Fishery Data Series No. 03-01

Chinook Salmon Creel Survey and Inriver Gillnetting Study, Lower Kenai River, Alaska, 2001

by

Adam Reimer

February 2003

Alaska Department of Fish and Game **Division of Sport Fish**

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Spell out acre and ton.

Time and temperature

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

Spell out year, month, and week.

Physics and chemistry

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

General

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

Mathematics, statistics, fisheries

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

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by

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ABSTRACT

A creel survey to estimate angler effort, catch and harvest of chinook salmon *Oncorhynchus tshawytscha* was conducted on the Kenai River between the Soldotna Bridge and the Warren Ames B ridge from 16 May 2001 through 31 July 2001. For the early run, (May and June) angler effort was 70,203 (SE = 2,693) angler-hours and harvest was 1,428 (SE = 190) chinook salmon. Unguided anglers accounted for 34% of the fishing effort and 10% of the harvest, versus guided anglers who accounted for 66% of the effort and 90% of the harvest. During the early run, most of the recreational harvest and inriver return was age-1.3 and age-1.4 fish. For the late run (July), angler effort was 236,633 (SE = 8,144) angler-hours and harvest was 13,736 (SE = 996) chinook salmo n. Unguided anglers accounted for 54% of the effort and 40% of the harvest, versus guided anglers who accounted for 46% of the effort and 60% of harvest. During the late run, most of the recreational harvest and inriver return was age-1.3 and age-1.4 fis h.

A standardized inriver gillnetting program was conducted near the chinook salmon sonar site from 16 May 2001 through 10 August 2001. Species composition of the catch was used inseason to index relative abundance of chinook vs. sockeye salmon. A small pilot study conducted in August indicated that larger, less size-selective catches could be obtained by changing to nets constructed from a different material, and by adding an additional mesh size.

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

INTRODUCTION

The Kenai River (Figure 1) supports the largest freshwater recreational fishery in Alaska with an average annual effort of 312,535 angler-days for all species from 1990–2000, which represents about 13% of the state's average annual recreational fishing effort during the same period (Mills 1991-1994; Howe et al. 1995, 1996, 2001a, b, c, d; Walker et al. *In prep*). Anglers fish for chinook salmon *Oncorhynchus tshawytscha,* coho salmon *O. kisutch*, sockeye salmon *O. nerka,* pink salmon *O. gorbuscha*, Dolly Varden *Salvelinus malma*, and rainbow trout *O. mykiss*. The Kenai River chinook salmon fishery between the Soldotna Bridge and Warren Ames Bridge is the subject of this report.

Chinook salmon return to the Kenai River in two periods: an early run, early May until late June, and a late run, late June through early August. For management purposes the early run is defined as all chinook salmon entering the river prior to 1 July and the late run is defined as all fish entering on or after 1 July. Recreational anglers value fish from both runs due to their large size; average weight is about 18 kg (40 lb) and some fish exceed 36 kg (80 lb). Late-run fish are generally larger at age than early-run fish; ho wever, the world record sport-caught chinook salmon of 44.1kg (97 lb) was harvested from the Kenai River in May 1985.

Prior to 1970, participation in the recreational fishery in the Kenai River was primarily by shorebased anglers targeting sockeye salmon in July and coho salmon in August and September. The department implemented a creel survey in 1974 in response to rising effort and harvest from boat anglers targeting chinook salmon. Angler effort and harvest increased through 1988 but dropped during the early 1990s because of small chinook salmon runs and fishery restrictions (Figures 2 and 3). Effort and harvest have never returned to 1987 and 1988 levels in the early run (Figure 2), but have been similar to historical averages in the late run since 1992 (Figure 3).

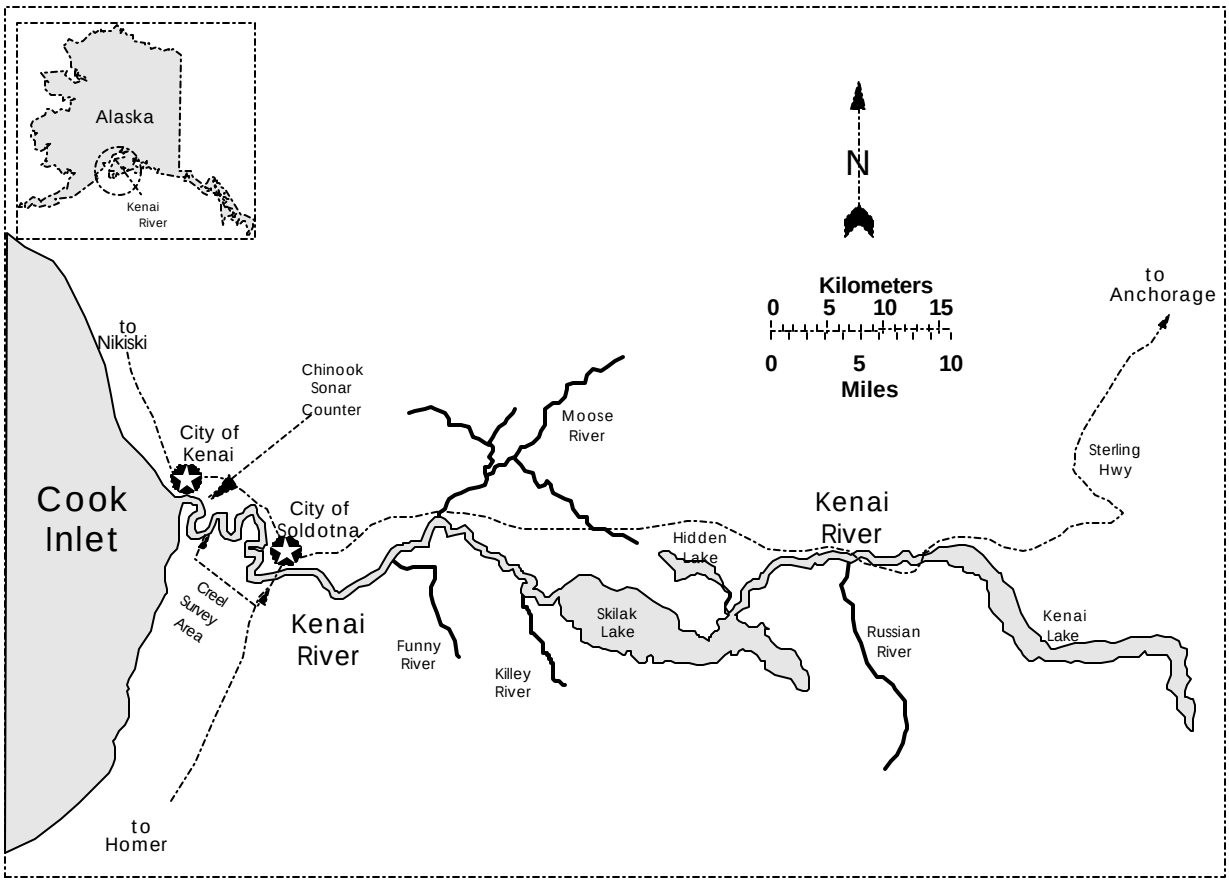


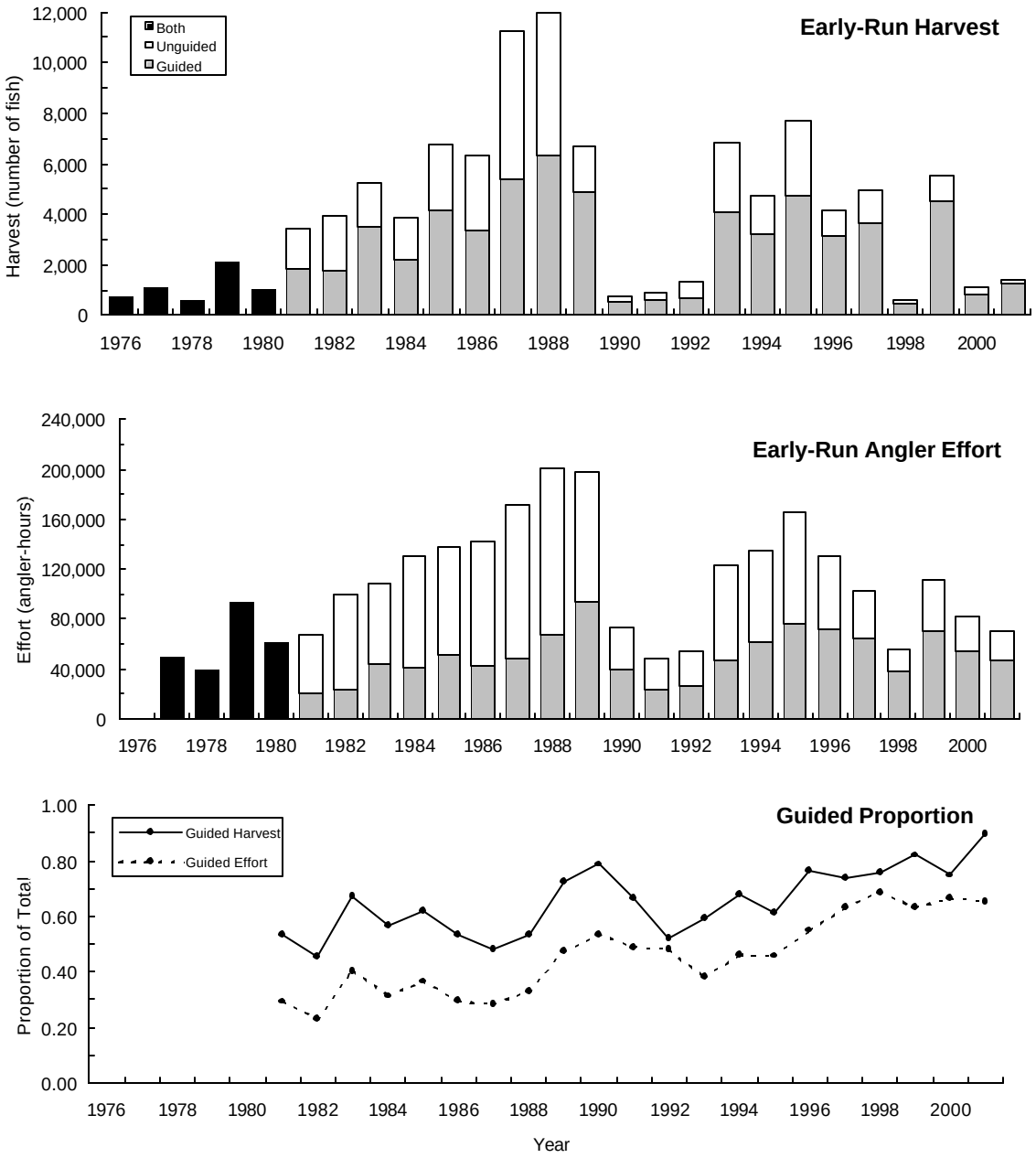
Figure 1.-The Kenai River and creel survey area.

Beginning in 1981, separate effort and harvest estimates have been produced for guided and unguided anglers. Guided anglers have accounted for an increasing proportion of the total effort and harvest in both runs (Figures 2 and 3).

MANAGEMENT PLANS

The early- and late-run Kenai River chinook salmon returns have separate inseason management plans adopted by the Board of Fisheries. Both plans utilize estimates of inriver return and harvest. Estimates of inriver return are obtained with inriver sonar (Miller et al. 2003) while estimates of harvest are obtained from the creel survey described herein. Previous information on the Kenai River chinook salmon creel survey was published by Conrad and Hammarstrom 1987; Hammarstrom 1975-1981, 1988-1994; Hammarstrom and Larson 1982-1984, 1986; Hammarstrom et al. 1985; King 1995-1997; Marsh 1999, 2000; Reimer et al. 2002.

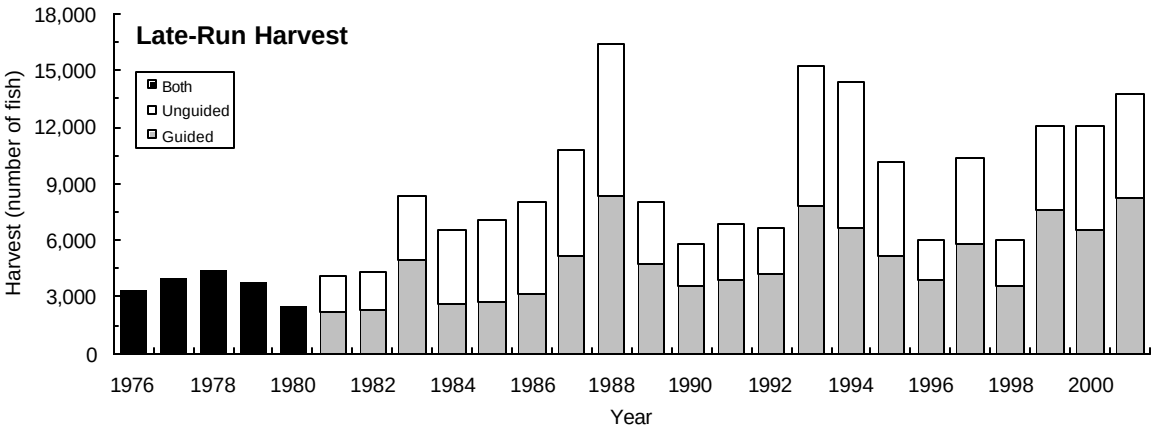
The Kenai River Early Run Chinook Salmon Management Plan (5 AAC 56.070, Figure 4) mandates the fishery be managed to achieve a spawning escapement of 7,200 to 14,400 chinook salmon. Bait, multiple hooks, and fishing from boats on Mondays are prohibited unless an estimated spawning escapement exceeding 14,400 fish is projected. If the projected spawning

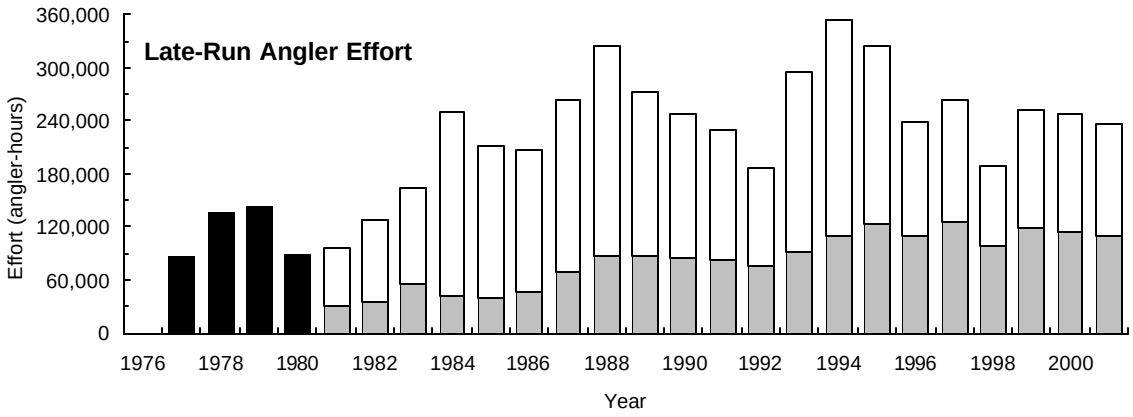


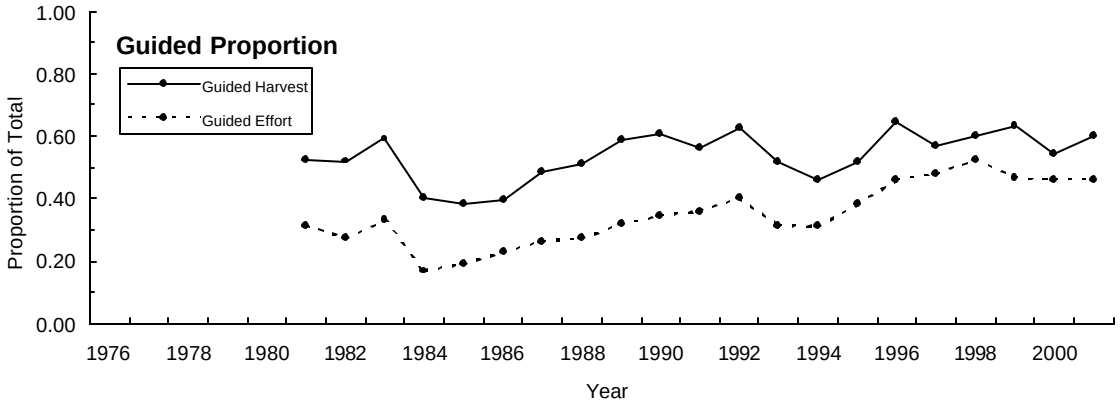
Notes: Estimates are from historical creel surveys; effort estimates unavailable for 1976; guided vs. unguided estimates not available prior to 1981.

Sources: Conrad and Hammarstrom 1987; Hammarstrom 1975-1981, 1988-1994; Hammarstrom and Larson 1982-1984, 1986; Hammarstrom et al. 1985; King 1995-1997; Marsh 1999, 2000; Reimer et al. 2002. Estimates for 2001 from this report.

Figure 2.-Historical harvest and angler effort for the early-run Kenai River chinook salmon fishery between the Soldotna Bridge and the Warren Ames Bridge, 1976-2001.







Notes: Estimates are from historical creel surveys; effort estimate unavailable for 1976; guided vs. unguided estimates not available prior to 1981.

Sources: Conrad and Hammarstrom 1987; Hammarstrom 1975-1979, 1988-1994; Hammarstrom and Larson 1982-1984, 1986; Hammarstrom et al. 1985; King 1995-1997; Marsh 1999, 2000; Reimer et al. 2002. Estimates for 2001 from this report.

Figure 3.-Historical harvest and angler effort for the late-run Kenai River chinook salmon fishery between the Soldotna Bridge and the Warren Ames Bridge, 1976-2001.

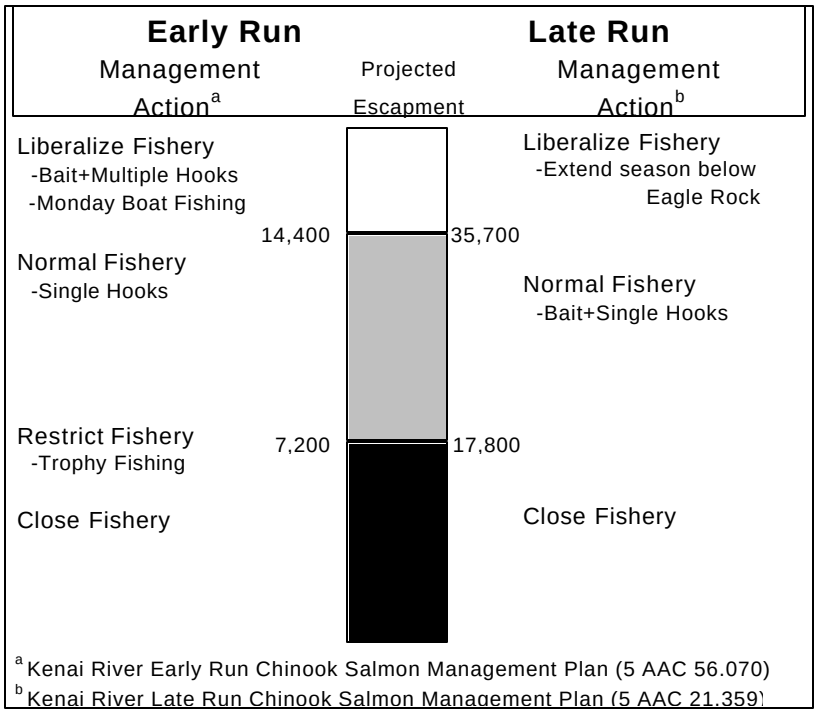


Figure 4.-Escapement levels and required inriver management actions for early-run (prior to 1 July) and late-run (after 30 June) chinook salmon fisheries of the Kenai River, 1999 and 2000.

escapement is below 7,200 fish the department will restrict the fishery to trophy fishing[1]. If the projected spawning escapement remains below 7,200 with the trophy fishing restriction the fishery will close until 1 July downstream of the Funny River and 10 July upstream of the Funny River (Figure 1).

Management of the late-run chinook salmon sport fishery is complicated because chinook salmon are harvested by the commercial sockeye salmon setnet fishery along the east shore of Cook Inlet (McBride et al. 1985). The inriver chinook salmon sport fishery is managed under the Kenai River Late Run Chinook Salmon Management Plan (5 AAC 21.359, Figure 4) while the marine sockeye salmon commercial fishery is managed under the Kenai River Late Run Sockeye Salmon Management Plan (5 AAC 21.360). The Kenai River Late Run Chinook Salmon Management Plan mandates the sport fishery be managed to achieve a spawning escapement of 17,800 to 35,700 chinook salmon. Bait and single hooks are permitted as long as the spawning escapement is projected to be above 17,800. If the projected spawning escapement falls below 17,800 then the sport fishery will be closed. If the projected spawning escapement exceeds 35,700 then the sport fishing season can be extended, past the normal closing day of 31 July, until 7 August downstream of Eagle Rock (river mile [rm] 11.25, river kilometer [rkm] 18; Figure 5).

[1] Catch-and-release of fish less than 132 cm (52 in).

FISHING REGULATIONS

Regulations for the chinook salmon fishery in the Kenai River are among the most restrictive of any open waters in Alaska. The river is open to chinook salmon fishing between the outlet of Skilak Lake and Cook Inlet, with the exception of the confluence areas of Slikok Creek, Funny River, Moose River and the Lower Killey River with the Kenai River (Figure 1). The Slikok Creek and Funny River confluence areas are closed until 15 July, the Lower Killey River confluence area is closed from 25 June to 14 July, and the Moose River closure is in effect for the entire chinook salmon fishing season. In addition, the area between Centennial Campground and the Soldotna Bridge is closed to fishing from boats for the entire chinook salmon fishing season (Figure 5). The chinook salmon season legally begins on 1 January, although fish do not enter the river in harvestable numbers until May, and normally closes on 31 July.

The daily bag and possession limit is one chinook salmon per day greater than 41 cm (16 in) long; the seasonal limit is two chinook salmon greater than 41 cm. Anyone retaining a chinook salmon greater than 41 cm long is prohibited from fishing from a boat in the Kenai River downstream of Skilak Lake for the remainder of that day. The early-run fishery is restricted from using bait or treble hooks. The late-run fishery is restricted from using treble hooks. Fishing from boats downstream from the outlet of Skilak Lake is prohibited on Mondays in May and June, except Memorial Day Monday. Mondays in July are open to fishing from unguided drift boats.

There are further restrictions for fishing guides and guided anglers. Guided anglers are only allowed to fish from 0600 to 1800 hours. Guided anglers are prohibited from fishing on Sundays and Mondays with the exception of Kid's Fishing Day (Sunday, 20 May) and Memorial Day (Monday, 28 May). Lastly, guides are prohibited from personally engaging in fishing while conducting clients.

OBJECTIVES

Objectives for the 2001 study were to:

1. Estimate harvest and catch for the early- and late-run inriver sport fishery between the Warren Ames and Soldotna bridges. Desired relative precision of these estimates for each fishery is $\pm 20\%$ of the true values 95% of the time.
2. Estimate angler effort for the early- and late-run inriver sport fishery between the Warren Ames and Soldotna bridges. Desired relative precision of these estimates for each fishery is $\pm 10\%$ of the true values 95% of the time.
3. Estimate the proportion by age and sex groups of the chinook salmon harvest such that the estimates during each 3-week time strata in the early run and each 2-week time strata in the late run are within 10 percentage points of the true values 95% of the time.
4. Estimate the proportion by age and sex groups of the chinook salmon inriver return such that the estimates during each three week time interval are within 10 percentage points of the true values 95% of the time.

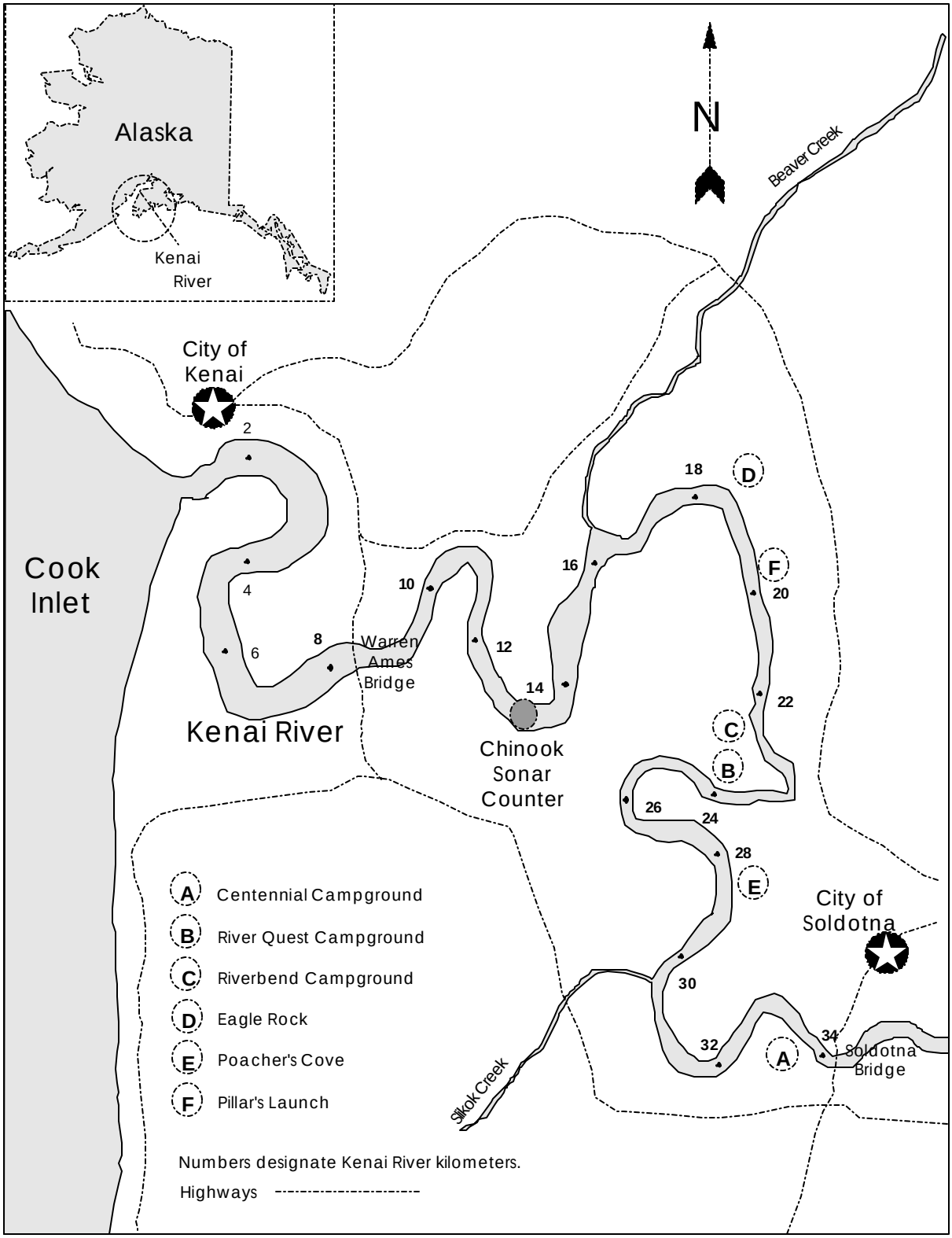


Figure 5.-Study area for the Kenai River creel survey, 2001.

In addition to the objectives outlined above the project is responsible for completing the following tasks:

1. Examine chinook salmon sampled from the sport harvest, commercial harvest and the inriver return for presence of the adipose fin;
2. Estimate the daily CPUE (catch per unit effort), by species, for the inriver netting crew; and
3. Estimate the proportion of fish within the insonified zone of the chinook salmon sonar counter that are chinook salmon.

METHODS

CREEL SURVEY

A stratified, two-stage roving-access creel survey (Bernard et al. 1998a, 1998b) was utilized to estimate sport fishing effort, and catch and harvest of chinook salmon from the Warren Ames Bridge (rm 5, rkm 8) to the Soldotna Bridge (rm 21, rkm 34) (Figure 5). The creel survey began on 16 May 2001 and continued through 31 July 2001. The first stage unit was days. The unguided angler day was 20 h long (0400 to 2400 hours) while the guided angler day was 12 h long (0600 to 1800 hours). The entire fishing day was sampled to minimize problems with length-of-stay bias (Bernard et al. 1998b). Daily catch and harvest[2] were estimated as the product of effort and CPUE or HPUE (harvest per unit effort). The second stage unit for estimating angler effort was periodic angler counts. The second stage unit for estimating CPUE or HPUE was angler trips, sampled by conducting completed-trip angler interviews.

Stratification accounted for the geographical, temporal and regulatory factors affecting the fishery. Since significant harvest below the sonar site would affect the sonar and escapement estimates, angler counts were geographically stratified into two areas: (1) between the Soldotna Bridge and the chinook salmon sonar site and (2) between the chinook salmon sonar site and the Warren Ames Bridge. Angler interviews did not include this level of stratification because past attempts to estimate catch and harvest below the sonar site were ineffective and unnecessary (Reimer et al. 2002).

Harvest and catch rates can differ by time intervals and between weekdays and weekend/holidays (J. Hasbrouck, Alaska Department of Fish and Game [ADF&G], Anchorage, personal communication). Therefore, the creel survey was temporally stratified into weekly time intervals and by day type (weekdays, weekends/holidays and Mondays).

Although both unguided and guided anglers participate in the Kenai River chinook salmon fishery, current regulations allow guided anglers to fish only between 0600 to 1800 hours and close the fishery to guided anglers on Sundays and Mondays. Further, catch rates can be significantly different between guided and unguided anglers (J. Hasbrouck, ADF&G, Anchorage, personal communication). Therefore, both angler counts and angler interviews were post-stratified by angler type.

Based upon these factors, the following strata were used for conducting angler counts and estimating creel statistics:

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[2] Harvest refers to fish caught and retained by anglers as part of their creel. Catch refers to fish caught and retained plus those reported as released by anglers, but not those fish that escaped before being brought to the boat.

Geographic	2 strata	upstream and downstream of the chinook sonar site (counts only)
Temporal	12 strata	weekly
Day Type	2-3 strata	weekday, weekend/holiday and Monday
Angler Type	2 strata	guided and unguided

During the early run, every legal fishing day was sampled, and each day comprised its own stratum (74 total). During the late run every weekend day, every holiday (Wednesday, 4 July), every Monday and 3 of 4 weekdays per week were sampled, creating 30 strata.

In addition to creel survey data collection, Secchi disc measurements were made twice daily at rm 15.6. The daily average reflects water clarity and is incorporated into a historical database.

Angler Counts

Four angler counts were conducted during each sampled day. The first count began at a randomly chosen time (0400, 0500, 0600, 0700, or 0800 hours) with the remaining counts done every 5 hours thereafter. The schedule ensured at least two guided-angler counts (between 0600-1800 hours) per day. Some deviations from the schedule occurred due to unforeseen circumstances.

Counts were conducted from a boat between the Soldotna Bridge and the Warren Ames Bridge. The starting point of each count (upstream or downstream end of the survey area) was chosen at random subject to the following constraint. Since Centennial Campground was at the far upstream end of the survey area, any count that was preceded by an interview period at Centennial Campground was done downstream and any count that was followed by an interview period at Centennial Campground was done upstream. Anglers were counted while driving the boat at a constant rate of speed through the survey area. The entire count usually required about 45 minutes and every effort was made to ensure that the trip was completed in less than 1 hour. Angler counts were treated as if they were instantaneous and reflected fishing effort at the time the count began. Anglers were considered fishing if the angler's line was in the water or the angler was rigging his/her line when the count was conducted. Boats were counted as fishing if the boat contained at least one angler. Nine "tally-whackers" were used to sum the following categories for each geographic stratum: (1) unguided power boats, (2) unguided drift boats, (3) guided power boats, (4) guided drift boats, (5) unguided anglers in power boats, (6) unguided anglers in drift boats, (7) guided anglers in power boats (excluding the guide), (8) guided anglers in drift boats (excluding the guide), and (9) shore anglers.

Angler Interviews

Anglers who had completed fishing were interviewed at the following boat launches:

A. Centennial Campground
B. River Quest RV Park
C. Riverbend Campground
D. Eagle Rock Launch Area
E. Poacher's Cove
F. Pillar's Launch Area.

Centennial Campground, Eagle Rock Launch Area, and Riverbend are not accessible in low water and were not initially sampled. Sampling began on 8 June at Centennial Campground, on 10 June at Riverbend Campground and on 2 July at Eagle Rock Launch Area. Each launch was added to the sampling schedule immediately after significant boat traffic was observed there.

There were four or five time intervals per day during which interviews could be conducted, three intervals between consecutive angler counts, plus additional intervals before the first count and/or after the last count. When there were more interview periods than accessible boat launches (16 May to 10 June), each launch was chosen once before any launch was repeated in the daily schedule. When there were more accessible boat launches than interview periods (11 June to 31 July), access location was chosen without replacement from the number available. Subject to the constraint below, time and boat launch were paired randomly.

Experience has shown that, with completely random assignment of interview periods to access locations, insufficient numbers of guided anglers may be interviewed when effort is low. Since guided anglers more frequently used Centennial, River Quest and Pillar's boat launches in 2000 and are only allowed to fish between 0600-1800 hours, we imposed the following constraint on the interviewing schedule. If the random assignment of access locations to time intervals did not allow at least 2 hours of interview time between 1000 and 1900 at either Centennial, River Quest or Pillar's, then the access locations and times were re-randomized until the constraint was met.

The following information was recorded for each interviewed angler: (1) time of interview, (2) boat or shore angler, (3) guided or unguided angler, (4) number of hours spent fishing downstream of the Soldotna bridge (to the nearest 0.5 hour), (5) number of fish harvested by species, and (6) number of fish released by species. Hours spent fishing included time when an angler's line was in the water or being rigged but not travel time or time after an angler had harvested a fish.

This year's study design differed from previous years in that only three technicians were employed, and each technician was responsible for both angler counts and angler interviews[3]. This redesign allowed less interview time per day, but an increase in sampling days[4]. Preseason analysis indicated that the loss of precision within days (from the decrease in interview time) would be offset by a gain in precision between days (from the increased number of sampling days). Loss of one boat count per day was projected to have very little effect on the precision of the effort, catch or harvest estimates.

Age, Sex, and Length of the Recreational Harvest

Harvested chinook salmon were sampled for age, sex, and length (ASL) during angler interviews. Sex was identified from external characteristics and MEF length was measured to the nearest half centimeter. Three scales were removed from the preferred area of each fish and placed on an adhesive coated card (Clutter and Whitesel 1956; Welander 1940). Acetate impressions of the scales were read with a microfiche reader to age the fish. Sport-harvest ASL samples were stratified into two 3-week strata in the early run (16 May-8 June and 9-30 June) and into two 2-week strata in the late run (1-15 July and 16-31 July). The sample goal was 150 fish for each stratum, sufficient to achieve the desired relative precision assuming 15% of the scales could not be aged (Thompson 1987).

Additionally, harvested fish were inspected for an adipose fin clip indicating the fish had received a coded wire tag as a juvenile. Coded wire tags help estimate the stock contribution of harvested Kenai River chinook salmon (King and Breakfield 1998). If an adipose fin clip was

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[3] In past years, four technicians were employed; two technicians were responsible for boat counts and two technicians were responsible for angler interviews. This allowed for five boat counts a day (versus four in 2001), and 20 h of interview time per day (versus approximately 15 h per day in 2001). Also, technicians responsible for angler interviews traveled by truck in 2000 (technicians traveled by boat in 2001).

[4] In past years, 4 days per week were sampled. In 2001, 6 days per week were sampled.

found, and permission was granted from the angler, the fish's head was removed for coded wire tag recovery.

INRIVER GILLNETTING

The inriver gillnetting program was designed to collect ASL samples of the inriver return, and estimate the daily netting CPUE, by species. An additional objective, new in 2001, was to estimate the proportion of fish within the insonified zone of the chinook salmon sonar counter that were chinook salmon (Reimer et al. 2002).

Inriver sampling occurred for 8 hours daily from 15 May until 10 August. The daily sampling schedule was constrained by the tidal influence at the study site, which makes drifting the net unfeasible during rising and high tide stages. The daily sampling schedule was 4 hours before to 4 hours after low tide, excluding hours of darkness (2300-0400 hours). During each day one low tide was sampled.

Chinook salmon were captured with 7.5 in mesh nylon gillnets. Each net was 10 fathoms (60 ft) long and 55 meshes deep. The mesh color was dark green, and was three strand, twisted nylon (cable-lay nylon). All nets used to collect ALS and CPUE data were the same color, size and mesh.

Each drift was positioned to sample fish that would pass through the insonified river channel (i.e. 15 m offshore from the right-bank transducer to 10 m offshore from the left-bank transducer). The drift area began immediately downstream from the sonar transducers (rm 8.6) and ended 0.75 mi downstream (rm 7.9). As the boat drifted downstream from the sonar transducers, and the effective insonified area became difficult to define, the net was drifted in the deepest channel. Drifts were terminated when a chinook salmon was captured or the end of the drift area was reached. If the net was pulled before reaching the end of the study area, the next drift began at the approximate river mile where the previous drift was terminated. Markers were placed onshore every 0.1 mi in the study area to help the crew identify and record their location. For each set the start and stop time (to the nearest minute) and location (river mile to the nearest 0.1 mile) were recorded. When fish were caught the number captured by species was recorded.

Water clarity and level were recorded at the beginning, end, and midpoint of each shift. Water level was a relative measure using a staff gauge at the sonar site. Water clarity was measured near the staff gauge each day with a Secchi disk.

Age, Sex, and Length of the Inriver Return

Chinook salmon captured in gillnets were untangled from the net and placed in a tagging cradle (Larson 1995) for ASL sampling prior to release. Inriver return ASL samples were handled and recorded in the same manner as those from the creel survey. To prevent resampling a recaptured fish, a hole punch mark was placed in the caudal or dorsal fin. Fish captured by the inriver gillnetting program were also checked for adipose fin clips. If an adipose fin clip was found, the fish was killed and the head removed for coded wire tag recovery. Sampling was stratified into two 3-week strata during each run with a 150 fish sample-size goal for each stratum. Strata for the early run were 16 May-8 June and 9-30 June; strata for the late run were 1-23 July and 24 July-15 August. Sockeye salmon were also measured for MEF length.

Estimates of the age, sex, and length composition from these data may be somewhat biased due to size selectivity by gillnets; however, we believe the bias to be relatively small. Some studies have detected no difference in the probability of capture by these nets due to length and

attributed differences in the age and length composition between the recreational harvest and gillnet samples to selectivity by anglers for larger (thus older) fish (Conrad and Larson 1987; Conrad 1988; Alexandersdottir and Marsh 1990). Carlon and Alexandersdottir (1989) concluded that the size selectivity of the inriver gillnet program differed from that of the recreational harvest, but the difference was small.

Multiple Mesh Pilot Study

Analyses of 1998-2000 data indicated that the netting data may be most useful as an index of species composition rather than abundance (Reimer et al. 2002). Preliminary findings suggested that catches from a single mesh size (7.5 in) would provide unbiased estimates of species composition. However, during the course of the 2001 season, several things led us to believe that more than one mesh size would be needed. First, we no longer had confidence in a previous analysis, which indicated that the 7.5 in gear captured sockeye and chinook salmon with equal efficiency. Second, net selectivity estimates from other projects suggested that chinook salmon would be captured more effectively than sockeye salmon in 7.5 in gear. Finally, the proportion of chinook salmon in the nets was highly variable.

Conversely, multiple mesh sizes could increase mortality of captured fish and create logistical difficulties inherent with fishing more than one gillnet from a small boat. Therefore a small pilot study was conducted in early August to test the feasibility of using multiple nets. To that end, two new nets were purchased with the same length, depth and hanging ratio as the 7.5 in mesh net (10 hung fathoms long, 2 to 1 hanging ratio and ~30 foot stretch depth) but with the following differing specifications:

1. 5.125 in multi-fiber, 70 meshes deep, R44 color (clear-steel blue), SMS38 twine.
2. 8.5 in multi-fiber, 45 meshes deep, clear-brown color, MS93 twine.

We had originally planned to drift three mesh sizes (5.125 in, 7.5 in and 8.5 in), alternating between sizes, from one boat. We were successful in alternating between two net sizes, by stacking each net on either the starboard or port side of the boat, but keeping three nets untangled in one boat was very difficult.

In light of the aforementioned difficulties, the 5.125 in net and the 8.5 in net were fished on 2 August, 7 August and 8 August during times when the regular inriver gillnetting crew was fishing. By fishing concurrently, we were able to make direct comparisons between the regular gillnetting program and the pilot study. The 5.125 in and 8.5 in nets were drifted within the insonified area, as defined above, but only between rm 8.6 and rm 8.1. Each net was set toward one bank of the river and drifted downstream until either rm 8.1 was reached, the net had caught several fish, or the net was drifting out of the channel. At that point the net would be pulled and reset at the upstream end of the study area. Two drifts (one starting on each bank) were completed with each mesh size before switching to the other. The sequence was repeated until the incoming tide made a downstream drift difficult or impossible. In contrast to the regular netting protocol, when a drift was aborted before river mile 8.1 due to captured fish or the net drifting out of the channel, the net was reset at the upstream end of the study area, not where the previous drift was aborted.

DATA ANALYSIS

Effort, catch, and harvest were estimated separately for guided and unguided anglers using the following procedures.

Angler Effort

The mean number of anglers on day i in stratum h was estimated by:

$$\bar{x}_{hi} = \frac{\sum_{g=1}^{r_{hi}} x_{hig}}{r_{hi}}, \quad (1)$$

where:

x_{hig} = the number of anglers observed in the gth count of day i in stratum h, and

r_{hi} = the number of counts on day i in stratum h.

Angler counts were conducted systematically within each sample day. The variance of the mean angler count was estimated by:

$$\hat{V}(\bar{x}_{hi}) = \frac{\sum_{g=2}^{r_{hi}} \left(x_{hig} - x_{hi(g-1)}\right)^2}{2r_{hi}(r_{hi}-1)}. \quad (2)$$

Effort (angler-hours) during day i in stratum h was estimated by:

$$\hat{E}_{hi} = L_{hi}\bar{x}_{hi}, \quad (3)$$

where:

L_{hi} = length of the sample day (20 hours for unguided anglers, 12 hours for guided anglers).

The within-day variance (effort) was estimated by:

$$\hat{V}(\hat{E}_{hi}) = L_{hi}^2 \hat{V}(\bar{x}_{hi}). \quad (4)$$

The mean effort of stratum h was estimated by:

$$\bar{E}_h = \frac{\sum_{i=1}^{d_h} \hat{E}_{hi}}{d_h}, \quad (5)$$

where:

d_h = number of days sampled in stratum h.

Days were sampled at random in each stratum; however, every weekend/holiday day was sampled. The sample variance of daily effort for stratum h was estimated by:

$$S_1^2(E)_h = \frac{\sum_{i=1}^{d_h} \left(\hat{E}_{hi} - \bar{E}_h\right)^2}{(d_h - 1)}. \quad (6)$$

Total effort of stratum h was estimated by:

$$\hat{E}_h = D_h \overline{E}_h, \tag{7}$$

where:

D_h = total number of days the fishery was open in stratum h.

The variance of total effort of each stratum in a two-stage design, omitting the finite population correction factor for the second stage, was estimated by (Cochran 1977):

$$\hat{V}\left(\hat{E}_h\right) = (1-f)D_h^2 \frac{S_1^2(E)_h}{d_h} + fD_h^2 \frac{\sum_{i=1}^{d_h} \hat{V}\left(\hat{E}_{hi}\right)}{d_h^2}, \tag{8}$$

where:

f = fraction of days sampled (= d_h / D_h).

Catch and Harvest

Catch and harvest per unit (hour) of effort for day i was estimated from angler interviews using the jackknife method to minimize the bias of these ratio estimators (Efron 1982). The jackknife estimate of CPUE (similarly HPUE) for angler j was:

$$CPUE^*_{hij} = \frac{\sum_{\substack{a=1 \\ a \neq j}}^{m_{hi}} c_{hia}}{\sum_{\substack{a=1 \\ a \neq j}}^{m_{hi}} e_{hia}}, \tag{9}$$

where:

c_{hia} = catch of angler a interviewed on day i in stratum h ,

e_{hia} = effort (hours fished) by angler a interviewed on day i in stratum h , and

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

The jackknife estimate of mean CPUE for day i was the mean of the angler estimates:

$$\overline{CPUE}^*_{hi} = \frac{\sum_{j=1}^{m_{hi}} CPUE^*_{hij}}{m_{hi}}, \tag{10}$$

and the bias corrected mean was:

$$\overline{CPUE}^{**}_{hi} = m_{hi}\left(\overline{CPUE}_{hi} - \overline{CPUE}^*_{hi}\right) + \overline{CPUE}^*_{hi}, \tag{11}$$

where:

$$\overline{CPUE}_{hi} = \frac{\sum_{j=1}^{m_{hi}} c_{hij}}{\sum_{j=1}^{m_{hi}} e_{hij}}.$$

The variance of the jackknife estimate of CPUE was estimated by:

$$\hat{V}\left(\overline{CPUE}^{**}_{hi}\right) = \frac{m_{hi}-1}{m_{hi}} \sum_{j=1}^{m_{hi}} \left(CPUE^{*}_{hij} - \overline{CPUE}^{*}_{hi}\right)^2. \quad (12)$$

Catch during each sample day was estimated as the product of effort and CPUE by:

$$\hat{C}_{hi} = \hat{E}_{hi}\overline{CPUE}^{**}_{hi}, \quad (13)$$

and the variance by (Goodman 1960):

$$\hat{V}\left(\hat{C}_{hi}\right) = \hat{V}\left(\hat{E}_{hi}\right)\left(\overline{CPUE}^{**}_{hi}\right)^2 + \hat{V}\left(\overline{CPUE}^{**}_{hi}\right)\hat{E}^2_{hi} - \hat{V}\left(\hat{E}_{hi}\right)\hat{V}\left(\overline{CPUE}^{**}_{hi}\right). \quad (14)$$

HPUE was estimated by substituting angler harvest for angler catch in equations (9) through (12). Harvest during sample day i was estimated by substituting the appropriate $HPUE_{hi}$ statistics into equations (13) and (14). Total catch and harvest during stratum h was estimated using equations (5) through (8), substituting estimated catch ($\hat{C}_{hi}$) and harvest ($\hat{H}_{hi}$) during sample day i for the estimated effort ($\hat{E}_{hi}$) during day i.

When no interviews from a particular angler type were obtained during a particular day, we lacked CPUE and HPUE estimates to pair with angler count data. On such days we substituted pooled estimates of CPUE and HPUE calculated from interviews obtained during the remaining days within the stratum, or similar strata. A bootstrap procedure was used to estimate the variance introduced by use of imputed values.

The estimates of total effort, catch, and harvest, and their respective variances, were summed across the strata within each run as these estimates were independent. Covariances that arise because angler type was poststratified (i.e., estimates of these strata are not statistically independent) are likely too small to affect the precision of the estimates.

Age and Sex Composition

Age and sex composition of the chinook salmon harvest and inriver return were estimated for each run. The proportion of chinook salmon in age/sex group b in stratum t was estimated as:

$$\hat{p}_{bt} = \frac{n_{bt}}{n_t}, \quad (15)$$

where:

n_{bt} = the number of fish of age/sex group b sampled during stratum t, and

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

The variance of $\hat{p}_{bt}$ was estimated as (Scheaffer et al. 1979):

$$\hat{V}(\hat{p}_{bt}) = \frac{\hat{p}_{bt}(1-\hat{p}_{bt})}{(n_t - 1)}. \quad (16)$$

If age/sex composition did not differ significantly ($P<0.05$) among strata, the proportion of chinook salmon in age/sex group b during an entire run, and its variance, was estimated by pooling data across strata (equations 15-16 ignoring stratum subscripts t).

CPUE from Inriver Gillnetting

Daily catch per unit effort r of species s for day i, and its variance were estimated by:

$$\hat{r}_{si} = \frac{\sum_{k=1}^{K_i} c_{sik}}{\sum_{k=1}^{K_i} e_{ik}}, \text{ and} \quad (17)$$

$$\hat{V}(\hat{r}_{si}) = \frac{\sum_{k=1}^{K_i} (c_{sik} - \hat{r}_{si} e_k)^2}{\bar{e}_i^2 K_i (K_i - 1)}, \quad (18)$$

where:

c_{sik} = catch of species s on day i during drift k,

e_k = effort during drift k,

$\bar{e}_i$ = mean effort during day i, and

K_i = number of drifts on day i.

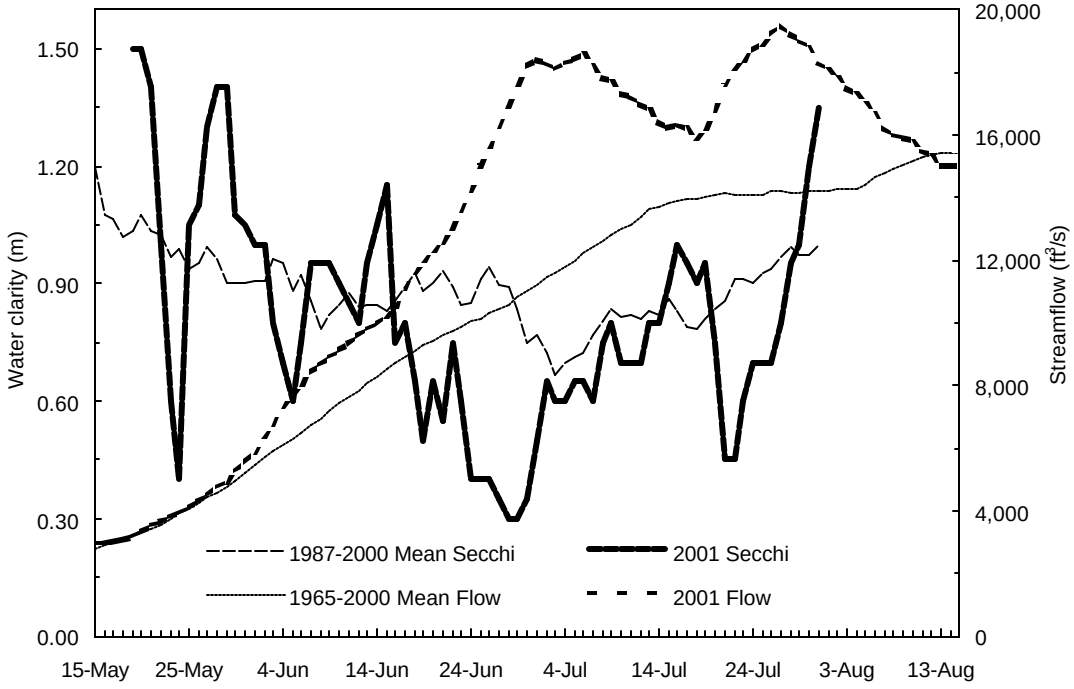
RESULTS

Kenai River water clarity varied around the historic average for much of the season, with the exception of 16 June-15 July where the water clarity was consistently below average (Figure 6). Kenai River flow was above average for all of June and July.

CREEL SURVEY

The creel survey ran from 16 May to 31 July, 2001. The early-run fishery was open 41 days for unguided anglers and 35 days for guided anglers during the sampling period, all of which were sampled (Table 1). During the late-run, the creel survey sampled 27 of the 31 days the fishery was open to unguided anglers and 17 of the 21 days the fishery was open to guided anglers (Table 2). A total of 2,918 angler interviews were conducted, 965 during the early run and 1,953 during the late run (Tables 1 and 2).

Only 1.4% of the early-run anglers and 8.8% of the late-run anglers counted were downstream of the sonar site (Appendices A1 and A2). These percentages are similar to 1996-2000 (Reimer et al. 2002), and are not large enough to create reliable CPUE or HPUE estimates for the area downstream of the chinook salmon sonar.



Notes: 1965-2000 mean flow from United States Geological Survey (USGS, Online a). 2001 flow from United States Geological Survey (USGS, Online b).

Figure 6.-Kenai River water clarity and stream flow.

During the early run, angler counts ranged from 0 to 123 for unguided anglers and from 0 to 309 for guided anglers (Appendix A1). The largest count occurred on 24 June for unguided anglers and on 26 June for guided anglers. During the late run, angler counts ranged from 5 to 920 for unguided anglers and from 146 to 775 for guided anglers (Appendix A2). The largest counts occurred on 24 July for both unguided and guided anglers.

Estimated effort was 70,203 (SE = 2,693) angler-hours during the early run (Table 1) and 236,633 (SE = 8,144) angler-hours during the late run (Table 2). The relative precision of both the early (±7.5%) and late (±6.7%) run effort estimates satisfied the goals for the survey (±10% of the true value 95% of the time). Guided anglers accounted for 66% of the early-run effort and 46% of the late-run effort.

Estimated daily catch rates of early-run chinook salmon ranged from 0 to 0.113 (SE = 0.058) fish per hour for unguided anglers and from 0 to 1.167 (SE = 0.500) fish per hour for guided anglers (Appendices B1 and B2). Peak daily catch rates of early-run chinook salmon occurred on 8 June for unguided anglers and on 18 May for guided anglers. Estimated daily catch rates of late-run chinook salmon ranged from 0.005 (SE = 0.005) to 0.248 (SE = 0.042) fish per hour for unguided anglers and from 0.015 (SE = 0.009) to 0.304 (SE = 0.050) fish per hour for guided anglers (Appendices B3 and B4). Peak daily catch rates of late-run chinook salmon occurred on 29 July for unguided anglers and on 26 July for guided anglers. During both runs, catch rates were generally higher for guided anglers than for unguided anglers.

Table 1.-Estimated effort, catch, and harvest during the early-run Kenai River chinook salmon fishery, 2001.

				Effort		Catch		Harvest	
	n[a]	N[b]	Int.[c]	Estimate	SE	Estimate	SE	Estimate	SE
16 - 20 May									
Guided weekdays	3	3	8	636	68	205	95	205	95
Guided weekends	1	1	10	236	92	0	0	0	0
Unguided weekdays	3	3	13	285	94	0	0	0	0
Unguided weekends	2	2	5	515	128	0	0	0	0
21 - 27 May									
Guided weekdays	4	4	34	3,024	394	18	11	18	11
Guided weekends	1	1	0[d]	840	396	8	9	8	9
Unguided weekdays	4	4	43	1,215	87	52	18	22	14
Unguided weekends	2	2	52	1,803	390	7	7	7	7
28 May - 3 June									
Guided weekdays	4	4	63	3,416	262	96	36	87	35
Guided weekends	2	2	24	1,888	559	28	18	28	18
Unguided weekdays	4	4	26	1,540	133	15	8	10	7
Unguided weekends	3	3	41	2,352	510	0	0	0	0
4 - 10 June									
Guided weekdays	4	4	40	5,264	652	299	94	218	78
Guided weekends	1	1	17	2,016	960	38	30	38	30
Unguided weekdays	4	4	44	1,785	216	87	35	41	23
Unguided weekends	2	2	46	2,080	434	44	23	44	23
11 -17 June									
Guided weekdays	4	4	99	8,288	999	458	113	248	81
Guided weekends	1	1	44	2,454	450	18	13	18	13
Unguided weekdays	4	4	41	2,380	237	23	13	23	13
Unguided weekends	2	2	34	2,720	439	28	28	0	0
18 - 24 June									
Guided weekdays	4	4	87	7,560	845	198	54	198	54
Guided weekends	1	1	16	2,370	594	0	0	0	0
Unguided weekdays	4	4	45	2,745	255	0	0	0	0
Unguided weekends	2	2	31	2,390	519	0	0	0	0
25 - 30 June									
Guided weekdays	4	4	60	6,940	1,159	188	80	188	80
Guided weekends	1	1	8	1,056	444	26	31	26	31
Unguided weekdays	4	4	32	1,810	217	0	0	0	0
Unguided weekends	1	1	2	595	244	0	0	0	0
Subtotals									
Guided weekdays	27	27	391	35,128	1,926	1,461	203	1,162	180
Guided weekends	8	8	119	10,860	1,467	118	49	118	49
Unguided weekdays	27	27	244	11,760	499	177	42	96	31
Unguided weekends	14	14	211	12,455	1,067	80	37	52	25
Totals									
Guided	35	35	510	45,988	2,421	1,580	209	1,280	186
% Guided			53%	66%		86%		90%	
Unguided	41	41	455	24,215	1,178	257	56	148	40
% Unguided			47%	34%		14%		10%	
Early-run Total			965	70,203	2,693	1,837	216	1,428	190

[a] Number of days sampled.

[b] Number of days fishery was open.

[c] Number of interviews conducted during stratum.

[d] Estimates are based on guided interviews from weekdays in the same time stratum.

Table 2.-Estimated effort, catch, and harvest during the late-run Kenai River chinook salmon fishery, 2001.

	n[a]	N[b]	Int.[c]	Effort		Catch		Harvest	
				Estimate	SE	Estimate	SE	Estimate	SE
1 July									
Unguided weekend	1	1	59	3,675	627	136	50	90	40
2 - 8 July									
Guided weekdays	2	3	81	12,507	1,966	1,097	268	895	183
Guided weekends	2	2	44	7,792	1,105	645	153	427	123
Unguided Monday	1	1	38	475	140	38	14	30	12
Unguided weekdays	2	3	52	6,120	1,127	300	106	241	85
Unguided weekends	3	3	132	9,615	1,408	235	76	217	72
9 - 15 July									
Guided weekdays	3	4	126	19,909	2,999	1,383	263	1,021	223
Guided weekends	1	1	25	4,296	894	342	125	264	112
Unguided Monday	1	1	48	830	247	110	37	73	25
Unguided weekdays	3	4	86	15,173	1,297	900	216	671	176
Unguided weekends	2	2	93	13,755	1,125	848	178	649	154
16 - 22 July									
Guided weekdays	3	4	173	24,152	2,073	2,328	413	1,940	448
Guided weekends	1	1	31	4,912	1,239	74	47	74	47
Unguided Monday	1	1	49	1,395	142	227	46	140	23
Unguided weekdays	3	4	102	17,113	1,586	836	182	481	137
Unguided weekends	2	2	132	12,107	1,966	143	60	119	55
23 - 29 July									
Guided weekdays	3	4	86	25,824	3,603	4,174	939	2,594	612
Guided weekends	1	1	91	4,350	726	579	123	480	106
Unguided Monday	1	1	84	1,180	100	93	20	33	10
Unguided weekdays	3	4	109	26,147	3,747	2,003	636	1,023	235
Unguided weekends	2	2	100	11,395	1,521	2,232	434	1,510	350
30 - 31 July									
Guided weekdays	1	1	75	5,496	1,109	671	167	545	139
Unguided Monday	1	1	73	2,120	357	85	28	63	19
Unguided weekdays	1	1	64	6,295	1,146	273	116	156	57
Subtotals									
Guided weekdays	12	16	541	87,888	5,601	9,654	1,105	6,995	823
Guided weekends	5	5	191	21,350	2,021	1,640	238	1,245	203
Unguided Monday	5	5	292	6,000	489	553	70	339	42
Unguided weekdays	12	16	413	70,848	4,563	4,311	713	2,571	340
Unguided weekends	10	10	516	50,547	3,134	3,593	482	2,586	395
Totals									
Guided	17	21	732	109,238	5,954	11,294	1,130	8,240	848
% Guided			37%	46%		57%		60%	
Unguided	27	31	1,221	127,395	5,557	8,458	864	5,496	523
% Unguided			63%	54%		43%		40%	
Late-run Total			1,953	236,633	8,144	19,752	1,422	13,736	996

[a] Number of days sampled.

[b] Number of days fishery was open.

[c] Number of interviews conducted during stratum.

An estimated 1,428 (SE = 190) chinook salmon were harvested during the early run (Table 1). Unguided anglers harvested 10% of the total and guided anglers harvested the remaining 90%. The estimated catch of early-run chinook was 1,837 (SE = 216), meaning 22% of the catch was released. The relative precision for total harvest and catch (±26.1% and ±23.0%, respectively) failed to satisfy the project goals (±20% of the true value 95% of the time). The creel survey has failed to meet the relative precision goals in the past when fishery restrictions limited angler effort. In 2001, there were no fishery restrictions but effort was very low compared to the historic average, and our inability to meet the objective had more to do with lack of anglers to interview than it did with insufficient sampling time.

An estimated 13,736 (SE = 996) chinook salmon were harvested during the late run (Table 2). Unguided anglers accounted for 40% of the harvest compared to 60% for guided anglers. The estimated catch of chinook salmon was 19,752 (SE = 1,422). Approximately 30% of the catch was released during the late run. The relative precision for total harvest and catch (±14.2% and ±14.1%, respectively) satisfied the desired levels of precision (±20% of the true value 95% of the time).

The 2001 season marks the third year that unguided anglers have been allowed to fish from drift boats on Mondays in July. For this group of anglers, catch, harvest and effort have increased each year (Figure 7), but represented only 2.5%, 2.8% and 2.5% of the late-run totals, respectively, in 2001.

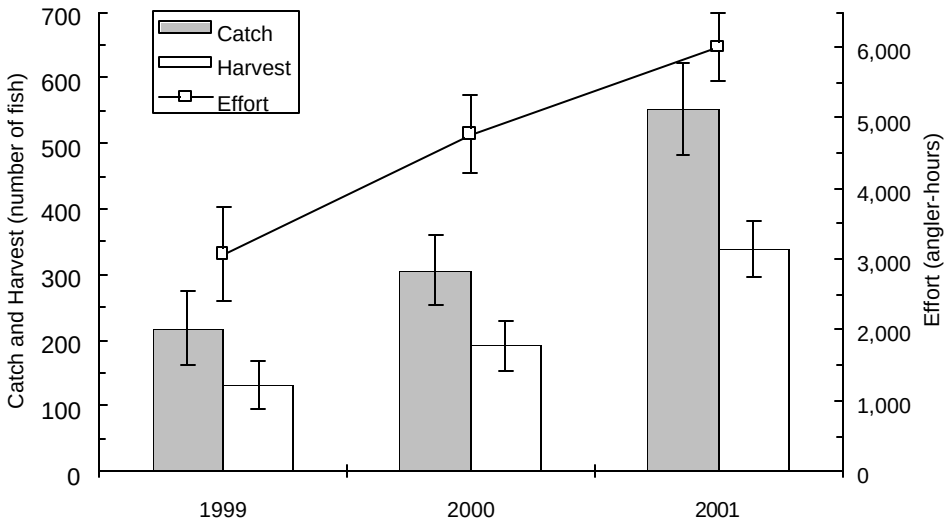
Age, Sex, and Length of the Recreational Harvest

During the early-run, the age composition of the sampled harvest did not differ significantly between temporal strata (χ^2 = 2.426; df = 2, P = 0.297). The most abundant age class in the early-run harvest was age-1.4 fish, which comprised 67.6% (SE = 5.6%) of the total sampled harvest (Table 3). The other predominant age classes were age-1.2 (12.7%, SE = 4.0%) and age-1.3 fish (16.9%, SE = 4.5%). The sample size goal was not met for either strata of the early-run harvest. Consequently, the estimates of sex proportion and age-1.3 and age-1.4 proportions failed to meet relative precision goals in both strata.

The age composition of the late-run harvest differed (χ^2 = 10.922, df = 2, P = 0.004) between temporal strata (1–15 July, 16-31 July) with age-1.2, age-1.3 and age-1.4 fish considered (96% of the sample). The most abundant ages were age-1.4 fish, age-1.3 fish and age-1.2 fish (Table 4). The sample size goals and the relative precision goals for estimates of age and sex proportion were met for both strata in the late-run harvest.

INRIVER GILLNETTING

During the early run, we captured a total of 435 salmon during inriver gillnetting, 259 chinook salmon and 176 sockeye salmon. Daily CPUE ranged from 0 to 0.059 chinook salmon per minute drifted (Appendix C1). The ratio of chinook salmon to total salmon captured ranged from 0 to 1.00, the mean value was 0.64 (Appendix C1). During the late run a total of 532 salmon were captured during inriver gillnetting, 312 chinook salmon and 208 sockeye salmon. Daily CPUE ranged from 0 to 0.096 chinook salmon per minute drifted (Appendix C2). The ratio of chinook salmon to total salmon captured ranged from 0.11 to 1.00, the mean value was 0.66 (Appendix C2).



Error bars show +/- 1 standard deviation

Figure 7.-Monday unguided drift boat catch, harvest and angler effort, 1999-2001.

Table 3.-Age composition and mean length-at-age (mid-eye to fork in millimeters) for the sport harvest of early-run Kenai River chinook salmon, 2001.

	Age					
Parameter	0.2	1.2	1.3	1.4	1.5	Total
Female						
MEF		642	804	973		916
SE MEF		15	17	11		19
Sample size		4	6	31		41
Percent		5.6%	8.5%	43.7%		57.7%
SE Percent		2.8%	3.3%	5.9%		5.9%
Male						
MEF	550	632	859	1,002	1,115	901
SE MEF		24	28	14		30
Sample size	1	5	6	17	1	30
Percent	1.4%	7.0%	8.5%	23.9%	1.4%	42.3%
SE Percent	1.4%	3.1%	3.3%	5.1%	1.4%	5.9%
Combined						
Sample size	1	9	12	48	1	71
Percent	1.4%	12.7%	16.9%	67.6%	1.4%	100.0%
SE Percent	1.4%	4.0%	4.5%	5.6%	1.4%	0.0%

Table 4.-Age composition and mean length-at-age (mid-eye to fork in millimeters) for the sport harvest of late-run Kenai River chinook salmon, 2001.

	Age						
Parameter	1.1	1.2	1.3	1.4	1.5	2.1	Total
1 July-15 July							
Female							
MEF	405	663	868	993	1,156		944
SE MEF		17	17	6			14
Sample size	1	8	8	65	1		83
Percent	0.6%	5.1%	5.1%	41.1%	0.6%		52.5%
SE Percent	0.6%	1.7%	1.7%	3.9%	0.6%		4.0%
Male							
MEF	418	653	838	1,040			863
SE MEF	9	13	22	9			24
Sample size	4	21	13	37			75
Percent	2.5%	13.3%	8.2%	23.4%			47.5%
SE Percent	1.3%	2.7%	2.2%	3.4%			4.0%
Combined							
Sample size	5	29	21	102	1		158
Percent	3.2%	18.4%	13.3%	64.6%	0.6%		100.0%
SE Percent	1.4%	3.1%	2.7%	3.8%	0.6%		0.0%
16 July-31 July							
Female							
MEF		605	867	995			964
SE MEF			13	6			8
Sample size		1	26	92			119
Percent		0.4%	11.3%	40.0%			51.7%
SE Percent		0.4%	2.1%	3.2%			3.3%
Male							
MEF	403	658	828	1,028	1,144	410	942
SE MEF	18	16	15	7	12		17
Sample size	2	16	12	74	6	1	111
Percent	0.9%	7.0%	5.2%	32.2%	2.6%	0.4%	48.3%
SE Percent	0.6%	1.7%	1.5%	3.1%	1.1%	0.4%	3.3%
Combined							
Sample size	2	17	38	166	6	1	230
Percent	0.9%	7.4%	16.5%	72.2%	2.6%	0.4%	100.0%
SE Percent	0.6%	1.7%	2.5%	3.0%	1.1%	0.4%	0.0%

Age, Sex, and Length of the Inriver Return

For the early-run inriver return, there was no significant difference in the age composition between temporal strata (χ^2 = 2.459, df = 2, P = 0.293). The most abundant age class was age-1.4 fish, which made up 53.0% (SE = 3.6%) of the inriver return (Table 5). Age-1.3 (27.8%, SE = 3.2%) and age-1.2 (16.2%, SE = 2.6%) were the next largest contributors. The sample size goal was not met for either strata of the early-run inriver return, and while the estimates of sex proportion and age-1.3 and age-1.4 proportions failed to meet the relative precision goal in the 15 May-8 June stratum, the age and sex proportion relative precision goals were satisfied in the 9-30 June stratum.

Table 5.-Age composition and mean length-at-age (mid-eye to fork in millimeters) for the inriver return of early-run Kenai River chinook salmon, 2001.

	Age					
Parameter	0.3	1.2	1.3	1.4	1.5	Total
Female						
MEF	775	631	832	967	1,090	912
SE MEF	35	16	10	8	20	12
Sample size	2	5	23	58	2	90
Percent	1.0%	2.5%	11.6%	29.3%	1.0%	45.5%
SE Percent	0.7%	1.1%	2.3%	3.2%	0.7%	3.5%
Male						
MEF		655	797	1,033	1,125	870
SE MEF		6	10	11	15	17
Sample size		27	32	47	2	108
Percent		13.6%	16.2%	23.7%	1.0%	54.5%
SE Percent		2.4%	2.6%	3.0%	0.7%	3.5%
Combined						
Sample size	2	32	55	105	4	198
Percent	1.0%	16.2%	27.8%	53.0%	2.0%	100.0%
SE Percent	0.7%	2.6%	3.2%	3.6%	1.0%	0.0%

During the late run, the age composition of the inriver return differed between time strata (χ^2 = 8.36, df =2, P = 0.015). The most abundant ages were age-1.4 fish, age-1.3 fish and age-1.2 fish (Table 6). The sample size goal was met in the 1-23 July stratum but not met in the 24 July-10 August stratum. Regardless, the relative precision goals for the estimates of sex and age proportion were met for both strata of the late-run inriver return.

Analysis-of-variance (ANOVA) was used to test for differences in mean length-at-age by sex, run, and sample for the 1.2, 1.3 and 1.4 age classes. A separate ANOVA was conducted for each age class. The age-1.2 ANOVA model was insignificant (F = 0.79; df = 7, 110; P = 0.6) indicating sex, run and sample do not explain any of the variance in length-at-age of this age class. For age-1.3 fish, the run, sex and the interactions run*sex and sex*sample were significant at P = 0.05 (Table 7). Late-run age-1.3 fish were on average 3.1 cm longer than early-run age-1.3 fish, while age-1.3 females were on average 4.4 cm longer than age-1.3 males. The significant interactions did not contradict the significant main effects. For age-1.4 fish, run and sex were significant at P = 0.05 (Table 7). Late-run age-1.4 fish were on average 2.0 cm longer than early-run age-1.4 fish, while age-1.4 males were on average 4.2 cm longer than age-1.4 females.

Multiple Mesh Pilot Study

Table 8 compares catch and CPUE for the 5.125 in, 7.5 in and 8.5 in gillnets on each day they were simultaneously fished. Multi-fiber gillnets had in excess of one order of magnitude larger CPUE than the cable-lay nylon gillnet for many species and days. The effect of net selectivity is clearly shown in the species proportion data, the larger the mesh size the larger the chinook salmon proportion. The performance of a program using two multi-fiber gillnets versus that of a program using one cable-lay nylon gillnet is also noted in Table 8. With two mesh sizes and

multi-fiber mesh, we could expect to conduct more sets per day, catch more fish per set, but fish fewer minutes per day. Presumably, the CPUE information would be more precise as well, since the standard errors from the multi-fiber nets are a smaller fraction of the estimate than for the cable-lay net. Also, the chinook salmon proportion seems more stable, although the data are limited.

Table 6.-Age composition and mean length-at-age (mid-eye to fork in millimeters) for the inriver return of late-run Kenai River chinook salmon, 2001.

	Age				
Parameter	1.2	1.3	1.4	1.5	Total
1 July - 23 July					
Female					
MEF	660	876	1,004	1,108	971
SE MEF	50	16	6	38	11
Sample size	3	16	61	3	83
Percent	1.7%	9.1%	34.7%	1.7%	47.2%
SE Percent	1.0%	2.2%	3.6%	1.0%	3.8%
Male					
MEF	670	804	1,024	1,170	889
SE MEF	10	14	9	20	18
Sample size	25	18	48	2	93
Percent	14.2%	10.2%	27.3%	1.1%	52.8%
SE Percent	2.6%	2.3%	3.4%	0.8%	3.8%
Combined					
Sample size	28	34	109	5	176
Percent	15.9%	19.3%	61.9%	2.8%	100.0%
SE Percent	2.8%	3.0%	3.7%	1.3%	0.0%
24 July - 10 August					
Female					
MEF	730	908	1,001	1,050	985
SE MEF		13	8		10
Sample size	1	5	36	1	43
Percent	1.2%	6.2%	44.4%	1.2%	53.1%
SE Percent	1.2%	2.7%	5.6%	1.2%	5.6%
Male					
MEF	665	805	1,063	1,100	975
SE MEF	5	25	13		25
Sample size	2	10	25	1	38
Percent	2.5%	12.3%	30.9%	1.2%	46.9%
SE Percent	1.7%	3.7%	5.2%	1.2%	5.6%
Combined					
Sample size	3	15	61	2	81
Percent	3.7%	18.5%	75.3%	2.5%	100.0%
SE Percent	2.1%	4.3%	4.8%	1.7%	0.0%

Table 7.-Analysis of variance for length of age-1.3 and age-1.4 fish by run, sex and sample.

Source	df	Sum of Squares	Mean Square	F-value	P
Age-1.3					
Model	7	168,617	24,088	6.74	<0.0001
Error	167	596,553	3,572		
Run[a]	1	16,936	16,936	4.74	0.0309
Sex[b]	1	15,625	15,625	4.37	0.0380
Run*Sex	1	32,019	32,019	8.96	0.0032
Sample[c]	1	3,984	3,984	1.12	0.2925
Run*Sample	1	883	883	0.25	0.6197
Sex*Sample	1	32,520	32,520	9.1	0.0030
Run*Sex*Sample	1	3,541	3,541	0.99	0.3209
Age-1.4					
Model	7	323,811	46,259	13.99	<0.0001
Error	583	1,928,135	3,307		
Run	1	47,728	47,728	14.43	0.0002
Sex	1	166,523	166,523	50.35	<0.0001
Run*Sex	1	3,258	3,258	0.99	0.3213
Sample	1	9,099	9,099	2.75	0.0977
Run*Sample	1	776	776	0.23	0.6284
Sex*Sample	1	6,529	6,529	1.97	0.1605
Run*Sex*Sample	1	9,738	9,738	2.94	0.0867

[a] Early run or late run.

[b] Male or female.

[c] Recreational harvest (creel survey) or inriver return (inriver gillnetting).

The multi-mono nets caught a few age-1.2 fish, which may be underrepresented in the catches from the 7.5 in nylon net (Table 9). We did not obtain a large enough sample to perform a valid test for a difference in age composition.

A primary concern of any proposed change in the existing netting program is increasing mortality of the fish that are caught. The multi-fiber material is considerably more abrasive than cable-lay nylon and with increased catch comes increased time to pick the net and increased stress for the fish. In the pilot study, one of the 25 chinook salmon caught was accidentally killed because the multi-fiber mesh got behind the gill plate as the fish struggled. This occurred in the 8.5 in mesh. Of the 57 sockeye and coho salmon caught, mortality was 14 fish, or 24.6%. Most of these deaths were the result of the fish being left in the net for too long, not from injuries sustained to the gills. However, as we gained experience picking the new nets and handling several fish per drift, the percentage of sockeye and coho salmon mortalities decreased, from 42.86% on 2 August to 29.41% on 7 August to 11.54% on 8 August.

Table 8.-Catch, CPUE and species proportion of three mesh sizes and two mesh types during a pilot study, August 2001.

Date	Mesh Size	Type	Sets	Minutes	Chinook			Sockeye			Coho			Total All Species			Ratio Chinook/ Total[a]	
					Num.	CPUE	SE	Num.	CPUE	SE	Num.	CPUE	SE	Num.	CPUE	SE		SE
8/2/2001	5.125 in	multi-fiber	9	47	7	0.150	0.048	8	0.171	0.120	6	0.129	0.066	21	0.450	0.186	0.333	0.098
	7.5 in	nylon	11	152	1	0.007	0.007	0	0	0	0	0	0	1	0.007	0.007	1.000	0.000
	8.5 in	multi-fiber	4	28	1	0.036	0.036	0	0	0	0	0	0	1	0.036	0.036	1.000	0.000
8/7/2001	5.125 in	multi-fiber	6	41	3	0.073	0.032	5	0.122	0.029	11	0.268	0.123	19	0.462	0.118	0.158	0.086
	7.5 in	nylon	10	101	2	0.020	0.013	0	0	0	1	0.010	0.014	3	0.030	0.015	0.667	0.287
	8.5 in	multi-fiber	6	46	8	0.173	0.065	1	0.022	0.023	0	0	0	9	0.195	0.077	0.889	0.099
8/8/2001	5.125 in	multi-fiber	6	42	1	0.024	0.024	1	0.024	0.022	20	0.475	0.205	22	0.523	0.192	0.045	0.054
	7.5 in	nylon	9	112	0	0	0	0	0	0	1	0.009	0.009	1	0.009	0.009	0	0
	8.5 in	multi-fiber	4	25	5	0.201	0.063	0	0	0	5	0.201	0.172	10	0.401	0.232	0.500	0.141
Multi-fiber Totals																		
8/2/2001	5.125 in+8.5 in	multi-fiber	13	75	8	0.107	0.035	8	0.107	0.075	6	0.080	0.042	22	0.294	0.122	0.364	0.103
8/7/2001	5.125 in+8.5 in	multi-fiber	12	87	11	0.126	0.040	6	0.069	0.024	11	0.126	0.066	28	0.321	0.073	0.393	0.144
8/8/2001	5.125 in+8.5 in	multi-fiber	10	67	6	0.090	0.036	1	0.015	0.014	25	0.373	0.147	32	0.478	0.143	0.188	0.093
Nylon Totals																		
8/2/2001	7.5 in	nylon	11	152	1	0.007	0.007	0	0	0	0	0	0	1	0.007	0.007	1.000	0.000
8/7/2001	7.5 in	nylon	10	101	2	0.020	0.013	0	0	0	1	0.010	0.014	3	0.030	0.015	0.667	0.287
8/8/2001	7.5 in	nylon	9	112	0	0	0	0	0	0	1	0.009	0.009	1	0.009	0.009	0	0

[a] Ratio of the number of chinook salmon to the total number of all species.

Table 9.-Age composition of chinook salmon caught in multi-fiber mesh and nylon mesh during a pilot study in the Kenai River, August 2001.

	Mesh Size		
	5.125 in and 8.5 in[a]	7.5 in[b]	Total
Age-1.2			
Cell Frequency	3	0	3
% of Sample	6.98	0	
% of Column	14.29	0	
Age-1.3			
Cell Frequency	3	6	9
% of Sample	6.98	13.95	
% of Column	14.29	27.27	
Age-1.4			
Cell Frequency	15	16	31
% of Sample	34.88	37.21	
% of Column	71.43	72.73	
Total	21	22	43

[a] Sampled on 2, 7 and 8 August 2001. Multi-fiber mesh.

[b] Sampled on 2-10 August 2001. Nylon mesh.

DISCUSSION AND RECOMMENDATIONS

During the 2001 early run, angler effort below the Soldotna Bridge was 35% less than the 1977-2000 historical average of 107,482 angler hours, while harvest below the Soldotna Bridge was 66% less than the 1976-2000 historical average of 4,158 chinook salmon. During the 2001 late run, angler effort below the Soldotna Bridge was greater than the 1977-2000 historical average of 216,890 angler hours by 9%. Harvest below the Soldotna Bridge was 74% more than the 1976-2000 historical average of 7,894 chinook salmon and 38% more than the 1991-2000 average of 9,971 chinook salmon, making it the fourth highest on record.

The 2001 season was the first year the creel survey used a three-person crew. Despite missing many of the early-run relative precision and sample size objectives, the new schedule was more efficient. The 2001 early-run creel survey obtained 10.8% and 15.5% more interviews per unit of recreational angler effort than it did in 1999 and 2000, respectively. The 2001 late-run creel survey obtained 13.3% and 9.4% more interviews per unit of recreational angler effort than it did in 1999 and 2000, respectively.

Inriver gillnetting continues to provide essential data on age and sex compositions of the inriver return. In addition, CPUE and chinook salmon proportion estimates obtained from gillnetting provide useful information for validating estimates of inriver abundance of chinook salmon obtained by sonar (Miller et al. 2003). The ratio of chinook salmon CPUE to total CPUE showed considerable day to day variability (Figure 8) and could be improved by increasing the sample size (catches).

CREEL SURVEY RECOMMENDATIONS

We recommend the following modifications for the creel survey.

1. Further reduce the creel crew to a two-person crew sampling 4 days per week.

   A two-person creel would sample both weekends and 2 of the 4 weekdays (Tuesday-Friday). Sampling would be dropped on Mondays (unguided drift boats only) in the late run. We believe this is feasible because drift Monday total catch harvest and effort was less than 3% of the late-run total in 2001. In addition, permanent staff would index angler effort on Mondays in July such that large changes would be noted. Simulation results suggest that the relative precision goals for angler effort, catch and harvest would be obtained in the late run. In a season with low effort, similar to 2001, the relative precision goals for angler effort, catch and harvest would continue to not be satisfied in the early run (S. J. Fleischman, ADF&G, Anchorage, personal communication). This change to the creel survey is driven by budget constraints and should provide the required data for inseason management at a reduced cost to the department.

2. Consider concentrating sampling effort at Pillar's Launch Area in May and early June.

   Due to the difficulty in obtaining interviews in the early run and restricted access to many launches due to low water, a disproportionate number of anglers used Pillar's Launch in May 2001 (Table 10). In 2002, to increase the number of interviews, a sampling design that concentrates more sampling effort at Pillar's Launch should be considered. Anglers using Pillar's Launch in May were, in general, more successful than their counterparts at other access locations. Thus, a design that oversampled Pillar's could introduce a positive bias to harvest estimates (S. J. Fleischman, ADF&G, Anchorage, personal communication). Further investigation is required to develop a weighted estimator that will provide more interviews in May without introducing unnecessary bias.

3. Begin interviews after the first randomly scheduled count is completed.

   The 2001 season is the first season where time of the interview was recorded. Analysis of the data shows that only 2.06% of the angler interviews were conducted before 0800 hours. By beginning interviews after the first boat count is over, we should retain ~77% of the interviews before 0800 hours while making the creel survey more efficient and economical. The possibility of bias was examined by looking at the 2001 data. Only unguided interviews were conducted before 0800, and of those the interviewees from 0400-0659 hours were less successful than average while the interviewees from 0700-0759 hours were more successful than average (S. J. Fleischman, ADF&G, Anchorage, personal communication). The mean CPUE for all interviews before 0800 hours was very close to the overall mean.

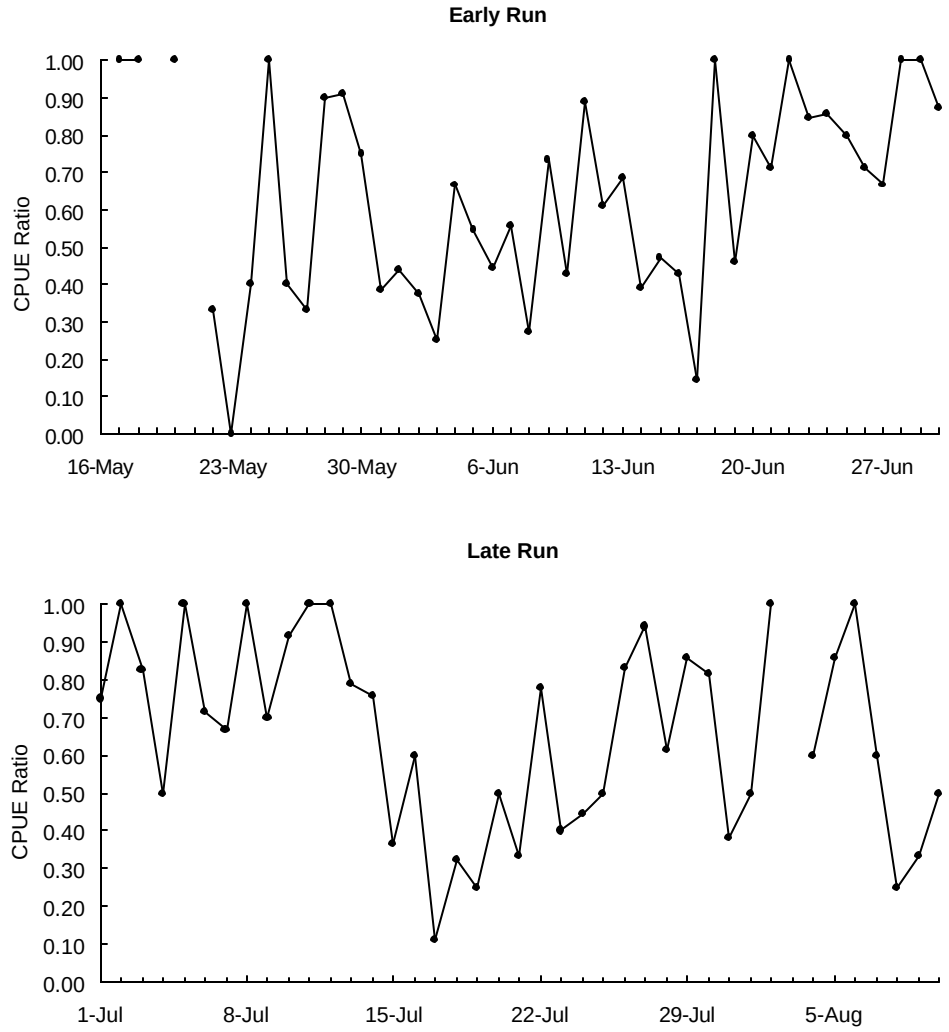


Figure 8.-Ratio of chinook salmon CPUE to total CPUE during inriver gillnetting in the early and late runs, Kenai River, 2001.

INRIVER GILLNETTING RECOMMENDATIONS

We recommend the following for the inriver gillnetting program.

1. Use 5 in and 7.5 in multi-mono gillnets sampled with equal frequency to apportion the unfiltered sonar estimates and collect chinook ASL.

   While the effect of size selectivity can be roughly seen in the catch data (Table 8), the most striking difference is the improved catch of the multi-fiber gillnets regardless of size. Part of this difference is attributable to the mesh material, while part is attributable to the mesh color. The clear-steel blue color (R44) was the most appropriate for the Kenai River. The magnitude of the increased catch and CPUE may not be the same in May, June and July as it was in August.

Table 10.-Number of interviews conducted by access location and month, Kenai River chinook salmon creel survey, 2001.

Access Location	Month			Total
	May	June	July	
Centennial (sampling began on 6/8)				
Cell Frequency	Not	32	63	95
Percent Row	Sampled	33.68	66.32	9.99
Percent Column		13.91	10.08	
Eagle Rock (sampling began on 7/2)				
Cell Frequency	Not	Not	118	118
Percent Row	Sampled	Sampled	100	12.41
Percent Column			18.88	
Pillars				
Cell Frequency	77	109	244	430
Percent Row	17.91	25.35	56.74	45.22
Percent Column	80.21	47.39	39.04	
Poacher's				
Cell Frequency	12	24	47	83
Percent Row	14.46	28.92	56.63	8.73
Percent Column	12.50	10.43	7.52	
River Bend (sampling began on 6/10)				
Cell Frequency	Not	19	75	94
Percent Row	Sampled	20.21	79.79	9.88
Percent Column		8.26	12.00	
Riverquest				
Cell Frequency	7	46	78	131
Percent Row	5.34	35.11	59.54	13.77
Percent Column	7.29	20.00	12.48	
Total				
Cell Frequency	96	230	625	951
Percent Column	10.09	24.19	65.72	100

With regard to selectivity, simulation results suggest that a combination of 5 in and 7.5 in mesh fished with equal sampling time should have an approximately flat selectivity curve over the range of chinook and sockeye salmon sizes seen in the Kenai River (S. J. Fleischman, ADF&G, Anchorage, personal communication). Both mesh sizes, 5 in for sockeye and 7.5 in for chinook, are slightly small for their directed species. Use of such gear should minimize mortality by reducing the number of fish captured past their gill plates.

A primary concern with fishing multi-fiber mesh is that we will catch too many fish and too much of the shift will be spent picking fish from the nets, or mortality will become a problem. The easiest way to combat this would be to set some sort of quasi-objective criteria for when to pull the net (e.g. 5-10 fish), such that a good sample size would be obtained with each drift without swamping the net. This would also ensure the fish could be picked and returned to the water quickly, thus minimizing injury and mortality.

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APPENDIX A. BOAT ANGLER COUNTS DURING THE KENAI RIVER CHINOOK SALMON FISHERY, 2001

Appendix A1.-Guided and unguided boat angler counts, by geographic strata, during the early-run Kenai River chinook salmon fishery, 2001.

		Downstream								Upstream								Combined Strata								%
	Day	Unguided Anglers				Guided Anglers				Unguided Anglers				Guided Anglers				Unguided Anglers				Guided Anglers				Down-
Date	Type[a]	A[b]	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	stream
5/16	wd	0	0	0	0	0	0	0		1	5	0	0	22	13	6		1	5	0	0	22	13	6		0.0%
5/17	wd	0	0	0	0	0	0	0		4	2	3	8	24	30	27		4	2	3	8	24	30	27		0.0%
5/18	wd	0	0	0	0	0	0	0		2	15	17	0	23	10	4		2	15	17	0	23	10	4		0.0%
5/19	we/hol	0	0	0	0	0	0	0		23	19	12	0	34	25	0		23	19	12	0	34	25	0		0.0%
5/20	we/hol	0	0	0	0					0	25	16	8					0	25	16	8					0.0%
5/21	Mon.																									
5/22	wd	0	0	0	0	0	0	0		19	9	14	23	71	90	18		19	9	14	23	71	90	18		0.0%
5/23	wd	0	0		0	0	0			11	9	16	6	72	47			11	9	16	6	72	47			0.0%
5/24	wd	0	0	4	0		0	0		11	10	9	18		72	37		11	10	13	18		72	37		2.5%
5/25	wd	0	0	0	0	0	0	0		20	25	19	20	90	94	51		20	25	19	20	90	94	51		0.0%
5/26	we/hol		0	0	0		0	0			37	27	43		103	37			37	27	43		103	37		0.0%
5/27	we/hol	0	0	0	0					21	100	55	42					21	100	55	42					0.0%
5/28	Mon.		0	0	0		0	0			66	21	22		119	27			66	21	22		119	27		0.0%
5/29	wd	0		0	0	0		0		23		10	5	76		53		23		10	5	76		53		0.0%
5/30	wd	0	0	0	0		0	0		9	23	15	17		67	53		9	23	15	17		67	53		0.0%
5/31	wd	0	0	0	0	0	0	0		15	31	21	18	59	81	27		15	31	21	18	59	81	27		0.0%
6/1	wd	0	0	0	0		0	0		16	23	38	35		108	101		16	23	38	35		108	101		0.0%
6/2	we/hol	0	0	0	0	0	0	0		53	25	66	33	96	73	84		53	25	66	33	96	73	84		0.0%
6/3	we/hol	0	2	0	0					12	75	59	0					12	77	59	0					1.4%
6/4	Mon.																									
6/5	wd	0	5	0	0	0	0	0		49	22	15	8	163	144	58		49	27	15	8	163	144	58		1.1%
6/6	wd	0	0	0	0		0	0		23	6	18	19		90	32		23	6	18	19		90	32		0.0%
6/7	wd	0	16	0	0	0	12			33	3	39	7	144	106			33	19	39	7	144	118			7.8%
6/8	wd	0	0	0	0		0	0		19	23	22	30		161	89		19	23	22	30		161	89		0.0%
6/9	we/hol	0	0	0	0		0	13		13	92	38	53		248	75		13	92	38	53		248	88		2.4%
6/10	we/hol	0	0	3	0					83	76	43	15					83	76	46	15					1.4%
6/11	Mon.																									
6/12	wd	0	0	0	0	0	0			46	12	10	12	296	176			46	12	10	12	296	176			0.0%
6/13	wd	0	0	0	0	0	0	2		31	26	18	29	215	114	64		31	26	18	29	215	114	66		0.4%
6/14	wd		2	0	0		1	0		9	42	37	44		157	116		9	44	37	44		158	116		0.7%

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		Downstream								Upstream								Combined Strata								%
	Day	Unguided Anglers				Guided Anglers				Unguided Anglers				Guided Anglers				Unguided Anglers				Guided Anglers				Down-
Date	Type[a]	A[b]	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	stream
6/15	wd	0	0	4	0		12	0		38	52	40	24		217	143		38	52	44	24		229	143		3.0%
6/16	we/hol	0	7	0	3		31	0		58	56	120	47		211	167		58	63	120	50		242	167		5.9%
6/17	we/hol	9	0	0	0					100	83	51	10					109	83	51	10					3.6%
6/18	Mon.																									
6/19	wd	0	0	0	0	0	17	0		33	43	45	18	303	183	90		33	43	45	18	303	200	90		2.3%
6/20	wd	0	2	0	0	0	0	0		32	28	39	19	188	113	75		32	30	39	19	188	113	75		0.4%
6/21	wd	0	0	0	0		4	0		34	30	25	34		182	100		34	30	25	34		186	100		1.0%
6/22	wd	0	0	4	0		0	7		40	27	22	74		189	132		40	27	26	74		189	139		2.2%
6/23	we/hol	0	0	3	0	0	0			47	53	93	33	247	148			47	53	96	33	247	148			0.5%
6/24	we/hol	2	0	0	0					70	123	38	16					72	123	38	16					0.8%
6/25	Mon.																									
6/26	wd	0	0	0	0	0	0			51	22	42	22	309	133			51	22	42	22	309	133			0.0%
6/27	wd	0	0	2	0	0	0	0		39	14	19	12	179	101	54		39	14	21	12	179	101	54		0.5%
6/28	wd	0	0	0	0		0	0		8	19	15	15		160	108		8	19	15	15		160	108		0.0%
6/29	wd	7	3	0	0	4	0			23	27	15	7	123	97			30	30	15	7	127	97			4.6%
6/30	we/hol	0	0	0	0		10	0		9	35	61	14		115	51		9	35	61	14		125	51		3.4%

[a] wd = weekday, we/hol = weekend/holiday, Mon.=Monday.

[b] Angler count timeframes: A = 0400-0859 hours, B = 0900-1359 hours, C = 1400-1959 hours, D = 2000-2359 hours.

Appendix A2.-Guided and unguided boat angler counts, by geographic strata, during the late-run Kenai River chinook salmon fishery, 2001.

		Downstream								Upstream								Combined Strata								%
	Day	Unguided Anglers				Guided Anglers				Unguided Anglers				Guided Anglers				Unguided Anglers				Guided Anglers				Down-
Date	Type[a]	A[b]	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	stream
7/1	we/hol	6	9	11	0					155	217	232	105					161	226	243	105					3.5%
7/2	Mon.[c]	0	0	0	0					47	19	24	5					47	19	24	5					0.0%
7/3	wd	8	2	0	0	2	23			121	72	71	22	317	207			129	74	71	22	319	230			4.1%
7/4	wd	0	2	1	0	0	0	0		132	102	65	63	384	328	146		132	104	66	63	384	328	146		0.2%
7/5	wd																									
7/6	wd	2	3	8	6	0	0	0		142	81	140	138	566	462	233		144	84	148	144	566	462	233		1.1%
7/7	we/hol	2	1	4	9	0	0	12		213	173	121	159	539	373	166		215	174	125	168	539	373	178		1.6%
7/8	we/hol	0	9	24	0					192	400	137	114					192	409	161	114					3.8%
7/9	Mon.[c]	0		0	0					37		59	34					37		59	34					0.0%
7/10	wd	0	14	10	0		8	28		228	277	115	98		587	228		228	291	125	98		595	256		3.8%
7/11	wd	0	9	8	16		12	62		147	197	117	210		553	330		147	206	125	226		565	392		6.4%
7/12	wd																									
7/13	wd	30	12	6	19	80	12	84		230	176	136	221	396	216	233		260	188	142	240	476	228	317		13.1%
7/14	we/hol	12	31	28	35	50	23	84		288	323	243	302	446	227	244		300	354	271	337	496	250	328		11.3%
7/15	we/hol	23	33	31	15					402	487	317	181					425	520	348	196					6.9%
7/16	Mon.[c]	0	0	0	0					55	82	82	60					55	82	82	60					0.0%
7/17	wd																									
7/18	wd	27	35	14	0	62	99			282	186	223	79	519	378			309	221	237	79	581	477			12.4%
7/19	wd	0	22	18	7		111	38		156	191	205	94		457	429		156	213	223	101		568	467		11.3%
7/20	wd	0	16	9	14		72	0		257	277	184	271		517	337		257	293	193	285		589	337		5.7%
7/21	we/hol	34	32	0	0	8	29	0		361	190	167	144	665	304	222		395	222	167	144	673	333	222		4.8%
7/22	we/hol		46	2	9						559	302	202						605	304	211					5.1%
7/23	Mon.[c]	0			8					54			56					54			64					6.8%
7/24	wd	12	45	25	3		51	110		908	356	161	261		724	313		920	401	186	264		775	423		8.3%
7/25	wd																									
7/26	wd	12	25	11	0	24	19	40		308	176	139	240	614	411	347		320	201	150	240	638	430	387		5.5%
7/27	wd	15	57	36	55		46	115		320	283	254	220		656	243		335	340	290	275		702	358		14.1%
7/28	we/hol		25	44	43		73	71		56	275	162	131		350	231		56	300	206	174		423	302		17.5%
7/29	we/hol	69	185	49	18					461	336	294	131					530	521	343	149					20.8%
7/30	Mon.[c]	0	0	0	0					73	145	126	80					73	145	126	80					0.0%
7/31	wd	60	62	55	90	110	108	76		363	142	174	313	578	266	236		423	204	229	403	688	374	312		0.21306

[a] wd = weekday, we/hol = weekend/holiday, Mon. = Monday.

[b] Angler count timeframes: A = 0400-0859 hours, B = 0900-1359 hours, C = 1400-1959 hours, D = 2000-2359 hours.

[c] Unguided drift boats only.

APPENDIX B. DAILY EFFORT, CATCH AND HARVEST ESTIMATES FOR THE KENAI RIVER CHINOOK SALMON FISHERY, 2001

Appendix B1.-Daily statistics for unguided boat anglers during the early-run Kenai River chinook salmon fishery, 2001.

	Day		Mean		Effort		Catch				Harvest			
Date	Type[a]	Counts	Count	Int.[b]	Est.	SE	Est.	SE	CPUE	SE	Est.	SE	HPUE	SE
5/16	wd	4	2	0[c]	30	26	0	0	0.000	0.000	0	0	0.000	0.000
5/17	wd	4	4	5	85	22	0	0	0.000	0.000	0	0	0.000	0.000
5/18	wd	4	9	8	170	88	0	0	0.000	0.000	0	0	0.000	0.000
5/19	we/hol	4	14	2	270	59	0	0	0.000	0.000	0	0	0.000	0.000
5/20	we/hol	4	12	3	245	113	0	0	0.000	0.000	0	0	0.000	0.000
5/22	wd	4	16	22	325	59	4	4	0.012	0.013	4	4	0.012	0.013
5/23	wd	4	11	8	210	50	13	9	0.063	0.044	13	9	0.063	0.044
5/24	wd	4	13	0[c]	260	24	10	10	0.037	0.040	5	11	0.019	0.042
5/25	wd	4	21	13	420	32	25	12	0.061	0.027	0	0	0.000	0.000
5/26	we/hol	3	36	10	713	109	0	0	0.000	0.000	0	0	0.000	0.000
5/27	we/hol	4	55	42	1,090	375	7	7	0.007	0.007	7	7	0.007	0.007
5/28	we/hol	3	36	21	727	260	0	0	0.000	0.000	0	0	0.000	0.000
5/29	wd	4	12	2	235	50	0	0	0.000	0.000	0	0	0.000	0.000
5/30	wd	4	16	13	320	66	15	8	0.046	0.024	10	7	0.030	0.021
5/31	wd	4	21	9	425	78	0	0	0.000	0.000	0	0	0.000	0.000
6/1	wd	4	28	2	560	69	0	0	0.000	0.000	0	0	0.000	0.000
6/2	we/hol	4	44	15	885	243	0	0	0.000	0.000	0	0	0.000	0.000
6/3	we/hol	4	37	5	740	366	0	0	0.000	0.000	0	0	0.000	0.000
6/5	wd	4	25	17	495	106	9	9	0.018	0.018	9	9	0.018	0.018
6/6	wd	4	17	0[c]	330	85	12	18	0.037	0.057	7	10	0.021	0.030
6/7	wd	4	25	20	490	164	13	8	0.027	0.015	9	7	0.018	0.013
6/8	wd	4	24	7	470	37	53	27	0.113	0.058	17	18	0.036	0.039
6/9	we/hol	4	49	20	980	395	12	12	0.012	0.013	12	12	0.012	0.013
6/10	we/hol	4	55	26	1,100	178	33	20	0.030	0.018	33	20	0.030	0.018
6/12	wd	4	20	8	400	139	0	0	0.000	0.000	0	0	0.000	0.000
6/13	wd	4	26	10	520	59	0	0	0.000	0.000	0	0	0.000	0.000
6/14	wd	4	34	21	670	148	23	13	0.035	0.018	23	13	0.035	0.018
6/15	wd	4	40	2	790	105	0	0	0.000	0.000	0	0	0.000	0.000
6/16	we/hol	4	73	21	1,455	369	0	0	0.000	0.000	0	0	0.000	0.000
6/17	we/hol	4	63	13	1,265	237	28	28	0.022	0.022	0	0	0.000	0.000
6/19	wd	4	35	7	695	118	0	0	0.000	0.000	0	0	0.000	0.000
6/20	wd	4	30	5	600	90	0	0	0.000	0.000	0	0	0.000	0.000
6/21	wd	4	31	10	615	45	0	0	0.000	0.000	0	0	0.000	0.000
6/22	wd	4	42	23	835	203	0	0	0.000	0.000	0	0	0.000	0.000
6/23	we/hol	4	57	7	1,145	312	0	0	0.000	0.000	0	0	0.000	0.000
6/24	we/hol	4	62	24	1,245	415	0	0	0.000	0.000	0	0	0.000	0.000
6/26	wd	4	34	20	685	165	0	0	0.000	0.000	0	0	0.000	0.000
6/27	wd	4	22	7	430	112	0	0	0.000	0.000	0	0	0.000	0.000
6/28	wd	4	14	4	285	48	0	0	0.000	0.000	0	0	0.000	0.000
6/29	wd	4	21	1	410	69	0		0.000	0.000	0		0.000	0.000
6/30	we/hol	4	30	2	595	244	0	0	0.000	0.000	0	0	0.000	0.000

[a] wd = weekdays, we/hol = weekends/holidays.

[b] Interviews.

[c] On days with no interviews, pooled estimates of CPUE and HPUE from other days in the stratum were used.

Appendix B2.-Statistics for daily guided boat anglers during the early-run Kenai River chinook salmon fishery, 2001.

Date	Day Type[a]	Counts	Mean Count	Int.[b]	Effort Est.	Effort SE	Catch Est.	Catch SE	Catch CPUE	Catch SE	Harvest Est.	Harvest SE	Harvest HPUE	Harvest SE
5/16	wd	3	14	3	164	39	5	7	0.032	0.042	5	7	0.032	0.042
5/17	wd	3	27	3	324	23	27	27	0.083	0.083	27	27	0.083	0.083
5/18	wd	3	12	2	148	50	173	91	1.167	0.500	173	91	1.167	0.500
5/19	we/hol	3	20	10	236	92	0	0	0.000	0.000	0	0	0.000	0.000
5/22	wd	3	60	10	716	258	0	0	0.000	0.000	0	0	0.000	0.000
5/23	wd	2	60	0	714	150	6	7	0.009	0.009	6	7	0.009	0.009
5/24	wd	2	55	18	654	210	11	8	0.017	0.012	11	8	0.017	0.012
5/25	wd	3	78	6	940	150	0	0	0.000	0.000	0	0	0.000	0.000
5/26	we/hol	2	70	0[c]	840	396	8	8	0.009	0.009	8	8	0.009	0.009
5/28	we/hol	2	73	8	876	552	19	16	0.021	0.015	19	16	0.021	0.015
5/29	wd	2	65	5	774	138	15	17	0.019	0.022	15	17	0.019	0.022
5/30	wd	2	60	33	720	84	44	13	0.061	0.017	35	12	0.049	0.015
5/31	wd	3	56	10	668	202	13	14	0.019	0.021	13	14	0.019	0.021
6/1	wd	2	105	15	1,254	42	24	25	0.019	0.020	24	25	0.019	0.020
6/2	we/hol	3	84	16	1,012	88	9	10	0.009	0.009	9	10	0.009	0.009
6/5	wd	3	122	15	1,460	305	53	33	0.036	0.022	34	27	0.024	0.018
6/6	wd	2	61	6	732	348	55	40	0.076	0.047	25	28	0.035	0.039
6/7	wd	2	131	0[c]	1,572	156	73	57	0.047	0.036	58	48	0.037	0.031
6/8	wd	2	125	19	1,500	432	117	50	0.078	0.025	100	45	0.067	0.024
6/9	we/hol	2	168	17	2,016	960	38	30	0.019	0.014	38	30	0.019	0.014
6/12	wd	2	236	15	2,832	720	172	84	0.061	0.026	87	60	0.031	0.020
6/13	wd	3	132	13	1,580	387	140	62	0.088	0.034	79	46	0.050	0.027
6/14	wd	2	137	36	1,644	252	58	23	0.035	0.013	49	21	0.030	0.012
6/15	wd	2	186	35	2,232	516	88	35	0.040	0.013	33	20	0.015	0.008
6/16	we/hol	2	205	44	2,454	450	18	13	0.007	0.005	18	13	0.007	0.005
6/19	wd	3	198	26	2,372	522	32	23	0.013	0.009	32	23	0.013	0.009
6/20	wd	3	125	17	1,504	291	64	31	0.043	0.019	64	31	0.043	0.019
6/21	wd	2	143	22	1,716	516	40	27	0.023	0.015	40	27	0.023	0.015
6/22	wd	2	164	22	1,968	300	61	27	0.031	0.013	61	27	0.031	0.013
6/23	we/hol	2	198	16	2,370	594	0	0	0.000	0.000	0	0	0.000	0.000
6/26	wd	2	221	22	2,652	1,056	120	66	0.045	0.019	120	66	0.045	0.019
6/27	wd	3	111	23	1,336	315	18	13	0.013	0.009	18	13	0.013	0.009
6/28	wd	2	134	15	1,608	312	19	19	0.012	0.012	19	19	0.012	0.012
6/29	wd	2	112	0	1,344	180	32	36	0.024	0.027	32	36	0.024	0.027
6/30	we/hol	2	88	8	1,056	444	26	31	0.025	0.030	26	31	0.025	0.030

[a] wd = weekdays, we/hol = weekends/holidays.

[b] Interviews.

[c] On days with no interviews, pooled estimates of CPUE and HPUE from other days in the stratum were used.

Appendix B3.-Daily statistics for unguided boat anglers during the late-run Kenai River chinook salmon fishery, 2001.

Date	Day Type[a]	Counts	Mean Count	Int.[b]	Effort		Catch				Harvest			
					Est.	SE	Est.	SE	CPUE	SE	Est.	SE	HPUE	SE
7/1	we/hol	4	184	59	3,675	627	136	50	0.037	0.012	90	40	0.024	0.010
7/2	Mon.[c]	4	24	38	475	140	38	14	0.080	0.020	30	12	0.063	0.018
7/3	wd	4	74	36	1,480	301	81	35	0.055	0.021	81	35	0.055	0.021
7/4	we/hol	4	91	17	1,825	193	44	27	0.024	0.015	44	27	0.024	0.015
7/6	wd	4	130	16	2,600	359	118	74	0.046	0.028	79	60	0.030	0.023
7/7	we/hol	4	171	50	3,410	314	36	26	0.010	0.007	36	26	0.010	0.007
7/8	we/hol	4	219	65	4,380	1,359	155	66	0.035	0.011	137	61	0.031	0.011
7/9	Mon.[c]	4	42	48	830	247	110	37	0.132	0.023	73	25	0.088	0.017
7/10	wd	4	186	38	3,710	733	298	104	0.080	0.024	192	78	0.052	0.019
7/11	wd	4	176	24	3,520	581	104	58	0.030	0.016	78	50	0.022	0.014
7/13	wd	4	208	24	4,150	531	272	98	0.066	0.022	233	91	0.056	0.021
7/14	we/hol	4	316	34	6,310	486	273	100	0.043	0.015	170	80	0.027	0.013
7/15	we/hol	4	372	59	7,445	1,014	575	147	0.077	0.017	480	132	0.064	0.015
7/16	Mon.[c]	4	70	49	1,395	142	227	46	0.163	0.028	140	23	0.100	0.013
7/18	wd	4	212	46	4,230	741	245	78	0.058	0.016	155	62	0.037	0.013
7/19	wd	4	173	26	3,465	551	227	101	0.065	0.027	89	65	0.026	0.019
7/20	wd	4	257	30	5,140	574	155	80	0.030	0.015	116	70	0.023	0.013
7/21	we/hol	4	232	53	4,640	747	24	24	0.005	0.005	0	0	0.000	0.000
7/22	we/hol	3	373	79	7,467	1,819	119	55	0.016	0.006	119	55	0.016	0.006
7/23	Mon.[c]	2	59	84	1,180	100	93	20	0.079	0.016	33	10	0.028	0.008
7/24	wd	4	443	58	8,855	2,315	936	362	0.106	0.031	304	126	0.034	0.011
7/26	wd	4	228	19	4,555	644	223	125	0.049	0.027	223	125	0.049	0.027
7/27	wd	4	310	32	6,200	214	343	105	0.055	0.017	240	90	0.039	0.015
7/28	we/hol	4	184	60	3,680	1,075	318	114	0.086	0.019	215	80	0.058	0.014
7/29	we/hol	4	386	40	7,715	1,075	1,915	419	0.248	0.042	1,295	341	0.168	0.038
7/30	Mon.[c]	4	106	73	2,120	357	85	28	0.040	0.012	63	19	0.030	0.008
7/31	wd	4	315	64	6,295	1,146	273	116	0.043	0.017	156	57	0.025	0.008

[a] wd = weekdays, we/hol = weekends/holidays, Mon.=Mondays.

[b] Interviews.

[c] Drift boats only.

Appendix B4.-Daily statistics for guided boat anglers during the late-run Kenai River chinook salmon fishery, 2001.

Date	Day Type[a]	Counts	Mean Count	Int.[b]	Effort		Catch				Harvest			
					Est.	SE	Est.	SE	CPUE	SE	Est.	SE	HPUE	SE
7/3	wd	2	275	56	3,294	534	285	74	0.086	0.018	272	72	0.082	0.018
7/4	we/hol	3	286	20	3,432	660	276	91	0.081	0.022	213	86	0.062	0.023
7/6	wd	3	420	25	5,044	871	447	171	0.089	0.031	325	125	0.064	0.022
7/7	we/hol	3	363	24	4,360	887	369	123	0.085	0.023	214	89	0.049	0.018
7/10	wd	2	426	61	5,106	2,034	369	162	0.072	0.015	295	133	0.058	0.014
7/11	wd	2	479	37	5,742	1,038	359	111	0.062	0.016	276	96	0.048	0.014
7/13	wd	3	340	28	4,084	913	310	111	0.076	0.022	195	87	0.048	0.019
7/14	we/hol	3	358	25	4,296	894	342	125	0.080	0.025	264	112	0.062	0.023
7/18	wd	2	529	46	6,348	624	881	181	0.139	0.025	848	179	0.134	0.025
7/19	wd	2	518	59	6,210	606	498	102	0.080	0.015	372	89	0.060	0.013
7/20	wd	2	463	68	5,556	1,512	367	118	0.066	0.012	235	84	0.042	0.010
7/21	we/hol	3	409	31	4,912	1,239	74	47	0.015	0.009	74	47	0.015	0.009
7/24	wd	2	599	32	7,188	2,112	701	270	0.098	0.025	493	197	0.069	0.019
7/26	wd	3	485	16	5,820	736	1,768	365	0.304	0.050	902	384	0.155	0.064
7/27	wd	2	530	38	6,360	2,064	661	245	0.104	0.020	551	213	0.087	0.019
7/28	we/hol	2	363	91	4,350	726	579	123	0.133	0.018	480	106	0.110	0.016
7/31	wd	3	458	75	5,496	1,109	671	167	0.122	0.018	545	139	0.099	0.016

[a] wd = weekdays, we/hol = weekends/holidays.

[b] Interviews.

APPENDIX C. INRIVER GILLNETTING DAILY CATCH, CPUE, AND SPECIES PROPORTION DURING THE KENAI RIVER CHINOOK SALMON FISHERY, 2001

Appendix C1.-Inriver gillnetting catch, CPUE and proportion of chinook salmon during the early-run Kenai River chinook salmon fishery, 2001.

			Chinook			Sockeye			Total All Species			Ratio Chinook/	
Date	Drifts	Minutes	Number	CPUE	SE	Number	CPUE	SE	Number	CPUE	SE	Total[a]	SE
5/16	4	137	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000		
5/17	8	224	1	0.004	0.005	0	0.000	0.000	1	0.004	0.005	1.00	0.00
5/18	11	156	3	0.019	0.013	0	0.000	0.000	3	0.019	0.013	1.00	0.00
5/19	8	233	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000		
5/20	14	269	4	0.015	0.008	0	0.000	0.000	4	0.015	0.008	1.00	0.00
5/21	10	266	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000		
5/22	14	309	1	0.003	0.003	2	0.006	0.004	3	0.010	0.005	0.33	0.28
5/23	5	113	0	0.000	0.000	1	0.009	0.008	1	0.009	0.008	0.00	0.00
5/24	11	218	2	0.009	0.007	3	0.014	0.006	5	0.023	0.008	0.40	0.23
5/25	8	123	3	0.024	0.015	0	0.000	0.000	3	0.024	0.015	1.00	0.00
5/26	16	215	4	0.019	0.009	6	0.028	0.013	10	0.047	0.015	0.40	0.17
5/27	15	288	3	0.010	0.006	6	0.021	0.009	9	0.031	0.010	0.33	0.17
5/28	19	307	9	0.029	0.010	1	0.003	0.003	10	0.033	0.011	0.90	0.10
5/29	17	257	10	0.039	0.012	1	0.004	0.004	11	0.043	0.014	0.91	0.08
5/30	16	279	9	0.032	0.011	3	0.011	0.008	12	0.043	0.012	0.75	0.16
5/31	13	223	5	0.022	0.012	8	0.036	0.015	13	0.058	0.021	0.38	0.15
6/1	16	235	7	0.030	0.011	9	0.038	0.010	16	0.068	0.017	0.44	0.09
6/2	13	224	3	0.013	0.007	5	0.022	0.009	8	0.036	0.009	0.38	0.18
6/3	14	261	3	0.011	0.006	9	0.034	0.014	12	0.046	0.014	0.25	0.14
6/4	15	263	6	0.023	0.011	3	0.011	0.006	9	0.034	0.011	0.67	0.18
6/5	19	271	12	0.044	0.014	10	0.037	0.018	22	0.081	0.024	0.55	0.13
6/6	17	204	8	0.039	0.012	10	0.049	0.015	18	0.088	0.019	0.44	0.11
6/7	18	206	5	0.024	0.010	4	0.019	0.009	9	0.044	0.014	0.56	0.15
6/8	19	285	6	0.021	0.010	16	0.056	0.015	22	0.077	0.020	0.27	0.09
6/9	19	277	11	0.040	0.016	4	0.014	0.007	15	0.054	0.020	0.73	0.08
6/10	22	294	6	0.020	0.011	8	0.027	0.013	14	0.048	0.016	0.43	0.19
6/11	20	285	8	0.028	0.010	1	0.004	0.003	9	0.032	0.011	0.89	0.10
6/12	20	270	11	0.041	0.012	7	0.026	0.013	18	0.067	0.021	0.61	0.11
6/13	21	300	11	0.037	0.013	5	0.017	0.010	16	0.053	0.016	0.69	0.15
6/14	23	296	9	0.030	0.009	14	0.047	0.011	23	0.078	0.017	0.39	0.08
6/15	22	251	8	0.032	0.015	9	0.036	0.012	17	0.068	0.023	0.47	0.12
6/16	16	256	3	0.012	0.006	4	0.016	0.007	7	0.027	0.008	0.43	0.19
6/17	21	319	1	0.003	0.003	6	0.019	0.013	7	0.022	0.013	0.14	0.15
6/18	20	283	7	0.025	0.010	0	0.000	0.000	7	0.025	0.010	1.00	0.00
6/19	20	272	6	0.022	0.008	7	0.026	0.014	13	0.048	0.015	0.46	0.18
6/20	19	217	8	0.037	0.014	2	0.009	0.006	10	0.046	0.016	0.80	0.12
6/21	20	237	5	0.021	0.011	2	0.008	0.006	7	0.030	0.014	0.71	0.16
6/22	23	289	3	0.010	0.006	0	0.000	0.000	3	0.010	0.006	1.00	0.00
6/23	22	226	11	0.049	0.016	2	0.009	0.006	13	0.058	0.019	0.85	0.09
6/24	23	289	6	0.021	0.009	1	0.003	0.003	7	0.024	0.010	0.86	0.14
6/25	23	272	8	0.029	0.012	2	0.007	0.005	10	0.037	0.013	0.80	0.12
6/26	20	246	5	0.020	0.011	2	0.008	0.006	7	0.028	0.015	0.71	0.13
6/27	27	270	4	0.015	0.008	2	0.007	0.005	6	0.022	0.009	0.67	0.20
6/28	17	187	11	0.059	0.015	0	0.000	0.000	11	0.059	0.015	1.00	0.00
6/29	20	243	6	0.025	0.011	0	0.000	0.000	6	0.025	0.011	1.00	0.00
6/30	19	227	7	0.031	0.010	1	0.004	0.004	8	0.035	0.010	0.88	0.12
Total	777	11,372	259	1.040		176	0.688		435	1.728			
Mean	17	247	6	0.023		4	0.015		9	0.038		0.64	

[a] Ratio of the chinook salmon CPUE to total CPUE.

Appendix C2.-Inriver gillnetting catch, CPUE and proportion of chinook salmon during the late-run Kenai River chinook salmon fishery, 2001.

			Chinook			Sockeye			Total All Species			Ratio Chinook/	
Date	Drifts	Minutes	Number	CPUE	SE	Number	CPUE	SE	Number	CPUE	SE	Total[a]	SE
7/1	25	289	6	0.021	0.008	2	0.007	0.007	8	0.028	0.010	0.75	0.21
7/2	22	236	7	0.030	0.013	0	0.000	0.000	7	0.030	0.013	1.00	0.00
7/3	24	241	19	0.079	0.018	4	0.017	0.008	23	0.095	0.022	0.83	0.07
7/4	19	215	4	0.019	0.009	4	0.019	0.011	8	0.037	0.013	0.50	0.20
7/5	18	197	7	0.036	0.015	0	0.000	0.000	7	0.036	0.015	1.00	0.00
7/6	26	248	5	0.020	0.008	2	0.008	0.006	7	0.028	0.009	0.71	0.17
7/7	21	188	8	0.043	0.017	4	0.021	0.017	12	0.064	0.027	0.67	0.18
7/8	25	279	6	0.022	0.008	0	0.000	0.000	6	0.022	0.008	1.00	0.00
7/9	24	275	7	0.025	0.010	3	0.011	0.006	10	0.036	0.012	0.70	0.14
7/10	20	207	11	0.053	0.012	1	0.005	0.005	12	0.058	0.012	0.92	0.08
7/11	24	274	13	0.047	0.011	0	0.000	0.000	13	0.047	0.011	1.00	0.00
7/12	28	258	13	0.050	0.013	0	0.000	0.000	13	0.050	0.013	1.00	0.00
7/13	25	261	19	0.073	0.019	5	0.019	0.009	24	0.092	0.023	0.79	0.08
7/14	27	228	22	0.096	0.021	7	0.031	0.011	29	0.127	0.025	0.76	0.07
7/15	21	238	4	0.017	0.008	7	0.029	0.014	11	0.046	0.016	0.36	0.16
7/16	21	255	12	0.047	0.011	8	0.031	0.011	20	0.078	0.016	0.60	0.10
7/17	25	254	7	0.028	0.011	55	0.217	0.069	62	0.244	0.067	0.11	0.05
7/18	21	179	10	0.056	0.015	21	0.117	0.059	31	0.173	0.060	0.32	0.13
7/19	22	250	3	0.012	0.007	9	0.036	0.015	12	0.048	0.015	0.25	0.14
7/20	23	243	15	0.062	0.015	15	0.062	0.021	30	0.123	0.026	0.50	0.10
7/21	20	220	5	0.023	0.011	10	0.045	0.017	15	0.068	0.018	0.33	0.15
7/22	22	266	7	0.026	0.008	2	0.008	0.005	9	0.034	0.009	0.78	0.15
7/23	23	261	4	0.015	0.007	6	0.023	0.016	10	0.038	0.017	0.40	0.21
7/24	25	244	8	0.033	0.011	10	0.041	0.015	18	0.074	0.018	0.44	0.13
7/25	22	256	7	0.027	0.010	7	0.027	0.009	14	0.055	0.014	0.50	0.13
7/26	24	275	5	0.018	0.007	1	0.004	0.004	6	0.022	0.008	0.83	0.16
7/27	26	236	16	0.068	0.017	1	0.004	0.004	17	0.072	0.018	0.94	0.06
7/28	25	277	8	0.029	0.012	5	0.018	0.009	13	0.047	0.019	0.62	0.10
7/29	26	254	12	0.047	0.013	2	0.008	0.005	14	0.055	0.013	0.86	0.10
7/30	27	261	9	0.034	0.009	2	0.008	0.006	11	0.042	0.010	0.82	0.12
7/31	27	232	8	0.034	0.014	12	0.052	0.017	21	0.091	0.024	0.38	0.11
8/1	23	254	1	0.004	0.004	0	0.000	0.000	2	0.008	0.005	0.50	0.36
8/2	23	272	3	0.011	0.007	0	0.000	0.000	3	0.011	0.007	1.00	0.00
8/3	20	249	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000		
8/4	21	234	6	0.026	0.012	2	0.009	0.006	10	0.043	0.013	0.60	0.17
8/5	10	144	6	0.042	0.021	1	0.007	0.004	7	0.049	0.019	0.86	0.12
8/6	19	242	3	0.012	0.007	0	0.000	0.000	3	0.012	0.007	1.00	0.00
8/7	21	258	3	0.012	0.007	0	0.000	0.000	5	0.019	0.008	0.60	0.22
8/8	18	223	1	0.004	0.004	0	0.000	0.000	4	0.018	0.010	0.25	0.16
8/9	19	231	1	0.004	0.004	0	0.000	0.000	3	0.013	0.007	0.33	0.28
8/10	18	245	1	0.004	0.004	0	0.000	0.000	2	0.008	0.006	0.50	0.36
Total	920	9,949	312	1.309		208	0.882		532	2.242			
Mean	22	243	8	0.032		5	0.022		13	0.055		0.66	

[a] Ratio of the chinook salmon CPUE to total CPUE.