boats on Mondays, fishing from a registered guide vessel on any Sunday in July is prohibited. In 1994, fishing from a guided boat was allowed only between 0600 and 1800 hours during June and July. There were no days or hours closed to boat fishing by either guided or unguided anglers during the remainder of the year.

In 1994, the river was opened to the use of bait on 24 June, and fishing from boats was permitted for all anglers on Monday, 25 July with guided anglers being restricted to 0600 to

1800 hours. The late-run fishery was also extended to allow chinook salmon retention through 7 August in that section of river downstream of "Eagle Rock" (approximately river kilometer 18). The above emergency orders were issued in response to the development of the inriver return in an attempt to allow maximum opportunity while insuring that escapement goals were achieved.

METHODS

CREEL SURVEY

A roving creel survey (Neuhold and Lu 1957) was used to estimate sport fishing effort, in units of angler-hours, by the recreational fishery for chinook salmon in the Kenai River. Harvest per unit of effort (HPUE) and catch per unit of effort (CPUE) for chinook salmon were estimated from angler interviews. Harvest and catch of chinook salmon were estimated by the product of effort and harvest (or catch) rate estimates. Fishery statistics were established separately for the early and late runs.

The chinook salmon fishery is limited to the lower Kenai River, defined as the mainstem waters downstream of Skilak Lake. During the 1994 early-run and late-run fisheries, angler effort, harvest, and catch were estimated only for the downstream section (Cook Inlet, river mile/kilometer 0, to the Soldotna Bridge, river mile [rm] 21 or river kilometer [rkm] 34) of the lower Kenai River (Figure 4). There was no attempt to survey the fishery upstream of the Soldotna Bridge in 1994 because of the difficulties in obtaining a sufficient number of interviews of completed-trip anglers and reliable angler counts given the limited manpower available to sample this section of the river.

Both unguided and guided anglers participate in the fishery for chinook salmon in the Kenai River. The times and days when guides may be used on the Kenai River are restricted, and anglers employing commercial guides have very different harvest and catch rates; therefore, effort, HPUE, CPUE, harvest, and catch were estimated separately for guided and unguided anglers. Guided anglers fish exclusively from boats and are easily recognized because these boats are required to display a prominent identifying decal. Since shore anglers harvest very few chinook salmon, only boat anglers were surveyed.

The creel survey of the fishery for chinook salmon began 17 May and continued through 7 August. The fishing day for unguided anglers was defined as 20 hours long, 0400 to 2400 hours, and was divided into five 4-hour time periods for effort estimation. The periods were: A, from 0400 to 0759 hours; B, from 0800 to 1159 hours; C, from 1200 to 1559 hours; D, from 1600 to 1959 hours; and E, from 2000 to 2359 hours. Waning daylight hours at the end of July tends to reduce boating (fishing) activities as the time approaches 2400 hours; consequently in August, the fishing day was considered to be 16 hours long, from 0600 to 2200 hours and was divided into four 4-hour periods. These periods were: A, from 0600 to 0959 hours; B, from 1000-1359 hours; C, from 1400 to 1739 hours; and D, from 1800 to 2159 hours. In May and August, stratification of the fishing day for guided anglers was the same as that for unguided anglers. However, by regulation, anglers may fish from a registered guide boat only from 0600 to 1800 hours during June and July, which therefore defined the fishing day (12 hours) for guided anglers. Since most guides schedule two trips per day, morning and afternoon, each fishing day for guided anglers had two temporal strata:

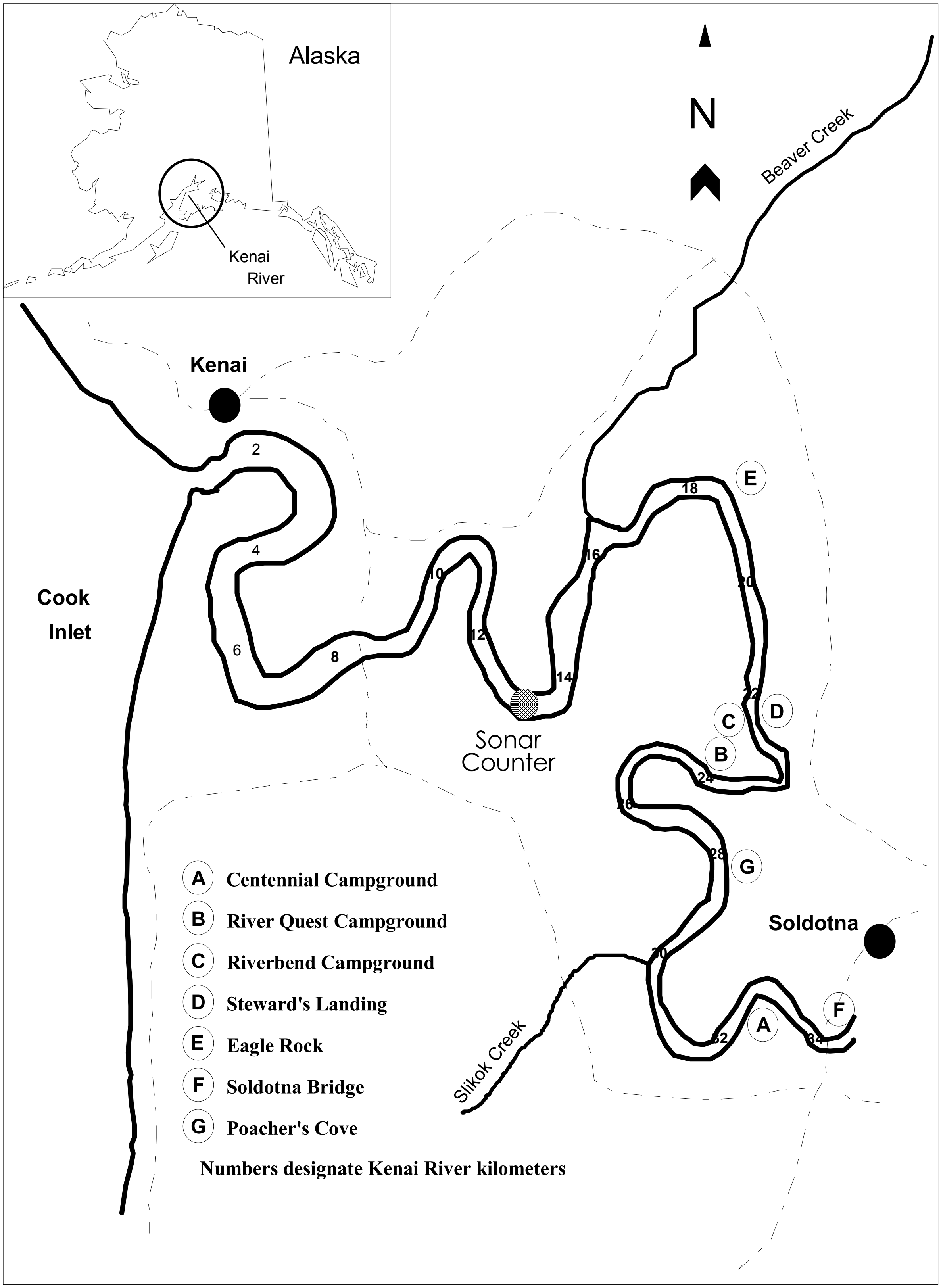

Figure 4.-Map of the Kenai River study area.

Period A, 0600 to 1159 hours and B, 1200 to 1759 hours. Unguided anglers were further stratified into weekdays and weekend/holidays. No further stratification for guided anglers was used.

The above design resulted in 20 strata: 12 during the early run, and eight during the late run. There were seven temporal units, four during the early run and three during the late run.

The early-run strata were:

(1) 5/17-5/31, unguided anglers, weekdays;
(2) 5/17-5/31, unguided anglers, weekends/holidays;
(3) 5/17-5/31, guided anglers;
(4) 6/01-6/13, unguided anglers, weekdays;
(5) 6/01-6/13, unguided anglers, weekends/holidays;
(6) 6/01-6/13, guided anglers;
(7) 6/14-6/23, unguided anglers, weekdays;
(8) 6/14-6/23, unguided anglers, weekends/holidays;
(9) 6/14-6/23, guided anglers;
(10) 6/24-6/30, unguided anglers, weekdays;
(11) 6/24-6/30, unguided anglers, weekends/holidays; and,
(12) 6/24-6/30, guided anglers.

The late-run strata were:

(13) 7/1-7/15, unguided anglers, weekdays;
(14) 7/1-7/15, unguided anglers; weekends/holidays;
(15) 7/1-7/16, guided anglers;
(16) 7/16-7/31, unguided anglers, weekdays;
(17) 7/16-7/31, unguided anglers, weekends/holidays;
(18) 7/17-7/31, guided anglers;
(19) 8/01-8/07, unguided anglers, all days; and,
(20) 8/01-8/07, guided anglers, all days.

Angler Counts

Sampling levels were designed to estimate effort within ± 10% of the true value 95% of the time, and catch and harvest within ± 15% of the true value 95% of the time. Two boat technicians, each working 37.5 hours per week, conducted the angler counts in the downstream section.

On every weekend day and holiday, an unguided angler count was made during each of the five periods. One of the 4 whole-hours of each period (A through E) was selected randomly as a time to initiate an unguided angler count. During each 4-day week (weekdays only Tuesday through Friday), 2 days for each period, A through E, were selected randomly to be sampled. Within each sampled period, an angler count was initiated at one of the four randomly selected whole-hours. This sampling design allowed for 10 unguided angler counts on a typical weekend and 10 unguided angler counts during the 4 weekdays the fishery was open.

Since guided and unguided anglers fished under similar regulations during May and August, guided angler counts were conducted as described above. However, during June and July, if a selected unguided angler count occurred during the A period (0600-1159 hours) or B period (1200-1759 hours) corresponding to the guided angler strata, then a guided angler count was also conducted. If no unguided angler counts were scheduled during the A or B period for guided anglers, an additional count for guided anglers only was conducted at a randomly selected whole-hour during the guided period in question. If two or more counts occurred during the guided period, A or B, then one was selected randomly as the guided angler count and the remaining counts were designated as unguided angler counts only.

Some deviation from the schedule did occur because of mechanical breakdown and/or other duties such as public assistance or enforcement activities.

Counts of anglers were conducted from a boat in the downstream section of the Kenai River. The starting point of each count (upstream or downstream extremity of the river section) was chosen at random. The technician counted anglers while driving the boat at a constant rate of speed through the survey area to the opposite end of the river section. This trip usually took about 45 minutes and every effort was made to ensure that the trip was completed in less than 1 hour. Angler counts were considered to be instantaneous and to reflect fishing effort at the time of the count. During the angler count, the boat technician recorded the following: (1) total number of unguided boats; (2) total number of guided boats; (3) total number of anglers in unguided boats; (4) total number of anglers in guided boats; and (5) total number of shore anglers. Boats and anglers were considered engaged in fishing and were counted if the boat was in operation, as opposed to tied to the shore, regardless of whether or not an angler's line was in the water when the count was conducted. Guides were not included in the counts during the chinook salmon fishery as they are prohibited from fishing while guiding. When the boat technicians were not conducting a count, they conducted completed-trip angler interviews at access locations.

Angler Interviews

The angler interview schedule in the downstream section was designed for two access technicians, each working 37.5 hours per week; however, the schedule was augmented by the two boat technicians who conducted angler interviews at times when they were not engaged in angler counts.

The following information was recorded for each angler interview: (1) powered or nonpowered boat; (2) fished midstream section only (yes or no); (3) guided or unguided angler; (4) number of hours spent fishing (to the nearest 0.5 hour); (5) number of fish, by species, retained; (6) number of fish, by species, released. Additional information regarding the presence of adipose fin clips was also recorded. Although boat type was recorded for each interview, these data are not presented in this report because they are collected for use by the Board of Fisheries and other agencies and are not germane to the objectives of this report.

Interviews of completed-trip anglers for harvest and catch rate information were conducted primarily at seven popular boat landings in the downstream section. Two access technicians conducted the interviews at the boat landings. Each technician was scheduled to work 7.5-hour days on each weekend/holiday day and on 3 randomly selected weekdays each week. Two randomly selected landings were sampled by a technician on a sample day. Thus on weekend/holidays, four landings were sampled each day, and on weekdays either two or four landings were sampled. The starting time for the 7.5-hour interview period was randomly selected from either an early shift (possible start times: 0600, 0630, 0700, or 0730 hours) or a late shift (possible start times: 1500, 1530, 1600, or 1630 hours). The creel survey clerks conducted interviews for about 3.5 hours at each landing. The two landings frequented by guided anglers were sampled primarily around noon or early evening hours to correspond with the times guides normally end a fishing trip.

AGE/SEX COMPOSITION

Harvest

Sampling goals for estimation of age composition of the harvest were 250 harvested fish from each run. Samples were obtained from anglers' creels during the surveys. Mid-eye to fork-of-tail length was measured to the nearest one-half centimeter, the sex of the fish was identified, and scales were removed from the preferred area (Clutter and Whitesel 1956; Welander 1940). Three scales were collected from each fish and placed on an adhesive-coated card. Impressions of the scales were made on acetate, and these images, observed with a microfiche reader were used for aging the fish. If the adipose fin was missing on any observed fish, every attempt was made to secure the head for later examination by the department's tag lab for the presence of a coded wire tag.

Inriver Return

To estimate the age and sex composition of the inriver return, chinook salmon were captured in 7 1/4 inch mesh gill nets in the intertidal area (approximately downstream of Beaver Creek to the Warren Ames Bridge), using the techniques described by Hammarstrom and Larson (1984). Two crews of two individuals each were used. Sampling was stratified into two 3-week periods during each run with a sampling goal of 125 fish per sample period. Fish were untangled from the gill net and placed in a tagging cradle to be sampled and later released. Biological data collected included length (mid-eye to fork of tail), sex (using external characteristics) and three scales which were taken from the preferred area. Scale samples were prepared similarly to those of the creel samples. As with the creel samples, each fish was examined for the presence of the adipose fin.

DATA ANALYSES

Angler-effort, harvest and catch rates for chinook salmon, harvest and catch of chinook salmon, and associated variances were estimated using the same procedures for guided and unguided anglers. In the following sections, harvest refers to fish retained by anglers and catch refers to fish retained plus those reported as released by anglers.

Effort

In the downstream section during the chinook salmon fishery, the number of angler-hours of effort during fishery stratum t was estimated as follows (Neuhold and Lu 1957):

$$\hat{E}_t = \sum_{j=1}^{s} H_{tj}\bar{x}_{tj}\ , \tag{1}$$

where:

$\bar{x}_{tj}$ = the mean number of anglers per count during period j of stratum t;

H_{tj} = the total number of hours of possible fishing time during period j of stratum t; and

S = the number of periods (A, B, C, etc.) in stratum t (5 in May and July, 4 in August.

The variance of effort was estimated as follows (Scheaffer et al. 1979):

$$V(\hat{E}_t) = \sum_{j=1}^{s} H_{tj}^2\left(\frac{s_{tj}^2}{n_{tj}}\right) \tag{2}$$

where:

s_{tj}^2 = the variance of $\bar{x}_{tj}$,

$$= \frac{\sum_{o=1}^{n_{tj}} (x_{tjo} - \bar{x}_{tj})^2}{n_{tj} - 1}, \quad (3)$$

n_{tj} = the number of angler counts during period j of stratum t, and

x_{tjo} = angler count o during period j of stratum t.

This method assumes a single-stage design with all possible counts within a stratum representing the population to be sampled. The finite population correction factor is not applied as angler counts are considered instantaneous, and so there are an infinite number of counts that can be taken.

Harvest Rates and Catch Rates

Mean effort and mean harvest per angler were estimated for each stratum using the angler interview data for the stratum. Only completed-trip interviews were used.

Mean effort per angler during stratum t was estimated as:

$$\bar{f}_t = \frac{\sum_{i=1}^{D} \sum_{k=1}^{m_i} f_{ik}}{\sum_{i=1}^{D} m_i}; \quad (4)$$

where:

f_{ik} = the effort (in hours) by angler k at the time of the interview on day i;

m_i = the number of anglers interviewed on day i; and

D = the number of days the fishery was open during stratum t.

A two-stage sample design with days representing the first-stage sample units and anglers the second-stage sample units was used to estimate the variance of mean effort (Von Geldern and Tomlinson 1973). The number of second-stage units available on a given sample day was unknown. The variance of mean effort was estimated as follows (Sukhatme et al. 1984):

$$V(\bar{f}_t) = \frac{(1 - \frac{d}{D}) s_B^2}{d} + \frac{\sum_{i=1}^{D} \frac{s_{Wi}^2}{m_i}}{dD}, \quad (5)$$

where:

d = the number of days interviews were conducted during stratum t;

s_{Wi}^2 = the sample variance of mean effort per angler for interviews conducted on day i; and

s_B^2 = the among-day variance of mean effort per angler.

The among-day variance, s_B^2, was estimated as follows:

$$s_B^2 = \frac{\sum_{i=1}^{d} (\bar{f}_{ti} - \bar{f}_t)^2}{d - 1}, \quad (6)$$

where:

$\bar{f}_{ti}$ = the mean effort per angler during day i of stratum t.

Mean harvest (or catch) and its variance were estimated identically to mean effort, except the corresponding quantities for harvest (or catch) were substituted for all occurrences of effort (f).

Harvest rate (HPUE) during stratum t was estimated by:

$$\hat{HPUE}_t = \frac{\bar{c}_t}{\bar{f}_t}, \quad (7)$$

where:

$\bar{c}_t$ = the mean harvest per angler during stratum t, obtained by substituting catch for effort in equation 4.

The variance of $HPUE_t$ was approximated by the variance for the quotient of the mean of two random variables (Jessen 1978), which is:

$$\hat{V}\left(\frac{\bar{c}_t}{\bar{f}_t}\right)=\left(\frac{\bar{c}_t}{\bar{f}_t}\right)^2\left(\frac{s_t^2}{\bar{c}_t^2}+\frac{s_f^2}{\bar{f}_t^2}-\frac{2rs_c^2 s_f^2}{\bar{c}_t\bar{f}_t}\right), \tag{8}$$

where:

s_c^2 = the two-stage estimate of variance for $\bar{c}_t$,

s_f^2 = the two-stage estimate of variance for $\bar{f}_t$, and

r = the correlation coefficient between the f_{ik} and the c_{ik} in stratum t.

Catch per unit effort (CPUE) and its variance were estimated by replacing the mean and variance of number of fish harvested per angler with the mean and variance of the number of fish caught per angler in equations 7 and 8.

Harvest and Catch

The harvest during each stratum was estimated by:

$$\hat{H}_t = \hat{E}_t H\hat{P}UE_t \tag{9}$$

The variance of $\hat{H}_t$ was estimated using Goodman's (1960) formula for the variance of the product of two independent random variables, which is:

$$\begin{aligned} V\left(\hat{H}_t\right) = &\left[\hat{E}_t^2\hat{V}\left(H\hat{P}UE_t\right)\right]+ \\ &\left[H\hat{P}UE_t^2 V\left(\hat{E}_t\right)\right]- \\ &\left[\hat{V}\left(\hat{E}_t\right)\hat{V}\left(H\hat{P}UE_t\right)\right]. \end{aligned} \tag{10}$$

Totals (for example, the total for unguided anglers during the early run) for effort and harvest were estimated by summing the appropriate stratum estimates. Estimates of effort and harvest for the strata are considered independent estimates, therefore, the variance of the total was estimated by the sum of the appropriate variances.

The major assumptions necessary for these analyses are:

1. significant fishing effort occurs only between the hours defined for the angler day;
2. individual effort and harvest (or catch) by anglers are normally distributed random variables;
3. anglers are interviewed in constant proportions to their abundance within each stratum (DiCostanzo 1956), and interviewed anglers are representative of the total angler population.

Biological Data

Age composition of the chinook salmon harvest and inriver return was estimated for each run. Letting $\hat{p}_{ht}$ equal the estimated proportion of age group h in stratum t, the variance of $\hat{p}_{ht}$ was estimated as (Scheaffer et al. 1979):

$$V(\hat{p}_{ht}) = \hat{p}_{ht}(1-\hat{p}_{ht})/(n_t-1), \tag{11}$$

where:

n_t = the number of legible scales read from chinook salmon sampled during stratum t.

It was assumed that there were no significant differences in the ages and lengths of fish harvested by guided and unguided anglers, therefore biological data from harvests of both angler types were pooled.

RESULTS

EFFORT

The creel survey commenced on 17 May. Angler counts were conducted on all of the 75 days possible: 40 during the early run and 35 during the late run.

During the early run, angler counts ranged from 0 to 285 for unguided anglers and from 0 to 347 for guided anglers (Appendix A1). The largest count of unguided anglers occurred on 26 June and of guided anglers on 14 June. During the late run, angler counts ranged from 26 to 1,064 for unguided anglers and from 0 to 888 for guided anglers (Appendix A2). The largest count of unguided anglers, a historical high, occurred on 19 July; and of guided anglers on 12 July. In general, mean angler counts are lowest in May, gradually increased throughout June and early July, with the highest mean angler counts occurring during the last two weeks of July. Summaries of angler counts are presented in Tables 1 and 2.

The estimated effort in the downstream section during the early run was 134,199 (SE = 3,661) angler-hours (Table 3). This is an increase of nearly 11,000 angler hours (10%) from the 1993 estimate (Hammarstrom 1994), which can be partly attributed to an earlier commencement date for the creel survey (5 days) and a regulation liberalization which allowed use of bait for 7 days (only 5 days in 1993) at the end of June. During the early run, 54% of the total effort was by unguided anglers, a decrease of nearly 4,000 angler hours (5%) from 1993. The increase in total early run effort from 1993 to 1994 was largely due to the increase in guided angler effort: nearly 15,000 angler hours (32%).

In 1990-1992, relatively weak returns resulted in restrictions to the recreational fishery that effectively reduced the harvest upstream of the Soldotna Bridge to an insignificant level, and this area was not surveyed. In 1994, as in 1993, there was more effort in this area than had been noticed in the past, suggesting a fishery similar to what had taken place during the years 1986-1989, which had been surveyed. In 1994 effort and harvest estimates for the upstream section were determined by using the same methodology used in 1993: an expansion of the harvest and effort estimates was derived for the downstream section by the average proportion noted in that area of the river upstream of the Soldotna Bridge during the years 1986-1989 (years when estimates were made and the fishery was conducted in a manner similar to 1993, i.e. there were no additional restrictions to the recreational fishery). Thus the downstream estimate was expanded by 33,340 angler-hours (19.9%) to account for the fishery in the unsurveyed area, resulting in a total early-run estimate of 167,539 angler-hours (Table 3).

The estimated effort during the late run was 354,778 (SE = 9,773) angler-hours (Table 4), an increase of 21% from the 1993 fishery (Hammarstrom 1994). This increase can be partly attributed to liberalized fishing regulations allowing 4 more days in the 1994 fishery. The majority of the 1994 effort (69%) was by unguided anglers. Both unguided and guided effort increased from 1993: 21% and 19%, respectively.

During interviews with completed-trip early-run anglers in the downstream section, a total of 17,435 angler-hours were reported. This represents 13% of the total estimated effort. During late-run interviews, anglers reported

Table 1.-Mean counts of boat anglers by period for each of the strata of the creel survey of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994.

	Period[a]				
Strata	A	B	C	D	E
1: 17 May - 31 May					
Unguided anglers, weekdays:					
Number of counts	5	4	3	2	3
Mean count	40.4	44.3	45.0	7.5	25.7
Standard error	10.1	4.8	0.6	7.5	19.1
Unguided anglers, weekends:					
Number of counts	3	4	5	5	5
Mean count	59.7	131.5	95.4	82.8	73.8
Standard error	45.7	24.7	16.6	24.0	21.3
Guided anglers, all days (May):					
Number of counts	8	8	8	7	8
Mean count	52.5	92.1	57.3	37.4	11.1
Standard error	16.1	12.0	8.3	7.2	3.8
2: 1 June - 13 June					
Unguided anglers, weekdays:					
Number of counts	3	5	5	4	4
Mean count	88.7	94.4	73.2	76.0	89.5
Standard error	12.7	16.4	9.7	12.6	21.1
Unguided anglers, weekends:					
Number of counts	4	4	4	4	3
Mean count	135.3	178.0	203.3	132.0	93.0
Standard error	24.0	28.1	24.0	23.6	34.0
Guided anglers, all days:					
Number of counts	11	11			
Mean count	203.4	100.8			
Standard error	20.0	17.5			
3: 14 June - 23 June					
Unguided anglers, weekdays:					
Number of counts	4	3	4	4	5
Mean count	140.0	91.0	72.8	64.8	76.0
Standard error	25.7	8.7	8.8	14.3	15.0
Unguided anglers, weekends:					
Number of counts	2	2	2	2	2
Mean count	68.0	172.0	139.5	63.0	48.0
Standard error	10.0	1.0	56.5	47.0	27.0
Guided anglers, all days:					
Number of counts	9	9			
Mean count	196.1	80.4			
Standard error	27.0	8.5			

-continued-

Table 1.-Page 2 of 2

Strata	Period[a] A	B	C	D	E
4: 24 June - 30 June					
Unguided anglers, weekdays:					
Number of counts	1	3	3	1	1
Mean count	93.0	129.3	116.0	117.0	234.0
Standard error		22.8	37.5		
Unguided anglers, weekends:					
Number of counts	2	2	2	2	2
Mean count	170.5	257.5	189.0	150.0	130.0
Standard error	21.5	27.5	29.0	14.0	32.0
Guided anglers, all days:					
Number of counts	6	6			
Mean count	221.0	115.2			
Standard error	19.7	8.2			

[a] Unguided anglers, all months:
Period A = 0400-0759
Period B = 0800-1159
Period C = 1200-1559
Period D = 1600-1959
Period E = 2000-2359

Guided anglers:
May: Same as unguided anglers

June: Period A = 0600-1159
Period B = 1200-1759

Table 2.-Mean counts of boat anglers by period for each of the strata of the creel survey of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994.

	Period[a]				
Strata	A	B	C	D	E
<u>5: 1 July - 15 July</u>					
Unguided anglers, weekdays:					
Number of counts	5	4	7	5	6
Mean count	332.4	376.5	286.6	267	344.2
Standard error	58.02	71.49	82.25	38.6	68.17
Unguided anglers, weekends:					
Number of counts	4	4	4	4	4
Mean count	142	272.3	300.8	234.5	192
Standard error	41.94	90.39	80.04	45.54	26.33
Guided anglers, all days[b]:					
Number of counts	12	11			
Mean count	451.2	253.1			
Standard error	47.36	34.41			
6: 16 July - 31 July					
Unguided anglers, weekdays:					
Number of counts	5	4	7	6	5
Mean count	652.2	573.3	381.6	420.3	287.6
Standard error	104.8	50.45	31.21	32.4	62.55
Unguided anglers, weekends:					
Number of counts	6	6	6	6	6
Mean count	576.3	845	628	494.8	488.5
Standard error	107.2	48.46	64.82	44.36	34.62
Guided anglers, all days[c]:					
Number of counts	10	11			
Mean count	483.6	273.9			
Standard error	13.31	33.13			
7: 1 August - 7 August					
Unguided anglers, all days:					
Number of counts	3	5	3	3	
Mean count	88.3	154.2	112.7	91.3	
Standard error	8.09	6.06	10.93	23.7	
Guided anglers, all days:					
Number of counts	3	5	3	3	
Mean count	115	140.8	73.7	4.3	
Standard error	23.39	21.2	31.1	2.6	

[a] Unguided anglers:

	July	August
Period A	= 0400-0759	0600 - 0959
Period B	= 0800-1159	1000 - 1359
Period C	= 1200-1559	1400 - 1759
Period D	= 1600-1959	1800 - 2159
Period E	= 2000-2359	

Guided anglers:

July: Period A = 0600-1159
Period B = 1200-1759

August: Same as unguided anglers

[b] Stratum length 1 July - 16 July

[c] Stratum length 17 July - 31 July

Table 3.-Estimated number of angler-hours of fishing effort by boat anglers during each of the strata of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994.

Strata	Estimated Effort	Standard Error	95% Confidence Interval			Relative Precision
EARLY RUN						
Downstream Section						
1: 17 May - 31 May						
Unguided, weekdays:	5,861	842	4,211	-	7,511	28.2 %
Unguided, weekends:	8,863	1,265	6,384	-	11,342	28.0 %
Guided, all days:	14,024	1,298	11,480	-	16,568	18.1 %
2: 1 June - 13 June						
Unguided, weekdays:	11,810	940	9,968	-	13,652	15.6 %
Unguided, weekends:	11,864	968	9,967	-	13,761	16.0 %
Guided, all days:	20,706	1,753	17,270	-	24,142	16.6 %
3: 14 June - 23 June						
Unguided, weekdays:	12,446	985	10,515	-	14,377	15.5 %
Unguided, weekends:	3,924	632	2,685	-	5,163	31.6 %
Guided, all days:	14,934	1,531	11,933	-	17,935	20.1 %
4: 24 June - 30 June						
Unguided, weekdays:	10,489					
Unguided, weekends:	7,176	458	6,278	-	8,074	12.5 %
Guided, all days:	12,102	767	10,599	-	13,605	12.4 %
Subtotals						
Unguided:	72,433	2,389	67,750	-	77,116	6.5 %
Guided:	61,766	2,773	56,331	-	67,201	8.8 %
Early Run Total	134,199	3,661	127,024	-	141,374	5.3 %
Expansion						
Upstream section:	33,340					
GRAND TOTAL	167,539					

Table 4.-Estimated number of angler-hours of fishing effort by boat anglers during each of the strata of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994.

Strata	Estimated Effort	Standard Error	95% Confidence Interval			Relative Precision
LATE RUN						
Downstream Section						
5: 1 July - 15 July						
Unguided, weekdays:	57,839	5,264	47,522	-	68,156	17.8 %
Unguided, weekends:	18,264	2,212	13,928	-	22,600	23.7 %
Guided, all days[a]:	50,707	4,215	42,446	-	58,968	16.3 %
6: 16 July - 31 July						
Unguided, weekdays:	83,339	5,021	73,498	-	93,180	11.8 %
Unguided, weekends:	72,784	3,496	65,932	-	79,636	9.4 %
Guided, all days[b]:	49,996	2,357	45,376	-	54,616	9.2 %
7: 1 August - 7 August						
Unguided, all days:	12,503	784	10,966	-	14,040	12.3 %
Guided, all days:	9,346	1,243	6,910	-	11,782	26.1 %
Subtotals						
Unguided:	244,729	8,405	228,255	-	261,203	6.7 %
Guided:	110,049	4,987	100,275	-	119,823	8.9 %
Late Run Total	354,778	9,773	335,622	-	373,934	5.4 %

[a] Stratum length 1 July - 16 July

[b] Stratum length 17 July - 31 July

28,436 angler-hours, 8% of the total estimated effort.

HARVEST RATES AND CATCH RATES

A total of 9,262 interviews with completed-trip anglers were collected: 3,607 interviews during the early run and 5,655 interviews during the late run (Tables 5 and 6). Interviews were conducted with both guided and unguided completed-trip anglers on each day of the fishery during both the early and late runs, beginning on 17 May.

Daily catch rates of early-run chinook salmon by unguided anglers ranged from 0.000 to 0.093 fish per hour and from 0.009 to 0.213 fish per hour for anglers employing guides (Appendices B1 and B2). Peak daily catch rates of early-run chinook salmon by unguided anglers occurred on 30 June and on 2 June for guided anglers. Daily catch rates of late-run chinook salmon by unguided anglers ranged from 0.000 to 0.098 fish per hour and from 0.000 to 0.150 fish per hour for guided anglers (Appendices B3 and B4). Peak daily catch rates of late-run chinook salmon by unguided anglers occurred on 19 July and by guided anglers on 1 August. Estimates of overall harvest rates are 0.0352 for the early run and 0.0406 for the late run. Overall catch rates are 0.0477 for the early run and 0.0523 for the late run (Tables 5 and 6).

HARVEST AND CATCH

An estimated 4,722 (SE = 300) chinook salmon were harvested during the early run in the downstream section (Table 7), 32% by unguided anglers. This estimate was expanded by 912 fish (16.2%) to account for those fish harvested upstream of the Soldotna Bridge during the early run. The estimated catch of early-run chinook salmon in the downstream section was 6,399 (SE = 404). Approximately 26% of the catch was voluntarily released.

An estimated 14,388 (SE = 637) chinook salmon were harvested during the late run (Table 8). Unguided anglers accounted for 54% of the harvest. The estimated catch of chinook salmon in the downstream section was 18,539 (SE = 770). Approximately 22% of the catch was voluntarily released during the late run.

During interviews with completed-trip early-run anglers in the downstream section, a total of 619 fish were reported as harvested. This represents 13.1% of the estimated total harvest. During late-run interviews, anglers reported a harvest of 1,124 fish, 7.8% of the estimated total harvest.

INRIVER RETURN

The inriver return of chinook salmon was estimated using hydroacoustic equipment (sonar). Information regarding the details of this project are presented by Eggers et al. (*In prep*). Daily counts of chinook salmon-sized targets for 1994 appear in Tables 9 and 10. The inriver return for the early run was 18,403 and for the late run was 53,474.

BIOLOGICAL DATA

Recreational Fishery

A significant difference in age composition of the recreational harvest was detected between time stratum 1 (17 May-31 May) and stratum 2 (1 June-13 June) (χ^2 = 15.65, df = 3, $P < 0.001$), and between time stratum 2 and strata 3 and 4 (14 June-30 June) (χ^2 = 10.36, df = 3, $0.010 < P < 0.025$). The most abundant age group in the early-run harvest of chinook salmon was age 1.4 which comprised 90.1% of stratum 1, 79.6% of stratum 2, and 81.7% of strata 3 and 4. The only other age classes of significance represented in the sample were 1.2, 1.3, and 1.5 (Table 11).

Among all strata (5, 1 July-15 July; 6, 16 July-31 July; and 7, 1 August-7 August) during the late-run chinook salmon fishery, a

Table 5.-Estimated harvest per unit effort (HPUE) and catch per unit of effort (CPUE) of chinook salmon by boat anglers during each stratum of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994.

Angler Day Type	Time Strata[a]	n[b]	N[c]	Number of Interviews[d]	HPUE	Standard Error	CPUE	Standard Error
Unguided weekdays	1	6	9	227	0.0299	0.00592	0.0431	0.00816
Unguided weekends	1	5	5	493	0.0283	0.00346	0.0367	0.00396
Guided all days	1	12	14	399	0.0466	0.00725	0.0632	0.00785
Unguided weekdays	2	7	7	353	0.0228	0.00417	0.0342	0.00526
Unguided weekends	2	4	4	493	0.0191	0.00302	0.0269	0.00373
Guided all days	2	11	11	516	0.0602	0.00637	0.0782	0.01170
Unguided weekdays	3	7	7	303	0.0083	0.00353	0.0116	0.00390
Unguided weekends	3	2	2	116	0.0082	0.00445	0.0103	0.00497
Guided all days	3	9	9	281	0.0274	0.00813	0.0336	0.00822
Unguided weekdays	4	4	4	63	0.0699	0.02721	0.1204	0.03675
Unguided weekends	4	2	2	119	0.0440	0.00865	0.0676	0.01155
Guided all days	4	6	6	244	0.0734	0.00790	0.0936	0.00972
Subtotals:								
Unguided		37	40	2,167	0.0210	0.00205	0.0312	0.00268
Guided		38	40	1,440	0.0518	0.00490	0.0670	0.00661
Early Run Total		37	40	3,607	0.0352	0.00245	0.0477	0.00330

[a] Time strata
1 (17 May - 31 May)
2 (1 June - 13 June)
3 (14 June - 23 June)
4 (24 June - 30 June)

[b] Number of days on which interviews were collected.

[c] Number of days possible for interviewing.

[d] Complete trip interviews only.

Table 6.-Estimated harvest per unit effort (HPUE) and catch per unit of effort (CPUE) of chinook salmon by boat anglers during each stratum of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994.

Angler Day Type	Time Strata[a]	n[b]	N[c]	Number of Interviews[d]	HPUE	Standard Error	CPUE	Standard Error
Unguided weekdays	5	9	9	905	0.0312	0.00381	0.0403	0.00415
Unguided weekends	5	4	4	813	0.0234	0.00235	0.0283	0.00262
Guided all days	5	12	12	906	0.0648	0.00418	0.0755	0.00438
Unguided weekdays	6	9	9	862	0.0320	0.00305	0.0482	0.00377
Unguided weekends	6	6	6	1,059	0.0361	0.00248	0.0462	0.00300
Guided all days	6	11	11	774	0.0596	0.00380	0.0752	0.00478
Unguided all days	7	7	7	292	0.0186	0.00403	0.0219	0.00522
Guided all days	7	7	7	132	0.0387	0.00924	0.0480	0.00924
Subtotals:								
Unguided		37	37	3,843	0.0317	0.00221	0.0429	0.00281
Guided		30	30	1,812	0.0602	0.00476	0.0730	0.00562
Late Run Total		37	37	5,655	0.0406	0.00211	0.0523	0.00260

[a] Time Strata:

	Unguided	Guided
5	(1 July - 15 July)	(1 July - 16 July)
6	(16 July - 31 July)	(17 July - 31 July)
7	(1 August - 7 August)	(1 August - 7 August)

[b] Number of days on which interviews were collected.

[c] Number of days possible for interviewing.

[d] Complete trip interviews only.

Table 7.-Estimated number of chinook salmon harvested and number caught by boat anglers during each stratum of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994.

Strata	Harvest[a]	SE	Relative Precision[b]	Catch[c]	SE	Relative Precision[b]
1: 17 May - 31 May						
Unguided weekdays	175	43	47.7 %	253	60	46.2 %
Unguided weekends	251	47	36.7 %	325	58	35.0 %
Guided all days	654	118	35.4 %	886	137	30.3 %
2: 1 June - 13 June						
Unguided weekdays	269	54	39.2 %	404	70	33.8 %
Unguided weekends	227	40	34.8 %	319	51	31.5 %
Guided all days	1,247	169	26.5 %	1,619	278	33.6 %
3: 14 June - 23 June						
Unguided weekdays	103	45	84.9 %	144	50	67.8 %
Unguided weekends	32	18	110.3 %	40	20	99.5 %
Guided all days	409	128	61.3 %	502	133	51.7 %
4: 24 June - 30 June						
Unguided weekdays	347	83	46.7 %	534	103	37.6 %
Unguided weekends	120	38	62.4 %	240	57	46.6 %
Guided all days	888	111	24.5 %	1,133	138	23.8 %
Subtotal:						
Unguided	1,524	138	17.8 %	2,259	176	15.3 %
Guided	3,198	266	16.3 %	4,140	364	17.2 %
Early Run Total	4,722	300	12.5 %	6,399	404	12.4 %
Expansion						
Upstream section	912					
GRAND TOTAL	5,634					

[a] Harvest includes only fish kept.

[b] Relative precision for 95% confidence interval.

[c] Catch includes fish kept and fish reported as released.

Table 8.-Estimated number of chinook salmon harvested and number caught by boat anglers during each stratum of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994.

Strata	Harvest[a]	SE	Relative Precision[b]	Catch[c]	SE	Relative Precision[b]
5: 1 July - 15 July						
Unguided weekdays	1,805	274	29.8 %	2,331	319	26.9 %
Unguided weekends	427	67	30.8 %	517	79	29.8 %
Guided all days[d]	3,286	345	20.6 %	3,828	388	19.9 %
6: 16 July - 31 July						
Unguided weekdays	2,667	300	22.1 %	4,017	396	19.3 %
Unguided weekends	2,628	220	16.4 %	3,363	272	15.8 %
Guided all days[e]	2,980	236	15.5 %	3,760	297	15.5 %
7: 1 August - 7 August						
Unguided all days	233	52	44.1 %	274	67	48.2 %
Guided all days	362	98	53.2 %	449	104	45.6 %
Subtotal:						
Unguided	7,760	470	11.9 %	10,502	586	10.9 %
Guided	6,628	430	12.7 %	8,037	500	12.2 %
Late Run Total	14,388	637	8.7 %	18,539	770	8.1 %

[a] Harvest includes only fish kept.

[b] Relative precision for 95% confidence interval.

[c] Catch includes fish kept and fish reported as released.

[d] Stratum length 1 July - 16 July

[e] Stratum length 17 July - 31 July

Table 9.-Daily counts of chinook salmon-sized targets during the early run as determined by dual-beam sonar, Kenai River, 1994.

Date	Daily Count	Cumulative Count
16-May	238	238
17-May	342	580
18-May	260	840
19-May	302	1,142
20-May	369	1,511
21-May	327	1,838
22-May	246	2,084
23-May	212	2,296
24-May	303	2,599
25-May	170	2,769
26-May	150	2,919
27-May	267	3,186
28-May	258	3,444
29-May	347	3,791
30-May	321	4,112
31-May	369	4,481
1-Jun	321	4,802
2-Jun	266	5,068
3-Jun	298	5,366
4-Jun	304	5,670
5-Jun	351	6,021
6-Jun	198	6,219
7-Jun	384	6,603
8-Jun	306	6,909
9-Jun	462	7,371
10-Jun	432	7,803
11-Jun	423	8,226
12-Jun	329	8,555
13-Jun	376	8,931
14-Jun	514	9,445
15-Jun	306	9,751
16-Jun	453	10,204
17-Jun	315	10,519
18-Jun	435	10,954
19-Jun	636	11,590
20-Jun	402	11,992
21-Jun	570	12,562
22-Jun	366	12,928
23-Jun	550	13,478
24-Jun	696	14,174
25-Jun	734	14,908
26-Jun	597	15,505
27-Jun	639	16,144
28-Jun	681	16,825
29-Jun	929	17,754
30-Jun	649	18,403

Table 10.-Daily counts of chinook salmon-sized targets during the late run as determined by dual-beam sonar, Kenai River, 1994.

Date	Daily Count	Cumulative Count
1-Jul	663	663
2-Jul	342	1,005
3-Jul	625	1,630
4-Jul	858	2,488
5-Jul	705	3,193
6-Jul	975	4,168
7-Jul	1,050	5,218
8-Jul	655	5,873
9-Jul	744	6,617
10-Jul	1,289	7,906
11-Jul	509	8,415
12-Jul	828	9,243
13-Jul	1,072	10,315
14-Jul	1,332	11,647
15-Jul	2,221	13,868
16-Jul	3,802	17,670
17-Jul	4,692	22,362
18-Jul	2,157	24,519
19-Jul	3,504	28,023
20-Jul	2,328	30,351
21-Jul	1,695	32,046
22-Jul	1,386	33,432
23-Jul	1,050	34,482
24-Jul	1,320	35,802
25-Jul	1,444	37,246
26-Jul	1,432	38,678
27-Jul	1,289	39,967
28-Jul	2,226	42,193
29-Jul	1,333	43,526
30-Jul	1,769	45,295
31-Jul	1,808	47,103
1-Aug	1,037	48,140
2-Aug	1,223	49,363
3-Aug	1,078	50,441
4-Aug	658	51,099
5-Aug	536	51,635
6-Aug	1,042	52,677
7-Aug	797	53,474

Table 11.-Age composition and mean length-at-age of chinook salmon sampled from the recreational harvest during the fishery for early-run chinook salmon in the Kenai River, 1994.

Sex		Age Group 1.2	1.3	1.4	1.5	Total
Stratum 1: (17 May - 31 May)						
Male	Percent	0.6	3.6	50.3	2.4	57.0
	SE	0.6	1.5	3.9	1.2	
Female	Percent	0	1.8	40.0	1.2	43.0
	SE		1.0	3.8	0.9	
Combined	Percent	0.6	5.5	90.3	3.6	
	SE	0.6	1.8	2.3	1.5	
Male	Mean Length (mm)[a]	595	793	1,010	1,064	
	SE		24	8	30	
	Sample size	1	6	83	4	94
Female	Mean Length (mm)[a]		827	943	1,035	
	SE		29	8	25	
	Sample size		3	66	2	71
Stratum 2: (1 June - 13 June)						
Male	Percent	2.2	4.3	28.0		34.5
	SE	1.5	2.1	4.7		
Female	Percent	2.2	11.8	51.6		65.6
	SE	1.5	3.4	5.2		
Combined	Percent	4.3	16.1	79.6		
	SE	2.1	3.8	4.2		
Male	Mean Length (mm)[a]	518	778	996		
	SE	98	33	19		
	Sample size	2	4	26		32
Female	Mean Length (mm)[a]	648	813	927		
	SE	53	20	9		
	Sample size	2	11	48		61
Strata 3 and 4: (14June - 30 June)						
Male	Percent	7.5	2.2	44.1	2.1	55.9
	SE	2.8	1.5	5.2	1.5	
Female	Percent	1.1	3.2	37.6	2.2	44.1
	SE	1.1	1.8	5.1	1.5	
Combined	Percent	8.6	5.4	81.7	4.3	
	SE	2.9	2.4	4.0	2.1	
Male	Mean Length (mm)[a]	670	860	1,032	1,127	
	SE	21	25	15	18	
	Sample size	7	2	41	2	52
Female	Mean Length (mm)[a]	610	855	972	1,065	
	SE		5	16	25	
	Sample size	1	3	35	2	41

[a] Lengths measured mid-eye to fork of tail.

significant difference in age composition of the recreational harvest was detected (χ^2 = 12.6, df = 6, 0.10 < P < 0.025). Age 1.4 was again the most abundant age in the late-run harvest sample, contributing 87.0%, 93.6%, and 93.3% to each stratum, respectively (Table 12). Other significant age classes included 1.2, 1.3, and 1.5. The mean lengths-at-age for each age/sex were generally greater for late-run fish than for early-run fish (Tables 11 and 12).

Inriver Return

There was a significant difference in the age/sex composition between the first 3-week stratum and second 3-week stratum during the early run (16 May-7 June, 8 June-30 June) (χ^2 = 9.59, df = 4, 0.025 < P < 0.050). The most abundant age for the early run in the samples collected with gill nets was 1.4, representing 76.2% of the first 3-week stratum and 67.0% of the second 3-week stratum (Table 13). Age 1.3 was the second largest contributor, followed by 1.5 and 1.2. There was a significant difference in the age/sex composition between the first 3-week stratum (1 July-23 July) and second 3-week stratum (24 July-15 August) during the late run (χ^2 = 25.65, df = 4,, P < 0.005). The most abundant age for the late run in the samples collected with gill nets was 1.4, representing 73.9% of the 3-week stratum ending 23 July and 91.7% of the last 3-week stratum (Table 14). Age 1.3 was again the second largest contributor to the late run, followed by 1.5 and 1.2.

The mean lengths-at-age for each age/sex were generally greater for late-run fish than for early-run fish (Tables 13 and 14).

DISCUSSION

In 1990, 1991 and 1992, emergency orders restricting the bag limit to 0 for fish less than 132 cm (hook and release fishing), or 1 fish 132 cm or greater (trophy fishing) severely affected the effort in this fishery (Figures 2 and 3). Success, as measured by number of fish caught in a given period of time, although relatively high, apparently does not provide sufficient angler satisfaction when fish retention is limited or prohibited. Effort declined after the implementation of the emergency orders, regardless of the increased numbers of fish entering the system and the numbers of fish caught in proportion to the number of angler-hours expended (Hammarstrom 1993). In 1993 and again in 1994 this situation did not occur. Daily effort during both runs did not exhibit any dramatic decrease over time, and this is assumed to be the result of no additional restrictions required inseason (Figures 5 and 6).

RECOMMENDATIONS

I recommend no significant changes in the creel survey program for the 1995 field season in the downstream section. As long as the regulations remain unchanged, the management objectives are consistent, and no major changes occur in the characteristics of the recreational fishery, the current design is appropriate. However, observation indicates that there is an increased effort in the fishery occurring upstream of the Soldotna Bridge. It would be prudent to design and implement an on-site creel survey which is appropriate to the characteristics of this fishery. This would provide harvest and effort estimates necessary for inseason management of the fishery.

ACKNOWLEDGMENTS

I would like to express my gratitude to those individuals involved with the success of the project. Jenny Johnson and Ed Borden conducted the boat creel survey in the downstream section and took care of most of the mechanical problems with equipment.

Table 12.-Age composition and mean length-at-age of chinook salmon sampled from the recreational harvest during the fishery for late-run chinook salmon in the Kenai River, 1994.

Sex		Age Group 1.2	1.3	1.4	1.5	Other	Total
Stratum 5: (1 July-15 July)							
Male	Percent	3.8	4.9	39.1	0.6	0.5	48.9
	SE	1.4	1.6	3.6	0.5	0.5	
Female	Percent	0.5	1.1	47.9	1.6		51.1
	SE	0.5	0.8	3.7	0.9		
Combined	Percent	4.3	6.2	87.0	2.2	0.5	
	SE	1.5	1.8	2.5	1.1	0.5	
Male	Mean Length (mm)[a]	639	729	1,061	1,150	310	
	SE	42	10	8			
	Sample size	7	9	72	1	1	90
Female	Mean Length (mm)[a]	690	810	1,005	1,073		
	SE		0	8	9		
	Sample size	1	2	88	3		94
Stratum 6: (16 July-31 July)							
Male	Percent		2.7	34.5	1.4	0.5	39.1
	SE		0.5	1.1	3.2	0.8	
Female	Percent		0.9	59.1	0.9		60.9
	SE		0.6	3.3	0.6		
Combined	Percent		3.6	93.6	2.3	0.5	
	SE		1.3	1.7	1.0	0.5	
Male	Mean Length (mm)[a]		772	1,054	1,150	1,110	
	SE		48	11	35		
	Sample size		6	76	3	1	86
Female	Mean Length (mm)[a]		840	1,006	1,075		
	SE		30	6	20		
	Sample size		2	130	2		134
Stratum 7: (1 August-7 August)							
Male	Percent			40.0			40.0
	SE			9.1			
Female	Percent			53.3	6.7		60.0
	SE			9.3	4.6		
Combined	Percent			93.3	6.7		
	SE			4.6	4.6		
Male	Mean Length (mm)[a]			1,034			
	SE			33			
	Sample size			12			12
Female	Mean Length (mm)[a]			998	1,078		
	SE			18	33		
	Sample size			16	2		18

-continued-

Table 12.-Page 2 of 2.

Sex		Age Group 1.2	1.3	1.4	1.5	Other	Total
Combined Strata:							
Male	Percent	1.6	3.5	36.9	0.9	0.2	43.3
	SE	0.23	0.6	0.9	2.3	0.2	
Female	Percent	0.2	0.9	53.9	1.6		56.7
	SE	0.2	0.5	2.4	0.6		
Combined	Percent	1.8	4.4	90.8	2.5	0.2	
	SE	0.7	1.0	1.4	0.8	0.2	
Male	Mean Length (mm)[a]	639	746	1,056	1,150	310	
	SE	42.0	19.7	6.8	24.8		
	Sample size	7	15	160	4	1	187
Female	Mean Length (mm)[a]	690	825	1005	1075		
	SE		15	4.5	9		
	Sample size	1	4	234	7		246

[a] Lengths measured mid-eye to fork of tail.

Table 13.-Age composition and mean length-at-age of chinook salmon sampled with large mesh gill nets during the fishery for early-run chinook salmon in the Kenai River, 1994.

		Age Group					
Sex		1.2	1.3	1.4	1.5	Other	Total
Stratum: (16 May - 7 June)							
Male	Percent	2.7	9.9	29.3	1.6	0.5	44.0
	SE	1.2	2.2	3.4	0.9	0.5	
Female	Percent		12.0	43.5		0.5	56.0
	SE		2.4	3.7		0.5	
Combined	Percent	3.9	24.1	76.2	2.5	1.5	
	SE	1.2	3.1	3.3	0.9	1.1	
Male	Mean Length (mm)[a]	650	778	1,005	1,073		
	SE	16	18	12	32		
	Sample size	5	18	54	3		80
Female	Mean Length (mm)[a]		787	927		830	
	SE		11	6			
	Sample size		22	80		1	103
Stratum: (8 June - 30 June)							
Male	Percent	4.1	13.0	30.7	4.8	2.6	55.2
	SE	1.2	2.0	2.8	1.3	0.6	
Female	Percent		5.9	36.3	1.1	1.5	44.8
	SE		1.4	2.9	0.6	1.2	
Combined	Percent	4.1	18.9	67.0	5.9	4.1	
	SE	1.2	2.4	2.9	1.4	1.9	
Male	Mean Length (mm)[a]	626	726	1,022	1,124	806	
	SE	12	11	12	25	32	
	Sample size	11	35	86	13	4	149
Female	Mean Length (mm)[a]		765	934	1,036	843	
	SE		17	8	3	2	
	Sample size		16	100	3	2	121
Combined Strata							
Male	Percent	3.5	11.7	30.9	3.5	0.9	50.5
	SE	0.9	1.5	2.2	0.9	0.8	
Female	Percent		8.4	39.7	0.7	0.7	49.5
	SE		1.3	2.3	0.4	0.5	
Combined	Percent	3.5	20.1	70.6	4.2	1.6	
	SE	0.9	1.9	2.1	0.9	1.0	
Male	Mean Length (mm)[a]	634	744	1,015	1,114	806	
	SE	9.9	9.9	8.8	21.4	32.5	
	Sample size	16	53	140	16	4	229
Female	Mean Length (mm)[a]		778	934	1,037	839	
	SE		9.8	5.5	3.3	17.5	
	Sample size		38	180	3	3	224

[a] Lengths measured mid-eye to fork of tail.

Table 14.-Age composition and mean length-at-age of chinook salmon sampled with large mesh gill nets during the fishery for late-run chinook salmon in the Kenai River, 1994.

Sex		Age Group 1.2	1.3	1.4	1.5	Other	Total
Stratum: (1 July - 23 July)							
Male	Percent	8.2	10.4	36.4	3.0		58.0
	SE	1.7	1.9	2.9	1.0		
Female	Percent		4.5	34.6	1.8	1.1	42.0
	SE		1.7	2.9	0.8	0.6	
Combined	Percent	9.9	16.8	73.9	5.8	1.1	
	SE	1.7	2.2	2.8	1.3	0.6	
Male	Mean Length (mm)[a]	675	820	1,089	1,134		
	SE	8	18	7	12		
	Sample size	22	28	98	8		156
Female	Mean Length (mm)[a]		918	1,016	1,114	1,000	
	SE		16	6	22	25	
	Sample size		12	93	5	3	113
Stratum: (24 July - 8 August)							
Male	Percent	0.7	3.4	33.8	0.7		38.6
	SE	0.7	1.5	3.9	0.7		
Female	Percent		1.4	57.9	2.1		61.4
	SE		1.0	4.1	1.2		
Combined	Percent	0.7	4.8	91.7	2.8		
	SE	0.7	1.8	2.3	1.4		
Male	Mean Length (mm)[a]	550	750	1,068	1,240		
	SE		52	10			
	Sample size	1	5	49	1		56
Female	Mean Length (mm)[a]		888	1,000	1,080		
	SE		13	7	20		
	Sample size		2	84	3		89

[a] Lengths measured mid-eye to fork of tail.

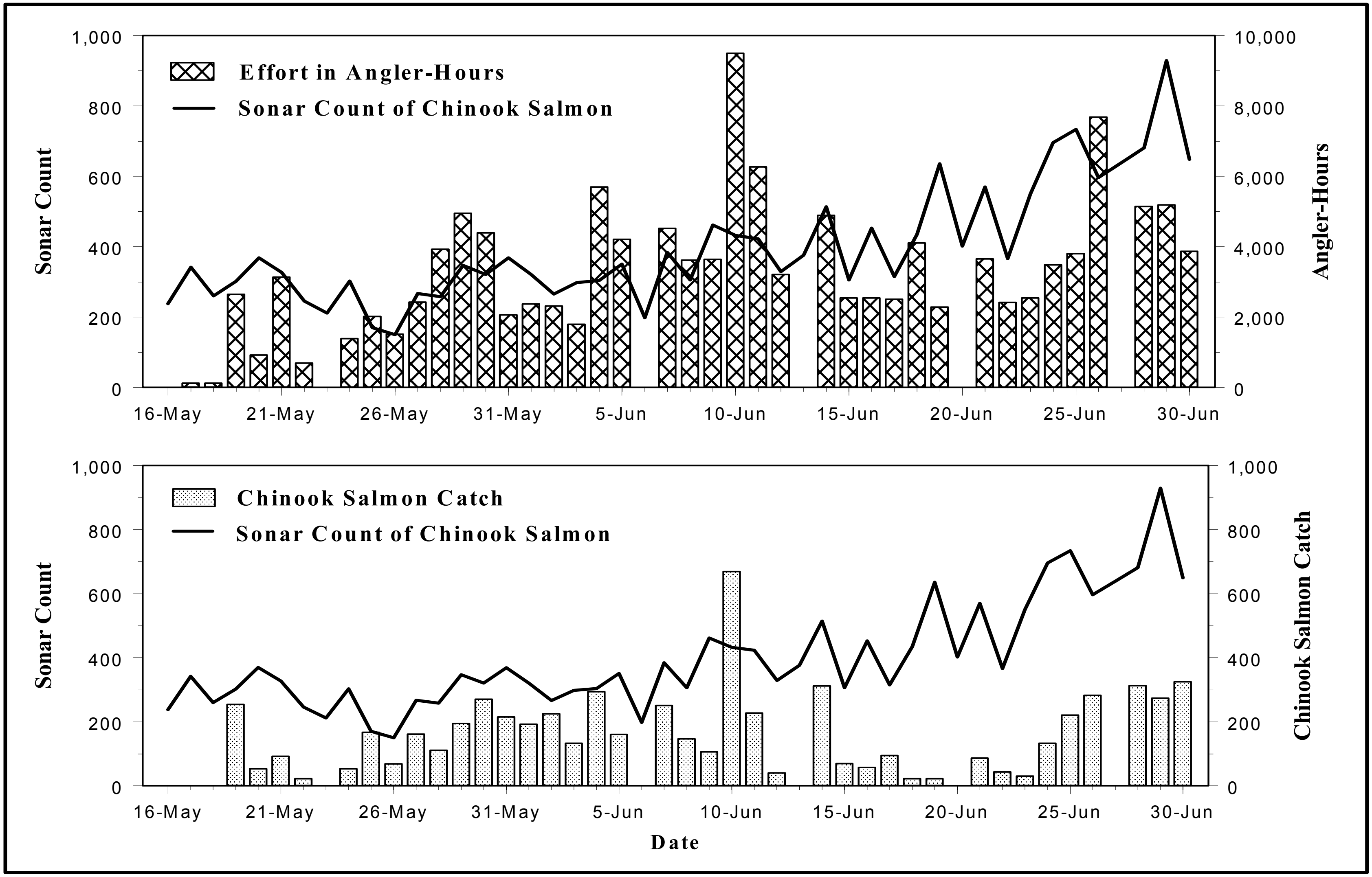

Figure 5.-Daily sonar counts of chinook salmon, recreational catch of chinook salmon and angler effort during the early run, Kenai River, 1994.

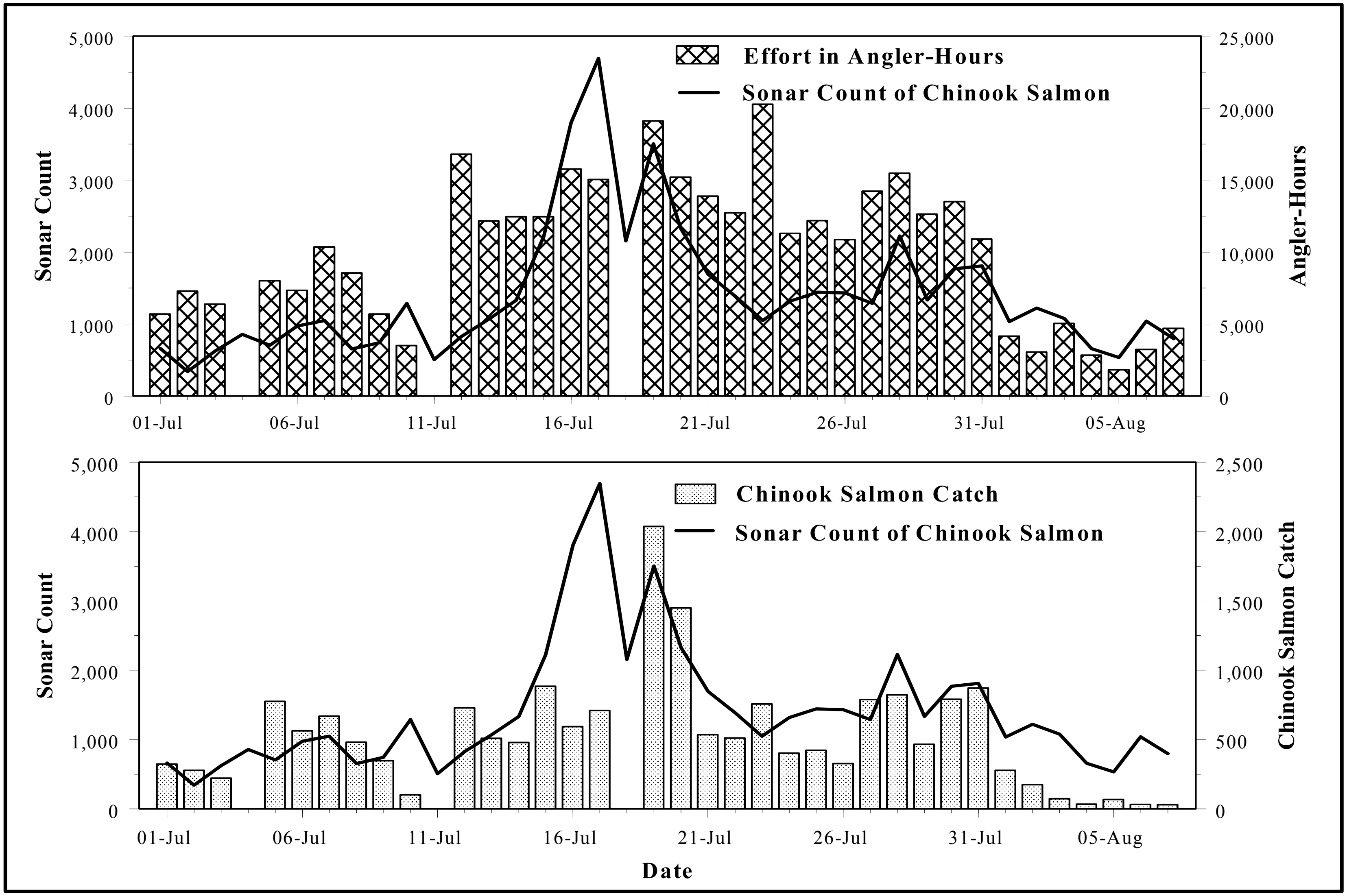

Figure 6.-Daily sonar counts of chinook salmon, recreational catch of chinook salmon and angler effort during the late run, Kenai River, 1994.

Phyllis McCutchan and Greta Glotfelty conducted angler interviews at the selected launch facilities in the downstream section. Patti Berkhahn assisted with data compilation as well as miscellaneous daily project needs. Steve Hammarstrom provided guidance and insight while overseeing the project. I also thank the Research and Technical Service staff, especially Gail Heineman for her assistance with computer programming and Jim Hasbrouck who provided valuable technical assistance with survey design.

LITERATURE CITED

Clutter, R. and L. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. International Pacific Salmon Commission, Bull. 9.

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.

DiCostanzo, C. J. 1956. Creel census techniques and harvest of fishes in Clear Lake, Iowa. Ph.D. dissertation, Iowa State College, Ames, Iowa.

Eggers, D., Skvorc, P., and Burwen, D. *In prep*. Abundance estimates of chinook salmon in the Kenai River using dual-beam sonar, 1995. Alaska Department of Fish and Game, Alaska Fisheries Research Bulletin. Anchorage.

Goodman, L. A. 1960. On the exact variance of products. Journal American Statistical Association 55:708-713.

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):27-68. 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):35-62. 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):29-46. 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):42-56. 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):49-96. 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):59-90. 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):33-61. 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.

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 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):1-47. 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):36-67. 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):1-39. 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):1-56. 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.

Jessen, R. J. 1978. Statistical survey techniques. John Wiley and Sons, New York, New York.

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 gill net fishery in Upper Cook Inlet, 1984. Alaska Department of Fish and Game, Informational Leaflet No. 251.

Mills, M. J. 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. J. 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. J. 1981a. 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.

Mills, M. J. 1981b. 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. J. 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. J. 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. J. 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.

LITERATURE CITED (Continued)

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

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

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

Mills, M. J. 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. J. 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. J. 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. J. 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. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 94-28. Anchorage.

Neuhold, J. M. and K. H. Lu. 1957. Creel census methods. Utah State Department of Fish and Game, Publ. 8, Salt Lake City, Utah.

Scheaffer, R. L., W. Mendenhall, and L. Ott. 1979. Elementary survey sampling. Duxbury Press, North Scituate, Massachusetts.

Sukhatme, P. V., B. V. Sukhatme, S. Sukhatme, and C. Asok. 1984. Sampling theory of surveys with applications. Iowa State University Press. Ames, Iowa.

Von Geldern, C. E. and P. K. Tomlinson. 1973. On the analysis of angler catch rate data from warmwater reservoirs. California Fish and Game 59(4):281-292.

Welander, A. D. 1940. A study of the development of the scale of the chinook salmon *Oncorhynchus tshawytscha*. Masters thesis, University of Washington, Seattle.

APPENDIX A. COUNTS OF BOAT ANGLERS DURING THE CREEL SURVEY OF THE FISHERY FOR CHINOOK SALMON ON THE KENAI RIVER, ALASKA, 1994

Appendix A1.-Counts of unguided and guided boat anglers during the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994.

		Unguided Anglers Period					Guided Anglers Period				
Date	Day Type[a]	A	B	C	D	E	A	B	C	D	E
17-May	Wd				0	0				13	0
18-May	Wd										
19-May	Wd	39	55	46			30	46	30		
20-May	Wd	13	32				13	42			
21-May	We			95	71	61			80	71	10
22-May	We	14	74	48	3	9	7	85	22	18	0
23-May	Wd			CLOSED					CLOSED		
24-May	Wd			44		63			38		7
25-May	Wd	24	43				64	100			
26-May	Wd		47			14		99			5
27-May	Wd	63				45	94		75		
28-May	We	14	111	87	131	115	0	139	73	42	22
29-May	We		154	152	134	126		122	77	37	30
30-May	We	151	187	95	75	58	108	104	63	46	15
31-May	Wd	63			15		104			35	
01-Jun	Wd		84	82	76	63	106	64			
02-Jun	Wd		108	44			121	40			
03-Jun	Wd	66			41	45	115	38			
04-Jun	We	120	217	237	175	61	236	109			
05-Jun	We	92	235	249	80	57	192	43			
06-Jun	Wd			CLOSED					CLOSED		
07-Jun	Wd		151	62			260	185			
08-Jun	Wd	90	59		88	117	262	100			
09-Jun	Wd		70	76			217	143			
10-Jun	Wd	110		102	99	133	263	151			
11-Jun	We	125	123	180	169	161	290	186			
12-Jun	We	204	137	147	104		175	50			
13-Jun	Wd			CLOSED					CLOSED		
14-Jun	Wd	188			89		347	138			
15-Jun	Wd		93	62	83	95	227	63			
16-Jun	Wd	112		74		104	231	104			
17-Jun	Wd		105	97		97	44	66			
18-Jun	We	78	171	196	110	75	169	70			
19-Jun	We	58	173	83	16	21	158	72			
20-Jun	Wd			CLOSED					CLOSED		
21-Jun	Wd	178			26		236	86			
22-Jun	Wd	82			61	25	178	62			
23-Jun	Wd		75	58		59	175	63			
24-Jun	Wd[b]		94	51			204	129			
25-Jun	Wd[b]	192	230	160	164	162	196	104			
26-Jun	Wd[b]	149	285	218	136	98	166	107			
27-Jun	Wd			CLOSED					CLOSED		
28-Jun	Wd[b]		172	116			308	148			
29-Jun	Wd[b]		122	181		234	221	92			
30-Jun	Wd[b]	93			117		231	111			

[a] Wd = weekday, We = weekend

[b] The use of bait was permitted by emergency order.

Appendix A2.-Counts of unguided and guided boat anglers during the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994.

	Day	Unguided Anglers Period					Guided Anglers Period				
Date	Type[a]	A	B	C	D	E	A	B	C	D	E
01-Jul	Wd	245		124	140	131	274	149			
02-Jul	We	26	199	390	357	271	245	115			
03-Jul	We	135	539	479	249	165					
04-Jul	We			CLOSED					CLOSED		
05-Jul	Wd		222	187		144	366	301			
06-Jul	Wd	189		165	219		387	168			
07-Jul	Wd	317		212	305	382	456	268			
08-Jul	Wd		321	239			392	169			
09-Jul	We	199	138	141	154	166	399	107			
10-Jul	We	208	213	193	178	166			CLOSED		
11-Jul	Wd			CLOSED					CLOSED		
12-Jul	Wd			760	319	529	888	379			
13-Jul	Wd		403	319		431	521	390			
14-Jul	Wd	521				448	470				
15-Jul	Wd	390	560		352		476	350			
16-Jul	We	428	717	548	570	393	540	388			
17-Jul	We	888	965	911	455	563			CLOSED		
18-Jul	Wd			CLOSED					CLOSED		
19-Jul	Wd	1064	674		389		537	379			
20-Jul	Wd		604		325	409	492	401			
21-Jul	Wd	556		314	487		567	142			
22-Jul	Wd	613		470	541	141	497	185			
23-Jul	We	884	994	710	611	560	451	281			
24-Jul	We	501	842	562	587	374			CLOSED		
25-Jul	Wd[b]			244		250		278			
26-Jul	Wd		434	377		180	448	117			
27-Jul	Wd	535		473	407	458	435	397			
28-Jul	Wd		581	377			476	412			
29-Jul	Wd	493		416	373		450	185			
30-Jul	We	225	713	566	365	543	483	236			
31-Jul	We	532	839	471	381	498			CLOSED		
01-Aug	Wd[c]		157	126				143	135		
02-Aug	Wd[c]	102	167		102		156	148		0	
03-Aug	Wd[c]				126					9	
04-Aug	Wd[c]		133	91				213	52		
05-Aug	Wd[c]	74					114				
06-Aug	Wd[c]		164	121	46			86	34	4	
07-Aug	Wd[c]	89	150				75	114			

[a] Wd = weekday, We = weekend/holiday

[b] Fishing for chinook salmon from a boat on the Kenai River on Monday permitted by emergency order.

[c] Fishery extended by emergency order. No restrictions on hours which anglers could fish from guided vessel. Fishing day equals 16 hours (0800 - 2200 hours).

APPENDIX B. DAILY SUMMARY STATISTICS FOR FISHING EFFORT, HARVEST RATE, AND CATCH RATE FOR ANGLERS INTERVIEWED DURING THE FISHERY FOR CHINOOK SALMON IN THE KENAI RIVER, ALASKA, 1994

Appendix B1.-Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for unguided anglers interviewed during the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only).

	Wd/	Effort (hours)			Harvest			Catch		
Date	We[a]	SS	Mean	SE	Mean	SE	CPUE	Mean	SE	CPUE
519	Wd	22	3.3	0.39	0.14	0.075	0.041	0.27	0.117	0.083
521	We	68	5.8	0.35	0.18	0.047	0.030	0.19	0.052	0.033
522	We	91	4.5	0.20	0.04	0.022	0.010	0.08	0.028	0.017
524	Wd	84	4.2	0.26	0.12	0.036	0.028	0.14	0.038	0.034
525	Wd	22	4.1	0.25	0.09	0.063	0.022	0.18	0.084	0.044
526	Wd	27	3.0	0.21	0.11	0.062	0.037	0.15	0.070	0.049
527	Wd	46	3.0	0.22	0.07	0.037	0.022	0.11	0.046	0.036
528	We	91	3.8	0.21	0.12	0.034	0.032	0.13	0.036	0.035
529	We	124	5.0	0.24	0.14	0.031	0.028	0.21	0.037	0.042
530	We	119	4.2	0.12	0.17	0.034	0.040	0.21	0.039	0.051
531	Wd	26	3.8	0.34	0.15	0.072	0.041	0.19	0.079	0.051
601	Wd	38	4.0	0.29	0.08	0.044	0.020	0.16	0.060	0.040
602	Wd	35	4.3	0.24	0.11	0.055	0.027	0.20	0.080	0.047
603	Wd	26	3.4	0.42	0.12	0.064	0.034	0.15	0.072	0.045
604	We	123	3.8	0.15	0.11	0.029	0.030	0.15	0.034	0.038
605	We	118	4.1	0.16	0.11	0.029	0.027	0.14	0.032	0.033
607	Wd	61	4.2	0.28	0.11	0.041	0.028	0.18	0.055	0.043
608	Wd	82	4.5	0.24	0.10	0.033	0.021	0.11	0.035	0.024
609	Wd	54	5.0	0.30	0.07	0.036	0.015	0.17	0.051	0.033
610	Wd	57	3.6	0.19	0.09	0.038	0.024	0.09	0.038	0.024
611	We	144	4.3	0.17	0.06	0.020	0.014	0.12	0.033	0.027
612	We	108	4.3	0.17	0.03	0.016	0.006	0.04	0.018	0.009
614	Wd	59	3.6	0.24	0.07	0.033	0.019	0.08	0.037	0.024
615	Wd	56	5.2	0.52	0.00	0.000	0.000	0.00	0.000	0.000
616	Wd	40	3.0	0.24	0.03	0.025	0.008	0.05	0.035	0.017
617	Wd	29	3.6	0.25	0.10	0.058	0.029	0.14	0.065	0.039
618	We	65	4.3	0.19	0.02	0.015	0.004	0.02	0.015	0.004
619	We	51	4.0	0.26	0.06	0.033	0.015	0.08	0.038	0.020
621	Wd	16	4.6	0.42	0.06	0.063	0.014	0.06	0.063	0.014
622	Wd	40	3.8	0.19	0.03	0.025	0.007	0.03	0.025	0.007
623	Wd	63	4.1	0.24	0.00	0.000	0.000	0.02	0.016	0.004
624	Wd	15	4.5	0.77	0.07	0.067	0.015	0.07	0.067	0.015
625	We	73	4.2	0.15	0.07	0.030	0.016	0.12	0.039	0.029
626	We	68	4.3	0.24	0.07	0.032	0.017	0.16	0.050	0.038
628	Wd	58	3.9	0.32	0.14	0.046	0.035	0.14	0.046	0.035
629	Wd	87	4.2	0.18	0.10	0.033	0.025	0.20	0.043	0.046
630	Wd	41	4.5	0.27	0.24	0.068	0.055	0.41	0.092	0.093

[a] Wd = weekday, We = weekend/holiday.

Appendix B2.-Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only).

	Wd/	Effort (hours)			Harvest			Catch		
Date	We[a]	SS	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
519	Wd	6	3.3	0.49	0.33	0.211	0.100	0.50	0.224	0.150
520	Wd	19	3.7	0.45	0.26	0.104	0.071	0.26	0.104	0.071
521	We	26	6.7	0.30	0.19	0.079	0.029	0.23	0.101	0.035
522	We	47	5.0	0.29	0.17	0.055	0.034	0.28	0.079	0.055
524	Wd	16	4.9	0.54	0.31	0.120	0.064	0.31	0.120	0.064
525	Wd	11	6.1	0.37	0.73	0.141	0.119	0.73	0.141	0.119
526	Wd	38	5.8	0.32	0.21	0.067	0.036	0.32	0.085	0.054
527	Wd	37	4.7	0.23	0.32	0.078	0.070	0.49	0.126	0.104
528	We	84	6.0	0.22	0.13	0.037	0.022	0.17	0.041	0.028
529	We	62	5.2	0.28	0.13	0.043	0.025	0.27	0.073	0.053
530	We	32	4.4	0.39	0.38	0.087	0.086	0.47	0.090	0.108
531	Wd	21	4.8	0.77	0.67	0.105	0.140	0.81	0.112	0.170
601	Wd	25	4.2	0.47	0.40	0.100	0.096	0.72	0.136	0.173
602	Wd	5	7.5	0.32	0.40	0.245	0.053	1.60	0.600	0.213
603	Wd	20	5.0	0.38	0.45	0.114	0.090	0.65	0.109	0.129
604	We	40	4.5	0.26	0.28	0.071	0.061	0.45	0.094	0.101
605	We	50	5.6	0.30	0.34	0.068	0.061	0.38	0.069	0.068
607	Wd	59	5.5	0.23	0.27	0.058	0.050	0.44	0.074	0.081
608	Wd	119	5.7	0.15	0.33	0.043	0.058	0.37	0.046	0.065
609	Wd	21	5.6	0.48	0.19	0.088	0.034	0.19	0.088	0.034
610	Wd	70	4.8	0.23	0.41	0.059	0.085	0.47	0.070	0.097
611	We	51	5.8	0.19	0.27	0.063	0.047	0.33	0.078	0.057
612	We	56	5.8	0.24	0.29	0.061	0.049	0.30	0.067	0.052
614	Wd	9	2.9	0.61	0.33	0.167	0.113	0.33	0.167	0.113
615	Wd	50	6.0	0.39	0.20	0.057	0.033	0.30	0.065	0.050
616	Wd	52	5.3	0.21	0.21	0.057	0.040	0.27	0.062	0.051
617	Wd	3	5.8	0.17	0.33	0.333	0.057	0.33	0.333	0.057
618	We	33	7.3	0.34	0.09	0.051	0.012	0.09	0.051	0.012
619	We	38	6.0	0.10	0.03	0.026	0.004	0.05	0.037	0.009
621	Wd	20	6.2	0.40	0.25	0.099	0.041	0.25	0.099	0.041
622	Wd	44	5.0	0.25	0.14	0.052	0.027	0.16	0.056	0.032
623	Wd	32	5.5	0.13	0.13	0.059	0.023	0.13	0.059	0.023
624	Wd	16	5.5	0.30	0.31	0.120	0.057	0.38	0.125	0.069
625	We	51	4.4	0.21	0.37	0.068	0.084	0.51	0.094	0.115
626	We	35	5.2	0.21	0.26	0.075	0.049	0.31	0.080	0.060
628	Wd	24	5.9	0.32	0.33	0.098	0.057	0.63	0.168	0.106
629	Wd	51	4.4	0.20	0.33	0.067	0.076	0.39	0.080	0.090
630	Wd	67	4.9	0.21	0.43	0.061	0.089	0.49	0.068	0.101

[a] Wd = weekday, We = weekend/holiday.

Appendix B3.-Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only).

	Wd/	Effort (hours)			Harvest			Catch		
Date	We[a]	SS	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
701	Wd	53	4.60	0.25	0.02	0.019	0.004	0.11	0.044	0.025
702	We	130	4.30	0.16	0.07	0.022	0.016	0.10	0.026	0.023
703	We	195	5.20	0.19	0.13	0.024	0.025	0.18	0.028	0.036
705	Wd	120	4.50	0.19	0.24	0.039	0.054	0.29	0.043	0.065
706	Wd	123	4.70	0.24	0.18	0.035	0.038	0.27	0.045	0.057
707	Wd	129	4.70	0.23	0.14	0.031	0.030	0.19	0.038	0.042
708	Wd	61	4.90	0.30	0.08	0.035	0.017	0.18	0.050	0.037
709	We	192	4.50	0.14	0.09	0.021	0.020	0.09	0.021	0.020
710	We	296	4.90	0.14	0.14	0.020	0.028	0.15	0.022	0.030
712	Wd	115	5.00	0.27	0.16	0.034	0.032	0.16	0.034	0.032
713	Wd	66	5.90	0.46	0.15	0.044	0.026	0.18	0.052	0.031
714	Wd	224	5.00	0.18	0.13	0.023	0.027	0.15	0.025	0.030
715	Wd	14	4.30	0.60	0.29	0.125	0.067	0.29	0.125	0.067
716	We	174	5.80	0.22	0.09	0.021	0.015	0.15	0.032	0.026
717	We	231	5.30	0.21	0.20	0.026	0.037	0.26	0.035	0.049
719	Wd	130	4.40	0.21	0.27	0.039	0.062	0.43	0.046	0.098
720	Wd	128	4.00	0.14	0.21	0.036	0.053	0.31	0.044	0.078
721	Wd	33	3.30	0.14	0.09	0.051	0.028	0.12	0.058	0.037
722	Wd	179	4.50	0.13	0.09	0.021	0.020	0.15	0.036	0.034
723	We	124	4.20	0.20	0.10	0.028	0.025	0.15	0.032	0.035
724	We	166	4.90	0.20	0.15	0.028	0.031	0.18	0.031	0.037
725	Wd	24	4.50	0.14	0.08	0.058	0.019	0.13	0.069	0.028
726	Wd	46	4.90	0.21	0.11	0.046	0.022	0.11	0.046	0.022
727	Wd	172	5.40	0.24	0.14	0.026	0.026	0.17	0.029	0.032
728	Wd	55	4.80	0.31	0.11	0.042	0.023	0.22	0.067	0.046
729	Wd	95	5.40	0.41	0.12	0.033	0.021	0.18	0.047	0.033
730	We	145	5.00	0.23	0.16	0.030	0.032	0.20	0.036	0.040
731	We	219	4.30	0.16	0.31	0.031	0.071	0.36	0.037	0.083
801	Wd	37	4.40	0.16	0.16	0.061	0.037	0.19	0.065	0.043
802	Wd	40	3.70	0.34	0.20	0.064	0.054	0.20	0.064	0.054
803	Wd	31	4.80	0.37	0.06	0.045	0.013	0.16	0.105	0.034
804	Wd	26	3.80	0.30	0.08	0.053	0.020	0.08	0.053	0.020
805	Wd	21	3.70	0.38	0.00	0.000	0.000	0.00	0.000	0.000
806	We	86	4.40	0.29	0.03	0.020	0.008	0.03	0.020	0.008
807	We	51	4.30	0.28	0.04	0.027	0.009	0.04	0.027	0.009

[a] Wd = weekday, We = weekend/holiday.

Appendix B4.-Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1994 (completed-trip interviews only).

	Wd/	Effort (hours)			Harvest			Catch		
Date	We[a]	SS	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
701	Wd	59	5.3	0.31	0.49	0.066	0.093	0.54	0.065	0.102
702	We	28	4.9	0.26	0.36	0.092	0.072	0.39	0.094	0.079
705	Wd	36	4.9	0.31	0.50	0.085	0.103	0.67	0.089	0.137
706	Wd	71	5.0	0.21	0.37	0.058	0.074	0.54	0.066	0.108
707	Wd	54	5.3	0.30	0.46	0.068	0.088	0.54	0.078	0.102
708	Wd	47	4.9	0.24	0.38	0.072	0.079	0.45	0.079	0.092
709	We	34	4.6	0.33	0.44	0.086	0.096	0.47	0.087	0.102
712	Wd	157	5.8	0.15	0.30	0.037	0.052	0.35	0.038	0.061
713	Wd	101	5.4	0.20	0.29	0.045	0.054	0.32	0.049	0.059
714	Wd	131	5.7	0.16	0.29	0.040	0.051	0.32	0.041	0.056
715	Wd	26	4.6	0.35	0.35	0.095	0.076	0.38	0.097	0.084
716	We	162	5.5	0.14	0.31	0.036	0.056	0.35	0.037	0.063
719	Wd	28	5.0	0.31	0.46	0.096	0.093	0.71	0.135	0.143
720	Wd	100	5.0	0.17	0.48	0.050	0.096	0.69	0.072	0.138
721	Wd	81	5.6	0.11	0.25	0.048	0.044	0.26	0.049	0.047
722	Wd	108	5.4	0.17	0.30	0.044	0.055	0.31	0.045	0.058
723	We	121	4.8	0.14	0.22	0.038	0.046	0.26	0.040	0.053
725	Wd	47	5.2	0.17	0.23	0.062	0.045	0.28	0.066	0.053
726	Wd	51	5.9	0.31	0.31	0.066	0.053	0.31	0.066	0.053
727	Wd	49	5.1	0.28	0.47	0.072	0.093	0.53	0.072	0.105
728	Wd	41	5.0	0.27	0.34	0.075	0.068	0.37	0.076	0.073
729	Wd	87	5.8	0.20	0.25	0.047	0.044	0.30	0.055	0.051
730	We	61	6.5	0.31	0.36	0.062	0.056	0.69	0.147	0.106
731	We	2	5.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
801	Wd	16	4.6	0.24	0.56	0.128	0.122	0.69	0.120	0.150
802	Wd	9	5.0	0.48	0.33	0.167	0.067	0.33	0.167	0.067
803	Wd	15	3.4	0.70	0.13	0.091	0.039	0.13	0.091	0.039
804	Wd	26	5.4	0.26	0.04	0.038	0.007	0.04	0.038	0.007
805	Wd	7	3.3	0.87	0.29	0.184	0.087	0.29	0.184	0.087
806	We	44	5.0	0.27	0.16	0.056	0.032	0.25	0.074	0.050
807	We	15	6.1	0.13	0.07	0.067	0.011	0.07	0.067	0.011

[a] Wd = weekday, We = weekend/holiday.