Fishery Data Series No. 96-22

Angler Effort and Harvest of Chinook Salmon by the Recreational Fisheries in the Lower Kenai River, 1995

by

Mary A. King

August 1996

Alaska Department of Fish and Game

Division of Sport Fish

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Spell out acre and ton.

Time and temperature

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

Spell out year, month, and week.

Physics and chemistry

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

General

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

Mathematics, statistics, fisheries

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

FISHERY DATA SERIES NO. 96-22

ANGLER EFFORT AND HARVEST OF CHINOOK SALMON BY THE RECREATIONAL FISHERIES IN THE LOWER KENAI RIVER, 1995

by

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August 1996

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ABSTRACT

A creel survey to estimate angler effort, catch, and harvest was conducted on the Kenai River between the Soldotna Bridge and Cook Inlet from 17 May through 6 August 1995. 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 165,990 (SE = 4,679) angler-hours and 7,733 (SE = 420) chinook salmon, respectively. The estimated angler-effort and harvest during the late (July and August) chinook salmon run were 323,982 (SE = 8,541) angler-hours and 10,125 (SE = 510) 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 6 August in response to a large return. Unguided anglers exerted 59% of the total effort and took 44% of the chinook salmon harvest while guided anglers exerted 41% of the effort and harvested 56% of the chinook salmon.

Age and sex compositions of the recreational harvest and inriver return showed age 1.4 fish to be the predominant age class, followed by age 1.3, during each run. The inriver return as estimated by sonar is 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 7 years (Mills 1989-1994, Howe et al. 1995). This represents approximately 15% of the state's recreational fishing effort. The majority of Kenai River angler-effort occurs during the chinook salmon *Oncorhynchus tshawytscha* fishery (May through July) in the section of the river between the outlet of Skilak Lake and Cook Inlet (Figure 1). 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 shorebased anglers targeting sockeye salmon in July and coho salmon in August and early September. In 1973, 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 valued by recreational anglers due to their large size, especially those from the late run which average about 18 kg (40 lb) and may exceed 36 kg (80 lb). 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 complicated by the relatively large commercial harvest of returning chinook salmon. Chinook salmon are commercially harvested primarily by the

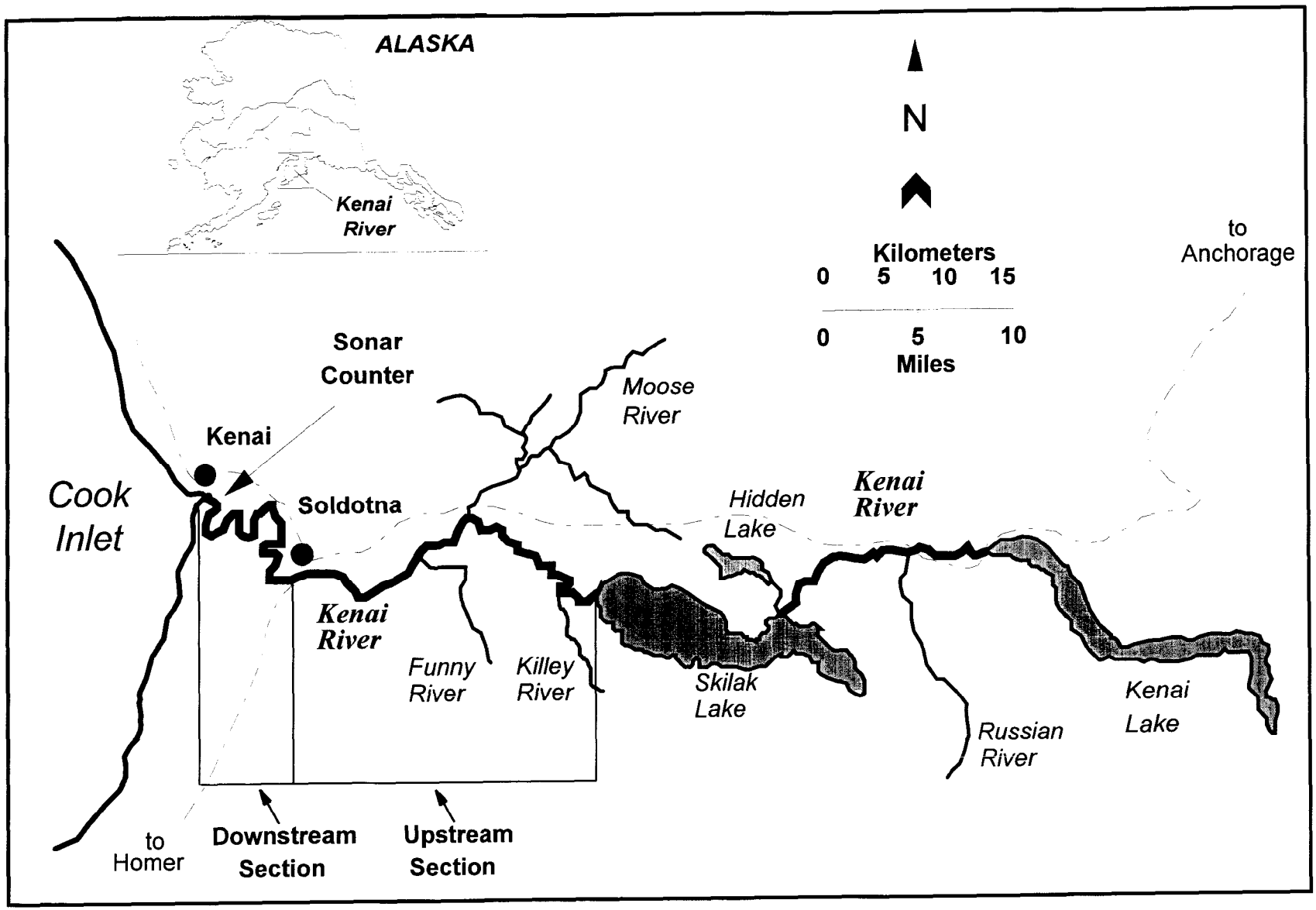

Figure 1.-Map of the Kenai River drainage.

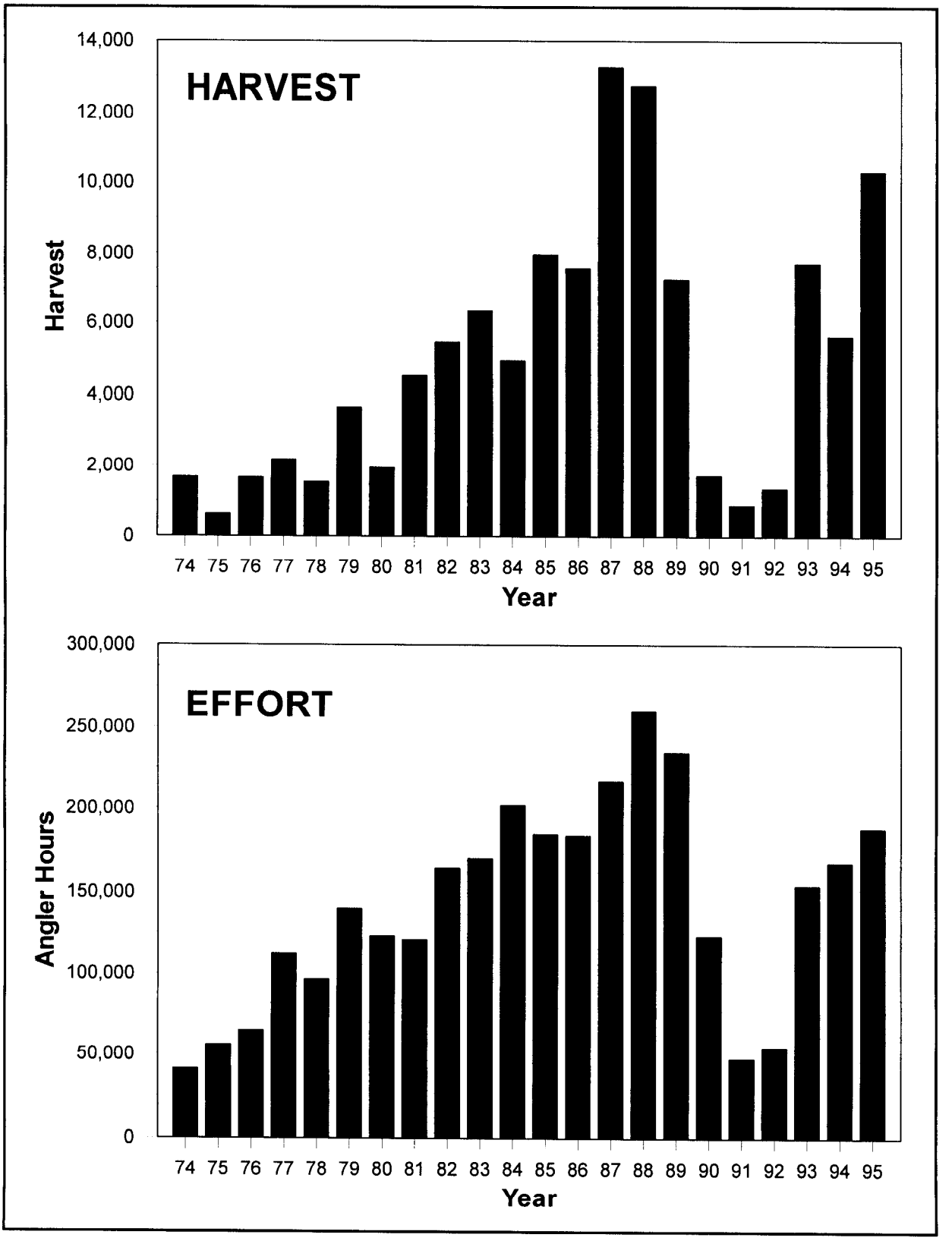

Figure 2.-Historical harvest and effort in the recreational fishery for early-run chinook salmon, Kenai River, 1974-1995.

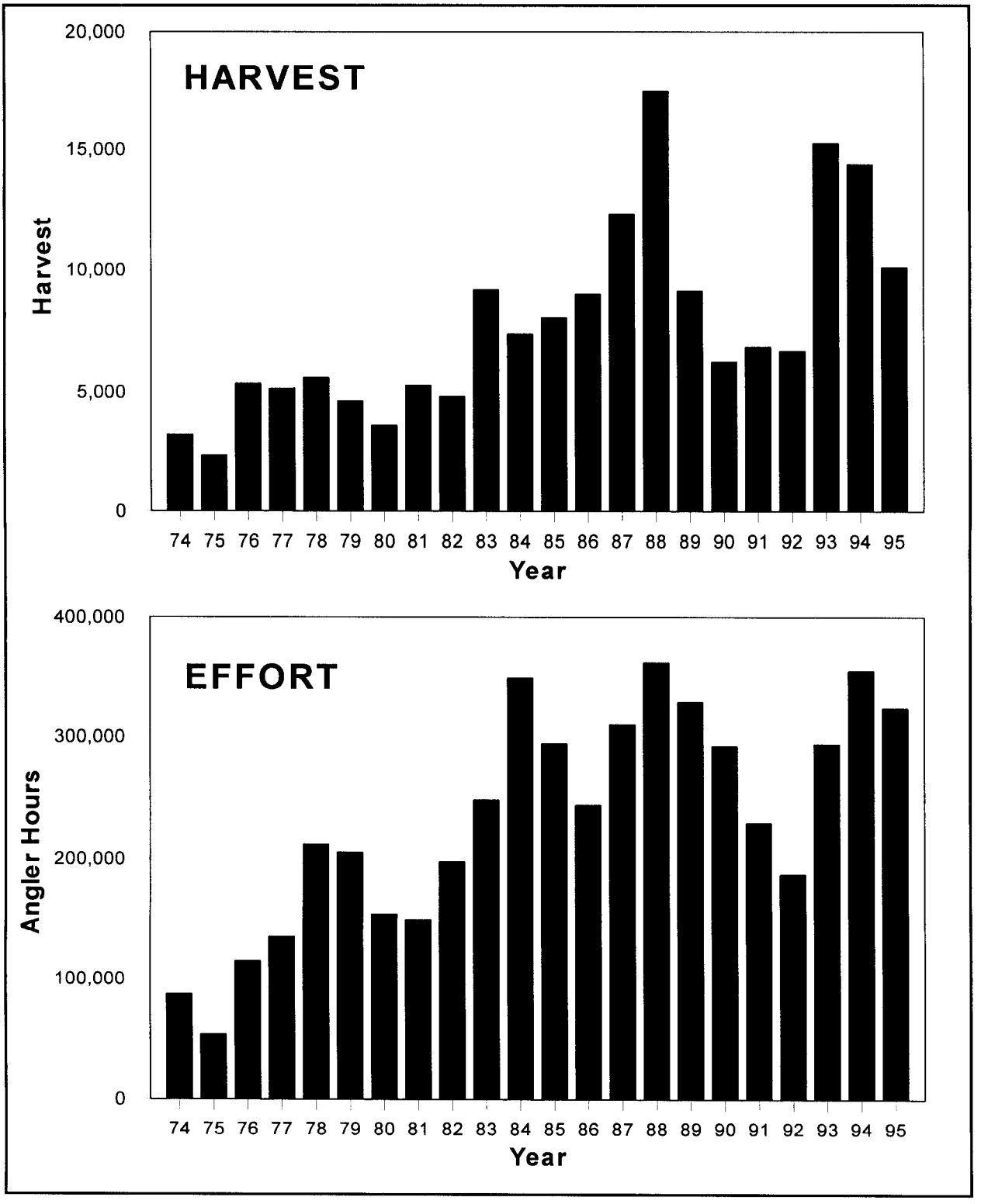

Figure 3.-Historical harvest and effort in the recreational fishery for late-run chinook salmon, Kenai River, 1974-1995.

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 accuracy and 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. These plans also define 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 fishery, however, legal complications delayed the implementation until 21 July 1991.

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), Conrad and Hammarstrom (1987), and King (1995). In addition, angler-effort and harvest by species for the recreational fishery have been estimated by Mills (1979-1994) and Howe et al. (1995) 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 estimate angler effort, angler catch and harvest, age/length/sex composition, and Kenai River chinook salmon escapement.

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 15 July 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 and the river becomes navigable. 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. Fishing from boats downstream from the outlet of Skilak Lake is prohibited on Mondays in May, June, and July, except Monday of Memorial Day. Anyone retaining a chinook salmon that is 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. Additionally, the early-run fishery is further restricted in that the use of bait is prohibited until the department is able to project an escapement of at least 9,000 fish or 1 July, whichever occurs 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. Fishing from a guided boat is allowed only between 0600 and 1800 hours during June and July. There are no days or hours closed to boat fishing by either guided or unguided anglers during the remainder of the year.

In 1995, the river was opened to the use of bait on 17 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 6 August downstream of a marker placed approximately 91 m (100 yards) upstream of "Eagle Rock" (approximately river kilometer 18.1). Anglers were also allowed to fish for chinook salmon from a boat on Monday, 31 July. 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 as the product of effort and harvest (or catch) rate estimates. Fishery statistics were estimated 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 1995 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 creel survey of the fishery upstream of the Soldotna Bridge in 1995 because of the difficulties in interviewing a representative sample of completed-trip anglers and conducting angler counts in this section of the river. However, a creel clerk was employed from 29 June to 4 July to interview all anglers (complete and incomplete) in the river section upstream of Naptowne Rapids. These data were necessary to provide management staff with an indication of effort and harvest levels.

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 6 August. The fishing day for unguided anglers was defined as 20 hours long, 0400 to 2400 hours, and was stratified into five 4-hour time periods to estimate effort. 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. 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: Period A, 0600 to 1159 hours and B, 1200 to 1759 hours. Unguided anglers were further stratified into weekdays and weekend/ holidays. Estimates for guided and unguided

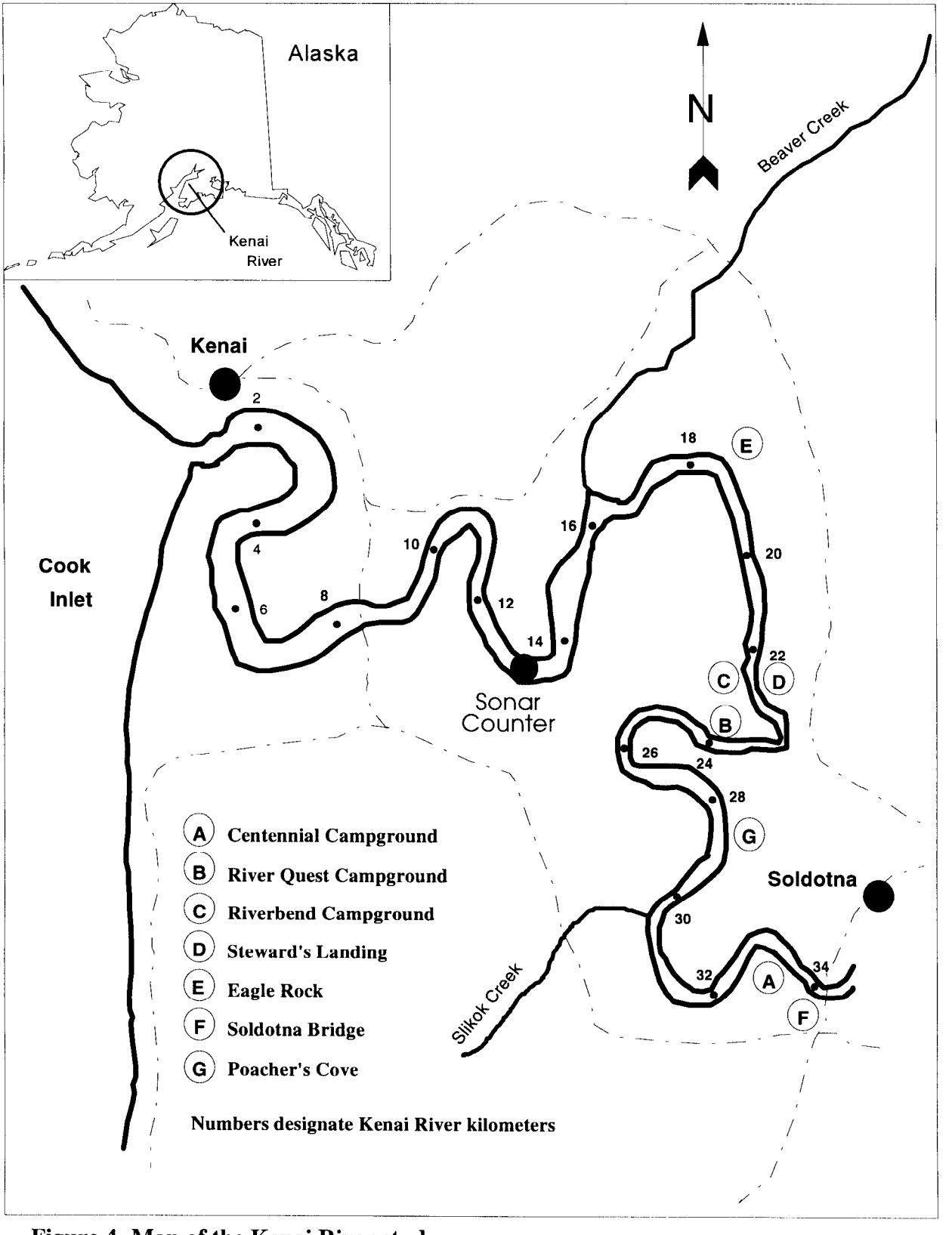

Figure 4.-Map of the Kenai River study area.

anglers were stratified temporally into approximate 2-week intervals.

The above design resulted in 17 strata: nine during the early run, and eight during the late run. There were six temporal units, three 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) 6/01-6/16, unguided anglers, weekdays;
(5) 6/01-6/16, unguided anglers, weekends/holidays;
(6) 6/01-6/16, guided anglers;
(7) 6/17-6/30, unguided anglers, weekdays;
(8) 6/17-6/30, unguided anglers, weekends/holidays;
(9) 6/17-6/30, guided anglers;

The late-run strata were:
(10) 7/1-7/16, unguided anglers, weekdays;
(11) 7/1-7/16, unguided anglers; weekends/holidays;
(12) 7/1-7/16, guided anglers;
(13) 7/16-7/30, unguided anglers, weekdays;
(14) 7/16-7/30, unguided anglers, weekends/holidays;
(15) 7/16-7/30, guided anglers;
(16) 7/31-8/06, unguided anglers, all days; and
(17) 7/31-8/06, 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 four 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 sampled at random. 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; however, this regulation does not apply to guides during August so guides were counted as anglers during the August extension of the fishery. 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 (upstream of the Soldotna Bridge to Naptowne Rapids) 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. 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 access sites in the downstream section. Two access technicians conducted the interviews at access sites. Each technician was scheduled to work 7.5-hour days on each weekend/holiday day and on 3 randomly selected weekdays each week. Two access sites were sampled by a technician on a sample day. The access sites sampled each day were chosen using a weighted random sampling procedure. Thus on weekend/holidays, four access sites were sampled each day, and on weekdays either two or four access sites 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 access site.

AGE/SEX COMPOSITION

Harvest

Sampling goals for estimation of age composition of the harvest were 120 harvested fish per 2-week stratum (three strata in the early run and two strata in the late 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 to age 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 150 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 h was estimated as follows (Neuhold and Lu 1957):

$$\hat{E}_h = D_h H_h \sum_{k=1}^{p_h} \bar{x}_{hk}, \qquad (1)$$

where:

$\bar{x}_{hk}$ = the mean angler count during period k of stratum h,

$$= \frac{\sum_{i=1}^{d_h} x_{hik}}{d_h},$$

x_{hik} = angler count on day i of period k,

d_h = the number of days sampled in stratum h,

H_h = the number of hours in the fishing day during stratum h,

D_h = the total number of days in stratum h, and

p_h = the number of periods (A, B, C, etc.) in stratum h.

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

$$V(\hat{E}_h) = (1 - f_h)(D_h H_h)^2 \sum_{k=1}^{p_h} \frac{s_{hk}^2}{d_h}, \quad (2)$$

where:

$f_h = \frac{d_h}{D_h}$, and

s_{hk}^2 = the variance of angler counts among days of period k during stratum h.

This method assumes a stratified two-stage design: strata being angler type, weekend or weekday (for unguided anglers), temporal interval and periods; first stage being days and second stage being counts. The finite population correction factor was not applied to the second stage because angler counts are considered instantaneous, and thus there are an infinite number of counts that can be taken.

Harvest Rates and Catch Rates

The catch or harvest per unit of effort (CPUE or HPUE) was estimated from completed-trip angler interviews in a two-stage design with days being the first stage and anglers being the second stage. The catch (or harvest) per angler hour for stratum h was estimated as a ratio of means (Pollock et al. 1994):

$$\hat{CPUE}_h = \frac{\bar{c}_h}{\bar{e}_h} = \frac{\sum_{i=1}^{d_h}\sum_{j=1}^{m_{hi}} c_{hij} \Big/ \sum_{i=1}^{d_h} m_{hi}}{\sum_{i=1}^{d_h}\sum_{j=1}^{m_{hi}} e_{hij} \Big/ \sum_{i=1}^{d_h} m_{hi}}, \quad (3)$$

and the variance was estimated by (Jensen 1978):

$$V(\hat{CPUE}_h) = \left(\frac{\bar{c}_h}{\bar{e}_h}\right)^2 \left[\frac{s_{ch}^2}{\bar{c}_h^2} + \frac{s_{eh}^2}{\bar{e}_h^2} - \frac{2\,\mathrm{cov}(\bar{c}_h, \bar{e}_h)}{\bar{c}_h \bar{e}_h}\right], \quad (4)$$

where:

C_{hij} = catch by angler j on day i of stratum h,

e_{hij} = hours fished by angler j on day i of stratum h, and

m_{hi} = number of anglers interviewed on day i of stratum h.

The covariance of catch and effort in stratum h was estimated by:

$$\mathrm{cov}(\bar{c}_h, \bar{e}_h) = \frac{\sum_{i=1}^{d_h}(\bar{c}_{hi} - \bar{c}_h)(\bar{e}_{hi} - \bar{e}_h)}{d_h - 1}. \quad (5)$$

The variances of angler catch (c) and effort (e) are two-stage variances and, ignoring the finite population correction factor for the second stage (anglers), were estimated by (Cochran 1977, Pollock et al. 1994):

$$s_{ch}^2 = (1 - f_h)\frac{s_h^2}{d_h} + \frac{f_h}{d_h^2}\sum_{i=1}^{d_h}\frac{s_{hi}^2}{m_{hi}}, \quad (6)$$

where:

s_h^2 = variance among days for catch (harvest) or effort, and

s_{hi}^2 = variance among anglers on day i,

$$= \frac{\sum_{j=1}^{m_{hi}}\left(c_{hij} - \bar{c}_{hi}\right)^2}{m_{hi} - 1}.$$

The variance of angler effort (s_{eh}^2) was estimated by substituting hours fished (e) for catch (c) in the above equation.

Harvest and Catch

The total catch (or harvest) during each stratum was estimated by:

$$\hat{C}_h = (\hat{CPUE}_h)(\hat{E}_h). \quad (7)$$

The variance of total catch (or harvest) was estimated as the variance of two independent random variables (Goodman 1960):

$$V(\hat{C}_h) = \left[\hat{E}_h^2 V(\hat{CPUE}_h)\right] + \left[\hat{CPUE}_h^2 V(\hat{E}_h)\right] - \left[V(\hat{CPUE}_h)V(\hat{E}_h)\right]. \quad (8)$$

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

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; and
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 $\hat{p}_{bt}$ equal the estimated proportion of age group b in stratum t, the variance of $\hat{p}_{bt}$ was estimated as (Scheaffer et al. 1979):

$$V(\hat{p}_{bt}) = \frac{\hat{p}_{bt}(1-\hat{p}_{bt})}{(n_t - 1)}, \quad (9)$$

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 73 days possible: 40 during the early run and 33 during the late run.

During the early run, angler counts ranged from 7 to 404 for unguided anglers and from 1 to 426 for guided anglers (Appendix A1). The largest count of unguided anglers occurred on 18 June and of guided anglers on 27 June. During the late run, angler counts ranged from 30 to 875 for unguided anglers and from 5 to 704 for guided anglers (Appendix A2). The largest count for both unguided and guided anglers occurred on 22 July. In general, mean angler counts are lowest in May and gradually increase throughout June and early July, with the highest mean angler counts occurring during the last 2 weeks of July (Tables 1 and 2).

The estimated effort in the downstream section during the early run was 165,990 (SE = 4,679) angler-hours (Table 3). The relative precision (5.5%) was within desired levels, ± 10% of the true values 95% of the time.

The estimated effort during the late run was 323,982 (SE = 8,541) angler-hours (Table 4). The relative precision (5.2%) was within the desired level of precision (± 10% of the true values 95% of the time).

Table 1.-Mean counts of boat anglers by period for each stratum of the creel survey of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1995.

Strata	Period[a] A	B	C	D	E
17 May - 31 May					
Unguided anglers, weekdays:					
Number of counts	4	5	4	6	4
Mean count	37.5	51.8	35.5	31.3	29.3
Standard error	9.8	8.2	12.6	8.1	15.3
Unguided anglers, weekends:					
Number of counts	5	5	5	5	5
Mean count	45.4	122.0	127.8	176.0	94.2
Standard error	14.5	16.9	26.4	57.6	23.4
Guided anglers, all days (May):					
Number of counts	9	10	9	10	10
Mean count	62.4	106.4	65.4	37.3	15.9
Standard error	15.0	9.3	10.5	13.0	4.1
1 June - 16 June					
Unguided anglers, weekdays:					
Number of counts	4	7	8	4	4
Mean count	65.5	98.1	92.4	43.8	58.3
Standard error	17.8	15.8	16.7	3.9	9.1
Unguided anglers, weekends:					
Number of counts	4	4	3	4	4
Mean count	166.0	202.3	214.7	187.3	155.5
Standard error	49.0	22.5	39.5	46.3	30.3
Guided anglers, all days:					
Number of counts	13	13			
Mean count	196.4	121.5			
Standard error	19.9	10.6			
17 June - 30 June					
Unguided anglers, weekdays:					
Number of counts	4	7	5	4	4
Mean count	152.0	172.0	136.2	143.0	136.3
Standard error	31.7	19.5	25.1	20.4	31.1
Unguided anglers, weekends:					
Number of counts	4	4	4	4	4
Mean count	173.0	292.5	269.8	238.8	185.8
Standard error	46.6	49.6	20.5	37.0	47.9
Guided anglers, all days:					
Number of counts	12	12			
Mean count	287.8	156.1			
Standard error	25.1	12.1			

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

Guided anglers:
May: Same as unguided anglers
June: Period A = 0600-1159 hours
Period B = 1200-1759 hours

Table 2.-Mean counts of boat anglers by period for each stratum of the creel survey of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1995.

	Period[a]				
Strata	A	B	C	D	E
1 July - 16 July					
Unguided anglers, weekdays:					
Number of counts	5	4	5	4	4
Mean count	301.4	226.5	193.0	202.3	196.5
Standard error	71.9	62.2	25.5	34.0	45.9
Unguided anglers, weekends:					
Number of counts	6	7	7	6	6
Mean count	287.8	475.6	383.1	399.3	362.0
Standard error	57.0	72.1	45.5	49.0	50.9
Guided anglers, all days:					
Number of counts	10	11			
Mean count	464.0	297.6			
Standard error	15.5	21.6			
17 July - 30 July					
Unguided anglers, weekdays:					
Number of counts	2	6	7	4	3
Mean count	421.5	472.5	394.7	387.3	296.7
Standard error	35.5	40.3	22.1	69.2	48.1
Unguided anglers, weekends:					
Number of counts	4	4	4	3	4
Mean count	463.0	580.5	595.5	375.0	333.0
Standard error	104.1	86.8	120.6	137.2	105.7
Guided anglers, all days:					
Number of counts	10	9			
Mean count	580.5	414.0			
Standard error	28.4	52.1			
31 July - 6 August					
Unguided anglers, all days:					
Number of counts	4	4	5	6	4
Mean count	91.5	127.5	154.4	72.8	87.8
Standard error	33.7	40.9	36.4	6.3	22.5
Guided anglers, all days:					
Number of counts	3	4	5	5	4
Mean count	119.0	174.0	120.4	54.0	19.5
Standard error	51.5	48.1	20.7	11.0	9.2

[a] Unguided anglers:

July: Period A = 0400-0759 hours
Period B = 0800-1159 hours
Period C = 1200-1559 hours
Period D = 1600-1959 hours
Period E = 2000-2359 hours

Guided anglers:

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

August: Same as unguided anglers

Table 3.-Estimated number of angler-hours of fishing effort by boat anglers during each stratum of the fishery for early-run chinook salmon in the downstream section of the Kenai River, 1995.

Strata	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
17 May - 31 May				
Unguided, weekdays:	7,415	996	5,463 - 9,367	26.3 %
Unguided, weekends:	11,308	1,423	8,519 - 14,097	24.7 %
Guided, all days:	17,250	1,480	14,349 - 20,151	16.8 %
1 June - 16 June				
Unguided, weekdays:	14,321	1,229	11,912 - 16,730	16.8 %
Unguided, weekends:	14,811	1,388	12,091 - 17,531	18.4 %
Guided, all days:	26,705	1,897	22,987 - 30,423	13.9 %
17 June - 30 June				
Unguided, weekdays:	23,662	1,865	20,007 - 27,317	15.4 %
Unguided, weekends:	18,556	1,460	15,694 - 21,418	15.4 %
Guided, all days:	31,962	2,010	28,022 - 35,902	12.3 %
Subtotals				
Unguided:	90,073	3,473	83,265 - 96,881	7.6 %
Guided:	75,917	3,135	69,772 - 82,062	8.1 %
Early Run Total	165,990	4,679	156,819 - 175,161	5.5 %

Table 4.-Estimated number of angler-hours of fishing effort by boat anglers during each stratum of the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1995.

Strata	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
1 July - 16 July				
Unguided, weekdays:	31,350	3,186	25,105 - 37,595	19.9 %
Unguided, weekends:	53,420	3,487	46,585 - 60,255	12.8 %
Guided, all days:	50,268	1,755	46,828 - 53,708	6.8 %
17 July - 30 July				
Unguided, weekdays:	63,124	3,275	56,705 - 69,543	10.2 %
Unguided, weekends:	37,552	4,013	29,687 - 45,417	20.9 %
Guided, all days:	59,670	3,559	52,694 - 66,646	11.7 %
31 July - 6 August				
Unguided, all days:	14,951	1,915	11,198 - 18,704	25.1 %
Guided, all days:	13,647	2,095	9,541 - 17,753	30.1 %
Subtotals				
Unguided:	200,397	7,267	186,154 - 214,640	7.1 %
Guided:	123,585	4,487	114,790 - 132,380	7.1 %
Late Run Total	323,982	8,541	307,242 - 340,722	5.2 %

Completed-trip anglers interviewed during the early run reported a total of 15,132 angler-hours, 9% of the total estimated effort. During late-run, interviewed anglers reported fishing a total of 25,225 angler-hours, 7% of the total estimated effort. Approximately 9% of the total late run effort occurred during the 7-day extension of the fishery.

Harvest Rates and Catch Rates

A total of 8,603 completed-trip angler interviews were collected: 3,473 during the early run and 5,130 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, excluding 8 June, 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 0.162 fish per hour and from 0.000 to 0.426 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 7 June and on 17 June for guided anglers. Daily catch rates of late-run chinook salmon by unguided anglers ranged from 0.005 to 0.073 fish per hour and from 0.010 to 0.267 fish per hour for guided anglers (Appendices B3 and B4). Peak daily catch rates of late-run chinook salmon by unguided anglers occurred on 5 July and by guided anglers on 3 August. During both runs guided angler catch and harvest rates were generally twice that of unguided anglers (Tables 5 and 6). Estimates of overall harvest rates were 0.047 for the early run and 0.031 for the late run. Overall catch rates were 0.068 for the early run and 0.043 for the late run (Tables 5 and 6).

Harvest and Catch

An estimated 7,733 (SE = 420) chinook salmon were harvested during the early run (Table 7), 39% by unguided anglers. The estimated catch of early-run chinook was 11,360 (SE = 541). The relative precision for catch and harvest (9.3% and 10.6%, respectively) were within desired levels of precision (± 15% of the true values 95% of the time). Approximately 32% of the catch was voluntarily released.

An estimated 10,125 (SE = 510) chinook salmon were harvested during the late run (Table 8). Unguided anglers accounted for 49% of the harvest. The estimated catch of chinook salmon was 13,899 (SE = 649). The relative precision for catch and harvest (9.2% and 9.9%, respectively) were within desired levels of precision (± 15% of the true values 95% of the time). Approximately 27% of the catch was voluntarily released during the late run.

Completed-trip anglers interviewed during the early run reported harvesting 659 fish. This represents 8.5% of the estimated total harvest. Anglers interviewed during the late run reported a harvest of 753 fish, 7.4% 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. (1995). Daily counts of chinook salmon for 1995 appear in Tables 9 and 10. The estimated inriver return in 1995 (Burwen and Bosch 1996) for the early run was 21,946 (SE = 396) and for the late run was 44,336 (SE = 970).

Biological Data

Recreational Fishery

There was a significant difference in the age composition of the recreational harvest among the three temporal strata of the early run (Table 11), whether considering all four major

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, 1995.

Angler Day Type	n[a]	N[b]	Number of Interviews[c]	HPUE	Standard Error	CPUE	Standard Error
17 - 31 May							
Unguided weekdays	9	9	236	0.035	0.007	0.058	0.010
Unguided weekends	5	5	452	0.025	0.004	0.035	0.005
Guided all days	14	14	287	0.046	0.007	0.060	0.008
1 - 16 June							
Unguided weekdays	9	10	370	0.045	0.008	0.060	0.009
Unguided weekends	4	4	450	0.029	0.004	0.042	0.005
Guided all days	13	13	389	0.051	0.007	0.062	0.008
17 - 30 May							
Unguided weekdays	8	8	369	0.032	0.005	0.052	0.006
Unguided weekends	4	4	424	0.035	0.004	0.062	0.007
Guided all days	12	12	496	0.081	0.006	0.013	0.008
Subtotals:							
Unguided	39	40	2,301	0.033	0.003	0.052	0.004
Guided	39	39	1,172	0.062	0.005	0.088	0.007
Early Run Total	39	40	3,473	0.047	0.003	0.068	0.004

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

[b] Number of days possible for interviewing.

[c] Completed-trip interviews only.

Table 6.-Estimated harvest per unit effort (HPUE) and catch per unit 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, 1995.

Angler Day Type	n[a]	N[b]	Number of Interviews[c]	HPUE	Standard Error	CPUE	Standard Error
1 - 16 July							
Unguided weekdays	7	7	733	0.019	0.003	0.033	0.005
Unguided weekends	7	7	1,034	0.016	0.002	0.023	0.002
Guided all days	11	11	723	0.040	0.004	0.054	0.005
17 - 30 July							
Unguided weekdays	8	8	834	0.034	0.003	0.048	0.004
Unguided weekends	4	4	580	0.029	0.003	0.042	0.004
Guided all days	10	10	797	0.047	0.004	0.059	0.005
31 July - 6 August							
Unguided all days	7	7	293	0.016	0.004	0.018	0.007
Guided all days	7	7	136	0.031	0.011	0.042	0.011
Subtotals:							
Unguided	35	35	3,474	0.025	0.002	0.036	0.003
Guided	28	28	1,656	0.042	0.003	0.055	0.004
Late Run Total	35	35	5,130	0.031	0.002	0.043	0.002

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

[b] Number of days possible for interviewing.

[c] Completed-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, 1995.

Strata	Harvest[a]	SE	Relative Precision[b]	Catch[c]	SE	Relative Precision[b]
17 May - 31 May						
Unguided weekday	256	64	49.0 %	432	92	41.7 %
Unguided weekend	282	57	39.6 %	394	74	36.6 %
Guided all days	787	134	33.3 %	1,033	158	30.0 %
1 June - 16 June						
Unguided weekday	649	124	37.4 %	862	144	32.7 %
Unguided weekend	435	71	31.8 %	622	89	28.2 %
Guided all days	1,354	218	31.6 %	1,650	233	27.7 %
17 June - 30 June						
Unguided weekday	745	122	32.2 %	1,228	164	26.1 %
Unguided weekend	642	95	29.1 %	1,141	150	25.8 %
Guided all days	2,583	243	18.4 %	3,998	349	17.1 %
Subtotal:						
Unguided	3,009	227	14.8 %	4,679	303	12.7 %
Guided	4,724	353	14.6 %	6,681	448	13.1 %
Early Run Total	7,733	420	10.6 %	11,360	541	9.3 %

[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, 1995.

Strata	Harvest[a]	SE	Relative Precision[b]	Catch[c]	SE	Relative Precision[b]
1 July - 16 July						
Unguided weekday	580	108	36.5 %	1,022	188	36.0 %
Unguided weekend	865	119	26.9 %	1,213	152	24.6 %
Guided all days	2,006	210	20.5 %	2,689	253	18.4 %
16 July - 30 July						
Unguided weekday	2,127	233	21.5 %	3,036	293	18.9 %
Unguided weekend	1,097	170	30.3 %	1,592	235	28.9 %
Guided all days	2,787	279	19.6 %	3,509	342	19.1 %
31 July - 6 August						
Unguided all days	245	68	54.7 %	263	103	76.8 %
Guided all days	418	159	74.6 %	575	176	59.9 %
Subtotal:						
Unguided	4,914	337	13.5 %	7,126	458	12.6 %
Guided	5,211	383	14.4 %	6,773	460	13.3 %
Late Run Total	10,125	510	9.9 %	13,899	649	9.2 %

[a] Harvest includes only fish kept.

[b] Relative precision for 95% confidence interval.

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

Table 9.-Daily counts of chinook salmon during the early run as determined by dual-beam sonar, Kenai River, 1995.

Date	Daily Count	Cumulative Count
16-May	98	98
17-May	99	197
18-May	78	275
19-May	149	424
20-May	228	652
21-May	465	1,117
22-May	265	1,382
23-May	286	1,668
24-May	265	1,933
25-May	198	2,131
26-May	189	2,320
27-May	165	2,485
28-May	159	2,644
29-May	222	2,866
30-May	351	3,217
31-May	282	3,499
1-Jun	357	3,856
2-Jun	369	4,225
3-Jun	549	4,774
4-Jun	693	5,467
5-Jun	429	5,896
6-Jun	807	6,703
7-Jun	843	7,546
8-Jun	999	8,545
9-Jun	789	9,334
10-Jun	876	10,210
11-Jun	774	10,984
12-Jun	417	11,401
13-Jun	492	11,893
14-Jun	691	12,584
15-Jun	636	13,220
16-Jun	648	13,868
17-Jun	750	14,618
18-Jun	808	15,426
19-Jun	419	15,845
20-Jun	594	16,439
21-Jun	438	16,877
22-Jun	375	17,252
23-Jun	178	17,430
24-Jun	450	17,880
25-Jun	429	18,309
26-Jun	334	18,643
27-Jun	946	19,589
28-Jun	696	20,285
29-Jun	984	21,269
30-Jun	615	21,884

From: Burwen and Bosch 1996

Table 10.-Daily counts of chinook salmon during the late run as determined by dual-beam sonar, Kenai River, 1995.

Date	Daily Count	Cumulative Count
1-Jul	350	350
2-Jul	398	748
3-Jul	353	1,101
4-Jul	439	1,540
5-Jul	667	2,207
6-Jul	720	2,927
7-Jul	931	3,858
8-Jul	417	4,275
9-Jul	519	4,794
10-Jul	450	5,244
11-Jul	325	5,569
12-Jul	276	5,845
13-Jul	570	6,415
14-Jul	714	7,129
15-Jul	750	7,879
16-Jul	1,962	9,841
17-Jul	1,128	10,969
18-Jul	3,942	14,911
19-Jul	4,692	19,603
20-Jul	4,779	24,382
21-Jul	3,132	27,514
22-Jul	3,465	30,979
23-Jul	2,421	33,400
24-Jul	831	34,231
25-Jul	840	35,071
26-Jul	1,683	36,754
27-Jul	1,806	38,560
28-Jul	789	39,349
29-Jul	558	39,907
30-Jul	510	40,417
31-Jul	480	40,897
1-Aug	474	41,371
2-Aug	369	41,740
3-Aug	447	42,187
4-Aug	519	42,706
5-Aug	404	43,110
6-Aug	408	43,518
7-Aug	279	43,797
8-Aug	267	44,064
9-Aug	272	44,336

From: Burwen and Bosch 1996

Table 11.-Age composition and mean length-at-age, by sex, of chinook salmon sampled from the recreational harvest during the fishery for early-run chinook salmon in the Kenai River, 1995.

Sex		Age Group 1.2	1.3	1.4	1.5	Total
17 May - 31 May						
Male	Percent		3.7	32.1	11.1	46.9
	SE		2.1	5.2	3.5	
Female	Percent			50.6	2.5	53.1
	SE			5.6	1.7	
Combined	Percent		3.7	82.7	13.6	
	SE		2.1	4.2	3.8	
Male	Mean Length (mm)[a]		818	1,023	1,103	
	SE		9	12	19	
	Sample size		3	26	9	38
Female	Mean Length (mm)[a]			971	1,070	
	SE			8	10	
	Sample size			41	2	43
1 June - 16 June						
Male	Percent	6.2	7.0	32.5		45.7
	SE	2.1	2.3	4.1		
Female	Percent		8.5	44.2	1.6	54.3
	SE		2.5	4.4	1.1	
Combined	Percent	6.2	15.5	76.7	1.6	
	SE	2.1	3.2	3.7	1.1	
Male	Mean Length (mm)[a]	565	851	1,007		
	SE	16	20	11		
	Sample size	8	9	42		59
Female	Mean Length (mm)[a]		846	965	1,150	
	Mean Length (mm)[a]		13	7	40	
	Sample size		11	57	2	70
17 June - 30 June						
Male	Percent	12.6	10.4	24.8	6.0	53.8
	SE	2.5	2.3	3.2	1.8	
Female	Percent		3.3	38.5	4.4	46.2
	SE		1.3	3.6	1.5	
Combined	Percent	12.6	13.7	63.3	10.4	
	SE	2.5	2.6	3.6	2.3	
Male	Mean Length (mm)[a]	635	798	1,044	1,139	
	SE	16	26	13	24	
	Sample size	23	19	45	11	98
Female	Mean Length (mm)[a]		830	993	1,076	
	SE		20	8	14	
	Sample size		6	70	8	84

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

age classes (χ^2 = 32.95, df = 6, P < 0.001) or just the two most predominant age classes (χ^2 = 7.63, df = 2, P = 0.02). Further testing showed a difference in the age composition between the first two strata, 17 May-31 May versus 1 June-16 June (all four age classes: χ^2 = 23.21, df = 3, P < 0.001; two predominant age classes: χ^2 = 6.47, df = 1, P = 0.01), and a significant difference between 1 June-16 June and 17 June-30 June due to an increase in fish aged 1.2 and 1.5 during the latter half of June (all four age classes: χ^2 = 14.15, df = 3, P = 0.003; two predominant age classes: χ^2 = 0.05, df = 1, P = 0.082). Therefore, age composition data and estimating harvest by age could not be combined by strata. The most abundant age group in the early-run harvest of chinook salmon was age 1.4 which comprised 82.7% of the harvest from 17-31 May, 76.7% from 1-16 June, and 63.3% from 17-31 June. The only other age classes of significance represented in the sample were 1.2, 1.3, and 1.5.

During the late run, there was no difference (χ^2 = 6.9, df = 3, P = 0.08) in the age composition of chinook salmon harvested from 17-31 July and those harvested during the extended fishery of 1-6 August. There was a significant difference (χ^2 = 16.90, df = 3, P < 0.001) in the age composition of the harvest between 1-16 July and 17 July-6 August, primarily due to the decline in fish age 1.2 (Table 12). There was no difference (χ^2 = 0.88, df = 1, P = 0.35) between time intervals of the two predomi-nant age classes.

Age 1.4 was again the most abundant age in the late-run harvest, contributing 65.1% of the harvest from 1-16 July and 75.4% from 17 July-6 August (Table 12). Other significant age classes included 1.2, 1.3, and 1.5.

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 = 12.5, df = 3, P < 0.005). The most abundant age for the early run in the samples collected with gill nets was 1.4, representing 76.8% of the first 3-week stratum and 61.0% of the second 3-week stratum (Table 13). Age 1.3 was the second largest contributor, with the 1.5 and 1.2 age classes being significantly represented, also. No significant difference was detected in the age/sex composition between the first 3-week stratum (1 July-23 July) and second 3-week stratum (24 July-11 August) during the late run (χ^2 = 4.8, df = 3, P > 0.900). The most abundant age for the late run in the samples collected with gill nets was 1.4, representing 50.5% of the return (Table 14). Atypically, age 1.2 was the second largest contributor to the late run, followed by 1.3 and 1.5.

ANOVA tests were used to detect differences of mean length-at-age by sex and sampling method (recreational harvest or inriver netting). For age-1.3 fish, there was no significant difference in mean length between early- and late-run chinook salmon; however, females tended to be larger than males (F = 23.86; df = 1, 173; P < 0.001) and recreationally harvested fish tended to be larger than those netted (F = 7.45; df = 1, 173, P = 0.007). There was significant interaction between run and sex because late-run females were larger than early-run females, but early-run males were larger than late-run males, particularly those males from the recreational harvest. For age-1.4 fish, the mean length for late-run fish was significantly larger than for early-run fish (F = 11.74; df = 1, 845; P < 0.001). The mean length for age-1.4 males was also significantly larger than for 1.4

Table 12.-Age composition and mean length-at-age, by sex, of chinook salmon sampled from the recreational harvest during the fishery for late-run chinook salmon in the Kenai River, 1995.

Sex		Age Group 1.2	1.3	1.4	1.5	Other	Total
1 July-16 July							
Male	Percent	12.6	9.1	25.7	2.9	1.1	51.4
	SE	2.5	2.2	3.3	1.3	0.8	
Female	Percent	1.1	1.8	39.4	6.3		48.6
	SE	0.8	1.0	3.7	1.8		
Combined	Percent	13.7	10.9	65.1	9.2	1.1	
	SE	2.6	2.4	3.6	2.2	0.8	
Male	Mean Length (mm)	622	766	1,030	1,152	370	
	SE	18	15	14	36	0	
	Sample size	22	16	45	5	2	90
Female	Mean Length (mm)	675	843	1,012	1,103		
	SE	45	16	8	7		
	Sample size	2	3	69	11		85
17 July-6 August							
Male	Percent	3.5	4.6	30.4	5.8	0.4	44.7
	SE	1.1	1.3	2.9	1.5	0.4	
Female	Percent		4.6	45.0	5.7		55.3
	SE		1.3	3.1	1.5		
Combined	Percent	3.5	9.2	75.4	11.5	0.4	
	SE	1.1	1.8	2.7	2.0	0.4	
Male	Mean Length (mm)	632	813	1,038	1,157	375	
	SE	20	30	9	13		
	Sample size	9	12	79	15	1	116
Female	Mean Length (mm)[a]		889	1,003	1,103		
	SE		21	5	13		
	Sample size		12	117	15		144

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

Table 13.-Age composition and mean length-at-age, by sex, of chinook salmon sampled with large mesh gill nets during the fishery for early-run chinook salmon in the Kenai River, 1995.

Sex		Age Group 1.2	1.3	1.4	1.5	Other	Total
16 May - 7 June							
Male	Percent	2.4	6.4	40.8	4.0		53.6
	SE	1.4	2.2	4.4	1.8		
Female	Percent	0.8	7.2	36.0	2.4		46.4
	SE	0.8	2.3	4.3	1.4		
Combined	Percent	3.2	13.6	76.8	6.4		
	SE	1.6	3.1	3.8	2.2		
Male	Mean Length (mm)	657	801	1,028	1,117		
	SE	19	13	10	30		
	Sample size	3	8	51	5		67
Female	Mean Length (mm)	665	804	969	1,110		
	SE		26	8	55		
	Sample size	1	9	45	3		58
8 June - 30 June							
Male	Percent	7.0	17.0	21.0	1.0		46.0
	SE	2.6	3.8	4.1	1.0		
Female	Percent		12.0	40.0	1.0	1.0	54.0
	SE		3.3	4.9	1.0	1.0	
Combined	Percent	7.0	29.0	61.0	2.0	1.0	
	SE	2.6	4.6	4.9	1.4	1.0	
Male	Mean Length (mm)	646	768	1,059	1,130		
	SE	9	10	25			
	Sample size	7	17	21	1		46
Female	Mean Length (mm)[a]		808	1,000	1,060	1,080	
	SE		16	12			
	Sample size		12	40	1	1	54

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

Table 14.-Age composition and mean length-at-age, by sex, of chinook salmon sampled with large mesh gill nets during the fishery for late-run chinook salmon in the Kenai River, 1995.

Sex		Age Group 1.2	1.3	1.4	1.5	Other	Total
1 July - 23 July							
Male	Percent	23.5	15.0	29.4	3.9		71.8
	SE	3.4	2.9	3.7	1.6		
Female	Percent		3.3	24.2	0.7		28.2
	SE		1.4	3.5	0.7		
Combined	Percent	23.5	18.3	53.6	4.6		
	SE	3.4	3.1	4.1	1.7		
Male	Mean Length (mm)[a]	643	766	1,034	1,195		
	SE	13	21	16	17		
	Sample size	36	23	45	6		110
Female	Mean Length (mm)[a]		844	1,016	1,135		
	SE		52	10			
	Sample size		5	37	1		43
24 July - 11 August							
Male	Percent	18.9	18.9	7.5	3.7	1.9	50.9
	SE	5.4	5.4	3.7	2.6	1.9	
Female	Percent		11.3	34.0	3.8		49.1
	SE		4.4	6.6	2.6		
Combined	Percent	18.9	30.2	41.5	7.5	1.9	
	SE	5.4	6.4	6.8	3.7	1.9	
Male	Mean Length (mm)[a]	655	797	1,093	1,150	540	
	SE	12	24	42	20		
	Sample size	10	10	4	2	1	27
Female	Mean Length (mm)[a]		888	1,025	1,050		
	SE		18	14	10		
	Sample size		6	18	2		26
1 July - 11 August							
Male	Percent	22.3	16.0	23.8	3.9	0.5	66.5
	SE	2.9	2.6	3.0	1.4	0.5	
Female	Percent		5.3	26.7	1.5		33.5
	SE		1.6	3.1	0.8		
Combined	Percent	22.3	21.3	50.5	5.4	0.5	
	SE	2.9	2.9	3.5	1.6	0.5	
Male	Mean Length (mm)[a]	646	775	1,039	1,184	540	
	SE	10	16	15	15		
	Sample size	46	33	49	8	1	137
Female	Mean Length (mm)[a]		868	1,019	1,078		
	SE		25	8	29		
	Sample size		11	55	3		69

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

females ($F = 44.62$; $df = 1, 845$; $P < 0.001$). Although there was no significant difference in mean length-at-age for age-1.4 fish sampled in the harvest versus nets, early-run females tended to be larger than those in the late run with little difference in mean lengths of 1.4 males, by run. The only detectable difference for age-1.5 fish was that males tended to be larger than females ($F = 13.56$; $df = 1, 91$; $P < 0.001$).

DISCUSSION

In 1990, 1991 and 1992, emergency orders restricting the bag limit to zero for fish less than 132 cm (hook and release fishing), or one fish 132 cm or greater (trophy fishing) severely affected the effort in this fishery (Figures 2 and 3). Relatively high catch rates apparently do 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 1993-1995 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).

During the early run there was an increase of nearly 31,000 angler hours (24%) from the 1994 estimate (King 1995). This can be partly attributed to the liberalization of the fishery allowing use of bait beginning 17 June (providing 14 days of a bait fishery in 1995 versus 7 days in 1994). The percent increase in effort was realized equally by both angler types (23% guided and 24% unguided). In 1995 unguided anglers contributed 54% of the total effort and guided anglers 46%.

For the late run there was a 9% decrease in effort from the 1994 fishery (King 1995). Although there was a 7% increase in effort by guided anglers (13,536 angler hours), the 7% decrease in effort by unguided anglers (44,332 angler hours) was primarily responsible for the overall decline in participation from 1994. The majority of the 1995 effort (62%) was by unguided anglers.

CPUE and HPUE for guided anglers was greater than that of the unguided anglers for both runs. The HPUE of the guided anglers was twice that of the unguided anglers, which has been the historical trend.

For both the early and late runs of chinook salmon there was a general trend for angler effort and catch to track with the daily estimates of chinook salmon abundance (sonar counts) (Figures 5 and 6).

Using data from the inriver sampling of the age composition (less size/age related bias than fish harvested during the recreational fishery), there was a higher percent of age 1.4 fish during the first 3 weeks of each run (early run 76.8%, late run 53.6%). During the remainder of each run there was a reduction in the percentage of age 1.4 fish with the largest increase in the percent of age 1.3 fish (Tables 13 and 14).

RECOMMENDATIONS

Observation of the fishery in the downstream section of the Kenai River in recent years has shown a marked shift in effort from formerly preferred fishing areas throughout this river section to an area downstream of river mile 9. In fact much of this effort now occurs below the chinook salmon sonar site at river mile 8.5. There is concern about the level of harvest occurring below the sonar counters and that a significant number of chinook salmon are being harvested prior to being

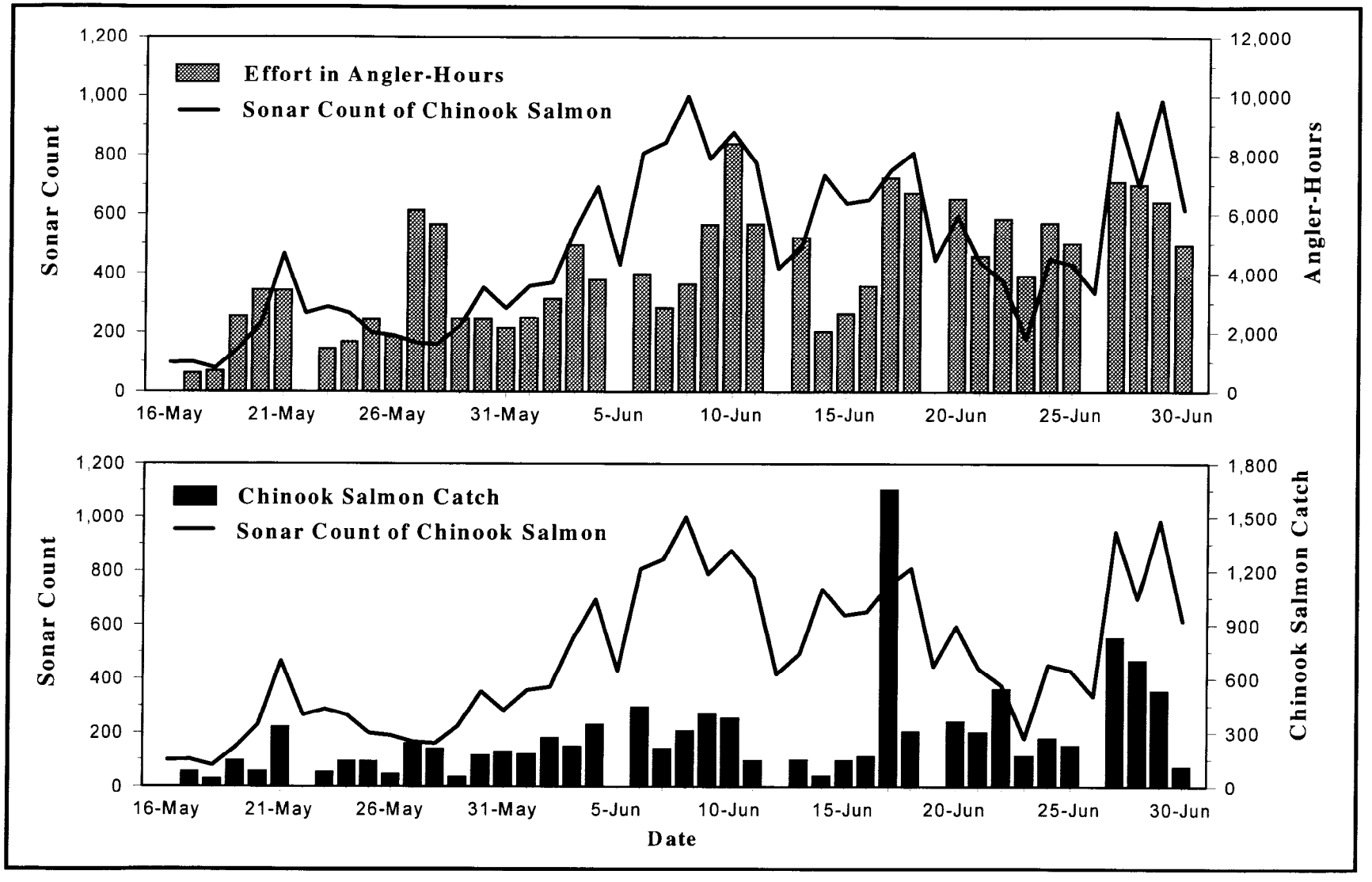

Figure 5.-Daily sonar counts of chinook salmon, recreational catch of chinook salmon (bottom) and angler effort (top) during the early run, Kenai River, 1995.

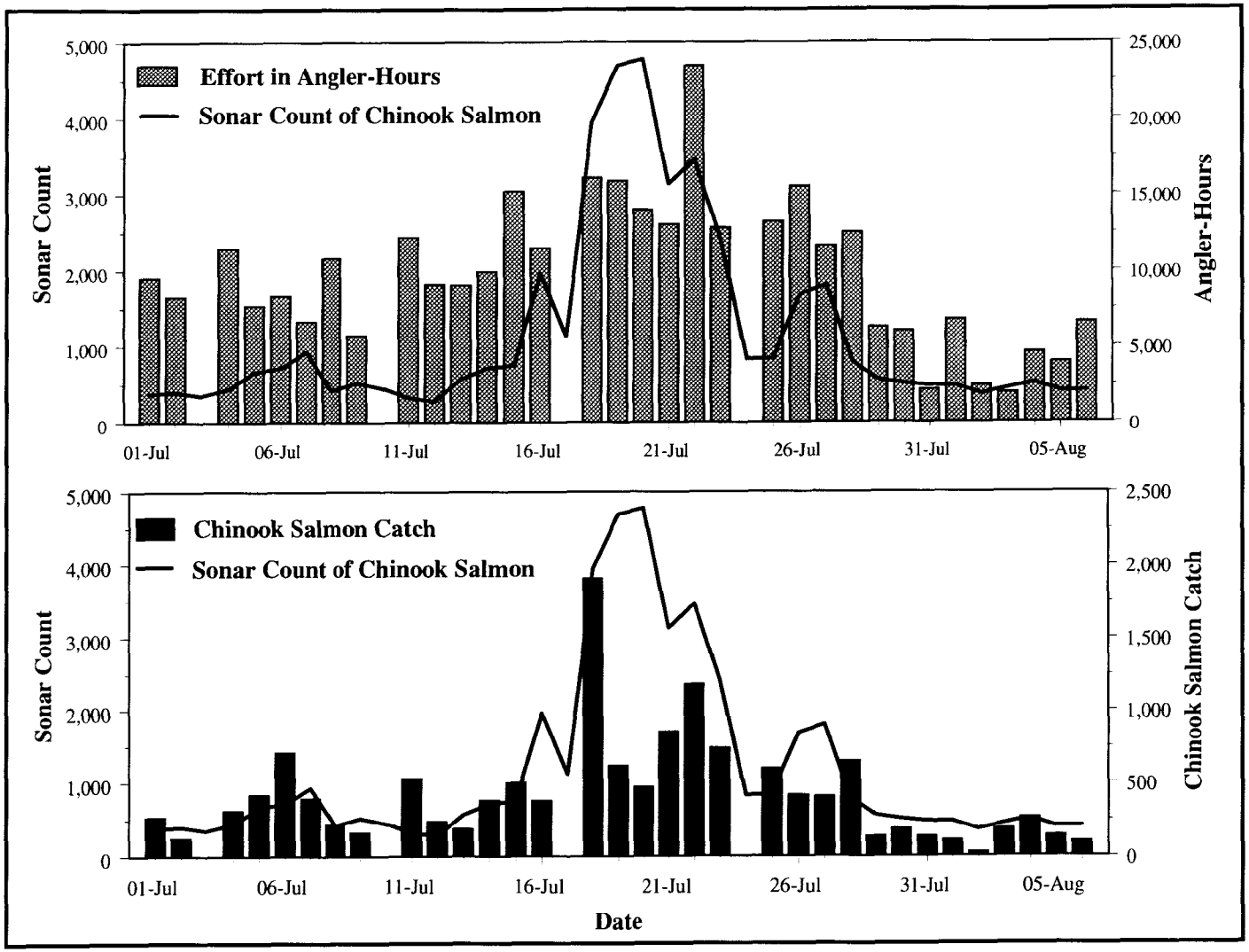

Figure 6.-Daily sonar counts of chinook salmon, recreational catch of chinook salmon (bottom) and angler effort (top) during the late run, Kenai River, 1995.

enumerated as part of the inriver return. This raises concerns by management as to the effectiveness of the management plans governing these fisheries. The creel survey design for the 1996 Kenai River chinook salmon fishery should be modified to provide an estimate of harvest downstream of the chinook salmon sonar counters.

In recent years observation has also indicated that there has been an increased effort in the fishery occurring upstream of the Soldotna Bridge. It would be prudent to design and implement an onsite 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.

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APPENDIX A. COUNTS OF BOAT ANGLERS DURING THE CREEL SURVEY OF THE FISHERY FOR CHINOOK SALMON ON THE KENAI RIVER, ALASKA, 1995

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, 1995.

Date	Day Type[a]	Unguided Anglers Period A	B	C	D	E	Guided Anglers Period A	B	C	D	E
17-May	Wd				13	15				10	8
18-May	Wd				10	17				31	4
19-May	Wd	34	63	36			56	60	37		
20-May	We	14	93	87	100	141	10	68	69	27	37
21-May	We	71	117	92	45	36	117	128	79	11	9
22-May	Wd			CLOSED					CLOSED		
23-May	Wd			25	33				59	4	
24-May	Wd	32	35		28	10	74	147		10	1
25-May	Wd	19	37				96	109			
26-May	Wd			70	40				76		7
27-May	We	74	79	111	332	138	106	102	85	129	36
28-May	We	7	162	231	296	116	3	149	126	92	20
29-May	We	61	159	118	107	40	8	109	25	40	13
30-May	Wd	65	78		64	75	92	98		19	24
31-May	Wd		46	11				94	33		
01-Jun	Wd	70			40	76	160	65			
02-Jun	Wd		97	95			146	103			
03-Jun	We	44	162	159	148	195	194	99			
04-Jun	We	168	179		80	82	161	74			
05-Jun	Wd			CLOSED					CLOSED		
06-Jun	Wd		91	83			193	168			
07-Jun	Wd	70	87	49	43	42	220	136			
08-Jun	Wd			94				163			
09-Jun	Wd		94	200			343	176			
10-Jun	We	168	265	291	292	214	262	146			
11-Jun	We	284	203	194	229	131	133	76			
12-Jun	Wd			CLOSED					CLOSED		
13-Jun	Wd		188	95			304	128			
14-Jun	Wd		59	52	37		77	95			
15-Jun	Wd	18	71	71		43	178	151			
16-Jun	Wd	104			55	72	182				
17-Jun	We[b]	291	327	317	270	251	296	167			
18-Jun	We	133	404	250	227	277	267	93			
19-Jun	Wd			CLOSED					CLOSED		
20-Jun	Wd		231		106		329	147			
21-Jun	Wd	104	144	171	110	196	220	173			
22-Jun	Wd		110	197			245	178			
23-Jun	Wd	91		69		54	255	87			
24-Jun	We	73	202	288	316	144	157	151			
25-Jun	We	195	237	224	142	71	169	144			
26-Jun	Wd			CLOSED					CLOSED		
27-Jun	Wd		207	159			426	245			
28-Jun	Wd	199	233		172		402	194			
29-Jun	Wd	214	159		184	170	389	149			
30-Jun	Wd		120	85		125	299	145			

[a] Wd = weekday, We = weekend

[b] The use of bait was permitted by emergency order 17-30 June.

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, 1995.

Date	Day Type[a]	Unguided Anglers Period A	B	C	D	E	Guided Anglers Period A	B	C	D	E
01-Jul	We	177	334	277	272	361	421	263			
02-Jul	We	370	447	423	458	469			CLOSED		
03-Jul	Wd			CLOSED					CLOSED		
04-Jul	We		403	210			464	386			
05-Jul	Wd	166	138		126	247	517	224			
06-Jul	Wd	119		174				324			
07-Jul	Wd		104	101	164	128	464	292			
08-Jul	We	261	269	326	354	239	456	382			
09-Jul	We	93	422	474	287	186			CLOSED		
10-Jul	Wd			CLOSED					CLOSED		
11-Jul	Wd	447	358	237		300	556	391			
12-Jul	Wd	299		225			444	224			
13-Jul	Wd		306	228	264	111	447	341			
14-Jul	Wd	476			255		380	255			
15-Jul	We	478	626	561	435	431	491	192			
16-Jul	We	348	828	411	590	486			CLOSED		
17-Jul	Wd			CLOSED					CLOSED		
18-Jul	Wd			445			631				
19-Jul	Wd		571	386	594	210	659	597			
20-Jul	Wd	457	586	457			604	193			
21-Jul	Wd		480	311	305		594	447			
22-Jul	We	647	708	875		607	704	629			
23-Jul	We	618	713	715	648	391			CLOSED		
24-Jul	Wd			CLOSED					CLOSED		
25-Jul	Wd			415	336	304	580	459			
26-Jul	Wd		465	428			574	515			
27-Jul	Wd	386	409		314	376	576	296			
28-Jul	Wd		324	321			510	369			
29-Jul	We	208	344	360	214	181	373	221			
30-Jul	We	379	557	432	263	153			CLOSED		
31-Jul	Wd[b]	38	43	54	58			63	56		
01-Aug	Wd[c]		133					290			
02-Aug	Wd	30	97	107	52		16	204	91	34	
03-Aug	Wd				83	31				55	5
04-Aug	Wd	136		155	75	118	169		161	43	7
05-Aug	We			187	76	129			162	42	21
06-Aug	We	162	237	269	93	73	172	141	132	96	45

[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, 1-6 August. No restrictions on hours which anglers could fish from guided vessel.

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, 1995

Appendix B1.-Daily sample size (n), effort, 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, 1995 (completed-trip interviews only).

Date	Wd/ We[a]	Effort (hours)			Harvest			Catch		
		n	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
17-May	Wd	25	3.2	0.32	0.24	0.087	0.075	0.36	0.098	0.113
18-May	Wd	11	4.8	0.71	0.27	0.141	0.057	0.55	0.157	0.113
19-May	Wd	15	4.8	0.42	0.00	0.000	0.000	0.13	0.091	0.028
20-May	We	50	4.0	0.37	0.10	0.043	0.025	0.12	0.046	0.030
21-May	We	62	4.4	0.31	0.16	0.047	0.037	0.32	0.064	0.074
23-May	Wd	24	3.9	0.44	0.29	0.095	0.074	0.38	0.118	0.095
24-May	Wd	37	3.6	0.33	0.08	0.045	0.022	0.14	0.057	0.037
25-May	Wd	14	6.0	0.41	0.07	0.071	0.012	0.21	0.114	0.036
26-May	Wd	60	3.6	0.33	0.08	0.036	0.023	0.10	0.046	0.028
27-May	We	121	4.6	0.19	0.08	0.025	0.018	0.09	0.026	0.020
28-May	We	121	4.0	0.16	0.12	0.030	0.031	0.16	0.037	0.040
29-May	We	98	4.2	0.18	0.08	0.028	0.019	0.11	0.032	0.027
30-May	Wd	20	3.6	0.28	0.20	0.092	0.056	0.20	0.092	0.056
31-May	Wd	30	4.0	0.31	0.10	0.056	0.025	0.33	0.088	0.084
1-Jun	Wd	29	3.1	0.34	0.24	0.081	0.077	0.24	0.081	0.077
2-Jun	Wd	51	3.5	0.32	0.20	0.056	0.056	0.25	0.068	0.073
3-Jun	We	94	4.5	0.24	0.10	0.031	0.021	0.17	0.039	0.038
4-Jun	We	109	3.6	0.19	0.23	0.040	0.063	0.29	0.044	0.081
6-Jun	Wd	28	3.5	0.38	0.25	0.083	0.071	0.43	0.108	0.121
7-Jun	Wd	35	3.2	0.24	0.37	0.083	0.117	0.51	0.111	0.162
9-Jun	Wd	79	4.5	0.29	0.06	0.028	0.014	0.14	0.047	0.031
10-Jun	We	110	4.6	0.23	0.09	0.028	0.020	0.15	0.035	0.033
11-Jun	We	137	4.2	0.15	0.09	0.024	0.021	0.11	0.029	0.026
13-Jun	Wd	25	4.4	0.41	0.08	0.055	0.018	0.08	0.055	0.018
14-Jun	Wd	19	3.6	0.68	0.16	0.086	0.044	0.21	0.096	0.059
15-Jun	Wd	40	2.9	0.18	0.10	0.048	0.034	0.13	0.053	0.043
16-Jun	Wd	64	4.0	0.23	0.09	0.037	0.024	0.17	0.061	0.043
17-Jun	We	107	3.4	0.17	0.30	0.044	0.088	0.50	0.069	0.148
18-Jun	We	153	4.2	0.17	0.11	0.025	0.027	0.18	0.031	0.042
20-Jun	Wd	22	6.1	0.91	0.09	0.063	0.015	0.09	0.063	0.015
21-Jun	Wd	43	2.8	0.13	0.05	0.032	0.016	0.14	0.053	0.049
22-Jun	Wd	30	3.3	0.26	0.13	0.063	0.040	0.20	0.074	0.061
23-Jun	Wd	26	3.6	0.28	0.00	0.000	0.000	0.00	0.000	0.000
24-Jun	We	73	4.0	0.32	0.04	0.023	0.010	0.15	0.042	0.037
25-Jun	We	91	4.1	0.20	0.07	0.026	0.016	0.12	0.038	0.029
27-Jun	Wd	57	4.7	0.27	0.26	0.059	0.056	0.53	0.091	0.112
28-Jun	Wd	72	4.7	0.23	0.15	0.043	0.032	0.28	0.057	0.059
29-Jun	Wd	96	3.9	0.21	0.13	0.034	0.032	0.14	0.035	0.034
30-Jun	Wd	23	3.8	0.48	0.09	0.060	0.023	0.09	0.060	0.023

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

Appendix B2.-Daily sample size (n), effort, 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, 1995 (completed-trip interviews only).

Date	Wd/ We[a]	Effort (hours)			Harvest			Catch		
		n	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
17-May	Wd	6	2.4	0.42	0.33	0.211	0.138	0.33	0.211	0.138
18-May	Wd	6	5.0	0.32	0.17	0.167	0.033	0.17	0.167	0.033
19-May	Wd	6	4.8	0.90	0.17	0.167	0.035	0.33	0.211	0.070
20-May	We	12	6.5	0.78	0.00	0.000	0.000	0.08	0.083	0.013
21-May	We	12	5.3	0.97	0.50	0.151	0.095	0.58	0.149	0.111
23-May	Wd	16	8.1	0.78	0.00	0.000	0.000	0.13	0.125	0.015
24-May	Wd	31	4.5	0.49	0.26	0.080	0.057	0.42	0.101	0.093
25-May	Wd	33	4.8	0.46	0.30	0.081	0.063	0.30	0.081	0.063
26-May	Wd	32	4.7	0.36	0.16	0.065	0.033	0.22	0.074	0.046
27-May	We	42	5.2	0.28	0.26	0.069	0.051	0.33	0.081	0.064
28-May	We	33	5.3	0.32	0.15	0.063	0.029	0.15	0.063	0.029
29-May	We	3	2.8	0.83	0.00	0.000	0.000	0.00	0.000	0.000
30-May	Wd	25	4.8	0.37	0.28	0.092	0.059	0.40	0.100	0.084
31-May	Wd	30	5.1	0.36	0.37	0.089	0.071	0.47	0.104	0.091
1-Jun	Wd	5	6.2	1.86	0.40	0.245	0.065	0.40	0.245	0.065
2-Jun	Wd	26	4.0	0.28	0.38	0.097	0.097	0.38	0.097	0.097
3-Jun	We	28	5.2	0.44	0.21	0.079	0.041	0.29	0.087	0.055
4-Jun	We	18	3.8	0.40	0.33	0.114	0.089	0.39	0.118	0.104
6-Jun	Wd	14	5.0	0.47	0.50	0.139	0.101	0.50	0.139	0.101
7-Jun	Wd	25	5.1	0.31	0.20	0.082	0.039	0.24	0.087	0.047
9-Jun	Wd	65	4.4	0.26	0.34	0.059	0.077	0.43	0.082	0.098
10-Jun	We	56	5.0	0.33	0.29	0.061	0.057	0.36	0.065	0.072
11-Jun	We	17	5.4	0.44	0.12	0.081	0.022	0.12	0.081	0.022
13-Jun	Wd	74	5.4	0.17	0.14	0.040	0.025	0.20	0.047	0.037
14-Jun	Wd	11	4.9	0.46	0.00	0.000	0.000	0.00	0.000	0.000
15-Jun	Wd	19	4.7	0.53	0.26	0.104	0.056	0.26	0.104	0.056
16-Jun	Wd	31	4.7	0.30	0.16	0.067	0.034	0.23	0.076	0.048
17-Jun	We	63	2.9	0.27	0.79	0.051	0.273	1.24	0.115	0.426
18-Jun	We	18	5.4	0.54	0.22	0.101	0.041	0.28	0.109	0.051
20-Jun	Wd	21	4.5	0.46	0.38	0.109	0.085	0.52	0.131	0.116
21-Jun	Wd	56	5.4	0.37	0.30	0.062	0.056	0.43	0.071	0.079
22-Jun	Wd	66	4.9	0.24	0.45	0.062	0.092	0.65	0.079	0.132
23-Jun	Wd	23	4.6	0.38	0.17	0.081	0.038	0.35	0.102	0.076
24-Jun	We	33	6.2	0.44	0.30	0.081	0.049	0.39	0.086	0.064
25-Jun	We	40	5.1	0.28	0.33	0.075	0.063	0.35	0.084	0.068
27-Jun	Wd	35	5.6	0.15	0.40	0.084	0.072	0.66	0.116	0.118
28-Jun	Wd	47	5.9	0.35	0.43	0.073	0.072	0.83	0.205	0.140
29-Jun	Wd	74	4.7	0.30	0.34	0.055	0.072	0.61	0.094	0.130
30-Jun	Wd	20	5.0	0.36	0.10	0.069	0.020	0.10	0.069	0.020

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

Appendix B3.-Daily sample size (n), effort, harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for unguided anglers interviewed during the fishery for late-run chinook salmon in the downstream section of the Kenai River, 1995 (completed-trip interviews only).

Date	Wd/ We[a]	Effort (hours)			Harvest			Catch		
		n	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
1-Jul	We	108	5.6	0.25	0.05	0.020	0.008	0.10	0.032	0.018
2-Jul	We	154	4.9	0.22	0.05	0.017	0.009	0.07	0.023	0.015
4-Jul	We	43	7.9	0.87	0.07	0.039	0.009	0.12	0.049	0.015
5-Jul	Wd	95	4.0	0.18	0.14	0.035	0.034	0.29	0.060	0.073
6-Jul	Wd	22	4.3	0.33	0.05	0.045	0.011	0.27	0.117	0.063
7-Jul	Wd	91	3.6	0.21	0.09	0.030	0.024	0.11	0.033	0.030
8-Jul	We	141	5.2	0.19	0.08	0.023	0.015	0.08	0.023	0.015
9-Jul	We	214	4.8	0.15	0.10	0.020	0.020	0.14	0.024	0.028
11-Jul	Wd	204	5.1	0.17	0.07	0.018	0.014	0.16	0.030	0.032
12-Jul	Wd	60	4.3	0.45	0.10	0.039	0.023	0.12	0.042	0.027
13-Jul	Wd	181	4.5	0.16	0.06	0.017	0.012	0.07	0.019	0.015
14-Jul	Wd	80	4.2	0.19	0.10	0.034	0.024	0.13	0.037	0.030
15-Jul	We	186	4.9	0.18	0.09	0.021	0.019	0.13	0.025	0.026
16-Jul	We	188	4.4	0.17	0.11	0.023	0.024	0.14	0.027	0.033
18-Jul	Wd	146	4.9	0.29	0.19	0.033	0.039	0.30	0.042	0.061
19-Jul	Wd	201	4.4	0.18	0.13	0.024	0.031	0.17	0.029	0.040
20-Jul	Wd	62	3.7	0.20	0.11	0.041	0.030	0.11	0.041	0.030
21-Jul	Wd	117	4.2	0.21	0.18	0.036	0.042	0.28	0.048	0.067
22-Jul	We	229	4.4	0.16	0.17	0.025	0.038	0.21	0.029	0.047
23-Jul	We	130	4.4	0.26	0.18	0.034	0.040	0.25	0.045	0.058
25-Jul	Wd	105	5.2	0.29	0.13	0.033	0.026	0.24	0.046	0.046
26-Jul	Wd	21	3.9	0.44	0.05	0.048	0.012	0.10	0.066	0.025
27-Jul	Wd	126	4.7	0.24	0.13	0.031	0.029	0.17	0.036	0.037
28-Jul	Wd	56	5.0	0.26	0.25	0.058	0.050	0.29	0.061	0.057
29-Jul	We	92	4.1	0.24	0.07	0.026	0.016	0.09	0.030	0.021
30-Jul	We	129	4.2	0.13	0.05	0.019	0.011	0.13	0.034	0.031
31-Jul	Wd	19	3.4	0.37	0.11	0.072	0.031	0.16	0.086	0.046
1-Aug	Wd	36	4.5	0.30	0.06	0.039	0.012	0.06	0.039	0.012
2-Aug	Wd	26	5.9	0.47	0.08	0.053	0.013	0.08	0.053	0.013
3-Aug	Wd	24	5.4	0.93	0.08	0.058	0.015	0.08	0.058	0.015
4-Aug	Wd	52	5.0	0.33	0.10	0.041	0.019	0.13	0.048	0.027
5-Aug	We	92	4.1	0.22	0.09	0.030	0.021	0.09	0.030	0.021
6-Aug	We	44	4.4	0.24	0.02	0.023	0.005	0.02	0.023	0.005

Appendix B4.-Daily sample size (n), effort, 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, 1995 (completed-trip interviews only).

Date	Wd/ We[a]	Effort (hours)			Harvest			Catch		
		n	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
1-Jul	We	34	5.8	0.36	0.24	0.074	0.040	0.29	0.090	0.051
4-Jul	We	32	6.1	0.43	0.19	0.070	0.031	0.31	0.105	0.052
5-Jul	Wd	58	5.9	0.33	0.19	0.052	0.032	0.31	0.075	0.052
6-Jul	Wd	19	4.7	0.50	0.42	0.116	0.089	0.63	0.137	0.133
7-Jul	Wd	93	4.7	0.18	0.31	0.048	0.066	0.43	0.054	0.091
8-Jul	We	86	6.8	0.34	0.15	0.039	0.022	0.22	0.048	0.032
11-Jul	Wd	92	5.4	0.15	0.24	0.045	0.044	0.38	0.055	0.070
12-Jul	Wd	31	5.1	0.24	0.16	0.067	0.031	0.16	0.067	0.031
13-Jul	Wd	160	6.3	0.21	0.16	0.029	0.026	0.20	0.032	0.032
14-Jul	Wd	23	4.7	0.46	0.26	0.094	0.056	0.30	0.098	0.065
15-Jul	We	95	5.2	0.21	0.32	0.048	0.061	0.34	0.051	0.065
18-Jul	Wd	32	4.1	0.35	0.63	0.087	0.152	0.94	0.134	0.227
19-Jul	Wd	114	5.0	0.17	0.18	0.036	0.037	0.24	0.042	0.047
20-Jul	Wd	95	5.0	0.16	0.23	0.044	0.047	0.26	0.048	0.053
21-Jul	Wd	119	5.5	0.23	0.30	0.042	0.055	0.44	0.050	0.079
22-Jul	We	104	5.1	0.17	0.33	0.046	0.064	0.37	0.047	0.071
25-Jul	Wd	71	5.6	0.23	0.25	0.052	0.045	0.31	0.059	0.055
26-Jul	Wd	57	6.3	0.40	0.19	0.053	0.031	0.23	0.066	0.036
27-Jul	Wd	99	5.6	0.23	0.18	0.039	0.032	0.22	0.042	0.040
28-Jul	Wd	28	5.1	0.36	0.29	0.087	0.056	0.29	0.087	0.056
29-Jul	We	78	5.3	0.21	0.12	0.036	0.022	0.14	0.040	0.027
31-Jul	Wd	17	4.9	0.53	0.29	0.114	0.060	0.29	0.114	0.060
1-Aug	Wd	32	5.8	0.21	0.06	0.043	0.011	0.13	0.059	0.022
2-Aug	Wd	28	7.4	0.65	0.07	0.050	0.010	0.07	0.050	0.010
3-Aug	Wd	3	2.5	1.00	0.67	0.333	0.267	0.67	0.333	0.267
4-Aug	Wd	12	4.9	0.56	0.42	0.149	0.085	0.58	0.149	0.120
5-Aug	We	26	4.8	0.34	0.15	0.072	0.032	0.35	0.110	0.072
6-Aug	We	18	6.4	0.53	0.22	0.101	0.035	0.22	0.101	0.035

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