FISHERY DATA SERIES NO. 50

ANGLER EFFORT AND HARVEST OF CHINOOK SALMON *Oncorhynchus tshawytscha* AND COHO SALMON *O. kisutch* BY THE RECREATIONAL FISHERIES IN THE LOWER KENAI RIVER, 1987[1]

By

S. L. Hammarstrom

Alaska Department of Fish and Game
Division of Sport Fish
Juneau, Alaska 99802

March 1988

[1] This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-3, Job No. S-32-1

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF APPENDICES

LIST OF APPENDICES (Continued)

ABSTRACT

A creel survey was conducted on the Kenai River between the outlet of Skilak Lake and Cook Inlet from 16 May through 30 September 1987. The recreational fishery in this section of the Kenai River is directed primarily for two species, chinook salmon *Oncorhynchus tshawytscha* during June and July, and coho salmon *O. kisutch* during August and September. The estimated angler effort and harvest during the early (May and June) chinook salmon run were 216,815 angler-hours and 13,281 chinook salmon, respectively. The estimated angler effort and harvest during the late (July) chinook salmon run were 310,840 angler-hours and 12,237 chinook salmon, respectively. Unguided anglers exerted 74.4 percent of the total effort and took 52.0 percent of the chinook salmon harvest while guided anglers exerted 25.6 percent of the effort and harvested 48.0 percent of the chinook salmon.

The estimated angler effort and harvest during the coho salmon fishery (August and September) were 199,891 angler-hours and 24,918 coho salmon, respectively. Unguided anglers exerted 82.4 percent of the total effort and took 74.1 percent of the coho salmon harvest while guided anglers exerted 17.6 percent of the effort and harvested 25.9 percent of the coho salmon.

Harvest and catch estimates for sockeye salmon *O. nerka*, rainbow trout *Salmo gairdneri*, and Dolly Varden char *Salvelinus malma* are presented, also.

KEY WORDS: Kenai River, chinook salmon, coho salmon, creel survey, effort, harvest.

INTRODUCTION

The largest freshwater recreational fishery in Alaska occurs in the Kenai River which received more than 320,000 angler-days of effort in both 1985 and 1986 (Mills 1986, 1987). 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 two major fisheries: (1) a fishery directed primarily at returning chinook salmon *Oncorhynchus tshawytscha* during May, June, and July; and (2) a fishery directed primarily at returning coho salmon *O. kisutch* during August and September. Angler effort in both fisheries has generally been increasing since creel surveys for these fisheries were begun in 1977 (Figure 2). Sockeye salmon *O. nerka*, pink salmon *O. gorbuscha*, Dolly Varden char *Salvelinus malma*, and rainbow trout *Salmo gairdneri* are also harvested by anglers in the Kenai River.

Prior to 1970, the recreational fishery in the Kenai River was confined to 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 which 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 very effective for chinook salmon on the Kenai River and the fishery began to expand rapidly.

The chinook salmon return to the Kenai River has two distinct components: (1) an early run which typically enters the river from mid-May until late June; and (2) 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 for a sport-caught chinook salmon was caught in the Kenai River in 1985; it weighed 44.1 kg (97 lbs). The separation date between the early run and late run varies annually and is determined by inspecting graphs of daily catch per unit effort (CPUE) for recreational anglers and for drift gillnets used in a chinook salmon mark-recapture study (Conrad in preparation). There is usually a low point on the two CPUE curves which is used to separate the runs. The two runs are not discrete units, however; as the number of early-run fish entering the Kenai River declines, the number of late-run fish increases. The degree of overlap is not estimated at this time.

The coho salmon return to the Kenai River has two distinct components, also: (1) an early run which typically peaks in August; and (2) a late run which typically peaks in September. The late run continues to enter the river into November but fishing effort after September is minimal.

Management of these recreational fisheries in the Kenai River is complicated by the relatively large commercial harvests of returning chinook and coho salmon. Chinook salmon are harvested primarily by the set net fishery along the eastern shore of Cook Inlet (McBride et al. 1985) and coho salmon are harvested primarily by the drift gill net fishery. User-group conflicts have necessitated that the Department of Fish and Game conduct increasingly precise management of the salmon resources of the Kenai River.

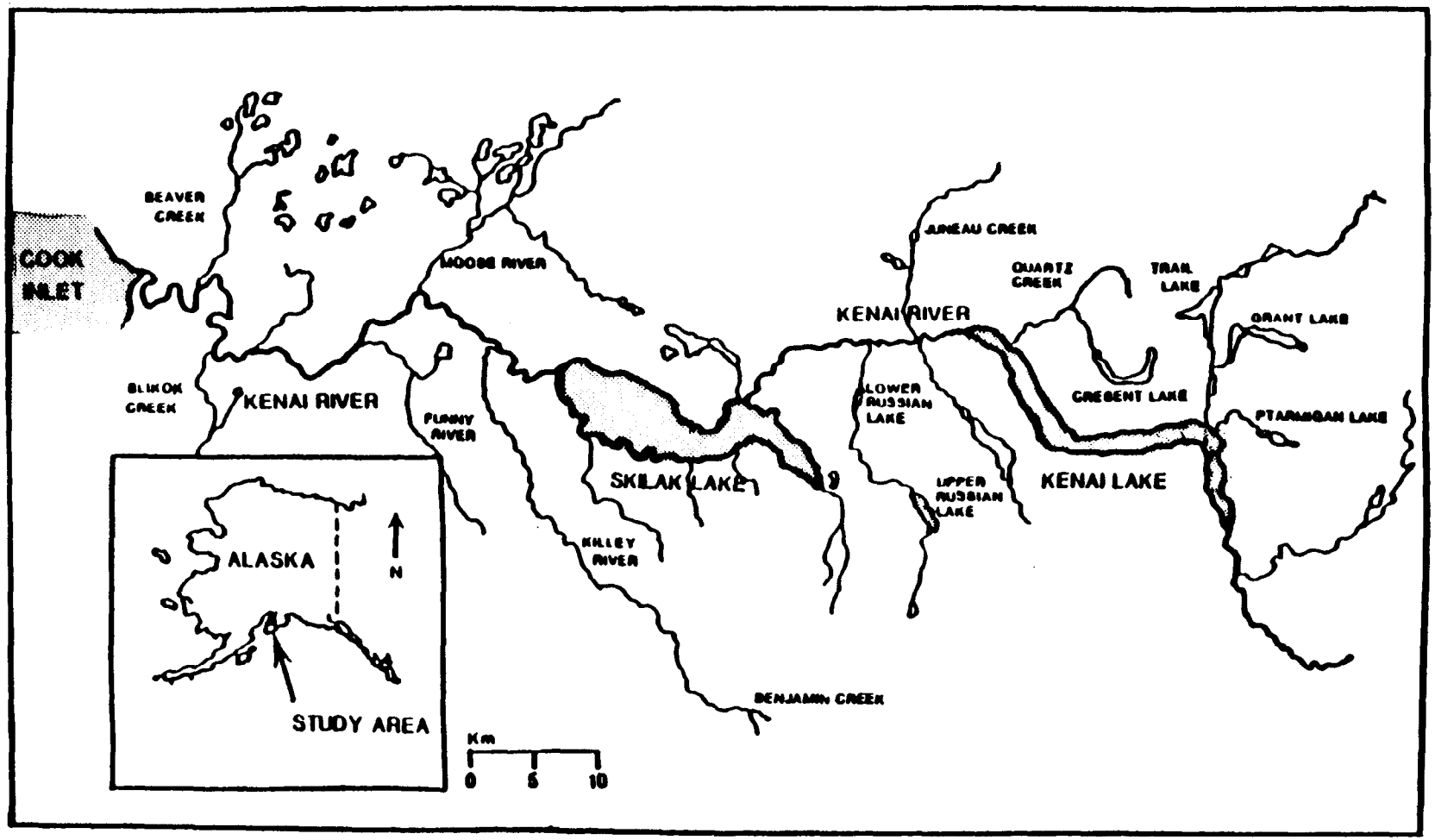

Figure 1. The Kenai River system.

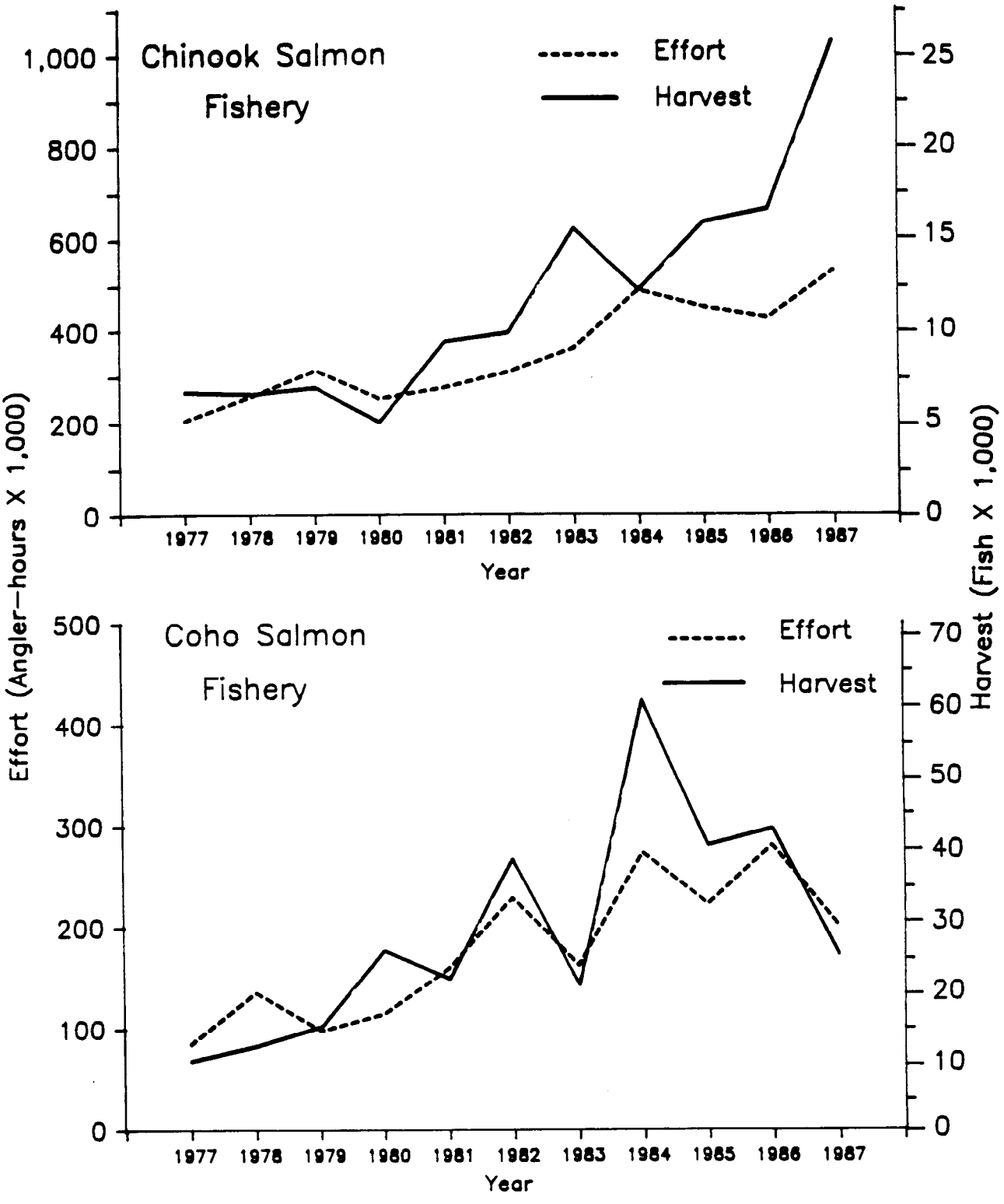

Figure 2. Estimated effort and harvest by the recreational fisheries for chinook and coho salmon in the Kenai River, 1977-1987.

The extreme popularity of the fishery resources of the Kenai River has increased the emphasis on habitat protection in the river. In 1984, the Alaska State Legislature created the Kenai River Special Management Area which placed the water column and state lands adjacent to the Kenai River into the state park system under the direction of the Department of Natural Resources, Division of Parks and Outdoor Recreation.

Previous information pertaining to the chinook and coho salmon fisheries in the Kenai River has been presented by Hammarstrom (1975-1981), 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 has been estimated by Mills (1978, 1980-1987) in the Alaska Statewide Harvest Survey.

The current creel survey program in the Kenai River provides data which: (1) are used as a basis for in-season management decisions for the recreational fishery; (2) are evaluated to refine long-term management objectives; and (3) are used by the Alaska Board of Fisheries to allocate the salmon resources. The objective of this report is to present detailed information for the creel surveys of the recreational fisheries for chinook salmon and coho salmon conducted in 1987.

Fishing Regulations

The regulations for the chinook salmon fishery in the Kenai River are the most restrictive in Alaska. Only the section of the river between the outlet of Skilak Lake and Cook Inlet is open to fishing for chinook salmon. By regulation the season for chinook salmon is from 1 January through 31 July, but it effectively begins in mid-May when the fish first begin entering the river. The daily bag and possession limits are one chinook salmon per day greater than 41 cm (16 in) in length and a seasonal limit of two chinook salmon greater than 41 cm. In 1987, fishing from boats below 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 is 41 cm in length or greater is prohibited from fishing from a boat in the Kenai River for the remainder of that day.

There are further restrictions for guided anglers. In addition to the closure to fishing from boats on Mondays, fishing from a registered guide vessel on any Sunday in July is prohibited. In 1987, fishing from a guided boat was allowed only between 0600 and 1800 hours during June and between 0700 and 1900 hours during July. There are no days or hours closed to boat fishing for either unguided or guided anglers during the remainder of the year.

The daily bag and possession limits for other salmon species are an aggregate of three fish that are 41 cm in length or greater, and there is no annual limit. The daily bag and possession limits for rainbow trout are two fish, only one of which may be over 51 cm (20 in) in length, and there is an annual limit of two fish over 51 cm. The daily bag and possession limits for Dolly Varden char are five fish.

METHODS

A roving creel survey (Neuhold and Lu 1957) was used to estimate sport fishing effort, in units of angler-hours, by the fisheries for chinook and coho salmon in the Kenai River. Harvest per unit effort (HPUE, number of fish harvested per hour fished) for each species was estimated from angler interviews. Harvest of each species was estimated by the product of the effort and harvest rate estimates. Angler effort was estimated for three sections of the Kenai River below Skilak Lake (Figure 3): (1) downstream, from Cook Inlet to the Soldotna Bridge; (2) midstream, from the Soldotna bridge to Naptowne Rapids; and (3) upstream, from Naptowne Rapids to the outlet of Skilak Lake. Effort and harvest were estimated separately for the early and late run components of the fisheries for chinook and coho salmon.

Both unguided and guided anglers participate in the fisheries for chinook and coho salmon in the Kenai River. These two groups have very different harvest rates; therefore, effort, HPUE, and harvest were estimated separately for unguided anglers and guided anglers. Guided anglers fish strictly from boats and are easily recognized because guided boats are required to display a large identifying decal. Only boat anglers were surveyed during the chinook salmon fishery because shore anglers harvest very few chinook salmon. During the coho salmon fishery, both boat and shore anglers were surveyed.

Creel Survey of the Chinook Salmon Fishery

The creel surveys of the chinook salmon fishery began on 16 May in the downstream section and on 2 June in the upstream section and continued until the end of the chinook salmon season on 31 July. The fishing day for unguided anglers was defined as 20 hours long, from 0400 to 2400 hours, and was stratified into five, 4-hour daily time strata (referred to as periods). The periods were: A from 0400 to 0759; B from 0800 to 1159; C from 1200 to 1559; D from 1600 to 1959; and E from 2000 to 2359. In May, the fishing day for guided anglers was the same as that for unguided anglers. Since most guides schedule two trips per day, one in the morning and one in the afternoon, the fishing day of guided anglers in June and July was stratified into only two periods: A, from 0600 to 1159 in June and from 0700 to 1259 in July; and B, from 1200 to 1759 in June and from 1300 to 1859 in July.

Estimates for unguided anglers are stratified further by weekdays and weekends/holidays. Estimates for guided anglers are not similarly stratified because this does not significantly reduce the variance of the effort estimates (Conrad and Hammarstrom 1987).

Angler Counts:

A modification of a stratified random sample design was used to count anglers in the upstream and downstream sections of the river; no anglers were counted in the midstream section. The modification incorporated a lattice sample design into that of a simple stratified random sample. The purpose of the lattice design was to ensure that angler counts were never

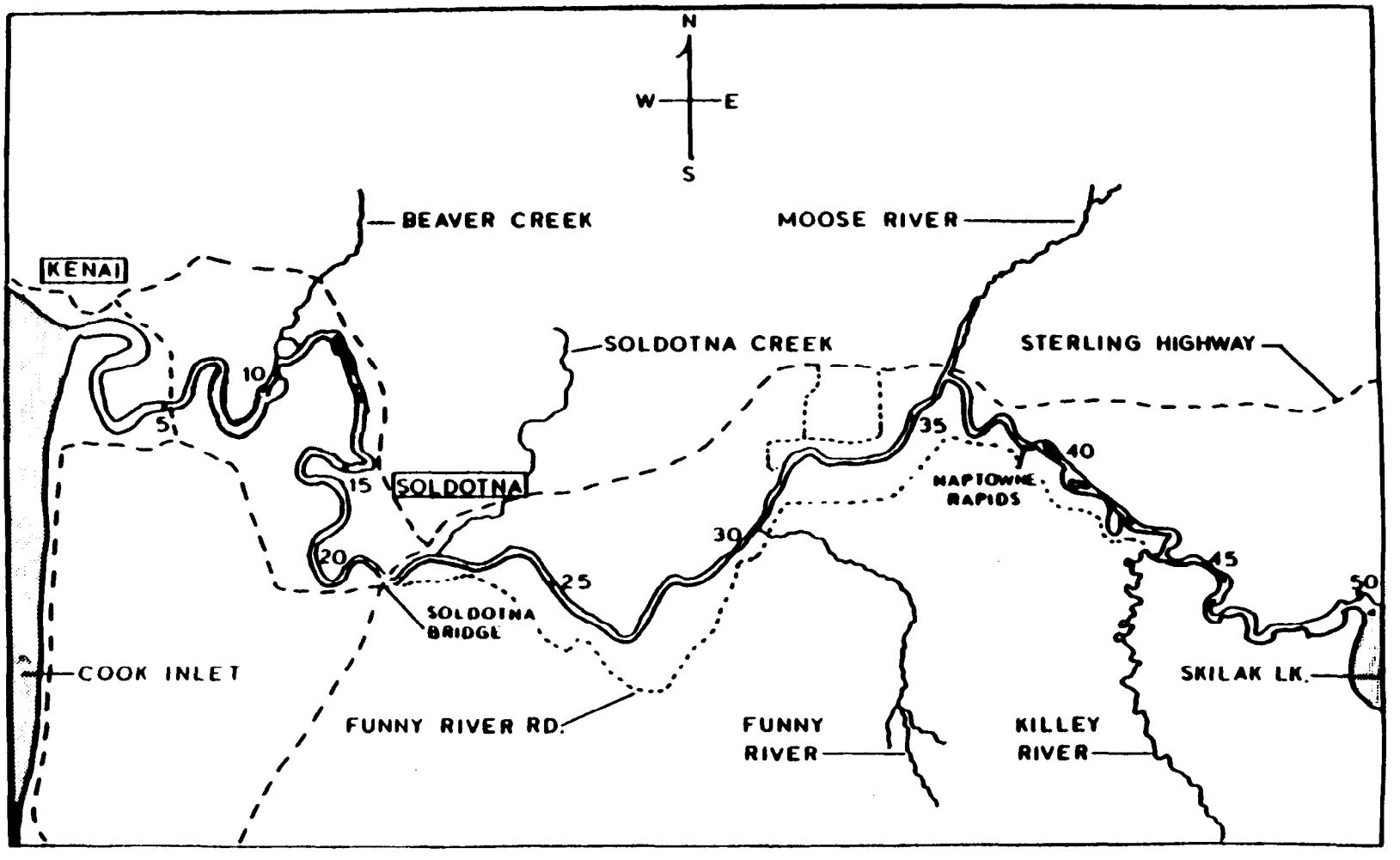

Figure 3. The lower Kenai River between Cook Inlet and the outlet of Skilak Lake.

conducted in two consecutive periods during the same day and in the same period on 2 consecutive days for the weekday component of the survey of unguided anglers. This modification was designed to minimize the autocorrelation between counts.

Separate sampling schedules were established for the downstream and upstream sections of the river. Sampling levels were determined by the amount of creel survey clerk time available. The creel survey in the downstream section was designed for two creel survey clerks each working 37.5 hours per week. The creel survey in the upstream section was designed for one creel survey clerk working 37.5 hours per week.

Counts of anglers were conducted from boats only in the downstream and upstream sections of the Kenai River. At the time designated on the schedule, a creel survey clerk was at a randomly selected end of the section of the river to be surveyed. The angler count was made while the boat was driven 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 creel survey clerk recorded the following: (1) number of boats without guides; (2) number of boats with guides; (3) number of anglers in boats without guides; (4) number of anglers in boats with guides; and (5) number of shore anglers. People were considered to be fishing from boats only if their boat was not tied to shore, and fishing gear could be seen regardless of whether or not their line was in the water when the count was being conducted. Guides were not included in the counts during the chinook salmon fishery as they are prohibited from fishing while guiding.

Downstream Section. There were two possible sampling patterns for the counts of unguided anglers during weekdays (Figure 4), one of which was randomly selected each week. Within a period (A, B, C, etc.) to be sampled, a starting time for the angler count was randomly selected from the four whole-hour times (for example, 0400, 0500, 0600, or 0700 for period A) in the period. For unguided anglers during weekend/holidays, an angler count was made during each period of each day. During weekend/ holidays, a starting time was randomly selected for the count in period A and counts in all subsequent periods began 4 hours after the starting time of the previous count. This modification was designed to minimize the autocorrelation between angler counts conducted on the same day.

One count of guided anglers was made during each of the two daily periods defined for guided anglers on each day the fishery was open to guided anglers. The counting schedule for guided anglers was established by overlaying the schedule for unguided anglers and randomly selecting a count time for those periods of the guided angler day when a count of unguided anglers was not being conducted.

Upstream Section. Angler counts were scheduled for each weekend/holiday day and on 3 randomly selected weekdays each week in the upstream section. On a sample day, two periods (A, B, C, etc.) were randomly selected without replacement and a starting time for the angler count designated as

DAY	PERIOD A	B	C	D	E
TUE		0800 0900 1000 1100		1600 1700 1800 1900	Possible starting times for angler counts
WED	0400 0500 0600 0700		1200 1300 1400 1500		2000 2100 2200 2300
THU		0800 0900 1000 1100		1600 1700 1800 1900	
FRI	0400 0500 0600 0700		1200 1300 1400 1500		2000 2100 2200 2300
TUE	0400 0500 0600 0700		1200 1300 1400 1500		2000 2100 2200 2300
WED		0800 0900 1000 1100		1600 1700 1800 1900	
THU	0400 0500 0600 0700		1200 1300 1400 1500		2000 2100 2200 2300
FRI		0800 0900 1000 1100		1600 1700 1800 1900	

Figure 4. The two possible lattice sampling patterns for counts of unguided anglers during weekdays of the Kenai River chinook salmon fishery, 1987.

described for the creel survey of unguided anglers during weekdays in the downstream section.

Midstream Section. Three aerial surveys of the river between Skilak Lake and Cook Inlet were scheduled each week, one on a weekend and two during weekdays. During the flight, a count of each party (boat) actively engaged in fishing was recorded for each section of the river. The boat counts were used to estimate the proportion of fishing effort occurring in the midstream section of the river.

Angler Interviews:

Interviews of anglers for harvest and catch rate information were conducted primarily at seven popular boat landings in the downstream section and two landings in the upstream section. Additional angler interviews were conducted at locations other than these, but at a much lower intensity, by the two survey clerks responsible for the angler counts.

Two creel survey clerks conducted the interviews at the boat landings. Each clerk was scheduled to work 5 days each week, on each weekend/holiday day and on 3 randomly selected weekdays. Two randomly selected landings were sampled 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) or a late shift (possible start times: 1500, 1530, 1600, or 1630). 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.

Anglers not using the seven primary landings were sampled by the two clerks conducting the angler counts. When these clerks were not conducting a count, they contacted completed-trip anglers who were docking at locations other than the seven primary landings.

The following information was recorded for each angler interviewed: (1) completed-trip or incomplete-trip angler; (2) guided or unguided angler; (3) number of hours spent fishing; (4) number and species of fish retained; (5) number and species of fish released; and (6) docking location (whether at a primary landing or other site). Additional information regarding the presence of tags was also recorded as part of the recovery effort in the project to estimate the escapement of chinook salmon into the Kenai River (Conrad in preparation).

Chinook salmon observed in anglers' creels during the surveys were randomly selected for biological sampling. Mid-eye to fork-of-tail length was measured to the nearest 1/2 centimeter, the sex of the fish was identified, and scales were removed from the preferred area (Clutter and Whitesel 1956). Three scales were collected from each fish and placed on an adhesive-coated card. Impressions of scale cards were made on acetate and scale images were examined using a microfiche reader.

Creel Survey of the Coho Salmon Fishery

The coho salmon creel survey began on 1 August and ended on 30 September in both the downstream and upstream sections of the river. The survey was conducted similarly to the creel survey of the chinook salmon fishery in the upstream section with the following exceptions. The fishing day was reduced to 16 hours in August (from 0600 to 2200) and 12 hours in September (from 0800 to 2000) to account for the decreased number of daylight hours. Daily time strata were adjusted for the coho salmon fishery by eliminating period E in August and shifting the starting time of period A to 0600 and, in September, eliminating period D and shifting the starting time of period A to 0800. The fishing day was the same for both unguided and guided anglers during the creel survey of the coho salmon fishery. The weekday and weekend/holiday stratification was used for both unguided and guided anglers, also. Shore anglers as well as boat anglers were interviewed during the coho salmon creel survey and both completed-trip and incomplete-trip anglers were interviewed.

Angler Counts:

Separate angler count schedules were established for the downstream and upstream sections of the river. Sampling levels were determined by the amount of creel survey clerk time available. Both creel surveys were designed for one creel survey clerk working 37.5 hours per week.

Angler counts were scheduled for each weekend/holiday day and on 3 randomly selected weekdays each week in both the downstream and upstream sections. Two angler counts were scheduled on each sample day. Sample periods and count times were selected as described for the creel survey of the chinook salmon fishery in the upstream section.

Angler counts were conducted following the procedures described for the counts during the chinook salmon fishery. One exception was that guides were included in the count of guided anglers as they are permitted to fish after 31 July.

Effort in the midstream section of the river was not estimated during the creel survey of the coho salmon fishery.

Angler Interviews:

Angler interviews were conducted following the procedures described for the creel survey of the chinook salmon fishery except that during August and September both shore and boat anglers were interviewed by the creel survey clerks. All interviews were collected by the survey clerks conducting the angler counts; there were no clerks stationed at boat landings as during the creel survey of the chinook salmon fishery.

Biological samples for coho salmon (scales, sex, and length) were collected identically to those for the chinook salmon survey.

Data Analyses

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

There were seven components to the chinook salmon fishery in the downstream section of the Kenai River, four in the early run and three in the late run. The early run components were: (1) unguided anglers weekdays; (2) unguided anglers weekends/holidays; (3) guided anglers in May; and (4) guided anglers in June. Effort for guided anglers had to be estimated separately for May and June because of the change in the length of the guided angler day from 20 hours to 12 hours on 1 June. The components to the late run of the downstream section were: (1) unguided anglers weekdays; (2) unguided anglers weekends/holidays; and (3) guided anglers.

There were seven components to the chinook salmon fishery in the upstream section of the Kenai River, four in the early run and three in the late run. The early run components were: (1) unguided anglers weekdays; (2) unguided anglers weekends/holidays; (3) guided anglers in June; and (4) guided anglers in July. Effort for guided anglers had to be estimated separately for June and July because of the change in the starting time of the guided angler day from 0600 to 0700 on 1 July. The components to the late run of the upstream section were: (1) unguided anglers weekdays; (2) unguided anglers weekends; and (3) guided anglers.

There were eight fishery components to the downstream and upstream sections during the coho salmon fishery. The early and late runs in each section had the same four components: (1) unguided anglers weekdays; (2) unguided anglers weekends/holidays; (3) guided anglers weekdays; and (4) guided anglers weekends/holidays.

Effort:

The number of angler-hours of effort during fishery component t was estimated as follows (Neuhold and Lu 1957):

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

where:

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

H_{tj} = the number of hours of possible fishing time during period j of component t, and

s = the number of periods (A, B, C, etc.) in component t.

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

$$V(\hat{E}_t) = \sum_{j=1}^{s} H_{tj}^2 \, (s_{tj}^2/n_{tj}), \qquad [2]$$

where:

s_{tj}^2 = the sample variance of x_{tj}, and

n_{tj} = the number of angler counts during period j of component t.

The finite population correction factor is not applied as angler counts are considered instantaneous.

Harvest Rates:

Mean effort and mean harvest by species per angler were estimated for each component using the angler interview data for the component. Only completed-trip interviews were used to make the estimates for the chinook salmon fishery; both completed-trip and incomplete-trip interviews were used to make the estimates for the coho salmon fishery.

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 mean effort and its variance (Von Geldern and Tomlinson 1973).

Mean effort per angler during a component was estimated:

$$\bar{f} = \left(\sum_{i=1}^{d} \sum_{k=1}^{m_i} f_{ik}\right) / \sum_{i=1}^{d} m_i, \qquad [3]$$

where:

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

$\bar{f}_i$ = the mean effort per angler during day i of the component.

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

d = the number of days the fishery was open during the component.

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):

$$V(\bar{f}) = [1 - (d/D)]\ s_B^2/d + (\sum_{i=1}^{d} s_{Wi}^2/m_i)/dD, \qquad [4]$$

where:

d = the number of days interviews were conducted during the component,

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

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

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

$$s_B^2 = [\sum_{i=1}^{d} (\bar{f}_i - \bar{f})^2]/(d-1). \qquad [5]$$

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

Harvest rate (HPUE) for a species during a component was estimated by:

$$\text{HPUE} = \bar{c}/\bar{f}, \qquad [6]$$

where:

$\bar{c}$ = the mean harvest of the species per angler during the component.

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

$$\hat{V}(\text{HPUE}) \approx (\bar{c}/\bar{f})^2 (s_c^2/\bar{c}^2 + s_f^2/\bar{f}^2 - 2r s_c s_f/\overline{cf}), \qquad [7]$$

where:

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

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

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

Catch per unit effort (CPUE) for a species 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 6 and 7.

Harvest:

The harvest of a species during each component t was estimated by:

$$\hat{H}_t = \hat{E}_t \text{HPUE}_t. \quad [8]$$

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:

$$V(\hat{H}_t) = [\hat{E}_t^2 \, V(\text{HPUE}_t)] + [\text{HPUE}_t^2 \, V(\hat{E}_t)] - [V(\hat{E}_t) \, V(\text{HPUE}_t)]. \quad [9]$$

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

Catch of a species and its variance were estimated by replacing HPUE with CPUE in equations 8 and 9.

Assumptions:

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. For the coho salmon creel survey, incomplete-trip angler interviews provide an unbiased estimate of completed-trip HPUE and CPUE (DiConstanzo 1956).

4. Anglers are interviewed in proportion to their abundance on day i (DiConstanzo 1956) and interviewed anglers are representative of the total angler population.

5. For the coho salmon creel survey, rates of harvest, or catch, and length of fishing trip are independent (DiConstanzo 1956).

Midstream Section Effort and Harvest:

Fishing effort in the midstream section of the Kenai River during the chinook salmon creel survey was estimated from the counts of boats made during aerial surveys of the river. The proportion of boat fishing effort

occurring in the midstream section was calculated separately for the early run and the late run. For each aerial survey, the proportion of effort in the midstream section (p_m) was calculated as the quotient of the number of boats counted in the midstream section and the number of boats counted between the outlet of Skilak Lake and Cook Inlet. Effort in the midstream section (E_m) during either the early run or the late run was estimated as follows for each component:

$$\hat{E}_m = \bar{p}_m \, (\hat{E}_d + \hat{E}_u)/(1-\bar{p}_m), \qquad [10]$$

where $\bar{p}_m$ = the mean of the p_ms for a run; for the component,

$\hat{E}_d$ = the estimated number of angler-hours of effort in the downstream section for a run; for the component, and

$\hat{E}_u$ = the estimated number of angler-hours of effort in the upstream section for a run for the component.

Effort was estimated separately for unguided and guided anglers. The variances of the midstream effort estimates were approximated by the delta method (Seber 1982) using the following formula:

$$V(\hat{E}_m) \approx [(\hat{E}_d+\hat{E}_u)/(1-\bar{p})^2]^2 V(\bar{p}) + [\bar{p}/(1-\bar{p})]^2 V(\hat{E}_d+\hat{E}_u), \qquad [11]$$

where the variance of $\bar{p}$ is the sample variance of the p_ms divided by the number of flights, the variances of $\hat{E}_d$ and $\hat{E}_u$ are estimated as described under Effort, and the covariance between the estimated effort for the downstream and upstream sections and $\bar{p}$ is assumed to be zero.

Harvest and catch rates for chinook salmon in the midstream section were estimated as the combined total for the number of chinook salmon harvested per hour for the downstream and upstream sections. This is expressed as:

$$HPUE_m = (\hat{H}_d + \hat{H}_u)/(\hat{E}_d + \hat{E}_u), \qquad [12]$$

for the harvest rate and:

$$CPUE_m = (\hat{C}_d + \hat{C}_u)/(\hat{E}_d + \hat{E}_u), \qquad [13]$$

for the catch rate, where the subscripts denote the middle (m), downstream (d), or upstream (u) sections of the river. The variances of the rates were approximated by the delta method, also. The following formula was used to estimate the variance of harvest rate (HPUE):

$$V(HPUE_m) \approx [1/(\hat{E}_d+\hat{E}_u)]^2 \, V(\hat{H}_d+\hat{H}_u) + [-(\hat{H}_d+\hat{H}_u)/(\hat{E}_d+\hat{E}_u)^2]^2 \, V(\hat{E}_d+\hat{E}_u), \qquad [14]$$

where the variances of $(\hat{E}_d+\hat{E}_u)$ and $(\hat{H}_d+\hat{H}_u)$ are calculated as described previously. The covariance between the combined downstream and upstream effort and harvest is omitted from the above equation because it is unknown, although it is assumed positive (as effort increases harvest should increase). The product of the covariance and the derivatives of the numerator and denominator of $HPUE_m$ (or $CPUE_m$) would be subtracted from equation 14 because of the negative derivative for the denominator. Therefore, the formula above is probably a conservative estimate of the variance of $HPUE_m$. The variance of $CPUE_m$ was estimated using the same formula but the combined downstream and upstream catches and their variances were substituted for the harvest counterparts.

The harvest and catch of chinook salmon in the midstream section were estimated for unguided and guided anglers following the procedures described for the downstream and upstream sections. The variances of these estimates were estimated as described previously, also.

Biological Data:

The proportional age composition of the chinook salmon harvest was estimated for each run. Letting p_{ht} equal the estimated proportion of age group h in component t, the variance of p_{ht} was estimated using the normal approximation to the binomial (Scheaffer et al. 1979):

$$V(\hat{p}_{ht}) = \hat{p}_{ht}(1-\hat{p}_{ht})/(n_{Tt}-1), \qquad [15]$$

where n_{Tt} is the number of legible scales read from chinook salmon sampled during component t.

Mean length at age by sex and its variance were estimated using standard normal procedures.

RESULTS

The following dates, based on the criteria described previously, were used to define the early and late runs in the chinook salmon fishery. The early run was from 16 May through 26 June and the late run from 27 June through 31 July in the downstream section. In the upstream section, the early run was from 2 June through 17 July and the late run from 18 July through 31 July. During the coho salmon fishery, the early run was designated from 1 August through 31 August and the late run from 1 September through 30 September in both the downstream and upstream sections of the river.

Chinook Salmon Creel Survey

Because of mechanical and other logistical problems during the creel survey in the downstream section of the Kenai River, angler counts were conducted on only 63 of the 67 days possible and interviews were conducted on 65 of the 67 days possible. In the upstream section, 39 of the 52 days possible were surveyed.

Effort:

Between one and five angler counts were conducted on each sample day in the downstream section (Appendix Tables A1 and A2). Two angler counts were conducted on each day surveyed in the upstream section (Appendix Tables A3 and A4).

Downstream Section. Angler counts in the downstream section ranged from 0 to 814 for unguided anglers and from 0 to 426 for guided anglers (Appendix Tables A1 and A2). The largest count of unguided anglers occurred on 18 July and the largest count of guided anglers on 14 July. The mean count of unguided anglers during the late run was larger than the mean count of unguided anglers during the early run in all periods for both weekday and weekend/holiday components (Table 1). For each period of both runs, except period E of the early run, the mean count of unguided anglers for the weekend/holiday component was larger than the mean count for the weekday component (Table 1).

The estimated effort during the early run was 170,954 angler-hours (Table 2). During the early run, 72% of the total effort was by unguided anglers; 39% of this effort occurred during weekdays and 33% during weekends/holidays. The estimated effort during the late run was 263,252 angler-hours (Table 2). The majority of this effort (74%) was by unguided anglers, also; 42% of this effort occurred during weekdays and 32% during weekends/holidays.

Upstream Section. Angler counts in the upstream section ranged from 0 to 149 for unguided anglers and from 0 to 26 for guided anglers (Appendix Tables A3 and A4). The largest count of unguided anglers occurred on 26 July and the largest count of guided anglers on 30 June. For each period of both runs, the mean count of unguided anglers for the weekend/holiday component was larger than the mean count for the weekday component (Table 3).

The estimated effort during the early run was 20,928 angler-hours (Table 4). During the early run, 93% of the total effort was by unguided anglers; 57% of this effort occurred during weekdays and 36% during weekends/holidays. During the late run, there were not enough counts of unguided anglers conducted in periods D and E of the weekday component and in periods C, D, and E of the weekend/holiday component to estimate effort using the stratified estimate. For these components, effort was estimated using the mean of all counts in the component. The estimation procedures were the same as for the stratified random sample except that there was no summation over periods and the mean and sample variance in equations 1 and 2 refer to the entire component. The estimated effort during the late run was 11,531 angler-hours (Table 4). The majority of this effort (96%) was by unguided anglers.

Midstream Section. The counts of sportfishing boats in each section of the Kenai River between Skilak Lake and Cook Inlet, conducted during aerial surveys, are summarized in Table 5. Nine counts were conducted during the early run and 10 counts during the late run. The mean proportion of the

Table 1. Mean counts of boat anglers by period for each of the components for the creel survey of the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Component	Period A	B	C	D	E
EARLY RUN					
Unguided anglers weekdays:					
Number of counts	9	12	8	11	8
Mean count	154.2	146.7	118.4	122.7	143.3
Standard error	34.5	20.4	26.6	24.6	18.2
Unguided anglers weekends:					
Number of counts	10	11	9	13	12
Mean count	216.8	305.1	267.1	197.8	111.2
Standard error	49.5	51.4	54.8	30.4	21.6
Guided anglers in May:					
Number of counts	6	7	5	9	7
Mean count	52.5	53.1	51.2	38.7	10.1
Standard error	24.9	6.4	17.4	10.8	5.4
Guided anglers in June[1]:					
Number of counts	20	20			
Mean count	162.1	108.7			
Standard error	12.4	7.4			
LATE RUN					
Unguided anglers weekdays:					
Number of counts	8	13	10	12	8
Mean count	337.1	345.6	283.0	260.7	223.9
Standard error	58.4	53.8	31.2	39.8	71.2
Unguided anglers weekends:					
Number of counts	11	9	11	9	10
Mean count	339.0	492.7	431.7	361.6	270.8
Standard error	57.5	72.3	60.8	31.2	42.9
Guided anglers[2]:					
Number of counts	21	23			
Mean count	263.9	182.4			
Standard error	23.2	20.2			

[1] Period A is from 0600 to 1159 hours
Period B is from 1200 to 1759 hours

[2] Period A is from 0700 to 1259 hours
Period B is from 1300 to 1859 hours

Table 2. Estimated number of angler-hours of fishing effort by boat anglers during each of the components of the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Component	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
EARLY RUN				
Unguided weekdays	65,783	5,470	55,062 - 76,504	16.3%
Unguided weekends	57,093	5,066	47,165 - 67,021	17.4%
Guided May	12,339	1,996	8,427 - 16,251	31.7%
Guided June	35,739	1,902	32,012 - 39,466	10.4%
Sub-totals:				
Unguided anglers	122,876	7,455	108,264 - 137,488	11.9%
Guided anglers	48,078	2,757	42,675 - 53,481	11.2%
Early Run Total	170,954	7,949	155,375 - 186,533	9.1%
LATE RUN				
Unguided weekdays	110,221	8,971	92,639 - 127,803	16.0%
Unguided weekends	83,409	5,397	72,831 - 93,987	12.7%
Guided	69,622	4,798	60,219 - 79,025	13.5%
Sub-totals:				
Unguided anglers	193,630	10,469	173,111 - 214,149	10.6%
Guided anglers	69,622	4,798	60,219 - 79,025	13.5%
Late Run Total	263,252	11,516	240,681 - 285,823	8.6%
BOTH RUNS COMBINED				
Unguided anglers	316,506	12,852	291,316 - 341,696	8.0%
Guided anglers	117,700	5,533	106,855 - 128,545	9.2%
GRAND TOTAL	434,206	13,993	406,780 - 461,632	6.3%

Table 3. Mean counts of boat anglers by period for each of the components for the creel survey of the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

Component	Period A	B	C	D	E
EARLY RUN					
Unguided anglers weekdays:					
Number of counts	4	7	6	8	8
Mean count	7.5	20.1	37.7	28.9	17.0
Standard error	3.5	3.6	4.2	7.4	2.2
Unguided anglers weekends:					
Number of counts	6	6	3	3	8
Mean count	8.5	32.8	44.3	30.0	27.8
Standard error	4.2	7.9	3.2	5.6	7.7
Guided anglers[1]:					
Number of counts	16	13			
Mean count	2.9	3.5			
Standard error	0.9	2.0			
LATE RUN					
Unguided anglers weekdays:					
Number of counts	3	3	3	1	0
Mean count	12.3	28.7	62.3	61.0	
Standard error	2.2	8.7	10.7		
Unguided anglers weekends:					
Number of counts	3	3	0	1	1
Mean count	19.3	115.7		63.0	41.0
Standard error	6.2	21.7			
Guided anglers[2]:					
Number of counts	6	4			
Mean count	2.7	5.8			
Standard error	2.0	3.2			

[1] Period A is from 0600 to 1159 hours
Period B is from 1200 to 1759 hours

[2] Period A is from 0700 to 1259 hours
Period B is from 1300 to 1859 hours

Table 4. Estimated number of angler-hours of fishing effort by boat anglers during each of the components of the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

Component	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
EARLY RUN				
Unguided weekdays	12,008	1,092	9,869 - 14,147	17.8%
Unguided weekends	7,458	697	6,092 - 8,824	18.3%
Guided	1,462	496	491 - 2,433	66.4%
Sub-totals:				
Unguided anglers	19,466	1,295	16,928 - 22,004	13.0%
Guided anglers	1,462	496	491 - 2,433	66.4%
Early Run Total	20,928	1,387	18,210 - 23,646	13.0%
LATE RUN				
Unguided weekdays	5,936	1,279	3,249 - 8,443	42.2%
Unguided weekends	5,090	1,707	1,745 - 8,453	65.7%
Guided	505	227	60 - 950	88.1%
Sub-totals:				
Unguided anglers	11,026	2,133	6,845 - 15,207	37.9%
Guided anglers	505	227	60 - 950	88.1%
Late Run Total	11,531	2,145	7,326 - 15,735	36.5%
BOTH RUNS COMBINED				
Unguided anglers	30,492	2,495	25,601 - 35,383	16.0%
Guided anglers	1,967	545	899 - 3,035	54.3%
GRAND TOTAL	32,459	2,554	27,452 - 37,465	15.4%

Table 5. Counts of sportfishing boats by river section conducted during aerial surveys of the fishery for chinook salmon in the Kenai River, 1987.

Date	Downstream Count	Downstream Pro.[1]	Midstream Count	Midstream Pro.	Upstream Count	Upstream Pro.	Total Count
EARLY RUN							
5/29	41	0.932	2	0.045	1	0.023	44
5/31	86	0.844	8	0.078	8	0.078	102
6/04	111	0.903	10	0.081	2	0.016	123
6/07	35	0.686	6	0.118	10	0.196	51
6/11	131	0.814	27	0.168	3	0.018	161
6/14	221	0.795	35	0.126	22	0.079	278
6/17	90	0.720	18	0.144	17	0.136	125
6/20	125	0.679	26	0.141	33	0.180	184
6/25	93	0.699	18	0.136	22	0.165	133
Mean		0.786		0.115		0.099	
Standard Error		0.032		0.013		0.024	
LATE RUN							
6/28	92	0.767	15	0.125	13	0.108	120
7/01	30	0.400	18	0.240	27	0.360	75
7/04	122	0.652	23	0.123	42	0.225	187
7/07	209	0.853	32	0.131	4	0.016	245
7/11	231	0.794	39	0.134	21	0.072	291
7/15	205	0.847	24	0.099	13	0.054	242
7/19	132	0.786	8	0.047	28	0.167	168
7/23	223	0.842	17	0.064	25	0.094	265
7/25	220	0.870	23	0.091	10	0.040	253
7/29	136	0.727	20	0.107	31	0.166	187
Mean		0.754		0.116		0.130	
Standard Error		0.045		0.017		0.033	

[1] Proportion of total count.

total boat effort in the midstream section was 0.115 for the early run and 0.116 for the late run. Because boats with unguided anglers cannot be distinguished from boats with guided anglers from the air, the estimated proportion of effort in the midstream section during each run was used to estimate both unguided and guided angler effort. Estimated effort for the midstream section during the early run was 18,496 angler-hours for unguided anglers (standard error [SE] = 2,573) and 6,437 angler-hours for guided anglers (SE = 904). During the late run, estimated effort for the midstream section was 26,855 angler-hours for unguided anglers (SE = 4,543) and 9,202 angler-hours for guided anglers (SE = 1,609).

Harvest Rates and Catch Rates:

A total of 6,524 interviews with completed-trip anglers were collected during the creel survey in the downstream section of the Kenai River; 2,530 interviews during the early run and 3,994 interviews during the late run. In the upstream section, 703 interviews with completed-trip anglers were collected, 566 interviews during the early run and 137 interviews during the late run.

Downstream Section. Daily harvest rates of chinook salmon by unguided anglers ranged from 0.000 to 0.333 fish per hour during the early run and from 0.000 to 0.097 fish per hour during the late run (Appendix Tables B1 and B3). Peak daily catch rates of chinook salmon by unguided anglers occurred on 16 May (only two anglers interviewed) during the early run and on 3 July during the late run (Figure 5). Daily harvest rates of chinook salmon by guided anglers ranged from 0.000 to 0.368 fish per hour during the early run and from 0.011 to 0.123 fish per hour during the late run (Appendix Tables B2 and B4). Peak daily catch rates of chinook salmon by guided anglers occurred on 3 June during the early run and 31 July during the late run (Figure 5). Estimates of overall harvest and catch rates of chinook salmon for each of the components were higher for guided anglers than for unguided anglers in all components (Table 6).

Harvest and catch rates of sockeye salmon, coho salmon, rainbow trout, and Dolly Varden char for each of the fishery components in the downstream section were all extremely low. Except for the harvest and catch rates of sockeye salmon for the unguided angler components during the late run, all rates were less than 0.01 fish per hour (Table 7). During the late run, the harvest and catch rates of sockeye salmon for the unguided angler components were actually higher than the harvest and catch rates of chinook salmon.

Upstream Section. Daily harvest rates of chinook salmon by unguided anglers ranged from 0.000 to 0.222 fish per hour during the early run and from 0.000 to 0.038 fish per hour during the late run (Appendix Tables B5 and B6). Peak daily catch rates of chinook salmon by unguided anglers occurred on 25 June (only two anglers interviewed) during the early run and on 30 July during the late run. Daily harvest rates of chinook salmon by guided anglers ranged from 0.075 to 0.256 fish per hour during the early run (Appendix Table B5). No guided anglers were interviewed during the late run. Peak daily catch rates of chinook salmon by guided anglers occurred on 25 June during the early run. For the early run, estimates of

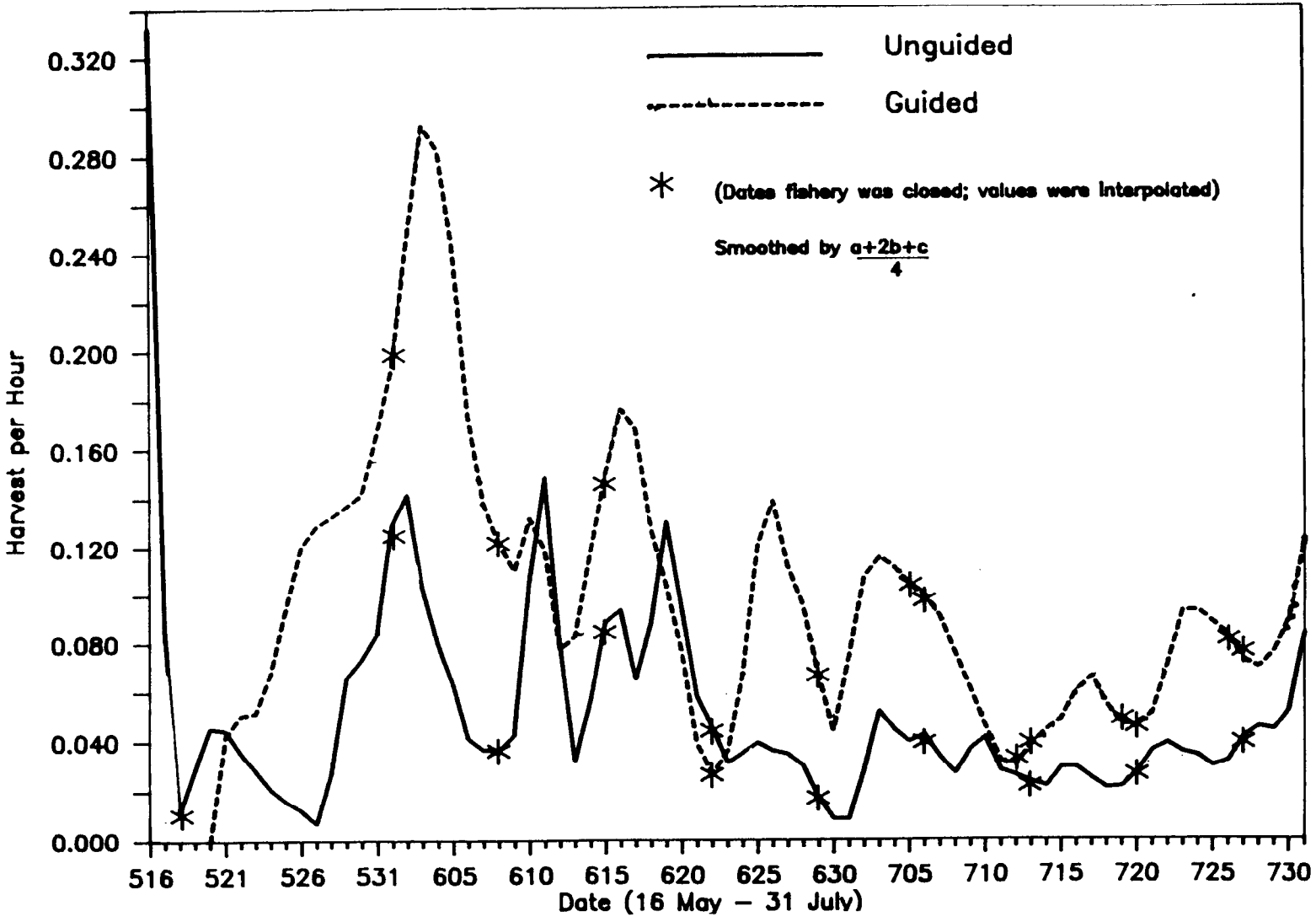

Figure 5. Daily harvest per hour of chinook salmon by guided and unguided anglers in the recreational fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Table 6. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of chinook salmon by boat anglers during each of the components of the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Component	Days n[1]	Days N[2]	Number of Interviews[3]	Harvest HPUE	Standard Error	Catch CPUE	Standard Error
EARLY RUN							
Unguided weekdays	22	24	628	0.0545	0.00911	0.0831	0.01116
Unguided weekends	13	13	857	0.0389	0.00297	0.0531	0.00420
Guided May	10	15	202	0.1077	0.01345	0.1375	0.01877
Guided June	22	22	843	0.1144	0.00718	0.1626	0.00987
LATE RUN							
Unguided weekdays	19	19	1,159	0.0321	0.00389	0.0448	0.00418
Unguided weekends	11	11	1,380	0.0244	0.00297	0.0369	0.00337
Guided	26	26	1,455	0.0746	0.00393	0.0945	0.00470

1 Number of days on which interviews were collected.

2 Number of days possible for interviewing.

3 Completed-trip interviews only.

Table 7. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of sockeye salmon, coho salmon, rainbow trout, and Dolly Varden char by boat anglers during each of the components of the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Component	SOCKEYE SALMON		COHO SALMON		RAINBOW TROUT		DOLLY VARDEN	
	HPUE	CPUE	HPUE	CPUE	HPUE	CPUE	HPUE	CPUE
EARLY RUN								
Unguided weekdays	0.0012	0.0016	0.0000	0.0000	0.0004	0.0004	0.0082	0.0115
(Standard Error)	(0.0009)	(0.0010)	(0.0000)	(0.0000)	(0.0002)	(0.0002)	(0.0014)	(0.0019)
Unguided weekends	0.0011	0.0013	0.0000	0.0000	0.0003	0.0005	0.0011	0.0013
(Standard Error)	(0.0003)	(0.0004)	(0.0000)	(0.0000)	(0.0004)	(0.0006)	(0.0006)	(0.0007)
Guided May	0.0011	0.0023	0.0000	0.0000	0.0000	0.0000	0.0023	0.0023
(Standard Error)	(0.0010)	(0.0031)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0013)	(0.0013)
Guided June	0.0029	0.0032	0.0000	0.0000	0.0006	0.0009	0.0070	0.0087
(Standard Error)	(0.0008)	(0.0009)	(0.0000)	(0.0000)	(0.0004)	(0.0005)	(0.0011)	(0.0013)
LATE RUN								
Unguided weekdays	0.0283	0.0583	0.0002	0.0002	0.0006	0.0006	0.0061	0.0067
(Standard Error)	(0.0037)	(0.0097)	(0.0001)	(0.0001)	(0.0003)	(0.0003)	(0.0044)	(0.0044)
Unguided weekends	0.0311	0.0901	0.0000	0.0000	0.0006	0.0007	0.0077	0.0102
(Standard Error)	(0.0023)	(0.0083)	(0.0000)	(0.0000)	(0.0015)	(0.0015)	(0.0014)	(0.0021)
Guided	0.0066	0.0097	0.0002	0.0002	0.0005	0.0014	0.0053	0.0065
(Standard Error)	(0.0012)	(0.0019)	(0.0001)	(0.0001)	(0.0003)	(0.0004)	(0.0014)	(0.0015)

overall harvest and catch rates of chinook salmon for each of the components were higher for guided anglers than for unguided anglers in all components (Table 8).

Harvest and catch rates of sockeye salmon, coho salmon, rainbow trout, and Dolly Varden char for each of the fishery components in the upstream section were generally higher than those in the downstream section (Table 9); this indicates the more diverse nature of the upstream fishery. Harvest and catch rates of sockeye salmon and Dolly Varden char were higher than the harvest and catch rates of chinook salmon for all unguided angler components except the early run weekends.

Midstream Section. During the early run, the harvest rates of chinook salmon for the downstream and upstream sections combined were 0.0429 fish per hour (SE = 0.00558) by unguided anglers and 0.1140 fish per hour (SE = 0.00962) by guided anglers. Catch rates of chinook salmon were 0.0642 fish per hour (SE = 0.00792) by unguided anglers and 0.1570 fish per hour (SE = 0.01497) by guided anglers. Estimated harvest rates of chinook salmon for the midstream section during the late run were 0.0275 fish per hour (SE = 0.00321) by unguided anglers and 0.0400 fish per hour (SE = 0.00403) by guided anglers. Estimated catch rates of chinook salmon during the late run were 0.0741 fish per hour (SE = 0.00818) by unguided anglers and 0.0938 fish per hour (SE = 0.01024) by guided anglers.

Harvest and Catch:

The harvest and catch of chinook salmon by boat anglers were estimated for each component in the downstream and upstream sections of the Kenai River. Estimated effort and catch rates for each component from Tables 2 and 6, respectively, were used to estimate harvest and catch in the downstream section. For the upstream section, estimated effort and catch rates for each component from Tables 4 and 8, respectively, were used to estimate harvest and catch.

Downstream Section. An estimated 21,991 chinook salmon were harvested by boat anglers in the downstream section: 11,224 fish (51%) during the early run and 10,767 fish (49%) during the late run (Table 10). Unguided anglers harvested 11,379 chinook salmon (52% of the total) and guided anglers harvested 10,612 fish (48% of the total). The total catch of chinook salmon by boat anglers in the downstream section was 30,602 fish: 16,007 fish (52%) during the early run and 14,595 fish (48%) during the late run (Table 10). Unguided anglers released 31% of their chinook salmon catch while guided anglers released 25% of their catch.

Upstream Section. An estimated 580 chinook salmon were harvested by boat anglers in the upstream section: 530 fish (91%) during the early run and 50 fish (9%) during the late run (Table 11). Unguided anglers harvested 350 chinook salmon (60% of the total) and guided anglers harvested 230 fish (40% of the total). The total catch of chinook salmon by boat anglers in the upstream fishery was 1,082 fish: 913 fish (84%) during the early run and 169 fish (16%) during the late run (Table 11). Unguided anglers released 57% of their chinook salmon catch while guided anglers released only 15% of their catch.

Table 8. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of chinook salmon by boat anglers during each of the components of the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

Component	Days n[1]	Days N[2]	Number of Interviews[3]	Harvest HPUE	Standard Error	Catch CPUE	Standard Error
EARLY RUN							
Unguided weekdays	15	27	256	0.0211	0.00952	0.0453	0.03307
Unguided weekends	10	13	267	0.0063	0.00247	0.0133	0.00533
Guided	4	32	43	0.1575	0.03882	0.1849	0.04281
LATE RUN							
Unguided weekdays	4	4	55	0.0058	0.00640	0.0233	0.01082
Unguided weekends	4	4	82	0.0031	0.00150	0.0061	0.00210
Guided	No guided anglers were interviewed during the late run.						

1 Number of days on which interviews were collected.

2 Number of days possible for interviewing.

3 Completed-trip interviews only.

Table 9. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of sockeye salmon, coho salmon, rainbow trout, and Dolly Varden char by boat anglers during each of the components of the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

Component	SOCKEYE SALMON		COHO SALMON		RAINBOW TROUT		DOLLY VARDEN	
	HPUE	CPUE	HPUE	CPUE	HPUE	CPUE	HPUE	CPUE
EARLY RUN								
Unguided weekdays	0.0239	0.0577	0.0000	0.0000	0.0050	0.0209	0.0597	0.0826
(Standard Error)	(0.0128)	(0.0238)	(0.0000)	(0.0000)	(0.0041)	(0.0076)	(0.0116)	(0.0130)
Unguided weekends	0.0016	0.0070	0.0000	0.0000	0.0047	0.0171	0.0786	0.1509
(Standard Error)	(0.0007)	(0.0020)	(0.0000)	(0.0000)	(0.0024)	(0.0044)	(0.0259)	(0.0460)
Guided	0.0068	0.0068	0.0000	0.0000	0.0000	0.0137	0.0205	0.0479
(Standard Error)	(0.0047)	(0.0047)	(0.0000)	(0.0000)	(0.0000)	(0.0118)	(0.0132)	(0.0312)
LATE RUN								
Unguided weekdays	0.6106	1.3846	0.0096	0.0192	0.0000	0.0000	0.1394	0.1490
(Standard Error)	(0.1130)	(0.2890)	(0.0047)	(0.0101)	(0.0000)	(0.0000)	(0.0064)	(0.0616)
Unguided weekends	0.2980	0.7005	0.0000	0.0000	0.0000	0.0000	0.0614	0.0614
(Standard Error)	(0.0289)	(0.0950)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0155)	(0.0155)
Guided								
(Standard Error)	No guided anglers were interviewed during the late run.							

Table 10. Estimated number of chinook salmon harvested and number caught by boat anglers during each of the components in the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Component	Harvest[1]	Standard Error	Rel. Pre.[2]	Catch[3]	Standard Error	Rel. Pre.
EARLY RUN						
Unguided weekdays	3,585	667	36.5%	5,467	861	30.9%
Unguided weekends	2,221	260	22.9%	3,032	360	23.2%
Guided May	1,329	270	39.9%	1,697	353	40.7%
Guided June	4,089	336	16.1%	5,811	469	15.8%
Sub-totals:						
Unguided	5,806	716	24.2%	8,499	934	21.5%
Guided	5,418	431	15.6%	7,508	587	15.3%
Early Run Total	11,224	836	14.6%	16,007	1,103	13.5%
LATE RUN						
Unguided weekdays	3,538	516	28.6%	4,938	610	24.2%
Unguided weekends	2,035	280	27.0%	3,078	344	21.9%
Guided anglers	5,194	450	17.0%	6,579	559	16.6%
Sub-totals:						
Unguided	5,573	587	20.6%	8,016	701	17.1%
Guided	5,194	450	17.0%	6,579	559	16.6%
Late Run Total	10,767	740	13.5%	14,595	896	12.0%
BOTH RUNS COMBINED						
Unguided	11,379	926	15.9%	16,515	1,168	13.9%
Guided	10,612	623	11.5%	14,087	811	11.3%
GRAND TOTAL	21,991	1,116	9.9%	30,602	1,421	9.1%

1 Harvest includes only fish kept.

2 Relative precision for 95% confidence interval.

3 Catch includes fish kept and fish reported as released.

Table 11. Estimated number of chinook salmon harvested and number caught by boat anglers during each of the components in the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

Component	Harvest[1]	Standard Error	Rel. Pre.[2]	Catch[3]	Standard Error	Rel. Pre.
EARLY RUN						
Unguided weekdays	253	116	89.8%	544	399	143.6%
Unguided weekends	47	20	83.4%	99	41	80.4%
Guided	230	95	80.6%	270	109	79.1%
Sub-totals:						
Unguided	300	118	76.9%	643	401	122.1%
Guided	230	95	80.6%	270	109	79.1%
Early Run Total	530	151	55.8%	913	415	89.1%
LATE RUN						
Unguided weekdays	34	38	218.1%	138	69	98.6%
Unguided weekends	16	9	109.5%	31	15	91.6%
Guided anglers[4]	0			0		
Sub-totals:						
Unguided	50	39	153.1%	169	71	81.9%
Guided[4]	0			0		
Late Run Total	50	39	153.1%	169	71	81.9%
BOTH RUNS COMBINED						
Unguided	350	124	69.6%	812	407	98.3%
Guided	230	95	80.6%	270	109	79.1%
GRAND TOTAL	580	156	52.9%	1,082	422	76.4%

1 Harvest includes only fish kept.

2 Relative precision for 95% confidence interval.

3 Catch includes fish kept and fish reported as released.

4 No guided anglers were interviewed during the late run. Harvest and catch assumed to be zero.

Midstream Section. During the early run, an estimated 793 chinook salmon (SE = 150) were harvested by unguided anglers in the midstream section and 734 fish (SE = 120) by guided anglers. Chinook salmon catches during the early run were 1,188 fish (SE = 220) and 1,011 fish (SE = 171) for unguided anglers and guided anglers, respectively. Estimated harvests of chinook salmon for the midstream section during the late run were 738 fish (SE = 151) by unguided anglers and 682 fish (SE = 140) by guided anglers. Estimated catches of chinook salmon during the late run were 1,074 fish (SE = 211) for unguided anglers and 863 fish (SE = 177) for guided anglers.

Other Species. The estimated harvest and catch of species other than chinook salmon for the downstream and upstream sections are summarized in Tables 12 and 13, respectively. Sockeye salmon was the second most common species caught after chinook salmon in the downstream section; 6,433 sockeye salmon were harvested and 14,937 fish were caught. Sockeye salmon was the most common species caught in the upstream section; 5,451 fish were harvested and 12,540 fish were caught.

Summary:

The estimated total angler effort during the chinook salmon fishery was 527,652 angler-hours (Table 14). Estimated harvest and catch of chinook salmon were 25,518 fish and 35,820 fish, respectively (Table 14). Unguided anglers exerted 74.4% of the effort and harvested 52.0% of the chinook salmon while guided anglers exerted 25.6% of the effort and harvested 48.0% of the fish. The majority of the effort (82.3%) and chinook salmon harvest (86.2%) were estimated to occur in the downstream section of the fishery (Figure 6). For effort, 6.2% occurred in the upstream section and 11.6% in the midstream section. Only 2.3% of the chinook salmon harvest was from the upstream section and 11.5% from the midstream section.

Biological Data:

The most abundant age groups in the harvest from the early run were ages 1.3 and 1.4 chinook salmon which composed 31.3% and 63.1% of the sample, respectively (Table 15). Ages 1.3 and 1.4 chinook salmon were the most abundant age groups in the late-run harvest, also, which comprised 22.8% and 72.7% of the sample, respectively (Table 15). The mean lengths at age for each sex were greater for fish in the harvest for the late-run than for chinook salmon in the early run for all age groups (Table 16). For both the early and late runs, the mean lengths of 4- and 5-ocean age male chinook salmon sampled from the harvest were larger than the mean lengths of females from the same age group but the converse was true for 2- and 3-ocean age fish.

Discussion:

The major assumptions necessary for the effort and harvest estimates were explained in the Methods section. It is important to determine how well the data conform to these assumptions to evaluate whether the current experimental design and methods of analysis are appropriate. It is beyond

Table 12. Estimated number of sockeye salmon, coho salmon, rainbow trout, and Dolly Varden char harvested and caught by boat anglers during the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

	Unguided Anglers				Guided Anglers				Total			
Species	Harv.[1]	SE	Catch[2]	SE	Harv.	SE	Catch	SE	Harv.	SE	Catch	SE
EARLY RUN												
Sockeye salmon	142	66	179	72	118	32	142	49	260	73	321	87
Rainbow trout	43	27	55	37	21	16	32	17	64	32	87	41
Dolly Varden	602	108	831	142	278	44	339	51	880	117	1,170	151
LATE RUN												
Sockeye salmon	5,713	545	13,941	1,454	460	91	675	138	6,173	553	14,616	1,461
Coho salmon	22	12	22	12	14	7	14	7	36	14	36	14
Rainbow trout	116	129	124	130	35	20	97	30	151	131	221	133
Dolly Varden	1,314	502	1,589	520	369	101	453	108	1,683	512	2,042	531

[1] Harvest includes only fish kept.

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

Table 13. Estimated number of sockeye salmon, coho salmon, rainbow trout, and Dolly Varden char harvested and caught by boat anglers during the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

	Unguided Anglers				Guided Anglers				Total			
Species	Harv.[1]	SE	Catch[2]	SE	Harv.	SE	Catch	SE	Harv.	SE	Catch	SE
EARLY RUN												
Sockeye salmon	299	155	745	292	10	7	10	7	309	156	755	292
Rainbow trout	95	52	379	100	0	0	20	18	95	52	399	102
Dolly Varden	1,303	252	2,117	400	30	21	70	50	1,333	253	2,187	403
LATE RUN												
Sockeye salmon	5,142	1,148	11,785	2,754	0[3]				5,142	1,148	11,785	2,754
Coho salmon	57	30	114	64	0[3]				57	30	114	64
Dolly Varden	1,140	223	1,197	425	0[3]				1,140	223	1,197	425

1 Harvest includes only fish kept.

2 Catch includes fish kept and fish reported as released.

3 No guided anglers were interviewed during the late run.

Table 14. Summary of estimated angler effort, chinook salmon harvest, and chinook salmon catch by all boat anglers for each river section of the fishery for chinook salmon in the Kenai River, 1987.

Run	Downstream Section	Upstream Section	Midstream Section	Total	95% Confidence Interval
Early Run					
Effort	170,954	20,928	24,933	216,815	200,120 - 233,509
SE	7,949	1,387	2,727	8,517	
Harvest	11,224	530	1,527	13,281	11,573 - 14,988
SE	836	151	192	871	
Catch	16,007	913	2,199	19,119	16,745 - 21,493
SE	1,103	415	279	1,211	
Late Run					
Effort	263,252	11,531	36,057	310,840	286,012 - 335,667
SE	11,516	2,145	4,820	12,667	
Harvest	10,767	50	1,420	12,237	10,729 - 13,744
SE	740	39	206	769	
Catch	14,595	169	1,937	16,701	14,858 - 18,543
SE	896	71	275	940	
Total Both Runs					
Effort	434,206	32,459	60,990	527,655	497,737 - 557,572
SE	13,993	2,554	5,538	15,264	
Harvest	21,991	580	2,947	25,518	23,240 - 27,796
SE	1,116	156	282	1,162	
Catch	30,602	1,082	4,136	35,820	32,814 - 38,825
SE	1,421	422	392	1,533	

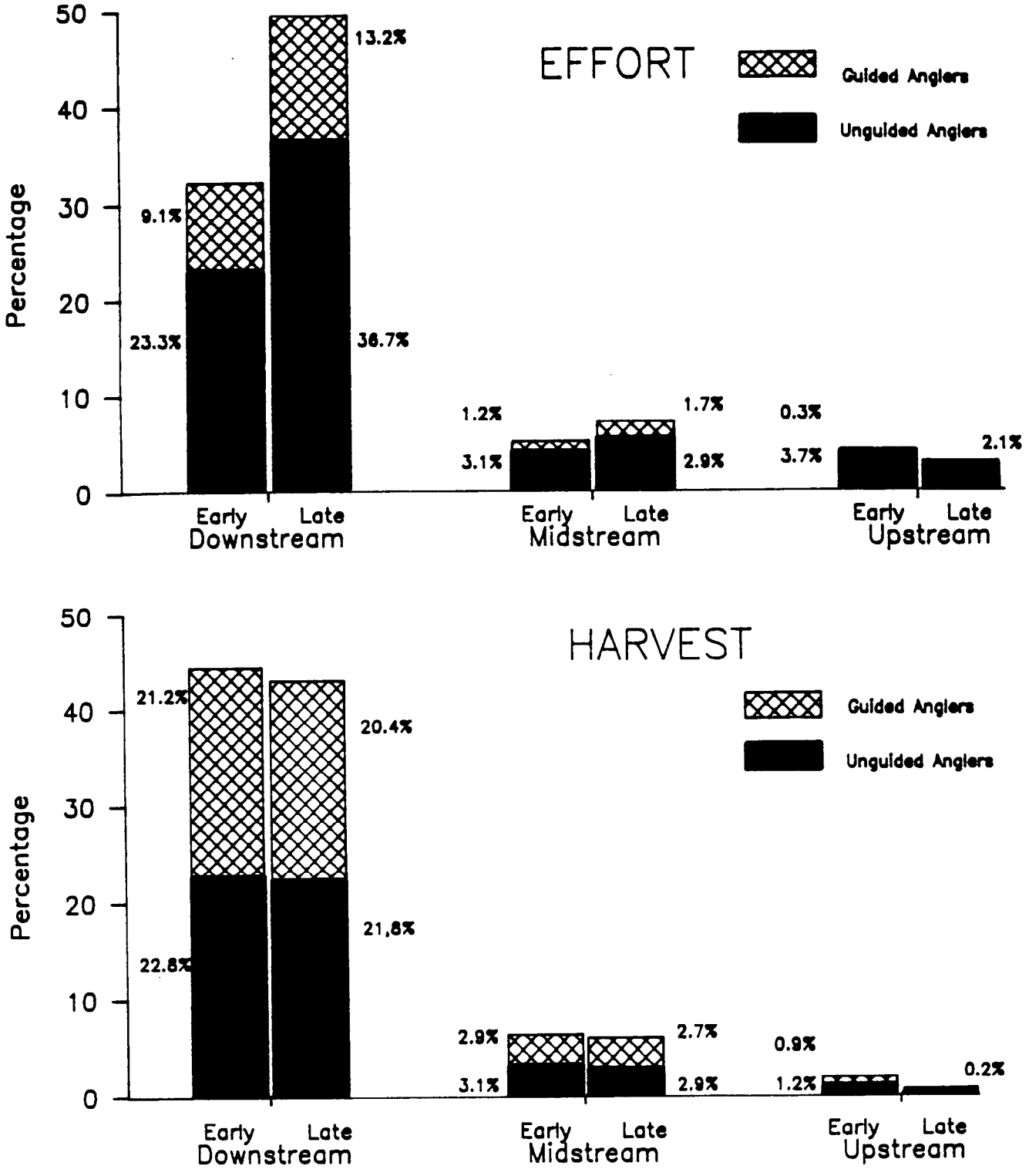

Figure 6. Percent of total angler effort and chinook salmon harvest by guided and unguided anglers for each run and river section of the chinook salmon fishery in the Kenai River, 1987.

Table 15. Age composition of chinook salmon sampled from the harvest during the early and late runs of the fishery for chinook salmon in the Kenai River, 1987.

RUN	Sex		Age Group 1.1	1.2	1.3	1.4	1.5	Total
EARLY	Male	Percent	0.0	0.6	13.9	22.3	2.4	39.2
(n=466)[1]	Female	Percent	0.0	0.2	17.4	40.8	2.4	60.8
	Combined	Percent	0.0	0.8	31.3	63.1	4.8	
		SE	0.0	0.4	2.2	2.2	1.0	
LATE	Male	Percent	0.2	0.6	11.2	34.6	2.5	49.1
(n=483)	Female	Percent	0.2	0.4	11.6	38.1	0.6	50.9
	Combined	Percent	0.4	1.0	22.8	72.7	3.1	
		SE	0.2	0.5	1.9	2.0	0.8	

[1] n = sample size.

Table 16. Mean length (mm) by age group of chinook salmon sampled from the harvest during the early and late runs of the fishery for chinook salmon in the Kenai River, 1987.

Run / Sex		Age Group 1.1	1.2	1.3	1.4	1.5
EARLY RUN						
Male	Mean Length		533	852	1,027	1,093
	Standard Error		33	9	8	23
	Sample Size		3	65	104	11
Female	Mean Length		550	870	965	996
	Standard Error			6	4	23
	Sample Size		1	81	190	11
LATE RUN						
Male	Mean Length	410	597	880	1,071	1,129
	Standard Error		65	13	5	14
	Sample Size	1	3	54	167	12
Female	Mean Length	380	630	910	1,013	1,100
	Standard Error		0	11	4	62
	Sample Size	1	2	56	184	3

the scope of this report to examine every assumption, but several were examined.

The assumption that interviews with unguided and guided anglers were conducted in proportion to the abundance of anglers at the time of the interview was examined previously by Conrad and Hammarstrom (1987) and found to be valid in 1985 and 1986. This assumption was not examined in 1987.

The survey for counting unguided anglers in the downstream section of the river during the chinook salmon fishery was designed to minimize the autocorrelation (Cochran 1977) among counts conducted on the same day. In previous years, angler counts were often conducted within 1 or 2 hours of each other (although they were conducted in different periods). Conrad and Hammarstrom (1987) found significant correlations between same-day counts of unguided anglers conducted from 1 to 7 hours apart for the creel survey of the Kenai River in 1986. In 1987, there were usually at least 8 hours between same-day counts of unguided anglers during the weekday component which eliminated the autocorrelation between counts. There was a minimum of 4 hours between same-day counts of unguided anglers in the weekend/holiday component. The mean length of an angler-trip in this component was 4.4 hours (SE = 0.082) during the early run and 5.1 hours (SE = 0.075) during the late run. We feel that the autocorrelation between counts made in consecutive periods of the weekend/holiday component was minimal as there should have been a large turnover in anglers during the time between counts in consecutive periods because the mean length of the angler-trip and the number of hours between counts were about the same.

Of the 1,404 angler interviews (both completed-trip and incomplete-trip) conducted by the roving creel survey clerks in the downstream section of the river, 66.7% (936 interviews) indicated that they entered the river from one of the seven monitored sites. A major assumption of the current creel survey design is that anglers using the seven surveyed boat launches are representative of the fishing population. To verify this assumption, harvest rates for completed-trip anglers from the seven monitored sites were compared to those of completed-trip anglers using areas other than these seven sites (collected by the roving creel survey clerks). A t-test between the two groups of data was conducted for each of the seven components of the creel survey in the downstream section of the Kenai River. A total of 6,520 interviews were used, 5,426 from the seven surveyed sites and 824 from other sites. HPUE values of the two groups were significantly different ($P < 0.05$) in five of the seven components, with the values from the seven monitored sites being less in each component except for the early-run unguided anglers on weekdays. However, when a sign test (Conover 1980) comparing the daily values of harvest rate for the two groups of anglers was conducted, no significant differences ($P > 0.05$) were found in any components. This means that, on a given day, which group had the higher harvest rate was a random event and there was no consistent difference between the groups.

HPUE for each of the components of the creel survey in the downstream section of the river was estimated separately for those anglers using the seven surveyed sites and those using other areas. The harvest of chinook

salmon was then estimated using each HPUE value. The estimated total harvest of chinook salmon using the interview data from the non-surveyed sites was only 7.3% larger than the estimate using only interview data from the monitored sites. We concluded that the interview data collected from the seven surveyed sites is a representative sample of the angling population and that there are no significant biases to the harvest and catch estimates from these data.

Coho Salmon Creel Survey

During the coho salmon fishery, 39 of the 61 days possible during the survey period were sampled in the downstream section of the Kenai River. In the upstream section, 41 of the 61 days possible were surveyed.

Effort:

Two angler counts were usually conducted on each sample day in the downstream section; there were 6 days when only one angler count was conducted. Two angler counts were conducted on each day surveyed in the upstream section.

Downstream Section. Angler counts in the downstream section ranged from 20 to 616 for unguided anglers and from 0 to 143 for guided anglers (Appendix Table C1). The largest count of unguided anglers occurred on 16 August and the largest count of guided anglers on 15 August. For each period in both runs, the mean count of unguided anglers for the weekend/holiday component was larger than the mean count for the weekday component (Table 17). The same was true for the mean counts of guided anglers, also, except for period C of the early run.

The estimated effort during the early run (August) was 104,942 angler-hours (Table 18). During the early run, 80% of the total effort was by unguided anglers; 42% of this effort occurred during weekdays and 38% during weekends/holidays. The estimated effort during the late run (September) was 52,141 angler-hours (Table 18). The majority of this effort (78%) was by unguided anglers, also; 38% of this effort occurred during weekdays and 40% during weekends/holidays.

Upstream Section. Angler counts in the upstream section ranged from 0 to 260 for unguided anglers and from 0 to 17 for guided anglers (Appendix Table C2). The largest count of unguided anglers occurred on 2 August and the largest count of guided anglers on 19 September. For each period in both runs, the mean count of unguided anglers for the weekend/holiday component was larger than the mean count for the weekday component (Table 19). The most common count for guided anglers in the upstream section was zero. Because very few guided anglers were interviewed, it was necessary to combine the weekday and weekend/holiday components in the upstream section to attain sufficient numbers of interviews to estimate harvest and catch rates for guided anglers.

The estimated effort during the early run was 28,785 angler-hours (Table 20). During the early run, 96% of the total effort was by unguided

Table 17. Mean counts of anglers by period for each of the components for the creel survey of the fishery for coho salmon in the downstream section of the Kenai River, 1987.

Component	Period A	B	C	D
EARLY RUN				
Unguided anglers weekdays:				
Number of counts	4	4	9	3
Mean count	111.0	163.3	159.4	86.0
Standard error	29.0	37.3	24.0	6.9
Unguided anglers weekends:				
Number of counts	6	5	4	4
Mean count	393.5	215.8	236.3	157.5
Standard error	82.0	49.0	67.5	13.4
Guided anglers weekdays:				
Number of counts	4	4	9	3
Mean count	56.5	59.3	36.6	4.0
Standard error	14.3	12.9	8.0	2.3
Guided anglers weekends:				
Number of counts	6	5	4	4
Mean count	91.5	68.4	29.3	11.8
Standard error	16.3	15.7	9.3	5.2
LATE RUN				
Unguided anglers weekdays:				
Number of counts	7	6	6	
Mean count	100.1	66.7	69.7	
Standard error	20.9	20.3	11.7	
Unguided anglers weekends:				
Number of counts	5	5	4	
Mean count	217.8	184.4	170.8	
Standard error	56.8	65.7	73.5	
Guided anglers weekdays:				
Number of counts	7	6	6	
Mean count	51.3	25.2	12.0	
Standard error	14.3	14.2	4.2	
Guided anglers weekends:				
Number of counts	5	5	4	
Mean count	65.2	34.8	17.3	
Standard error	21.3	14.2	4.0	

Table 18. Estimated number of angler-hours of fishing effort during each of the components of the fishery for coho salmon in the downstream section of the Kenai River, 1987.

Component	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
EARLY RUN				
Unguided weekdays	43,654	4,486	34,862 - 52,446	20.1%
Unguided weekends	40,122	4,710	30,890 - 49,354	23.0%
Guided weekdays	13,130	1,759	9,683 - 16,577	26.3%
Guided weekends	8,036	1,000	6,076 - 9,996	24.4%
Sub-totals:				
Unguided anglers	83,776	6,504	71,027 - 96,525	15.2%
Guided anglers	21,166	2,023	17,201 - 25,131	18.7%
Early Run Total	104,942	6,812	91,591 - 118,293	12.7%
LATE RUN				
Unguided weekdays	19,864	2,637	14,695 - 25,033	26.0%
Unguided weekends	20,626	4,095	12,600 - 28,652	38.9%
Guided weekdays	7,430	1,729	4,042 - 10,818	45.6%
Guided weekends	4,221	932	2,394 - 6,048	43.3%
Sub-totals:				
Unguided anglers	40,490	4,871	30,944 - 50,036	23.6%
Guided anglers	11,651	1,964	7,802 - 15,500	33.0%
Late Run Total	52,141	5,252	41,848 - 62,434	19.7%
BOTH RUNS COMBINED				
Unguided anglers	124,266	8,126	108,339 - 140,193	12.8%
Guided anglers	32,817	2,820	27,291 - 38,343	16.8%
GRAND TOTAL	157,083	8,601	140,225 - 173,941	10.7%

Table 19. Mean counts of anglers by period for each of the components for the creel survey of the fishery for coho salmon in the upstream section of the Kenai River, 1987.

Component	Period A	B	C	D
EARLY RUN				
Unguided anglers weekdays:				
Number of counts	5	6	11	6
Mean count	11.4	47.5	51.8	34.8
Standard error	6.6	13.6	9.6	4.3
Unguided anglers weekends:				
Number of counts	6	3	3	5
Mean count	38.2	103.7	150.3	90.2
Standard error	6.4	13.9	73.8	30.6
Guided anglers:				
Number of counts	11	9	14	11
Mean count	0.0	5.3	4.5	0.4
Standard error	0.0	1.5	1.2	0.2
LATE RUN				
Unguided anglers weekdays:				
Number of counts	5	8	7	
Mean count	23.4	29.8	14.9	
Standard error	7.5	6.4	3.7	
Unguided anglers weekends:				
Number of counts	4	7	5	
Mean count	48.8	77.0	72.8	
Standard error	10.1	15.5	15.6	
Guided anglers:				
Number of counts	9	15	12	
Mean count	3.0	5.6	1.1	
Standard error	1.0	1.5	0.6	

Table 20. Estimated number of angler-hours of fishing effort during each of the components of the fishery for coho salmon in the upstream section of the Kenai River, 1987.

Component	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
EARLY RUN				
Unguided weekdays	12,226	1,547	9,194 - 15,258	24.8%
Unguided weekends	15,295	3,253	8,919 - 21,671	41.7%
Guided	1,264	235	803 - 1,725	36.4%
Sub-totals:				
Unguided anglers	27,521	3,602	20,461 - 34,581	25.7%
Guided anglers	1,264	235	803 - 1,725	36.4%
Early Run Total	28,785	3,610	21,709 - 35,860	24.6%
LATE RUN				
Unguided weekdays	5,713	885	3,979 - 7,447	30.3%
Unguided weekends	7,148	872	5,349 - 8,857	23.9%
Guided	1,162	223	724 - 1,599	37.6%
Sub-totals:				
Unguided anglers	12,861	1,242	10,427 - 15,295	18.9%
Guided anglers	1,162	223	724 - 1,599	37.6%
Late Run Total	14,023	1,262	11,548 - 16,497	17.6%
BOTH RUNS COMBINED				
Unguided anglers	40,382	3,810	32,914 - 47,850	18.5%
Guided anglers	2,426	324	1,791 - 3,061	26.2%
GRAND TOTAL	42,808	3,824	35,312 - 50,303	17.5%

anglers; 43% of this effort occurred during weekdays and 53% during weekends/holidays. The estimated effort during the late run was 14,023 angler-hours (Table 20). The majority of this effort (92%) was by unguided anglers, also.

Midstream Section. Aerial surveys of the distribution of fishing effort in the downstream, midstream, and upstream sections of the Kenai River were not conducted during the coho salmon fishery. Effort and harvest were not estimated for the midstream section during the coho salmon fishery.

Harvest Rates and Catch Rates:

A total of 3,607 angler interviews (both completed-trip and incomplete-trip) were collected during the creel survey in the downstream section of the Kenai River; 1,930 during the early run and 1,677 during the late run. In the upstream section, 3,979 angler interviews were collected; 2,244 during the early run and 1,735 during the late run.

Downstream Section. Daily harvest rates of coho salmon by unguided anglers ranged from 0.053 to 0.436 fish per hour during the early run and from 0.040 to 0.247 fish per hour during the late run (Appendix Table D1). Peak daily catch rates of coho salmon by unguided anglers occurred on 14 August during the early run and on 23 September during the late run (Figure 7). Daily harvest rates of coho salmon by guided anglers ranged from 0.057 to 0.552 fish per hour during the early run and from 0.000 to 0.245 fish per hour during the late run (Appendix Table D2). Peak daily catch rates by guided anglers occurred on 14 August during the early run and on 10 September during the late run (Figure 7). Estimates of overall harvest and catch rates of coho salmon for each of the components were higher for guided anglers than for unguided anglers in all components (Table 21).

Harvest and catch rates of other species (sockeye salmon, rainbow trout, or Dolly Varden char) by anglers in the downstream section were all much lower than the rates for coho salmon (Table 22). Harvest and catch rates for these species were lower during the coho salmon fishery than during the chinook salmon fishery.

Upstream Section. Daily harvest rates of coho salmon by unguided anglers ranged from 0.000 to 0.133 fish per hour during the early run and from 0.041 to 0.190 fish per hour during the late run (Appendix Table D3). Peak daily catch rates of coho salmon by unguided anglers occurred on 17 August during the early run and on 18 September during the late run. Daily harvest rates of coho salmon by guided anglers ranged from 0.000 to 0.435 fish per hour during the early run and from 0.044 to 0.357 fish per hour during the late run (Appendix Table D4). Peak daily catch rates of coho salmon by guided anglers occurred on 31 August during the early run and on 12 September during the late run. Overall harvest and catch rates of coho salmon by guided anglers were much higher than those for unguided anglers during both runs (Table 23).

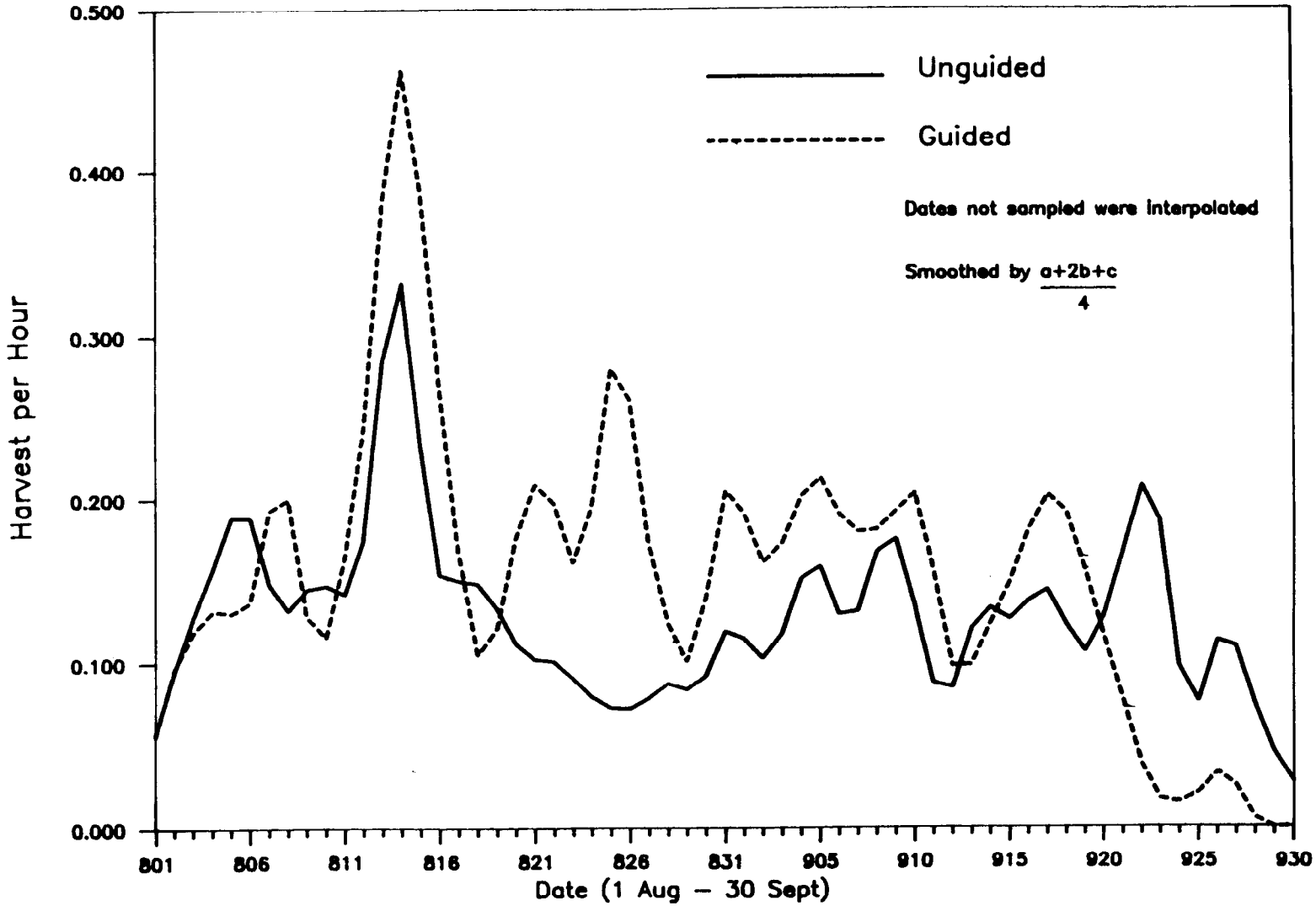

Figure 7. Daily harvest per hour of coho salmon by guided and unguided anglers in the recreational fishery for coho salmon in the downstream section of the Kenai River, 1987.

Table 21. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of coho salmon by anglers during each of the components of the fishery for coho salmon in the downstream section of the Kenai River, 1987.

Component	Days n[1]	Days N[2]	Number of Interviews[3]	Harvest HPUE	Standard Error	Catch CPUE	Standard Error
EARLY RUN							
Unguided weekdays	11	21	557	0.1548	0.02054	0.1601	0.02286
Unguided weekends	10	10	699	0.1112	0.00847	0.1126	0.00857
Guided weekdays	11	21	382	0.2221	0.03133	0.2221	0.03133
Guided weekends	10	10	292	0.1508	0.01737	0.1508	0.01737
LATE RUN							
Unguided weekdays	11	21	538	0.1395	0.01305	0.1395	0.01305
Unguided weekends	7	9	560	0.1015	0.01136	0.1033	0.01168
Guided weekdays	11	21	325	0.1737	0.02478	0.1737	0.02478
Guided weekends	7	9	254	0.1465	0.02012	0.1465	0.02012

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

[2] Number of days possible for interviewing.

[3] Both completed-trip and incomplete trip interviews.

Table 22. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of sockeye salmon, rainbow trout, and Dolly Varden char by anglers during each of the components of the fishery for coho salmon in the downstream section of the Kenai River, 1987.

Component	SOCKEYE SALMON HPUE	SOCKEYE SALMON CPUE	RAINBOW TROUT HPUE	RAINBOW TROUT CPUE	DOLLY VARDEN HPUE	DOLLY VARDEN CPUE
EARLY RUN						
Unguided weekdays	0.0020	0.0020	0.0000	0.0000	0.0179	0.0218
(Standard Error)	(0.0011)	(0.0011)	(0.0000)	(0.0000)	(0.0091)	(0.0127)
Unguided weekends	0.0118	0.0118	0.0009	0.0014	0.0052	0.0085
(Standard Error)	(0.0043)	(0.0043)	(0.0007)	(0.0008)	(0.0023)	(0.0034)
Guided weekdays	0.0000	0.0000	0.0020	0.0020	0.0087	0.0087
(Standard Error)	(0.0000)	(0.0000)	(0.0012)	(0.0012)	(0.0070)	(0.0070)
Guided weekends	0.0163	0.0163	0.0000	0.0000	0.0074	0.0082
(Standard Error)	(0.0045)	(0.0045)	(0.0000)	(0.0000)	(0.0266)	(0.0266)
LATE RUN						
Unguided weekdays	0.0000	0.0000	0.0017	0.0029	0.0006	0.0011
(Standard Error)	(0.0000)	(0.0000)	(0.0023)	(0.0055)	(0.0048)	(0.0048)
Unguided weekends	0.0000	0.0000	0.0000	0.0006	0.0029	0.0092
(Standard Error)	(0.0000)	(0.0000)	(0.0000)	(0.0006)	(0.0022)	(0.0071)
Guided weekdays	0.0000	0.0000	0.0000	0.0006	0.0000	0.0013
(Standard Error)	(0.0000)	(0.0000)	(0.0000)	(0.0097)	(0.0000)	(0.0007)
Guided weekends	0.0000	0.0000	0.0000	0.0000	0.0010	0.0019
(Standard Error)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0006)	(0.0012)

Table 23. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of coho salmon by anglers during each of the components of the fishery for coho salmon in the upstream section of the Kenai River, 1987.

Component	Days n[1]	Days N[2]	Number of Interviews[3]	Harvest HPUE	Standard Error	Catch CPUE	Standard Error
EARLY RUN							
Unguided weekdays	14	21	982	0.0425	0.00766	0.0455	0.00756
Unguided weekends	9	10	1,164	0.0333	0.00601	0.0354	0.00744
Guided	23	31	98	0.1496	0.03997	0.1496	0.03997
LATE RUN							
Unguided weekdays	10	21	578	0.1263	0.01229	0.1298	0.01210
Unguided weekends	8	9	1,011	0.0895	0.00732	0.0911	0.00748
Guided	18	30	146	0.1857	0.02345	0.1896	0.02438

1 Number of days on which interviews were collected.

2 Number of days possible for interviewing.

3 Both completed-trip and incomplete trip interviews.

As was found during the chinook salmon fishery, harvest and catch rates of sockeye salmon, rainbow trout, and Dolly Varden char for each of the fishery components in the upstream section were higher than those in the downstream section (Table 24). Again, this indicates the more diverse nature of the upstream fishery. Harvest and catch rates of sockeye salmon and Dolly Varden char were higher than the harvest and catch rates of coho salmon for the unguided angler components of the early run.

Harvest and Catch:

Harvest and catch of coho salmon by shore and boat anglers combined were estimated for each component in the downstream and upstream sections of the Kenai River. Estimated effort and catch rates for each component from Tables 18 and 21, respectively, were used to estimate harvest and catch in the downstream section. For the upstream section, estimated effort and catch rates for each component from Tables 20 and 23, respectively, were used to estimate harvest and catch.

Downstream Section. An estimated 22,122 coho salmon were harvested by anglers in the downstream section: 15,348 fish (69%) during the early run and 6,774 fish (31%) during the late run (Table 25). Unguided anglers harvested 16,085 coho salmon (73% of the total) and guided anglers harvested 6,037 fish (27% of the total). The total coho salmon catch by anglers in the downstream section was 22,446 fish: 15,635 fish (70%) during the early run and 6,811 fish (30%) during the late run (Table 25). Unguided anglers released only 2% of their coho salmon catch while guided anglers did not release any of their catch.

Upstream Section. An estimated 2,796 coho salmon were harvested by anglers in the upstream section: 1,218 fish (44%) during the early run and 1,578 fish (56%) during the late run (Table 26). Unguided anglers harvested 2,391 coho salmon (86% of the total) and guided anglers harvested 405 fish (14% of the total). The total coho salmon catch by anglers in the upstream section was 2,899 fish: 1,286 fish (44%) during the early run and 1,613 fish (56%) during the late run (Table 26). Unguided anglers released 4% of their coho salmon catch while guided anglers released only 1% of their catch.

Other Species. The estimated harvest and catch of species other than coho salmon for the downstream and upstream sections are summarized in Tables 27 and 28, respectively. Dolly Varden char were the second most common species caught after coho salmon in the downstream section; 1,239 Dolly Varden were harvested and 1,703 were caught. More Dolly Varden char (10,810 fish) and sockeye salmon (11,474 fish) were caught than coho salmon in the upstream section. The harvests of Dolly Varden and sockeye salmon in the upstream section were 2,982 fish and 3,620 fish, respectively.

Summary:

The estimated total angler-effort in the downstream and upstream sections of the Kenai River during the coho salmon fishery was 199,891 angler-hours (Table 29). Estimated harvest and catch of coho salmon during the coho salmon fishery were 24,918 fish and 25,345 fish, respectively (Table 29).

Table 24. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of sockeye salmon, rainbow trout, and Dolly Varden char by anglers during each of the components of the fishery for coho salmon in the upstream section of the Kenai River, 1987.

Component	SOCKEYE SALMON HPUE	SOCKEYE SALMON CPUE	RAINBOW TROUT HPUE	RAINBOW TROUT CPUE	DOLLY VARDEN HPUE	DOLLY VARDEN CPUE
EARLY RUN						
Unguided weekdays	0.1270	0.3682	0.0026	0.0103	0.0910	0.3295
(Standard Error)	(0.0252)	(0.0606)	(0.0010)	(0.0030)	(0.0110)	(0.0482)
Unguided weekends	0.1275	0.3899	0.0031	0.0088	0.0731	0.2900
(Standard Error)	(0.0152)	(0.0436)	(0.0011)	(0.0026)	(0.0079)	(0.0378)
Guided	0.0939	0.4577	0.0000	0.0035	0.0313	0.0904
(Standard Error)	(0.0399)	(0.1080)	(0.0000)	(0.0076)	(0.0278)	(0.0732)
LATE RUN						
Unguided weekdays	0.0000	0.0169	0.0056	0.0141	0.0614	0.1841
(Standard Error)	(0.0000)	(0.0039)	(0.0025)	(0.0044)	(0.0102)	(0.0486)
Unguided weekends	0.0000	0.0379	0.0056	0.0161	0.0488	0.1600
(Standard Error)	(0.0000)	(0.0065)	(0.0015)	(0.0030)	(0.0071)	(0.0213)
Guided	0.0000	0.0561	0.0039	0.0290	0.0097	0.0309
(Standard Error)	(0.0000)	(0.0258)	(0.0021)	(0.0129)	(0.0056)	(0.0146)

Table 25. Estimated number of coho salmon harvested and number caught by anglers during each of the components in the fishery for coho salmon in the downstream section of the Kenai River, 1987.

Component	Harvest[1]	Standard Error	Rel. Pre.[2]	Catch[3]	Standard Error	Rel. Pre.
EARLY RUN						
Unguided weekdays	6,758	1,131	32.8%	6,989	1,225	34.4%
Unguided weekends	4,462	623	27.4%	4,518	631	27.4%
Guided weekdays	2,916	565	38.0%	2,916	565	38.0%
Guided weekends	1,212	205	33.1%	1,212	205	33.1%
Sub-totals:						
Unguided	11,220	1,291	22.5%	11,507	1,378	23.5%
Guided	4,128	601	28.5%	4,128	601	28.5%
Early Run Total	15,348	1,424	18.2%	15,635	1,503	18.8%
LATE RUN						
Unguided weekdays	2,771	449	31.7%	2,771	449	31.7%
Unguided weekends	2,094	475	44.4%	2,131	484	44.6%
Guided weekdays	1,291	350	53.1%	1,291	350	53.1%
Guided weekdays	618	160	50.6%	618	160	50.6%
Sub-totals:						
Unguided	4,865	653	26.3%	4,902	660	26.4%
Guided	1,909	384	39.5%	1,909	384	39.5%
Late Run Total	6,774	758	21.9%	6,811	764	22.0%
BOTH RUNS COMBINED						
Unguided	16,085	1,447	17.6%	16,409	1,528	18.3%
Guided	6,037	713	23.2%	6,037	713	23.2%
GRAND TOTAL	22,122	1,613	14.3%	22,446	1,686	14.7%

1 Harvest includes only fish kept.

2 Relative precision for 95% confidence interval.

3 Catch includes fish kept and fish reported as released.

Table 26. Estimated number of coho salmon harvested and number caught by anglers during each of the components in the fishery for coho salmon in the upstream section of the Kenai River, 1987.

Component	Harvest[1]	Standard Error	Rel. Pre.[2]	Catch[3]	Standard Error	Rel. Pre.
EARLY RUN						
Unguided weekdays	520	114	42.9%	556	116	40.7%
Unguided weekends	509	141	54.2%	541	160	58.0%
Guided anglers	189	61	63.1%	189	61	63.1%
Sub-totals:						
Unguided	1,029	181	34.5%	1,097	198	35.3%
Guided	189	61	63.1%	189	61	63.1%
Early Run Total	1,218	191	30.7%	1,286	207	31.6%
LATE RUN						
Unguided weekdays	722	132	35.7%	742	134	35.3%
Unguided weekends	640	94	28.7%	651	96	28.8%
Guided anglers	216	49	44.7%	220	51	45.1%
Sub-totals:						
Unguided	1,362	162	23.2%	1,393	164	23.1%
Guided	216	49	44.7%	220	51	45.1%
Late Run Total	1,578	169	21.0%	1,613	172	20.9%
BOTH RUNS COMBINED						
Unguided	2,391	243	19.9%	2,490	257	20.2%
Guided	405	78	37.9%	409	80	38.1%
GRAND TOTAL	2,796	255	17.9%	2,899	269	18.2%

1 Harvest includes only fish kept.

2 Relative precision for 95% confidence interval.

3 Catch includes fish kept and fish reported as released.

Table 27. Estimated number of sockeye salmon, rainbow trout, and Dolly Varden char harvested and caught by anglers during the fishery for coho salmon in the downstream section of the Kenai River, 1987.

	Unguided Anglers				Guided Anglers				Total			
Species	Harv.[1]	SE	Catch[2]	SE	Harv.	SE	Catch	SE	Harv.	SE	Catch	SE
EARLY RUN												
Sockeye salmon	560	187	560	187	131	39	131	39	691	191	691	191
Rainbow trout	36	28	56	32	26	16	26	16	62	32	82	36
Dolly Varden	990	415	1,293	578	173	231	180	231	1,163	475	1,473	623
LATE RUN												
Rainbow trout	34	46	70	110	0	0	4	70	34	46	74	131
Dolly Varden	72	104	212	176	4	3	18	8	76	104	230	176

[1] Harvest includes only fish kept.

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

Table 28. Estimated number of sockeye salmon, rainbow trout, and Dolly Varden char harvested and caught by anglers during the fishery for coho salmon in the upstream section of the Kenai River, 1987.

	Unguided Anglers				Guided Anglers				Total			
Species	Harv.[1]	SE	Catch[2]	SE	Harv.	SE	Catch	SE	Harv.	SE	Catch	SE
EARLY RUN												
Sockeye salmon	3,501	596	10,465	1,703	93	54	450	142	3,620	598	11,041	1,712
Rainbow trout	78	22	261	63	0	0	4	10	78	22	265	64
Dolly Varden	2,231	329	8,464	1,346	40	36	114	93	2,271	331	8,578	1,349
LATE RUN												
Sockeye salmon	0	0	368	62	0	0	65	32	0	0	433	70
Rainbow trout	72	19	196	38	5	3	34	16	77	19	230	41
Dolly Varden	700	103	2,196	380	11	7	36	18	711	103	2,232	380

[1] Harvest includes only fish kept.

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

Table 29. Summary of estimated angler-effort, coho salmon harvest, and coho salmon catch by all anglers for each river section of the fishery for coho salmon in the Kenai River, 1987.

Run	Downstream Section	Upstream Section	Total	95% Confidence Interval
Chinook Season				
Harvest	36	107	143	29 - 257
SE	14	56	58	
Catch	36	214	250	15 - 485
SE	14	119	120	
Early Run				
Effort	104,942	28,785	133,727	118,616 - 148,837
SE	6,812	3,610	7,709	
Harvest	15,348	1,218	16,566	13,749 - 19,382
SE	1,424	191	1,437	
Catch	15,635	1,286	16,921	13,947 - 19,895
SE	1,503	207	1,517	
Late Run				
Effort	52,141	14,023	66,164	55,577 - 76,751
SE	5,252	1,262	5,401	
Harvest	6,774	1,578	8,352	6,830 - 9,874
SE	758	169	777	
Catch	6,811	1,613	8,424	6,889 - 9,959
SE	764	172	783	
Early and Late Runs Combined				
Effort	157,083	42,808	199,891	181,442 - 218,340
SE	8,601	3,824	9,413	
Harvest	22,122	2,796	24,918	21,717 - 28,119
SE	1,613	255	1,633	
Catch	22,446	2,899	25,345	21,999 - 28,691
SE	1,686	269	1,707	
Grand Total				
Harvest	22,158	2,903	25,061	21,858 - 28,264
SE	1,613	261	1,634	
Catch	22,482	3,113	25,595	22,241 - 28,949
SE	1,686	294	1,711	

An additional 93 coho salmon were harvested during the chinook salmon fishery. Unguided anglers exerted 82.4% of the effort and harvested 74.1% of the coho salmon while guided anglers exerted 17.6% of the effort and harvested 25.9% of the fish. The majority of the effort (78.6%) and coho salmon harvest (88.8%) were estimated to occur in the downstream section of the fishery (Figure 8). In contrast to the chinook salmon fishery, where an estimated 29% of the chinook salmon caught by anglers were released, less than 2% of the coho salmon caught were released.

Biological Data:

The most abundant age groups in the early run harvest were ages 2.1 and 3.1 coho salmon which composed 76.3% and 22.0% of the sample, respectively (Table 30). Ages 2.1 and 3.1 coho salmon were the most abundant age groups in the late run harvest, also, contributing 87.1% and 9.7% to the sample, respectively (Table 30). Mean length at age by sex and run are presented in Table 31.

Discussion:

There were not sufficient numbers of completed-trip angler interviews to examine the assumption that incomplete-trip interviews provide an unbiased estimate of harvest rate. Conrad and Hammarstrom (1987) concluded that this was not a significant source of error in the 1986 survey. The assumption that interviews were collected in proportion to effort was also examined in 1986 (Conrad and Hammarstrom 1987) and concluded to be met, thus no similar examination was performed in 1987.

SUMMARY

Creel surveys were conducted from 16 May through 30 September in the downstream section and from 2 June through 30 September in the upstream section of the Kenai River. The estimated total effort by recreational anglers in the Kenai River between the outlet of Skilak Lake and Cook Inlet was 727,546 angler-hours (Table 32). This is a minimum estimate of effort as it does not include the effort by shore anglers during the period 16 May through 31 July or the effort in the mid-stream section of the river during the period 1 August through 30 September. Most fishing effort occurred in the downstream section of the Kenai River. About 77% of the total effort was by unguided anglers and 23% by guided anglers. Effort during the chinook salmon fishery was the largest recorded since creel surveys of these fisheries began in 1977.

The harvest of chinook salmon was the largest recorded since 1977, also. Sockeye salmon were the most frequently caught species in the survey area (Table 33), followed by chinook and coho salmon. More chinook salmon were harvested than any other species in the survey area (Table 33), followed by coho salmon and sockeye salmon. The estimated harvest of sockeye salmon is a minimum estimate because shore-based anglers during late July and the fishery in the midstream section during early August harvests large numbers of this species.

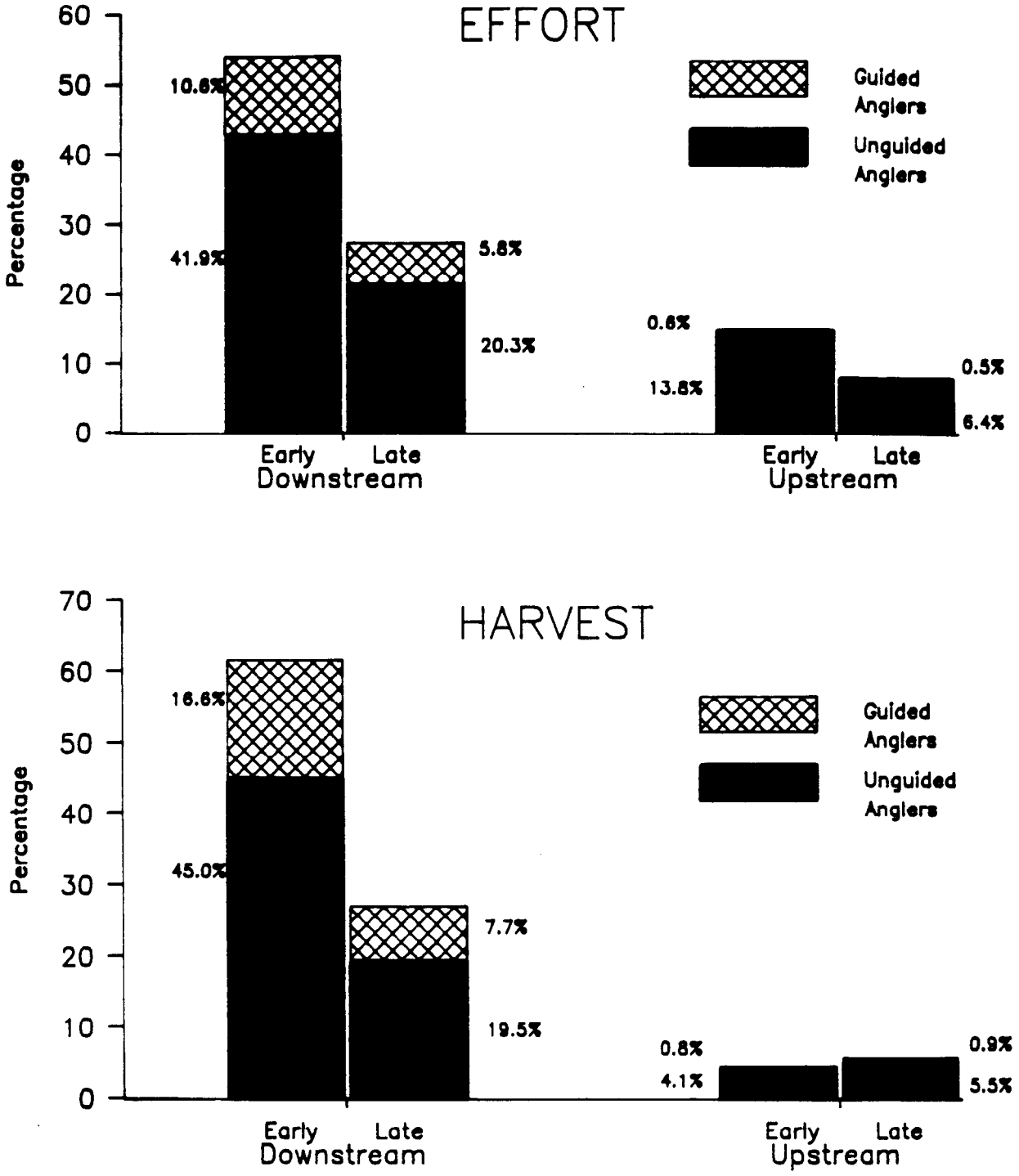

Figure 8. Percent of total angler effort and coho salmon harvest by guided and unguided anglers for each run and river section of the coho salmon fishery in the Kenai River, 1987.

Table 30. Age composition of coho salmon sampled from the harvest during the early and late runs of the fishery for coho salmon in the Kenai River, 1987.

RUN	Sex		Age Group 1.1	2.1	3.1	Total
EARLY	Male	Percent	0.6	32.4	9.8	42.8
(n=173)[1]	Female	Percent	1.1	43.9	12.2	57.2
	Combined	Percent	1.7	76.3	22.0	
		SE	1.0	3.2	3.2	
LATE	Male	Percent	1.6	31.5	3.2	36.3
(n=124)	Female	Percent	1.6	55.6	6.5	63.7
	Combined	Percent	3.2	87.1	9.7	
		SE	1.6	3.0	2.7	

[1] n = sample size.

Table 31. Mean length (mm) by age group of coho salmon sampled from the harvest during the early and late runs of the fishery for coho salmon in the Kenai River, 1987.

Run / Sex		Age Group 1.1	2.1	3.1
EARLY RUN				
Male	Mean Length	550	618	602
	Standard Error		5	9
	Sample Size	1	56	17
Female	Mean Length	595	602	591
	Standard Error	15	4	8
	Sample Size	2	76	21
LATE RUN				
Male	Mean Length	580	621	648
	Standard Error	50	10	6
	Sample Size	2	39	4
Female	Mean Length	640	608	626
	Standard Error	10	13	18
	Sample Size	2	69	8

Table 32. Summary of the number of angler-hours of fishing effort estimated for each of the major components of the recreational fishery in the lower Kenai River, 1987.

Component	Estimated Effort	Standard Error
Chinook Salmon Fishery[1]		
Early Run - Downstream - Unguided anglers	122,876	7,455
- Guided anglers	48,078	2,757
- Upstream - Unguided anglers	19,466	1,295
- Guided anglers	1,462	496
- Midstream - Unguided anglers	18,496	2,573
- Guided anglers	6,437	904
Late Run - Downstream - Unguided anglers	193,630	10,469
- Guided anglers	69,622	4,798
- Upstream - Unguided anglers	11,026	2,133
- Guided anglers	505	227
- Midstream - Unguided anglers	26,855	4,543
- Guided anglers	9,202	1,609
Coho Salmon Fishery[2]		
Early Run - Downstream - Unguided anglers	83,776	6,504
- Guided anglers	21,166	2,023
- Upstream - Unguided anglers	27,521	3,602
- Guided anglers	1,264	235
Late Run - Downstream - Unguided anglers	40,490	4,871
- Guided anglers	11,651	1,964
- Upstream - Unguided anglers	12,861	1,242
- Guided anglers	1,162	223
Sub-totals:		
Unguided anglers	556,997	16,710
Guided anglers	170,549	6,510
GRAND TOTAL	727,546	17,933

1 Estimates are for boat anglers only.

2 Estimates are for both boat and shore anglers.

Table 33. Estimated harvest and catch of major fish species by anglers during the recreational fisheries surveyed in the lower Kenai River, 1987.

Species	Estimated Harvest	Standard Error	Estimated Catch	Standard Error
Chinook salmon	25,518	1,162	35,820	1,533
Coho salmon	25,011	1,634	25,495	1,709
Sockeye salmon	16,195	1,431	39,642	3,575
Rainbow trout	561	158	1,358	233
Dolly Varden char	9,257	864	19,109	1,741

RECOMMENDATIONS

Based upon the results of the creel survey conducted in the lower Kenai River in 1987, we recommend the following changes to the sample design and data analyses for 1988.

1. When not conducting angler counts during the chinook salmon fishery, the survey clerks using boats should proceed to an alternate boat launch facility, not one of the seven already surveyed, and collect completed-trip angler interviews.

2. During both the chinook and coho fisheries, the upstream survey clerk should conduct angler interviews in the midstream section. If effort counts of shore anglers are not feasible to conduct from the air, then the survey clerk should also conduct effort counts in the midstream section during August and September.

ACKNOWLEDGEMENTS

We would like to express our gratitude to those individuals that assisted with data collection, compilation, and analysis. Larry Marsh and Gino Del Frate conducted the boat creel survey in the downstream section and took care of most of the mechanical problems. Elizabeth Lenart and Jim Gebhard conducted angler interviews at the selected launch facilities. Laurie Flagg conducted the creel survey in the upstream section. Dave Athons flew many of the aerial surveys, both as pilot or observer. Jay Carlon provided most of the local data processing support, including programming and in-season repair to the Epson HX-20 field data recorders. The Research and Technical Service staff, specifically Gary Fidler, who provided microcomputer troubleshooting and especially Bob Conrad who provided invaluable assistance with data analysis and a thorough review of this report.

LITERATURE CITED

Clutter, R. and L. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. International Pacific Salmon Commission, Bull. 9. 159 pp.

Cochran, W. G. 1977. Sampling techniques. John Wiley and Sons, New York. 428 pp.

Conrad, R. H. In preparation. Abundance estimates for chinook salmon *Oncorhynchus tshawytscha* in the escapement into the Kenai River, Alaska by analysis of tagging data, 1987. Alaska Department of Fish and Game, Sport Fish Division, Fishery Data Series Report.

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. 124 pp.

Conover, W. J. 1980. Practical nonparametric statistics. John Wiley and Sons, New York. 493 pp.

DiConstanzo, C. J. 1956. Creel census techniques and harvest of fishes in Clear Lake, Iowa. Ph.D. Dissertation, Iowa State College. 130 pp.

Goodman, L. A. 1960. On the exact variance of products. Journal American Statistical Association. 66:708-713.

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.

_____. 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.

_____. 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.

_____. 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.

_____. 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.

_____. 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.

_____. 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.

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.

_____. 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.

_____. 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.

_____. 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.

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). 89 pp.

Jessen, R. J. 1978. Statistical survey techniques. John Wiley and Sons, New York. 520 pp.

McBride, D. N., R. D. Harding, B. A. Cross, and R. H. Conrad. 1985. Origins of chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), in the commercial catches from the central district eastside set gillnet fishery in Upper Cook Inlet, 1984. Alaska Department of Fish and Game, Informational Leaflet No. 251. 68 pp.

Mills, M. 1978. 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). 112 pp.

_____. 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). 65 pp.

_____. 1981. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22(SW-1). 107 pp.

_____. 1982. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23(SW-1). 115 pp.

_____. 1983. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24(SW-1). 115 pp.

_____. 1984. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984. Project F-9-16, 25(SW-1-A). 122 pp.

_____. 1985. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26(SW-1-A). 135 pp.

_____. 1986. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27(RT-2). 137 pp.

_____. 1987. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Fishery Data Series No. 2. 140 pp.

Neuhold, J. M. and K. H. Lu. 1957. Creel census method. Utah Department of Fish and Game, Publication No. 8, 36 pp.

Scheaffer, R. L., W. Mendenhall, and L. Ott. 1979. Elementary survey sampling. Duxbury Press, North Scituate, Mass. 278 pp.

Seber, G. A. F. 1982. The estimation of animal abundance. MacMillan Publishing Co., Inc. New York. 654 pp.

Sukhatme, P. V., B. V. Sukhatme, S. Sukhatme, and C. Asok. 1984. Sampling theory of surveys with applications. Iowa State University Press, Ames, Iowa. 526 pp.

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.

APPENDIX A

Counts of boat anglers during the creel survey of the fishery for chinook salmon in the Kenai River, 1987

Appendix Table A1. Counts of unguided and guided boat anglers during the early run of the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Date	Wd/ We	Unguided Anglers Period A	B	C	D	E	Guided Anglers[1] Period A	B	C	D	E
5/16	We				54	16				0	0
5/17	We	21	73	47	41	22	41	35	24	4	0
5/18						CLOSED					
5/19	Wd		34		17		9	45		8	
5/20	Wd	5									
5/21	Wd										
5/22	Wd										
5/23	We		162		156			47		73	
5/24	We				232	78				66	13
5/25	We	32	72		109	23	9	55		33	0
5/26	Wd		54	47				67	19		
5/27	Wd			28	56				29	34	
5/28	Wd	0				111	0				11
5/29	Wd										
5/30	We	219	208	214	231	188	143	40	107	92	40
5/31	We	183	274	103	148	128	113	83	77	38	7
6/01						CLOSED					
6/02	Wd		193		75		83	43			
6/03	Wd	183		85		168	169	89			
6/04	Wd		166		94		77	74			
6/05	Wd	206		184		221	144	99			
6/06	We	414	531	582	295	242	148	93			
6/07	We	224	457	406	190	84	72	97			
6/08						CLOSED					
6/09	Wd	326	266	258		137	264	184			
6/10	Wd		124		191		178	156			
6/11	Wd	184		142			217	90			
6/12	Wd		191		270		187	114			
6/13	We	519	485	293	462	114	229	64			
6/14	We	102	516	164	202	77	171	101			
6/15						CLOSED					
6/16	Wd		100		123		151	104			
6/17	Wd	208	183		120	166	252	159			
6/18	Wd		235		115		142	140			
6/19	Wd	173				145					
6/20	We	185	298	354	267	202	189	116			
6/21	We	269	280	241	184	160	167	100			
6/22						CLOSED					
6/23	Wd	103		91		43	187	125			
6/24	Wd		112		44		129	105			
6/25	Wd					155					
6/26	Wd		102	112	245		85	121			

[1] Count periods A and B for guided anglers differ from unguided anglers from 6/2 through 6/26

Appendix Table A2. Counts of unguided and guided boat anglers during the late run of the fishery for chinook salmon in the downstream section of the Kenai River, 1987.

Date	Wd/ We	Unguided Anglers Period A	B	C	D	E	Guided Anglers Period A	B
6/27	We	80	211	174	324	375	174	132
6/28	We	344	229	175	210	31	172	61
6/29						CLOSED		
6/30	Wd		197		20		145	22
7/01	Wd	29	40				35	
7/02	Wd		177		121		116	82
7/03	We	194	287	260		294	174	94
7/04	We	87	446	377		328	129	105
7/05	We	255	616	693	326	159	CLOSED TO GUIDES	
7/06						CLOSED		
7/07	Wd	347		286	97	84	217	97
7/08	Wd			144	211			125
7/09	Wd	360	303		300	77	291	145
7/10	Wd							
7/11	We	363		529	422	387		108
7/12	We	272	489	232	310	316	CLOSED TO GUIDES	
7/13						CLOSED		
7/14	Wd		744	323	463		426	320
7/15	Wd	533		293		51	385	327
7/16	Wd		286		341		316	226
7/17	Wd	374	542	409		259	367	163
7/18	We	587	814	694	403	114	376	196
7/19	We	355	695	428	330		CLOSED TO GUIDES	
7/20						CLOSED		
7/21	Wd	428		346		241		348
7/22	Wd		124	102	193		317	74
7/23	Wd		339	374	406	53	267	270
7/24	Wd		393		416		333	
7/25	We	541	647	552	549	469	288	230
7/26	We	651		634	380	235	CLOSED TO GUIDES	
7/27						CLOSED		
7/28	Wd		534		320		361	282
7/29	Wd		336		240		324	242
7/30	Wd	465		224		426		272
7/31	Wd	161	478	329		600	328	275

Appendix Table A3. Counts of unguided and guided boat anglers during the early run of the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

Date	Wd/ We	Unguided Anglers Period A	B	C	D	E	Guided Anglers Period A	B
6/02	Wd							
6/03	Wd							
6/04	Wd	1			5		0	
6/05	Wd							
6/06	We		11		26		0	
6/07	We	2	16				0	
6/08						CLOSED		
6/09	Wd		12			7	0	
6/10	Wd							
6/11	Wd		10				0	
6/12	Wd				8	18		
6/13	We			48		44		4
6/14	We	5			23			2
6/15						CLOSED		
6/16	Wd							
6/17	Wd		14			18		1
6/18	Wd		26		13		9	
6/19	Wd	13		52			2	2
6/20	We		49			64	2	
6/21	We	10				6		
6/22						CLOSED		
6/23	Wd				33	25		
6/24	Wd							
6/25	Wd	2	36				7	
6/26	Wd	14		25			3	6
6/27	We		21			32	10	
6/28	We			38		1	4	
6/29						CLOSED		
6/30	Wd			37		10		26
7/01	Wd							
7/02	Wd							
7/03	We	0		47				5
7/04	We	28	57				9	
7/05	We				41	21	CLOSED TO GUIDES	
7/06						CLOSED		
7/07	Wd				27	20		0
7/08	Wd							
7/09	Wd			38		14		0
7/10	Wd			46	39			0
7/11	We		43			43	0	
7/12	We	6				11	CLOSED TO GUIDES	
7/13						CLOSED		
7/14	Wd		26		37		0	0
7/15	Wd			28		24		0
7/16	Wd							
7/17	Wd		17		69		0	0

Appendix Table A4. Counts of unguided and guided boat anglers during the late run of the fishery for chinook salmon in the upstream section of the Kenai River, 1987.

Date	Wd/ We	Unguided Anglers Period A	B	C	D	E	Guided Anglers Period A	B
7/18	We	10			63		0	
7/19	We		75			41	CLOSED TO GUIDES	
7/20						CLOSED		
7/21	Wd							
7/22	Wd	15	18				0	
7/23	Wd	14		42			0	0
7/24	Wd		22	67			0	4
7/25	We	17	123				4	
7/26	We	31	149				CLOSED TO GUIDES	
7/27						CLOSED		
7/28	Wd							
7/29	Wd	8			61			4
7/30	Wd		46	78			12	15
7/31	Wd							

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, 1987

Appendix Table B1. Daily summary statistics for fishing effort, chinook salmon harvest, and chinook salmon catch by unguided anglers interviewed during the early run of the fishery for chinook salmon in the downstream section of the Kenai River, 1987 (completed-trip interviews only).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
5/16	We	2	3.0	0.00	1.00	0.000	0.333	1.00	0.000	0.333
5/17	We	21	3.8	0.29	0.00	0.000	0.000	0.05	0.048	0.013
5/19	Wd	8	5.5	1.43	0.13	0.125	0.023	0.13	0.125	0.023
5/20	Wd	4	4.3	0.43	0.25	0.250	0.059	1.00	0.408	0.235
5/21	Wd	25	6.6	0.91	0.28	0.092	0.042	0.28	0.092	0.042
5/23	We	57	4.8	0.38	0.14	0.046	0.029	0.19	0.053	0.040
5/24	We	111	4.6	0.22	0.09	0.027	0.020	0.09	0.027	0.020
5/25	We	58	4.7	0.34	0.07	0.034	0.015	0.21	0.054	0.044
5/26	Wd	28	4.9	0.31	0.07	0.050	0.014	0.39	0.139	0.079
5/28	Wd	4	3.5	2.50	0.00	0.000	0.000	0.00	0.000	0.000
5/29	Wd	7	2.8	0.54	0.29	0.184	0.103	0.57	0.202	0.205
5/30	We	80	4.0	0.21	0.24	0.048	0.059	0.33	0.056	0.081
5/31	We	108	3.8	0.26	0.28	0.043	0.074	0.40	0.062	0.106
6/02	Wd	18	1.8	0.19	0.33	0.114	0.185	0.44	0.121	0.246
6/03	Wd	61	3.6	0.29	0.25	0.056	0.068	0.34	0.066	0.095
6/04	Wd	16	3.4	0.47	0.31	0.120	0.092	0.50	0.158	0.147
6/05	Wd	17	2.6	0.38	0.18	0.095	0.067	0.18	0.095	0.067
6/06	We	76	5.2	0.41	0.14	0.041	0.028	0.17	0.043	0.033
6/07	We	60	4.1	0.34	0.17	0.049	0.041	0.18	0.056	0.045
6/09	Wd	58	3.8	0.36	0.12	0.043	0.032	0.16	0.048	0.041
6/10	Wd	29	4.4	0.62	0.31	0.087	0.071	0.48	0.137	0.110
6/11	Wd	2	2.0	1.00	0.50	0.500	0.250	0.50	0.500	0.250
6/12	Wd	50	4.1	0.34	0.10	0.043	0.024	0.14	0.050	0.034
6/13	We	113	5.1	0.27	0.12	0.031	0.024	0.15	0.034	0.030
6/14	We	88	4.0	0.22	0.23	0.045	0.057	0.31	0.049	0.077
6/16	Wd	67	3.2	0.26	0.39	0.064	0.120	0.55	0.068	0.170
6/17	Wd	36	2.9	0.15	0.14	0.058	0.048	0.28	0.094	0.097
6/18	Wd	74	3.9	0.31	0.18	0.045	0.045	0.22	0.052	0.056
6/19	Wd	12	3.1	0.57	0.67	0.142	0.216	0.83	0.207	0.270
6/20	We	40	4.3	0.41	0.20	0.064	0.046	0.35	0.141	0.081
6/21	We	43	3.0	0.28	0.21	0.063	0.071	0.26	0.067	0.087
6/23	Wd	16	3.1	0.51	0.06	0.063	0.020	0.06	0.063	0.020
6/24	Wd	19	6.6	0.89	0.26	0.104	0.040	0.26	0.104	0.040
6/25	Wd	25	2.8	0.34	0.12	0.066	0.043	0.20	0.100	0.071
6/26	Wd	52	4.7	0.44	0.15	0.051	0.033	0.40	0.100	0.086

[1] Sample size, number of anglers interviewed.

Appendix Table B2. Daily summary statistics for fishing effort, chinook salmon harvest, and chinook salmon catch by guided anglers interviewed during the early run of the fishery for chinook salmon in the downstream section of the Kenai River, 1987 (completed-trip interviews only).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
5/20	Wd	7	5.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000
5/21	Wd	8	4.1	0.99	0.25	0.164	0.061	0.38	0.183	0.091
5/23	We	23	5.2	0.33	0.22	0.088	0.042	0.26	0.094	0.050
5/24	We	23	4.8	0.48	0.35	0.102	0.073	0.35	0.102	0.073
5/25	We	10	4.7	0.49	0.40	0.163	0.085	0.40	0.163	0.085
5/26	Wd	27	5.0	0.22	0.67	0.092	0.134	1.07	0.091	0.216
5/28	Wd	13	3.7	0.54	0.46	0.144	0.124	0.77	0.231	0.206
5/29	Wd	19	3.8	0.38	0.58	0.116	0.153	0.74	0.104	0.194
5/30	We	31	4.4	0.53	0.52	0.091	0.118	0.61	0.100	0.140
5/31	We	41	3.3	0.26	0.59	0.078	0.178	0.66	0.090	0.200
6/02	Wd	40	3.1	0.30	0.65	0.076	0.212	1.15	0.146	0.376
6/03	Wd	16	2.4	0.45	0.88	0.085	0.368	1.00	0.091	0.421
6/04	Wd	3	3.0	0.87	0.67	0.333	0.222	1.00	0.577	0.333
6/05	Wd	24	2.5	0.38	0.79	0.085	0.317	0.88	0.092	0.350
6/06	We	40	3.9	0.29	0.42	0.079	0.108	0.70	0.103	0.178
6/07	We	36	3.8	0.37	0.61	0.082	0.161	0.81	0.096	0.212
6/09	Wd	67	4.9	0.25	0.40	0.060	0.082	0.57	0.074	0.116
6/10	Wd	28	3.5	0.31	0.54	0.096	0.154	0.75	0.142	0.215
6/11	Wd	57	3.9	0.25	0.54	0.067	0.138	0.74	0.081	0.187
6/12	Wd	17	5.4	0.57	0.24	0.106	0.044	0.35	0.119	0.066
6/13	We	32	4.1	0.39	0.34	0.085	0.084	0.47	0.100	0.115
6/14	We	40	4.4	0.39	0.53	0.080	0.120	0.68	0.104	0.155
6/16	Wd	62	3.8	0.28	0.69	0.059	0.180	0.92	0.066	0.239
6/17	Wd	38	3.2	0.31	0.63	0.079	0.197	0.92	0.109	0.287
6/18	Wd	28	4.4	0.40	0.43	0.095	0.098	0.86	0.123	0.196
6/19	Wd	28	4.5	0.41	0.54	0.096	0.118	1.14	0.099	0.252
6/20	We	37	4.3	0.33	0.35	0.080	0.082	0.54	0.132	0.126
6/21	We	34	4.9	0.34	0.12	0.056	0.024	0.24	0.074	0.048
6/23	Wd	60	5.0	0.13	0.15	0.046	0.030	0.20	0.057	0.040
6/24	Wd	58	4.9	0.23	0.29	0.060	0.060	0.43	0.082	0.089
6/25	Wd	63	4.2	0.25	0.51	0.063	0.121	0.57	0.084	0.136
6/26	Wd	35	2.5	0.29	0.46	0.085	0.182	0.54	0.085	0.216

[1] Sample size, number of anglers interviewed.

Appendix Table B3. Daily summary statistics for fishing effort, chinook salmon harvest, and chinook salmon catch by unguided anglers interviewed during the late run of the fishery for chinook salmon in the downstream section of the Kenai River, 1987 (completed-trip interviews only).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
6/27	We	80	3.1	0.17	0.11	0.036	0.036	0.21	0.058	0.068
6/28	We	79	4.1	0.32	0.14	0.039	0.034	0.20	0.049	0.049
6/30	Wd	29	3.9	0.21	0.00	0.000	0.000	0.00	0.000	0.000
7/01	Wd	18	3.2	0.38	0.06	0.056	0.017	0.06	0.056	0.017
7/02	Wd	19	2.7	0.33	0.00	0.000	0.000	0.00	0.000	0.000
7/03	We	12	2.6	0.23	0.25	0.131	0.097	0.25	0.131	0.097
7/04	We	76	4.0	0.29	0.07	0.029	0.016	0.14	0.045	0.036
7/05	We	128	4.6	0.20	0.23	0.037	0.050	0.27	0.040	0.060
7/07	Wd	66	4.3	0.29	0.15	0.044	0.036	0.18	0.048	0.043
7/08	Wd	76	5.1	0.34	0.11	0.035	0.020	0.14	0.041	0.028
7/09	Wd	35	2.7	0.25	0.09	0.048	0.032	0.11	0.055	0.043
7/10	Wd	4	3.9	1.13	0.25	0.250	0.065	0.25	0.250	0.065
7/11	We	174	6.0	0.22	0.03	0.013	0.005	0.06	0.019	0.011
7/12	We	133	4.5	0.22	0.17	0.033	0.038	0.29	0.043	0.063
7/14	Wd	148	5.4	0.29	0.05	0.018	0.009	0.13	0.034	0.024
7/15	Wd	62	4.3	0.24	0.19	0.051	0.045	0.21	0.052	0.048
7/16	Wd	42	4.5	0.39	0.10	0.046	0.021	0.14	0.055	0.032
7/17	Wd	149	5.0	0.23	0.16	0.030	0.032	0.27	0.047	0.054
7/18	We	192	6.0	0.22	0.09	0.021	0.015	0.14	0.029	0.023
7/19	We	171	5.5	0.23	0.12	0.025	0.022	0.17	0.030	0.031
7/21	Wd	53	3.4	0.21	0.11	0.044	0.033	0.17	0.052	0.049
7/22	Wd	34	3.9	0.37	0.21	0.070	0.052	0.24	0.085	0.060
7/23	Wd	85	5.1	0.25	0.11	0.034	0.021	0.14	0.038	0.028
7/24	Wd	51	4.0	0.47	0.20	0.056	0.048	0.22	0.058	0.053
7/25	We	142	6.3	0.36	0.12	0.027	0.019	0.19	0.045	0.030
7/26	We	193	4.8	0.20	0.17	0.027	0.034	0.24	0.037	0.050
7/28	Wd	105	4.5	0.27	0.22	0.041	0.049	0.31	0.047	0.070
7/29	Wd	77	4.5	0.32	0.19	0.045	0.044	0.26	0.057	0.058
7/30	Wd	63	4.3	0.30	0.17	0.048	0.041	0.21	0.051	0.048
7/31	Wd	43	5.0	0.51	0.42	0.076	0.084	0.53	0.117	0.106

[1] Sample size, number of anglers interviewed.

Appendix Table B4. Daily summary statistics for fishing effort, chinook salmon harvest, and chinook salmon catch by guided anglers interviewed during the late run of the fishery for chinook salmon in the downstream section of the Kenai River, 1987 (completed-trip interviews only).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
6/27	We	36	4.3	0.50	0.31	0.078	0.071	0.36	0.081	0.084
6/28	We	57	4.4	0.34	0.54	0.067	0.122	0.68	0.071	0.154
6/30	Wd	47	5.7	0.22	0.06	0.036	0.011	0.06	0.036	0.011
7/01	Wd	34	4.0	0.32	0.35	0.083	0.088	0.38	0.085	0.095
7/02	Wd	33	3.3	0.36	0.36	0.085	0.110	0.48	0.098	0.146
7/03	We	53	4.0	0.28	0.49	0.069	0.122	0.57	0.087	0.141
7/04	We	18	5.6	0.76	0.61	0.118	0.109	0.83	0.232	0.149
7/07	Wd	27	4.3	0.43	0.41	0.096	0.095	0.63	0.143	0.147
7/08	Wd	67	4.4	0.25	0.33	0.058	0.074	0.34	0.058	0.078
7/09	Wd	70	5.3	0.24	0.31	0.056	0.060	0.44	0.063	0.084
7/10	Wd	8	4.9	0.64	0.25	0.164	0.051	0.25	0.164	0.051
7/11	We	41	6.4	0.40	0.15	0.056	0.023	0.20	0.072	0.031
7/14	Wd	44	4.4	0.26	0.20	0.062	0.047	0.20	0.062	0.047
7/15	Wd	32	4.8	0.13	0.22	0.074	0.046	0.31	0.083	0.066
7/16	Wd	97	5.7	0.25	0.32	0.048	0.057	0.42	0.053	0.075
7/17	Wd	76	4.6	0.26	0.38	0.056	0.082	0.46	0.066	0.099
7/18	We	120	4.7	0.17	0.22	0.038	0.046	0.23	0.038	0.048
7/21	Wd	37	5.1	0.23	0.24	0.072	0.048	0.32	0.078	0.064
7/22	Wd	76	4.9	0.30	0.30	0.053	0.062	0.42	0.057	0.086
7/23	Wd	122	4.0	0.19	0.47	0.045	0.115	0.57	0.048	0.142
7/24	Wd	32	5.0	0.48	0.41	0.088	0.082	0.47	0.100	0.095
7/25	We	75	4.1	0.23	0.39	0.057	0.094	0.68	0.069	0.165
7/28	Wd	29	5.0	0.49	0.31	0.087	0.062	0.59	0.105	0.116
7/29	Wd	89	4.4	0.18	0.37	0.051	0.083	0.42	0.053	0.094
7/30	Wd	43	5.4	0.44	0.42	0.076	0.077	0.60	0.101	0.111
7/31	Wd	92	3.9	0.20	0.48	0.052	0.123	0.53	0.055	0.137

[1] Sample size, number of anglers interviewed.

Appendix Table B5. Daily summary statistics for fishing effort, chinook salmon harvest, and chinook salmon catch by unguided and guided anglers interviewed during the early run of the fishery for chinook salmon in the upstream section of the Kenai River, 1987 (completed-trip interviews only).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
					Unguided anglers					
6/09	Wd	6	7.3	1.12	0.00	0.000	0.000	0.00	0.000	0.000
6/12	Wd	8	2.6	0.48	0.13	0.125	0.049	0.13	0.125	0.049
6/13	We	36	3.4	0.23	0.00	0.000	0.000	0.00	0.000	0.000
6/14	We	26	4.6	0.47	0.04	0.038	0.008	0.04	0.038	0.008
6/17	Wd	25	3.9	0.41	0.20	0.082	0.051	0.32	0.111	0.082
6/18	Wd	11	3.3	0.70	0.00	0.000	0.000	0.00	0.000	0.000
6/19	Wd	9	3.2	0.15	0.00	0.000	0.000	0.00	0.000	0.000
6/20	We	46	6.0	0.41	0.02	0.022	0.004	0.02	0.022	0.004
6/21	We	11	3.6	0.55	0.09	0.091	0.025	0.18	0.122	0.050
6/23	Wd	30	3.6	0.36	0.03	0.033	0.009	0.07	0.046	0.019
6/25	Wd	2	2.3	1.75	0.50	0.500	0.222	2.50	1.500	1.111
6/26	Wd	5	5.9	0.37	0.00	0.000	0.000	0.00	0.000	0.000
6/27	We	33	4.0	0.19	0.03	0.030	0.008	0.03	0.030	0.008
6/28	We	18	5.1	0.25	0.00	0.000	0.000	0.00	0.000	0.000
6/30	Wd	30	4.2	0.29	0.20	0.074	0.048	0.70	0.240	0.168
7/03	We	5	3.8	0.12	0.00	0.000	0.000	0.20	0.200	0.053
7/05	We	47	4.8	0.31	0.00	0.000	0.000	0.09	0.051	0.018
7/07	Wd	23	3.2	0.23	0.00	0.000	0.000	0.00	0.000	0.000
7/09	Wd	26	3.4	0.37	0.15	0.072	0.045	0.15	0.072	0.045
7/10	Wd	17	5.9	0.31	0.12	0.081	0.020	0.18	0.095	0.030
7/11	We	39	6.0	0.48	0.10	0.049	0.017	0.18	0.072	0.030
7/12	We	6	2.5	0.22	0.00	0.000	0.000	0.00	0.000	0.000
7/14	Wd	23	2.8	0.33	0.04	0.043	0.015	0.04	0.043	0.015
7/15	Wd	23	3.5	0.29	0.00	0.000	0.000	0.00	0.000	0.000
7/17	Wd	18	5.0	0.32	0.00	0.000	0.000	0.00	0.000	0.000
					Guided anglers					
6/13	We	4	4.0	1.06	0.50	0.289	0.125	0.50	0.289	0.125
6/23	Wd	16	3.8	0.79	0.50	0.129	0.132	0.56	0.157	0.149
6/25	Wd	17	2.5	0.33	0.65	0.119	0.256	0.65	0.119	0.256
6/30	Wd	6	4.4	0.49	0.33	0.211	0.075	0.83	0.307	0.189

[1] Sample size, number of anglers interviewed.

Appendix Table B6. Daily summary statistics for fishing effort, chinook salmon harvest, and chinook salmon catch by unguided anglers interviewed during the late run of the fishery for chinook salmon in the upstream section of the Kenai River, 1987 (completed-trip interviews only).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
					Unguided anglers					
7/18	We	12	5.5	0.41	0.00	0.000	0.000	0.00	0.000	0.000
7/19	We	42	4.0	0.21	0.02	0.024	0.006	0.05	0.033	0.012
7/23	Wd	5	4.8	0.73	0.00	0.000	0.000	0.00	0.000	0.000
7/24	Wd	14	3.3	0.29	0.00	0.000	0.000	0.00	0.000	0.000
7/25	We	16	3.2	0.16	0.00	0.000	0.000	0.00	0.000	0.000
7/26	We	12	3.3	0.13	0.00	0.000	0.000	0.00	0.000	0.000
7/29	Wd	23	3.3	0.40	0.00	0.000	0.000	0.13	0.072	0.040
7/30	Wd	13	2.0	0.30	0.08	0.077	0.038	0.08	0.077	0.038
					Guided anglers[2]					

[1] Sample size, number of anglers interviewed.

[2] No guided anglers were interviewed during the late run.

APPENDIX C

Counts of anglers during the creel survey of the fishery for coho salmon in the Kenai River, 1987

Appendix Table C1. Counts of unguided and guided anglers during the fishery for coho salmon in August and September in the downstream section of the Kenai River, 1987.

Date	Wd/ We	Unguided Anglers Period A	B	C	D	Guided Anglers Period A	B	C	D
8/01	We		145		158		118		26
8/02	We	129	137			52	34		
8/03	Wd								
8/04	Wd								
8/05	Wd	50		168		29		54	
8/06	Wd			99	86			19	0
8/07	Wd	80	156			37	57		
8/08	We	159	219			62	74		
8/09	We			263				28	
8/10	Wd								
8/11	Wd								
8/12	Wd	133		163		90		84	
8/13	Wd								
8/14	Wd		270	307			94	50	
8/15	We	502			166	143			5
8/16	We	616		398		96		54	
8/17	Wd								
8/18	Wd			217				48	
8/19	Wd								
8/20	Wd								
8/21	Wd	181		190		70		29	
8/22	We	505	403			135	81		
8/23	We	450			185	61			13
8/24	Wd		125	94			32	13	
8/25	Wd		102	102			54	17	
8/26	Wd								
8/27	Wd			95	98			15	4
8/28	Wd								
8/29	We			213	121			9	3
8/30	We		175	71			35	26	
8/31	Wd				74				8
9/01	Wd	92		101		47		5	
9/02	Wd								
9/03	Wd		136	98			67	29	
9/04	Wd								
9/05	We	405	399			136	68		
9/06	We		263	370			67	22	
9/07	We								
9/08	Wd	155		68		62		0	
9/09	Wd	183		67		101		12	
9/10	Wd	86	56			53	3		
9/11	Wd								
9/12	We	228		189		57		25	
9/13	We	233		85		73		15	
9/14	Wd								
9/15	Wd	111				89			
9/16	Wd								
9/17	Wd		120	62			73	17	
9/19	We	169	143			57	30		
9/19	We								
9/20	We								
9/21	Wd								
9/22	Wd								
9/23	Wd	43	46			3	3		
9/24	Wd			22				9	
9/25	Wd		20				2		
9/26	We	54	41			3	3		
9/27	We		76	39			6	7	
9/28	Wd	31	22			4	3		

Appendix Table C2. Counts of unguided and guided anglers during the fishery for coho salmon in August and September in the upstream section of the Kenai River, 1987.

Date	Wd/ We	Unguided Anglers Period A	B	C	D	Guided Anglers Period A	B	C	D
8/01	We				196				0
8/02	We	40		260		0		2	
8/03	Wd								
8/04	Wd								
8/05	Wd	0		62		0		1	
8/06	Wd			101	39			4	0
8/07	Wd		94	110			3	3	
8/08	We	37			120	0			0
8/09	We			181	36			4	0
8/10	Wd			63	52			10	2
8/11	Wd								
8/12	Wd	2	82			0	0		
8/13	Wd								
8/14	Wd	30		34		0		4	
8/15	We	16			64	0			0
8/16	We	26	86			0	10		
8/17	Wd		39	23			0	0	
8/18	Wd								
8/19	Wd								
8/20	Wd			46	28			15	0
8/21	Wd	0		63		0		4	
8/22	We	53	131			0	4		
8/23	We	57			35	0			2
8/24	Wd	25			34	0			0
8/25	Wd		34	33			11	8	
8/26	Wd		28		35		11		0
8/27	Wd			23	21			8	0
8/28	Wd								
8/29	We								
8/30	We		94	10			3	0	
8/31	Wd		8	12			6	0	
9/01	Wd	13		6		0		0	
9/02	Wd								
9/03	Wd		19	20			0	0	
9/04	Wd								
9/05	We		144	132			4	0	
9/06	We	39	46			4	8		
9/07	We								
9/08	Wd		19	17			0	0	
9/09	Wd								
9/10	Wd	7		4		0		0	
9/11	Wd								
9/12	We	37		58		2		0	
9/13	We	40	15			4	4		
9/14	Wd								
9/15	Wd	14	12			0	0		
9/16	Wd		10	7			16	0	
9/17	Wd								
9/18	Wd	43	30			4	13		
9/19	We		92	58			17	0	
9/20	We	79	99			9	0		
9/21	Wd		41	31			7	7	
9/22	Wd		46	19			4	3	
9/23	Wd								
9/24	Wd								
9/25	Wd	40	61			4	4		
9/26	We		73	74			3	3	
9/27	We		70	42			4	0	

APPENDIX D

Daily summary statistics for fishing effort, harvest rate, and catch rate for anglers interviewed during the fishery for coho salmon in the Kenai River, 1987

Appendix Table D1. Daily summary statistics for fishing effort, coho salmon harvest, and coho salmon catch by unguided anglers interviewed during the fishery for coho salmon in August and September in the downstream section of the Kenai River, 1987 (both completed-trip and incomplete-trip interviews).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
8/01	We	48	3.2	0.23	0.19	0.077	0.058	0.19	0.077	0.058
8/02	We	53	2.5	0.23	0.25	0.080	0.098	0.25	0.080	0.098
8/05	Wd	43	2.7	0.28	0.51	0.107	0.187	0.51	0.107	0.187
8/06	Wd	36	3.2	0.54	0.72	0.189	0.224	0.72	0.189	0.224
8/07	Wd	67	2.0	0.16	0.24	0.060	0.120	0.24	0.060	0.120
8/08	We	66	2.1	0.12	0.27	0.095	0.127	0.27	0.095	0.127
8/09	We	55	3.2	0.24	0.49	0.110	0.153	0.49	0.110	0.153
8/12	Wd	60	1.8	0.20	0.25	0.077	0.136	0.25	0.077	0.136
8/14	Wd	65	2.3	0.16	1.02	0.166	0.436	1.14	0.197	0.488
8/15	We	99	2.5	0.16	0.43	0.085	0.174	0.46	0.092	0.186
8/16	We	99	2.9	0.19	0.42	0.076	0.145	0.42	0.076	0.145
8/18	Wd	50	1.3	0.10	0.20	0.057	0.154	0.20	0.057	0.154
8/21	Wd	74	3.8	0.41	0.34	0.078	0.090	0.34	0.078	0.090
8/22	We	39	2.2	0.16	0.26	0.080	0.116	0.26	0.080	0.116
8/23	We	85	2.6	0.18	0.21	0.058	0.080	0.21	0.058	0.080
8/24	Wd	38	3.7	0.41	0.32	0.142	0.086	0.32	0.142	0.086
8/25	Wd	26	2.9	0.41	0.19	0.096	0.066	0.19	0.096	0.066
8/27	Wd	55	3.5	0.48	0.27	0.084	0.078	0.27	0.084	0.078
8/29	We	95	4.9	0.32	0.47	0.093	0.097	0.47	0.093	0.097
8/30	We	60	3.5	0.32	0.18	0.077	0.053	0.18	0.077	0.053
8/31	Wd	43	3.1	0.36	0.51	0.154	0.165	0.51	0.154	0.165
9/01	Wd	52	3.2	0.35	0.31	0.070	0.096	0.31	0.070	0.096
9/03	Wd	74	4.0	0.28	0.43	0.092	0.109	0.43	0.092	0.109
9/05	We	97	2.6	0.15	0.49	0.096	0.194	0.53	0.103	0.206
9/06	We	63	2.6	0.28	0.25	0.071	0.096	0.25	0.071	0.096
9/08	Wd	68	3.2	0.23	0.53	0.104	0.167	0.53	0.104	0.167
9/09	Wd	64	3.2	0.24	0.66	0.122	0.206	0.66	0.122	0.206
9/10	Wd	31	2.4	0.34	0.29	0.115	0.123	0.29	0.115	0.123
9/12	We	177	3.6	0.17	0.18	0.038	0.050	0.18	0.038	0.050
9/13	We	85	2.5	0.17	0.38	0.089	0.150	0.38	0.089	0.150
9/15	Wd	69	3.8	0.29	0.45	0.091	0.117	0.45	0.091	0.117
9/17	Wd	106	3.0	0.18	0.48	0.072	0.158	0.48	0.072	0.158
9/19	We	76	3.6	0.25	0.32	0.068	0.088	0.32	0.068	0.088
9/23	Wd	29	2.5	0.42	0.62	0.152	0.247	0.62	0.152	0.247
9/24	Wd	6	4.2	0.70	0.17	0.167	0.040	0.17	0.167	0.040
9/25	Wd	10	3.2	0.83	0.20	0.133	0.063	0.20	0.133	0.063
9/26	We	33	3.1	0.32	0.42	0.115	0.139	0.42	0.115	0.139
9/27	We	29	3.0	0.27	0.34	0.134	0.114	0.34	0.134	0.114
9/28	Wd	29	2.4	0.29	0.17	0.071	0.071	0.17	0.071	0.071

[1] Sample size, number of anglers interviewed.

Appendix Table D2. Daily summary statistics for fishing effort, coho salmon harvest, and coho salmon catch by guided anglers interviewed during the fishery for coho salmon in August and September in the downstream section of the Kenai River, 1987 (both completed-trip and incomplete-trip interviews).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
8/01	We	39	7.1	0.54	0.41	0.131	0.057	0.41	0.131	0.057
8/02	We	32	4.4	0.24	0.47	0.142	0.106	0.47	0.142	0.106
8/05	Wd	57	3.6	0.19	0.53	0.107	0.145	0.53	0.107	0.145
8/06	Wd	12	7.6	0.64	0.75	0.279	0.099	0.75	0.279	0.099
8/07	Wd	43	2.4	0.22	0.49	0.112	0.205	0.49	0.112	0.205
8/08	We	35	2.8	0.22	0.74	0.185	0.264	0.74	0.185	0.264
8/09	We	5	6.0	0.00	0.40	0.400	0.067	0.40	0.400	0.067
8/12	Wd	64	3.3	0.15	0.70	0.147	0.213	0.70	0.147	0.213
8/14	Wd	46	3.2	0.18	1.74	0.202	0.552	1.74	0.202	0.552
8/15	We	23	2.3	0.27	0.83	0.264	0.362	0.83	0.264	0.362
8/16	We	41	4.3	0.26	1.15	0.208	0.268	1.15	0.208	0.268
8/18	Wd	22	5.5	0.50	0.36	0.181	0.066	0.36	0.181	0.066
8/21	Wd	61	3.7	0.28	0.85	0.155	0.230	0.85	0.155	0.230
8/22	We	44	4.0	0.23	0.80	0.144	0.198	0.80	0.144	0.198
8/23	We	29	3.7	0.23	0.59	0.195	0.160	0.59	0.195	0.160
8/24	Wd	25	6.7	0.22	0.84	0.243	0.125	0.84	0.243	0.125
8/25	Wd	18	5.0	0.39	1.83	0.326	0.367	1.83	0.326	0.367
8/27	Wd	12	2.8	0.36	0.42	0.260	0.152	0.42	0.260	0.152
8/29	We	9	11.6	0.18	1.11	0.484	0.096	1.11	0.484	0.096
8/30	We	35	5.2	0.46	0.46	0.138	0.088	0.46	0.138	0.088
8/31	Wd	22	4.3	0.51	1.23	0.271	0.287	1.23	0.271	0.287
9/01	Wd	34	6.8	0.29	1.06	0.202	0.157	1.06	0.202	0.157
9/03	Wd	37	5.7	0.48	0.95	0.190	0.165	0.95	0.190	0.165
9/05	We	87	3.6	0.12	0.87	0.129	0.239	0.87	0.129	0.239
9/06	We	27	4.5	0.27	0.78	0.216	0.171	0.78	0.216	0.171
9/08	Wd	40	3.1	0.35	0.57	0.156	0.188	0.57	0.156	0.188
9/09	Wd	54	3.4	0.16	0.57	0.136	0.169	0.57	0.136	0.169
9/10	Wd	46	3.5	0.12	0.87	0.172	0.245	0.87	0.172	0.245
9/12	We	57	4.6	0.23	0.30	0.087	0.066	0.30	0.087	0.066
9/13	We	33	4.1	0.46	0.42	0.138	0.104	0.42	0.138	0.104
9/15	Wd	55	5.5	0.22	0.80	0.138	0.147	0.80	0.138	0.147
9/17	Wd	43	6.4	0.20	1.37	0.137	0.215	1.37	0.137	0.215
9/19	We	40	3.7	0.19	0.57	0.118	0.154	0.57	0.118	0.154
9/23	Wd	6	2.8	0.34	0.00	0.000	0.000	0.00	0.000	0.000
9/24	Wd	4	8.0	0.00	0.25	0.250	0.031	0.25	0.250	0.031
9/25	Wd	2	1.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000
9/26	We	3	6.0	0.00	0.33	0.333	0.056	0.33	0.333	0.056
9/27	We	7	6.3	0.81	0.14	0.143	0.023	0.14	0.143	0.023
9/28	Wd	4	3.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000

[1] Sample size, number of anglers interviewed.

Appendix Table D3. Daily summary statistics for fishing effort, coho salmon harvest, and coho salmon catch by unguided anglers interviewed during the fishery for coho salmon in August and September in the upstream section of the Kenai River, 1987 (both completed-trip and incomplete-trip interviews).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
8/01	We	228	3.1	0.16	0.00	0.000	0.000	0.00	0.000	0.000
8/02	We	135	2.4	0.12	0.00	0.000	0.000	0.00	0.000	0.000
8/05	Wd	61	2.5	0.16	0.00	0.000	0.000	0.00	0.000	0.000
8/06	Wd	83	2.1	0.21	0.01	0.012	0.006	0.06	0.036	0.029
8/07	Wd	107	2.2	0.10	0.00	0.000	0.000	0.00	0.000	0.000
8/08	We	89	2.7	0.15	0.02	0.016	0.008	0.02	0.016	0.008
8/09	We	130	3.5	0.18	0.04	0.017	0.011	0.04	0.017	0.011
8/10	Wd	93	2.6	0.19	0.00	0.000	0.000	0.00	0.000	0.000
8/12	Wd	78	1.4	0.11	0.08	0.035	0.053	0.09	0.037	0.062
8/14	Wd	59	2.1	0.14	0.14	0.056	0.065	0.15	0.063	0.073
8/15	We	76	2.4	0.19	0.17	0.063	0.072	0.25	0.113	0.105
8/16	We	110	2.1	0.16	0.27	0.055	0.128	0.27	0.055	0.128
8/17	Wd	75	1.8	0.15	0.24	0.065	0.133	0.24	0.065	0.133
8/20	Wd	75	2.7	0.20	0.29	0.065	0.109	0.29	0.065	0.109
8/21	Wd	41	2.3	0.22	0.27	0.086	0.115	0.27	0.086	0.115
8/22	We	162	1.9	0.11	0.19	0.040	0.095	0.19	0.040	0.095
8/23	We	103	1.8	0.11	0.11	0.039	0.059	0.11	0.039	0.059
8/24	Wd	72	2.7	0.26	0.11	0.047	0.041	0.11	0.047	0.041
8/25	Wd	76	3.2	0.27	0.12	0.046	0.038	0.13	0.047	0.042
8/26	Wd	80	2.8	0.18	0.15	0.047	0.055	0.15	0.047	0.055
8/27	Wd	54	2.6	0.21	0.04	0.026	0.014	0.04	0.026	0.014
8/30	We	131	2.4	0.13	0.05	0.025	0.022	0.05	0.025	0.022
8/31	Wd	28	1.9	0.26	0.07	0.050	0.037	0.07	0.050	0.037
9/01	Wd	36	1.9	0.28	0.28	0.094	0.144	0.28	0.094	0.144
9/03	Wd	48	2.7	0.22	0.21	0.094	0.076	0.21	0.094	0.076
9/05	We	152	3.0	0.16	0.20	0.047	0.065	0.20	0.047	0.065
9/06	We	68	1.8	0.15	0.26	0.071	0.144	0.29	0.073	0.160
9/08	Wd	42	2.5	0.33	0.19	0.070	0.077	0.21	0.073	0.087
9/10	Wd	28	2.3	0.34	0.14	0.067	0.062	0.14	0.067	0.062
9/12	We	129	2.6	0.18	0.14	0.034	0.054	0.14	0.034	0.054
9/13	We	73	2.0	0.20	0.08	0.032	0.041	0.08	0.032	0.041
9/15	Wd	35	2.2	0.21	0.11	0.055	0.051	0.17	0.077	0.077
9/16	Wd	33	2.9	0.35	0.27	0.100	0.094	0.27	0.100	0.094
9/18	Wd	81	2.2	0.14	0.42	0.084	0.190	0.42	0.084	0.190
9/19	We	130	2.8	0.19	0.32	0.050	0.112	0.33	0.051	0.118
9/20	We	186	2.0	0.10	0.26	0.042	0.129	0.26	0.042	0.129
9/21	Wd	76	2.9	0.22	0.49	0.087	0.171	0.51	0.091	0.180
9/22	Wd	85	3.2	0.23	0.28	0.062	0.089	0.28	0.062	0.089
9/25	Wd	114	1.8	0.12	0.34	0.061	0.186	0.34	0.061	0.186
9/26	We	132	2.2	0.14	0.14	0.036	0.064	0.14	0.036	0.064
9/27	We	141	2.6	0.13	0.29	0.052	0.110	0.29	0.052	0.110

[1] Sample size, number of anglers interviewed.

Appendix Table D4. Daily summary statistics for fishing effort, coho salmon harvest, and coho salmon catch by guided anglers interviewed during the fishery for coho salmon in August and September in the upstream section of the Kenai River, 1987 (both completed-trip and incomplete-trip interviews).

Date	Wd/ We	EFFORT (hrs) SS[1]	Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
8/01	We	4	2.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
8/02	We	4	4.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
8/06	Wd	4	4.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
8/07	Wd	3	4.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000
8/10	Wd	13	2.7	0.46	0.00	0.000	0.000	0.00	0.000	0.000
8/14	Wd	4	2.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000
8/16	We	5	2.5	0.00	0.20	0.200	0.080	0.20	0.200	0.080
8/20	Wd	12	2.2	0.07	0.58	0.229	0.264	0.58	0.229	0.264
8/22	We	6	6.5	0.00	1.00	0.258	0.154	1.00	0.258	0.154
8/24	Wd	4	0.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000
8/25	Wd	14	1.4	0.23	0.07	0.071	0.050	0.07	0.071	0.050
8/26	Wd	8	2.8	0.09	0.50	0.267	0.178	0.50	0.267	0.178
8/27	Wd	8	2.5	0.19	1.00	0.267	0.400	1.00	0.267	0.400
8/30	We	3	4.0	0.00	0.33	0.333	0.083	0.33	0.333	0.083
8/31	Wd	6	5.8	0.11	2.50	0.224	0.435	2.50	0.224	0.435
9/06	We	16	2.8	0.34	0.19	0.101	0.068	0.19	0.101	0.068
9/12	We	5	2.8	0.73	1.00	0.447	0.357	1.00	0.447	0.357
9/13	We	8	3.1	0.55	0.75	0.313	0.245	0.75	0.313	0.245
9/16	Wd	19	4.8	0.36	0.58	0.176	0.120	0.58	0.176	0.120
9/18	Wd	13	4.7	0.35	1.46	0.183	0.311	1.46	0.183	0.311
9/19	We	13	5.5	0.88	0.62	0.241	0.111	0.62	0.241	0.111
9/20	We	22	2.0	0.19	0.09	0.063	0.044	0.09	0.063	0.044
9/21	Wd	14	3.4	0.54	1.07	0.370	0.319	1.07	0.370	0.319
9/22	Wd	7	4.0	0.71	0.86	0.340	0.214	1.14	0.404	0.286
9/25	Wd	8	3.0	0.57	1.00	0.267	0.333	1.00	0.267	0.333
9/26	We	15	2.8	0.46	0.60	0.254	0.214	0.60	0.254	0.214
9/27	We	6	4.0	0.00	0.67	0.211	0.167	0.67	0.211	0.167

[1] Sample size, number of anglers interviewed.