

Fishery Data Series No. 93-40

**Angler Effort and Harvest of Chinook Salmon
by the Recreational Fisheries in the Lower
Kenai River, 1992**

by

S. L. Hammarstrom

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Alaska Department of Fish and Game

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ABSTRACT

A creel survey was conducted on the Kenai River between the Soldotna Bridge and Cook Inlet from 19 May through 31 July 1992. The recreational fishery in this section of the Kenai River is primarily targeting on chinook salmon *Oncorhynchus tshawytscha*. The estimated angler-effort and harvest during the early (May and June) chinook salmon run were 54,330 angler-hours and 1,365 chinook salmon, respectively. The estimated angler-effort and harvest during the late (July) chinook salmon run were 187,415 angler-hours and 6,680 chinook salmon, respectively. Inseason restrictions to the recreational fisheries were issued for conservation reasons during both runs. Unguided anglers exerted 58.0% of the total effort and took 39.2% of the chinook salmon harvest while guided anglers exerted 42.0% of the effort and harvested 60.8% of the chinook salmon. Inriver return, estimated using dual beam sonar, was 10,087 fish during the early run and 30,314 fish during the late run.

Age and sex composition of the recreational harvest and the inriver return are also presented.

KEY WORDS: Kenai River, chinook salmon, creel survey, effort, harvest, *Oncorhynchus tshawytscha*.

INTRODUCTION

The Kenai River supports the largest freshwater recreational fishery in Alaska with an average annual effort of nearly 270,000 angler-days from 1983 to 1991 (Mills 1984-1992). This represents approximately 15% of the state's recreational fishing effort. The majority of the angler-effort occurs in the section of the river between the outlet of Skilak Lake and Cook Inlet (Figure 1) during a fishery directed primarily at returning chinook salmon *Oncorhynchus tshawytscha* during May, June, and July. Angler effort directed at chinook salmon increased from 1974 to 1988 but has declined since 1988 (Figures 2 and 3). Although coho salmon *O. kisutch*, sockeye salmon *O. nerka*, pink salmon *O. gorbuscha*, Dolly Varden *Salvelinus malma*, and rainbow trout *O. mykiss* are also harvested by anglers in the Kenai River, this report deals only with the chinook salmon fishery.

Prior to 1970, the recreational fishery in the Kenai River consisted of shorebased anglers targeting sockeye salmon in July and coho salmon in August and early September. In 1973, large numbers of anglers began experimenting with bouncing brightly colored terminal gear along the river bottom from a drifting boat. This technique had been used effectively by anglers fishing for chinook salmon on rivers in the Pacific Northwest. It proved to be a very effective method for catching chinook salmon on the Kenai River, and the fishery began to expand rapidly (Figures 2 and 3).

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

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

Previous information pertaining to the chinook salmon fisheries in the Kenai River has been presented by Hammarstrom (1975-1981, 1988-1992), Hammarstrom and Larson (1982-1984, 1986), Hammarstrom et al. (1985), and Conrad and Hammarstrom (1987). In addition, angler-effort and harvest by species for the recreational fishery have been estimated by Mills (1979-1992) in the Alaska Statewide Sport Fish Harvest Survey.

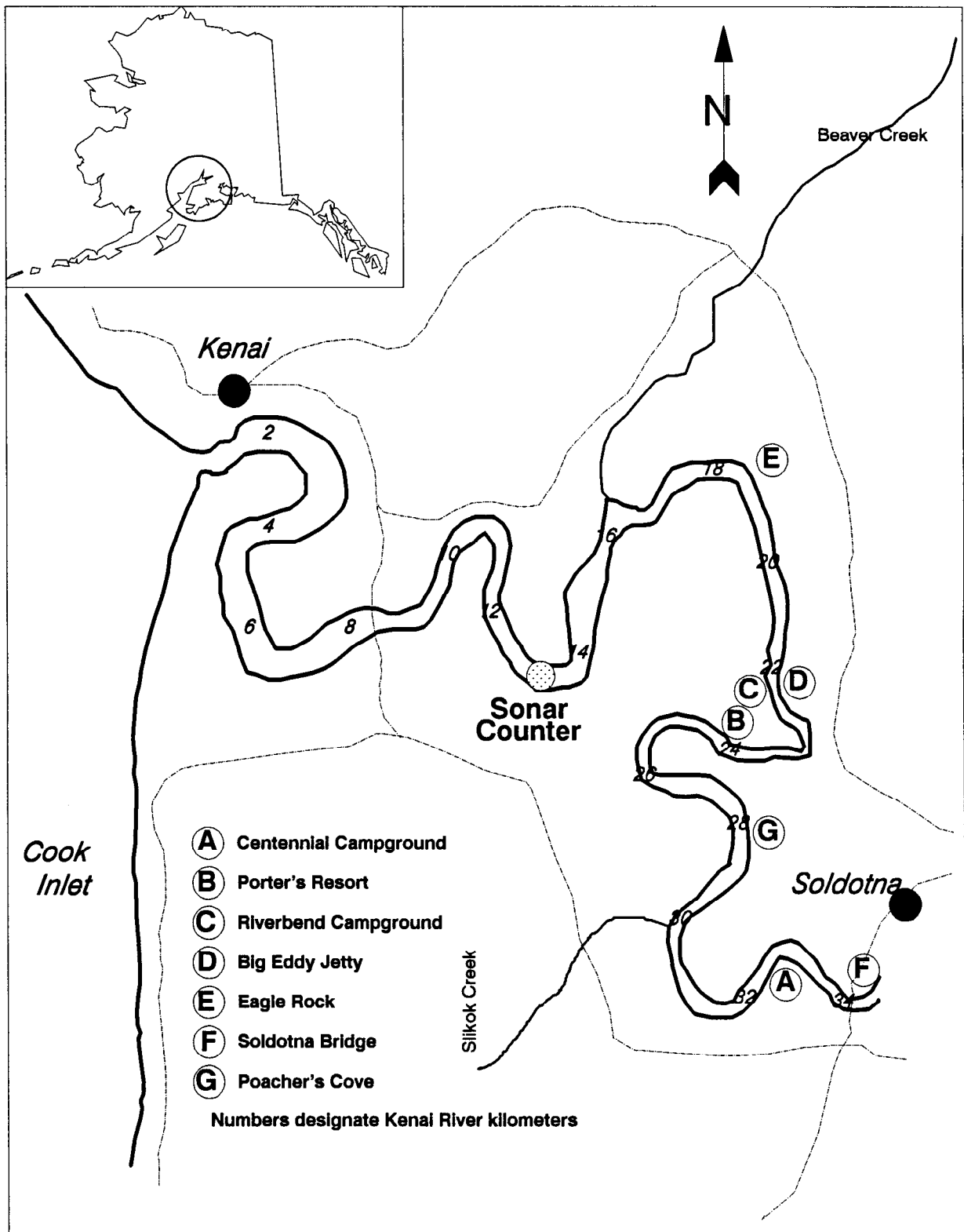


Figure 1. Map of the Kenai River study area.

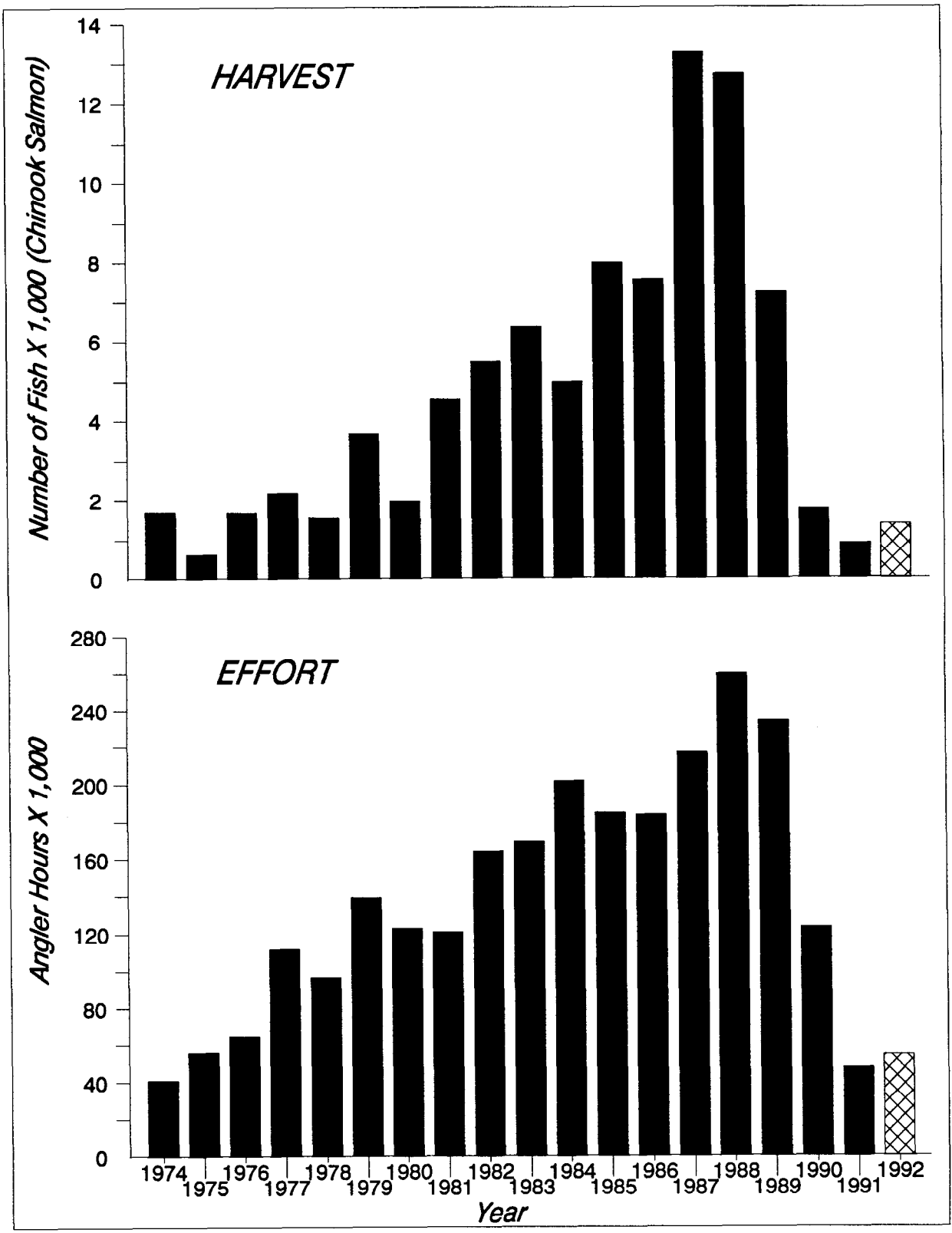


Figure 2. Historical harvest and effort in the recreational fishery for early-run chinook salmon, Kenai River, Alaska, 1974-1992.

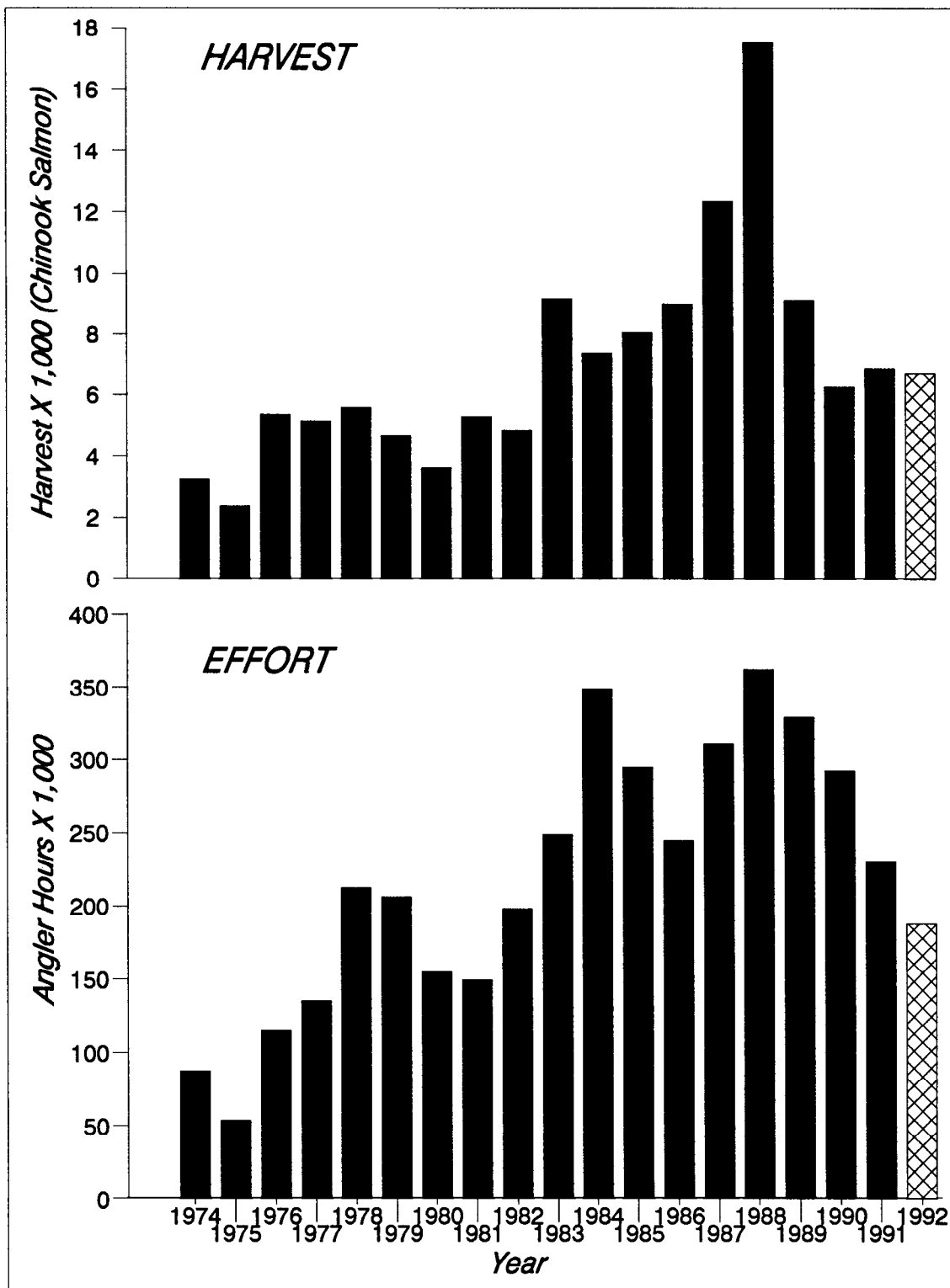


Figure 3. Historical harvest and effort in the recreational fishery for late-run chinook salmon, Kenai River, Alaska, 1974-1992.

The creel survey program on the Kenai River provides data used for inseason management decisions on the recreational fishery, to evaluate long-term management objectives, and for the Alaska Board of Fisheries to allocate salmon resources. The objective of this report is to present detailed information of the creel survey on the recreational fishery of chinook salmon in 1992.

Fishing Regulations

The regulations for the chinook salmon fishery on the Kenai River are the most restrictive of any open waters in Alaska. The only section of the river open to fishing for chinook salmon is between the outlet of Skilak Lake and Cook Inlet. 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 1992, fishing from boats downstream from the outlet of Skilak Lake was prohibited on Mondays in May, June, and July, except Monday of Memorial Day. Anyone retaining a chinook salmon that was 41 cm in length or greater was prohibited from fishing from a boat in the Kenai River for the remainder of that day. Additionally, the early-run fishery was further restricted in that the use of bait was prohibited until the department was able to project an escapement of at least 9,000 fish or 1 July, whichever occurred first.

There were further restrictions for guided anglers. In addition to the regulation prohibiting fishing from boats on Mondays, fishing from a registered guide vessel was prohibited on Sunday in July. In 1992, fishing from a guided boat was allowed only between 0600 and 1800 hours during June and July. There were no days or hours closed to boat fishing for either guided or unguided anglers during the remainder of the year.

METHODS

Creel Survey

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

The chinook salmon fishery is limited to the lower Kenai River defined as the mainstem waters downstream of Skilak Lake. During the 1992 early-run and late-run fisheries, angler effort, harvest, and catch were estimated only for the downstream section (Cook Inlet, river mile/kilometer 0, to the Soldotna Bridge, river mile [rm] 21 or river kilometer [rk] 34) of the lower Kenai River (Figure 1). Because of emergency orders that restricted the fishery and reduced effort upstream of the Soldotna Bridge (upstream section of the lower Kenai River), that area was not surveyed in 1992.

Both unguided and guided anglers fish for chinook salmon in the Kenai River. The times and days when guides work on the Kenai River are restricted and anglers employing commercial guides have very different harvest and catch rates (Conrad and Hammarstrom 1987); therefore, effort, HPUE, CPUE, harvest, and catch were estimated separately for guided and unguided anglers. Guided clients fish exclusively from boats and are easily recognized because these boats must be marked with a prominent identifying decal. Since shore anglers harvest very few chinook salmon, only boat anglers were surveyed.

The creel survey began 19 May and continued through 31 July. The fishing day for unguided anglers was defined as 20 hours long, from 0400 to 2400 hours and was divided into five 4-hour periods for estimating effort. The periods were: A, from 0400 to 0759 hours; B, from 0800 to 1159 hours; C, from 1200 to 1559 hours; D, from 1600 to 1959 hours; and E, from 2000 to 2359 hours. Since effort, CPUE, and HPUE differed for unguided anglers on weekends as opposed to weekdays (Conrad and Hammarstrom 1987), unguided anglers were further stratified into weekdays and weekend/holidays. In May, the guided angler day was divided into the same five 4-hour periods; however, no differentiation was made between weekdays and weekend/holidays. However, by regulation, anglers could fish from a registered guide boat only from 0600 to 1800 hours during June and July, which therefore defined the fishing day (12 hours) for guided anglers. Since most guides schedule two trips per day, morning and afternoon, each fishing day for guided anglers had two periods: Period A, 0600 to 1159 hours and B, 1200 to 1759 hours. No further stratification for guided anglers was used.

In addition, the survey was divided into 7 temporal strata, 3 during the early run and 4 during the late run, which corresponded to changes in management strategies that altered the fishery. On 10 June, the river was restricted to trophy fishing. The river was reopened to retention of all fish on 1 July downstream from Slikok Creek and closed to chinook salmon fishing upstream of Slikok Creek (which reopened 16 July). The use of bait was not allowed until 1 July when the late-run fishery began. The use of bait was prohibited and trophy fishing imposed on 24 July; these restrictions were removed on 30 July. The above emergency orders were issued based on estimates of the inriver return to allow maximum angling opportunity while insuring achievement of escapement goals. There were 20 strata in the chinook salmon fishery in the downstream section of the Kenai River, 9 in the early run and 11 in the late run:

Early Run

Temporal Stratum 1 (19 May to 31 May)

1. Unguided angler weekdays,
2. Unguided anglers weekend/holidays,
3. Guided anglers,

Temporal Stratum 2 (1 June to 9 June)

4. Unguided anglers, weekdays,
5. Unguided anglers, weekend/holidays,
6. Guided anglers,

Temporal Stratum 3 (10 June to 30 June)

7. Unguided anglers weekdays,
8. Unguided anglers weekends/holidays,
9. Guided anglers,

Late Run

Temporal Stratum 4 (1 July to 15 July)

10. Unguided anglers weekdays,
11. Unguided anglers weekend/holidays,
12. Guided anglers,

Temporal Stratum 5 (16 July to 23 July)

13. Unguided anglers weekdays,
14. Unguided anglers weekend/holidays,
15. Guided anglers,

Temporal Stratum 6 (24 July to 29 July)

16. Unguided anglers weekdays,
17. Unguided anglers weekend/holidays,
18. Guided anglers,

Temporal Stratum 7 (30 July to 31 July)

19. Unguided anglers weekdays, and
20. Guided anglers.

Angler Counts:

Sampling levels were designed to estimate catch and harvest within 15% of their true values 95% of the time. Two creel survey clerks, each working 37.5 hours per week, conducted the angler counts.

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

Since guided and unguided anglers fished under similar regulations during May, guided angler counts in May were conducted as described above. However, during June and July, if a selected unguided angler count occurred during an A period (0600-1159 hours) of the guided angler strata, then a guided angler count was also conducted simultaneously. If no unguided angler counts were scheduled during an A period for guided anglers, an additional count for guided anglers only was conducted at a randomly selected whole-hour during the

guided period in question. The same protocol held for B periods (1200 to 1759 hours) in guided strata. If two or more counts occurred during a guided period, then one was selected randomly as the guided angler count.

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

Counts of anglers were conducted from a boat. Direction of travel (either upstream or downstream) was randomly selected. The clerk counted anglers while driving the boat at a constant 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 instantaneous and reflect fishing effort at the time of the count. During the angler count, the creel survey clerk recorded the following: (1) total number of unguided boats, (2) total number of guided boats, (3) total number of anglers in unguided boats, (4) total number of anglers in guided boats, and (5) total number of shore anglers. Boats and anglers were considered engaged in fishing and were counted if the boat was in operation, as opposed to tied to the shore, regardless of whether or not an angler's line was in the water when the count was being conducted. Guides were not included in the counts during the chinook salmon fishery as they were prohibited from fishing while guiding. When the clerks responsible for angler counts were not conducting a count, they conducted completed-trip angler interviews at access locations.

Angler Interviews:

The angler interview schedule was designed for two access survey clerks, each working 37.5 hours per week. In addition, the two angler count clerks conducted interviews during sample periods when they were not doing counts.

The following information was recorded for each angler interview: (1) powered or nonpowered boat, (2) guided or unguided angler, (3) number of hours spent fishing (to the nearest 0.5 hour), (4) number and species of fish retained, and (5) number and species of fish released.

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

Age/Sex Composition

Harvest:

Sampling goals for estimation of age composition of the harvest were 250 harvested fish from each run. Samples were obtained from anglers' creels during the surveys. Mid-eye to fork-of-tail length was measured to the nearest one-half centimeter, the sex of the fish was identified, and scales were removed from the preferred area as described for sockeye salmon (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.

Inriver Return:

The inriver return was estimated with dual-beam sonar (Burwen and Skvorc *In Prep*). To estimate the age and sex composition of the inriver return, chinook salmon were captured in large mesh gill nets in the intertidal area using the techniques described by Hammarstrom and Larson (1984). Sampling was stratified into two 3-week periods during each run with a sampling goal of 125 fish per sample period (Thompson 1987).

Fish were placed in a tagging cradle, untangled from the gill net, measured, sex determined from external characteristics and three scales taken from the preferred area. Scale samples were prepared similarly to those of the recreational harvest samples.

Data Analyses

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

Effort:

The number of angler-hours of effort during time stratum t was estimated as (Neuhold and Lu 1957):

$$\hat{E}_t = \sum_{j=1}^J H_{tj} \bar{x}_{tj}, \quad (1)$$

where:

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

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

J = the number of periods (A, B, C, etc.) in stratum t .

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

$$V(\hat{E}_t) = \sum_{j=1}^J H_{tj}^2 (s_{tj}^2/n_{tj}), \quad (2)$$

where:

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

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

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

Harvest Rates:

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

Mean effort per angler during component t was estimated as:

$$\bar{f}_t = \left(\sum_{i=1}^d \sum_{k=1}^{m_i} f_{ik} \right) / \sum_{i=1}^d m_i; \quad (4)$$

where:

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

f_{ik} = the effort (in hours) by angler k interviewed on day i ;

m_i = the number of anglers interviewed on day i .

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

$$V(\bar{f}_t) = [1 - (d/D)] s_B^2/d + \left(\sum_{i=1}^d s_{wi}^2/m_i \right) / dD, \quad (5)$$

where:

D = the number of days the fishery was open during component t ;

s_B^2 = the sample variance among days of mean effort per angler; and

s_{wi}^2 = the sample variance among anglers of mean effort per angler for interviews on day i .

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

$$s_{tB}^2 = \left[\sum_{i=1}^d (\bar{f}_{ti} - \bar{f}_t)^2 \right] / (d_t - 1), \quad (6)$$

where:

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

Mean harvest (or catch) 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) during stratum t was estimated by:

$$\hat{HPUE}_t = \bar{h}_t / \bar{f}_t, \quad (7)$$

where:

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

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

$$V(\bar{h}_t / \bar{f}_t) \approx (\bar{h}_t / \bar{f}_t)^2 (s_h^2 / \bar{h}_t^2 + s_f^2 / \bar{f}_t^2 - 2r_t s_h s_f / \bar{h}_t \bar{f}_t), \quad (8)$$

where:

s_h^2 = the two-stage estimate of variance for \bar{h}_t ;

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

r_t = the correlation coefficient between the f_{ik} and the h_{ik} in component t .

Catch per unit effort (CPUE) and its variance were estimated by replacing harvest statistics with catch statistics in equations 7 and 8.

Harvest:

The harvest during each component was estimated by:

$$\hat{H}_t = \hat{E}_t \hat{HPUE}_t . \quad (9)$$

The variance of \hat{H}_t was estimated as (Goodman 1960):

$$\hat{V}(H_t) = [\hat{E}_t^2 \hat{V}(\hat{HPUE}_t)] + [\hat{HPUE}_t^2 \hat{V}(\hat{E}_t)] - [\hat{V}(\hat{E}_t) \hat{V}(\hat{HPUE}_t)] . \quad (10)$$

Total (for example, the total for unguided anglers during the early run) of effort and harvest of each run 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.

The major assumptions necessary for these analyses are:

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

Biological Data:

Age composition of the chinook salmon harvest and inriver return were estimated for each run. Letting p_{at} equal the estimated proportion of age group a in component t, the variance of p_{at} was estimated as (Scheaffer et al. 1979):

$$\hat{V}(p_{at}) = \hat{p}_{at}(1-\hat{p}_{at})/(n_t-1) \quad (11)$$

where:

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

RESULTS

Effort

As a result of inseason restrictions, the fishery occurred only in the downstream section of the lower Kenai River. Low water levels and lack of observed angling delayed beginning of the creel survey until 19 May. Because

of mechanical and other logistical problems or illness, angler counts were conducted on only 62 of the 65 days possible; 35 of 38 during the early run and 27 of 27 during the late run.

Between one and five angler counts were conducted on each sample day. During the early run, angler counts ranged from 0 to 138 for unguided anglers and from 0 to 207 for guided anglers (Appendix A1). The largest count of unguided anglers occurred on 6 June and of guided anglers on 9 June. During the late run, angler counts ranged from 11 to 692 for unguided anglers and from 75 to 653 for guided anglers (Appendix A2). The largest count of unguided anglers occurred on 19 July and of guided anglers on 30 July.

Mean angler counts for each period by component were calculated for the early run (Table 1) and for the late run (Table 2). After trophy fishing was imposed (10 June-30 June during the early run and 24 July-29 July during the late run), mean angler counts for each period declined.

The estimated effort in the downstream section during the early run was 54,330 (SE = 2,388) angler-hours (Table 3). As happened during 1990 and 1991, effort declined upon implementation of mandatory catch and release fishing (1990, 1991) or "trophy fishing" (1992). During the early run, 52% of the total effort was by unguided anglers. The estimated effort during the late run was 187,415 (SE = 6,808) angler-hours (Table 4). The majority of this effort (60%) was by unguided anglers.

Harvest Rates and Catch Rates

A total of 3,835 interviews of completed-trip anglers was collected: 1,228 interviews during the early run and 2,607 interviews during the late run (Tables 5 and 6). There was 1 day during the early run (11 June) when no completed-trip angler interviews were collected.

Daily catch rates of early-run chinook salmon by unguided anglers ranged from 0.000 to 0.583 fish per hour and from 0.000 to 0.264 fish per hour for guided anglers (Appendices B1 and B2). Peak daily catch rates of early-run chinook salmon by unguided anglers occurred on 30 June and on 26 June for guided anglers. Daily catch rates of late-run chinook salmon by unguided anglers ranged from 0.006 to 0.156 fish per hour and from 0.000 to 0.224 fish per hour for guided anglers (Appendices B3 and B4). Peak daily catch rates of late chinook salmon by unguided anglers occurred on 29 July and by guided anglers occurred on 30 July. Estimates of overall harvest and catch rates of chinook salmon for each of the components appear in Tables 5 and 6.

Harvest and Catch

Estimated effort and harvest and catch rates for each early-run component (Tables 3 and 5, respectively) were used to estimate harvest and catch during the early run (Table 7). Estimates of harvest and catch for the late run (Table 8) were calculated for each component from the values presented in Tables 4 and 6.

A total of 1,365 (SE = 151) fish were harvested during the early run and 6,680 (SE = 462) fish were harvested during the late run (Tables 7 and 8). Guided anglers harvested more fish than did unguided anglers during both runs.

Table 1. Mean counts of boat anglers by period for each of the components of the creel survey of the fishery for early-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Period ^a				
	A	B	C	D	E
<u>Period 1 (18 May - 31 May)</u>					
Unguided anglers, weekdays:					
Number of counts	1	2	2	2	1
Mean count	0.0	15.5	22.5	11.5	13.0
Standard error		5.5	16.5	7.5	
Unguided anglers, weekends:					
Number of counts	4	4	4	5	4
Mean count	39.0	66.3	83.0	64.6	34.3
Standard error	8.7	14.7	4.5	5.6	8.3
Guided anglers, all days (May):					
Number of counts	4	6	6	7	5
Mean count	29.5	47.7	25.2	12.3	1.4
Standard error	17.1	9.4	6.9	2.4	1.4
<u>Period 2 (1 June - 9 June)</u>					
Unguided anglers, weekdays:					
Number of counts	1	4	1	4	3
Mean count	29	59.5	60	52.3	79.7
Standard error		15.7		8.3	4.1
Unguided anglers, weekends:					
Number of counts	2	2	1	1	1
Mean count	60.0	137.0	125.0	95.0	85.0
Standard error	52.0	1.0			
Guided anglers, all days:					
Number of counts	6	5			
Mean count	131.0	48.2			
Standard error	17	8.5			
<u>Period 3 (10 June - 30 June)</u>					
Unguided anglers, all days:					
Number of counts	5	8	9	8	7
Mean count	18.6	28.3	24.1	25.3	20.9
Standard error	5.4	4.6	3.3	4.2	3.6
Unguided anglers, weekends:					
Number of counts	6	6	6	6	6
Mean count	21.5	48.5	41.2	41.0	42.0
Standard error	5.8	9.9	6.0	8.1	10.7
Guided anglers, all days:					
Number of counts	17	17			
Mean count	78.5	37.7			
Standard error	6.5	4.7			

^a Unguided anglers, all months:

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

Guided angler:

May: Same as unguided angler

June:

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

Table 2. Mean counts of boat anglers by period for each of the components of the creel survey of the fishery for late-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Period ^a				
	A	B	C	D	E
<u>Period 4 (1 July - 15 July)</u>					
Unguided anglers, weekdays:					
Number of counts	6	7	5	6	5
Mean count	243.8	180.4	153.6	164.3	155.2
Standard error	64.6	22.7	26.9	46.3	20.6
Unguided anglers, weekends:					
Number of counts	4	3	4	4	4
Mean count	207.0	238.0	268.3	175.5	146.0
Standard error	49.3	23.7	36.8	23.8	31.9
Guided anglers, all days:					
Number of counts	11	11			
Mean count	297.1	152.6			
Standard error	26.7	19.6			
<u>Period 5 (16 July - 23 July)</u>					
Unguided anglers, weekdays:					
Number of counts	1	4	4	2	2
Mean count	399.0	265.3	211.0	188.0	349.0
Standard error		35.6	48.1	16	205.0
Unguided anglers, weekends:					
Number of counts	2	2	2	2	2
Mean count	333.0	618.0	455.0	388.0	342.5
Standard error	252.0	74.0	89.0	6.0	45.5
Guided anglers, all days:					
Number of counts	6	6			
Mean count	412	278.5			
Standard error	49.3	49.0			
<u>Period 6 (24 July - 29 July)</u>					
Unguided anglers, weekdays:					
Number of counts	3	1	2	3	3
Mean count	116.7	103.0	108.5	71.0	40.7
Standard error	34.3		58.5	12.6	16.0
Unguided anglers, weekends:					
Number of counts	1	1	1	2	2
Mean count	83.0	144.0	124.0	82.0	73.5
Standard error				17.0	1.5
Guided anglers, all days:					
Number of counts	3	4			
Mean count	307.0	115.0			
Standard error	20.0	6.2			

-continued-

Table 2. (Page 2 of 2).

Component	Period ^a				
	A	B	C	D	E
<u>Period 7 (30 July - 31 July)</u>					
Unguided anglers, all days:					
Number of counts	2	1	1	1	0
Mean count	359.0	261.0	212.0	227.0	
Standard error	280.0				
Guided anglers, all days:					
Number of counts	1	1			
Mean count	653.0	235.0			
Standard error					

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

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

Table 3. Estimated number of angler-hours of fishing effort by boat anglers during each of the components of the fishery for early-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
<u>EARLY RUN</u>				
Period 1 (18 May - 31 May)				
Unguided weekdays:	2,240	701	866 - 3,614	61.3 %
Unguided weekends:	5,742	406	4,946 - 6,538	13.9 %
Guided anglers (May):	6,034	1,087	3,903 - 8,165	35.3 %
Period 2 (1 June - 9 June)				
Unguided weekdays:	5,962	633	4,721 - 7,203	20.8 %
Unguided weekends:	3,994	1,294	1,458 - 6,530	63.5 %
Guided anglers:	7,526	799	5,960 - 9,092	20.8 %
Period 3 (10 June - 30 June)				
Unguided weekdays:	5,619	460	4,717 - 6,521	16.0 %
Unguided weekends:	4,660	446	3,786 - 5,534	18.8 %
Guided anglers:	12,553	861	10,865 - 14,241	13.4 %
Subtotals:				
Unguided:	28,217	1,773	24,743 - 31,691	12.3 %
Guided:	26,113	1,600	22,976 - 29,250	12.0 %
<u>Early Run Total</u>	<u>54,330</u>	<u>2,388</u>	<u>49,649 - 59,011</u>	<u>8.6 %</u>

Table 4. Estimated number of angler-hours of fishing effort by boat anglers during each of the components of the fishery for late-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
<u>LATE RUN</u>				
Period 4 (1 July - 15 July)				
Unguided weekdays:	32,306	3,215	26,005 - 38,607	19.5%
Unguided weekends:	16,556	1,232	14,141 - 18,971	14.6%
Guided anglers:	29,682	2,185	25,399 - 33,965	14.4%
Period 5 (16 July - 23 July)				
Unguided weekdays:	25,985	2,884	20,332 - 31,638	21.8%
Unguided weekends:	17,092	2,249	12,684 - 21,500	25.8%
Guided anglers:	24,858	2,502	19,954 - 29,762	19.7%
Period 6 (24 July - 29 July)				
Unguided weekdays:	5,025	1,066	2,936 - 7,114	41.6%
Unguided weekends:	3,783	391	3,017 - 4,549	20.3%
Guided anglers:	10,128	503	9,142 - 11,114	9.7%
Period 7 (30 July - 31 July)				
Unguided:	11,344	2,922	5,617 - 17,071	50.5%
Guided anglers:	10,656	0	10,656 - 10,656	0.0%
Subtotals:				
Unguided:	112,091	5,921	100,486 - 123,696	10.4%
Guided:	75,324	3,360	68,739 - 81,909	8.7%
Late Run Total	187,415	6,808	174,072 - 200,758	7.1%

Table 5. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of chinook salmon by boat anglers during each component of the fishery for early-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Time Period ^a	n ^b	N ^c	Number of Interviews ^d	HPUE	Standard Error	CPUE	Standard Error
Unguided weekdays	1	8	8	104	0.0228	0.00537	0.0354	0.00715
Unguided weekends	1	5	5	169	0.0250	0.00587	0.0394	0.00838
Guided all days	1	11	13	102	0.0494	0.00867	0.0547	0.01167
Unguided weekdays	2	5	5	135	0.0523	0.00983	0.0793	0.01299
Unguided weekends	2	2	2	114	0.0344	0.00911	0.0435	0.01005
Guided all days	2	7	7	136	0.0538	0.01005	0.1008	0.01284
Unguided weekdays	3	11	12	88	0.0000	0.00000	0.0646	0.02683
Unguided weekends	3	6	6	131	0.0019	0.00410	0.0508	0.01061
Guided all days	3	17	18	249	0.0007	0.00044	0.1004	0.01126
Subtotals:								
Unguided		37	38	741	0.0231	0.00377	0.0550	0.00603
Guided		35	38	487	0.0273	0.00468	0.0900	0.01030
Early Run Total		37	38	1,228	0.0251	0.00299	0.0718	0.00583

^a Period

- 1 (19 May - 31 May)
- 2 (1 June - 9 June)
- 3 (10 June - 30 June)

^b Number of days on which interviews were collected.

^c Number of days possible for interviewing.

^d Complete trip interviews only.

Table 6. Estimated harvest per unit effort (HPUE) and catch per unit effort (CPUE) of chinook salmon by boat anglers during each component of the fishery for late-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Time Period ^a	n ^b	N ^c	Number of Interviews ^d	HPUE	Standard Error	CPUE	Standard Error
Unguided weekdays	4	9	9	492	0.0215	0.00320	0.0350	0.00584
Unguided weekends	4	4	4	357	0.0095	0.00267	0.0142	0.00342
Guided all days	4	11	11	297	0.0463	0.00738	0.0546	0.00770
Unguided weekdays	5	5	5	269	0.0386	0.00719	0.0479	0.00743
Unguided weekends	5	2	2	346	0.0081	0.00249	0.0143	0.00423
Guided all days	5	6	6	341	0.0453	0.00527	0.0553	0.00570
Unguided weekdays	6	3	3	56	0.0047	0.00673	0.1075	0.03498
Unguided weekends	6	2	2	58	0.0040	0.00436	0.1032	0.02274
Guided all days	6	4	4	147	0.0024	0.00115	0.0878	0.01248
Unguided all days	7	2	2	166	0.0416	0.00738	0.0506	0.00837
Guided all days	7	2	2	78	0.1550	0.01790	0.2018	0.02364
Subtotals:								
Unguided		27	27	1,744	0.0223	0.00291	0.0389	0.00444
Guided		23	23	863	0.0554	0.00529	0.0801	0.00676
Late Run Total		27	27	2,607	0.0356	0.00278	0.0555	0.00386

^a Period:

- 4 (1 July-15 July)
- 5 (16 July-23 July)
- 6 (24 July-29 July)
- 7 (30 July-31 July)

^b Number of days on which interviews were collected.

^c Number of days possible for interviewing.

^d Complete trip interviews only.

Table 7. Estimated number of chinook salmon harvested and number caught by boat anglers during each component of the fishery for early-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Harvest ^a	SE	Relative Precision ^b	Catch ^c	SE	Relative Precision ^b
<u>Period 1</u> (18 May - 31 May)						
Unguided weekdays	51	20	75.7 %	79	29	72.2 %
Unguided weekends	144	35	47.8 %	226	51	43.9 %
Guided all days	298	74	48.9 %	330	91	54.2 %
<u>Period 2</u> (1 June - 9 June)						
Unguided weekdays	312	67	42.1 %	473	92	38.1 %
Unguided weekends	137	56	80.5 %	174	68	76.5 %
Guided all days	405	87	41.9 %	759	125	32.4 %
<u>Period 3</u> (10 June - 30 June)						
Unguided weekdays	0	0		363	153	82.7 %
Unguided weekends	9	19	416.0 %	237	54	44.8 %
Guided all days	9	6	122.0 %	1,260	165	25.7 %
Subtotal:						
Unguided	653	98	29.5 %	1,552	207	26.1 %
Guided	712	114	31.4 %	2,349	227	18.9 %
<u>Early Run Total</u>	<u>1,365</u>	<u>151</u>	<u>21.6 %</u>	<u>3,901</u>	<u>307</u>	<u>15.4 %</u>

^a Harvest includes only fish kept.

^b Relative precision for 95% confidence interval.

^c Catch includes fish kept and fish reported as released.

Table 8. Estimated number of chinook salmon harvested and number caught by boat anglers during each component of the fishery for late-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Component	Harvest ^a	Relative		Catch ^c	Relative	
		SE	Precision ^b		SE	Precision ^b
<u>Period 4</u> (1 July - 15 July)						
Unguided weekdays	695	124	34.9 %	1,131	219	38.0 %
Unguided weekends	157	46	57.1 %	235	59	49.3 %
Guided all days	1,374	241	34.3 %	1,621	257	31.1 %
<u>Period 5</u> (16 July - 23 July)						
Unguided weekdays	1,003	217	42.3 %	1,245	235	36.9 %
Unguided weekends	138	46	65.3 %	244	79	63.1 %
Guided all days	1,126	173	30.1 %	1,375	197	28.1 %
<u>Period 6</u> (24 July - 29 July)						
Unguided weekdays	24	33	272.8 %	540	207	75.0 %
Unguided weekends	15	17	215.6 %	390	94.6	47.5 %
Guided all days	24	12	95.6 %	889	134	29.5 %
<u>Period 7</u> (30 July - 31 July)						
Unguided all days	472	146	60.6 %	574	174	59.4 %
Guided all days	1,652	191	22.6 %	2,150	252	23.0 %
Subtotal:						
Unguided	2,504	299	23.4 %	4,359	441	19.8 %
Guided	4,176	353	16.6 %	6,035	432	14.0 %
Late Run Total	6,680	462	13.6 %	10,394	617	11.6 %

^a Harvest includes only fish kept.

^b Relative precision for 95% confidence interval.

^c Catch includes fish kept and fish reported as released.

Because of the trophy fishing imposed during both runs, 65% of the catch was released during the early run and 36% of the catch was released during the late run.

Inriver Return

A total of 10,087 chinook salmon was estimated during the early run (Table 9) and 30,314 during the late run (Table 10).

Biological Data

Recreational Fishery:

The most abundant age group of the early-run harvest of chinook salmon was age 1.4 which composed 75.8% of the sample (Table 11). The only other age classes represented in the sample were 1.2, 1.3 and 1.5; 4.2%, 16.8% and 3.2%, respectively. Inseason harvest restriction to this fishery precluded examination for temporal trends in age composition.

Age 1.4 was again the most abundant age in the late-run harvest sample, contributing 76.1% to the sample (Table 12). The next largest contributor was age 1.3 (15.4%) followed by 1.5 (6.0%), 1.2 (2.0%) and 1.1 (0.5%). Age composition did not significantly differ between the first half of the harvest and the second ($\chi^2 = 8.22$, $df = 4$, $\alpha = 0.05$). Because of low sample sizes for some age classes, this hypothesis was again tested for only age-1.3, -1.4, and -1.5 fish; again differences were not significant ($\chi^2 = 2.39$, $df = 2$, $\alpha = 0.05$). The mean lengths at age for each age/sex group were generally greater for late-run fish than for early-run fish, except that early-run males age 1.2 were slightly larger than late-run males of the same age.

Inriver Return:

Age-1.4 fish dominated both the early run (58.1%) (Table 13) and late run (74.4%) (Table 14). For the early run, there was no significant difference in age composition between the first half and second half of the run ($\chi^2 = 4.48$, $df = 3$, $\alpha = 0.05$, $P > 0.10$). Age 1.3 was the second largest contributor (28.5%) of the early run and 16.0% of the late run. Age 1.2 represented 8.1% of the early-run sample and 7.3% of the late-run sample. Age-1.5 fish composed 5.3% of the early-run sample and 2.3% of the late-run sample. As with the harvest, length-at-age of both sexes was generally larger for late-run fish than early-run fish.

DISCUSSION

As demonstrated during 1990, 1991, and 1992, emergency order restrictions to the bag limit (either compulsory hook-and-release or trophy fishing) severely impacted effort (Figures 4 and 5). The relatively high CPUE realized during these restrictions was not a sufficient attractant to maintain higher levels of fishing effort. Also, the trend for higher CPUE during periods of lower fishing effort is probably indicative of gear competition.

The estimates of harvest, effort, and catch by run component are biased low to a small degree. While historically negligible, there is a small fishery that

Table 9. Daily estimates of chinook salmon during the early run as determined by dual-beam sonar, Kenai River, Alaska, 1992.

Date	Daily Count	Cumulative Count
16 May	54	54
17 May	48	102
18 May	88	190
19 May	40	230
20 May	78	308
21 May	90	398
22 May	108	506
23 May	150	656
24 May	126	782
25 May	79	861
26 May	93	954
27 May	66	1,020
28 May	78	1,098
29 May	45	1,143
30 May	111	1,254
31 May	114	1,368
1 Jun	106	1,474
2 Jun	107	1,581
3 Jun	232	1,813
4 Jun	190	2,003
5 Jun	166	2,169
6 Jun	319	2,488
7 Jun	515	3,003
8 Jun	375	3,378
9 Jun	486	3,864
10 Jun	264	4,128
11 Jun	234	4,362
12 Jun	394	4,756
13 Jun	236	4,992
14 Jun	174	5,166
15 Jun	312	5,478
16 Jun	239	5,717
17 Jun	339	6,056
18 Jun	320	6,376
19 Jun	390	6,766
20 Jun	548	7,314
21 Jun	372	7,686
22 Jun	297	7,983
23 Jun	213	8,196
24 Jun	337	8,533
25 Jun	362	8,895
26 Jun	330	9,225
27 Jun	291	9,516
28 Jun	253	9,769
29 Jun	121	9,890
30 Jun	197	10,087

Table 10. Daily estimates of chinook salmon during the late run as determined by dual-beam sonar, Kenai River, Alaska, 1992.

Date	Daily Count	Cumulative Count
1 Jul	364	364
2 Jul	297	661
3 Jul	320	981
4 Jul	198	1,179
5 Jul	225	1,404
6 Jul	331	1,735
7 Jul	247	1,982
8 Jul	170	2,152
9 Jul	205	2,357
10 Jul	221	2,578
11 Jul	143	2,721
12 Jul	1,027	3,748
13 Jul	605	4,353
14 Jul	689	5,042
15 Jul	745	5,787
16 Jul	703	6,490
17 Jul	570	7,060
18 Jul	853	7,913
19 Jul	1,128	9,041
20 Jul	1,144	10,185
21 Jul	799	10,984
22 Jul	619	11,603
23 Jul	1,449	13,052
24 Jul	711	13,763
25 Jul	1,713	15,476
26 Jul	1,296	16,772
27 Jul	1,561	18,333
28 Jul	1,957	20,290
29 Jul	1,533	21,823
30 Jul	1,198	23,021
31 Jul	951	23,972
1 Aug	921	24,893
2 Aug	1,018	25,911
3 Aug	837	26,748
4 Aug	862	27,610
5 Aug	861	28,471
6 Aug	654	29,125
7 Aug	558	29,683
8 Aug	217	29,900
9 Aug	165	30,065
10 Aug	249	30,314

Table 11. Age composition and mean length at age of chinook salmon sampled from the recreational harvest during the fishery for early-run chinook salmon in the Kenai River, Alaska, 1992.

Sex		Age Group				Total
		1.2	1.3	1.4	1.5	
Male	Percent	2.1	12.6	36.8	1.1	52.6
	SE	2.1	3.9	4.4	1.8	
Female	Percent	2.1	4.2	38.9	2.1	47.4
	SE	2.1	3.9	4.4	1.8	
Male	Mean Length (mm) ^a	625	756	945	1,040	
	SE	10	11	15		
	Sample size	2	12	35	1	50
Female	Mean Length (mm) ^a	618	778	906	1,060	
	SE	33	13	10	5	
	Sample size	2	4	37	2	45

^a Lengths measured mid-eye to fork of tail.

Table 12. Age composition and mean length-at-age of chinook salmon sampled from the recreational harvest during the fishery for late-run chinook salmon in the Kenai River, Alaska, 1992.

Sex		Age Group					Total
		1.1	1.2	1.3	1.4	1.5	
Male	Percent	0.5	1.5	9.5	36.8	3.5	51.7
	SE	0.5	1.0	2.6	3.0	1.7	
Female	Percent	0.0	0.5	6.0	39.3	2.5	48.3
	SE	0.0	0.1	0.6	1.9	0.4	
Combined	Percent	0.5	2.0	15.4	76.1	6.0	
	SE	0.5	1.0	2.6	3.0	1.7	
Male	Mean Length (mm) ^a	380	558	790	1,009	1,094	
	SE		13	18	10	17	
	Sample size	1	3	19	74	7	104
Female	Mean Length (mm) ^a		610	801	985	1,100	
	SE			13	8	58	
	Sample size		1	12	79	5	97

^a Lengths measured mid-eye to fork of tail.

Table 13. Age composition and mean length-at-age of chinook salmon sampled with large mesh gill nets during the fishery for early-run chinook salmon in the Kenai River, Alaska, 1992.

Sex		Age Group				Total
		1.2	1.3	1.4	1.5	
Male	Percent	7.7	20.3	17.5	3.3	48.8
Female	Percent	0.4	8.1	40.7	2.0	51.2
Combined	Percent	8.1	28.5	58.1	5.3	
	SE	1.7	2.9	3.2	1.4	
Male	Mean Length (mm) ^a	648	767	957	1,123	
	SE	7	5	16	38	
	Sample size	19	50	43	8	120
Female	Mean Length (mm) ^a	560	779	904	999	
	SE		7	6	24	
	Sample size	1	20	100	5	126

^a Lengths measured mid-eye to fork of tail.

Table 14. Age composition and mean length-at-age of chinook salmon sampled with large mesh gill nets during the fishery for late-run chinook salmon in the Kenai River, Alaska, 1992.

Sex		Age Group				Total
		1.2	1.3	1.4	1.5	
Male	Percent	7.3	12.0	30.2	1.1	50.5
	SE	1.4	2.0	2.4	0.8	
Female	Percent	0.0	4.1	44.2	1.2	51.2
	SE					
Combined	Percent	7.3	16.0	74.4	2.3	
	SE	1.4	2.0	2.4	0.8	
Male	Mean Length (mm) ^a	666	800	1,016	1,077	
	SE	5	8	9	36	
	Sample size	23	40	101	4	168
Female	Mean Length (mm) ^a		838	979	1,060	
	SE		13	6	37	
	Sample size		14	155	4	173

^a Lengths measured mid-eye to fork of tail.

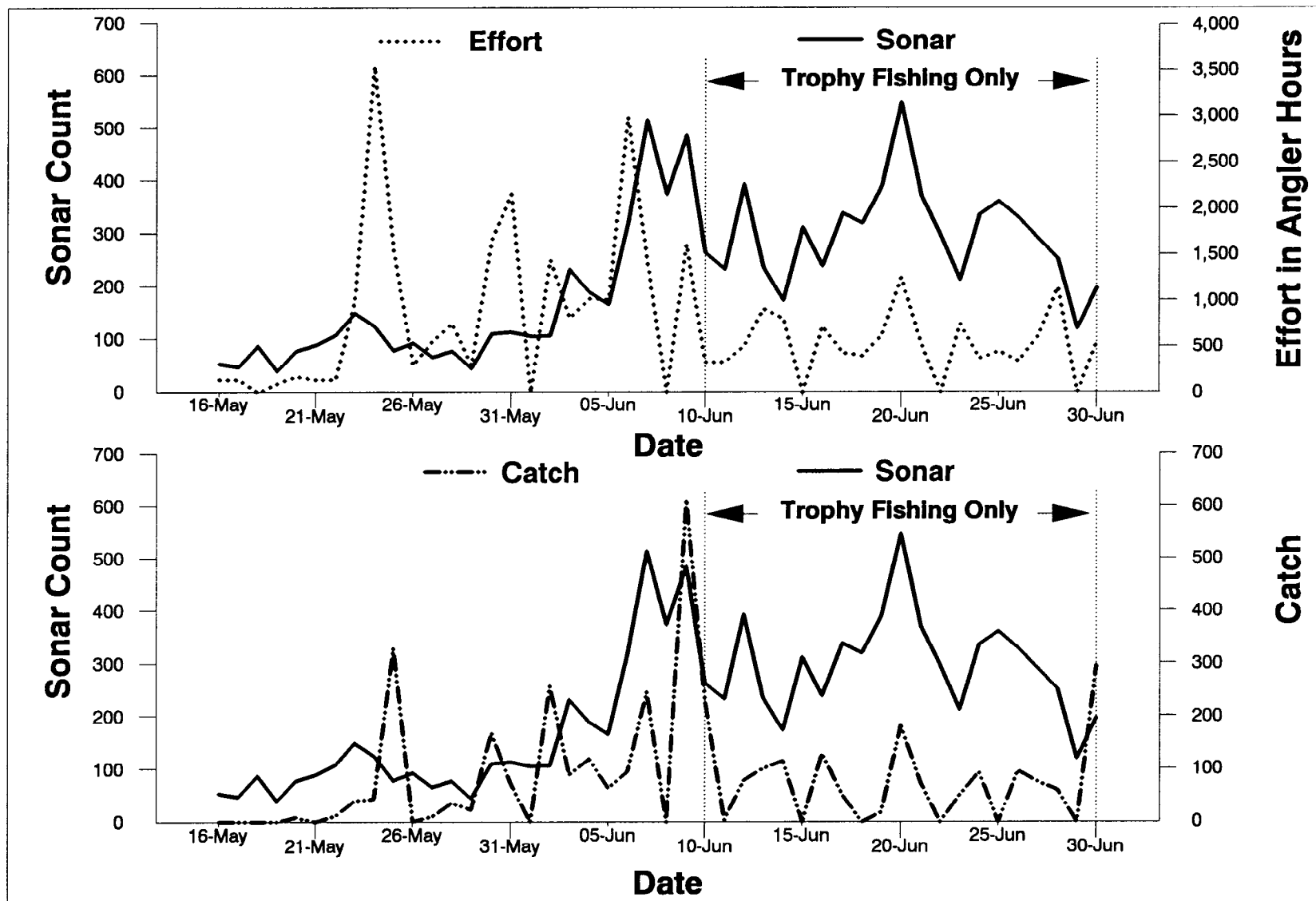


Figure 4. Daily sonar counts of chinook salmon, recreational catch of chinook salmon and angler effort during the early run, Kenai River, Alaska, 1992.

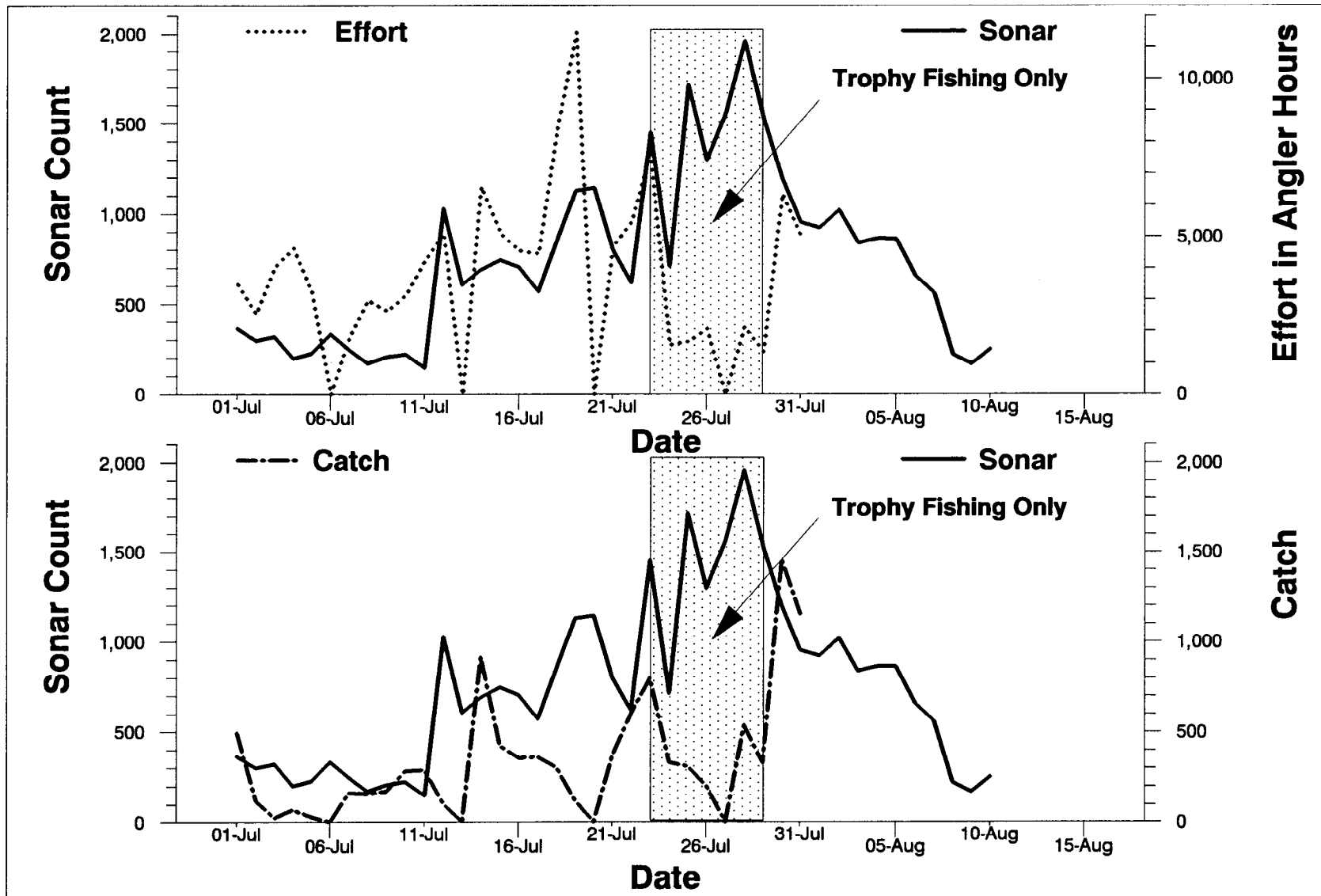


Figure 5. Daily sonar counts of chinook salmon, recreational catch of chinook salmon and angler effort during the late run, Kenai River, Alaska, 1992.

occurs in the upstream section (Naptowne Rapids to the outlet of Skilak Lake). Additionally, the midstream section (Soldotna Bridge to Naptowne Rapids) has also provided a relatively small harvest, the majority of which occurs during the early run. It had been planned to conduct a creel survey of the river between the Soldotna Bridge and Skilak Lake during the early run only (Memorial Day through 15 July). However, when the fishery was restricted to trophy fishing, effort dropped dramatically with virtually no effort upstream of the Soldotna Bridge. Further, chinook salmon fishing was prohibited upstream of Slikok Creek through 15 July to protect the remainder of those early-run fish. Thus, no survey was conducted upstream of the Soldotna Bridge.

RECOMMENDATIONS

I recommend no significant changes in the creel survey program for the 1993 field season. As long as the regulations remain unchanged, the management objectives are consistent, and no major changes occur in the characteristics of the recreational fishery, the current design is adequate to manage the early- and late-run fisheries for their respective escapement goals. Further, I would like to conduct a creel survey of the fishery upstream of the Soldotna Bridge to adequately evaluate the design changes that have been made for that section of the river.

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APPENDIX A

Counts of boat anglers during the creel survey of the fishery for chinook salmon on the Kenai River, Alaska, 1992.

Appendix A1. Counts of unguided and guided boat anglers during the fishery for early-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Date	Wd/ We ^a	Unguided Anglers Period					Guided Anglers Period				
		A	B	C	D	E	A	B	C	D	E
5/19	Wd				4					7	
5/20	Wd		10	6				16	9		
5/21	Wd										
5/22	Wd										
5/23	We				50					11	
5/24	We	30	93	81	74	33		37	21	18	0
5/25	We	59	29	80	53	30	63	85	58	10	0
5/26	Wd				19	13				3	0
5/27	Wd		21					43			
5/28	Wd			39					18		
5/29	Wd	0					0				
5/30	We	47	57	75	68	17	55	59	24	19	0
5/31	We	20	86	96	78	57	0	46	21	18	7
6/01	Wd	CLOSED					CLOSED				
6/02	Wd		72				132				
6/03	Wd		31	60	62		105	41			
6/04	Wd		37		32	87	85	40			
6/05	Wd	29			46	79		27			
6/06	We	112	138	125	95	85	135	77			
6/07	We	8	136				122				
6/08	Wd	CLOSED					CLOSED				
6/09	Wd		98		69	73	207	56			
6/10	Wd ^b		12	23	11	20	41				
6/11	Wd ^b										
6/12	Wd ^b		23	27		20	65	27			
6/13	We ^b	2	29	35	72	37	87	10			
6/14	We ^b	24	57	38	35	24	60	31			
6/15	Wd	CLOSED					CLOSED				
6/16	Wd ^b		19	45	46		98	45			
6/17	Wd ^b	32		17	9	32	77	31			
6/18	Wd ^b	4	22		29	28	87	32			
6/19	Wd ^b	23	41	33	25	29	61	43			
6/20	We ^b	13	73	57	34	93	84	18			
6/21	We ^b	37	42	24	12	22	85	24			
6/22	Wd	CLOSED					CLOSED				
6/23	Wd ^b		53		33		148	34			
6/24	Wd ^b	26	28	16	27	10	75	19			
6/25	Wd ^b	8		23			46	60			
6/26	Wd ^b			13	22	7	106	73			
6/27	We ^b	15	15	32	48	42	93	83			
6/28	We ^b	38	75	61	45	34	38	44			
6/29	Wd	CLOSED					CLOSED				
6/30	Wd ^b		28	20			84	34			

^a Wd = Weekday, We = Weekend

^b Closed to retention of chinook salmon smaller than 132 cm (52 inches).

Appendix A2. Counts of unguided and guided boat anglers during the fishery for late-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992.

Date	Wd/ We ^a	Unguided Anglers Period					Guided Anglers Period				
		A	B	C	D	E	A	B	C	D	E
7/01	Wd	206	164		135	192	321	109			
7/02	Wd		113		97		227	75			
7/03	Wd	162	210		190	216	279	81			
7/04	We	208	238	235	185	213	190	75			
7/05	We	141	279	193	106	118				CLOSED	
7/06	Wd		CLOSED								CLOSED
7/07	Wd	51		91	89	131	328	196			
7/08	Wd		170	101			271	190			
7/09	Wd	175	140		93	126	238	115			
7/10	Wd		167	147			253	159			
7/11	We	133	197	280	199	182	256	253			
7/12	We	346		365	212	71				CLOSED	
7/13	Wd		CLOSED								CLOSED
7/14	Wd	470	299	202	382	111	498	234			
7/15	Wd	399		227			407	192			
7/16	Wd		299	156			361	204			
7/17	Wd		319	209		144	266	133			
7/18	We	81	544	366	382	388	319	250			
7/19	We	585	692	544	394	297				CLOSED	
7/20	Wd		CLOSED								CLOSED
7/21	Wd		161	132			596	486			
7/22	Wd		282	347	172		484	280			
7/23	Wd	399			204	554	446	318			
7/24	Wd ^b	77		167	56	11	299	106			
7/25	We ^b				99	75		103			
7/26	We ^b	83	144	124	65	72				CLOSED	
7/27	Wd ^b		CLOSED								CLOSED
7/28	Wd ^b	185			86	45	345	128			
7/29	Wd ^b	88	103	50	61	66	277	123			
7/30	Wd	567	261	212	227		653	235			
7/31	Wd	151									

^a Wd = Weekday, We = Weekend

^b Closed to retention of chinook salmon smaller than 132 cm (52 inches) and closed to the use of bait.

APPENDIX B

Daily summary statistics for fishing effort, harvest rate,
and catch rate for anglers interviewed during the fishery
for chinook salmon in the Kenai River, Alaska, 1992.

Appendix B1. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for unguided anglers interviewed during the fishery for early-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992 (completed-trip interviews only).

Date	Wd/ We ^a	Effort (hours)			Harvest			Catch		
		SS	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
519	Wd	10	3.0	0.29	0.00	0.000	0.000	0.00	0.000	0.000
520	Wd	9	3.8	0.46	0.00	0.000	0.000	0.00	0.000	0.000
521	Wd	5	3.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
522	Wd	25	3.9	0.34	0.08	0.055	0.020	0.20	0.100	0.051
523	We	29	6.0	0.56	0.21	0.077	0.035	0.24	0.081	0.040
524	We	44	4.1	0.24	0.05	0.032	0.011	0.05	0.032	0.011
525	We	32	3.8	0.23	0.13	0.059	0.033	0.38	0.140	0.098
526	Wd	12	6.4	0.83	0.08	0.083	0.013	0.08	0.083	0.013
527	Wd	3	4.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
528	Wd	16	3.4	0.62	0.19	0.101	0.056	0.19	0.101	0.056
529	Wd	24	3.2	0.26	0.13	0.069	0.039	0.21	0.134	0.066
530	We	32	3.8	0.20	0.09	0.052	0.025	0.13	0.059	0.033
531	We	32	5.1	0.38	0.13	0.059	0.024	0.16	0.065	0.030
602	Wd	16	5.3	0.42	0.06	0.063	0.012	0.31	0.120	0.059
603	Wd	50	4.0	0.36	0.18	0.055	0.045	0.22	0.059	0.055
604	Wd	30	3.7	0.29	0.33	0.088	0.091	0.50	0.150	0.137
605	Wd	8	2.9	0.21	0.13	0.125	0.043	0.13	0.125	0.043
606	We	66	3.8	0.17	0.11	0.038	0.028	0.11	0.038	0.028
607	We	48	3.9	0.24	0.17	0.054	0.043	0.25	0.063	0.065
609	Wd	31	4.4	0.36	0.26	0.080	0.059	0.39	0.110	0.088
610	Wd	10	3.6	0.45	0.00	0.000	0.000	0.10	0.100	0.028
612	Wd	11	4.1	0.76	0.00	0.000	0.000	0.00	0.000	0.000
613	We	10	3.6	0.16	0.10	0.100	0.028	0.10	0.100	0.028
614	We	32	3.6	0.45	0.00	0.000	0.000	0.22	0.108	0.060
616	Wd	11	5.5	0.59	0.00	0.000	0.000	0.18	0.122	0.033
617	Wd	14	4.1	0.40	0.00	0.000	0.000	0.00	0.000	0.000
618	Wd	4	3.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
619	Wd	3	4.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
620	We	12	3.4	0.21	0.00	0.000	0.000	0.33	0.142	0.099
621	We	26	3.4	0.16	0.00	0.000	0.000	0.12	0.064	0.034
623	Wd	9	3.9	0.68	0.00	0.000	0.000	0.00	0.000	0.000
624	Wd	15	4.3	0.49	0.00	0.000	0.000	0.80	0.439	0.188
625	Wd	4	1.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
626	Wd	5	3.8	0.12	0.00	0.000	0.000	0.20	0.200	0.053
627	We	22	4.8	0.28	0.00	0.000	0.000	0.27	0.117	0.057
628	We	29	5.0	0.33	0.00	0.000	0.000	0.21	0.091	0.041
630	Wd	2	6.0	0.00	0.00	0.000	0.000	3.50	0.500	0.583

^a Wd = Weekday, We = Weekend.

Appendix B2. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for early-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992 (completed-trip interviews only).

Date	Wd/ We ^a	Effort (hours)			Harvest			Catch		
		SS	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
520	Wd	8	4.3	0.61	0.25	0.164	0.059	0.25	0.164	0.059
522	Wd	11	5.0	0.33	0.00	0.000	0.000	0.00	0.000	0.000
523	We	7	4.9	0.70	0.43	0.202	0.088	0.43	0.202	0.088
524	We	6	4.0	0.45	0.00	0.000	0.000	0.00	0.000	0.000
525	We	11	5.8	0.75	0.27	0.141	0.047	0.36	0.152	0.063
526	Wd	16	7.2	0.60	0.25	0.112	0.035	0.25	0.112	0.035
527	Wd	15	6.0	0.00	0.47	0.133	0.078	0.47	0.133	0.078
528	Wd	9	6.0	0.93	0.44	0.176	0.074	0.44	0.176	0.074
529	Wd	2	3.5	0.00	0.00	0.000	0.000	0.50	0.500	0.143
530	We	10	6.0	0.15	0.20	0.133	0.033	0.30	0.153	0.050
531	We	7	4.8	0.43	0.43	0.202	0.090	0.43	0.202	0.090
602	Wd	14	4.0	0.39	0.29	0.125	0.072	0.71	0.163	0.180
603	Wd	24	5.8	0.51	0.29	0.095	0.050	0.54	0.120	0.094
604	Wd	43	5.7	0.41	0.30	0.071	0.053	0.58	0.083	0.102
605	Wd	4	5.0	0.00	0.25	0.250	0.050	0.25	0.250	0.050
606	We	22	5.3	0.51	0.41	0.107	0.078	0.59	0.142	0.112
607	We	16	4.9	0.80	0.19	0.101	0.038	0.19	0.101	0.038
609	Wd	13	6.9	0.61	0.23	0.122	0.033	0.77	0.303	0.111
610	Wd	3	4.5	0.00	0.00	0.000	0.000	0.33	0.333	0.074
612	Wd	5	5.8	0.12	0.00	0.000	0.000	1.00	0.447	0.172
613	We	10	5.8	0.08	0.00	0.000	0.000	1.00	0.258	0.172
614	We	7	5.7	0.18	0.00	0.000	0.000	0.71	0.184	0.125
616	Wd	14	5.9	0.26	0.00	0.000	0.000	0.57	0.272	0.098
617	Wd	24	4.5	0.32	0.00	0.000	0.000	0.08	0.058	0.018
618	Wd	24	5.2	0.15	0.04	0.042	0.008	0.54	0.159	0.104
619	Wd	44	5.3	0.16	0.00	0.000	0.000	0.43	0.094	0.082
620	We	12	5.7	0.07	0.00	0.000	0.000	0.17	0.112	0.029
621	We	16	5.8	0.13	0.00	0.000	0.000	0.94	0.249	0.160
623	Wd	28	6.8	0.29	0.00	0.000	0.000	0.68	0.116	0.100
624	Wd	16	5.3	0.42	0.00	0.000	0.000	0.25	0.112	0.047
625	Wd	2	6.0	0.00	0.00	0.000	0.000	1.00	0.000	0.167
626	Wd	11	6.5	0.16	0.00	0.000	0.000	1.73	0.541	0.264
627	We	12	5.2	0.32	0.00	0.000	0.000	0.42	0.149	0.080
628	We	3	6.0	0.00	0.00	0.000	0.000	0.33	0.333	0.056
630	Wd	18	5.3	0.27	0.00	0.000	0.000	0.50	0.167	0.095

^a Wd = Weekday, We = Weekend.

Appendix B3. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for unguided anglers interviewed during the fishery for late-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992 (completed-trip interviews only).

Date	Wd/ We ^a	Effort (hours)			Harvest			Catch		
		SS	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
701	Wd	18	4.6	0.90	0.06	0.056	0.012	0.39	0.164	0.084
702	Wd	55	4.0	0.31	0.07	0.035	0.018	0.09	0.039	0.023
703	Wd	26	6.0	0.65	0.04	0.038	0.006	0.04	0.038	0.006
704	We	104	4.1	0.20	0.02	0.014	0.005	0.03	0.016	0.007
705	We	88	3.8	0.19	0.03	0.019	0.009	0.03	0.019	0.009
707	Wd	53	3.9	0.47	0.04	0.026	0.010	0.15	0.068	0.039
708	Wd	28	4.1	0.31	0.04	0.036	0.009	0.04	0.036	0.009
709	Wd	41	3.8	0.38	0.10	0.047	0.026	0.20	0.063	0.052
710	Wd	36	4.6	0.31	0.03	0.028	0.006	0.08	0.047	0.018
711	We	39	2.9	0.26	0.05	0.036	0.017	0.08	0.043	0.026
712	We	132	4.8	0.17	0.06	0.021	0.013	0.10	0.026	0.021
714	Wd	134	3.9	0.17	0.17	0.033	0.044	0.22	0.041	0.057
715	Wd	101	3.7	0.16	0.06	0.024	0.016	0.07	0.029	0.019
716	Wd	27	4.7	0.25	0.11	0.062	0.024	0.15	0.070	0.032
717	Wd	14	4.3	0.37	0.21	0.114	0.050	0.21	0.114	0.050
718	We	102	4.3	0.20	0.04	0.019	0.009	0.10	0.036	0.023
719	We	244	4.8	0.15	0.04	0.012	0.008	0.05	0.016	0.011
721	Wd	45	4.1	0.28	0.16	0.055	0.038	0.16	0.055	0.038
722	Wd	100	5.3	0.24	0.08	0.027	0.015	0.17	0.043	0.032
723	Wd	83	3.4	0.23	0.30	0.051	0.088	0.31	0.051	0.091
724	Wd	13	3.8	0.34	0.08	0.077	0.020	0.38	0.311	0.100
725	We	26	4.8	0.54	0.04	0.038	0.008	0.50	0.159	0.105
726	We	32	4.0	0.29	0.00	0.000	0.000	0.41	0.148	0.102
728	Wd	25	4.0	0.30	0.00	0.000	0.000	0.32	0.150	0.080
729	Wd	18	3.6	0.37	0.00	0.000	0.000	0.56	0.258	0.156
730	Wd	89	4.6	0.24	0.16	0.039	0.034	0.21	0.049	0.046
731	Wd	77	3.4	0.23	0.18	0.044	0.054	0.19	0.045	0.058

^a Wd = Weekday, We = Weekend.

Appendix B4. Daily sample size (SS), harvest per unit of effort (HPUE), catch per unit of effort (CPUE), and other summary statistics for guided anglers interviewed during the fishery for late-run chinook salmon in the downstream section of the Kenai River, Alaska, 1992 (completed-trip interviews only).

Date	Wd/ We ^a	Effort (hours)			Harvest			Catch		
		SS	Mean	SE	Mean	SE	HPUE	Mean	SE	CPUE
701	Wd	22	5.4	0.57	0.41	0.107	0.076	0.45	0.127	0.084
702	Wd	38	6.4	0.29	0.21	0.067	0.033	0.21	0.067	0.033
703	Wd	3	5.7	0.33	0.00	0.000	0.000	0.00	0.000	0.000
704	We	51	6.0	0.18	0.12	0.046	0.020	0.14	0.049	0.023
707	Wd	28	7.1	0.74	0.21	0.079	0.030	0.21	0.079	0.030
708	Wd	14	7.6	0.43	0.36	0.133	0.047	0.36	0.133	0.047
709	Wd	40	5.2	0.16	0.10	0.048	0.019	0.10	0.048	0.019
710	Wd	32	5.1	0.30	0.25	0.078	0.049	0.47	0.110	0.093
711	We	3	5.0	1.00	0.33	0.333	0.067	0.33	0.333	0.067
714	Wd	44	4.4	0.44	0.48	0.076	0.108	0.57	0.076	0.129
715	Wd	22	5.4	0.55	0.45	0.109	0.084	0.50	0.109	0.093
716	Wd	76	5.1	0.18	0.25	0.050	0.049	0.33	0.054	0.064
717	Wd	42	4.9	0.27	0.24	0.067	0.048	0.31	0.080	0.063
718	We	70	5.1	0.19	0.16	0.044	0.031	0.19	0.047	0.036
721	Wd	17	5.7	0.14	0.18	0.095	0.031	0.18	0.095	0.031
722	Wd	71	4.7	0.20	0.37	0.058	0.077	0.45	0.066	0.095
723	Wd	65	6.2	0.26	0.18	0.048	0.030	0.20	0.050	0.032
724	Wd	25	5.3	0.43	0.00	0.000	0.000	0.40	0.141	0.075
725	We	20	5.7	0.09	0.00	0.000	0.000	0.50	0.185	0.088
728	Wd	54	5.6	0.08	0.04	0.026	0.007	0.70	0.144	0.126
729	Wd	48	5.9	0.03	0.00	0.000	0.000	0.31	0.074	0.053
730	Wd	52	4.0	0.25	0.69	0.065	0.172	0.90	0.121	0.224
731	Wd	26	5.1	0.36	0.65	0.095	0.128	0.85	0.107	0.166

^a Wd = Weekday, We = Weekend.

