FISHERY DATA SERIES NO. 90-32

ESTIMATES OF EFFORT AND HARVEST FOR SELECTED SPORT FISHERIES FOR CHINOOK SALMON IN NORTHERN COOK INLET, ALASKA, 1989[1]

By

Dana E. Sweet
and
Keith A. Webster

Alaska Department of Fish and Game
Division of Sport Fish
Anchorage, Alaska

September 1990

[1] This information was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-5, Job No. S-32-7.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF APPENDICES

LIST OF APPENDICES (Continued)

ABSTRACT

Creel surveys of selected sport fisheries for chinook salmon *Oncorhynchus tshawytscha* in northern Cook Inlet were conducted during 1989. Roving creel surveys were conducted at the Deshka River, Alexander Creek, Lake Creek, Willow Creek, and the weekend-only fisheries at Sheep and Montana Creeks. Direct expansion creel surveys were conducted at Clear Creek and the Talkeetna River. For all the fisheries surveyed, the estimated total effort by anglers was 268,983 angler-hours (standard error = 8,395). An estimated 21,202 (standard error = 1,243) chinook salmon were harvested (fish kept only) by anglers and 33,154 (standard error = 1,770) chinook salmon were caught (fish kept and fish released). Within selected road accessible and remote tributaries to the Susitna River, 73 percent of the angler-effort, 73 percent of the chinook salmon harvest, and 79 percent of the chinook salmon catch occurred in the remote (accessible only by boat or plane) fisheries which were open 7 days a week. The road accessible fisheries in Willow, Sheep, and Montana Creeks, however, ranked in the top five for angler-effort and harvest per hour. The 1.2, 1.3, and 1.4 age groups were the most abundant in the sport harvests in all streams. The contribution of hatchery-produced chinook salmon to the Willow Creek, Deshka River, Montana Creek, and Sheep Creek sport harvest was estimated to be 10.6 percent, all originating from 1985 and 1986 Willow Creek and 1988 Montana Creek smolt releases. An escapement index of 27,935 chinook salmon was counted in the tributaries to the Susitna River. It is not possible at this time to estimate total return or exploitation rate of chinook salmon, as creel surveys and escapement counts were not conducted on all tributaries and an unknown number of chinook salmon are harvested in the mixed stock commercial fisheries of northern Cook Inlet.

KEY WORDS: creel survey, northern Cook Inlet, chinook salmon, *Oncorhynchus tshawytscha*, harvest, catch, effort, escapement counts, population age structure.

INTRODUCTION

The sport fishery for chinook salmon *Oncorhynchus tshawytscha* in northern Cook Inlet is among the largest recreational fisheries in Alaska (Mills 1987). This fishery occurs in tributaries to the Susitna River and other smaller rivers which drain directly into northern Cook Inlet (Figure 1). The areas where the sport fishery occurs can be categorized into three groups: (1) tributaries on the east side of the Susitna River that are accessible from the Parks Highway; (2) remote Susitna and Yentna River tributaries that are not road-accessible and primarily enter the mainstem of these rivers from the west and north; and (3) remote river systems that drain directly into northern Cook Inlet from the north and west.

During the 1960s and 1970s, the sport fishery for chinook salmon in northern Cook Inlet systems was periodically closed because of low escapement. The commercial fishery for chinook salmon returning to northern Cook Inlet systems was closed from 1963 to 1985. These closures helped increase the returns to a level that resource managers felt could once again be exploited. The sport fishery has been open every year since 1979 and a limited commercial fishery in northern Cook Inlet reopened in 1986.

Prior to 1986, only five streams along the Parks Highway were open to sport fishing for chinook salmon. Three of these streams (Willow, Montana, and Caswell Creeks) were open only during four weekends from mid-June through early July, while the Talkeetna and Little Susitna Rivers were open to continuous fishing from late May to early July. Effort in these fisheries increased from an estimated 47,500 angler-hours in 1979 to over 155,000 angler-hours in 1985 (Hepler and Bentz 1986). During this period, the estimated harvests of chinook salmon by these fisheries ranged from 1,650 fish in 1979 to nearly 4,900 fish in 1984 (Hepler and Bentz 1986). In 1986, five additional road-accessible streams (Little Willow, Sheep, Goose, Sunshine, and Birch Creeks) were opened to fishing during four weekends from mid-June through early July. In 1987, the entire Susitna River corridor between the mouth of the river and upstream to the confluence of the Talkeetna River was opened to sport fishing and the weekend fishing period on these streams was extended to include Mondays. The same regulations remained in effect in 1988 for all the streams, although the season on Willow Creek was extended for an additional 3 days by Emergency Order.

In 1989, regulation changes extended the Willow Creek fishery to include weekdays until mid-June followed by weekends only until early July. The seasonal bag limit was also removed for all Susitna-West Cook Inlet area chinook salmon sport fisheries.

The number of remote streams open to chinook salmon fishing in the Susitna and Yentna River drainages and in western Cook Inlet has also increased since 1979. From 1979 to 1982, only the Deshka River, Lake Creek, and Alexander Creek were open to chinook salmon fishing. In 1983, the open area was expanded to include the entire Chuitna and Yentna River drainages. In 1984, all coastal streams draining into western Cook Inlet north of the West Foreland and all tributaries on the west side of the Susitna River downstream of the Deshka River were added to the open area (Figure 1). These additional

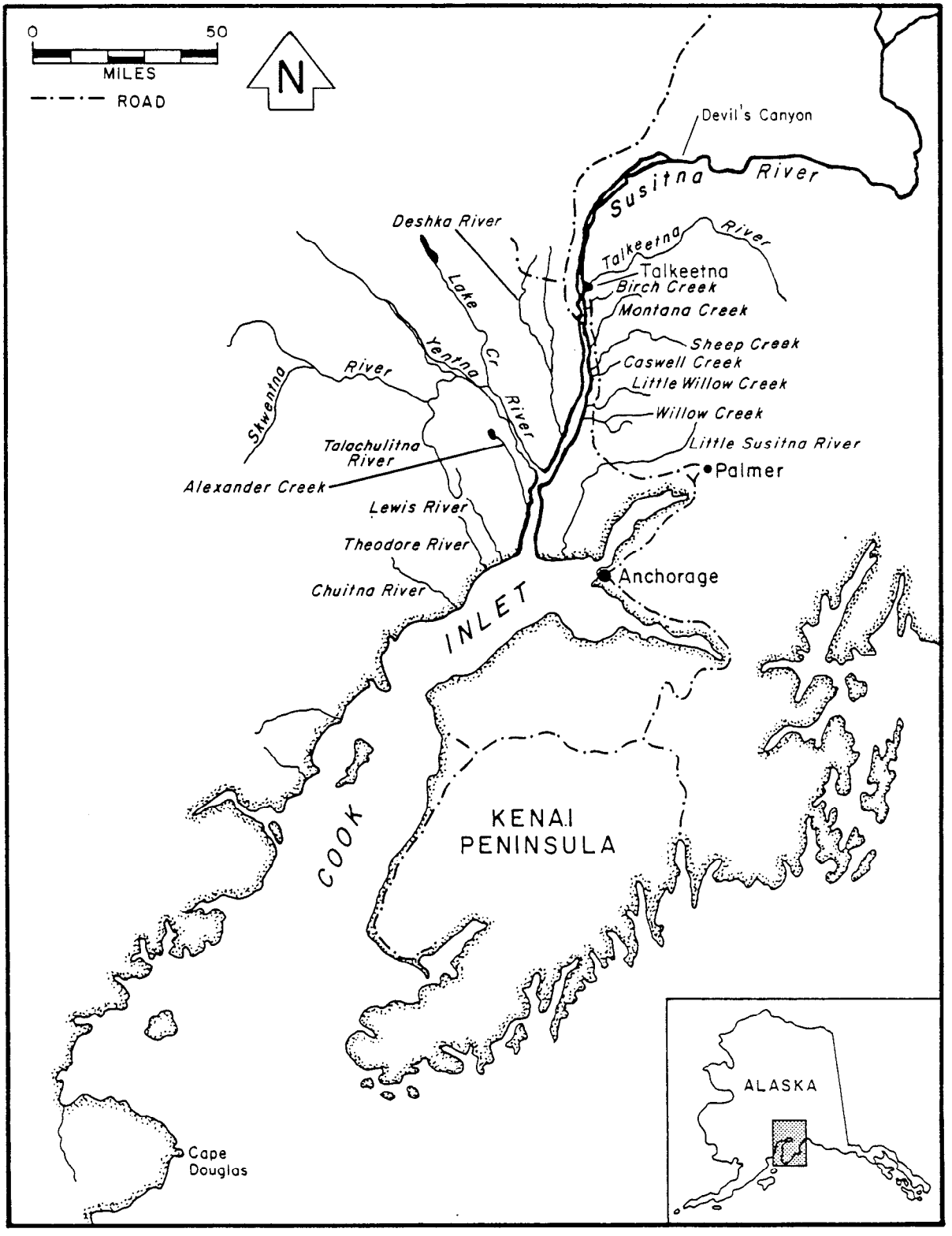

Figure 1. Map of the northern Cook Inlet area.

openings increased angler-effort in the remote fisheries from an estimated 65,900 angler-hours in 1979 to 136,400 angler-hours in 1985 (Hepler and Bentz 1986). During the period 1979 through 1986, the estimated harvests of chinook salmon by these fisheries ranged from 3,166 fish in 1981 to 11,413 fish in 1985 (Hepler and Bentz 1986). In 1987, the upper Susitna River drainage above its confluence with the Talkeetna River was also opened to sport fishing and one additional week was added to the fishing season on the remote streams. The same regulations remained in effect on all the remote streams in 1989 with the exception of the removal of the seasonal bag limit.

The objectives of this report are to present:

1. estimates of angler-effort (total number of angler-hours expended) for sport fisheries in selected roadside and remote streams in the Susitna River drainage;
2. estimates of the harvest (number of fish kept by anglers) and catch (number of fish kept plus number released) of chinook salmon in these streams;
3. estimates of the sex, age, and length compositions of chinook salmon harvested in these streams;
4. estimates of the ordinal index of chinook salmon spawning in selected streams in northern Cook Inlet; and
5. estimates of the contribution of hatchery-reared chinook salmon to the sport harvest in selected roadside and remote streams in the Susitna River drainage.

Harvest and effort estimates for the years 1979 to 1988 are presented in Kubik (1980), Watsjold (1980), Kubik (1981), Watsjold (1981), Bentz (1982), Hepler and Kubik (1982), Bentz (1983), Delaney and Hepler (1983), Hepler and Bentz (1984, 1985, 1986, 1987), and Hepler et al. (1988, 1989).

METHODS

Creel Surveys

Two types of creel surveys, roving and direct expansion, were used in this study. Direct expansion surveys are used in locations where the majority of the anglers exit through one location whereas roving creel surveys are used where anglers can exit at a variety of locations. The sample design and methods of analysis for each are described below.

Roving Creel Surveys:

Roving creel surveys (Neuhold and Lu 1957) were conducted to estimate effort for and catch and harvest of chinook salmon on the Deshka River, Alexander, Lake, Montana, Sheep, and Willow Creeks. Brief descriptions of the systems follow:

Deshka River. Approximately 50 km (31 mi) of the Deshka River were open to fishing for chinook salmon from 1 January to 13 July. The open section was divided into two survey areas for the creel survey. The downstream area

consisted of the lower 1.6 km (1.0 mi) of the river from its confluence with the Susitna River upstream to the Alaska Department of Fish and Game cabin. Primary access to the downstream area is by riverboat launched from Susitna or Deshka landing. The upstream area included the remaining open section from the cabin upstream to the confluence of Moose and Kroto Creeks. Access to this area is by riverboat, airboat, floatplane, raft, or canoe.

Alexander Creek. The entire drainage of Alexander Creek was open to fishing for chinook salmon from 1 January to 13 July. The open section was divided into two survey areas. The downstream area consisted of the lower 1.6 km (1.0 mi) from the creek's confluence with the Susitna River upstream to Gabbert's Fish Camp. The upstream area included the remaining open section from Gabbert's Fish Camp to Alexander Lake. Access by anglers to the downstream area is riverboat, wheelplane, and floatplane. Access to the upper area is by float trip that originates at Alexander Lake and riverboats that travel upstream from the creek's mouth.

Lake Creek. The entire drainage of Lake Creek was open to fishing for chinook salmon from 1 January to 13 July. Physical barriers within the river, however, restricted the majority of the anglers to the lower 3.2 km (2.0 mi) of the river. The survey area, therefore, only included the lower 3.2 km of the stream. Primary access by anglers to this fishery is floatplane, wheelplane, and riverboat.

Willow Creek. The section open to fishing for chinook salmon in Willow Creek included all waters within a 0.4 km (0.25 mi) radius of the creek's confluence with the Susitna River and upstream to the Parks Highway. This section was open to fishing 1 January to 19 June and Saturday, Sunday, and Monday only for two consecutive weeks commencing on 24 June. The stream is accessible by road and primary access to the fishery is by vehicle and foot. The majority of anglers fish within 0.8 km (0.5 mi) of the Parks Highway bridge and at the mouth. The three major access locations that were surveyed are: (1) the Parks Highway bridge, where anglers either access the creek from the road and fish near the bridge or use the private boat launch near the bridge; (2) Susitna Landing and Deshka Landing where anglers reach Willow Creek by riverboat; and (3) the head of the trail that leads to the mouth of Willow Creek, where anglers reach the stream by foot and fish in the vicinity of the creek's confluence with the Susitna River. Relatively few anglers access the fishery through other locations.

Sheep and Montana Creeks. These streams were open to chinook salmon fishing on four consecutive weekends (0001 Saturday to 2400 Monday) from 10 June to 3 July. The open area included all waters within a 0.4 km (0.25 mi) radius of their confluence with the Susitna River and upstream to the Parks Highway bridges. The length of stream which is open to fishing varies with the morphology of the stream and ranges approximately 3.0 km for Montana Creek to 13.0 km for Sheep Creek. These streams are accessible from the Parks Highway, by foot trails leading to fishing areas, and by riverboat. The majority of the fishing occurs at the mouths of these creeks which are accessible from the Parks Highway. Both the streams were surveyed at the main access point to the mouth.

A stratified random sample design was used for angler counts and interview periods on downstream areas of the Deshka River and Alexander Creek, and on Lake Creek, Willow Creek, Sheep Creek, and Montana Creek. Days were stratified into three (Deshka, Alexander, and Willow), four (Montana and Sheep) and five (Lake) sample periods. Angler effort (angler hours) and its variance were estimated separately for weekdays and for weekends/holidays for all sites except Lake Creek which was estimated by weekly periods. For Alexander Creek and Deshka River, 2 days were randomly selected without replacement within each weekday component for days off. Angler counts and interviews were conducted in each period (A, B, and C) on each day not selected. For each weekend/holiday component, angler counts and interviews were conducted in all periods. For Lake Creek, one Saturday, Sunday, or Monday of every weekend was randomly selected for travel to assess the upper Yentna River area fishery. Of the remaining 6 days, 2 days were selected for days off leaving 4 days to conduct angler counts and interviews. Angler counts and interviews were conducted in each period of each day selected for census. For the weekend-only fisheries on Sheep and Montana Creeks, angler counts and interviews were conducted in all four periods of each weekend day. For Willow Creek, angler counts and interviews were conducted in all three periods of each weekend day (Saturday, Sunday, and Monday). Two days were randomly chosen without replacement from the weekday component. Angler counts and interviews were conducted in each period on each selected day. The first day of the census was a Friday so only 1 day of that weekday component was selected.

Details for the creel survey at each location were:

Deshka River - downstream.

1. Dates: 27 May to 29 June (the fishery has moved upstream by the end of June).
2. Fishing day: 18 hours, 0600 through 2400.
3. Daily periods: three 6-hour sample periods (A, B, and C).
4. Sample unit length: 2.5 hours (includes 0.5 hour for angler count).
5. Other: Survey clerks only interviewed anglers who indicated they would not exit this fishery through the boat launch at Susitna Landing or Deshka Landing.

Alexander Creek - downstream.

1. Dates: 22 May to 18 June (the fishery has moved upstream by the third week in June).
2. Fishing day: 18 hours, 0600 through 2400.
3. Daily periods: three 6-hour sample periods (A, B, and C).
4. Sample unit length: 2.5 hours (includes 0.5 hour for angler count).
5. Other: Additional catch and harvest rate data were collected from anglers exiting the fishery at Deshka and Susitna Landings.

Lake Creek.

1. Dates: 3 June to 13 July.
2. Fishing day: 20 hours, 0500 through 0100.

3. Daily periods: five 4-hour sample periods (A, B, C, D, and E).
4. Sample unit length: 1.5 hours (includes 0.5 hour for angler counts).

Deshka Landing and Susitna Landing.

Deshka Landing and Susitna Landing are the primary boat launches used by recreational and commercial boaters for the Susitna River drainage below the Parks Highway bridge. Susitna Landing is located on the Kashwitna River at its confluence with the Susitna River. Deshka Landing is located west of the town of Willow on the Susitna River.

1. Dates: 27 May to 13 July.
2. Fishing day: 18 hours, 0600 through 2400.
3. Daily periods: three 6-hour sample periods (A, B, and C).
4. Sample unit length: Deshka Landing, A = 2 hours, B and C = 2.5 hours; Susitna Landing, A, B, and C = 2 hours.
5. Other: Data collected from these locations were included in harvest and catch rates for Deshka River downstream, Deshka River upstream, Alexander Creek downstream, Alexander Creek upstream, Willow, and Sheep Creeks. Each sampling day, two periods were spent at Deshka Landing, one at Susitna Landing.

Willow Creek - mouth.

1. Dates: 9 June to 19 June daily, 24 June to 3 July, Saturday, Sunday, and Monday only.
2. Fishing day: 24 hours, 0000 through 2400.
3. Daily periods: three periods; A = 6 hours, B = 12 hours, C = 6 hours.
4. Sample unit length: 2 hours, 9 June to 19 June; 3.5 hours, 24 June to 3 July (includes 0.5 hour for angler counts).

Willow Creek - bridge.

1. Dates: 1 July to 3 July.
2. Fishing day: 24 hours, 0000 through 2400.
3. Daily periods: three sample periods; A = 6 hours, B = 12 hours, C = 6 hours.
4. Sample unit length: 3.5 hours (includes 0.5 hour angler count).

Sheep Creek and Montana Creek.

1. Dates: Sheep Creek, 10 June to 3 July, Saturday, Sunday, and Monday only; Montana Creek; 17 June to 3 July, Saturday, Sunday, and Monday only.
2. Fishing day: 24 hours, 0000 through 2400.
3. Daily periods: four 6-hour sample periods.
4. Sample unit length: 2.5 hours (includes 0.5 hour for angler count).

Within a period selected for sampling, a starting time was randomly selected to conduct an angler count from the whole hours in the period (0500, 0600,

etc.). Anglers were counted by a creel clerk who drove a riverboat the length of the survey area on Lake Creek and in the downstream survey areas of the Deshka River and Alexander Creek. Montana, Sheep, and Willow Creek counts were conducted on foot. It took approximately 30 minutes to conduct an angler count. Anglers were counted by a creel clerk from a fixed-wing aircraft on the upstream areas of the Deshka River and Alexander Creek. Angler counts were considered instantaneous events (Neuhold and Lu 1957).

Angler interviews were conducted during the time remaining in a sample unit not used for the angler count. Interviews were conducted throughout the length of the survey area on Lake Creek, from the mouth of Alexander Creek upstream to Sucker Creek, and the downstream area of the Deshka River. Willow Creek, Sheep Creek, and Montana Creek anglers were interviewed at the access points. Survey clerks recorded the following information from each angler interviewed:

1. the number of hours spent fishing;
2. the number and species of fish harvested (kept);
3. the number and species of fish released;
4. whether the angler had completed the fishing trip or not;
5. whether the angler was a boat or shore angler;
6. whether the angler used chartered or private transportation to reach the fishery;
7. for boat anglers, whether the boat was an inboard, airboat, raft, or outboard. If an outboard was used, which of the following categories it fell into: 2-49 horsepower, 50-80 horsepower, or greater than 80 horsepower;
8. whether the angler used lures, bait, or both;
9. whether the angler fished the previous day.

For all survey sites except Lake Creek and the upstream areas of Alexander Creek and Deshka River, angler effort (E) and its variance were estimated separately for the weekdays and weekend/holiday component of each week. For the Lake Creek survey, angler effort and its variance were estimated by weekly periods (Saturday through Friday). For the upstream areas of Alexander Creek and the Deshka River, angler effort and its variance were estimated by seasonal weekday and weekend components. Effort in all survey sites except Lake Creek and the upstream areas of Alexander Creek and Deshka River was estimated for each temporal component of the fishery using a stratified random sampling approach by period. Within each temporal component, effort (E_j) was estimated as follows:

$$\hat{E}_j = \sum_{i=1}^{p} H_{ji}\bar{x}_{ji}; \qquad (1)$$

where:

p = total number of periods in temporal component j;

H_{ji} = the total number of hours of possible fishing time during period i, within temporal component j;

$\bar{x}_{ji}$ = the mean angler count during period i within temporal component j;

$$= \sum_{k=1}^{m_{ji}} x_{jik} / m_{ji}; \quad (2)$$

m_{ji} = the number of counts of anglers conducted during period i and temporal component j; and

x_{jik} = the number of anglers fishing during count k within period i and temporal component j.

The variance of the estimate of E_j was estimated as follows:

$$\hat{V}(\hat{E}_j) = \sum_{i=1}^{p} H_{ji}^2 (s_{ji}^2/m_{ji}); \quad (3)$$

where:

$$s_{ji}^2 = [\sum_{k=1}^{m_{ji}} (x_{jik} - \bar{x}_{ji})^2]/(m_{ji} - 1). \quad (4)$$

The total number of angler-hours of effort for the season was estimated by summing the estimates of effort for each of the temporal components. Because these are independent estimates, the variance for the total number of angler-hours of effort is the sum of the individual variances for each temporal component estimate.

Rates of catch (CPUE, fish kept plus those released) and harvest (HPUE, fish kept only) of chinook salmon were estimated using a two-stage design with a finite number of primary sampling units (days) and an unknown number of secondary units (anglers). Only completed-trip interviews were used to estimate catch and harvest rates for all locations except downstream Alexander Creek. All angler interviews (completed and incomplete) were used for downstream Alexander Creek because of the small numbers of completed interviews. The incomplete and completed interviews were combined to reduce the variability of the estimates. Catch rates were estimated for each sampled day and for each weekday and weekend/holiday component.

Mean catch per unit effort (catch per angler-hour) was estimated for each temporal component as:

$$\overline{CPUE}_j = \sum_{k=1}^{d_j} \sum_{o=1}^{m_k} c_{jko} / \sum_{k=1}^{d_j} \sum_{o=1}^{m_k} e_{jko}; \quad (5)$$

where:

d_j = the number of days sampled for angler interviews during temporal component j;

m_k = the number of anglers interviewed during day k and temporal component j;

c_{jko} = the catch by angler o interviewed during day k and temporal component j; and

e_{jko} = the effort (number of hours) expended by angler o interviewed during day k and temporal component j.

The variance of mean $CPUE_j$ was approximated as (Jessen 1978):

$$\hat{V}(\overline{CPUE_j}) = (\bar{C}_j/\bar{E}_j)^2 [s_c^2/\bar{C}_j^2 + s_e^2/\bar{E}_j^2 - (2r_j s_c s_e/\bar{C}_j\bar{E}_j)]; \quad (6)$$

where:

$$\bar{C}_j = (\sum_{k=1}^{d_j}\sum_{o=1}^{m_k} c_{jko}) / \sum_{k=1}^{d_j} m_k; \quad (7)$$

$$\bar{E}_j = (\sum_{k=1}^{d_j}\sum_{o=1}^{m_k} e_{jko}) / \sum_{k=1}^{d_j} m_k; \quad (8)$$

$$s_c^2 = (1/d_j)[\sum_{k=1}^{d_j}(\bar{c}_{jk}-\bar{C}_j)^2/(d_j-1)+\sum_{k=1}^{d_j}(1/m_k)\sum_{o=1}^{m_k}(c_{jko}-\bar{c}_{jk})^2/(m_k-1)]; \quad (9)$$

$$\bar{c}_{jk} = \sum_{o=1}^{m_k} c_{jko} / m_k; \quad (10)$$

$$s_e^2 = (1/d_j)[\sum_{k=1}^{d_j}(\bar{e}_{jk}-\bar{E}_j)^2/(d_j-1)+\sum_{k=1}^{d_j}(1/m_k)\sum_{o=1}^{m_k}(e_{jko}-\bar{e}_{jk})^2/(m_k-1)]; \quad (11)$$

$$\bar{e}_{jk} = \sum_{o=1}^{m_k} e_{jko} / m_k; \text{ and} \quad (12)$$

$$r_j = \frac{\sum_{k=1}^{d_j}\sum_{o=1}^{m_k}(c_{jko}-\bar{C}_j)(e_{jko}-\bar{E}_j)}{[\sum_{k=1}^{d_j}\sum_{o=1}^{m_k}(c_{jko}-\bar{C}_j)^2][\sum_{k=1}^{d_j}\sum_{o=1}^{m_k}(e_{jko}-\bar{E}_j)^2]}. \quad (13)$$

The catch of each species during temporal component j was estimated by:

$$\hat{C}_j = \hat{E}_j(\overline{CPUE}_j). \quad (14)$$

The variance of the estimated catch of each species was estimated using the product of two independent random variables as described by Goodman (1960):

$$\hat{V}(\hat{C}_j) = \hat{E}_j^2\hat{V}(\overline{CPUE}_j) + \overline{CPUE}_j^2\hat{V}(\hat{E}_j) - \hat{V}(\hat{E}_j)\hat{V}(\overline{CPUE}_j). \quad (15)$$

Harvest rates and total harvest of each species were estimated for each temporal component by substituting appropriate harvests for catches in equations 5-15. Catch rate and harvest rate data collected from anglers at the Susitna Landing and Deshka Landing locations were combined with data collected on site. The total harvest and catch for each of the fisheries in the downstream areas of the Deshka River and Alexander Creek, and on Willow Creek, Sheep Creek, and Montana Creek were estimated by summing the estimates for all the weekday and weekend/holiday components. Since these are considered independent estimates, the estimated variance of the total was the sum of the variances.

Estimates of catch and harvest rates, and total harvest of chinook salmon for downstream Alexander Creek during 1989, are based on combined incomplete and complete angler interviews using a stratified random sampling approach by week only. Future creel surveys on downstream Alexander Creek should use a stratified random sampling design by period and week, using completed angler interviews only. Additionally, estimates of catch and harvest rates, and total harvest of chinook salmon for Lake Creek during 1989, are based on a stratified random sampling design by week only. Future creel surveys on Lake Creek should use a stratified random sampling design by period and week.

On the upstream areas of the Deshka River and Alexander Creek, counts of anglers were conducted from a fixed-wing aircraft. Five counts were conducted each week; three on randomly selected (without replacement) weekdays, and one on each weekend/holiday day. A stratified simple random sample design by period was used. The fishing day was stratified into three 6-hour sample periods to ensure the distribution of sampling effort.

Details for the creel survey at each location were:

Deshka River - upstream.

1. Dates: 27 May to 13 July.
2. Fishing day: 18 hours, 0600 through 2400.
3. Daily periods: three 6-hour sample periods (A, B, and C). See details for Deshka Landing and Susitna Landing.
4. Other: Catch rate and harvest rate data for this location were collected from anglers exiting the fishery at Susitna Landing and Deshka Landing.

Alexander Creek - upstream.

1. Dates: 14 June to 13 July.
2. Fishing day: 18 hours, 0600 through 2400.
3. Daily periods: three 6-hour sample periods (A, B, and C). See details for Deshka Landing and Susitna Landing.
4. Sample unit length: 2.5 hours (includes 0.5 hour for angler counts).
5. Other: Additional catch and harvest rate data were collected from anglers exiting the fishery through Deshka Landing and Susitna Landing. Prior to June 14, interviews were conducted at the landings.

For the upstream areas of the Deshka River and Alexander Creek, effort was estimated for the entire season of the fishery using a stratified random sampling approach by period. Effort (E) was estimated as follows:

$$\hat{E} = \sum_{i=1}^{p} H_i \bar{x}_i; \quad (16)$$

where:

p = total number of periods,

H_i = the total number of hours of possible fishing time in period i, and

$\bar{x}_i$ = the mean angler count for period i.

The variance of the estimate of E was estimated as follows:

$$\hat{V}(\hat{E}) = \sum_{i=1}^{p} H_i^2 \, (s_i^2/m_i); \quad (17)$$

where:

$$s_i^2 = [\sum_{k=1}^{m_i} (x_{ik} - \bar{x}_i)^2]/(m_i - 1) \quad (18)$$

and:

x_{ik} = a count of anglers made during day k and period i;

m_i = the number of counts of anglers conducted during period i; and

$\bar{x}_i$ = the mean angler count during period i;

$$= \sum_{k=1}^{m_i} x_{ik} / m_i. \qquad (19)$$

Mean catch per unit effort (catch per angler-hour) was estimated as:

$$\overline{CPUE} = \sum_{h=1}^{d} \sum_{o=1}^{m_h} c_{ho} / \sum_{h=1}^{d} \sum_{o=1}^{m_h} e_{ho}; \qquad (20)$$

where:

d = the number of days sampled for angler interviews,

m_h = the number of anglers interviewed during sample h,

c_{ho} = the catch by angler o interviewed during sample h, and

e_{ho} = the effort (number of hours) expended by angler o interviewed during sample h.

The variance of mean CPUE was approximated as (Jessen 1978):

$$\hat{V}(\overline{CPUE}) = (\bar{C}/\bar{E})^2 [s_c^2/\bar{C}^2 + s_e^2/\bar{E}^2 - (2rs_cs_e/\bar{C}\bar{E})]; \qquad (21)$$

where:

$$\bar{C} = (\sum_{h=1}^{d} \sum_{o=1}^{m_h} c_{ho}) / \sum_{h=1}^{d} m_h; \qquad (22)$$

$$\bar{E} = (\sum_{h=1}^{d} \sum_{o=1}^{m_h} e_{ho}) / \sum_{h=1}^{d} m_h; \qquad (23)$$

$$s_c^2 = (1/d)[\sum_{h=1}^{d} (\bar{c}_h-\bar{C})^2/(d-1) + \sum_{h=1}^{d} (1/m_h) \sum_{o=1}^{m_h} (c_{ho}-\bar{c}_h)^2/(m_h-1)]; \qquad (24)$$

$$\bar{c}_h = \sum_{o=1}^{m} c_{ho} / m_h; \qquad (25)$$

$$s_e^2 = (1/d)[\sum_{h=1}^{d} (\bar{e}_h-\bar{E})^2/(d-1) + \sum_{h=1}^{d} (1/m_h) \sum_{o=1}^{m_h} (e_{ho}-\bar{e}_h)^2/(m_h-1)]; \qquad (26)$$

$$\bar{e}_h = \sum_{o=1}^{m} e_{ho} / m_h; \text{ and} \qquad (27)$$

$$r = \frac{\sum_{h=1}^{d}\sum_{o=1}^{m_h}(c_{ho}-\bar{C})(e_{ho}-\bar{E})}{\left[\sum_{h=1}^{d}\sum_{o=1}^{m_h}(c_{ho}-\bar{C})^2\right]\left[\sum_{h=1}^{d}\sum_{o=1}^{m_h}(e_{ho}-\bar{E})^2\right]} . \quad (28)$$

The catch of each species was estimated by:

$$\hat{C} = \hat{E}(\overline{CPUE}) . \quad (29)$$

The variance of the estimated catch of each species was estimated using the product of two independent random variables as described by Goodman (1960):

$$\hat{V}(\hat{C}) = \hat{E}^2\hat{V}(\overline{CPUE}) + \overline{CPUE}^2\hat{V}(\hat{E}) - \hat{V}(\hat{E})\hat{V}(\overline{CPUE}) . \quad (30)$$

Harvest rates and total harvest of each species were estimated by substituting appropriate harvests for catches in equations 20-30. The total harvest and catch for each of the fisheries in the upstream areas of the Deshka River and Alexander Creek were estimated by summing the estimates for the seasonal weekday and weekend/holiday components. Since these are considered independent estimates, the estimated variance of the total was the sum of the variances.

Several necessary assumptions for these analyses are:

1. Angler counts made during the same day and on consecutive days are independent. Exploratory data analyses suggest that counts made during the same day may not be independent if the periods are not spaced far enough apart to prevent the same anglers from being counted repeatedly.
2. Interviewed anglers are representative of the total angler population.
3. The number of anglers interviewed during any day is proportional to the effort on that day. This assumption is probably met most of the time; however, on days of peak effort creel survey clerks were not always able to interview all anglers.
4. No significant fishing effort occurs during the hours not included in the fishing day. Exploratory data analyses revealed that high angler counts did occasionally occur at the beginning and/or end of an angler day, at some of the fisheries, suggesting that the definition of an angler day deserves special attention during the design of the 1990 creel surveys.

Direct Expansion Creel Surveys:

Direct expansion surveys census all anglers exiting an access site during a sampling period. The information is then expanded to include periods not

surveyed. Direct expansion surveys were implemented on the Talkeetna River and Clear Creek.

Talkeetna River and Clear Creek. The Talkeetna River, a major tributary to the Susitna River, enters from the east at kilometer 157.8 (mile 98). The entire Talkeetna River drainage was open to chinook salmon fishing in 1989. High turbidity in the mainstem of the Talkeetna River and rapids which are not passable by boat at approximately kilometer 29.0 (mile 18.0) concentrated most of the fishing effort at the mouth of Clear Creek, kilometer 8.1 (mile 5.0). Clear Creek, a tributary to the Talkeetna River, was open to chinook salmon fishing for 3.2 km (2.0 mi) upstream from the creek's mouth from 1 January to 13 July. Anglers accessed this fishery primarily by riverboat, via the boat landing in the village of Talkeetna. Accordingly, angler interviews for this fishery were collected at the boat landing in the village of Talkeetna.

A stratified random sample design was used for the direct expansion creel surveys. The fishing day was stratified into two sample periods. Effort was estimated separately for the weekday and weekend/holiday components of each week the fishery was surveyed. Two days were randomly selected without replacement for days off within each weekday component. All periods were sampled in each weekday not selected. Each period was sampled on each weekend/holiday day.

Details for the creel survey are as follows:

Talkeetna Boat Landing (Clear Creek and Talkeetna River).

The Talkeetna boat landing is the primary boat launch used for the Talkeetna River drainage. The landing is located in the village of Talkeetna near the Talkeetna River's confluence with the Susitna River.

1. Dates: 17 June to 13 July.
2. Fishing day: 16 hours, 0800 through 2400.
3. Daily periods: two 8-hour sample periods (A and B).
4. Sample unit length: 3.5 hours.

Within a period selected for sampling, a time to begin sampling was randomly selected from those whole hours in the period (0800, 0900, etc.) which would allow the entire sample unit to fall within the defined period. A creel clerk was stationed at the boat landing during each selected sample period. An attempt was made to contact all anglers departing the fishery through the access site during the sample period. If the survey clerk was unable to contact all anglers (due to large numbers of anglers leaving the fishery at the same time) a count of missed anglers was recorded. Creel clerks recorded the same information from each interviewed angler as previously described for the roving creel surveys.

The estimation of angler effort by a direct expansion creel survey can be considered as a problem of estimating a rate. Effort in temporal component j (E_j) was estimated in units of angler-hours. The rate estimated was the number of angler-hours leaving an access site during each hour the fishery was in progress. Only completed-trip angler interviews were used in the analyses.

The product of this rate and the total number of possible fishing hours in the fishery is an estimate of angler effort. This can be expressed as:

$$\hat{E}_j = \sum_{i=1}^{p} \left\{ \frac{H_{ij}}{h_{ij}} e_{ij} \right\} ; \quad (31)$$

where:

p_j = the total number of daily time periods in temporal component j;

H_{ij} = the total number of hours of possible fishing time in period i during temporal component j;

h_{ij} = the number of hours sampled during period i of temporal component j; and

e_{ij} = the amount of effort in hours expended by interviewed anglers during period i during temporal component j.

The variance of effort was estimated as:

$$\hat{V}(E_j) = \sum_{i=1}^{p} \left\{ \frac{H_{ij}^2}{h_{ij}^2} s_e^2 \right\} ; \quad (32)$$

where:

$$s_e^2 = (1-(h_{ij}/H_{ij}))*s_b^2/d_{ij}+[h_{ij}/(H_{ij}*d_{ij})]s_w^2/d_{ij}; \quad (33)$$

s_b^2 = the between sample variance of angler effort;

$$= (1/(d_{ij}-1)) \sum_{k=1}^{d_{ij}} (e_{ijk} - \bar{e}_{ij})^2 ; \quad (34)$$

d_{ij} = the number of days sampled in period i during temporal component j;

e_{ijk} = the number of hours of angler effort recorded in period i, during temporal component j, on day k;

$\bar{e}_{ij}$ = the mean effort of anglers interviewed during period i of temporal component j;

s_w^2 = the within sample (between angler) variance of angler effort;

$$= \sum_{k=1}^{d_{ij}} \sum_{o=1}^{m_{ik}} (e_{iko} - \bar{e}_{ik})/m_{ik}\text{-}1; \qquad (35)$$

e_{iko} = effort by angler o on day k, in period i of temporal component j;

$\bar{e}_{ik}$ = mean effort of anglers interviewed on day k, in period i of temporal component j; and

m_{ik} = number of anglers interviewed on day k, in period i of temporal component j.

The harvest and catch of a species and their variances were estimated with the same procedures used to estimate effort by substituting the corresponding quantities for harvest or catch in place of effort. The total harvest and catch for the fisheries in Clear Creek and Talkeetna River were estimated by summing each of the estimates for the weekday and weekend/holiday components. Since these are considered independent estimates, the estimated variance of the total was the sum of the variances.

Assumptions necessary for the direct expansion creel survey design are:

1. Interviewed anglers correctly report their catch, harvest, and effort;
2. No significant fishing effort occurs during the hours not included in the fishing day;
3. All anglers participating in a particular fishery exit the fishery through a surveyed access site; and
4. All anglers who are not interviewed are counted and all non-interviewed anglers are completed-trip anglers.

The total harvest and catch for all the fisheries in the Deshka River, Alexander Creek, Willow Creek, Lake Creek, Sheep Creek, Montana Creek, Clear Creek, and Talkeetna River were estimated by summing the individual estimates for each fishery. Since these are considered independent estimates, the estimated variance of the total was the sum of the variances.

Biological Data:

In each fishery, the chinook salmon harvested by the sport fishery were randomly sampled for age, sex, and length. In addition, carcasses of chinook salmon in the spawning escapement to the Deshka River were randomly sampled for age, sex, and length. Three scales were collected on the left side of each fish approximately two rows above the lateral line and on the diagonal row downward from the posterior insertion of the dorsal fin as described in Clutter and Whitesel (1956). Scales were mounted on adhesive-coated cards and impressions were made in cellulose acetate. Age determinations were made by examination of scales using a microfiche reader. Ages were designated using the European method (Koo 1962), where winter checks are counted and the first number refers to the number of years (winters) of freshwater residence after emergence and the second number refers to the number of years (winters) of

marine residence. Fish lengths were measured from the middle of the eye to fork of the tail, to the nearest 0.5 cm.

The proportional age composition of the sampled portion of the sport harvest was estimated for each fishery. Letting p_h equal the estimated proportion of age group h in the sample, the variance of p_h was estimated using the normal approximation to the binomial (Scheaffer et al. 1979):

$$V(\hat{p}_h) = \hat{p}_h(1-\hat{p}_h)/(n_T-1), \quad (36)$$

where n_T is the total number of legible scales collected from chinook salmon during the fishery.

Mean length at age by sex with the associated errors will be estimated using standard statistical procedures (Sokal and Rohlf 1981).

Escapement Counts

Chinook salmon spawning in established index streams within the study area were counted using aerial (rotary-wing aircraft) and foot surveys, and at a weir. Ease of access determined the survey type for each index stream. Surveys were conducted during the peak spawning period which was identified through frequent inspections of spawning activity in index streams. Escapement data reported are the number of fish, both alive and dead, observed during a single survey. No attempt has been made to account for fish not observed due to poor visibility, migrational timing, or decay. Additional escapement data were collected from weirs located on Deception Creek, a tributary to Willow Creek, and the Little Susitna River.

Hatchery Contributions

A portion of the chinook salmon harvested by the sport fisheries at all creel census sites were examined for a missing adipose fin. Chinook salmon having a missing adipose fin were assumed to contain a coded-wire tag (CWT) implanted at a hatchery. Adult chinook salmon were expected to return to Willow Creek from a stocking of 534,447 smolts during 1985, a stocking of 179,138 smolts in 1986 and 201,091 in 1988. In 1988, Montana Creek was also stocked with 132,465 smolts and Sheep Creek with 132,125 smolts (Clupach 1989). The contribution of stocked fish to the harvest was calculated as (using equation [10] from Clark and Bernard 1987):

$\hat{H}_{a_h}$ = estimated contribution of stocked fish from release associated with unique tag code *i* for fishery stratum *h*;

$$= \left\{ \frac{\hat{H}_h}{n_{2_h}} \right\} \left\{ \frac{a_{1_h}}{a_{2_h}} \right\} \left\{ \frac{m_{1_h}}{m_{2_h}} \right\} \left\{ \frac{m_{a_h}}{\theta_a} \right\}; \quad (37)$$

where:

$\hat{H}_h$ = the estimated harvest of all chinook salmon within fishery stratum *h* (as appropriate for each creel survey);

n_{2_h} = number of salmon inspected for missing adipose fins from the sampled harvest in fishery stratum *h*;

a_{1_h} = number of salmon with a missing adipose fin which were counted and marked with a head strap from stratum *h*;

a_{2_h} = number of salmon heads previously marked with a head strap which arrived at the tag lab, from fish originally sampled from stratum *h*;

m_{1_h} = number of coded-wire tags which were detected in the salmon heads at the tag lab, from those sampled from stratum *h*;

m_{2_h} = number of coded-wire tags which were removed from the salmon heads and decoded, from salmon sampled from stratum *h*;

m_{a_h} = number of coded-wire tags dissected out of the salmon heads and decoded as the unique tag code *a*, originally sampled from stratum *h*; and

θ_a = proportion of a particular hatchery release which contains a coded-wire tag of the unique tag code *a*.

The variance of the above was obtained following the approach proposed by Conrad and Larson (1987), in which the number of tags decoded as a unique tag code (*a*) and the total harvest estimate were treated as random variates, and all other terms in equation (37) were treated as constants (accordingly the approach first proposed by Goodman 1960 was used for the second major term in equation (38)):

$$s^2_{H_{a_h}} = \left\{ \frac{1}{n_{2_h}} \; \frac{a_{1_h}}{a_{2_h}} \; \frac{m_{1_h}}{m_{2_h}} \; \frac{1}{\theta_a} \right\}^2 \left\{ \hat{H}_h \, \hat{V}[m_{a_h}] + m^2_{a_h} \, \hat{V}[\hat{H}_h] - \hat{V}[m_{a_h}] \, \hat{V}[\hat{H}_h] \right\} ; \quad (38)$$

where:

$\hat{V}[\hat{H}_h]$ = estimated variance of overall chinook salmon harvest estimate for stratum *h*, obtained from creel survey sampling program; and

$V[{}^{m}a_h]$ = variance of "random variate" ma_h, approximated by the approach used by Clark and Bernard (1987; equation [12]);

$$\approx \frac{n_{2_h}(n_{2_h}-1)a_{2_h}(a_{2_h}-1)m_{2_h}(m_{2_h}-1)\hat{H}_{a_h}(\hat{H}_{a_h}-1)\theta_a^2}{\hat{H}_h(\hat{H}_h-1)a_{1_h}(a_{1_h}-1)m_{1_h}(m_{1_h}-1)} + \frac{n_{2_h}a_{2_h}m_{2_h}\hat{H}_{a_h}\theta_a}{\hat{H}_h a_{1_h} m_{1_h}} - \left\{ \frac{n_{2_h}a_{2_h}m_{2_h}\hat{H}_{a_h}\theta_a}{\hat{H}_h a_{1_h} m_{1_h}} \right\}^2 . \quad (39)$$

The final step in calculating the variance of the contribution estimate for each tag code was to perform the following bias correction (Clark and Bernard 1987; equation [15]):

$$\hat{V}[\hat{H}_{a_h}] = \left\{ \frac{(\hat{H}_h-1)n_{2_h}(a_{1_h}-1)a_{2_h}(m_{1_h}-1)m_{2_h}}{\hat{H}_h(n_{2_h}-1)a_{1_h}(a_{2_h}-1)m_{1_h}(m_{2_h}-1)} \right\} s^2_{H_{a_h}} . \quad (40)$$

Total contribution estimates were obtained by summing the individual contribution estimates for each tag code both within and across strata. The variance of this total was obtained by summing the corresponding variance terms. As such, we assumed independence of contribution estimates both within and among strata. This assumption is probably invalid for the within stratum components, however, as noted by Clark and Bernard (1987), the impact of the within stratum covariance is to reduce the overall size of the variance (i.e., negative covariances), as such our estimates of combined contribution variances are conservative.

RESULTS

Remote Streams

The remote streams are those which anglers can reach only by boat or plane. In 1989, creel surveys were conducted on the following remote streams: the Deshka River, both downstream and upstream sections; Alexander Creek, both downstream and upstream sections; Lake Creek; Clear Creek; and the Talkeetna River. Roving creel surveys were used at all locations except Clear Creek and the Talkeetna River where direct expansion creel surveys were used. The fisheries in these streams are open 7 days a week.

Deshka River:

The creel survey of the Deshka River was conducted from 27 May through 29 June in the downstream section and 27 May through 13 July in the upstream section of the river.

Effort. Number of anglers counted ranged from 2 to 280 in the downstream section and from 2 to 110 in the upstream section (Appendix A1). Estimated angler-effort during the survey was 78,607 angler-hours, of which 53,085 angler-hours (68%) were in the downstream section and 25,522 angler-hours (32%) were in the upstream section (Table 1). Forty percent of the downstream and 33% of the upstream effort occurred during the weekend/holiday component. Effort peaked in the downstream section during the weekday period of 12 June through 16 June (Table 1, Figures 2 and 3).

Harvest Rates and Catch Rates. Daily harvest and catch rates ranged from 0.000 to 0.219 and 0.000 to 0.313 fish per hour, respectively (Appendix A2) in the downstream section of the Deshka River, and from 0.000 to 0.163 and 0.000 to 0.300 fish per hour in the upstream section (Appendix A3). The weekday component from 12 to 16 June had the highest harvest rate (0.098 fish per hour) and catch rate (0.126 fish per hour), in the downstream section (Table 2, Figure 2). In the upstream section, the seasonal weekend component had a greater harvest and catch rate (0.072 and 0.096 fish per hour respectively) than the weekday component (0.049 and 0.054 fish per hour respectively) (Table 2, Figure 3).

Harvest and Catch. The estimated harvest in the Deshka River during the creel survey was 5,308 fish; 3,663 (70%) were harvested in the downstream section and 1,645 (30%) were harvested in the upstream section (Table 3). In the downstream section, 15% of the chinook salmon caught by anglers were released and in the upstream section 17% were released. Catch and harvest in the downstream and upstream section peaked in the weekday component from 12 June through 16 June. Seventy-four percent of the harvest and 78% of the catch occurred during weekdays, in the upstream section (Table 3, Figures 2 and 3).

Alexander Creek:

The creel survey of Alexander Creek was conducted from 22 May through 18 June in the downstream section and from 27 May through 13 July in the upstream section.

Effort. Number of anglers counted ranged from 0 to 145 in the downstream section and from 0 to 99 in the upstream section (Appendix A4). Estimated effort during the survey was 43,907 angler-hours of which 21,626 angler-hours (49%) were in the downstream section and 22,281 angler-hours (51%) were in the upstream section (Table 4). In the downstream section of the river, 45% of the angler-effort occurred during the weekend/holiday component. In the upstream section, 36% of the effort occurred during this component. Effort peaked in the downstream section during the weekday component from 5 June through 9 June (Figures 4 and 5).

Table 1. Estimated number of angler-hours of effort during each of the weekday and weekend/holiday components of the fishery for chinook salmon in the Deshka River, 1989.

Location / Component[a]		Effort	Standard Error	95% Confidence Interval	Relative Precision[b]
Downstream					
WE	5/27-5/29	3,840.0	615.5	2,634 - 5,046	31.4%
WE	6/03-6/04	4,782.0	1360.3	2,116 - 7,447	55.8%
WE	6/10-6/11	6,078.0	918.0	4,279 - 7,877	29.6%
WE	6/17-6/18	4,464.0	854.0	2,790 - 6,138	37.5%
WE	6/24-6/25	1,836.0	383.9	1,084 - 2,588	41.0%
	Sub-total	21,000.0	1,987.0	17,105 - 24,895	18.5%
WD	5/30-6/02	5,172.0	530.7	4,132 - 6,212	20.1%
WD	6/04-6/09	9,866.0	1,027.3	7,852 - 11,880	20.4%
WD	6/12-6/16	10,016.0	1,302.1	7,464 - 12,568	25.5%
WD	6/19-6/23	6,143.0	894.0	4,391 - 7,895	28.5%
WD	6/26-6/29	888.0	366.7	169 - 1,607	80.1%
	Sub-total	32,085.0	1,992.0	28,180 - 35,989	12.2%
TOTAL		53,085.0	2,813.4	47,571 - 58,599	10.4%
Upstream					
WE	5/27-7/09	8,466.0	1,617.0	5,296 - 11,635	37.4%
WD	5/30-7/13	17,056.0	4,342.0	8,545 - 25,566	49.9%
TOTAL		25,522.0	4,632.9	16,442 - 34,602	35.6%
GRAND TOTAL		78,607.0	5,420.2	67,983 - 89,231	13.5%

[a] WE = weekend/holiday; WD = weekday.
[b] Relative precision of 95% confidence interval.

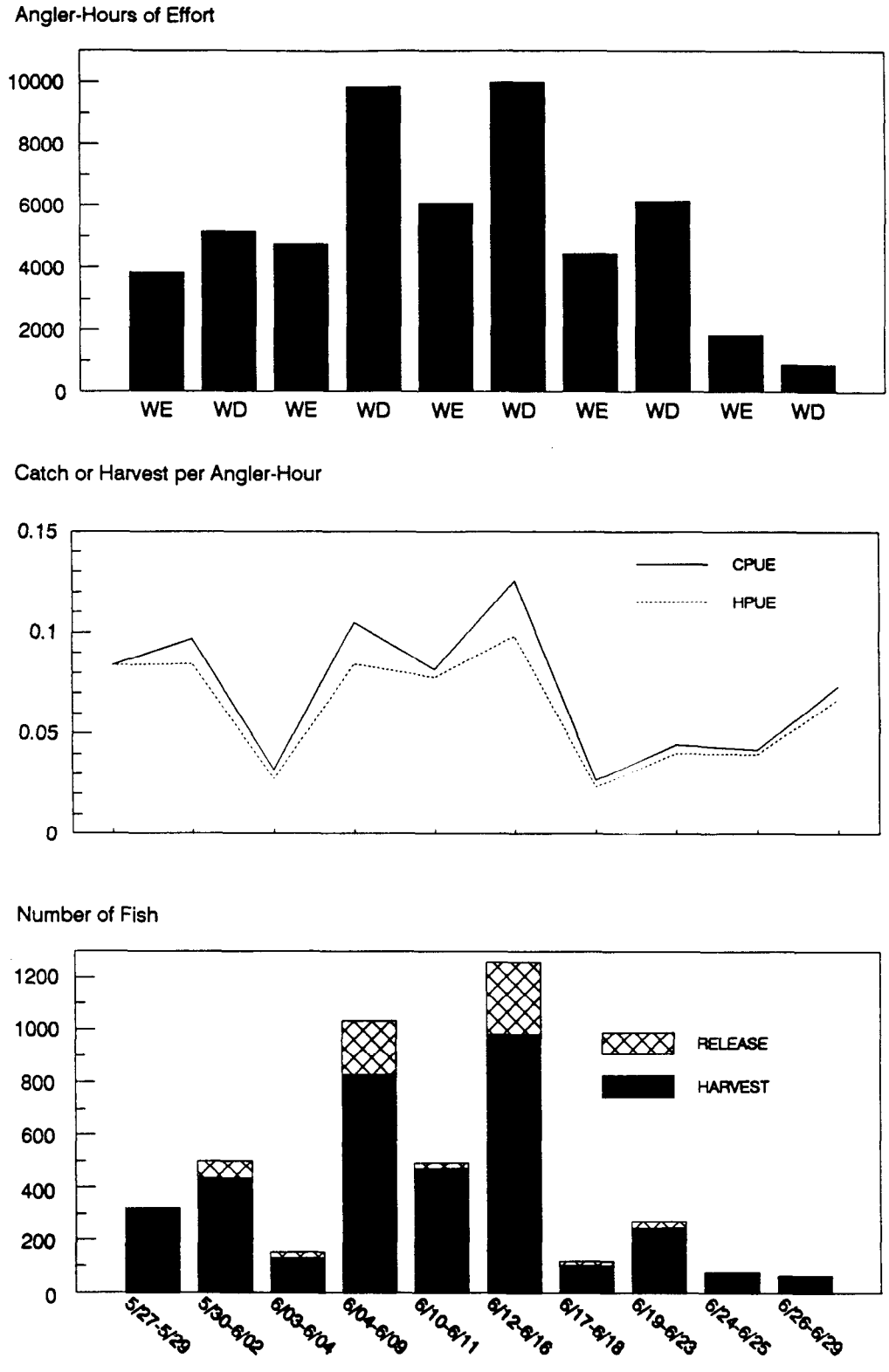

Figure 2. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in the downstream location of the Deshka River, 1989.

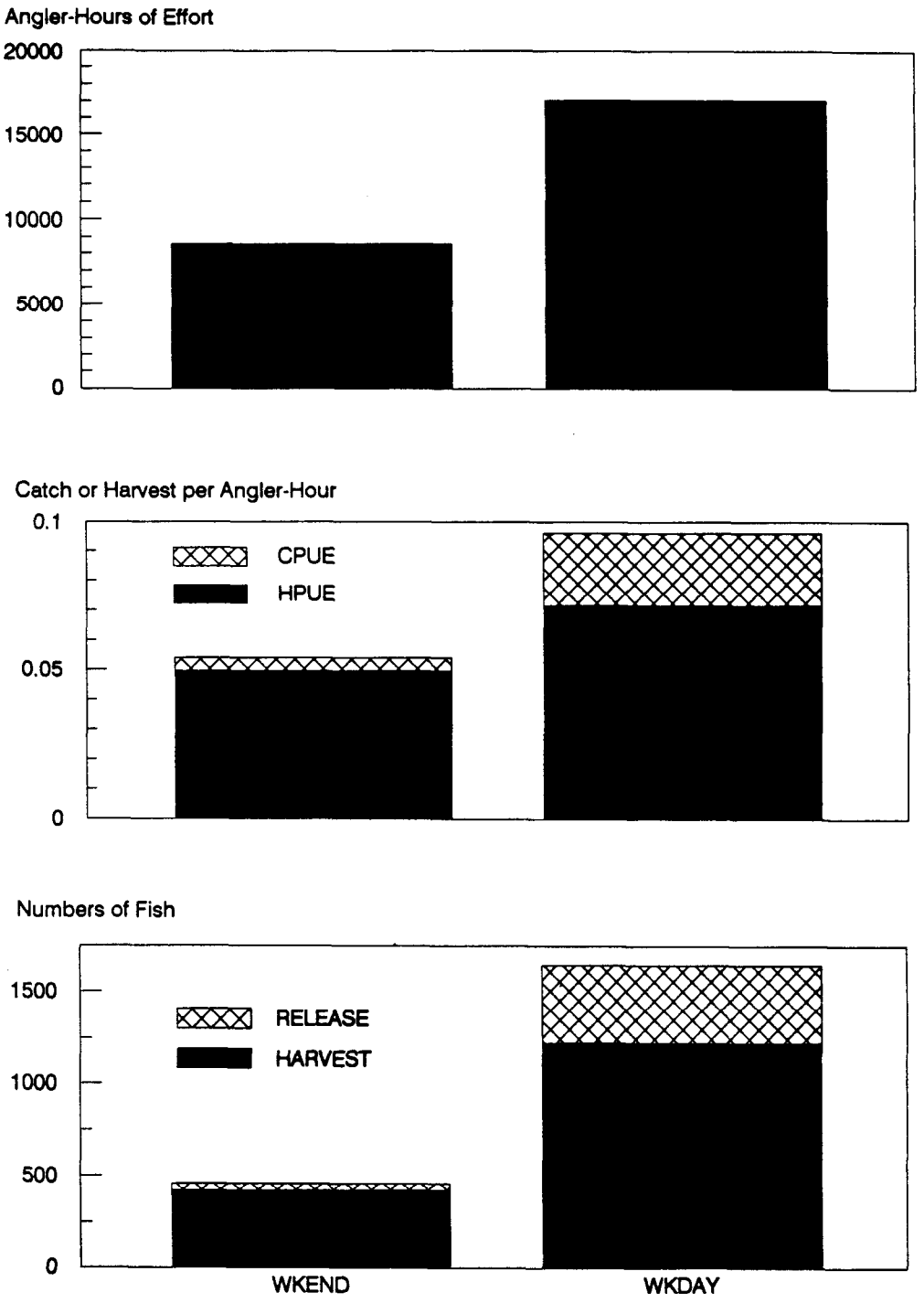

Figure 3. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for weekday and weekend components of the sport fishery in the upstream location of the Deshka River, 1989.

Table 2. Estimated harvest and catch rates[a] of chinook salmon during each of the weekday and weekend/holiday components of the fishery for chinook salmon in the Deshka River, 1989.

Location / Component[b]	Number of Interviews[c]	Harvest Rate	Standard Error	Catch Rate	Standard Error
Downstream					
WE 5/27-5/29	175	0.0839	0.0091	0.0839	0.0091
WE 6/03-6/04	322	0.0275	0.0038	0.0321	0.0048
WE 6/10-6/11	280	0.0777	0.0071	0.0815	0.0074
WE 6/17-6/18	231	0.0236	0.0043	0.0269	0.0048
WE 6/24-6/25	135	0.0399	0.0066	0.0423	0.0074
WE 7/01-7/04	33	0.0056	0.0038	0.0056	0.0038
WE 7/08-7/09	5	0.0526	0.0439	0.0526	0.0439
WD 5/30-6/02	89	0.0842	0.0159	0.0968	0.0232
WD 6/05-6/09	261	0.0842	0.0107	0.1049	0.0166
WD 6/12-6/16	315	0.0983	0.0124	0.1257	0.0149
WD 6/19-6/23	200	0.0403	0.0130	0.0446	0.0212
WD 6/26-6/30	71	0.0672	0.0171	0.0733	0.0200
WD 7/03-7/07	33	0.0000	0.0000	0.0000	0.0000
WD 7/10-7/13	15	0.0000	0.0000	0.0000	0.0000
Upstream					
WE 5/27-7/09	478	0.0496	0.0060	0.0541	0.0085
WD 5/30-7/13	276	0.0718	0.0086	0.0962	0.0143

[a] Harvest includes only fish kept and catch includes fish kept and fish reported as released. Rates are number of fish harvested or caught per hour fished for interviewed anglers.

[b] WE = weekend/holiday; WD = weekday.

[c] Completed-trip angler interviews only.

Table 3. Estimated number of chinook salmon harvested[a] and number caught[b] during each of the weekday and weekend/holiday components of the fishery for chinook salmon in the Deshka River, 1989.

Location / Component[c]		Harvest	SE	95% Confidence Interval	Catch	SE	95% Confidence Interval
Downstream							
WE	5/27-5/29	322	62.1	200 - 444	322	62.0	200 - 444
WE	6/03-6/04	132	41.3	51 - 213	154	49.0	58 - 250
WE	6/10-6/11	472	83.1	309 - 635	495	87.0	325 - 665
WE	6/17-6/18	105	27.7	51 - 159	120	31.1	59 - 181
WE	6/24-6/25	73	19.4	35 - 111	78	21.0	37 - 119
WE	7/01-7/04	0	0.0	0 - 0	0	0.0	0 - 0
WE	7/08-7/09	0	0.0	0 - 0	0	0.0	0 - 0
	Sub-total	1,104	116.7	875 - 1,333	1,169	123.4	927 - 1,411
WD	5/30-6/02	435	93.3	252 - 618	501	130.1	246 - 756
WD	6/05-6/09	831	135.7	565 - 1,097	1,035	195.6	652 - 1,418
WD	6/12-6/16	985	177.7	637 - 1,333	1,259	220.9	826 - 1,692
WD	6/19-6/23	248	87.0	77 - 419	274	134.7	10 - 538
WD	6/26-6/30	60	28.3	5 - 115	65	31.4	4 - 126
WD	7/03-7/07	0	0.0	0 - 0	0	0.0	0 - 0
WD	7/10-7/13	0	0.0	0 - 0	0	0.0	0 - 0
	Sub-total	2,559	258.9	2,051 - 3,067	3,134	350.9	2,446 - 3,822
TOTAL		3,663	284.0	3,106 - 4,220	4,303	371.9	3,574 - 5,032
Upstream							
WE	5/27-7/09	420	94.3	235 - 605	458	112.5	237 - 679
WD	5/30-7/13	1,225	342.7	553 - 1,897	1,641	479.4	701 - 2,581
TOTAL		1,645	355.4	948 - 2,342	2,099	492.5	1,134 - 3,064
GRAND TOTAL		5,308	454.9	4,416 - 6,200	6,402	617.1	5,192 - 7,612

[a] Harvest includes only fish kept.
[b] Catch includes fish kept and fish reported as released.
[c] WE = weekend/holiday; WD = weekday.

Table 4. Estimated number of angler-hours of effort during each of the weekday and weekend/holiday components of the fishery for chinook salmon in Alexander Creek, 1989.

Location / Component[a]	Effort	Standard Error	95% Confidence Interval	Relative Precision[b]
Downstream				
WE 5/28-5/29	2,730.0	485.0	1,779 - 3,681	34.8%
WE 6/03-6/04	3,552.0	502.1	2,568 - 4,536	27.7%
WE 6/10-6/11	2,820.0	758.4	1,334 - 4,307	52.7%
WE 6/17-6/18	624.0	153.2	324 - 924	48.1%
Sub-total	9,726.0	1,042.0	7,683 - 11,769	21.0%
WD 5/22-5/26	700.0	248.6	213 - 1,187	69.6%
WD 5/30-6/02	2,160.0	228.6	1,712 - 2,608	20.7%
WD 6/05-6/09	6,430.0	759.8	4,941 - 7,919	23.2%
WD 6/12-6/16	2,610.0	574.6	1,484 - 3,736	43.2%
Sub-total	11,900.0	1,010.6	9,919 - 13,881	16.7%
TOTAL	21,626.0	1,451.7	18,781 - 24,471	13.2%
Upstream				
WE 5/27-7/09	7,916.0	2,155.0	3,692 - 12,140	53.4%
WD 5/30-7/13	14,365.0	3,499.0	7,506 - 21,223	47.7%
TOTAL	22,281.0	4,109.0	14,227 - 30,335	36.2%
GRAND TOTAL	43,907.0	4,357.9	35,366 - 52,448	19.5%

[a] WE = weekend/holiday; WD = weekday.
[b] Relative precision of 95% confidence interval.

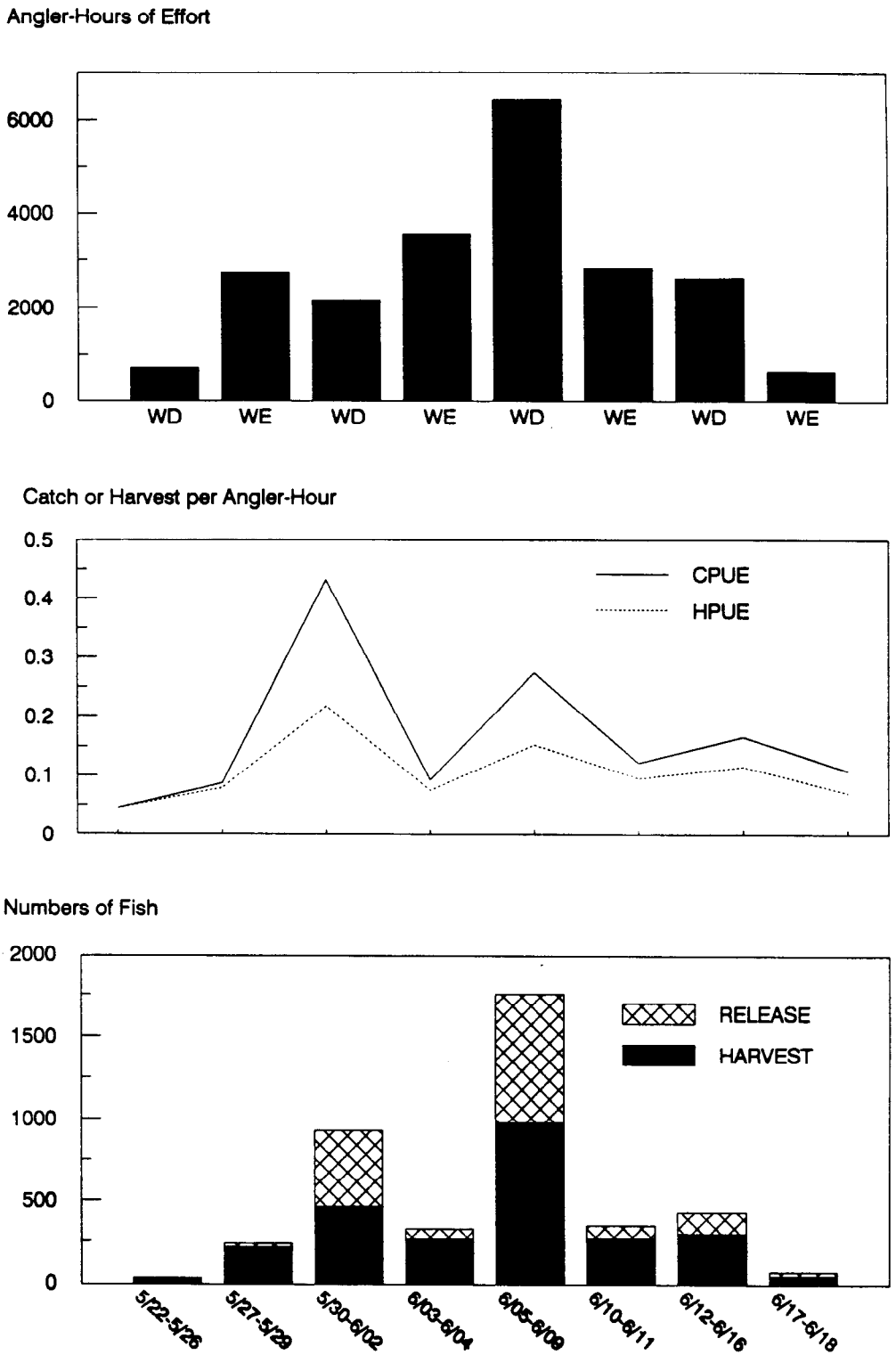

Figure 4. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in the downstream location of Alexander Creek, 1989.

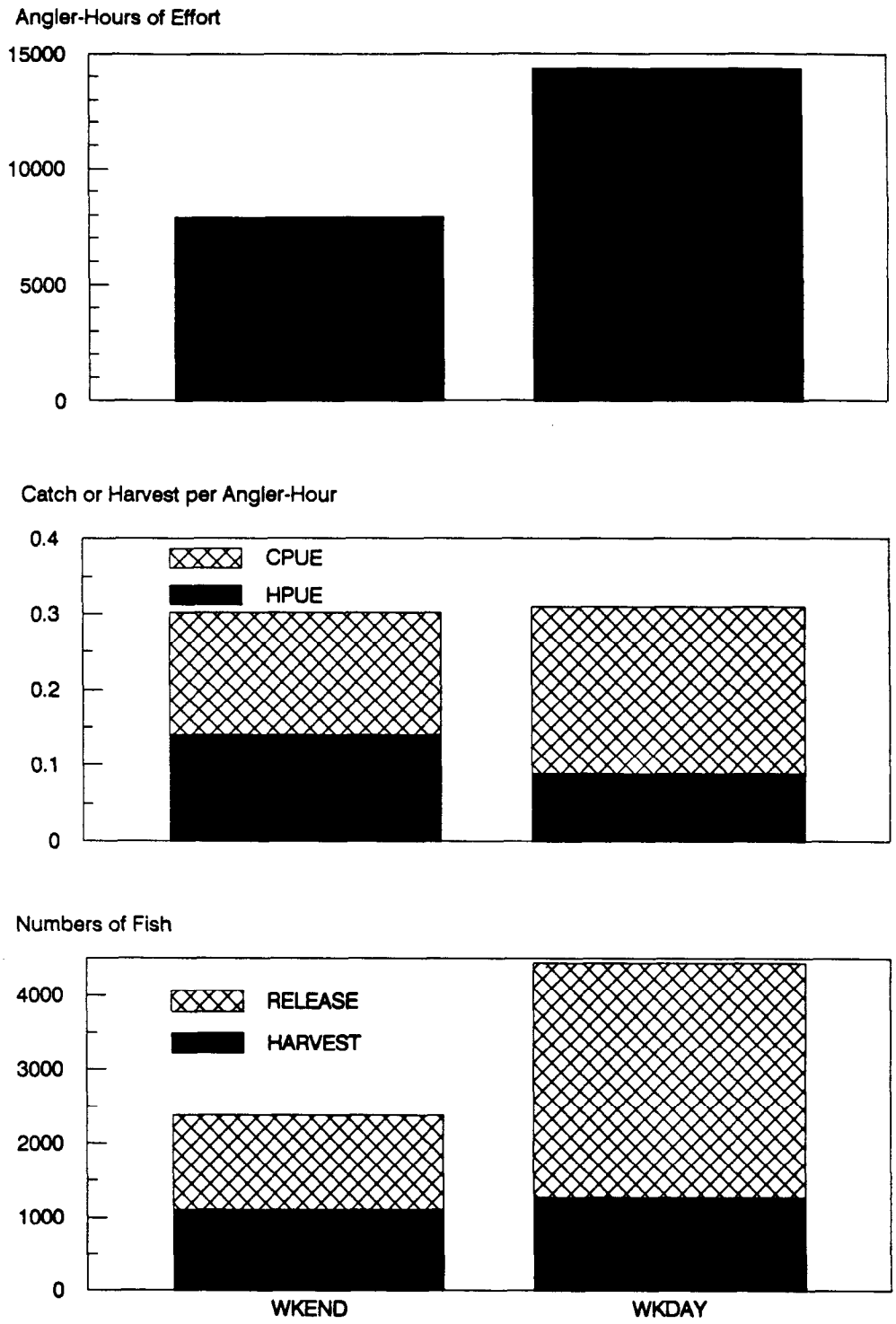

Figure 5. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for weekday and weekend components of the sport fishery in the upstream location of Alexander Creek, 1989.

Harvest Rates and Catch Rates. Daily harvest and catch rates ranged from 0.010 to 0.245 and 0.010 to 0.650 fish per hour, respectively, (Appendix A5) in the downstream section of Alexander Creek and from 0.000 to 0.300 and 0.024 to 0.667 fish per hour, respectively, in the upstream section (Appendix A6). The weekday component from 30 May to 2 June had the highest harvest rate, 0.217 fish per hour, and catch rate, 0.431 fish per hour, in the downstream section (Table 5, Figure 4). The weekend/holiday component had a greater seasonal harvest rate (0.140) than the weekday component (0.089), in the upstream section (Table 5, Figure 5).

Harvest and Catch. The estimated harvest in Alexander Creek during the creel survey was 4,970 fish of which 2,580 (52%) were harvested in the downstream section and 2,390 (48%) were harvested in the upstream section (Table 6). In the downstream section, 38% of the chinook salmon caught by anglers were released, and, in the upstream section, 55% were released. Catch and harvest peaked in the downstream section during the weekday component from 5 to 9 June (Table 6, Figure 4). Fifty-three percent of the harvest and 65% of the catch, occurred during the weekday component, in the upstream section (Table 6, Figure 5).

Lake Creek:

The creel survey of Lake Creek was conducted from 3 June through 13 July.

Effort. Numbers of anglers counted ranged from 0 to 136 (Appendix A7). Estimated angler-effort during the survey was 33,231 angler-hours (Table 7). Effort peaked during the weekly period from 17 June through 23 June (Figure 6).

Harvest Rates and Catch Rates. Daily harvest rates ranged from 0.000 to 0.222 fish per hour and daily catch rates from 0.000 to 0.350 fish per hour (Appendix A8). The weekly component from 17 to 23 June had the highest harvest rate at 0.113 fish per hour and catch rate at 0.182 fish per hour (Table 8, Figure 6).

Harvest and Catch. The estimated harvest in Lake Creek during the creel survey was 2,812 fish (Table 9). Catch and harvest peaked during the weekly component from 17 June through 23 June (Figure 6). Anglers released 38% of the chinook salmon caught during the Lake Creek fishery.

Clear Creek and Talkeetna River:

A direct expansion creel survey was conducted at the Talkeetna boat landing from 17 June through 13 July to estimate angler-effort and chinook salmon harvest by the fisheries in Clear Creek and the Talkeetna River.

Effort. The number of anglers exiting the fishery at Clear Creek through Talkeetna Landing during a surveyed period ranged from 2 to 128 (Appendix A9). Estimated angler-effort during the survey was 33,235 angler-hours of which 17,223 angler-hours (52%) occurred during the weekend/holiday component and 16,012 angler-hours (48%) during the weekday component (Table 10). Effort

Table 5. Estimated harvest and catch rates[a] of chinook salmon during each of the weekday and weekend/holiday components of the fishery for chinook salmon in Alexander Creek, 1989.

Location Component[b]	Number of Interviews[c]	Harvest Rate	Standard Error	Catch Rate	Standard Error
Downstream					
WE 5/27-5/29	312	0.0791	0.0087	0.0870	0.0098
WE 6/03-6/04	284	0.0755	0.0083	0.0930	0.0117
WE 6/10-6/11	361	0.0962	0.0090	0.1224	0.0118
WE 6/17-6/18	150	0.0711	0.0127	0.1088	0.0183
WD 5/22-5/26	73	0.0405	0.0147	0.0450	0.0168
WD 5/30-6/02	130	0.2173	0.0309	0.4310	0.1625
WD 6/05-6/09	355	0.1526	0.0397	0.2739	0.0374
WD 6/12-6/16	220	0.1160	0.0148	0.1662	0.0218
Upstream					
WE 6/03-7/09	221	0.1402	0.0072	0.3016	0.0197
WD 6/05-7/13	211	0.0891	0.0127	0.3098	0.0320

[a] Harvest includes only fish kept and catch includes fish kept and fish reported as released. Rates are number of fish harvested or caught per hour fished for interviewed anglers.

[b] WE = weekend/holiday; WD = weekday.

[c] Complete and incomplete-trip angler interviews were used for downstream component; only complete-trip angler interviews were used for upstream component.

Table 6. Estimated number of chinook salmon harvested[a] and number caught[b] during each of the weekday and weekend/holiday components of the fishery for chinook salmon in Alexander Creek, 1989.

Location / Component[c]		Harvest	SE	95% Confidence Interval	Catch	SE	95% Confidence Interval
Downstream							
WE	5/27-5/29	216	44.9	128 - 304	238	49.7	141 - 335
WE	6/03-6/04	268	47.9	174 - 362	330	62.2	208 - 452
WE	6/10-6/11	271	77.0	120 - 422	351	99.7	156 - 546
WE	6/17-6/18	44	13.4	18 - 70	68	20.0	29 - 107
	Sub-total	799	102.1	599 - 999	987	129.1	734 - 1,240
WD	5/22-5/26	28	13.9	1 - 55	32	15.7	1 - 63
WD	5/30-6/02	469	83.0	306 - 632	931	362.6	220 - 1,642
WD	6/05-6/09	981	278.6	435 - 1,527	1,761	316.6	1,141 - 2,381
WD	6/12-6/16	303	76.6	153 - 453	434	110.5	217 - 651
	Sub-total	1,781	300.9	1,191 - 2,371	3,158	494.1	2,190 - 4,126
TOTAL		2,580	317.7	1,957 - 3,203	4,145	510.7	3,144 - 5,146
Upstream							
WE	5/27-7/09	1,110	307.0	508 - 1,712	2,387	666.9	1,080 - 3,694
WD	5/30-7/13	1,280	358.5	577 - 1,983	4,450	1,172.2	2,152 - 6,748
TOTAL		2,390	472.0	1,465 - 3,315	6,837	1,348.7	4,194 - 9,480
GRAND TOTAL		4,970	568.9	3,855 - 6,085	10,982	1,442.0	8,155 -13,809

[a] Harvest includes only fish kept.
[b] Catch includes fish kept and fish reported as released.
[c] WE = weekend/holiday; WD = weekday.

Table 7. Estimated number of angler-hours of effort during each week of the fishery for chinook salmon in Lake Creek, 1989.

Component[a]	Effort	Standard Error	95% Confidence Interval	Relative Precision[b]
WK 6/03-6/09	735.0	312.3	123 - 1,347	83.3%
WK 6/10-6/16	5,208.0	447.2	4,331 - 6,085	16.8%
WK 6/17-6/23	12,385.0	875.6	10,669 - 14,101	13.9%
WK 6/24-6/30	9,842.0	1,140.3	7,607 - 12,077	22.7%
WK 7/01-7/07	3,801.0	548.0	2,727 - 4,875	28.3%
WK 7/08-7/13	1,260.0	205.8	857 - 1,663	32.0%
TOTAL	33,231.0	1,645.0	30,006 - 36,455	9.7%

[a] WK = week.
[b] Relative precision of 95% confidence interval.

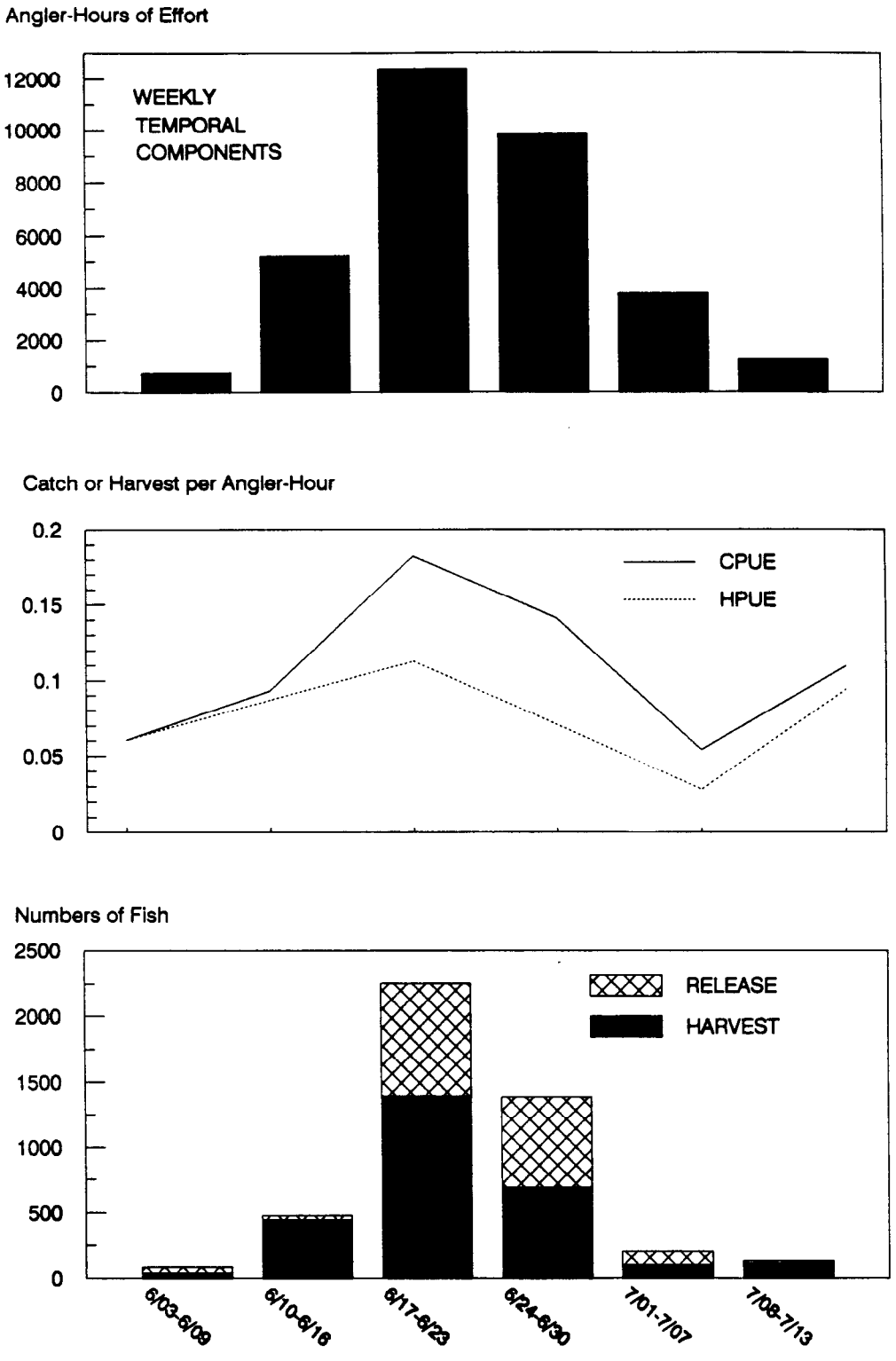

Figure 6. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in Lake Creek, 1989.

Table 8. Estimated harvest and catch rates[a] of chinook salmon during each week of the fishery for chinook salmon in Lake Creek, 1989.

Component[b]	Number of Interviews[c]	Harvest Rate	Standard Error	Catch Rate	Standard Error
WK 6/03-6/09	15	0.0606	0.0280	0.0606	0.0280
WK 6/10-6/16	91	0.0868	0.0146	0.0931	0.0154
WK 6/17-6/23	134	0.1128	0.0154	0.1821	0.0299
WK 6/24-6/30	121	0.0705	0.0090	0.1411	0.0263
WK 7/01-7/07	125	0.0280	0.0065	0.0542	0.0097
WK 7/08-7/13	27	0.0938	0.0186	0.1094	0.0200

[a] Harvest includes only fish kept and catch includes fish kept and fish reported as released. Rates are number of fish harvested or caught per hour fished for interviewed anglers.
[b] WK = week.
[c] Completed-trip angler interviews only.

Table 9. Estimated number of chinook salmon harvested[a] and number caught[b] during each week of the fishery for chinook salmon in Lake Creek, 1989.

Component[c]		Harvest	SE	95% Confidence Interval	Catch	SE	95% Confidence Interval
WK	6/03-6/09	45	26.6	0 - 97	45	26.6	0 - 97
WK	6/10-6/16	452	84.9	286 - 618	485	72.9	342 - 628
WK	6/17-6/23	1,397	214.2	977 - 1,817	2,255	402.0	1,467 - 3,043
WK	6/24-6/30	694	884.9	0 - 2,428	1,389	303.2	795 - 1,983
WK	7/01-7/07	106	243.8	0 - 584	206	365.4	0 - 922
WK	7/08-7/13	118	30.1	59 - 177	138	33.6	72 - 204
TOTAL		2,812	947.2	956 - 4,668	4,518	627.9	3,287 - 5,749

[a] Harvest includes only fish kept.
[b] Catch includes fish kept and fish reported as released.
[c] WK = week.

Table 10. Estimated number of angler-hours of effort during each of the weekday and weekend/holiday components of the fisheries for chinook salmon in Clear Creek and Talkeetna River, 1989.

Fishery Component[a]		Effort	Standard Error	95% Confidence Interval	Relative Precision[b]
Clear Creek					
WE	6/17-6/18	585.1	359.7	0 - 1,290	120.5%
WE	6/24-6/25	1,467.1	591.2	308 - 2,626	78.9%
WE	7/01-7/04	9,159.4	1,789.6	5,652 - 12,667	38.3%
WE	7/08-7/09	6,010.9	1,757.8	2,566 - 9,456	57.3
	Sub-total	17,222.5	2,602.2	12,122 - 22,322	29.6%
WD	6/19-6/23	144.7	60.3	27 - 263	81.7%
WD	6/26-6/30	4,810.0	1,282.8	2,296 - 7,324	52.3%
WD	7/03-7/07	6,361.5	1,647.2	3,133 - 9,590	50.8%
WD	7/10-7/13	4,696.0	875.9	2,979 - 6,413	36.6%
	Sub-total	16,012.2	2,264.9	11,573 - 20,451	27.7%
TOTAL		33,234.7	3,449.8	26,473 - 39,996	20.3%
Talkeetna River					
WE	6/17-6/18	192.0	61.7	71 - 313	63.0%
WE	6/24-6/25	755.4	258.6	249 - 1,262	67.1%
WE	7/01-7/04	2,020.3	465.1	1,109 - 2,932	45.1%
WE	7/08-7/09	1,173.6	343.7	500 - 1,847	57.4%
	Sub total	4,141.3	636.5	2,894 - 5,389	30.1%
WD	6/19-6/23	388.5	243.2	0 - 865	122.7%
WD	6/26-6/30	1,526.7	417.6	708 - 2,345	53.6%
WD	7/03-7/07	227.6	144.1	0 - 510	124.1%
WD	7/10/7/13	253.0	107.4	42 - 464	83.2%
	Sub-total	2,395.8	515.6	1,385 - 3,406	42.2%
TOTAL		6,537.1	819.1	4,932 - 8,143	24.6%

[a] WE = weekend/holiday; WD = weekday.
[b] Relative precision of 95% confidence interval.

peaked during the weekend/holiday component from 1 to 4 July (Table 10, Figure 7).

The number of anglers exiting the fishery in the Talkeetna River through Talkeetna Landing during a surveyed period ranged from 0 to 25 (Appendix A10). A total of 6,537 angler-hours of effort were estimated for this fishery. Peak effort occurred during the weekend/holiday component from 1 to 4 July (Table 10, Figure 8).

Harvest Rates and Catch Rates. The weekday component from 26 to 30 June had the highest harvest rate, 0.093 fish per hour, of all temporal components in the fishery at Clear Creek (Table 11, Figure 7). Catch rates (0.208 fish per hour) peaked during the same weekday period (26 June through 30 June) (Table 11, Figure 7).

The weekday component of 26 to 30 June had the highest harvest rate, 0.160 fish per hour for Talkeetna River (Table 11, Figure 8). Catch rates (0.273 fish per hour) peaked during the same weekday component (26 to 30 June) of the fishery at Talkeetna River (Table 11, Figure 8).

Harvest and Catch. The estimated harvest in Clear Creek during the creel survey was 1,918 fish of which 828 (43%) were harvested during the weekend/holiday component and 1,090 (57%) were harvested during the weekday component (Table 12). Harvest and catch peaked during the weekend/holiday component from 1 July through 4 July and the weekday component 26 through 30 June, respectively (Table 12, Figure 7). During the fishery at Clear Creek, 44% of the chinook salmon caught by anglers were released.

A harvest of 548 chinook salmon was estimated for the fishery in the Talkeetna River of which 59% occurred during the weekday components (Table 12). Harvest and catch peaked during the weekday component from 26 to 30 June (Table 12, Figure 8). Anglers released 38% of their chinook salmon catch during the Talkeetna River fishery.

Roadside Streams

The roadside streams are those which are accessible to anglers from the Parks Highway road system. In 1989, creel surveys were conducted in the following roadside streams: Willow, Sheep, and Montana Creeks. Roving creel surveys were used at these locations. The fisheries in all roadside streams except Willow Creek were weekend-only fisheries (midnight Friday to midnight Monday). Beginning in 1989, Willow Creek was open to sport fishing daily, from 1 January through 19 June (the third Monday in June), followed by weekends only for the next two weekends (24-26 June and 1-3 July).

Willow Creek:

A roving creel survey was conducted at the stream mouth daily from 9 June to 19 June and weekends from 24 June to 3 July. A survey was also conducted at the Parks Highway bridge during the weekend of 1 to 3 July. Boat anglers exiting the Willow Creek fishery at Deshka Landing or Susitna Landing were interviewed at Deshka or Susitna Landing.

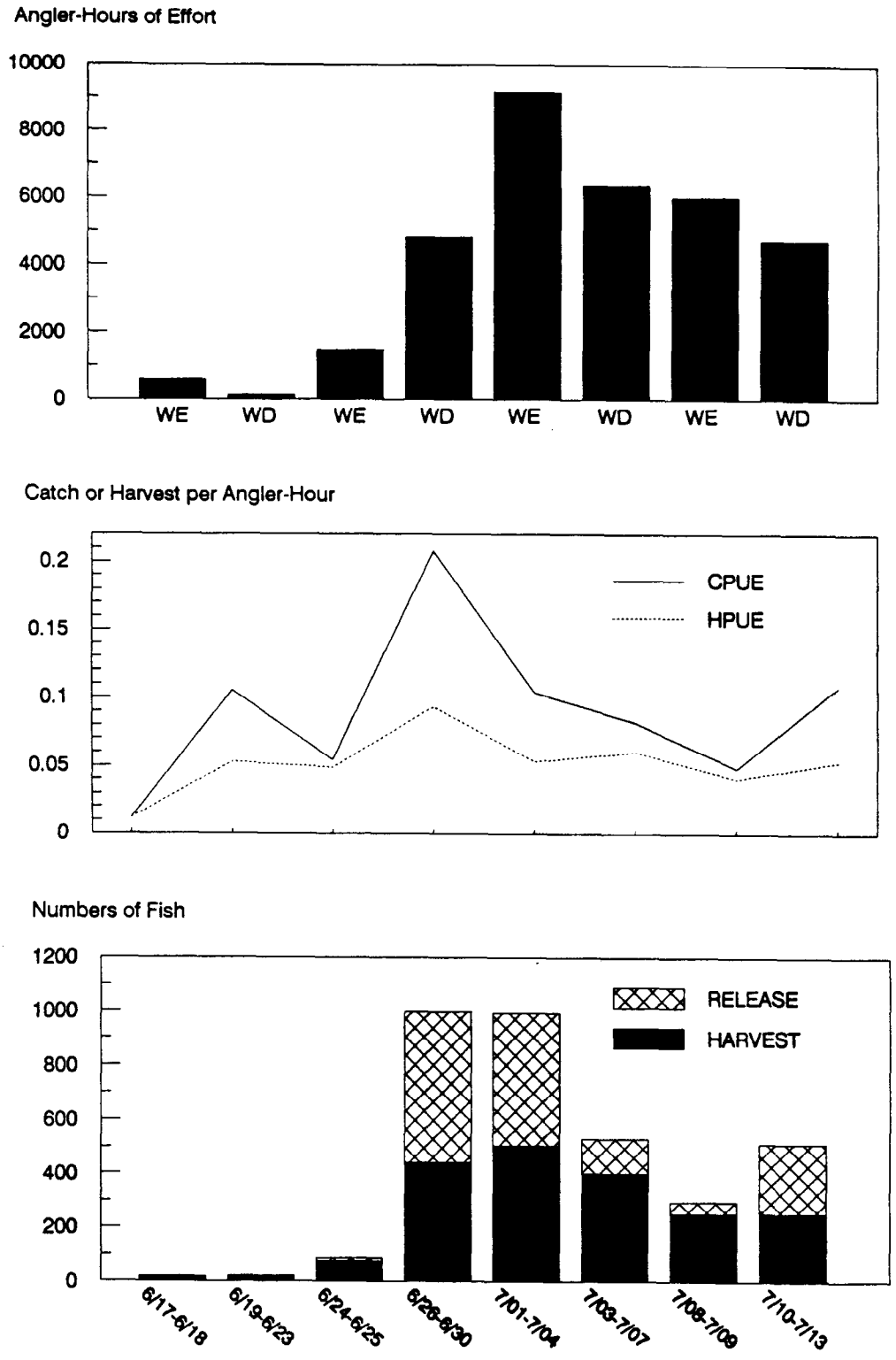

Figure 7. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in Clear Creek, 1989.

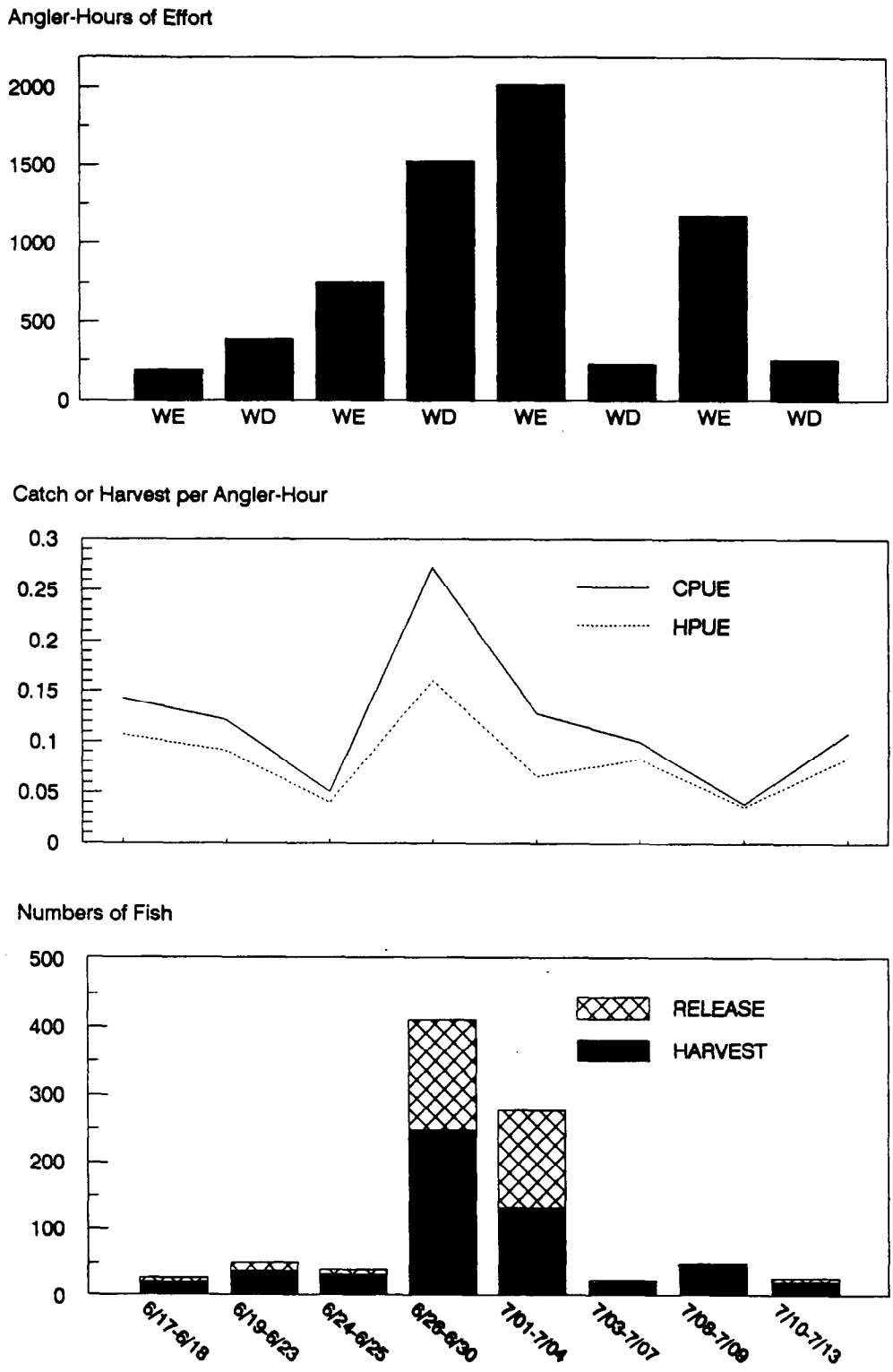

Figure 8. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in Talkeetna River, 1989.

Table 11. Estimated harvest and catch rates[a] of chinook salmon during each of the weekday and weekend/holiday components of the fishery for chinook salmon in Clear Creek and Talkeetna River, 1989.

Location Component[b]	Number of Interviews[c]	Harvest Rate	Standard Error	Catch Rate	Standard Error
Clear Creek					
WE 6/17-6/18	26	0.0117	0.0198	0.0117	0.0198
WE 6/24-6/25	57	0.0485	0.0089	0.0544	0.0097
WE 7/01-7/04	333	0.0535	0.0039	0.1040	0.0103
WE 7/08-7/09	253	0.0406	0.0034	0.0482	0.0038
WD 6/19-6/20	8	0.0526	0.0883	0.1053	0.1766
WD 6/26-6/30	157	0.0934	0.0122	0.2079	0.0284
WD 7/03-7/07	135	0.0603	0.0107	0.0818	0.0151
WD 7/10-7/13	185	0.0526	0.0047	0.1081	0.0101
Talkeetna River					
WE 6/17-6/18	10	0.1071	0.0199	0.1429	0.0298
WE 6/24-6/25	33	0.0401	0.0111	0.0511	0.0169
WE 7/01-7/04	54	0.0662	0.0080	0.1276	0.0240
WE 7/08-7/09	61	0.0368	0.0093	0.0390	0.0097
WD 6/19-6/23	20	0.0909	0.0539	0.1212	0.0408
WD 6/26-6/30	61	0.1604	0.0134	0.2727	0.0370
WD 7/03-7/07	14	0.0833	0.0361	0.1000	0.0516
WD 7/10-7/13	11	0.0843	0.0347	0.1084	0.0535

[a] Harvest includes only fish kept and catch includes fish kept and fish reported as released. Rates are number of fish harvested or caught per hour fished for interviewed anglers.
[b] WE = weekend/holiday; WD = weekday.
[c] Completed-trip angler interviews only.

Table 12. Estimated number of chinook salmon harvested[a] and number caught[b] during each of the weekday and weekend/holiday components of the fisheries for chinook salmon in Clear Creek and Talkeetna River, 1989.

Fishery Component[c]		Harvest	SE	95% Confidence Interval	Catch	SE	95% Confidence Interval
Clear Creek							
WE	6/17-6/18	7	5.1	0 - 17	7	5.1	0 - 17
WE	6/24-6/25	73	37.9	0 - 147	83	44.7	0 - 171
WE	7/01-7/04	501	54.3	395 - 607	990	140.3	715 - 1,265
WE	7/08-7/09	247	97.5	56 - 438	290	118.2	58 - 522
	Sub-total	828	118.0	597 - 1,059	1,370	188.9	1,000 - 1,740
WD	6/19-6/23	8	6.5	0 - 19	15	13.1	0 - 41
WD	6/26-6/30	438	81.1	279 - 597	994	239.5	525 - 1,463
WD	7/03-7/07	397	125.7	151 - 643	526	148.4	235 - 817
WD	7/10-7/13	247	46.0	157 - 337	508	107.0	298 - 718
	Sub-total	1,090	156.6	783 - 1,397	2,043	301.7	1,452 - 2,634
TOTAL		1,918	196.1	1,534 - 2,302	3,413	355.9	2,715 - 4,111
Talkeetna River							
WE	6/17-6/18	21	12.0	0 - 45	27	17.1	0 - 61
WE	6/24-6/25	32	14.3	4 - 60	39	13.9	12 - 66
WE	7/01-7/04	130	37.4	57 - 203	274	101.1	76 - 472
WE	7/08-7/09	44	17.0	11 - 77	46	18.6	10 - 82
	Sub-total	227	45.1	138 - 315	386	105.1	180 - 592
WD	6/19-6/23	38	17.6	4 - 72	50	27.0	0 - 102
WD	6/26-6/30	244	66.9	113 - 375	407	124.4	163 - 651
WD	7/03-7/07	18	10.8	0 - 39	21	12.6	0 - 46
WD	7/10-7/13	21	10.9	0 - 42	27	15.6	0 - 58
	Sub-total	321	70.9	182 - 460	505	128.9	252 - 758
TOTAL		548	84.0	383 - 713	891	166.3	565 - 1,217

[a] Harvest includes only fish kept.
[b] Catch includes fish kept and fish reported as released.
[c] WE = weekend/holiday; WD = weekday.

Effort. The number of shore anglers counted ranged from 4 to 229 at the mouth and from 20 to 101 at the Parks Highway bridge. Boat angler counts at the mouth ranged from 0 to 12 (Appendix A11, A13, and A15). Estimated effort during the survey was 33,002 angler-hours of which 27,757 angler-hours (84%) were at the mouth, 4,208 angler-hours (13%) were at the Parks Highway bridge, and 1,037 angler-hours (3%) were boat anglers (Table 13). Effort at the mouth for both shore and boat anglers peaked during the weekend of 1 through 3 July (Table 13, Figure 9).

Harvest Rates and Catch Rates. Daily harvest rates at the mouth of Willow Creek ranged from 0.000 to 0.500 fish per hour for boat anglers (Appendix A12) and from 0.000 to 0.155 fish per hour for shore anglers (Appendix A14). Daily catch rates ranged from 0.000 to 0.500 fish per hour for boat anglers (Appendix A12) and from 0.000 to 0.169 for shore anglers (Appendix A14). The highest component harvest and catch rate, 0.111 and 0.160 fish per hour respectively, occurred during the weekend from 1 July to 3 July for anglers exiting the fishery at the Parks Highway bridge (Table 14).

Harvest and Catch. The estimated harvest in Willow Creek during the creel survey was 2,570 fish (Table 15). Harvest and catch peaked during the weekend of 1 to 3 July (Table 15, Figure 9). During the Willow Creek fishery, only 7% of the chinook salmon caught by anglers were released.

Sheep Creek:

A roving creel survey was conducted at the mouth of Sheep Creek during the four weekends from 10 June to 3 July.

Effort. The number of shore anglers counted ranged from 8 to 138. Boat angler counts ranged from 0 to 16 (Appendix A17). An insufficient number of angler interviews were conducted to determine catch rates for boat anglers, therefore, boat and shore angler effort estimates and boat and shore angler harvest and catch rates were combined. Estimated angler-effort during the survey was 15,138 angler-hours (Table 16). Effort peaked during the third weekend of the fishery, 24 to 26 July, and decreased slightly the following weekend (Table 16, Figure 10).

Harvest Rates and Catch Rates. Daily harvest rates ranged from 0.009 to 0.093 fish per hour and daily catch rates ranged from 0.013 to 0.102 fish per hour (Appendix A18). The highest component harvest and catch rate of 0.076 and 0.096 fish per hour, respectively, occurred during the weekend from 24 June to 26 June (Table 17, Figure 10).

Harvest and Catch. The estimated harvest during the creel survey was 855 fish (Table 18). The peak harvest and catch occurred during the weekend of 24 to 26 June (Table 18, Figure 10). Fourteen percent of the chinook salmon caught by anglers were released.

Montana Creek:

A roving creel survey was conducted between the Parks Highway bridge and the mouth of Montana Creek during the three weekends from 17 June to 3 July.

Table 13. Estimated number of angler-hours of effort during each weekday and weekend component of the fishery for chinook salmon in Willow Creek, 1989.

Fishery - Location Component[a]		Effort	Standard Error	95% Confidence Interval	Relative Precision[b]
Willow Creek - Mouth, Shore anglers					
WE	6/10-6/12	1,696.0	210.8	1,283 - 2,109	24.4%
WE	6/17-6/19	4,952.0	659.6	3,659 - 6,245	26.1%
WE	6/24-6/26	8,904.0	1,017.9	6,909 - 10,899	22.4%
WE	7/01-7/03	10,680.0	894.8	8,926 - 12,434	16.4%
	Sub-total	26,232.0	1,522.0	23,248 - 29,215	11.4%
WD	6/09 & 6/13 thru 6/16	1,525.0	332.0	874 - 2,176	42.7%
TOTAL		27,757.0	1,557.6	24,704 - 30,810	21.6%
Willow Creek - Mouth, Boat anglers					
WE	6/10-6/12	40.0	21.2	0 - 81	104.0%
WE	6/17-6/19	232.0	59.3	116 - 348	50.1%
WE	6/24-6/26	336.0	95.0	150 - 522	55.4%
WE	7/01-7/03	376.0	82.8	214 - 538	43.2%
	Sub-total	984.0	140.9	708 - 1,260	28.1%
WD	6/09 & 6/13 thru 6/16	53.0	30.0	0 - 112	110.9%
TOTAL		1,037.0	144.1	755 - 1,319	27.2%
Willow Creek - Bridge					
WE	7/01-7/03	4,208.0	441.0	3,343 - 5,072	20.5%
GRAND TOTAL		33,002.0	1,625.0	29,817 - 36,187	9.7%

[a] WE = weekend/holiday; WD = weekday.
[b] Relative precision of 95% confidence interval.

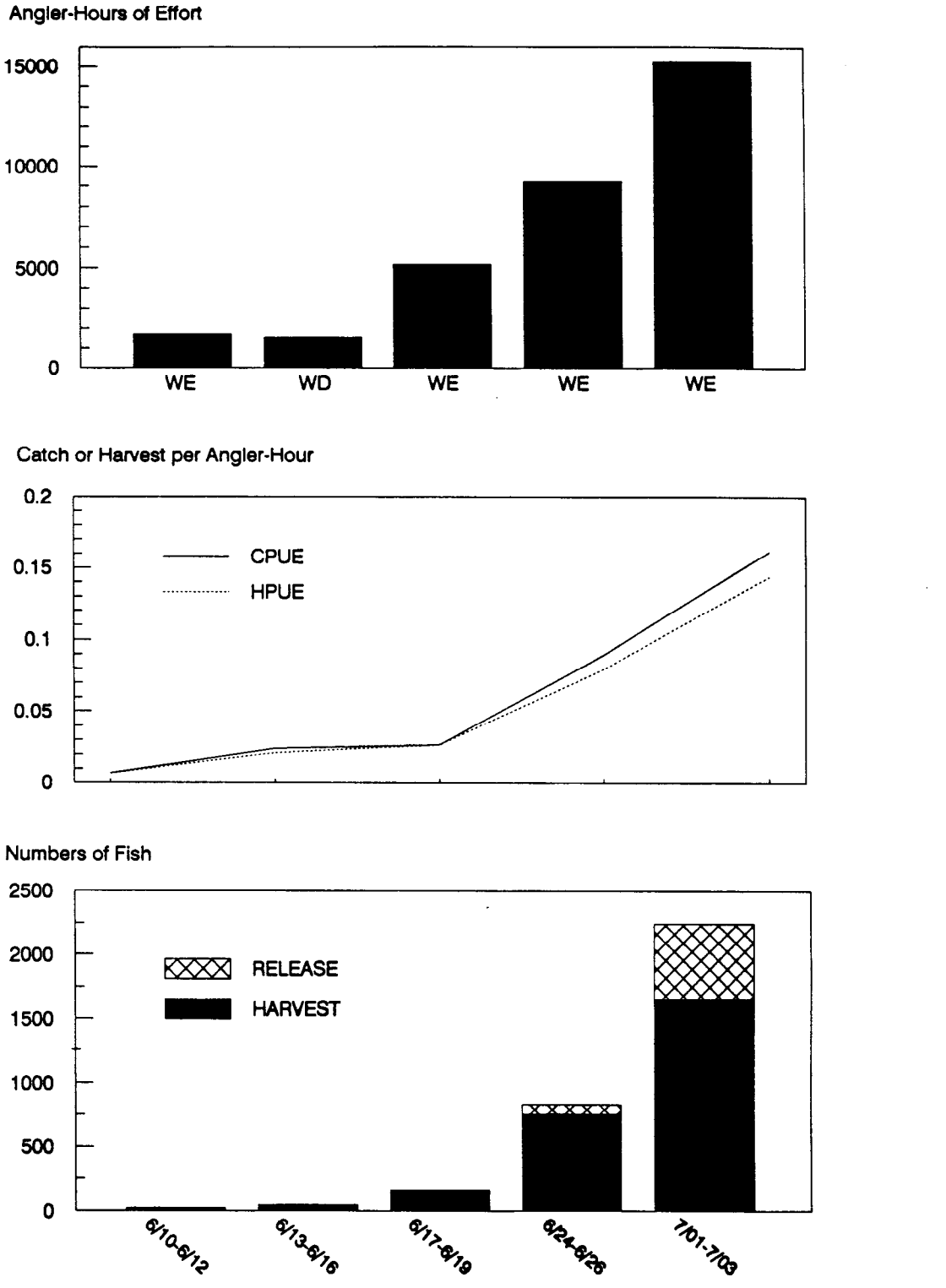

Figure 9. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in Willow Creek, 1989.

Table 14. Estimated harvest and catch rates[a] of chinook salmon during the weekend and weekday fishery for chinook salmon in Willow Creek, 1989.

Location Component[b]	Number of Interviews[c]	Harvest Rate	Standard Error	Catch Rate	Standard Error
Willow Creek, Bridge					
WE 7/01-7/03	239	0.1113	0.0110	0.1602	0.0127
Willow Creek, Mouth - Shore anglers					
WE 6/10-6/12	197	0.0068	0.0034	0.0068	0.0034
WE 6/17-6/19	259	0.0293	0.0052	0.0303	0.0052
WE 6/24-6/26	645	0.0818	0.0054	0.0921	0.0075
WE 7/01-7/03	372	0.1082	0.0079	0.1443	0.0129
WD 6/09 & 6/13 thru 6/16	127	0.0211	0.0061	0.0264	0.0067
Willow Creek, Mouth - Boat anglers					
WE 6/10-6/12	4	0.0	0.0	0.0	0.0
WE 6/17-6/19	24	0.0	0.0	0.0	0.0
WE 6/24-6/26	41	0.0450	0.0085	0.0450	0.0085
WE 7/01-7/03	41	0.0364	0.0128	0.0364	0.0128
WD 6/09 & 6/13 thru 6/16	2	0.0000	0.0000	0.0000	0.0000
Willow Creek, All sites combined					
WE 6/10-6/12	201	0.0067	0.0366	0.0067	0.0436
WE 6/17-6/19	283	0.0268	0.0680	0.0268	0.0680
WE 6/24-6/26	686	0.0796	0.0101	0.0893	0.0113
WE 7/01-7/03	652	0.1612	0.0186	0.1433	0.0222
WD 6/09 & 6/13 thru 6/16	129	0.0208	0.0061	0.0241	0.0067

[a] Harvest includes only fish kept and catch includes fish kept and fish reported as released. Rates are number of fish harvested or caught per hour fished for interviewed anglers.
[b] WE = weekend/holiday; WD = weekday.
[c] Completed-trip angler interviews only.

Table 15. Estimated number of chinook salmon harvested[a] and number caught[b] during the weekend and weekday fishery for chinook salmon in Willow Creek, 1989.

Location Component[c]		Harvest	SE	95% Confidence Interval	Catch	SE	95% Confidence Interval
Willow Creek - Mouth - Boat							
WE	6/10-6/12	0	0.0	0 - 0	0	0.0	0 - 0
WE	6/17-6/19	0	0.0	0 - 0	0	0.0	0 - 0
WE	6/24-6/26	15	5.0	5 - 25	15	5.0	5 - 25
WE	7/01-7/03	14	5.6	3 - 25	14	5.6	3 - 25
	Sub-total	29	7.5	14 - 44	29	7.5	14 - 44
WD	6/09 & 6/13 thru 6/16	0	0.0	0 - 0	0	0.0	0 - 0
Total		29	7.5	14 - 44	29	7.5	14 - 44
Willow Creek - Mouth - Shore							
WE	6/10-6/12	12	5.9	0 - 24	12	5.9	0 - 24
WE	6/17-6/19	145	31.8	83 - 207	150	32.5	86 - 214
WE	6/24-6/26	728	96.0	540 - 916	820	114.8	595 - 1,045
WE	7/01-7/03	1,156	128.0	905 - 1,407	1,541	188.1	1,172 - 1,910
	Sub-total	2,041	163.2	1,721 - 2,361	2,523	222.8	2,086 - 2,960
WD	6/09 & 6/13 thru 6/16	32	11.5	10 - 54	40	13.2	14 - 66
Total		2,073	163.6	1,753 - 2,394	2,563	223.2	2,126 - 3,000
Willow Creek - Bridge							
WE	7/01-7/03	468	67.2	336 - 600	674	88.44	501 - 847
GRAND TOTAL		2,570	177.0	2,223 - 2,917	2,764	240.2	2,293 - 3,235

[a] Harvest includes only fish kept.
[b] Catch includes fish kept and fish reported as released.
[c] WE = weekend/holiday; WD = weekday.

Table 16. Estimated number of angler-hours of effort during the weekend-only fisheries for chinook salmon in Sheep and Montana Creeks, 1989.

Fishery Component[a]	Effort	Standard Error	95% Confidence Interval	Relative Precision[b]
Sheep Creek				
WE 6/10-6/12	1,578.0	134.7	1,314 - 1,842	16.7%
WE 6/17-6/19	3,006.0	556.6	1,915 - 4,097	36.3%
WE 6/24-6/26	5,394.0	522.9	4,369 - 6,419	19.0%
WE 7/01-7/03	5,160.0	585.7	4,012 - 6,308	22.2%
TOTAL	15,138.0	978.0	13,221 - 17,055	12.7%
Montana				
WE 6/17-6/19	3,114.0	493.8	2,140 - 4,088	31.3%
WE 6/24-6/26	7,560.0	782.3	6,027 - 9,093	20.3%
WE 7/01-7/03	14,652.0	1,540.7	11,632 - 17,672	20.6%
TOTAL	25,326.0	1,799.0	21,799 - 28,852	13.9%

[a] WE = weekend/holiday.
[b] Relative precision of 95% confidence interval.

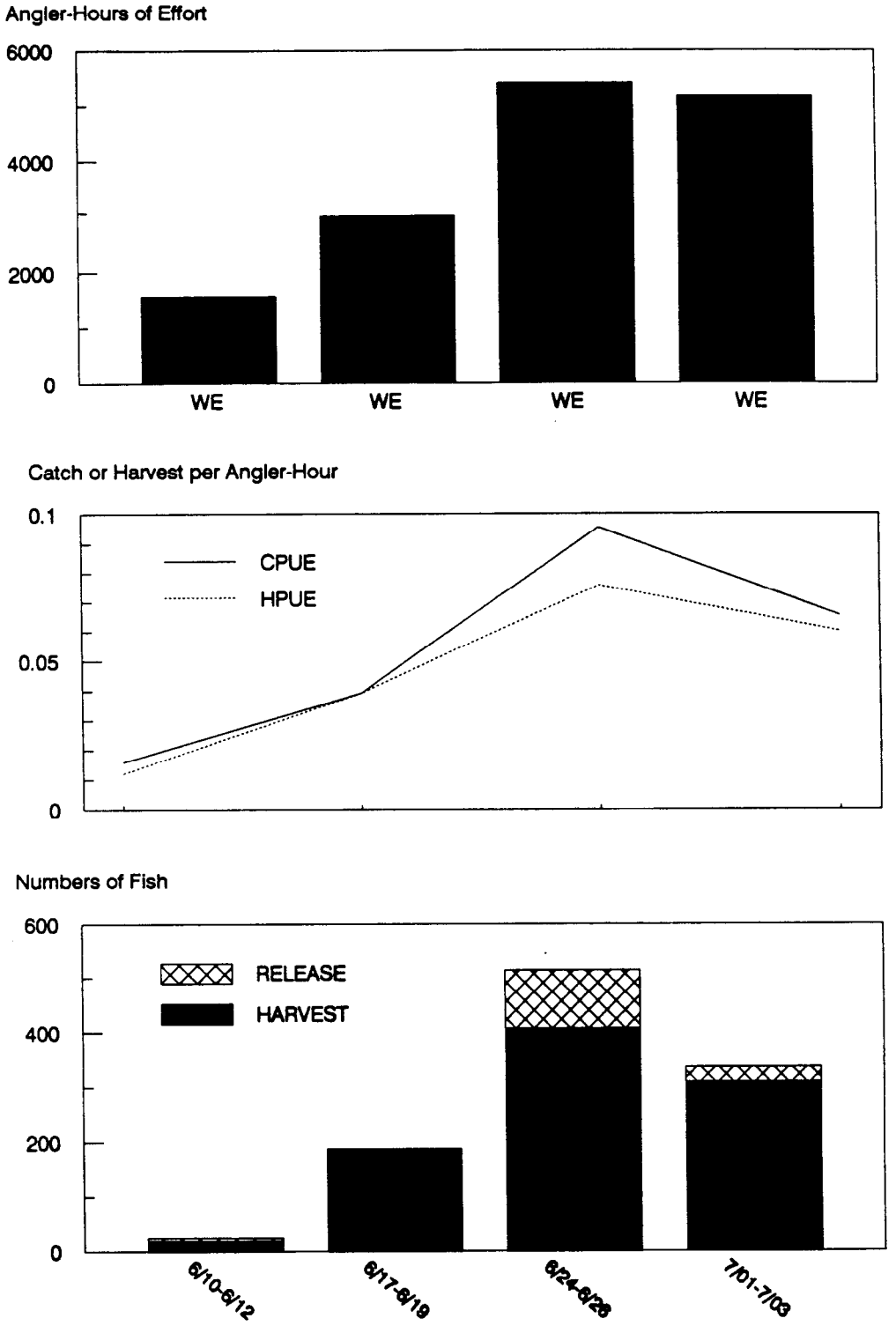

Figure 10. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in Sheep Creek, 1989.

Table 17. Estimated harvest and catch rates[a] of chinook salmon during the weekend-only fisheries for chinook salmon in Sheep and Montana Creeks, 1989.

Location Component[b]	Number of Interviews[c]	Harvest Rate	Standard Error	Catch Rate	Standard Error
Sheep Creek					
WE 6/10-6/12	240	0.0122	0.0049	0.0158	0.0052
WE 6/17-6/19	176	0.0393	0.0170	0.0393	0.0170
WE 6/24-6/26	481	0.0757	0.0061	0.0955	0.0067
WE 7/01-7/03	484	0.0600	0.0058	0.0653	0.0059
Montana Creek					
WE 6/17-6/19	245	0.0820	0.0089	0.0863	0.0094
WE 6/24-6/26	463	0.1143	0.0074	0.1277	0.0088
WE 7/01-7/03	534	0.0752	0.0053	0.0992	0.0083

[a] Harvest includes only fish kept and catch includes fish kept and fish reported as released. Rates are number of fish harvested or caught per hour fished for interviewed anglers.
[b] WE = weekend/holiday.
[c] Completed-trip angler interviews only.

Table 18. Estimated number of chinook salmon harvested[a] and number caught[b] during the weekend-only fisheries for chinook salmon in Sheep and Montana Creeks, 1989.

Fishery Component[c]	Harvest	SE	95% Confidence Interval	Catch	SE	95% Confidence Interval
Sheep Creek						
WE 6/10-6/12	19	7.8	4 - 34	25	8.4	9 - 41
WE 6/17-6/19	118	55.0	10 - 226	118	55.0	10 - 226
WE 6/24-6/26	408	51.3	308 - 508	515	61.5	394 - 636
WE 7/01-7/03	310	45.9	220 - 400	337	48.7	242 - 432
TOTAL	855	88.4	682 - 1,028	995	96.2	806 - 1,184
Montana Creek						
WE 6/17-6/19	255	48.9	159 - 351	269	51.5	168 - 370
WE 6/24-6/26	864	105.7	657 - 1,071	965	120.4	729 - 1,201
WE 7/01-7/03	1,102	139.5	829 - 1,375	1,453	194.8	1,071 - 1,835
TOTAL	2,221	181.7	1,865 - 2,577	2,687	234.7	2,227 - 3,147

[a] Harvest includes only fish kept.
[b] Catch includes fish kept and fish reported as released.
[c] WE = weekend/holiday.

Effort. The number of anglers counted ranged from 9 to 379 (Appendix A19). Estimated angler-effort during the survey was 25,326 angler-hours (Table 16). Most of the effort (58% of the total) occurred during the last weekend of the fishery, 1 to 3 July (Table 16, Figure 11).

Harvest Rates and Catch Rates. Daily harvest rates ranged from 0.55 to 0.152 fish per hour and daily catch rates ranged from 0.72 to 0.181 fish per hour (Appendix A20). The highest component harvest and catch rates (0.114 and 0.128 fish per hour, respectively) for the fishery in Montana Creek, occurred during the weekend from 24 to 26 June (Table 17, Figure 11).

Harvest and Catch. The estimated harvest in Montana Creek during the creel survey was 2,221 fish (Table 18). Harvest and catch peaked during the last weekend the fishery was open, 1 July to 3 July (Table 18, Figure 11). Seventeen percent of the chinook salmon caught by anglers were released.

Summary

Of the selected sport fisheries surveyed, the remote fisheries accounted for 195,517 (SE = 7,978) angler-hours of effort, a harvest of 15,556 (SE = 1,214) chinook salmon, and a catch of 26,206 (SE = 1,735) chinook salmon (Table 19). Of the remote fisheries surveyed, the Deshka River fishery had the highest estimated effort and harvest of chinook salmon (78,607 angler-hours and 5,308 chinook salmon) whereas Alexander Creek had the highest catch (10,982 chinook salmon). The Alexander Creek fishery had the second highest effort, while the Deshka River had the second highest catch. The proportion of the harvest and catch from each of the remote fisheries compared to the proportion of the effort in the fishery to the total for the remote fisheries varied. For example, Alexander Creek had 32% of the harvest and 42% of the catch, but only 22% of the effort for the remote streams. Lake Creek was more consistent with 18% of the harvest, 17% of the catch and 17% of the effort (Figure 12).

While the roadside streams were less significant overall than the remote streams in terms of effort (73,466 angler-hours; SE = 2,614), harvest (5,646; SE = 269), and catch (6,948; SE = 349) of chinook salmon, they did provide significant fishing opportunity during 1989 (Table 19). The harvest of chinook salmon from two roadside streams (Willow and Montana Creeks) were greater than in two remote streams (Clear Creek and the Talkeetna River). The proportion of the catch and harvest by each roadside fishery to the proportion of effort in each fishery was more consistent than in the remote fisheries. For example, Willow Creek had 45% of the roadside fishery effort, 46% of the harvest and 47% of the catch of chinook salmon. Montana Creek had 34% of the effort, 39% of the harvest and 39% of the catch. Sheep Creek varied the greatest with 21% of the effort, 15% of the harvest and 14% of the catch (Figure 13).

The number of angler-hours of effort for each fishery is not the best measure of the popularity of the fisheries. The fisheries in the remote streams are open 7 days a week over a period of 4 to 6 weeks while the fisheries in the roadside streams, except Willow Creek, occur during three or four 3-day weekends. For this reason, we divided the totals for angler-effort, chinook salmon harvest, and chinook salmon catch estimated for each fishery by the

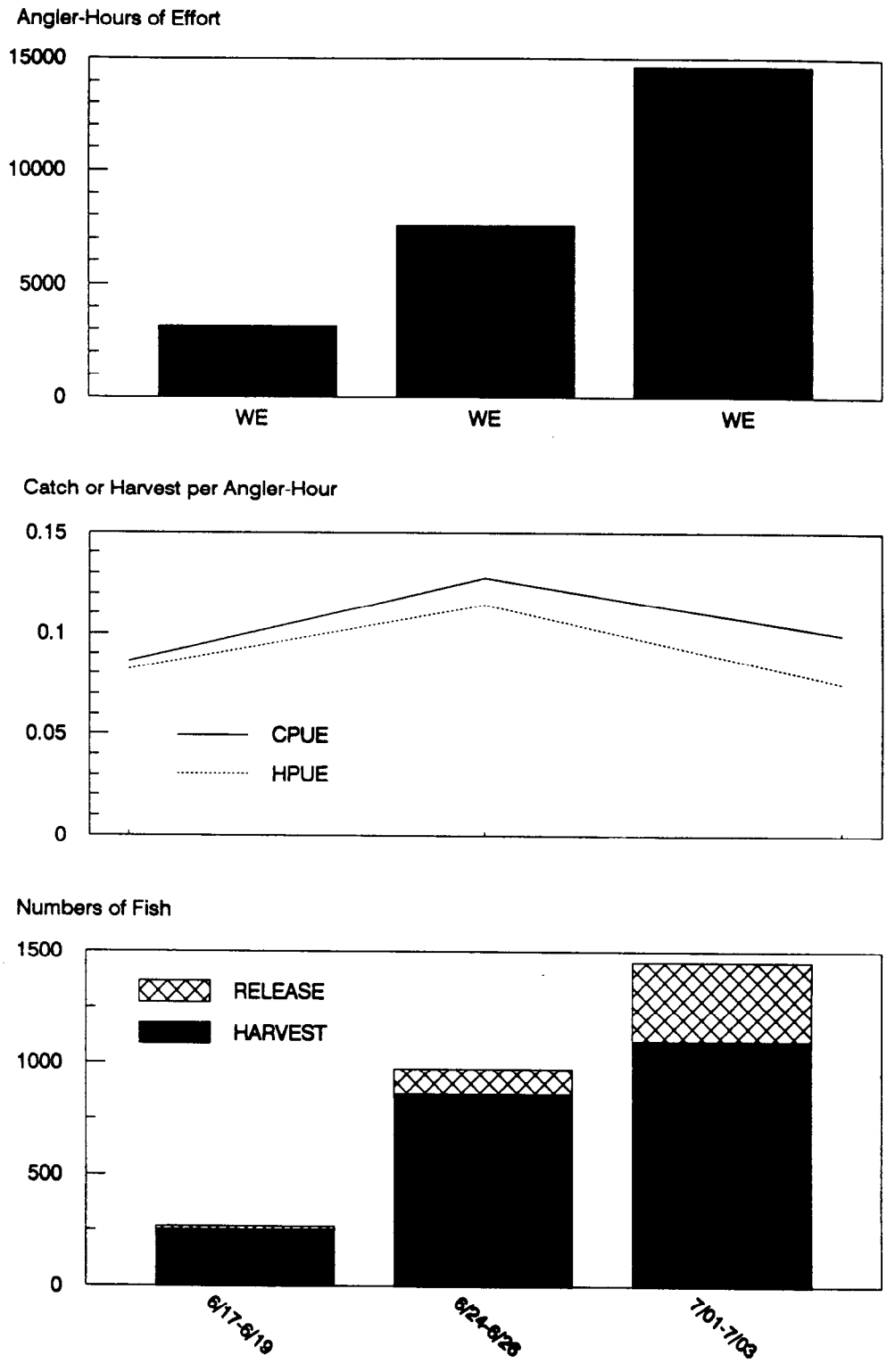

Figure 11. Angler-effort; catch and harvest per unit effort (CPUE and HPUE); and catch and harvest of chinook salmon for temporal components of the sport fishery in Montana Creek, 1989.

Table 19. Summary of estimated angler-effort, chinook salmon harvest, and chinook salmon catch by sport fisheries in northern Cook Inlet that were surveyed during 1989.

Fishery	Effort (angler-hours)	Standard Error	Rel. Pre.[a]	Harvest[b]	Standard Error	Rel. Pre.[a]	Catch[c]	Standard Error	Rel. Pre.[a]
Deshka River	78,607	5,420	13.5%	5,308	455	16.8%	6,402	617	18.9%
Alexander Creek	43,907	4,358	19.5%	4,970	569	22.4%	10,982	1,442	25.7%
Lake Creek	33,231	1,645	9.7%	2,812	947	66.0%	4,518	628	27.2%
Clear Creek	33,235	3,450	20.3%	1,918	196	20.0%	3,413	356	20.4%
Talkeetna River	6,537	819	24.6%	548	84	30.0%	891	166	36.6%
Remote Sub-total	195,517	7,978	8.0%	15,556	1,214	15.3%	26,206	1,735	13.0%
Willow Creek	33,002	1,625	9.6%	2,570	177	13.5%	3,266	240	14.4%
Sheep Creek	15,138	978	12.7%	855	88	20.3%	995	96	18.9%
Montana Creek	25,326	1,799	13.9%	2,221	182	16.0%	2,687	235	17.1%
Roadside Sub-total	73,466	2,614	7.0%	5,646	269	9.3%	6,948	349	9.9%
GRAND TOTAL	268,983	8,395	6.1%	21,202	1,243	11.5%	33,154	1,770	10.5%

[a] Relative precision of 95% confidence interval.

[b] Harvest includes only fish kept.

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

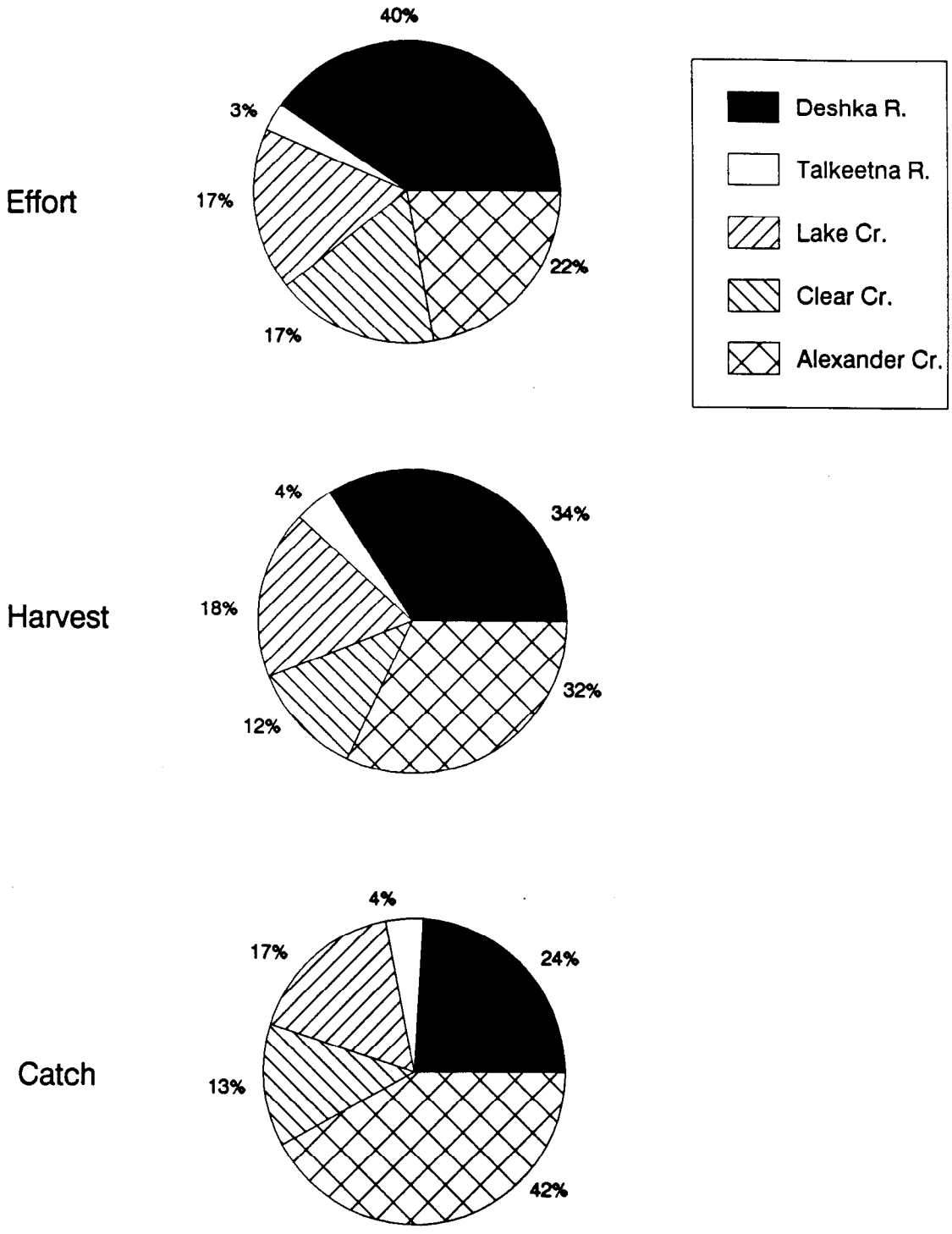

Figure 12. Percent of angler-effort, chinook salmon harvest, and chinook salmon catch contributed by each of the remote stream fisheries surveyed to the total for those fisheries, 1989.

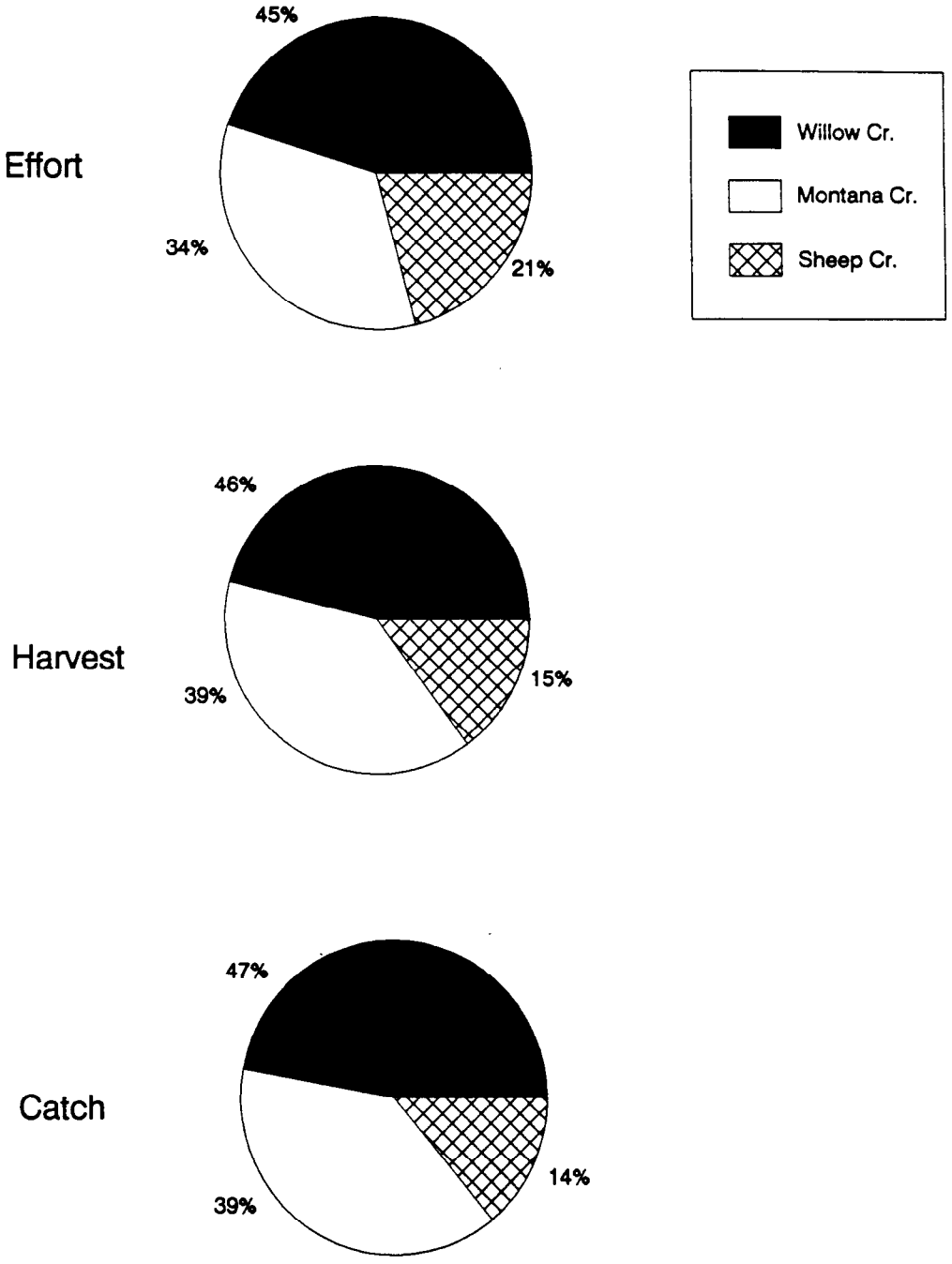

Figure 13. Percent of angler-effort, chinook salmon harvest, and chinook salmon catch contributed by each of the roadside stream fisheries surveyed to the total for those fisheries, 1989.

number of possible fishing hours during the creel survey for that fishery to index the intensity of the fishery. The number of hours of possible fishing was computed as the product of the number of days the fishery was open during the creel survey and the number of hours in the defined angler day. The computed indices can be used to compare the popularity of the weekend-only fisheries in the roadside streams to the remote fisheries. The fisheries in Montana and Willow Creeks rank in the top three of the indices for angler-effort, harvest, and catch (Table 20, Figure 14). More chinook salmon were harvested in Montana Creek per hour the fishery was open (10.3) than in any other surveyed fishery. The second highest harvest per hour was in Willow Creek where 6.3 chinook salmon were harvested during each hour the fishery was open. The downstream section of the Deshka River and Clear Creek were the first and second most popular remote fisheries (Table 20, Figure 14).

Age, Sex, and Length Compositions of Harvested Chinook Salmon

Chinook salmon aged 1.2, 1.3, and 1.4 were the predominant age groups in the harvests of all the fisheries sampled (Table 21). Mean lengths by sex and age group for the sampled harvests are summarized in Table 22. Age distribution of chinook salmon sampled from the sport fishery in the Deshka River indicated a predominant age group of 1.4, while samples obtained from carcass surveys indicated a predominant 1.3 age group (Tables 21 and 23). Mean lengths by sex and age group for the Deshka River escapement are summarized in Table 24.

Escapement Counts

Overall, 35,769 spawning chinook salmon were counted in index streams in northern Cook Inlet during 1989 (Table 25). A total of 27,935 chinook salmon were counted in Susitna River tributaries with escapement counts ranging from 355 fish for the North Fork Kashwitna River to 9,463 fish for Prairie Creek (no survey was conducted on Deshka River, Lake Creek, Clear Creek, Talachulitna River, or Grizzly Creek). In western Cook Inlet, a total of 2,486 chinook salmon were counted. Escapement through the weir located on the Little Susitna River was 4,367 (Bartlett and Sonnichsen in press).

Hatchery Contributions

Of the estimated sport harvest of 2,570 chinook salmon at Willow Creek, 1,005 were examined and 16 were observed to have a missing adipose fin and a decodeable CWT. These 16 fish represented three different lots released into Willow Creek in 1985 and two lots released in 1986. The estimated contribution of hatchery-produced chinook salmon to the Willow Creek harvest during 1989 was 951 fish (incorporating the bias-corrected variance associated with the harvest estimate, SE = 235.0) (Table 26). In the Deshka River survey, 997 of the estimated harvest of 5,308 chinook salmon were examined and one was found to have a missing adipose fin and a decodeable CWT. This fish was a stray from a Willow Creek release lot. The hatchery contribution in the Deshka River harvest was estimated at 148 fish (Table 26). Three hundred and twelve of the estimated 2,221 chinook salmon harvested were inspected in the Montana Creek creel census. One chinook salmon, representing one lot released into Montana Creek in 1988, was found to have a missing adipose fin and decodeable CWT. This represented a hatchery-produced contribution of 44 fish

Table 20. Measures of the intensity of the fisheries for chinook salmon for each of the sport fisheries surveyed in northern Cook Inlet in 1989.

Fishery	Hours Poss.[a]	Effort (ang-hrs)	Effort/ hour[b]	Rank	Harvest	Harvest/ hour[c]	Rank	Catch	Catch/ hour[d]	Rank
Montana Creek	216	25,326	117.2	1	2,221	10.3	1	2,687	12.4	2
Deshka R. - downstream	612	53,085	86.7	2	3,663	6.0	3	4,303	7.0	5
Willow Creek	408	33,002	80.9	3	2,570	6.3	2	6,266	15.4	1
Clear Creek	432	33,235	76.9	4	1,918	4.4	4	3,413	7.9	4
Sheep Creek	288	15,138	52.6	5	855	3.0	7	995	3.5	8
Lake Creek	820	33,231	40.5	6	2,812	3.4	5	4,518	5.5	7
Deshka R. - upstream	864	25,522	29.5	7	1,645	1.9	9	2,099	2.4	9
Alexander Cr. - downstream	738	21,626	29.3	8	2,580	3.5	6	4,145	5.6	6
Alexander Cr. - upstream	864	22,281	25.8	9	2,390	2.8	8	6,837	7.9	3
Talkeetna River	432	6,537	15.1	10	548	0.7	10	891	2.1	10

[a] Total number of hours possible for fishing during the creel survey period. Defined as the product of the number of days in the creel survey period and the number of hours in the defined angler day.

[b] Average number of hours of angler-effort on the stream during an hour.

[c] Average number of chinook salmon harvested in the stream during an hour.

[d] Average number of chinook salmon caught in the stream during an hour.

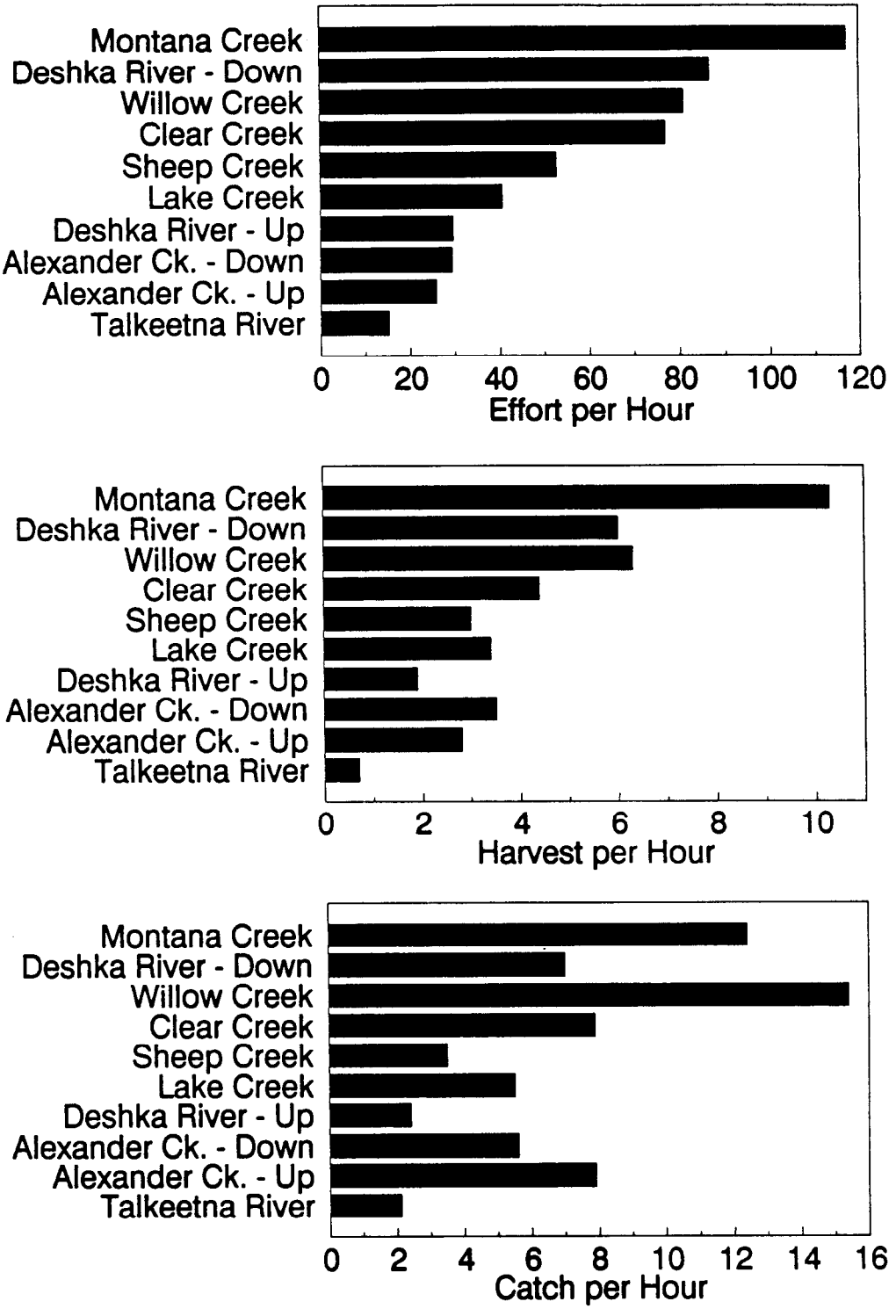

Figure 14. Measure of the intensity of the fisheries for chinook salmon for each of the sport fisheries surveyed in northern Cook Inlet, 1989.

Table 21. Sex and age composition of chinook salmon sampled from sport fisheries in northern Cook Inlet, 1989.

Fishery	Sex		Age Group 1.5	2.4	1.4	2.3	1.3	2.2	1.2	1.1	Total
Alexander Creek											
Downstream											
	Male	Percent	0.0	0.0	2.9	0.4	9.9	0.0	43.2	1.2	57.6
	Female	Percent	0.0	0.0	14.8	0.4	25.5	0.0	1.6	0.0	42.4
(n = 243)[a]	Combined	Percent	0.0	0.0	17.7	0.8	35.4	0.0	44.9	1.2	100.0
		SE	0.00	0.00	2.45	0.58	3.07	0.00	3.20	0.71	
Upstream											
	Male	Percent	0.0	0.0	4.8	0.0	13.5	0.0	35.7	0.8	54.8
	Female	Percent	0.0	0.0	25.4	0.0	19.0	0.0	0.8	0.0	45.2
(n = 126)[a]	Combined	Percent	0.0	0.0	30.2	0.0	32.5	0.0	36.5	0.8	100.0
		SE	0.00	0.00	4.10	0.00	4.19	0.00	4.31	0.79	
Locations Combined											
	Male	Percent	0.0	0.0	6.2	0.6	19.6	0.0	71.8	1.9	56.6
	Female	Percent	0.0	0.0	42.5	0.5	53.8	0.0	3.1	0.0	43.4
(n = 369)[a]	Combined	Percent	0.0	0.0	21.9	0.5	34.4	0.0	42.0	1.1	100.0
		SE	0.00	0.00	4.78	0.58	5.19	0.00	5.36	1.06	
Deshka River											
Downstream											
	Male	Percent	0.4	0.0	15.2	0.8	11.4	0.4	21.7	1.5	51.3
	Female	Percent	0.4	0.4	28.9	0.8	15.6	0.0	2.7	0.0	48.7
(n = 263)[a]	Combined	Percent	0.8	0.4	44.1	1.5	27.0	0.4	24.3	1.5	100.0
		SE	0.54	0.38	3.07	0.76	2.74	0.38	2.65	0.76	
Upstream											
	Male	Percent	0.0	0.0	25.0	0.0	9.1	0.0	31.8	2.3	68.2
	Female	Percent	2.3	0.0	22.7	2.3	4.5	0.0	0.0	0.0	31.8
(n = 44)[a]	Combined	Percent	2.3	0.0	47.7	2.3	13.6	0.0	31.8	2.3	100.0
		SE	2.27	0.00	7.62	2.27	5.23	0.00	7.10	2.27	
Locations Combined											
	Male	Percent	0.6	0.0	30.9	1.2	20.6	0.6	43.0	3.0	53.7
	Female	Percent	1.4	0.7	60.6	2.1	30.3	0.0	4.9	0.0	46.3
(n = 307)[a]	Combined	Percent	1.0	0.3	44.6	1.6	25.1	0.3	25.4	1.6	100.0
		SE	2.44	0.38	8.21	2.39	5.90	0.38	7.58	2.39	
Lake Creek											
	Male	Percent	1.0	0.0	19.5	0.0	7.0	0.0	22.1	0.3	50.0
	Female	Percent	1.0	0.0	37.9	0.7	7.4	0.0	3.0	0.0	50.0
(n = 298)[a]	Combined	Percent	2.0	0.0	57.4	0.7	14.4	0.0	25.2	0.3	100.0
		SE	0.82	0.00	2.87	0.47	2.04	0.00	2.52	0.34	

-continued-

Table 21. (Page 2 of 2).

Fishery	Sex		Age Group 1.5	2.4	1.4	2.3	1.3	2.2	1.2	1.1	Total
Talkeetna River											
	Male	Percent	1.2	0.0	28.4	0.0	10.0	0.0	19.6	0.3	59.5
	Female	Percent	1.2	0.0	27.0	0.0	9.7	0.0	2.6	0.0	40.5
(n = 341)[a]	Combined	Percent	2.3	0.0	55.4	0.0	19.6	0.0	22.3	0.3	100.0
		SE	0.82	0.00	2.70	0.00	2.15	0.00	2.26	0.29	
Montana Creek											
	Male	Percent	0.0	0.0	13.8	0.0	17.6	0.0	24.1	5.0	60.5
	Female	Percent	1.1	0.0	31.8	0.0	5.7	0.0	0.8	0.0	39.5
(n = 261)[a]	Combined	Percent	1.1	0.0	45.6	0.0	23.4	0.0	24.9	5.0	100.0
		SE	0.66	0.00	3.09	0.00	2.62	0.00	2.68	1.35	
Sheep Creek											
	Male	Percent	1.9	1.2	16.7	0.8	9.7	0.0	14.8	0.8	45.9
	Female	Percent	2.3	0.0	43.2	0.0	7.4	0.0	1.2	0.0	54.1
(n = 257)[a]	Combined	Percent	4.3	1.2	59.9	0.8	17.1	0.0	16.0	0.8	100.0
		SE	1.27	0.67	3.06	0.55	2.35	0.00	2.29	0.55	
Willow Creek: Mouth[b]											
	Male	Percent	0.2	0.2	23.0	0.0	12.8	0.0	7.3	0.0	43.5
	Female	Percent	0.6	0.6	49.8	0.0	5.5	0.0	0.0	0.0	56.5
(n = 368)[a]	Combined	Percent	0.8	0.8	72.8	0.0	18.3	0.0	7.3	0.0	100.0
		SE	0.41	0.41	2.01	0.00	1.74	0.00	1.18	0.00	

[a] n = sample size.

[b] Thirty-seven percent of the Willow Creek harvest consisted of hatchery-produced fish whose ages were 0.3 or 0.4. These fish are included in the age groups 1.3 and 1.4.

Table 22. Mean length (mid-eye to fork-of-tail) in millimeters by sex and age group of chinook salmon sampled from sport fisheries in northern Cook Inlet, 1989.

Fishery	Sex		Age Group 1.5	2.4	1.4	2.3	1.3	2.2	1.2	1.1
Alexander Creek - downstream										
	Male	Mean	0	0	939	840	767	0	590	368
		Standard Error	0	0	17	0	14	0	5	24
		Sample Size	0	0	7	1	24	0	103	3
	Female	Mean	0	0	881	840	778	0	633	0
		Standard Error	0	0	9	0	7	0	20	0
		Sample Size	0	0	35	1	61	0	4	0
Alexander Creek - upstream										
	Male	Mean	0	0	918	0	782	0	565	340
		Standard Error	0	0	15	0	13	0	9	0
		Sample Size	0	0	6	0	17	0	45	1
	Female	Mean	0	0	871	0	774	0	580	0
		Standard Error	0	0	7	0	11	0	0	0
		Sample Size	0	0	32	0	24	0	1	0
Alexander Creek - all sites										
	Male	Mean	0	0	929	840	773	0	583	361
		Standard Error	0	0	22	0	19	0	10	24
		Sample Size	0	0	13	1	41	0	148	4
	Female	Mean	0	0	876	0	777	0	622	0
		Standard Error	0	0	11	0	13	0	20	0
		Sample Size	0	0	67	0	85	0	5	0
Lake Creek										
	Male	Mean	1,050	0	967	0	812	0	578	380
		Standard Error	24	0	10	0	10	0	9	0
		Sample Size	3	0	57	0	20	0	66	1
	Female	Mean	987	0	933	895	825	0	601	0
		Standard Error	35	0	5	25	8	0	17	0
		Sample Size	3	0	111	2	22	0	9	0
Talkeetna River										
	Male	Mean	1,019	0	908	0	765	0	563	290
		Standard Error	8	0	6	0	12	0	9	0
		Sample Size	4	0	78	0	25	0	54	1
	Female	Mean	913	0	878	0	770	0	589	0
		Standard Error	8	0	6	0	11	0	11	0
		Sample Size	4	0	80	0	23	0	9	0

-continued-

Table 22. (Page 2 of 3).

Fishery	Sex		Age Group 1.5	2.4	1.4	2.3	1.3	2.2	1.2	1.1
Deshka River - downstream										
	Male	Mean	1020	0	879	770	729	710	550	364
		Standard Error	0	0	13	5	20	0	8	13
		Sample Size	1	0	41	2	35	1	57	4
	Female	Mean	1102	965	860	823	777	0	682	0
		Standard Error	0	0	7	28	11	0	39	0
		Sample Size	1	1	76	2	41	0	7	0
Deshka River - upstream										
	Male	Mean	0	0	924	0	824	0	513	355
		Standard Error	0	0	14	0	26	0	16	0
		Sample Size	0	0	11	0	4	0	14	1
	Female	Mean	960	0	840	790	803	0	0	0
		Standard Error	0	0	18	0	38	0	0	0
		Sample Size	1	0	10	1	2	0	0	0
Deshka River - all sites										
	Male	Mean	1020	0	889	770	739	710	543	362
		Standard Error	0	0	19	5	11	0	12	
		Sample Size	1	0	52	2	39	1	71	5
	Female	Mean	1031	965	858	812	778	0	682	0
		Standard Error		0	19		39	0	39	0
		Sample Size	2	1	86	3	43	0	7	0
Montana Creek										
	Male	Mean	0	0	969	0	812	0	603	347
		Standard Error	0	0	14	0	11	0	7	15
		Sample Size	0	0	36	0	44	0	63	13
	Female	Mean	987	0	939	0	848	0	570	0
		Standard Error	38	0	5	0	12	0	5	0
		Sample Size	3	0	78	0	15	0	2	0
Sheep Creek										
	Male	Mean	1,103	953	972	935	807	0	618	365
		Standard Error	25	49	11	5	25	0	8	15
		Sample Size	5	3	43	2	24	0	38	2
	Female	Mean	985	0	944	0	849	0	647	0
		Standard Error	20	0	5	0	8	0	18	0
		Sample Size	6	0	111	0	18	0	3	0

-continued-

Table 22. (Page 3 of 3).

Fishery	Sex		Age Group 1.5	2.4	1.4	2.3	1.3	2.2	1.2	1.1
Willow Creek - mouth[a]										
	Male	Mean	1015	925	952	0	790	0	578	0
		Standard Error	0	0	7	0	13	0	12	0
		Sample Size	1	1	112	0	63	0	36	0
	Female	Mean	930	938	914	0	835	0	0	0
		Standard Error	39	16	4	0	12	0	0	0
		Sample Size	3	3	245	0	27	0	0	0

[a] Thirty-seven percent of the Willow Creek harvest consisted of hatchery-produced fish whose age was 0.3 or 0.4. These fish are included in Willow Creek age groups 1.3 and 1.4.

Table 23. Sex and age composition of chinook salmon sampled from escapement carcass surveys in northern Cook Inlet, 1989.

Fishery	Sex		Age Group 1.5	2.4	1.4	2.3	1.3	2.2	1.2	1.1	Total
Deshka River (Moose Creek)											
	Male	Percent	0.0	0.0	20.3	0.0	22.9	0.0	22.5	0.0	65.8
	Female	Percent	0.0	0.0	13.0	0.0	20.3	0.0	0.9	0.0	34.2
(n = 231)[a]	Combined	Percent	0.0	0.0	33.3	0.0	43.3	0.0	23.4	0.0	100.0
		SE	0.00	0.00	3.11	0.00	3.27	0.00	2.79	0.00	

[a] n = sample size.

Table 24. Mean length (mid-eye to fork-of-tail) in millimeters by sex and age group of chinook salmon sampled from escapement carcass surveys in northern Cook Inlet, 1989.

Fishery	Sex		Age Group 1.5	2.4	1.4	2.3	1.3	2.2	1.2	1.1
Deshka River (Moose Creek)										
	Male	Mean	0	0	931	0	815	0	568	0
		Standard Error	0	0	7	0	12	0	8	0
		Sample Size	0	0	47	0	53	0	52	0
	Female	Mean	0	0	848	0	824	0	563	0
		Standard Error	0	0	7	0	8	0	48	0
		Sample Size	0	0	30	0	46	0	2	0

Table 25. Escapement counts[a] of chinook salmon for northern Cook Inlet streams in 1989.

Location	Count
Susitna River tributaries	
Deshka River	---[b]
Prairie Creek	9,463
Lake Creek	---[b]
Alexander Creek	3,497
Clear Creek	---[b]
Talachulitna River	---[b]
Peters Creek	959
Willow Creek	5,060
Montana Creek	2,701
Little Willow Creek	1,325
Portage Creek	1,309
Sheep Creek	610
North Fork Kashwitna River	355
Goose Creek	835
Cache Creek	362
Deception Creek	800[c]
Grizzly Creek	---[b]
Indian Creek	659
Sub-total	27,935
Little Susitna River	4,367[c]
Matanuska River	
Moose Creek	999[d]
West Cook Inlet	
Theodore River	1,026
Chuitna River	990
Lewis River	452
Sub-total	2,468
TOTAL	35,769

[a] Surveys were conducted from rotary-wing aircraft unless otherwise noted.
[b] No survey was conducted.
[c] Escapement through a weir.
[d] Survey was conducted on foot.

Table 26. Estimated contribution of hatchery-produced chinook salmon to the Willow Creek, Deshka River, Montana Creek, and Sheep Creek sport harvests in 1989.

Fishery/ Release Code	Year Stock	m_1	m_2	a_1	a_2	Estimated Sport Harvest Estimate	SE	n_2	m_c	p_r	Estimated Hatchery Contribution Estimate	SE	Percent of Total Harvest
Willow Creek													
31.16.42	1985	No CWT recovered.											
31.16.45	1985	16	16	27	22	2,570	177.0	1,005	10	0.0515	609	187.0	
31.16.47	1985	16	16	27	22	2,570	177.0	1,005	5	0.0490	320	140.7	
31.17.27	1986	16	16	27	22	2,570	177.0	1,005	1	0.1413	22	21.6	
31.17.33	1986	No CWT recovered.											
										Sub-total	951	235.0	37.0%
Deshka River													
31.16.47	1985	1	1	10	7	5,308	454.9	997	1	0.0515	148[a]	--[b]	2.8%
Montana Creek													
31.17.59	1988	1	1	1	1	2,221	181.7	312	1	0.1632	44	--[b]	2.0%
Sheep Creek													
31.17.59	1988	1	1	1	1	855	88.4	303	1	0.1632	17[c]	--[b]	2.0%
TOTAL						10,954	528.3				1,160		10.6%

[a] Estimate is based on one Willow Creek stray observed (with ad-clip and decodeable CWT) in 997 fish examined.

[b] Unable to calculate variance and standard error as only one marked fish was observed with ad-clip and decodeable CWT.

[c] Estimate is based on one Montana Creek stray observed (with ad-clip and decodeable CWT) in 303 fish examined.

(Table 26). In the Sheep Creek creel census, one clipped and coded-wire-tagged Montana Creek stray was observed in 303 fish examined. This represented an estimated hatchery-produced contribution of 17 fish (Table 26).

DISCUSSION

The estimated 268,983 (SE = 8,395) angler-hours of effort for and the estimated harvest of 21,202 (SE = 1,243) chinook salmon was the largest on record for selected roadside and remote streams in the Susitna River drainage. Effort increased 47,996 angler-hours and the harvest increased by 6,612 fish from that estimated in 1988 (Hepler, Hoffmann, and Vincent-Lang 1989). The increase in effort and harvest is attributed, in part, to increased angler accessibility to remote streams through the newly constructed Deshka Landing and the extremely good weather (i.e., low, clear water) during the 1989 fishing season.

It is not possible at this time to estimate the total return of chinook salmon to northern Cook Inlet, or their exploitation rate, as an unknown number of chinook salmon were harvested in western Cook Inlet sport fisheries and in the mixed-stock commercial fisheries of upper Cook Inlet. However, an estimated escapement of 35,769 chinook salmon were observed from aerial surveys of northern Cook Inlet streams and an estimated 21,202 chinook salmon were harvested from selected roadside and remote stream sport fisheries in the Susitna River drainage. This represents a minimum inriver return of 56,971 chinook salmon to northern Cook Inlet, in 1989.

An estimated 1,160 (10.6%) of the 10,954 (SE = 528.4) chinook salmon harvested in Willow Creek, Deshka River, Montana Creek, and Sheep Creek originated from stocking efforts (Table 26). We assume, based on tag decoding information obtained in the sport fishery recoveries, that these fish originated from the 1985 and 1986 Willow Creek and 1988 Montana Creek smolt releases.

Special attention will be given to any differential timing and magnitude patterns observed between the wild (non-hatchery) and the hatchery produced chinook salmon, during the 1990 field season.

ACKNOWLEDGMENTS

This report represents the efforts of several persons not named in the text who substantially contributed to a successful field season and reporting process. The authors wish to thank Terry Bradley and Andy Hoffmann for their help with the multitude of details involved in a creel survey of this size. Thanks also go to the following technicians who collected the survey data: Kiana Koenan, Bob Begich, Marilyn Clouser, Jane Mulhall, Sara Wilber, Judy Price, Jim Ball, Bob Derick, Robin Jenne, Stan Walker, Regis Papart, and Reed Rychliuk. Special thanks go to Larry Engel for sharing his knowledge of northern Cook Inlet chinook salmon fisheries. Thanks go to Allen Bingham for his development of statistical procedures and assistance with the data analysis. We are grateful to Margaret Leonard and Gwyn Karcz for editing and final publication of this report. This project and report were made possible by

partial funding provided by the U.S. Fish and Wildlife Service through the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under project F-10-5, Job Number S-32-7.

LITERATURE CITED

Bartlett, L. and S. Sonnichsen. *In Press*. Creel and escapement statistics for coho salmon and chinook salmon on the Little Susitna River, Alaska, during 1989. Alaska Department of Fish and Game. Fishery Data Series Report. Juneau, Alaska, USA.

Bentz, R. W. 1982. Inventory and cataloging of the sport fish and sport fish waters in upper Cook Inlet. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23(G-I-D):76-112.

_____. 1983. Inventory and cataloging of sport fish and sport fish waters in upper Cook Inlet. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24(G-I-D):59-104.

Clark, J. E., and D. R. Bernard. 1987. A compound multivariate binomial-hypergeometric distribution describing coded microwire tag recovery from commercial salmon catches in southeastern Alaska. Alaska Department of Fish and Game. Informational Leaflet, Number 261, Juneau, Alaska, USA. v + 113 pp.

Clupach, B. 1989. Northern Cook Inlet chinook and coho salmon enhancement. Alaska Department of Fish and Game. Federal Aid in Fish Restoration. Division of Fisheries Rehabilitation, Enhancement, and Development. Project F-27-R, Volume 4, Number 3. 23 pp.

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

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

Conrad, R. H., and L. L. Larson. 1987. Abundance estimates for chinook salmon (*Oncorhynchus tshawytscha*) in the escapement into the Kenai River, Alaska, by analysis of tagging data, 1986. Alaska Department of Fish and Game, Division of Sport Fish. Fishery Data Series No. 34. Juneau, Alaska, USA. vi + 93 pp.

Delaney, K. and K. Hepler. 1983. Inventory and cataloging of the sport fish and sport fish waters in lower Susitna River and central Cook Inlet drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24(G-I-H):55-78.

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

Hepler, K. R. and R. W. Bentz. 1984. Chinook salmon population and angler use studies of upper Cook Inlet waters. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25(G-II-M):40-58.

_____. 1985. Chinook salmon population and angler use studies of northern Cook Inlet waters. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26(G-II-M):150-172.

_____. 1986. Cook Inlet chinook salmon studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-9-18, 27(S-32-7 and 8):174-195.

_____. 1987. Harvest, effort, and escapement statistics for selected chinook salmon (*Oncorhynchus tshawytscha*) sport fisheries in northern Cook Inlet, Alaska, 1986. Alaska Department of Fish and Game. Fishery Data Series Report No. 8. 86 pp.

Hepler, K. R., R. Conrad, and D. Vincent-Lang. 1988. Estimates of effort and harvest for selected sport fisheries for chinook salmon in northern Cook Inlet, Alaska, 1987. Alaska Department of Fish and Game. Fishery Data Series No. 59. 95 pp.

Hepler, K. R. and S. W. Kubik. 1982. Inventory and cataloging of the sport fish and sport fish waters in lower Susitna River and Central Cook Inlet drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23(G-I-H):66-83.

Hepler, K. R., A. Hoffmann, and D. Vincent-Lang. 1989. Estimates of effort and harvest for selected sport fisheries for chinook salmon in northern Cook Inlet, Alaska, 1988. Alaska Department of Fish and Game. Fishery Data Series No. 85. 89 pp.

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

Koo, T. S. Y. 1962. Age designation in salmon. Pages 37-48 *in* Studies of Alaska Red Salmon. University of Washington Publications in Fisheries, New Series Volume 1. Seattle, Washington.

Kubik, S. W. 1980. Inventory and cataloging of the sport fish and sport fish waters in lower Susitna River and central Cook Inlet drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21(G-I-H):52-78.

_____. 1981. Inventory and cataloging of the sport fish and sport fish waters in lower Susitna River and central Cook Inlet drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22(G-I-H):67-88.

Mills, M. J. 1987. Alaska statewide sport fisheries harvest report (1986). 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 State Department of Fish and Game. Publication 8. 33 pp.

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

Sokal, R. R., and F. J. Rohlf. 1981. Biometry. W. H. Freeman and Company, New York, New York.

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

Watsjold, D. A. 1980. Inventory and cataloging of the sport fish and sport fish waters in upper Cook Inlet. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21(G-I-D):91-120.

_____. 1981. Inventory and cataloging of the sport fish and sport fish waters in upper Cook Inlet. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project F-9-13, 22(G-I-D):62-85.

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

APPENDIX A

Appendix A1. Angler counts during the fishery for chinook salmon in the Deshka River, 1989.

Date	Weekend/ Holiday(*)	Counts by Period: Downstream Fishery[a] A	B	C	Upstream Fishery[b] A	B	C
527	*	28	62	50		15	
528	*	83	129	110			14
529	*	44	117	17			4
530							2
531							8
601		96	74	49			
602		99	68	45			
603	*	153	280	79			46
604	*	53	190	42		50	
605		93		74			27
606		76	97	121			14
607							
608							
609		144	145	127			35
610	*	221	263	148			26
611	*	68	199	114	15		
612		79	120	96	40		
613						66	
614							14
615		86		84			
616		164	150				
617	*	169	216	100		92	
618	*	57	153	49	33		
619		90	101	94		110	
620							
621							
622		67	52			60	
623		47	71	24			20
624	*	85		43			48
625	*	40	47	35			69
626							7
627							9
628		14	23	21	9		
629		2	9	5			
630							
701	*					22	
702	*						30
703							17
704	*					4	

-continued-

Appendix A1. (Page 2 of 2).

Date	Weekend/ Holiday(*)	Counts by Period: Downstream Fishery[a] A	B	C	Upstream Fishery[b] A	B	C
705							
706						9	
707							5
708	*					15	
709	*				16		
710					3		
711							2
712							
713					5		

[a] Period A: 0600 to 1159 hours; Period B: 1200 to 1759 hours; Period C: 1800 to 2400 hours.

[b] Period A: 0600 to 1159 hours; Period B: 1200 to 1759 hours; Period C: 1800 to 2400 hours.

Appendix A2. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip anglers interviewed during the fishery for chinook salmon in the downstream area of the Deshka River, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	EFFORT (hrs) SE	HARVEST Mean	HARVEST SE	HARVEST HPUE	CATCH Mean	CATCH SE	CATCH CPUE
527	We	32	4.6	0.31	0.22	0.074	0.047	0.22	0.074	0.047
528	We	61	3.4	0.18	0.26	0.057	0.078	0.26	0.057	0.078
529	We	82	4.9	0.24	0.49	0.072	0.101	0.49	0.072	0.101
530	Wd	24	4.3	0.49	0.67	0.098	0.157	0.92	0.169	0.216
531	Wd	48	6.3	0.26	0.42	0.093	0.066	0.42	0.093	0.066
602	Wd	17	4.2	0.58	0.24	0.136	0.056	0.24	0.136	0.056
603	We	167	6.0	0.23	0.16	0.032	0.026	0.17	0.033	0.029
604	We	155	4.6	0.21	0.14	0.028	0.029	0.17	0.041	0.036
605	Wd	47	5.3	0.40	0.51	0.109	0.097	0.60	0.157	0.113
606	Wd	82	5.3	0.24	0.60	0.085	0.113	0.71	0.114	0.134
607	Wd	75	5.0	0.24	0.25	0.051	0.051	0.25	0.051	0.051
608	Wd	10	5.3	0.47	0.60	0.221	0.113	0.90	0.348	0.170
609	Wd	47	5.2	0.55	0.34	0.088	0.065	0.60	0.194	0.114
610	We	171	6.0	0.28	0.46	0.056	0.077	0.49	0.060	0.081
611	We	109	5.0	0.23	0.39	0.061	0.079	0.41	0.061	0.083
612	Wd	93	6.2	0.30	0.85	0.072	0.138	0.96	0.097	0.156
613	Wd	91	6.2	0.25	0.79	0.074	0.128	1.07	0.136	0.172
614	Wd	107	7.4	0.26	0.46	0.063	0.062	0.64	0.095	0.086
616	Wd	24	6.3	0.84	0.17	0.078	0.027	0.29	0.112	0.047
617	We	120	5.9	0.29	0.16	0.035	0.027	0.19	0.041	0.032
618	We	111	4.7	0.29	0.09	0.027	0.019	0.09	0.027	0.019
619	Wd	79	5.0	0.34	0.19	0.044	0.038	0.19	0.044	0.038
620	Wd	62	6.3	0.43	0.27	0.077	0.044	0.31	0.088	0.049
621	Wd	45	6.5	0.30	0.04	0.031	0.007	0.04	0.031	0.007
622	Wd	5	6.4	0.98	1.40	0.245	0.219	2.00	0.548	0.313
623	Wd	9	6.0	0.87	0.67	0.289	0.111	0.67	0.289	0.111
624	We	65	7.0	0.39	0.29	0.061	0.042	0.32	0.073	0.046
625	We	70	5.3	0.31	0.20	0.056	0.037	0.20	0.056	0.037
626	Wd	21	4.1	0.56	0.38	0.109	0.093	0.48	0.148	0.116
627	Wd	25	4.7	0.59	0.44	0.130	0.094	0.44	0.130	0.094
628	Wd	25	5.0	0.52	0.12	0.066	0.024	0.12	0.066	0.024
701	We	16	6.1	0.66	0.06	0.063	0.010	0.06	0.063	0.010
702	We	4	9.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
703	Wd	31	2.1	0.11	0.00	0.000	0.000	0.00	0.000	0.000
704	We	13	3.5	0.42	0.00	0.000	0.000	0.00	0.000	0.000
705	Wd	2	3.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
708	We	2	3.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000

-continued-

Appendix A2. (Page 2 of 2).

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
709	We	3	4.0	0.00	0.33	0.333	0.083	0.33	0.333	0.083
710	Wd	6	2.2	0.38	0.00	0.000	0.000	0.00	0.000	0.000
711	Wd	3	4.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
712	Wd	6	5.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A3. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip anglers interviewed during the fishery for chinook salmon in the upstream area of the Deshka River, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	EFFORT (hrs) SE	HARVEST Mean	HARVEST SE	HARVEST HPUE	CATCH Mean	CATCH SE	CATCH CPUE
528	We	12	3.7	0.33	0.17	0.112	0.045	0.17	0.112	0.045
529	We	3	1.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
531	Wd	3	3.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
603	We	37	4.9	0.52	0.14	0.057	0.027	0.14	0.057	0.027
604	We	63	5.7	0.33	0.14	0.044	0.025	0.14	0.044	0.025
605	Wd	7	5.3	0.18	0.29	0.184	0.054	0.43	0.202	0.081
606	Wd	20	5.2	0.59	0.25	0.099	0.048	0.25	0.099	0.048
607	Wd	18	3.6	0.45	0.17	0.090	0.046	0.17	0.090	0.046
609	Wd	9	3.3	0.71	0.22	0.147	0.067	0.22	0.147	0.067
610	We	66	5.7	0.33	0.23	0.056	0.040	0.23	0.056	0.040
611	We	56	5.2	0.31	0.20	0.059	0.038	0.20	0.059	0.038
612	Wd	13	6.2	0.97	0.46	0.144	0.075	0.69	0.263	0.113
613	Wd	25	6.4	0.85	1.04	0.147	0.163	1.92	0.513	0.300
614	Wd	17	8.8	0.80	0.53	0.125	0.060	0.71	0.187	0.080
617	We	34	7.9	0.73	0.47	0.087	0.059	0.47	0.087	0.059
618	We	40	4.3	0.38	0.28	0.095	0.063	0.28	0.095	0.063
619	Wd	29	3.0	0.39	0.10	0.058	0.034	0.10	0.058	0.034
620	Wd	35	5.2	0.43	0.29	0.097	0.055	0.31	0.098	0.060
621	Wd	25	7.4	0.56	0.32	0.095	0.043	0.32	0.095	0.043
623	Wd	13	8.1	1.23	0.31	0.133	0.038	0.31	0.133	0.038
624	We	46	5.2	0.42	0.26	0.065	0.050	0.28	0.074	0.054
625	We	61	5.6	0.44	0.28	0.062	0.050	0.28	0.062	0.050
626	Wd	9	3.8	0.36	0.33	0.167	0.088	0.33	0.167	0.088
627	Wd	14	5.8	0.79	0.86	0.143	0.149	1.36	0.248	0.236
628	Wd	16	8.8	0.21	0.63	0.155	0.071	0.69	0.176	0.079
702	We	12	7.5	1.33	0.50	0.151	0.067	0.50	0.151	0.067
703	Wd	9	4.7	0.62	0.67	0.167	0.141	0.67	0.167	0.141
704	We	17	4.7	0.51	0.12	0.081	0.025	0.12	0.081	0.025
705	Wd	7	4.9	1.42	0.43	0.297	0.088	0.43	0.297	0.088
708	We	13	5.2	0.63	0.62	0.241	0.119	0.92	0.415	0.179
709	We	18	6.8	0.63	0.94	0.206	0.139	1.33	0.323	0.197
710	Wd	4	2.3	0.14	0.00	0.000	0.000	0.00	0.000	0.000
711	Wd	3	9.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A4. Angler counts during the fishery for chinook salmon in Alexander Creek, 1989.

Date	Weekend/ Holiday(*)	Counts by Period: Downstream Fishery[a] A	B	C	Upstream Fishery[b] A	B	C
522		0	4	0			
523		18	18	6			
524		1	8	15			
525							
526							
527	*	16	22	39		4	
528	*	70	105	68			10
529	*	47	84	4			3
530		29	35	34			2
531		41	18	23			0
601							
602							
603	*	110	132	70			5
604	*	132	89	59		17	
605		77	75	40			16
606		55	83	60			5
607							
608							
609		123	91	39			40
610	*	68	105	34			18
611	*	145	99	19	16		
612		12	62	4	20		
613		46	48	22		75	
614		11	38	18			27
615							
616							
617	*	3	27	14		79	
618	*	28	11	21	66		
619						99	
620							
621							
622						40	
623							35
624	*						62
625	*						53
626							27
627							11
628					8		
629							
630							

-continued-

Appendix A4. (Page 2 of 2).

Date	Weekend/ Holiday(*)	Counts by Period: Downstream Fishery[a] A	B	C	Upstream Fishery[b] A	B	C
701	*					35	
702	*						40
703							13
704	*					19	
705							
706						11	
707							1
708	*					15	
709	*				10		
710					4		
711							6
712							
713					2		

[a] Period A: 0600 to 1159 hours; Period B: 1200 to 1759 hours; Period C: 1800 to 2400 hours.

[b] Period A: 0600 to 1159 hours; Period B: 1200 to 1759 hours; Period C: 1800 to 2400 hours.

Appendix A5. Daily summary statistics for effort, chinook salmon harvest and catch by all anglers interviewed during the fishery for chinook salmon in the downstream area of Alexander Creek, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
522	Wd	22	4.8	0.48	0.05	0.045	0.010	0.05	0.045	0.010
523	Wd	21	3.5	0.60	0.19	0.088	0.055	0.24	0.095	0.069
524	Wd	30	1.5	0.19	0.13	0.063	0.088	0.13	0.063	0.088
527	We	70	3.0	0.19	0.14	0.042	0.048	0.20	0.052	0.067
528	We	141	2.7	0.12	0.23	0.039	0.087	0.24	0.039	0.090
529	We	101	3.0	0.20	0.27	0.044	0.091	0.29	0.049	0.097
530	Wd	78	2.1	0.23	0.41	0.064	0.197	0.56	0.074	0.271
531	Wd	52	2.3	0.27	0.56	0.097	0.245	1.48	0.463	0.650
603	We	134	4.6	0.33	0.26	0.045	0.056	0.40	0.081	0.087
604	We	150	3.1	0.23	0.31	0.043	0.101	0.31	0.043	0.101
605	Wd	104	2.8	0.22	0.43	0.061	0.155	0.68	0.112	0.245
606	Wd	113	2.6	0.21	0.47	0.059	0.182	0.95	0.170	0.368
607	Wd	9	5.6	0.82	1.33	0.236	0.240	1.33	0.236	0.240
609	Wd	129	3.5	0.29	0.43	0.055	0.122	0.84	0.116	0.236
610	We	202	3.4	0.16	0.33	0.040	0.097	0.44	0.053	0.127
611	We	159	3.2	0.16	0.31	0.045	0.095	0.39	0.056	0.120
612	Wd	62	4.9	0.25	0.45	0.068	0.092	0.76	0.143	0.155
613	Wd	102	3.1	0.14	0.38	0.058	0.123	0.49	0.075	0.158
614	Wd	32	3.5	0.33	0.69	0.122	0.196	0.88	0.154	0.250
616	Wd	24	4.4	0.60	0.33	0.143	0.077	0.58	0.248	0.134
617	We	83	3.4	0.34	0.28	0.055	0.081	0.42	0.084	0.124
618	We	67	2.5	0.22	0.13	0.052	0.054	0.21	0.069	0.084

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A6. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip anglers interviewed during the fishery for chinook salmon in the upstream area of Alexander Creek, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
603	We	5	4.4	0.98	1.00	0.000	0.227	1.20	0.200	0.273
604	We	4	5.0	1.00	0.25	0.250	0.050	0.25	0.250	0.050
610	We	2	10.0	0.00	2.00	0.000	0.200	3.00	1.000	0.300
611	We	13	5.9	0.70	1.15	0.222	0.195	1.38	0.331	0.234
612	Wd	10	6.0	0.00	1.40	0.267	0.233	1.40	0.267	0.233
614	Wd	4	3.0	0.58	0.50	0.289	0.167	2.00	1.683	0.667
616	Wd	39	6.4	0.52	0.44	0.109	0.069	3.67	0.844	0.577
617	We	108	4.9	0.21	0.63	0.067	0.129	1.19	0.134	0.245
618	We	93	4.7	0.29	0.69	0.076	0.146	1.44	0.229	0.307
619	Wd	5	5.0	0.00	1.40	0.245	0.280	1.80	0.490	0.360
620	Wd	13	8.7	0.87	0.38	0.140	0.044	3.46	0.433	0.398
621	Wd	51	4.1	0.32	0.45	0.085	0.109	0.88	0.165	0.213
622	Wd	29	5.3	0.51	0.52	0.118	0.098	0.66	0.151	0.124
623	Wd	28	5.6	0.60	0.21	0.107	0.038	0.46	0.150	0.083
624	We	73	3.9	0.24	0.33	0.073	0.084	0.90	0.157	0.232
625	We	46	2.9	0.26	0.26	0.072	0.091	0.37	0.109	0.129
626	Wd	4	2.5	0.00	0.75	0.250	0.300	0.75	0.250	0.300
627	Wd	24	4.4	0.52	0.17	0.078	0.038	0.50	0.170	0.113
628	Wd	43	4.0	0.39	0.35	0.093	0.087	1.37	0.284	0.344
629	Wd	40	3.0	0.30	0.53	0.101	0.172	0.93	0.213	0.303
630	Wd	30	2.8	0.36	0.17	0.069	0.059	0.73	0.235	0.259
701	We	47	2.9	0.28	0.28	0.084	0.094	1.21	0.280	0.412
702	We	28	4.0	0.17	0.29	0.087	0.072	0.93	0.295	0.234
703	Wd	53	4.1	0.21	0.36	0.072	0.087	0.91	0.173	0.221
704	We	10	2.1	0.46	0.30	0.213	0.143	0.30	0.213	0.143
706	Wd	14	5.0	0.91	0.36	0.133	0.071	0.79	0.261	0.157
707	Wd	13	4.5	0.89	0.38	0.140	0.085	0.69	0.237	0.153
708	We	32	2.9	0.47	0.38	0.133	0.130	1.09	0.296	0.379
709	We	10	4.2	0.53	0.00	0.000	0.000	0.10	0.100	0.024
711	Wd	13	4.8	0.12	0.62	0.140	0.129	1.08	0.239	0.226
712	Wd	6	2.0	0.00	0.00	0.000	0.000	0.50	0.342	0.250
713	Wd	6	1.8	0.31	0.00	0.000	0.000	0.50	0.224	0.273

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A7. Angler counts during the fishery for chinook salmon in Lake Creek, 1989.

Date	Counts by Period[a] A	B	C	D	E
603					
604	0	0	3	2	0
605	0	0	0	0	0
606					
607					
608	0	2	4	6	24
609	1	11	11	18	23
610	24	20	41	50	37
611	14	40	59	54	44
612					
613	31	50	64	29	31
614	30	57	39	17	13
615					
616					
617	52	99	108	58	86
618	32	134	136	76	92
619					
620					
621					
622					
623	61	119	114	86	74
624	43	108	135	96	87
625					
626	48	97	94	75	100
627					
628					
629	42	93	63	43	40
630	42	53	47	29	71

-continued-

Appendix A7. (Page 2 of 2).

Date	Counts by Period[a]				
	A	B	C	D	E
701					
702	33	35	49	8	57
703	9	53	38	21	48
704	11	16	23	23	16
705	25	37	7	16	18
706					
707					
708	16	19	19	11	9
709	2	26	19	8	8
710					
711	3	4	16	6	4
712	0	7	10	11	0
713	0	7	10	4	6

[a] Period A: 0500 to 0859 hours;
Period B: 0900 to 1259 hours;
Period C: 1300 to 1659 hours;
Period D: 1700 to 2059 hours;
Period E: 2100 to 0100 hours.

Appendix A8. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip anglers interviewed during the fishery for chinook salmon in Lake Creek, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
604	We	2	2.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
608	Wd	3	5.0	0.00	0.33	0.333	0.067	0.33	0.333	0.067
609	Wd	6	4.0	0.45	0.33	0.211	0.083	0.33	0.211	0.083
610	We	36	5.3	0.41	0.47	0.101	0.089	0.53	0.116	0.099
611	We	13	5.6	0.90	1.00	0.160	0.178	1.00	0.160	0.178
612	Wd	5	12.0	0.00	0.60	0.245	0.050	0.60	0.245	0.050
613	Wd	14	3.9	0.69	0.14	0.097	0.037	0.14	0.097	0.037
614	Wd	6	2.5	0.22	0.50	0.342	0.200	0.50	0.342	0.200
616	Wd	3	2.0	0.00	0.00	0.000	0.000	0.33	0.333	0.167
617	We	4	5.5	1.44	0.75	0.479	0.136	0.75	0.479	0.136
618	We	38	3.0	0.38	0.34	0.078	0.113	0.39	0.089	0.130
619	Wd	5	9.8	1.71	0.40	0.245	0.041	0.80	0.490	0.082
620	Wd	18	3.9	0.46	0.61	0.143	0.155	1.17	0.305	0.296
621	Wd	15	3.1	0.32	0.40	0.131	0.128	0.40	0.131	0.128
622	Wd	12	4.4	0.50	0.58	0.288	0.132	1.00	0.461	0.226
623	Wd	17	7.1	0.57	0.65	0.170	0.091	1.82	0.637	0.256
624	We	18	5.8	0.51	0.72	0.109	0.125	1.78	0.592	0.308
625	We	35	6.2	0.42	0.46	0.085	0.074	0.51	0.086	0.083
626	Wd	12	6.7	1.24	0.67	0.142	0.100	2.33	0.916	0.350
628	Wd	3	7.0	0.00	0.33	0.333	0.048	0.33	0.333	0.048
629	Wd	10	5.6	0.40	0.20	0.133	0.036	0.20	0.133	0.036
630	Wd	27	8.0	0.00	0.33	0.092	0.042	0.52	0.124	0.065
701	We	26	4.5	0.90	0.12	0.064	0.026	0.12	0.064	0.026
702	We	6	5.3	0.42	0.00	0.000	0.000	0.00	0.000	0.000
703	Wd	51	5.0	0.40	0.14	0.049	0.027	0.29	0.098	0.059
704	We	16	2.8	0.21	0.13	0.085	0.044	0.13	0.085	0.044
705	Wd	4	2.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
707	Wd	4	3.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
708	We	4	3.3	0.75	0.25	0.250	0.077	0.50	0.289	0.154
709	We	6	5.0	1.32	0.67	0.211	0.133	0.83	0.307	0.167
710	Wd	3	3.0	0.00	0.33	0.333	0.111	0.33	0.333	0.111
711	Wd	4	6.0	1.15	0.00	0.000	0.000	0.00	0.000	0.000
712	Wd	2	4.5	0.00	1.00	0.000	0.222	1.00	0.000	0.222
713	Wd	3	8.0	0.00	0.67	0.333	0.083	0.67	0.333	0.083

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A9. Daily totals, means, and standard errors for effort, chinook salmon harvest and catch by completed-trip anglers exiting the fishery in Clear Creek at Talkeetna Landing during periods A and B, 1989.

Date	We/ Wd[a]	Hours Censused	Angler Interviews	Missed Anglers	Effort Total	Effort Mean	Effort SE	Harvest Total	Harvest Mean	Harvest SE	Catch Total	Catch Mean	Catch SE
PERIOD A (0800-1559 hours)													
617	We	3.5	2	0	5.00	2.50	0.000	0	0.00	0.00	0	0.00	0.00
618	We	3.5	21	0	211.00	10.05	1.913	0	0.00	0.00	0	0.00	0.00
619	Wd	3.5	4	0	12.00	3.00	0.577	0	0.00	0.00	0	0.00	0.00
620	Wd	3.5	0	0									
621	Wd	3.5	2	0	12.00	6.00	0.000	2	1.00	0.00	4	2.00	0.00
622	Wd												
623	Wd												
624	We	3.5	10	0	68.00	6.80	1.652	2	0.20	0.13	2	0.20	0.13
625	We	3.5	27	9	309.00	11.44	1.153	18	0.67	0.11	21	0.78	0.13
626	Wd												
627	Wd												
628	Wd	3.5	22	0	91.00	4.14	0.136	20	0.91	0.09	25	1.14	0.17
629	Wd	3.5	35	2	284.00	8.11	0.911	34	0.97	0.14	61	1.74	0.29
630	Wd	3.5	12	0	58.00	4.83	0.976	13	1.08	0.23	15	1.25	0.30
701	We	3.5	57	11	612.00	10.74	0.781	35	0.61	0.08	38	0.67	0.08
702	We	3.5	36	14	366.50	10.18	1.460	19	0.53	0.14	75	2.08	0.54
703	Wd	3.5	59	8	516.50	8.75	0.569	31	0.53	0.09	41	0.69	0.13
704	We	3.5	89	9	1488.00	16.72	1.476	49	0.55	0.06	86	0.97	0.15
705	Wd	3.5	15	0	181.00	12.07	2.285	10	0.67	0.25	10	0.67	0.25
706	Wd												
707	Wd												
708	We	3.5	25	0	242.00	9.68	1.110	3	0.12	0.07	3	0.12	0.07
709	We	3.5	60	12	880.00	14.67	1.246	39	0.65	0.07	47	0.78	0.09
710	Wd	3.5	5	0	48.00	9.60	0.980	5	1.00	0.00	7	1.40	0.24
711	Wd	3.5	28	0	290.00	10.36	1.236	16	0.57	0.12	41	1.46	0.33
712	Wd	3.5	23	0	354.00	15.39	1.618	21	0.91	0.14	71	3.09	0.63
713	Wd	3.5	12	0	495.00	41.25	6.689	14	1.17	0.30	34	2.83	0.73
PERIOD B (1600-2400 hours)													
617	We	3.5	3	0	40.00	13.33	4.667	3	1.00	0.58	3	1.00	0.58
618	We	3.5	0	0									
619	Wd	3.5	2	0	14.00	7.00	0.000	0	0.00	0.00	0	0.00	0.00
620	Wd	3.5	0	0									
621	Wd	3.5	0	0									
622	Wd												

-continued-

Appendix A9. (Page 2 of 2).

Date	We/ Wd[a]	Hours Censused	Angler Interviews	Missed Anglers	Effort Total	Effort Mean	Effort SE	Harvest Total	Harvest Mean	Harvest SE	Catch Total	Catch Mean	Catch SE
PERIOD B (1600-2400 hours)													
623	Wd												
624	We	3.5	8	0	90.00	11.25	2.033	3	0.38	0.18	3	0.38	0.18
625	We	3.5	12	6	48.00	4.00	0.853	2	0.17	0.11	2	0.17	0.11
626	Wd												
627	Wd												
628	Wd	3.5	44	6	351.00	7.98	0.627	17	0.39	0.07	43	0.98	0.20
629	Wd	3.5	32	7	291.00	9.09	1.314	16	0.50	0.11	71	2.22	0.73
630	Wd	3.5	12	0	60.00	5.00	0.492	6	0.50	0.19	21	1.75	0.94
701	We	3.5	39	9	257.00	6.59	0.633	19	0.49	0.10	49	1.26	0.33
702	We	3.5	65	15	357.00	5.49	0.422	38	0.58	0.08	79	1.22	0.27
703	Wd	3.5	33	9	228.00	6.91	0.605	23	0.70	0.12	26	0.79	0.14
704	We	3.5	47	15	283.50	6.03	0.593	20	0.43	0.07	23	0.49	0.09
705	Wd	3.5	28	0	334.00	11.93	1.471	12	0.43	0.11	26	0.93	0.23
706	Wd												
707	Wd												
708	We	3.5	40	6	308.50	7.71	0.859	9	0.23	0.08	10	0.25	0.08
709	We	3.5	128	6	933.50	7.29	0.299	45	0.35	0.04	54	0.42	0.05
710	Wd	3.5	0	0									
711	Wd	3.5	47	0	337.50	7.18	0.354	17	0.36	0.07	23	0.49	0.10
712	Wd	3.5	53	0	377.00	7.11	0.231	27	0.51	0.07	38	0.72	0.09
713	Wd	3.5	17	0	153.00	9.00	1.269	8	0.47	0.12	8	0.47	0.12

[a] Wd = Weekday; We = Weekend/holiday.

Appendix A10. Daily totals, means, and standard errors for effort, chinook salmon harvest and catch by completed-trip anglers exiting the fishery in the Talkeetna River at Talkeetna Landing during periods A and B, 1989.

Date	We/ Wd[a]	Hours Censused	Angler Interviews	Missed Anglers	Effort			Harvest			Catch		
					Total	Mean	SE	Total	Mean	SE	Total	Mean	SE
PERIOD A (0800-1559 hours)													
617	We	3.5	4	0	24.00	6.00	0.000	1	0.25	0.25	1	0.25	0.25
618	We	3.5	6	0	60.00	10.00	0.894	8	1.33	0.33	11	1.83	0.54
619	Wd	3.5	1	0	2.00	2.00	0.000	1	1.00	0.00	1	1.00	0.00
620	Wd	3.5	1	0	3.00	3.00	0.000	1	1.00	0.00	1	1.00	0.00
621	Wd	3.5											
622	Wd												
623	Wd												
624	We	3.5	4	0	10.00	2.50	0.289	0	0.00	0.00	0	0.00	0.00
625	We	3.5	12	2	135.00	11.25	3.527	7	0.58	0.23	7	0.58	0.23
626	Wd												
627	Wd												
628	Wd	3.5	12	0	48.00	4.00	0.739	12	1.00	0.00	18	1.50	0.15
629	Wd	3.5	7	1	53.00	7.57	2.626	8	1.14	0.34	10	1.43	0.48
630	Wd	3.5		0									
701	We	3.5	4	3	192.00	48.00	0.000	12	3.00	1.00	37	9.25	3.30
702	We	3.5	11	3	133.00	12.09	0.625	4	0.36	0.15	6	0.55	0.21
703	Wd	3.5											
704	Wd	3.5	6	3	27.00	4.50	0.922	2	0.33	0.33	8	1.33	1.33
705	Wd	3.5	6	0	21.00	3.50	0.500	3	0.50	0.22	4	0.67	0.33
706	Wd												
707	Wd												
708	We	3.5	4	0	40.00	10.00	0.000	0	0.00	0.00	0	0.00	0.00
709	We	3.5	25	3	209.00	8.36	1.864	8	0.32	0.10	9	0.36	0.11
710	Wd	3.5											
711	Wd	3.5											
712	Wd	3.5											
713	Wd	3.5											
PERIOD B (1800-2400 hours)													
617	We	3.5											
618	We	3.5											
619	Wd	3.5	17	0	81.00	4.76	0.349	6	0.35	0.12	9	0.53	0.19
620	Wd	3.5											
621	Wd	3.5	2	0	16.00	8.00	0.000	2	1.00	0.00	2	1.00	0.00
622	Wd												
623	Wd												
624	We	3.5	15	0	95.00	6.33	0.630	2	0.13	0.09	5	0.33	0.27

-continued-

Appendix A10. (Page 2 of 2).

Date	We/ Wd[a]	Hours Censused	Angler Interviews	Missed Anglers	Effort Total	Effort Mean	Effort SE	Harvest Total	Harvest Mean	Harvest SE	Catch Total	Catch Mean	Catch SE
PERIOD B (1800-2400 hours)													
625	We	3.5	2	2	34.00	17.00	0.000	2	1.00	0.00	2	1.00	0.00
626	Wd												
627	Wd												
628	Wd	3.5	15	0	108.00	7.20	0.380	14	0.93	0.07	29	1.93	0.33
629	Wd	3.5	2	1	12.00	6.00	2.000	2	1.00	0.00	2	1.00	0.00
630	Wd	3.5	25	0	153.00	6.12	0.742	24	0.96	0.15	43	1.72	0.45
701	We	3.5	16	3	144.00	9.00	1.041	13	0.81	0.19	17	1.06	0.30
702	We	3.5	7	3	56.00	8.00	0.000	1	0.14	0.14	2	0.29	0.18
703	Wd	3.5	8	0	39.00	4.88	0.549	2	0.25	0.16	2	0.25	0.16
704	We	3.5	10	3	67.00	6.70	0.153	9	0.90	0.10	9	0.90	0.10
705	Wd	3.5											
706	Wd												
707	Wd												
708	We	3.5	13	2	83.00	6.38	0.417	6	0.46	0.14	6	0.46	0.14
709	We	3.5	19	2	130.00	6.84	0.279	3	0.16	0.09	3	0.16	0.09
710	Wd	3.5											
711	Wd	3.5											
712	Wd	3.5	5	0	35.00	7.00	1.000	5	1.00	0.00	7	1.40	0.24
713	Wd	3.5	6	0	48.00	8.00	0.000	2	0.33	0.21	2	0.33	0.21

[a] Wd = Weekday; We = Weekend/holiday.

Appendix A11. Angler counts for boat anglers during the fishery for chinook salmon at the mouth of Willow Creek, 1989.

Date	Weekend/ Holiday(*)	Counts by Period[a] A	B	C
609		0	0	0
610	*	0	0	0
611	*	0	0	0
612	*	2	0	3
613		1	0	0
614		0	1	2
615				
616				
617	*	3	5	4
618	*	2	3	9
619	*	0	0	3
624	*	8	4	5
625	*	2	12	0
626	*	3	3	5
701	*	12	7	3
702	*	5	3	4
703	*	6	7	0

[a] Period A: 0000 to 0559 hours; Period B: 0600 to 1759 hours; Period C: 1800 to 2359 hours.

Appendix A12. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip boat anglers interviewed during the fishery for chinook salmon at the mouth of Willow Creek, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
604	We	3	1.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
610	We	4	1.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
614	Wd	2	0.5	0.00	0.00	0.000	0.000	0.00	0.000	0.000
617	We	8	7.5	0.33	0.00	0.000	0.000	0.00	0.000	0.000
618	We	12	3.0	0.34	0.00	0.000	0.000	0.00	0.000	0.000
619	Wd	4	6.0	0.00	0.00	0.000	0.000	0.00	0.000	0.000
624	We	15	3.0	0.71	0.13	0.091	0.044	0.13	0.091	0.044
625	We	24	5.4	0.79	0.17	0.078	0.031	0.17	0.078	0.031
626	Wd	2	2.0	0.00	1.00	0.000	0.500	1.00	0.000	0.500
701	We	7	3.4	0.51	0.29	0.184	0.083	0.29	0.184	0.083
702	We	12	7.5	0.78	0.58	0.149	0.078	0.58	0.149	0.078
703	Wd	22	6.0	0.45	0.00	0.000	0.000	0.00	0.000	0.000

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A13. Angler counts for shore anglers during the fishery for chinook salmon at the mouth of Willow Creek, 1989.

Date	Weekend/ Holiday(*)	Counts by Period[a] A	B	C
610	*	15	33	35
611	*	16	23	15
612	*	16	24	35
613		10	19	19
614		4	25	33
615		5	5	23
616				
617	*	48	93	88
618	*	68	40	87
619	*	42	50	103
624	*	123	103	115
625	*	83	98	135
626	*	125	102	229
701	*	187	179	173
702	*	93	104	180
703	*	154	91	174

[a] Period A: 0000 to 0559 hours; Period B: 0600 to 1759 hours; Period C: 1800 to 2400 hours.

Appendix A14. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip shore anglers interviewed during the fishery for chinook salmon at the mouth of Willow Creek, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
610	We	83	2.2	0.18	0.02	0.017	0.011	0.02	0.017	0.011
611	We	56	3.6	0.28	0.02	0.018	0.005	0.02	0.018	0.005
612	Wd	58	3.4	0.42	0.02	0.017	0.005	0.02	0.017	0.005
613	Wd	31	3.4	0.39	0.06	0.045	0.019	0.06	0.045	0.019
614	Wd	45	2.8	0.29	0.11	0.047	0.039	0.16	0.055	0.055
615	Wd	43	3.0	0.55	0.02	0.023	0.008	0.02	0.023	0.008
616	Wd	8	2.4	1.10	0.00	0.000	0.000	0.00	0.000	0.000
617	We	104	3.7	0.25	0.10	0.029	0.026	0.10	0.029	0.026
618	We	82	4.1	0.32	0.10	0.033	0.024	0.10	0.033	0.024
619	Wd	73	3.7	0.26	0.15	0.042	0.041	0.16	0.044	0.044
624	We	258	4.0	0.21	0.24	0.027	0.062	0.28	0.043	0.071
625	We	261	3.8	0.21	0.33	0.029	0.086	0.36	0.038	0.095
626	Wd	126	3.3	0.24	0.40	0.044	0.121	0.45	0.059	0.138
701	We	149	3.3	0.23	0.52	0.041	0.155	0.56	0.057	0.169
702	We	97	4.1	0.34	0.38	0.050	0.093	0.53	0.082	0.128
703	Wd	126	4.8	0.31	0.38	0.043	0.080	0.64	0.093	0.134

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A15. Angler counts for shore anglers during the fishery for chinook salmon in Willow Creek at the Parks Highway bridge, 1989.

Date	Weekend/ Holiday(*)	Counts by Period[a] A	B	C
701	*	71	101	62
702	*	76	59	51
703	*	27	20	59

[a] Period A: 0000 to 0559 hours; Period B: 0600 to 1759 hours; Period C: 1800 to 2400 hours.

Appendix A16. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip shore anglers interviewed during the fishery for chinook salmon in Willow Creek at the Parks Highway bridge, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
701	We	133	4.2	0.29	0.31	0.040	0.074	0.37	0.055	0.089
702	We	39	3.7	0.52	0.59	0.080	0.158	0.59	0.080	0.158
703	Wd	31	3.1	0.26	0.71	0.083	0.228	0.74	0.092	0.238

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A17. Angler counts for shore and boat anglers during the fishery for chinook salmon in Sheep Creek, 1989.

Date	Weekend/ Holiday(*)	Counts by Period[a] A	B	C	D
Shore Anglers					
610	*	28	41	37	31
611	*	20	10	13	20
612	*	10	21	10	8
617	*	131	35	38	47
618	*	22	28	29	41
619	*	31	23	20	29
624	*	44	48	96	61
625	*	54	56	115	97
626	*	59	31	86	60
701	*	138	48	75	113
702	*	70	41	57	68
703	*	34	38	42	62
Boat Anglers					
610	*	0	4	0	0
611	*	0	0	0	2
612	*	0	2	4	2
617	*	6	4	7	4
618	*	0	1	0	1
619	*	0	1	2	1
624	*	8	6	2	16
625	*	6	6	12	9
626	*	9	13	2	3
701	*	14	6	6	4
702	*	12	1	0	0
703	*	0	12	7	12

[a] Period A: 0000 to 0559 hours; Period B: 0600 to 1159 hours; Period C: 1200 to 1759 hours; Period D: 1800 to 2400 hours.

Appendix A18. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip shore anglers interviewed during the fishery for chinook salmon in Sheep Creek, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
610	We	137	3.3	0.23	0.03	0.014	0.009	0.04	0.018	0.013
611	We	59	3.5	0.36	0.05	0.029	0.015	0.07	0.033	0.020
612	Wd	44	3.7	0.40	0.07	0.038	0.018	0.07	0.038	0.018
617	We	132	2.3	0.24	0.08	0.024	0.037	0.08	0.024	0.037
618	We	31	3.1	0.33	0.13	0.061	0.042	0.13	0.061	0.042
619	Wd	13	3.0	0.73	0.15	0.104	0.052	0.15	0.104	0.052
624	We	224	3.9	0.20	0.25	0.029	0.065	0.36	0.036	0.092
625	We	162	4.3	0.24	0.35	0.037	0.080	0.44	0.045	0.102
626	Wd	95	4.1	0.41	0.38	0.050	0.093	0.38	0.050	0.093
701	We	254	3.9	0.19	0.27	0.031	0.069	0.30	0.032	0.078
702	We	136	3.6	0.21	0.18	0.033	0.049	0.18	0.033	0.049
703	Wd	94	4.2	0.25	0.21	0.042	0.051	0.22	0.043	0.053

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.

Appendix A19. Angler counts for shore anglers during the fishery for chinook salmon in Montana Creek, 1989.

Date	Weekend/ Holiday(*)	Counts by Period[a] A	B	C	D
617	*	85	48	52	47
618	*	19	14	43	88
619	*	33	9	41	40
624	*	81	73	162	137
625	*	91	66	166	130
626	*	62	86	89	117
701	*	379	158	376	203
702	*	199	136	226	172
703	*	100	183	183	127

[a] Period A: 0000 to 0559 hours; Period B: 0600 to 1159 hours; Period C: 1200 to 1759 hours; Period D: 1800 to 2400 hours.

Appendix A20. Daily summary statistics for effort, chinook salmon harvest and catch by completed-trip shore anglers interviewed during the fishery for chinook salmon in Montana Creek, 1989.

Date	Wd/ We[a]	SS[b]	EFFORT (hrs) Mean	SE	HARVEST Mean	SE	HPUE	CATCH Mean	SE	CPUE
617	We	79	3.9	0.34	0.30	0.052	0.078	0.30	0.052	0.078
618	We	105	3.9	0.21	0.26	0.043	0.066	0.29	0.052	0.074
619	Wd	61	3.5	0.24	0.41	0.063	0.117	0.43	0.064	0.122
624	We	192	3.1	0.15	0.46	0.036	0.152	0.55	0.056	0.181
625	We	148	4.1	0.18	0.36	0.040	0.089	0.39	0.047	0.096
626	Wd	123	3.7	0.24	0.37	0.044	0.099	0.37	0.044	0.101
701	We	211	4.2	0.21	0.42	0.034	0.101	0.56	0.073	0.134
702	We	164	3.3	0.15	0.20	0.031	0.059	0.24	0.040	0.072
703	Wd	159	4.5	0.20	0.25	0.034	0.055	0.34	0.050	0.076

[a] Weekday (Wd) or Weekend/holiday (We).
[b] Sample size, number of anglers interviewed.