Fishery Data Series No. 12-84

Chinook Salmon Creel Survey and Inriver Gillnetting Study, Lower Kenai River, Alaska, 2011

by

Jeff Perschbacher

December 2012

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

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

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

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

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
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
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
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	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
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.
minute (angular)	'
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
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 12-84

CHINOOK SALMON CREEL SURVEY AND INRIVER GILLNETTING STUDY, LOWER KENAI RIVER, ALASKA, 2011

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ABSTRACT

A creel survey to estimate angler effort, catch, and harvest of early- and late-run Chinook salmon (*Oncorhynchus tshawytscha*) was conducted on the Kenai River between the Soldotna Bridge and the Warren Ames Bridge from 16 May through 31 July 2011. A standardized inriver gillnetting program was conducted to estimate species catch rates and species composition near the Chinook salmon sonar site from 16 May through 10 August 2011. During the early run (16 May–30 June), anglers caught 1,090 (SE 186) and harvested 816 (SE 156) Chinook salmon with 44,363 (SE 2,127) angler-hours of effort. Guided anglers accounted for 63% of effort and 81% of harvest; the remaining effort and harvest were unguided. During the early run, 221 Chinook salmon and 1,688 sockeye salmon were captured in the inriver gillnetting program near the Chinook salmon sonar site; the ratio of Chinook salmon CPUE to all species CPUE averaged 0.21. The age composition of early-run Chinook salmon passage at the sonar site of 1.6% (SE 0.9%) age-1.1 fish, 25.8% (SE 3.3%) age-1.2 fish, 30.8% (SE 3.4%) age-1.3 fish, 40.7% (SE 3.7%) age-1.4 fish, and 1.1% (SE 0.8%) age-1.5 fish, was similar to the age composition of the early-run harvest although the harvest had a smaller proportion of age-1.2 fish (19.6%, SE 5.4%) and zero age-1.1 and age-1.5 fish. During the late run (1 July–31 July), anglers caught 9,580 (SE 716) and harvested 6,458 (SE 525) Chinook salmon with 148,213 (SE 6,870) angler-hours of effort. Guided anglers accounted for 45% of effort and 52% of harvest; the remaining effort and harvest were unguided. During the late run, 472 Chinook salmon, 3,548 sockeye salmon, 77 coho salmon, 3 pink salmon, and 6 Dolly Varden were captured in the inriver gillnetting program; the ratio of Chinook salmon CPUE to all species CPUE averaged 0.08. The age composition of late-run (1 July–10 August) Chinook salmon passage at the sonar site of 2.4% (SE 0.9%) age-1.1 fish, 29.9% (SE 2.7%) age-1.2 fish, 19.2% (SE 2.3%) age-1.3 fish, 46.4% (SE 2.9%) age-1.4 fish, and 2.1% (SE 0.8%) age-1.5 fish, was similar to the age composition of the late-run harvest although the harvest had a smaller proportion of age-1.2 fish (15.9%, SE 2.4%) and a larger proportion of age-1.4 fish (57.9%, SE 3.2%).

Key words: Kenai River, *Oncorhynchus tshawytscha*, Chinook salmon, creel survey, effort, harvest, gillnet, CPUE, age composition

INTRODUCTION

The Kenai River (Figure 1) supports the largest freshwater sport fishery in Alaska. 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 Warren Ames Bridge (river mile [RM] 5.2) and Soldotna Bridge (RM 21.1), and a standardized inriver gillnetting study (approximately RM 8.5) are the subject of this report (Figure 2).

Chinook salmon returning to the Kenai River exhibit two distinct run-timing patterns: "early" (late April–late June) and "late" (late June–early August). For management purposes, the early run is composed of all Chinook salmon entering the river before 1 July and the late run is composed of those entering on or after 1 July. Sport fish anglers value fish from both runs because of their large size, especially late-run fish, which average approximately 18 kg (40 lb) and can exceed 36 kg (80 lb). The world record sport-caught Chinook salmon (44.1 kg; 97 lb, 4 oz) was harvested from the Kenai River in May 1985.

The Alaska Department of Fish and Game (ADF&G) implemented a creel survey in 1974 in response to an increase in the number of boat anglers targeting Chinook salmon, and to monitor the age, sex, and length (ASL) composition of harvested Chinook salmon. Angler effort and harvest increased through 1988 but declined in the early 1990s and in the past few years because of low Chinook salmon runs and fishery restrictions (Figures 3–4). Beginning in 1981, separate effort and harvest estimates have been produced for guided and unguided anglers (Figures 3–4).

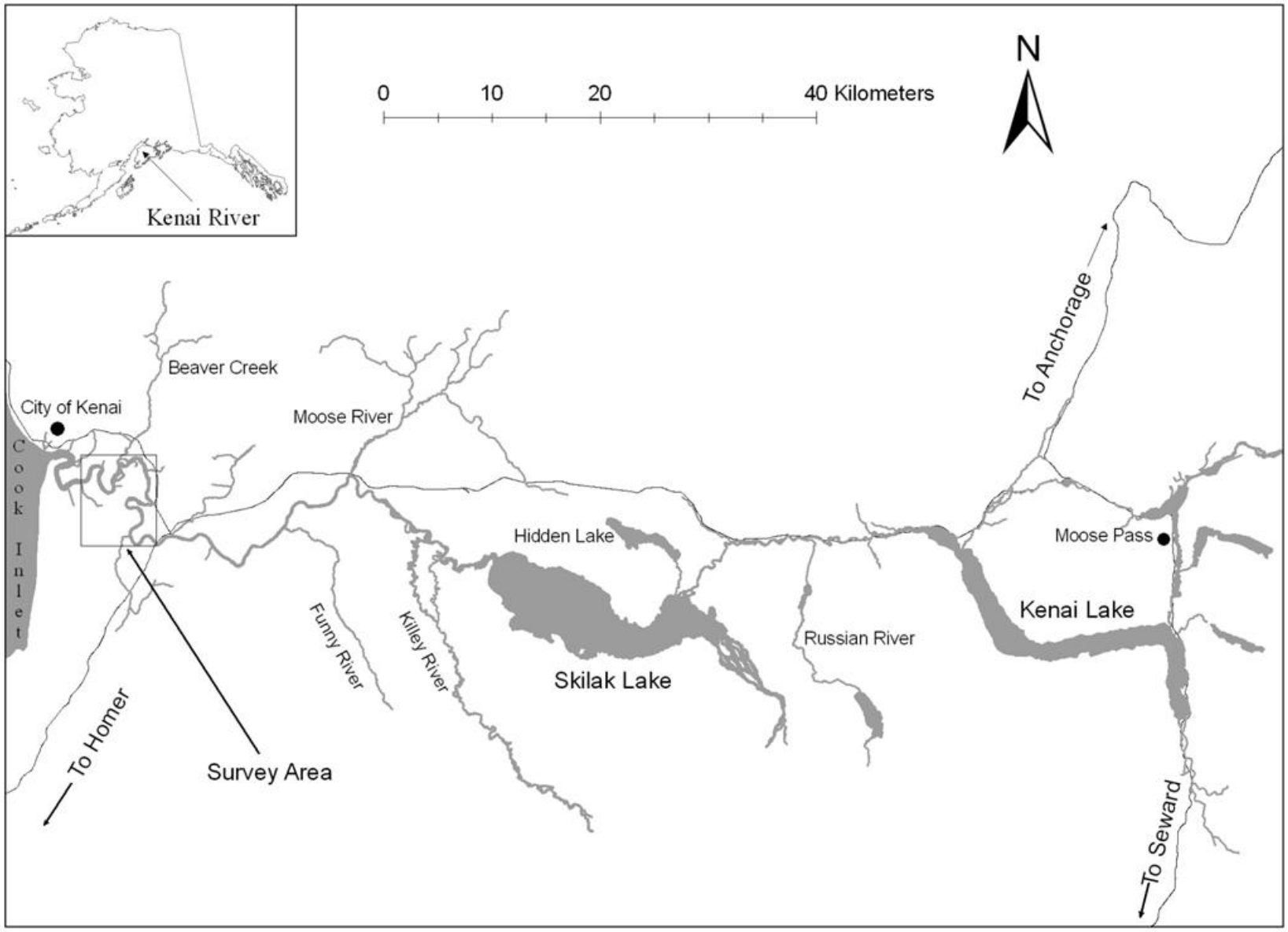

Figure 1.–Kenai River drainage on the Kenai Peninsula in Southcentral Alaska.

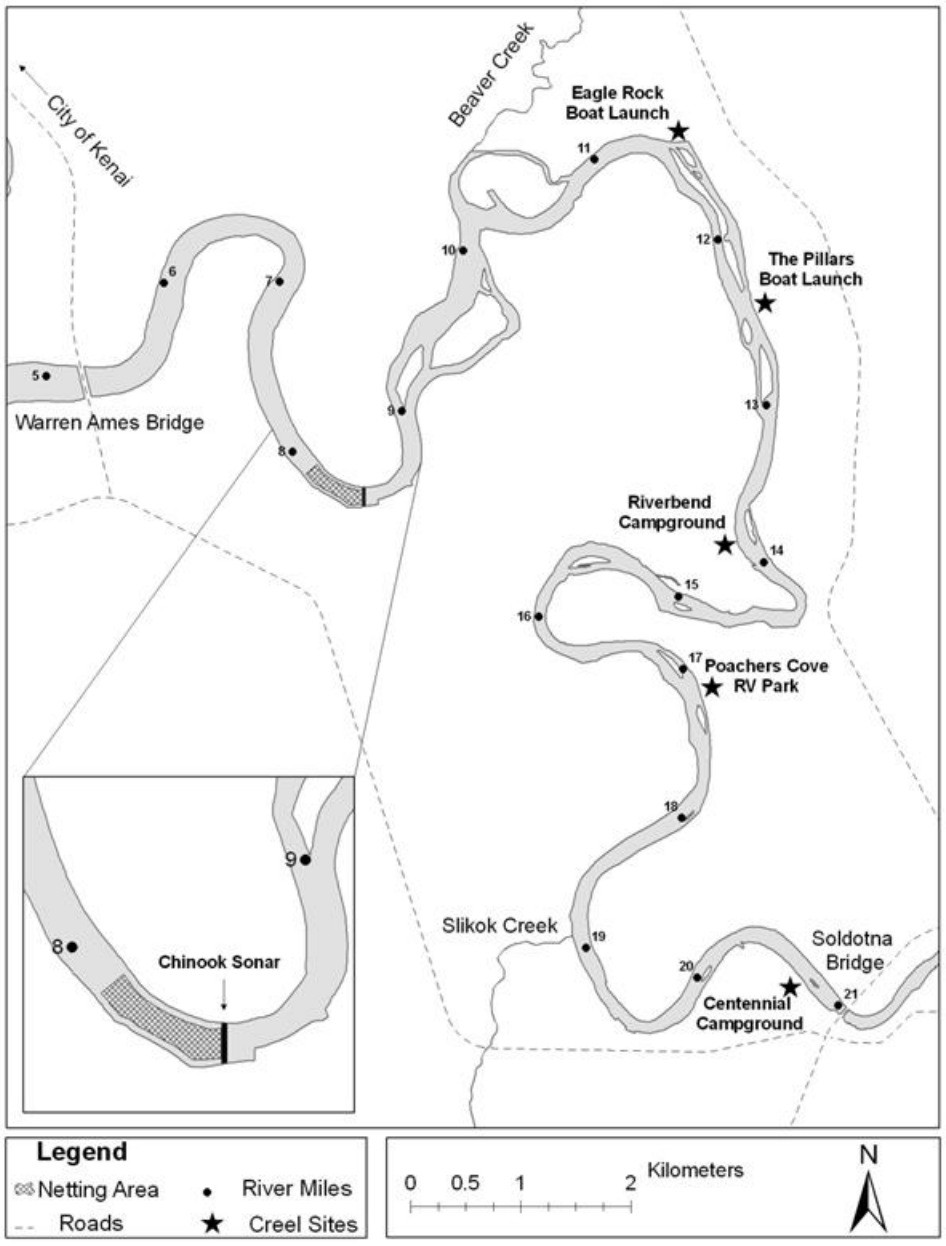

Figure 2.–Lower Kenai River from Warren Ames Bridge (RM 5.2) to Soldotna Bridge (RM 21.1).

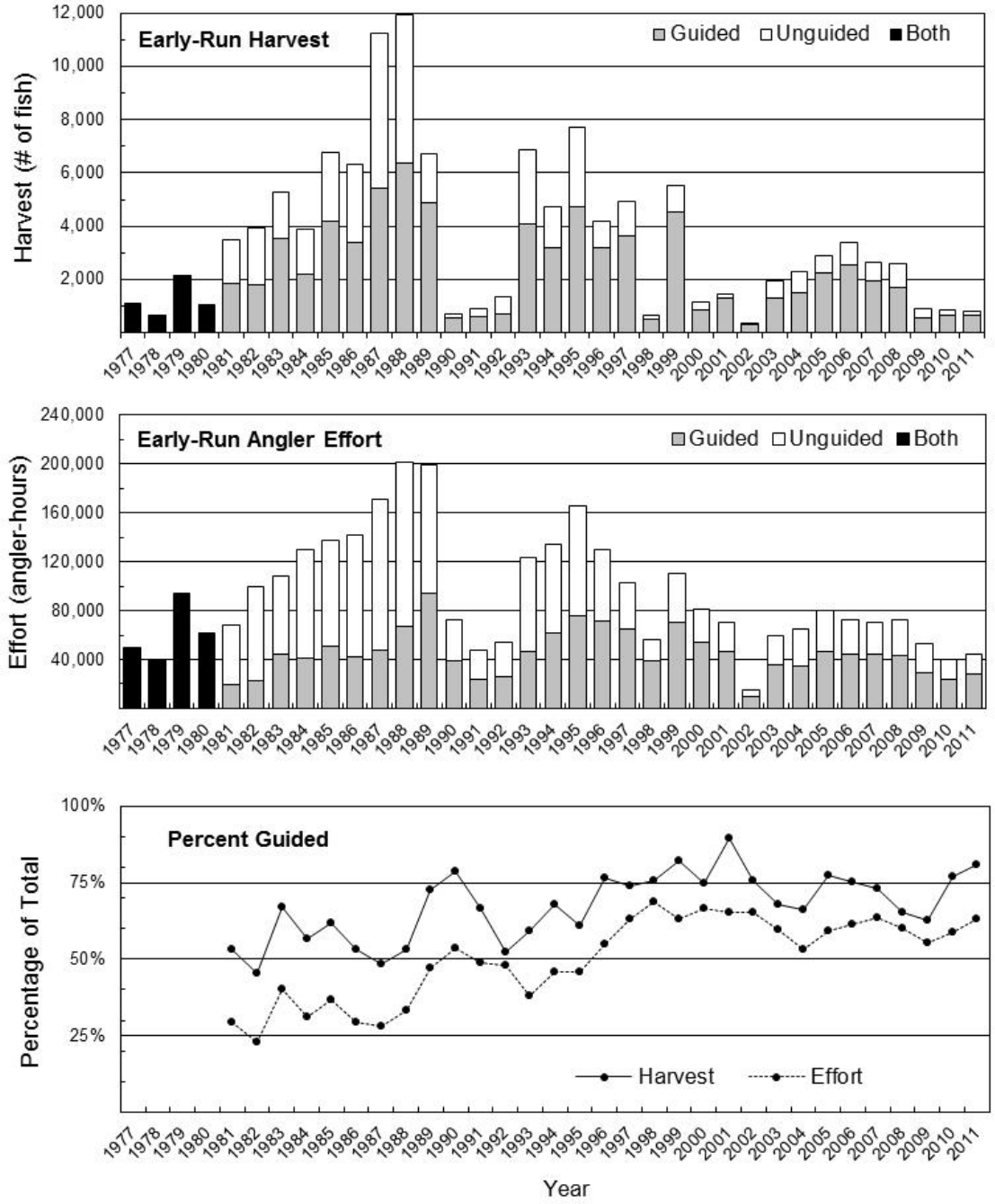

Figure 3.–Guided and unguided sport harvest (top), angler effort (middle), and percent of guided anglers (bottom) from ADF&G creel surveys for the early-run Kenai River Chinook salmon fishery between Soldotna Bridge and Warren Ames Bridge, 1977–2011.

Note: Prior to 1981, there was no distinction between guided and unguided anglers.

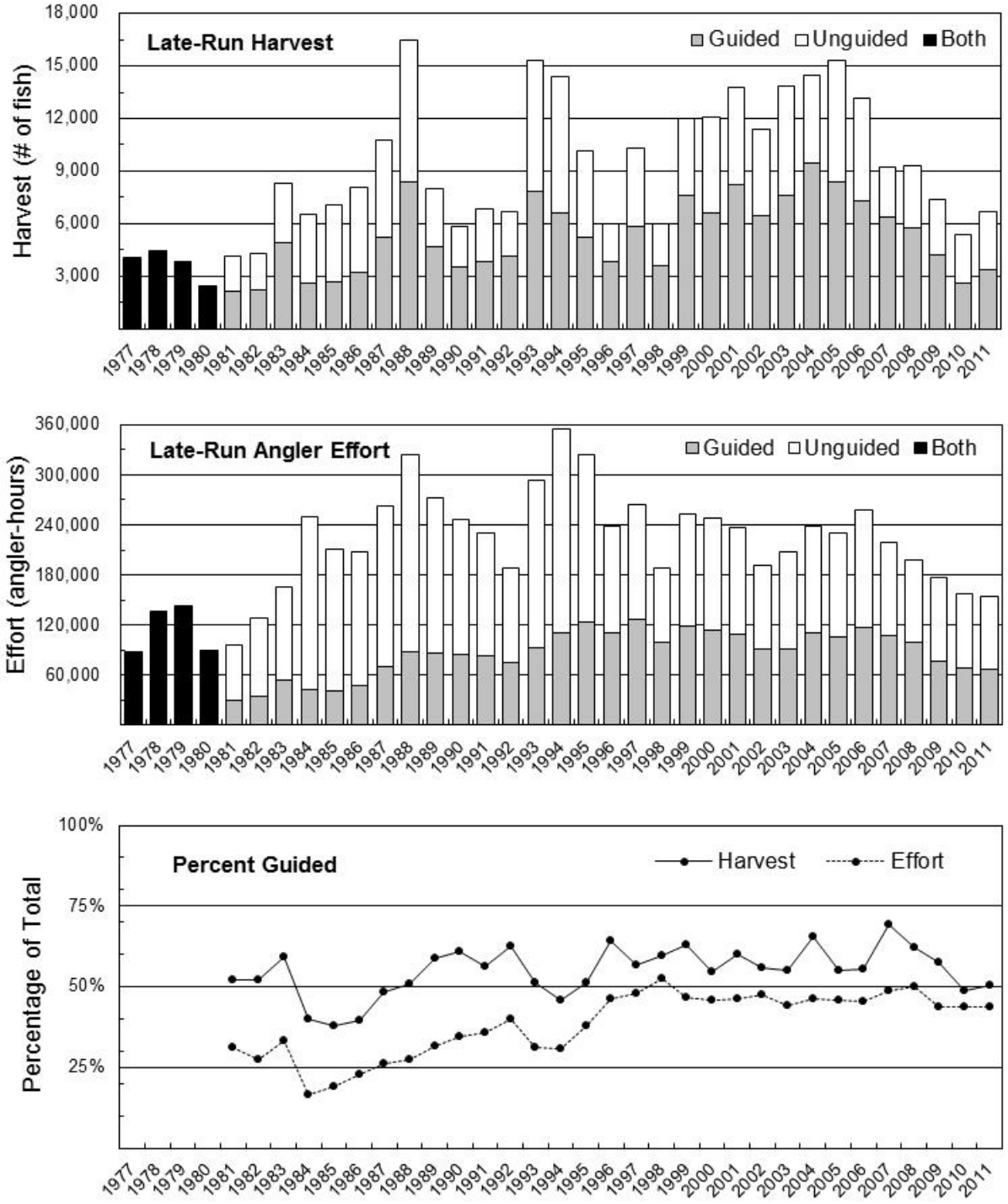

Figure 4.–Guided and unguided sport harvest (top), angler effort (middle), and percent of guided anglers (bottom) from ADF&G creel surveys for the late-run Kenai River Chinook salmon fishery between Soldotna Bridge and Warren Ames Bridge, 1977–2011.

Note: Prior to 1981, there was no distinction between guided and unguided anglers.

In 1979, ADF&G began monitoring the ASL composition of the inriver run by implementing an inriver gillnetting program. Inriver gillnetting was standardized to include catch rates in 1998 near the sonar site at RM 8.5 and further standardized to include species composition in 2002. The creel survey and inriver gillnetting programs coupled with the Chinook salmon sonar project are critical to inseason management and development of management plans and escapement goals for Kenai River Chinook salmon.

MANAGEMENT PLANS

The early and late Kenai River Chinook salmon runs have separate management plans adopted by the Alaska Board of Fisheries (BOF). Management within these plans utilizes estimates of inriver run and harvest. Estimates of inriver run are obtained with sonar (Miller et al. 2011) while estimates of harvest are obtained from creel surveys. Previous Kenai River Chinook salmon creel surveys are published in Conrad and Hammarstrom (1987); Eskelin (2007, 2009, 2010); Hammarstrom (1975-1981, 1988-1994); Hammarstrom et al. (1985); Hammarstrom and Larson (1982-1984, 1986); King (1995-1997); Marsh (1999, 2000); Perschbacher (2012a-c); Reimer (2003, 2004a-b); and Reimer et al. (2002).

The early run is managed to attain an optimal escapement goal of 5,300 to 9,000 Chinook salmon. If the spawning escapement is projected to exceed 9,000 fish, the fishery is liberalized to allow bait. If the spawning escapement is projected to be less than 5,300 fish, ADF&G implements more conservative regulations adopted by BOF which restricts the harvest of Chinook salmon less than 55 inches total length (TL) or closes the fishery. In March 2003, BOF introduced a slot limit (harvest restricted between minimum and maximum sizes) into the *Kenai River and Kasilof River Early-Run King Salmon Conservation Management Plan* (Alaska Administrative Code 5 AAC 57.160). Under the slot limit, anglers were allowed to retain Chinook salmon less than 44 inches TL or 55 inches TL or greater until 1 July below the Soldotna Bridge and until 15 July above the Soldotna Bridge (Figure 5). This change was implemented to protect early-run Chinook salmon that spend five winters in salt water. In March 2008, BOF liberalized the slot limit by raising the lower end from 44 inches TL to 46 inches TL. The recent modification to the slot limit was implemented to allow more harvest of younger Chinook salmon while continuing to protect those that spend five winters in salt water.

Management of the late-run Chinook salmon sport fishery is complex because multiple fisheries harvest Chinook salmon prior to the inriver sport fishery. The inriver late-run Chinook salmon sport fishery is managed under the *Kenai River Late-Run King Salmon Management Plan* (Alaska Administrative Code 5 AAC 21.359 updated through register 174; Figure 5), which mandates the late run to be managed to achieve a spawning escapement of 17,800 to 35,700 Chinook salmon.

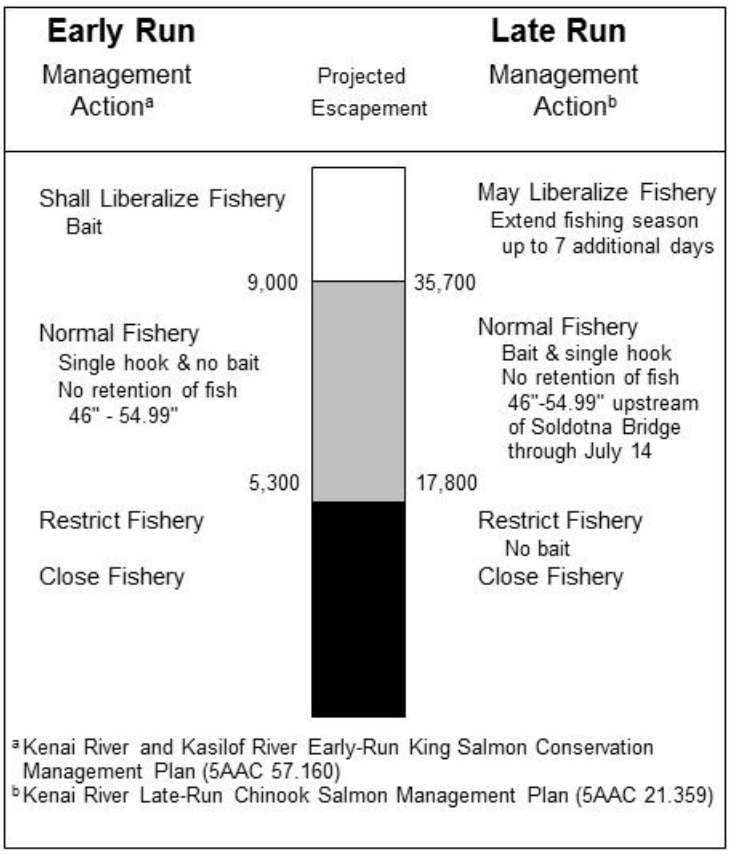

Figure 5.–Escapement levels and sport fish management actions for the Kenai River Chinook salmon fisheries.

FISHING REGULATIONS

Regulations for the Chinook salmon sport fishery in the Kenai River are among the most restrictive of any waters open to Chinook salmon fishing in Alaska. Although fish do not enter the river in appreciable numbers until mid-May, the Chinook salmon season is open 1 January through 31 July. The area open to Chinook salmon fishing extends from the outlet of Skilak Lake to Cook Inlet, with the exception of the confluence areas of Slikok Creek (RM 18.9), Funny River (RM 30.4), Moose River (RM 36.4), and the Lower Killey River (RM 44.0) (Figures 1 and 2). The Slikok Creek, Lower Killey River, and Funny River confluence areas are closed from 1 January through 31 July; the Moose River confluence area is closed from 15 May through 31 July. The portion of the Kenai River between the Upper Killey River confluence and the outlet of Skilak Lake is closed to all fishing 2 May through 10 June. In addition, the area between Centennial Campground (RM 20.3) and the Soldotna Bridge (RM 21.1; Figure 2), and the area around Morgan's Hole (approximately RM 31) are closed to fishing from boats for the entire Chinook salmon fishing season. The confluence areas restrict Chinook salmon fishing based on telemetry studies in the early 1980s and early 1990s when early-run Chinook salmon were observed to hold in these areas into July before ascending tributaries to spawn (McKinley et al. 2002).

The daily bag and possession limit for Kenai River Chinook salmon is one per day, 20 inches TL or longer, or 10 Chinook salmon less than 20 inches TL per day. The annual limit is two Chinook

salmon either measuring 28 inches TL or longer prior to 1 July or 20 inches TL or longer from 1 July through 31 July. Chinook salmon measuring 46 inches TL to 55 inches TL may not be retained before 1 July downstream of the Soldotna Bridge or before 15 July upstream of the Soldotna Bridge. A person who retains a Chinook salmon 20 inches TL or longer is prohibited from fishing from a boat in the Kenai River downstream of Skilak Lake for the remainder of that day. The use of multiple hooks and treble hooks is prohibited in the early- and late-run fisheries. During the early-run fishery, use of bait is not allowed, whereas bait is allowed during the late-run fishery. On Sundays and Mondays, only unguided fishing is allowed and on Mondays, unguided boat anglers may only fish from non-motorized vessels downstream of the outlet of Skilak Lake.

Kenai River Chinook salmon 55 inches TL or greater must be "sealed" within three days of harvest at the Soldotna ADF&G office. The seal consists of a numbered tag that is affixed to the lower jaw after ASL data are recorded and a sample of tissue is collected for genetic analysis. In addition, an angler interview is conducted to collect information regarding the harvest of the largest Kenai River Chinook salmon.

There are additional restrictions for fishing guides and guided anglers. Guided anglers are only allowed to fish from 0600 to 1800 hours. Guides are also prohibited from personally fishing while conducting clients and are prohibited from conducting clients on Sundays and Mondays, with the exception of Memorial Day, and a designated Sunday in June for the benefit of the Wounded Warriors Project.

During 2011, to achieve escapement goals, the early- and late-run sport fisheries were restricted inseason by emergency orders to limit harvest of Chinook salmon. A portion of the Kenai River upstream of the Slikok Creek confluence area (RM 18.8) to the outlet of Skilak Lake (RM 50.0) was closed to the harvest of Chinook salmon 20 inches TL to 55 inches TL from 29 June through 31 July. Bait was not allowed in that section of river the entire season. The use of bait was prohibited river-wide from 25 July through 31 July.

OBJECTIVES

Objectives for the 2011 study were as follows:

1) Estimate catch and harvest of Chinook salmon[1] by the sport fishery in the mainstem Kenai River between the Warren Ames and Soldotna bridges from 16 May through 30 June (early run) and from 1 through 31 July (late run) such that the relative precision of the estimates for each run is within 20%, or 1,000 fish, of the true value 95% of the time.
2) Estimate the proportion by age of the Chinook salmon population passing the Chinook salmon sonar site (RM 8.5) from 16 May through 10 August such that all age-proportion estimates for each run are within 10 percentage points of the true values 95% of the time.
3) Estimate the proportion by age of Chinook salmon harvested by the sport fishery in the mainstem Kenai River downstream from the Soldotna Bridge such that all age-proportion estimates for each run are within 20 percentage points of the true values 80% of the time.

[1] Harvest is the number of fish caught and retained while catch is the total number of fish caught (including those intentionally released).

In addition to the objectives outlined above, the project was responsible for completing the following tasks[2]:

1) Estimate total sport angler effort, by run, in angler-hours. Precision of the effort estimates are driven by that of the catch and harvest estimates (Objective 1).
2) Estimate daily CPUE of Chinook salmon captured in inriver gillnets at RM 8.5. Precision of the CPUE estimates is driven by that of the Chinook salmon proportion estimates by age. (Objective 2).
3) Calculate the proportion of fish captured in the inriver drift gillnets that are Chinook salmon.
4) Examine Chinook salmon sampled from the sport harvest and the inriver drift gillnets for external sexual characteristics, presence or absence of the adipose fin, and presence of a radio tag.
5) Collect tissue samples from Kenai River Chinook salmon sampled from inriver gillnets and the sport fish harvest for genetic analysis.
6) Insert esophageal radio transmitters in Chinook salmon captured in inriver gillnets between 16 May and 5 July, in conjunction with the *Kenai River Chinook salmon Abundance and Migratory Timing Study*.[3]
7) Collect secchi disk and water temperature readings midchannel at RM 15.3 during creel survey sampling days and collect daily secchi disk readings at RM 8.5.

METHODS

CREEL SURVEY

A stratified, two-stage roving-access creel survey (Bernard et al. 1998) was employed to estimate sport fishing effort, catch, and harvest of Chinook salmon from the Warren Ames Bridge (RM 5.2) to the Soldotna Bridge (RM 21.1) (Figure 2). The creel survey was conducted from 16 May through 31 July 2011. First-stage sampling units were days. The unguided angler-day was assumed to be 20 h long (0400 to 2400 hours) while the guided angler-day was 12 h long (0600 to 1800 hours) by regulation. Daily catch and harvest were estimated as the product of effort (angler-hours) and CPUE or harvest per unit effort (HPUE). Second-stage units for estimating angler effort and CPUE or HPUE were periodic angler counts and angler trips. Angler trips were sampled by interviewing anglers at the end of their fishing trips.

Stratification accounted for the geographical, temporal, and regulatory factors affecting the fishery. Because significant harvest below the sonar site would affect inriver run 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 downstream of the sonar site using geographically-stratified angler interviews were ineffective (Marsh 2000). Thus, catch and harvest downstream

[2] Tasks are of secondary importance and collected as ancillary information.
[3] Reimer FY10/FY11 Operational Plan, *Kenai River Chinook Salmon Abundance and Migratory Timing Study.*

of the sonar site are based on estimated effort downstream of the sonar site while assuming CPUE and HPUE are constant throughout the study area.

The creel survey was temporally stratified by week and day type (weekday, weekends/holidays) because harvest and catch rates can differ by time (King 1995-1997), and by angler type (guided vs. unguided) because catch rates between guided and unguided anglers can differ (Reimer 2004b). "Late-run Mondays" (for which unguided angler effort, catch, and harvest are generated based on an "index" angler count and ad hoc method) were also included as day-type strata in 2011 because of an increasing trend in harvest estimates (Perschbacher 2012a).[4] The index conversion factor of 78% estimated in 2001 to generate estimates for 2002–2008, was recalibrated to 52% in 2011 as a result of including late-run Mondays into the creel survey sampling design during 2009–2010 (Perschbacher 2012c). The new conversion factor of 52% is based on the average of the number of anglers counted in 2009–2010 during the index period (0800–1400 hours) in relation to the daily mean angler counts. The selection of CPUE and HPUE from plotted creel survey estimates versus day (with angler interviews) was found to be a reliable substitution when angler interviews were unavailable on late-run Mondays. The sampling strata used for conducting Kenai River Chinook salmon angler counts and estimating creel statistics are presented in Table 1.

Table 1.–Sampling strata used for conducting Kenai River Chinook salmon angler counts and estimating creel statistics, 2011.

Type	Number	Description
Geographic[a]	2	Warren Ames Bridge (RM 5.1) to Chinook salmon sonar site (RM 8.5) Chinook salmon sonar site (RM 8.5) to Soldotna Bridge (RM 21.1)
Temporal	7	Early run: 16–22 May, 24–30 May, 31 May–5 June, 7–12 June, 14–19 June, 21–26 June, and 28–30 June
	5	Late run: 1–3 July, 5–10 July, 12–17 July, 19–24 July, 26–31 July
Day type[b]	3	Weekdays Weekends/holidays Late-run Mondays
Angler type	2	Guided Unguided

[a] Used for angler counts only.

[b] Creel statistics for Mondays were not sampled but estimated using an index during the late run.

Two of the four available weekdays and both weekend days were sampled each week. An exception was the week of 24 May through 30 May, when two days were selected randomly from the three weekend or holiday days available. The early run was composed of 26 strata. The late run was composed of 24 strata.

Water clarity was measured to the nearest 0.05 m with a Secchi disk, and temperature was measured to the nearest 0.1°F twice daily near midchannel at RM 15.3.

[4] See page 17 for an explanation of Monday angler counts.

Angler Counts

Four angler counts were conducted during each sampled day. The first count began at the start of a randomly chosen hour (0400, 0500, 0600, 0700, or 0800 hours) with the remaining counts done every five hours. The schedule ensured that at least two angler counts were conducted while guided anglers were fishing (between 0600 and 1800 hours) each day.

Counts were conducted from a survey boat between the Soldotna Bridge and the Warren Ames Bridge, a distance of 15.9 mi. To maximize interview time, the direction (upstream or downstream) traveled to conduct angler counts was pre-selected to minimize total distance traveled and time spent conducting the count. Anglers were counted while driving the survey boat through the survey area and counts were typically completed in less than one hour. Angler counts were treated as instantaneous counts; they reflect fishing effort at the time the count began. Anglers were counted if they were fishing or rigging their line when observed during an angler count. Boats were counted as fishing if the boat contained at least one angler. Ten thumb counters 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), 9) active boats,[5] and 10) non-active boats.[6] Only categories 5–8 were required for this project; categories 1–4, and 9–10 were supplementary information for management purposes.

The boat count, completed between 0800 and 1400 hours for each Monday during the late run (restricted to unguided drift boats), was used to generate index estimates of effort, catch, and harvest.

Angler Interviews

Anglers who completed fishing were interviewed at the following boat launch sites (Figure 2):

1) Centennial Campground
2) Poacher's Cove
3) Riverbend Campground
4) Pillars Boat Launch
5) Eagle Rock Campground

When the creel survey began on 16 May, interviews were conducted only at Pillar's Boat Launch. The other boat launch sites were added to the sampling schedule immediately after sufficient boat traffic was observed. Centennial Campground was added to the sampling schedule on 31 May, Riverbend Campground was added on 4 June, Poacher's Cove was added on 12 June, and Eagle Rock Campground was added on 2 July. For each day sampled, the first randomly scheduled boat count of the day was completed (between 0500 and 0900 hours) prior to conducting interviews; therefore, there was a smaller probability of sampling the first 1–4 hours of the angler-day. The chance of introducing length-of-stay bias (Bernard et al. 1998) is small; in 2001, only 2% of the interviews were conducted from 0400 to 0859 hours and the mean CPUE for that period was similar to the overall mean (Reimer 2003). This is typical across years.

[5] Boats were counted as active boats if there were no anglers actively fishing from the boat, but the boat and motor were in operation.

[6] Boats were counted as non-active boats if there were no anglers actively fishing from the boat, the motor was not in operation, but it was obvious the motor had been run during the day.

There were four time intervals per day during which interviews could be conducted: three intervals between consecutive angler counts and one interval after the last angler count. During the early run, when there were more interview periods than active boat launches, each launch was sampled once before it was repeated in the daily schedule. During the late run, when there were more accessible boat launches than interview periods, access location was chosen without replacement from the locations available. Time and boat launch were paired randomly.

The following information was recorded for each interviewed angler: 1) time of interview, 2) guided or unguided angler, 3) number of hours spent fishing downstream of the Soldotna Bridge,[7] 4) number of Chinook salmon harvested downstream of the Soldotna Bridge, 5) number of Chinook salmon released downstream of the Soldotna Bridge, and during the early run only 6) whether released Chinook salmon were less than 46 inches, 46–54.99 inches TL, or 55 inches TL or greater.

Age, Sex, and Length of the Sport Harvest

Harvested Chinook salmon were sampled for ASL during angler interviews. Sex was identified from external morphological characteristics (i.e., protruding ovipositor on females or a developing kype on males). Mid eye to tail fork (METF) 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 aged using a microfiche reader.

Additionally, a tissue sample (tip of axillary process) was taken from harvested fish for genetic analysis, and each fish was inspected for an adipose fin. A missing adipose fin indicates the fish is either missing the fin naturally or received a coded wire tag as a juvenile. Presence of a coded wire tag may identify a hatchery-produced Chinook salmon, or a wild Chinook salmon tagged in another river system that strayed to the Kenai River. If a fish without an adipose fin was found, and permission was granted from the angler, the fish's head was removed and examined later for a coded wire tag.

INRIVER GILLNETTING

The inriver gillnetting program began in 1979 and has been modified several times to meet the changing needs of the Kenai River Chinook salmon fishery. Due to concerns of net selectivity bias with respect to CPUE, species composition estimates, abundance estimates, as well as gillnetting time and area considerations, the gillnetting program was standardized in 2002 to estimate ASL of inriver runs, CPUE, and species composition (Reimer 2004b). Inriver gillnetting was conducted six hours each day from 16 May through 10 August in an area approximately 0.3 mi in length located immediately downstream of the Chinook salmon sonar site at RM 8.5 (Figure 2). Nets of two mesh sizes were fished with equal frequency. Specifications of the nets used during 2002–2011 are shown below:

1) 5.0 inch (stretched mesh) multifiber, 80 meshes deep, 10 fathoms long, Shade 1 (clear-steel blue), MS73 (14 strand) twine.
2) 7.5 inch (stretched mesh) multifiber, 55 meshes deep, 10 fathoms long, Shade 1, MS93 (18 strand) twine.

[7] Hours fishing were rounded to the nearest 0.25 hour and included 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.

During the years 2004–2006, gillnet sampling was conducted approximately six hours per day from three hours before to three hours after a low tide. By examining the percentage of fish passing the sonar site at particular tide stages, it became clear that potentially more fish could be intercepted by inriver gillnets if sampling were to begin as close to high tide as possible without interfering with the gillnetting crews' ability to drift the net effectively (Eskelin 2010). During 2007–2010, sampling was scheduled for six consecutive hours beginning five hours before low tide. One tide was sampled each day, excluding hours of darkness (2300–0400 hours). For most years, this sampling schedule change resulted in a higher percentage of fish passing the Chinook salmon sonar site during the time when inriver gillnetting was conducted (Figure 6). As a result, the 2011 study was scheduled the same as those conducted in 2007–2010: one tide per day beginning five hours before low tide, for six consecutive hours, excluding hours of darkness.

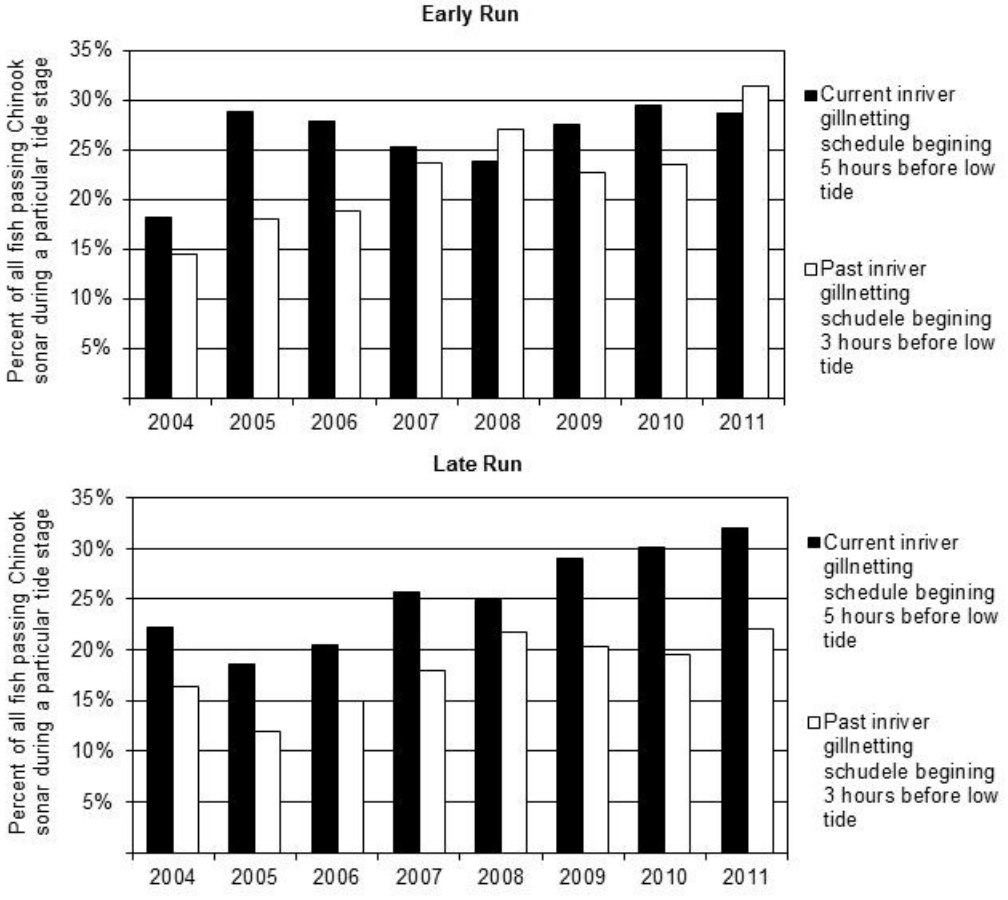

Figure 6.–Percentage of all fish passing the Kenai River Chinook salmon sonar site during 2 tide stages in 6-hour periods for early- (top) and late-run (bottom) Kenai River Chinook salmon, 2004–2011.

Note: two tide stages were compared: three hours before low tide to three hours after low tide (2004–2006 gillnet sampling schedule) vs. five hours before low tide to one hour after low tide (2007–2011 gillnet sampling schedule).

Each drift was positioned to sample fish that would pass through the insonified river channel (approximately 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 8.5) and ended approximately 0.3 mi downstream (RM 8.2). Drifts were terminated when either 1) the crew believed there were five fish in the net, or 2) the net was drifting within approximately 30 m of either bank, or 3) the net became snagged on the bottom or was not fishing properly, or 4) the end of the drift area was reached. Drifts always began at the upstream end of the study area. Two drifts (1 starting on each bank) were completed with one mesh size before switching to the other mesh size. For each set, the mesh size, starting bank, start and stop times, and number of fish caught by species were recorded on a Juniper Systems Allegro CX[8] field computer.

Water clarity was measured to the nearest 0.05 m with a Secchi disk three times daily (beginning, middle, and end of scheduled shift) in midchannel, near the sonar site at RM 8.5.

Age, Sex, and Length of the Inriver Run

Chinook salmon captured in gillnets were removed and placed in a tagging cradle (Larson 1995), and sampled for ASL. To prevent resampling, a quarter-inch hole was punched in the dorsal lobe of the caudal fin on every Chinook salmon handled. Each captured Chinook salmon was examined for a hole-punch prior to sampling. Chinook salmon were also checked for an adipose fin. If a Chinook salmon adipose fin was missing, the fish was sacrificed and the head was removed and examined later for a coded wire tag. Injuries sustained by Chinook salmon during the capture and handling process were also recorded. Samples were stratified into two approximately three-week strata during each run with a sample-size goal of 149 fish for each stratum. Strata for the early run were 16 May through 9 June and 10 June through 30 June; strata for the late run were 1 July through 20 July and 21 July through 10 August.

The number and species of all fish captured were recorded. In addition, METF lengths of captured sockeye, pink, and coho salmon were measured every other day. Length distribution of captured salmon was used as one variable in a mixture model to evaluate species composition in the insonified area at RM 8.5 (Miller et al. 2005).

Tissue samples (dorsal finclips) were collected from all Chinook salmon captured. Samples were placed in individually numbered 2 ml plastic tubes and immersed in an alcohol buffer. Each tube had a unique number and was stored at the ADF&G Gene Conservation Laboratory for future analysis.

After 30 June, only every other Chinook salmon per drift was sampled for ASL data. All other captured Chinook salmon were not placed in the cradle but had a tissue sample taken for genetic analysis, and were given a hole-punch on the dorsal lobe of the caudal fin to prevent resampling before being released. Estimates of ASL composition of the inriver run were generated using the Chinook salmon catches from 5.0- and 7.5-inch mesh gillnets combined.

Radio Transmitter Deployment

The inriver gillnetting study served as the marking event for a separate *Kenai River Chinook salmon Abundance and Migratory Timing Study* (Adam Reimer, Sport Fish Biologist, Soldotna, in preparation). During 16 May through 5 July, all Chinook salmon sampled for ASL received an

[8] Product names used in this publication are included for completeness but do not constitute product endorsement.

Advanced Telemetry Systems (ATS, Isanti, MN) model F1845B radio transmitter. Fish with profusely bleeding gills, measuring 550 mm TL or less, or observed to be injured were released without tagging to minimize potential differences in survival and behavior between tagged and untagged populations.

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 as follows:

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

where

x_{hig} = the number of anglers observed in the g^{th} 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 as follows:

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

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

$$\hat{E}_{hi} = L_{hi}\bar{x}_{hi}, \tag{3}$$

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 as follows:

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

The mean effort for stratum *h* was estimated by

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

where

d_h = number of days sampled in stratum *h*.

The sample variance of daily effort for stratum *h* was estimated as follows:

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

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 Bernard et al. (1998):

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

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 as follows:

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

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

$$\hat{C}_{hi} = \hat{E}_{hi}\overline{CPUE}_{hi}^{**} \tag{13}$$

and the variance by (Goodman 1960):

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

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, there were no CPUE and HPUE estimates to pair with angler counts. For these days, pooled estimates of CPUE and HPUE calculated from interviews obtained during the remaining days within the stratum, or similar strata, were imputed. A bootstrap procedure was used to estimate the variance introduced by use of imputed values.

Total effort, catch, and harvest estimates, and their respective variances, were summed across strata within each run. Technically, estimates of catch and harvest by geographic location and angler type were not statistically independent, because HPUE and CPUE were estimated from the same interviews for both geographic strata, and estimates were post-stratified by angler type. This lack of independence between strata could underestimate variances; however, the bias in variance estimates is small.

Angler Effort, Catch, and Harvest on Mondays

Regulations allow only unguided fishing from drift boats or from shore on Mondays. Due to budgetary constraints, the creel survey was not conducted on Mondays for the years 2002–2008 and 2011; rather, "index" angler counts were conducted each late-run Monday between 0800 and

1400 hours. The index count was used in the following ad hoc procedure to estimate effort, catch, and harvest on drift-boat Mondays:

1) The relationship between index counts and mean angler counts on Mondays for 2009–2010 angler count data was used to estimate the relationship between index counts and mean angler counts on Mondays for 2011. The mean number of anglers was approximately 52% of the number of anglers counted during the "index" period.
2) To estimate angler-hours of effort *E*, the estimated mean count was multiplied by the length of the unguided angler-day (20 hours).
3) To estimate CPUE and HPUE on Mondays without angler interviews, we exploited the tendency for angler success to exhibit an autocorrelated time trend. CPUE and HPUE were plotted versus time for days sampled with angler interviews, and then we imputed CPUE and HPUE values for each Monday.
4) Catch and harvest were estimated as the product of the imputed values of CPUE and HPUE and the estimate of *E* derived from the index count.

CPUE of Inriver Gillnetting

Two gillnet mesh sizes were deployed: 5.0 and 7.5 inches. Two drifts were conducted with one mesh size, originating from each side (*k*) of the river; then the sequence was repeated with the other mesh size. A repetition *j* consisted of a complete set of four such drifts. Daily CPUE *r* of species *s* in mesh *m* for day *i* was estimated as follows:

$$\hat{r}_{smi} = \frac{\sum_{j=1}^{J_i}\sum_{k=1}^{2} c_{smijk}}{\sum_{j=1}^{J_i}\sum_{k=1}^{2} e_{mijk}}, \tag{15}$$

with variance

$$\hat{V}(\hat{r}_{smi}) = \frac{\sum_{j=1}^{J_i}\left(c_{smij\cdot} - \hat{r}_{smi} e_{mij\cdot}\right)^2}{\bar{e}_{mi}^{\,2} J_i (J_i - 1)}, \tag{16}$$

where c_{smijk} is the catch of species *s* in mesh *m* during a drift originating from bank *k* during repetition *j* on day *i*, e_{mijk} is the effort (soak time in minutes) for that drift, J_i is the number of repetitions completed on day *i*, c_{smij} is the catch of species *i* in mesh *m* summed across drifts on both banks conducted during repetition *j* of day *i*, $e_{mij.}$ is the effort for mesh *m* summed across drifts on both banks conducted during repetition *j* of day *i*, and $\bar{e}_{mi}$ is the mean of e_{mij} across all repetitions *j* for mesh *m* on day *i*. The variance follows Cochran (1977:66).

Proportion of Chinook Salmon Captured by Inriver Gillnetting

The proportion of species *s* passing through the insonified zone of the river channel during the test-netting period on day *i* was estimated as follows:

$$\hat{p}_{si} = \frac{\sum_{j}^{J_i} \hat{r}_{sij}}{\sum_{s}\sum_{j}^{J_i} \hat{r}_{sij}} \tag{17}$$

with variance

$$\hat{V}(\hat{p}_{si}) = \frac{\sum_{j=1}^{J_i} \left(\hat{r}_{sij} - \hat{p}_{si}\hat{r}_{\cdot ij}\right)^2}{\bar{r}_i^{\,2} J_i (J_i - 1)}, \tag{18}$$

where CPUE *r* of species *s* during repetition *j* of day *i* is estimated as the mean of the CPUEs, pooled across bank, for each mesh size:

$$\hat{r}_{sij} = \frac{1}{2}\sum_{m=1}^{2} \frac{\sum_{k=1}^{2} c_{smijk}}{\sum_{k=1}^{2} e_{mijk}} \tag{19}$$

and where

r_{ij} = $\sum_{s} \hat{r}_{sij}$ is the CPUE summed across all species caught during repetition *j* of day *i*, and

$\bar{r}_i$ = the mean CPUE of salmon (all species) caught across all drifts *k* during day *i*.

Only data from repetitions with at least one drift with each mesh were used for estimation of species proportions.

Age and Sex Composition

Age and sex composition of the Chinook salmon harvest were estimated for each run by time stratum *t*. The proportion of Chinook salmon in age or sex group *b* in time stratum *t* was estimated as follows:

$$\hat{p}_{bt} = \frac{n_{bt}}{n_t}, \tag{20}$$

where

n_{bt} = the number of Chinook salmon of age or sex group *b* sampled during stratum *t*, and

n_t = the number of successfully aged Chinook salmon sampled during stratum *t*.

The variance of $\hat{p}_{bt}$ was approximated[9] as follows (Cochran 1977):

$$\hat{V}(\hat{p}_{bt}) = \frac{\hat{p}_{bt}(1-\hat{p}_{bt})}{(n_t - 1)}. \tag{21}$$

Contingency tables and chi-square tests were used to determine if age or sex composition differed significantly ($P < 0.05$) among strata. If not, the proportion of Chinook salmon in age or sex group *b* during an entire run, and its variance, were estimated by pooling data across strata (equations 20–21 without stratum subscripts *t*).

The harvest of each age or sex group by time stratum *t* and geographic stratum *g* (above and below the sonar), was estimated by

$$\hat{H}_{gbt} = \hat{H}_{gt}\hat{p}_{bt} \tag{22}$$

with variance (Goodman 1960)

$$\hat{V}\left(\hat{H}_{gbt}\right) = \hat{H}_{gt}^2\hat{V}\left(\hat{p}_{bt}\right) + \hat{p}_{bt}^2\hat{V}\left(\hat{H}_{gt}\right) - \hat{V}\left(\hat{p}_{bt}\right)\hat{V}\left(\hat{H}_{gt}\right), \tag{23}$$

where

$\hat{H}_{gt}$ and $\hat{V}\left(\hat{H}_{gt}\right)$ = estimated harvest and its variance in geographic stratum *g* during temporal stratum *t*.

If age or sex composition differed ($P < 0.05$) among strata, a weighted proportion and its variance were calculated as follows:

$$\hat{p}_{gb} = \frac{\sum_t \hat{H}_{gt}\hat{p}_{bt}}{\sum_t \hat{H}_{gt}} \text{ and} \tag{24}$$

$$\hat{V}(\hat{p}_{gb}) = \frac{1}{\hat{H}_g^2}\left[\frac{\hat{v}(\hat{H}_{g1})\left[\hat{p}_{b1}\hat{H}_{g2} - \hat{H}_{gb2}\right]^2}{\hat{H}_g^2} + \frac{v(\hat{H}_{g2})\left[\hat{p}_{b2}\hat{H}_{g1} - \hat{H}_{gb1}\right]^2}{\hat{H}_g^2} + \hat{v}(\hat{p}_{b1})\hat{H}_{g1}^2 + \hat{v}(\hat{p}_{b2})\hat{H}_{g2}^2\right]. \tag{25}$$

The number of Chinook salmon passing the sonar *N* was apportioned by age and sex similarly, using equations 20–24, ignoring geographic stratum subscript *g*, substituting *N* for *H*, and using the net-captured Chinook salmon to estimate *p*. The inriver run *R* of age or sex group *b* was estimated as the sum of the age or sex specific sonar passage N_b and harvest below the sonar H_{2b},

$$\hat{R}_b = \hat{N}_b + \hat{H}_{2b}. \tag{26}$$

[9] Variance estimates for species proportions assume that each fish sampled is an independent observation (i.e., that simple random sampling, SRS, was employed). In reality, the sport harvest is sampled with a multistage design (creel survey), and the inriver return with a cluster design (netting); and technically, the age proportion variances should be estimated in the context of those designs. However age composition changes very slowly over time; in the past we have assumed that variability between sampling stages and among clusters is negligible. To verify this, we reanalyzed the 2006 netting data, calculated the age proportions using a modified version of equation eight and compared them to the SRS estimates in equation 20. The point estimates and their standard errors were essentially equivalent. Based on this evidence, we continue to use the SRS equations for convenience.

RESULTS

CREEL SURVEY

Effort, Catch, and Harvest

The creel survey was conducted from 16 May through 31 July. During the early run, the creel survey sampled 57% (20/35) of the days the fishery was open to guided anglers and 63% (25/40) of the days open to unguided anglers (Table 2). During the late run, the creel survey sampled 61% (14/22) of the days the fishery was open to guided anglers and 71% (19/27) of the days the fishery was open to unguided anglers (Table 3). Index estimates of catch, harvest, and effort on the four late-run Mondays are not included in the unguided angler subtotals and season totals but presented herein. A total of 2,411 angler interviews were conducted: 850 during the early run and 1,561 during the late run (Tables 2–3).

During the early run, angler counts ranged from 0 to 103 for unguided anglers and from 0 to 232 for guided anglers (Appendix A1). The largest count occurred on 26 June for unguided anglers and on 28 June for guided anglers. The largest count in the early run for guided and unguided anglers combined was 293 anglers on 18 June. During the late run, angler counts ranged from 0 to 493 for unguided anglers and from 43 to 476 for guided anglers (Appendix A2). The largest count occurred on 17 July for unguided anglers and on 26 July for guided anglers. The largest count in the late run for guided and unguided anglers combined was 842 anglers on 16 July.

Estimated effort was 44,363 (SE 2,127) angler-hours during the early run (Table 2), and 148,213 (SE 6,870) angler-hours during the late run (Table 3). Angler effort was below average for both runs; early-run effort was approximately 28% below the recent five-year average and 53% below the historic (1977–2010) early-run average, while late-run effort was the lowest on record since 1982 (Figures 3–4). Guided anglers accounted for 63% of the early-run effort and 45% of the late-run effort.

In the early run, daily CPUE varied from 0 to 0.065 and averaged 0.017 fish per hour for unguided anglers, while daily CPUE for guided anglers ranged from 0 to 0.060 and averaged 0.027 fish per hour (Appendices B1–B2). Daily CPUE in the early run was greatest on 16 June for unguided anglers and on 25 May for guided anglers. In the late run, daily CPUE varied from 0.013 to 0.147 and averaged 0.059 fish per hour for unguided anglers, while daily CPUE for guided anglers ranged from 0.031 to 0.140 and averaged 0.069 fish per hour (Appendices B3 and B4). Daily CPUE was greatest in the late run on 17 July for unguided anglers and 14 July for guided anglers.

The estimated harvest of Chinook salmon during the early run was 816 (SE 156) fish (Table 2). Early-run harvest was approximately 61% below the recent five-year average and 77% below the historic (1977–2010) early run average (Figure 3). Guided anglers accounted for 81% of the harvest compared to 19% for unguided anglers. The estimated catch of early-run Chinook salmon was 1,090 (SE 186) fish, meaning approximately 25% of the catch was released (Table 2). There were 850 interviews conducted during the early run with anglers reported to have released 23 Chinook salmon, of which 83% were reported below the slot limit (less than 46 inches TL) and 17% were reported within the slot limit (46–55 inches TL) (Table 4). The absolute precision (±306 fish) for total early-run harvest and catch (±365 fish) satisfied the project objectives.

Table 2.–Estimated early-run Kenai River Chinook salmon sport fishery effort, catch, and harvest between Soldotna Bridge and Warren Ames Bridge, 16 May–30 June 2011.

						Chinook salmon			
				Effort		Catch [b]		Harvest [c]	
Fishing periods[a]	Days open to fishing from powerboats	Sampling days	Number of interviews	Hours fished	SE	No. fish	SE	No. fish	SE
17–22 May									
Guided weekdays	4	2	13	200	32	0	0	0	0
Guided weekends	1	1	11	168	42	0	0	0	0
Unguided weekdays	4	2	19	360	101	0	0	0	0
Unguided weekends	2	2	36	305	127	3	3	3	3
24–30 May									
Guided weekdays	4	2	42	1,112	205	48	16	30	13
Guided wkends/holiday	2	1	27	872	193	10	6	10	6
Unguided weekdays	4	2	25	430	73	7	6	7	6
Unguided wkends/holiday	3	2	78	795	191	12	7	10	8
31 May–5 June									
Guided weekdays	4	2	19	1,424	226	46	26	36	30
Guided weekends/holiday	2	2	3	392	159	12	9	9	9
Unguided weekdays	4	2	18	460	137	0	0	0	0
Unguided weekends	2	2	26	500	97	11	12	11	12
7–12 June									
Guided weekdays	4	2	40	3,240	512	151	38	98	30
Guided weekends	1	1	34	1,172	372	22	12	22	12
Unguided weekdays	4	2	21	1,180	316	29	27	29	27
Unguided weekends	2	2	69	1,605	318	65	29	21	13
14–19 June									
Guided weekdays	4	2	47	5,280	1,287	216	113	216	113
Guided weekends	1	1	4	1,400	526	62	48	62	48
Unguided weekdays	4	2	20	2,140	555	94	77	30	31
Unguided weekends	2	2	89	2,115	300	53	19	33	15
21–26 June									
Guided weekdays	4	2	45	5,900	690	111	88	73	61
Guided weekends	1	1	40	1,272	255	57	22	57	22
Unguided weekdays	4	2	28	1,970	259	25	9	12	6
Unguided weekends	2	2	46	2,340	423	11	11	0	0
28–30 June									
Guided weekdays	3	1	37	5,676	699	48	20	48	20
Unguided weekdays	3	1	13	2,055	241	0	0	0	0

-continued-

Table 2.–Part 2 of 2.

Fishing periods[a]	Days open to fishing from powerboats	Sampling days	Number of interviews	Effort		Chinook salmon Catch[b]		Chinook salmon Harvest[c]	
				Hours fished	SE	No. fish	SE	No. fish	SE
Day type subtotals									
Guided weekdays	27	13	243	22,832	1,726	618	153	500	138
Guided weekends/holiday	8	7	119	5,276	738	163	55	160	55
Unguided weekdays	27	13	144	8,595	753	154	82	78	42
Unguided wkends/holiday	13	12	344	7,660	657	155	40	77	24
Angler type subtotals									
Guided	35	20	362	28,108	1,877	782	163	661	148
% Guided			43%	63%		72%		81%	
Unguided[d]	40	25	488	16,255	1,000	309	91	155	49
% Unguided			57%	37%		28%		19%	
Early-run total[d]			850	44,363	2,127	1,090	186	816	156

[a] Sport fishery closed to harvest of Chinook salmon 20-55 inches TL upstream of Slikok Creek confluence (RM 18.8), 29–30 June.

[b] "Catch" = fish harvested plus fish released; catch estimates may not sum to total due to rounding.

[c] "Harvest" = fish kept; harvest estimates may not sum to total due to rounding.

[d] Because Mondays were not sampled, unguided angler estimates are biased and may underestimate the true value.

Table 3.–Estimated late-run Kenai River Chinook salmon sport fishery effort, catch, and harvest between Soldotna Bridge and Warren Ames Bridge, 1–31 July 2011.

Fishing periods[a]	Days open to fishing from powerboats	Sampling days	Number of interviews	Effort		Chinook salmon Catch[b]		Chinook salmon Harvest[c]	
				Hours fished	SE	No. fish	SE	No. fish	SE
1–3 July									
Guided weekdays	1	1	47	1,878	588	206	74	167	63
Guided weekends	1	1	60	1,836	593	115	46	105	42
Unguided weekdays	1	1	47	2,295	531	242	102	139	56
Unguided weekends	2	2	100	5,065	642	224	63	192	58
4–10 July									
Monday[d]	0	1	0	811	NA	25	NA	17	NA
Guided weekdays	4	2	49	6,828	1,330	394	138	337	104
Guided weekends	1	1	56	3,642	592	246	65	194	50
Unguided weekdays	4	2	68	5,270	757	235	63	150	49
Unguided weekends	2	2	106	6,695	644	271	74	131	40
11–17 July									
Monday[d]	0	1	0	1,820	NA	100	NA	60	NA
Guided weekdays	4	2	174	12,392	2,777	1,260	355	865	224
Guided weekends	1	1	24	3,288	1,159	270	149	114	57
Unguided weekdays	4	2	110	13,180	1,460	1,112	199	723	155
Unguided weekends	2	2	132	9,960	1,601	991	267	668	182

-continued-

Table 3.–Part 2 of 2.

Fishing periods[a]	Days open to fishing from powerboats	Sampling days	Number of interviews	Effort		Chinook salmon			
						Catch[b]		Harvest[c]	
				Hours fished	SE	No. fish	SE	No. fish	SE
18–24 July									
Monday[d]	0	1	0	1,914	NA	205	NA	105	NA
Guided weekdays	4	2	134	17,088	3,238	1,210	300	928	263
Guided weekends	1	1	32	3,556	846	174	63	154	58
Unguided weekdays	4	2	92	14,930	3,277	794	199	242	124
Unguided weekends	2	2	110	9,935	1,122	689	139	422	100
25–31 July									
Monday[d]	0	1	0	1,050	NA	58	NA	39	NA
Guided weekdays	4	2	97	14,160	1,717	583	159	445	133
Guided weekends	1	1	53	2,540	318	122	34	68	25
Unguided weekdays	4	2	21	8,370	1,591	213	118	213	118
Unguided weekends	2	2	49	5,305	412	228	78	199	74
Day type subtotals									
Monday[d]	0	4	0	5,595	NA	388	NA	221	NA
Guided weekdays	17	9	501	52,346	4,823	3,653	516	2,742	389
Guided weekends	5	5	225	14,862	1,692	928	183	636	107
Unguided weekdays	17	9	338	44,045	4,032	2,596	328	1,467	243
Unguided weekends	10	10	497	36,960	2,195	2,404	326	1,613	232
Angler type subtotals									
Guided	22	14	726	67,208	5,111	4,581	547	3,378	404
% Guided			47%	45%		48%		52%	
Unguided[e]	27	19	835	81,005	4,591	5,000	462	3,080	335
% Unguided			53%	55%		52%		48%	
Late-run total[e]	49	33	1,561	148,213	6,870	9,580	716	6,458	525

Note: "NA" = no data available.

[a] Emergency orders prohibited retention of Chinook salmon 20–54.99 inches TL and the use of bait upstream of Slikok Creek confluence (RM 18.8) beginning 1 July.

[b] "Catch" = fish harvested plus fish released; catch estimates may not sum to total due to rounding.

[c] "Harvest" = fish kept; harvest estimates may not sum to total due to rounding.

[d] Mondays were days when only unguided drift boat fishing was allowed. Estimates of effort, catch, and harvest were based on an index described in detail on pages 17–18 in the methods section "Angler Effort, Catch, and Harvest on Mondays."

[e] Unguided angler totals do not include Monday index estimates.

Table 4.–Kenai River Chinook salmon reported to be released during the early-run slot-limit sport fishery between Warren Ames Bridge and Soldotna Bridge, 2003–2011.

	Early-run Chinook salmon		
	Below slot limit[a]	Within slot limit[a]	Total number
Year	% released[b]	% released[b]	released[c]
2003	52%	48%	64
2004	67%	33%	73
2005	65%	35%	109
2006	65%	35%	100
2007	70%	30%	67
2008	78%	22%	89
2009	85%	15%	20
2010	80%	20%	35
2011	83%	17%	23
Min	52%	15%	20
Mean	72%	28%	64
Max	85%	48%	109

[a] During 2003–2007 the 44–55 inch slot limit was in effect and during 2008–2011 the 46–55 inch slot limit was in effect.

[b] The number of fish released below or within the slot limit was given by anglers during creel survey interviews.

[c] There were no fish reported to be released above the slot limit.

The estimated harvest of Chinook salmon during the late run was 6,458 (SE 525) fish (Table 3). Late-run harvest was approximately 25% below the recent five-year and historic (1977–2010) averages (Figure 4). Guided anglers accounted for 52% of the harvest compared to 48% for unguided anglers. The estimated catch of late-run Chinook salmon was 9,580 (SE 716), meaning 32% of the catch was released (Table 3). The relative precision for total late-run harvest (±15.9%) and catch (±14.6%) satisfied the project objectives.

Approximately 2.2% of the early-run effort and 6.9% of the late-run effort occurred downstream of the Chinook salmon sonar site (Appendices C1–C2). The estimate of late-run harvest below the Chinook salmon sonar site was 458 (SE 83) (7.1%), whereas 6,000 (SE 518) (92.9%) Chinook salmon were harvested from the Chinook salmon sonar site to the Soldotna Bridge (Appendix C2).

The daily angler count for each late-run Monday (Appendix A2) and interpolated values of HPUE and CPUE (Appendix B3) were used to index effort, harvest, and catch estimates (Table 3). It was estimated that unguided drift boat anglers caught 388 and harvested 221 Chinook salmon with an effort of 5,595 angler-hours during late-run Mondays (Table 3 and Figure 7). This represented approximately 3.3% of total effort, 3.9% of total catch, and 3.6% of total harvest in the late-run.

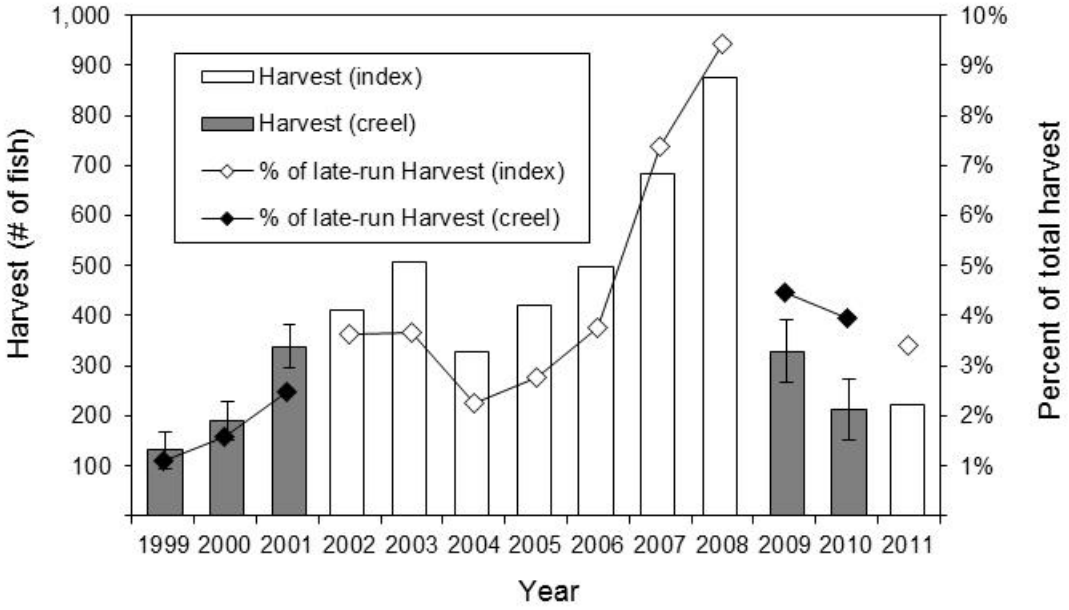

Figure 7.–Late-run Monday unguided drift-boat sport harvest, and percent of total late-run harvest of Kenai River Chinook salmon estimated by index and creel surveys between Soldotna Bridge and Warren Ames Bridge, Kenai River, 1999–2011.

Note: Error bars show ±1 standard error during 1999–2001 and 2009–2010 when Mondays were included in the creel survey. Precision estimates are unavailable for 2002–2008 and 2011 when angler effort, catch, and harvest were estimated using an index.

SPECIES COMPOSITION FROM INRIVER GILLNETTING

During the early run, 227 Chinook salmon and 1,744 sockeye salmon greater than 400 mm METF length were captured with gillnets (Appendix D1). A total of 55 other fish (53 starry flounder [*Platichthys stellatus*], and two eulachon [*Thaleichthys pacificus*]) were also captured. Only salmonids greater than 400 mm METF (the lower length limit that is generally detectable by split-beam sonar; Debby Burwen, ADF&G, Sport Fish Division, Anchorage, personal communication) were used to calculate daily CPUE by species and daily Chinook salmon ratios. Daily Chinook salmon CPUE for both mesh sizes combined ranged from 0 to 0.115, and averaged 0.037 (Appendix D2). The daily ratio of Chinook salmon to total number of fish captured ranged from 0 to 1.00 and averaged 0.21 (Appendix D2).

During the late run, 488 Chinook salmon, 3,619 sockeye salmon, 77 coho salmon, 3 pink salmon, and 6 Dolly Varden greater than 400 mm METL length were captured with gillnets (Appendix D3). Daily Chinook salmon CPUE ranged from 0.014 to 0.456 and averaged 0.125 (Appendix D4). The daily ratio of Chinook salmon to total number of fish captured ranged from 0.02 to 0.23 and averaged 0.08 (Appendix D4).

During both the early and late runs, the 2011 sockeye salmon cumulative CPUE was substantially above the 2002–2010 average, whereas Chinook salmon cumulative CPUE was below the 2002–2010 average (Figure 8).

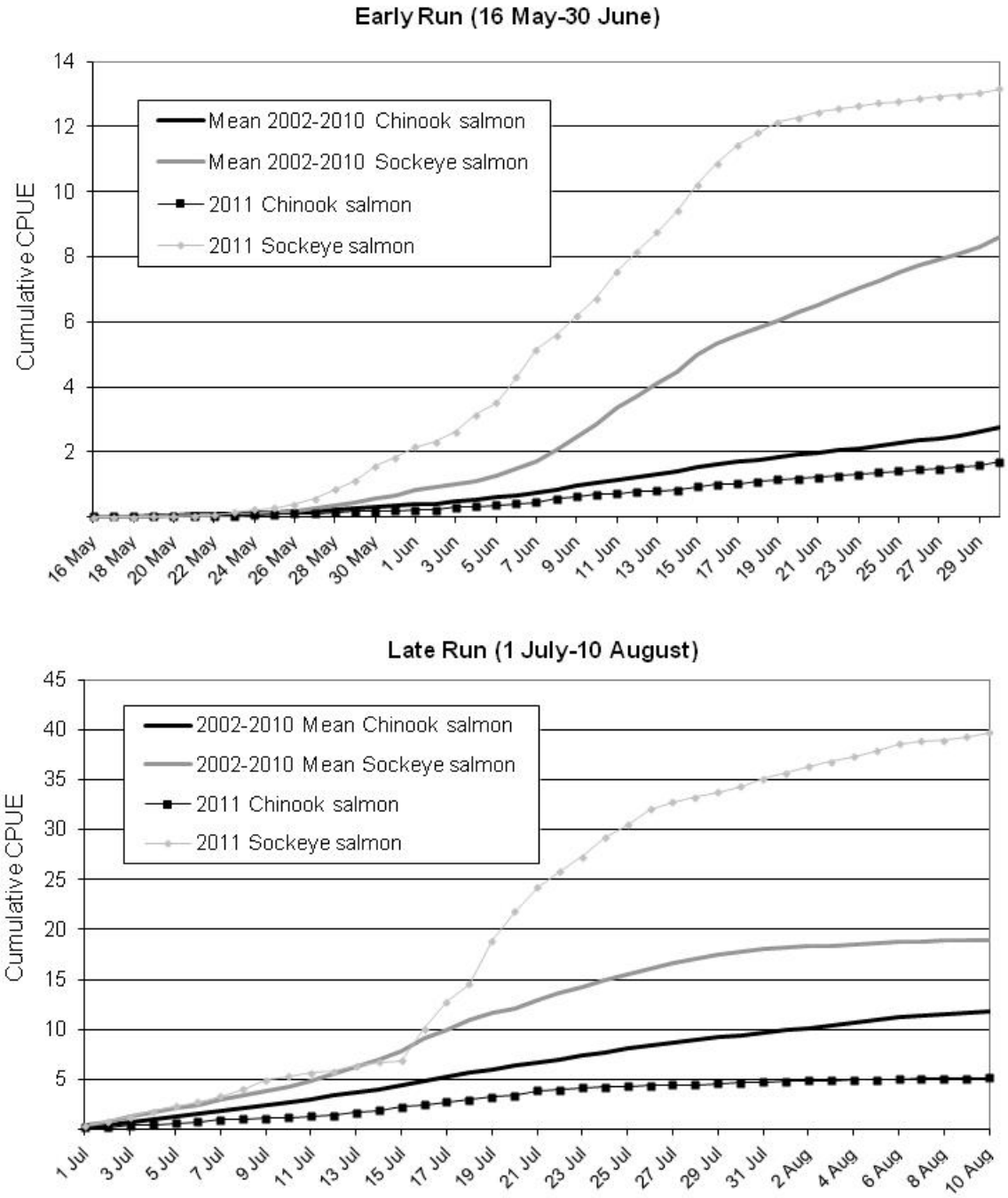

Figure 8.–Cumulative CPUE for early-run (top) and late-run (bottom) Kenai River Chinook and sockeye salmon inriver gillnet catches, 2002–2011.

Note: Cumulative CPUE is catch per minute.

AGE, SEX, AND LENGTH

Creel Survey

The age composition of the early-run harvest was comprised of 19.6% (SE 5.4%) age-1.2 fish, 35.7% (SE 6.5%) age-1.3 fish, and 44.6% (SE 6.7%) age-1.4 fish (Table 5 and Figure 9). There were no age-1.1 or age-1.5 fish in the harvest. Age-1.3 males and females were harvested in equal proportion, but age-1.4 females were harvested in larger proportions (30.4%, SE 6.2%) than were age-1.4 males (14.3%, SE 4.7%). All harvested age-1.2 Chinook salmon sampled in the early-run sport fishery were males.

During the late run, the age composition of the harvest was comprised of 1.3% (SE 0.7%) age-1.1 fish, 15.9% (SE 2.4%) age-1.2 fish, 21.5% (SE 2.7%) age-1.3 fish, 57.9% (SE 3.2%) age-1.4 fish, and 3.4% (SE 1.2%) age-1.5 fish (Table 6). Compared to the early-run harvest, the late-run sport fishery harvested similar proportions of age-1.3 females and males (approximately 10.5%) with a higher proportion of age-1.4 females (36.5%, SE 3.2%) than males (21.5%, SE 2.7%); all sampled age-1.1 and 1.2 Chinook salmon were males.

One illegally harvested Chinook salmon that was within the early-run slot limit (46–55 inches TL) was sampled in the creel survey (Figure 10). The 2008 slot limit change resulted in an additional 12% of Chinook salmon sampled in the creel survey measuring between 44 inches TL and 46 inches TL during 2011. Approximately 15% of early-run Chinook salmon sampled in the creel survey were below 28 inches TL compared to the five-year average (2003–2007) of 6% when Chinook salmon measuring between 20 inches TL and 28 inches TL counted toward the annual limit prior to 1 July.

Sample size goals and relative precision goals for estimates of age proportions of the harvest were met for each sampling stratum in both the early run and late run.

Table 5.–Age composition and estimated sport harvest by age class for early-run Kenai River Chinook salmon between Soldotna Bridge and Warren Ames Bridge, 16 May–30 June 2011.

	Age			
Parameter	1.2	1.3	1.4	Total
Female				
Sample size		10	17	27
Harvest		146	248	393
SE harvest		50	69	93
% Harvest		17.9%	30.4%	48.2%
SE % harvest		5.2%	6.2%	6.7%
Male				
Sample size	11	10	8	29
Harvest	160	146	117	423
SE harvest	53	50	44	97
% Harvest	19.6%	17.9%	14.3%	51.8%
SE % harvest	5.4%	5.2%	4.7%	6.7%
Both sexes combined				
Sample size	11	20	25	56
Harvest	160	291	364	816
SE harvest	53	76	88	156
% Harvest	19.6%	35.7%	44.6%	100.0%
SE % harvest	5.4%	6.5%	6.7%	0.0%

Note: Values given by age and sex may not sum to totals due to rounding.

Table 6.–Age composition and estimated sport harvest by age class and geographic strata for late-run Kenai River Chinook salmon between Soldotna Bridge and Warren Ames Bridge, 1–31 July 2011.

	Age					
Parameter[a]	1.1	1.2	1.3	1.4	1.5	Total
Female						
Sample size			24	85	2	111
% Sample			10.3%	36.5%	0.9%	47.6%
SE % sample			2.0%	3.2%	0.6%	3.3%
Downstream harvest			47	167	4	218
SE downstream harvest			12	34	3	42
Upstream harvest			618	2,189	52	2,858
SE upstream harvest			131	267	36	315
Total harvest			665	2,356	55	3,077
SE total harvest			139	279	39	327
Male						
Sample size	3	37	26	50	6	122
% Sample	1.3%	15.9%	11.2%	21.5%	2.6%	52.4%
SE % sample	0.7%	2.4%	2.1%	2.7%	1.0%	3.3%
Downstream harvest	6	73	51	98	12	240
SE downstream harvest	4	17	13	22	5	46
Upstream harvest	77	953	670	1,288	155	3,142
SE upstream harvest	45	165	136	196	64	335
Total harvest	83	1,026	721	1,386	166	3,381
SE total harvest	48	176	145	207	68	347
Both sexes combined						
Sample size	3	37	50	135	8	233
% Sample	1.3%	15.9%	21.5%	57.9%	3.4%	100.0%
SE % sample	0.7%	2.4%	2.7%	3.2%	1.2%	0.0%
Downstream harvest	6	73	98	265	16	458
SE downstream harvest	4	17	22	50	6	83
Upstream harvest	77	953	1,288	3,477	206	6,000
SE upstream harvest	45	165	196	357	74	518
Total harvest	83	1,026	1,386	3,742	222	6,458
SE total harvest	48	176	207	369	79	525

Note: Values given by age and sex may not sum to totals due to rounding.

[a] "Downstream" = Kenai River reach between Warren Ames Bridge and the Chinook salmon sonar site; "Upstream" = Kenai River reach between the Chinook salmon sonar site and Soldotna Bridge; "Total harvest" = the downstream and upstream reach harvests combined.

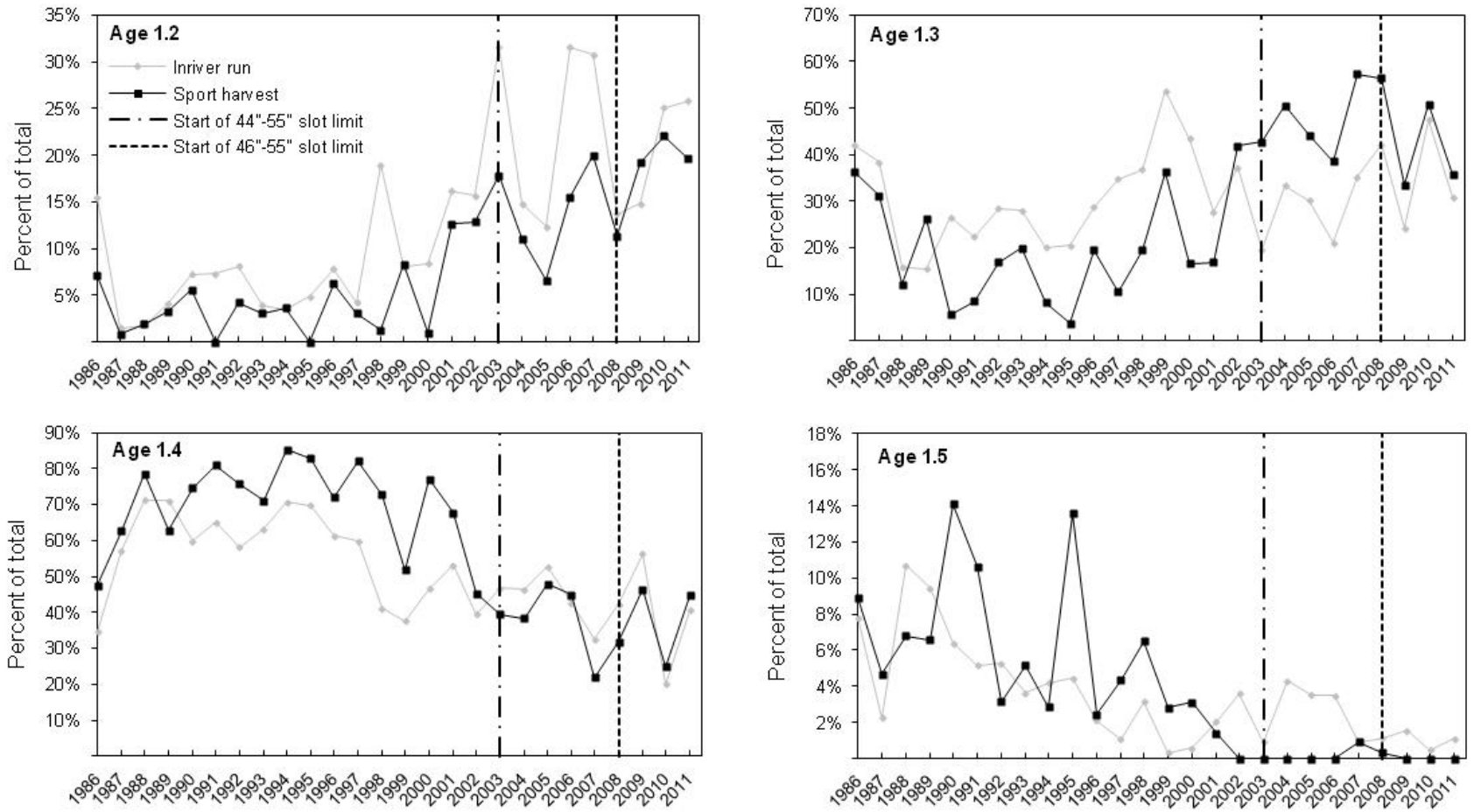

Figure 9.–Age composition of early-run harvest versus inriver early run between Soldotna Bridge and Warren Ames Bridge for age-1.2 (top left), age-1.3 (top right), age-1.4 (bottom left), and age-1.5 (bottom right) Chinook salmon, Kenai River, 1986–2011.

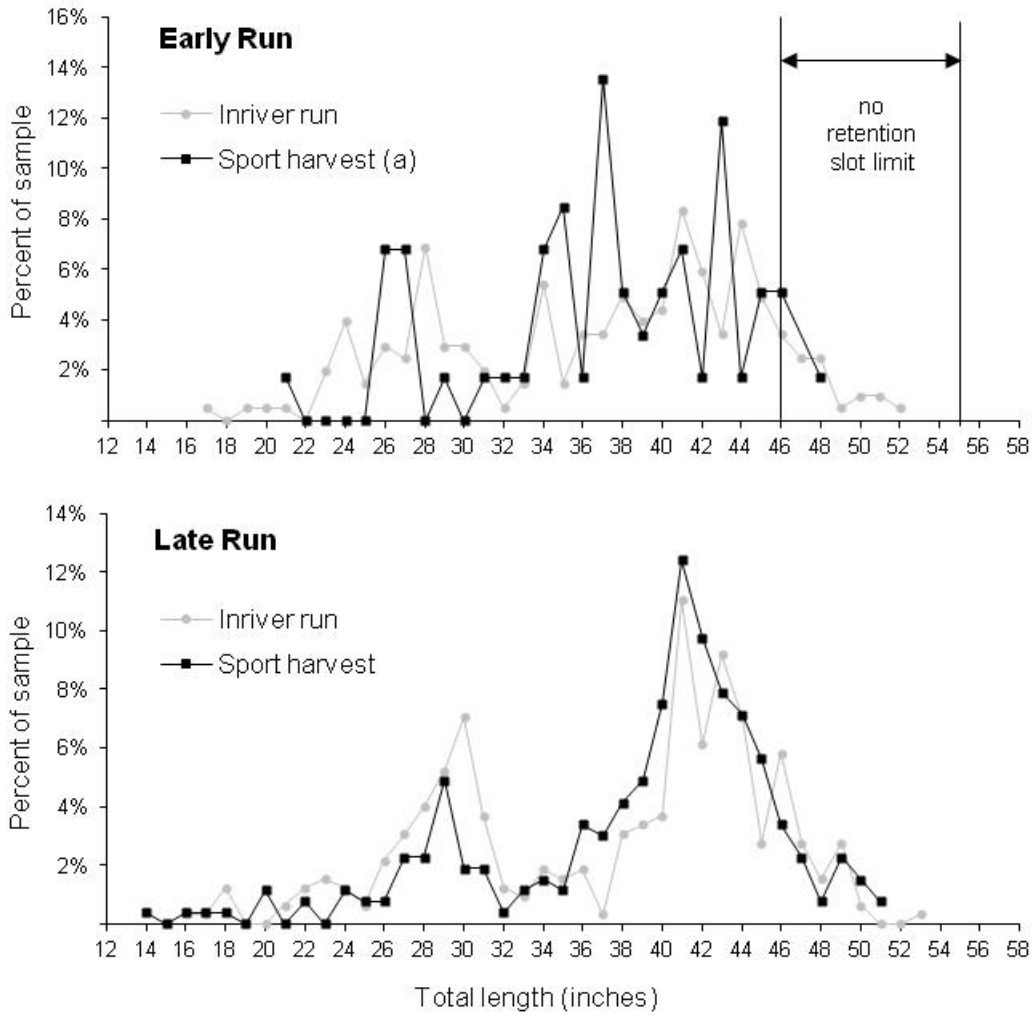

Figure 10.–Length distribution of early-run (top) and late-run (bottom) Kenai River Chinook salmon creel survey and inriver gillnetting samples, 2011.

[a] One illegally harvested Chinook salmon within the slot limit 46–55 inches TL was sampled in the creel survey.

Inriver Gillnetting

The inriver early-run age composition estimate was composed of 1.6% (SE 0.9%) age-1.1 fish, 25.8% (SE 3.3%) age-1.2 fish, 30.8% (SE 3.4%) age-1.3 fish, 40.7% (SE 3.7%) age-1.4 fish, and 1.1% (SE 0.8%) age-1.5 fish (Table 7 and Figure 9). Age-1.3 and age-1.4 females were captured in higher proportions than males of the same age classes while all captured age-1.5 Chinook salmon were males. During the late run, the age composition estimate of the inriver run was composed of 2.4% (SE 0.9%) age-1.1 fish, 29.9% (SE 2.7%) age-1.2 fish, 19.2% (SE 2.3%) age-1.3 fish, 46.4% (SE 2.9%) age-1.4 fish, and 2.1% (SE 0.8%) age-1.5 fish (Table 8). Males were captured in larger proportions than females for their respective age classes except for the 1.4 age class (33.3%, SE 2.8% females; 13.1%, SE 2.0% males). Overall, the proportion of males to females was similar in the early and late runs with a larger proportion of males (approximately 59%, SE 4%) than females (approximately 41%, SE 4%) (Tables 7–8).

The age compositions of the inriver early and late runs differed significantly ($\chi^2 = 7.71$, df = 2, $P = 0.02$) with age-1.2, -1.3, and -1.4 fish considered. Age-1.4 fish, and age-1.3 fish in the early run were the most abundant, while age-1.4 fish, and age-1.2 fish were the most abundant in the late run.

The age composition of the early-run harvest and the early-run inriver run did not differ significantly ($\chi^2 = 1.11$, df = 2, $P = 0.573$) with ages 1.2, 1.3, and 1.4 fish considered (Tables 5 and 7). The age compositions of the late-run harvest and the late-run inriver run were significantly different ($\chi^2 = 14.41$, df = 2, $P = .0007$), with ages 1.2, 1.3, and 1.4 fish considered (Tables 6 and 8). Harvest in the late-run was comprised of a higher proportion of age-1.4 (57.9%, SE 3.2%) fish, and a lower proportion of age-1.2 (15.9% SE 2.4%) fish, compared to the late-run inriver run of 46.4% (SE 2.9%) age-1.4 fish, and 29.9% (SE 2.7%) age-1.2 fish.

Table 7.–Age composition and estimated inriver run by age class for early-run Kenai River Chinook salmon, 16 May–30 June 2011.

	Age					
Parameter	1.1	1.2	1.3	1.4	1.5	Total
Female						
Sample size			30	44		74
% Inriver run			16.5%	24.2%		40.7%
SE % inriver run			2.8%	3.2%		3.7%
Male						
Sample size	3	47	26	30	2	108
% Inriver run	1.6%	25.8%	14.3%	16.5%	1.1%	59.3%
SE % inriver run	0.9%	3.3%	2.6%	2.8%	0.8%	3.7%
Both sexes combined						
Sample size	3	47	56	74	2	182
% Inriver run	1.6%	25.8%	30.8%	40.7%	1.1%	100.0%
SE % inriver run	0.9%	3.3%	3.4%	3.7%	0.8%	0.0%

Note: Values given by age and sex may not sum to totals due to rounding.

Table 8.–Age composition and estimated inriver run by age class for late-run Kenai River Chinook salmon, 1 July–10 August 2011.

	Age					
Parameter	1.1	1.2	1.3	1.4	1.5	Total
Female						
Sample size		3	19	97	1	120
% Inriver run		1.0%	6.5%	33.3%	0.3%	41.2%
SE % inriver run		0.6%	1.5%	2.8%	0.3%	2.9%
Male						
Sample size	7	84	37	38	5	171
% Inriver run	2.4%	28.9%	12.7%	13.1%	1.7%	58.8%
SE % inriver run	0.9%	2.7%	2.0%	2.0%	0.8%	2.9%
Both sexes combined						
Sample size	7	87	56	135	6	291
% Inriver run	2.4%	29.9%	19.2%	46.4%	2.1%	100.0%
SE % inriver run	0.9%	2.7%	2.3%	2.9%	0.8%	0.0%

Note: Values given by age and sex may not sum to totals due to rounding.

LENGTH-AT-AGE COMPARISONS

METF lengths are compiled by age and sex for the early run (Table 9) and the late run (Table 10). A graphical depiction of length-at-age is shown in Figure 11. On average, age-1.3 female Chinook salmon were slightly larger than age-1.3 males, while age-1.4 and age-1.5 male Chinook salmon were larger on average than females of these ages.

OTHER RESULTS

River conditions during both the early and late runs were above average in water clarity and less than average for river discharge measurements. Kenai River Secchi disk measurements of water clarity (taken within the sport fishery at RM 15.3) ranged between 0.6 m and 2.0 m, with the average (1.3 m) above the historic (1998–2010) average of 0.9 m (Figure 12). Secchi disk measurements at the Chinook salmon sonar site (RM 8.5) ranged between 0.1 m and 1.3 m with an average (0.6 m) equal to the historic average of 0.6 m. The 2011 average discharge (8,439 ft^3/s) was below the historic (1965–2010) average discharge of 10,249 ft^3/s.

Harvest of late-run Chinook salmon downstream of the Chinook salmon sonar site (a tidally-influenced section of river) increased from 5% to 25% of total late-run harvest (1996–2006), but decreased from 19% to 7% of the total late-run harvest from 2007 to 2011 (Figure 13).

No adipose finclipped Chinook salmon were observed in the creel survey or inriver gillnetting study.

There was no reported harvest of Chinook salmon 55 inches TL or greater in either run.

Genetic tissue samples were taken from 648 Chinook salmon captured in inriver gillnets (203 early run, 445 late run), and 320 tissue samples were taken from Chinook salmon sampled during the creel survey (59 early run, 261 late run).

A total of 228 Chinook salmon received an esophageal radio transmitter during the inriver gillnetting study at RM 8.5, from 16 May–5 July. A total of six radio transmitters were recovered from harvested Chinook salmon during creel survey sampling.

Table 9.–Early-run Kenai River Chinook salmon lengths by sex and age from creel survey and inriver gillnet samples, 16 May–30 June 2011.

		Age					
Source	Parameter	1.1	1.2	1.3	1.4	1.5	Combined
Creel Survey							
	Females						
	Sample size			10	17		27
	Mean length (mm)			821	979		920
	SE length (mm)			13	13		18
	Min length (mm)			740	905		740
	Max length (mm)			870	1,080		1,080
	Males						
	Sample size		11	10	8		29
	Mean length (mm)		613	832	969		786
	SE length (mm)		15	17	19		29
	Min length (mm)		505	745	890		505
	Max length (mm)		680	920	1,035		1,035
	Both sexes combined						
	Sample size		11	20	25		56
	Mean length (mm)		613	826	976		851
	SE length (mm)		15	11	10		19
	Min length (mm)		505	740	890		505
	Max length (mm)		680	920	1,080		1,080
Inriver Gillnet Samples							
	Females						
	Sample size			30	44		74
	Mean length (mm)			852	996		938
	SE length (mm)			9	8		10
	Min length (mm)			770	845		770
	Max length (mm)			945	1,120		1,120
	Males						
	Sample size	3	47	26	30	2	108
	Mean length (mm)	440	617	848	1,036	1,088	793
	SE length (mm)	18	8	14	11	38	19
	Min length (mm)	405	475	720	925	1,050	405
	Max length (mm)	465	710	955	1,172	1,125	1,172
	Both sexes combined						
	Sample size	3	47	56	74	2	182
	Mean length (mm)	440	617	850	1,012	1,088	852
	SE length (mm)	18	8	8	7	38	13
	Min length (mm)	405	475	720	845	1,050	405
	Max length (mm)	465	710	955	1,172	1,125	1,172

Note: All lengths measured from mid eye to tail fork.

Table 10.–Late-run Kenai River Chinook salmon lengths by sex and age from creel survey and inriver gillnet samples, 1–31 July 2011.

Source	Parameter	Age 1.1	1.2	1.3	1.4	1.5	Combined
Creel Survey							
	Females						
	Sample size			24	85	2	111
	Mean length (mm)			890	972	1,073	956
	SE length (mm)			10	5	3	6
	Min length (mm)			730	865	1,070	730
	Max length (mm)			950	1,130	1,075	1,130
	Males						
	Sample size	3	37	26	50	6	122
	Mean length (mm)	380	621	822	1,007	1,101	840
	SE length (mm)	21	9	14	9	17	18
	Min length (mm)	340	450	675	900	1,020	340
	Max length (mm)	410	700	940	1,150	1,135	1,150
	Both sexes combined						
	Sample size	3	37	50	135	8	233
	Mean length (mm)	380	621	855	985	1,094	895
	SE length (mm)	21	9	10	5	14	10
	Min length (mm)	340	450	675	865	1,020	340
	Max length (mm)	410	700	950	1,150	1,135	1,150
Inriver Gillnet Samples							
	Females						
	Sample size		3	19	97	1	120
	Mean length (mm)		589	892	994	1,090	969
	SE length (mm)		60	11	5		8
	Min length (mm)		486	780	895	1,090	486
	Max length (mm)		695	940	1,110	1,090	1,110
	Males						
	Sample size	7	84	37	38	5	171
	Mean length (mm)	415	640	832	1,039	1,105	775
	SE length (mm)	12	6	13	10	12	15
	Min length (mm)	375	500	695	940	1,060	375
	Max length (mm)	480	720	940	1,210	1,130	1,210
	Both sexes combined						
	Sample size	7	87	56	135	6	291
	Mean length (mm)	415	639	852	1,007	1,103	854
	SE length (mm)	12	6	10	5	10	11
	Min length (mm)	375	486	695	895	1,060	375
	Max length (mm)	480	720	940	1,210	1,130	1,210

Note: All lengths measured from mid eye to tail fork.

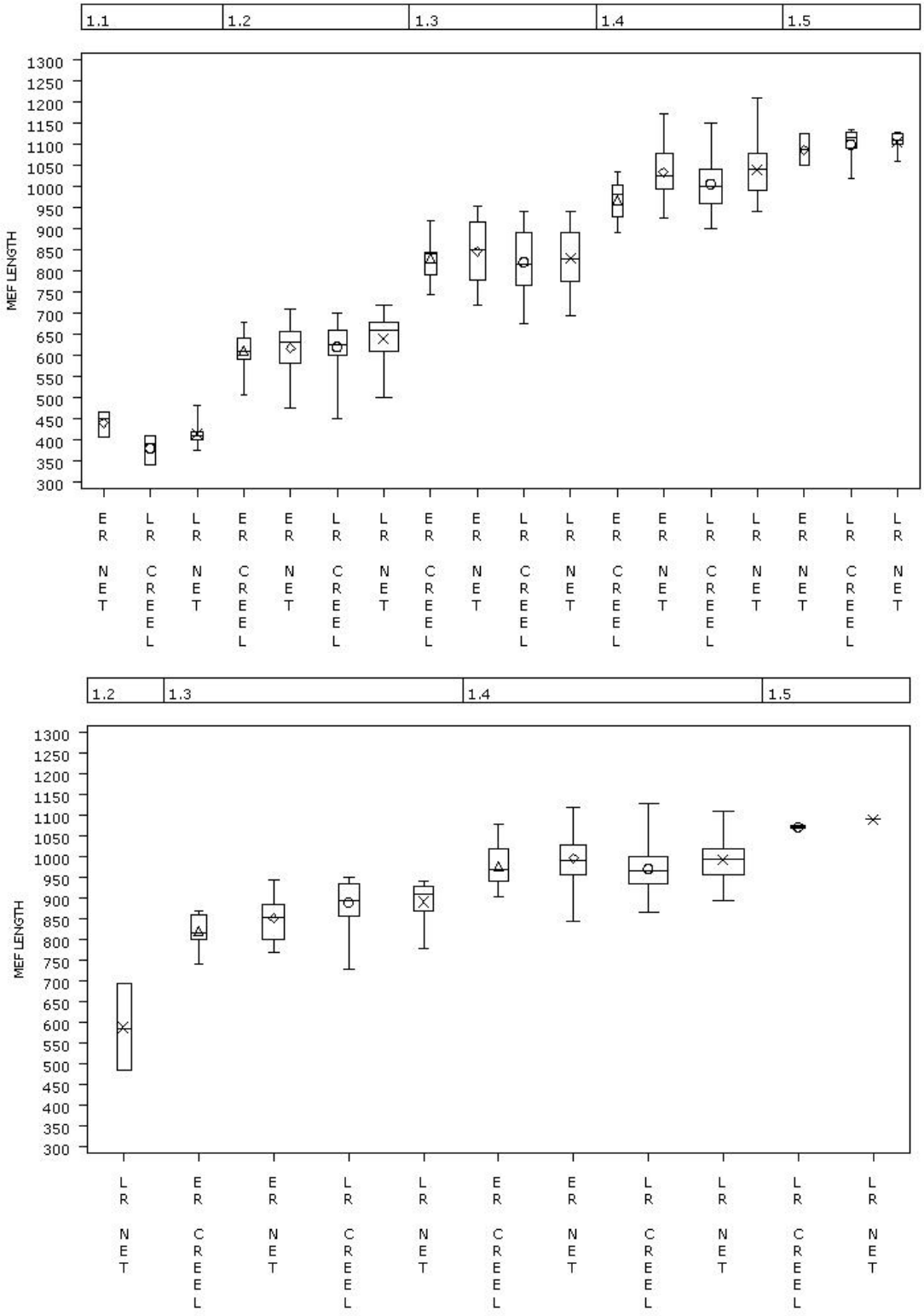

Figure 11.–Box plots of length distribution by sex and age of early- and late-run Kenai River Chinook salmon males (top) and females (bottom) from creel survey and inriver gillnetting samples, 2011.

Note: "ER" = early run; "LR" = late run. The single character within each box identifies the source of the data (e.g., Δ = early-run creel; ◊ = early-run net; O = late-run creel; and X = late-run net).

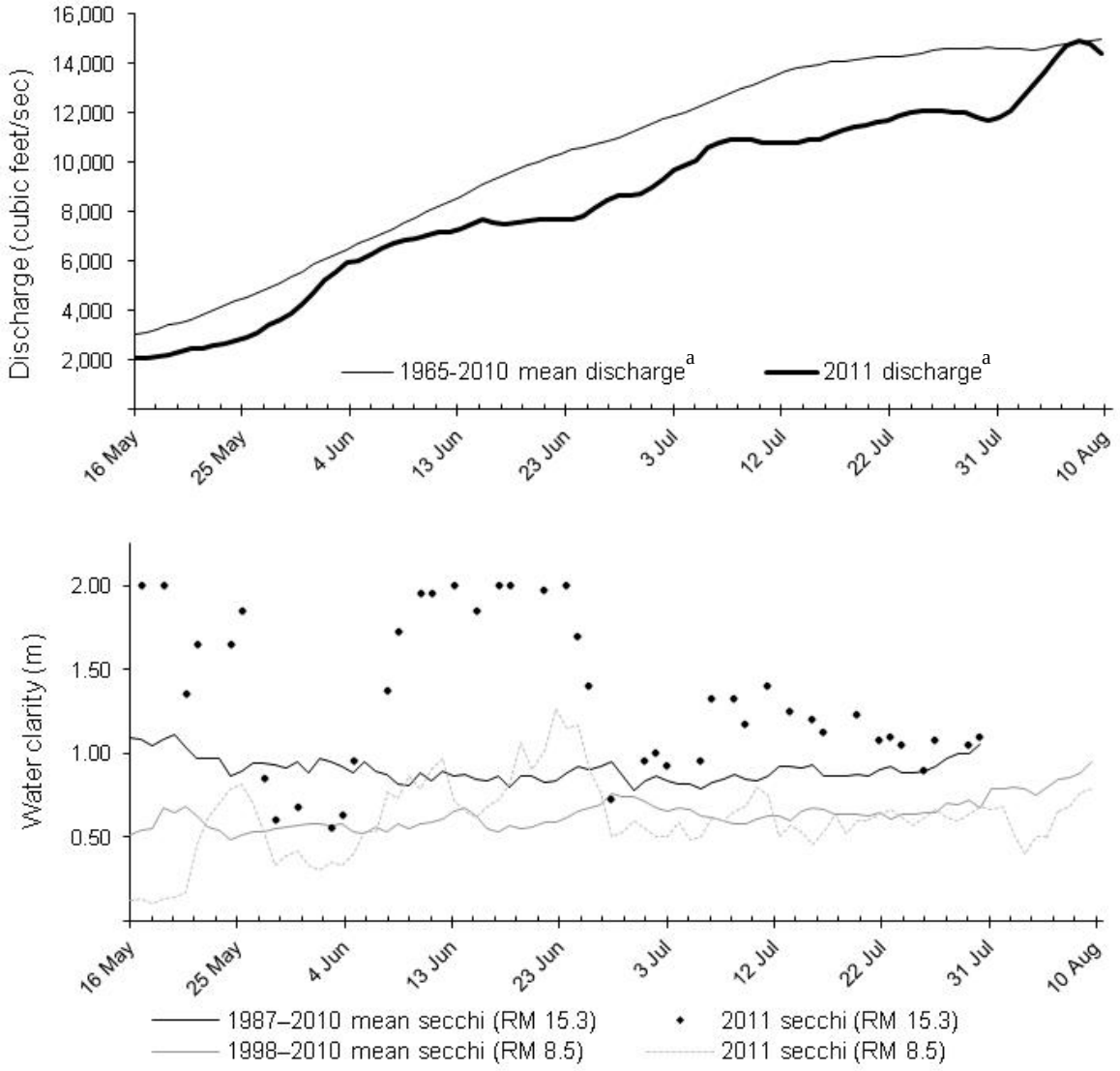

Figure 12.–Kenai River discharge (top) and water clarity (bottom), 16 May–10 August, 2011.

[a] Discharge data downloaded from USGS 15266300 KENAI RIVER AT SOLDOTNA AK. 2011-10-03 15:30:11 EST http://waterdata.usgs.gov/ak/nwis/dv

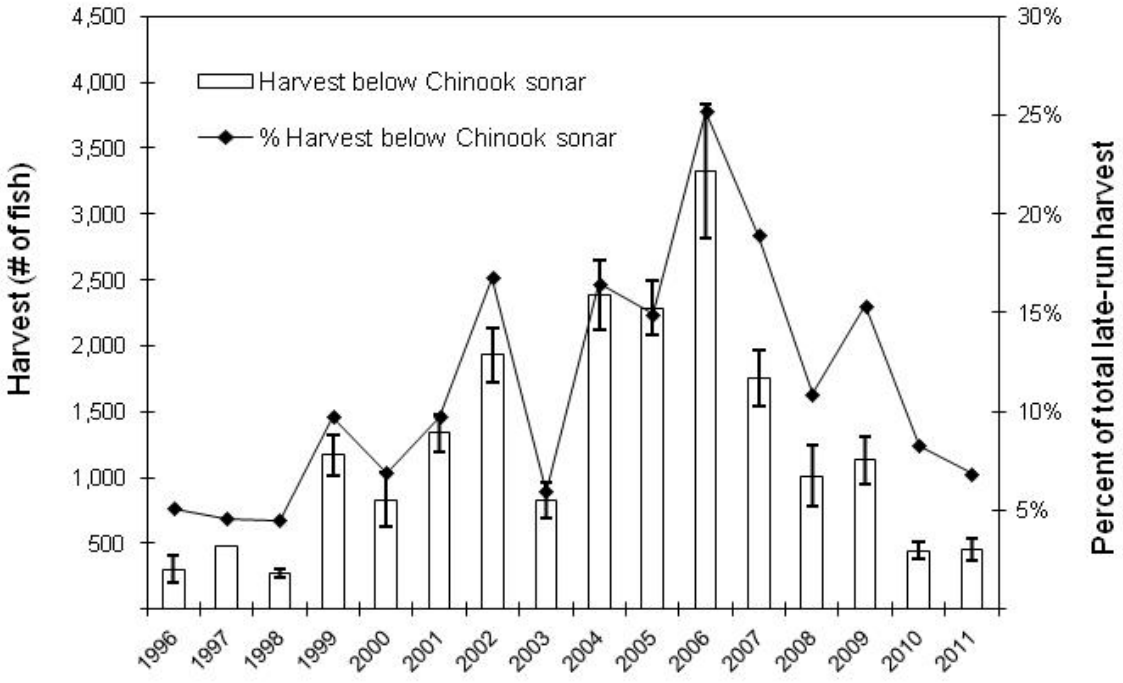

Figure 13.–Estimated number of fish and percent of late-run Kenai River Chinook salmon sport harvest between the Chinook salmon sonar site (RM 8.5) and Warren Ames Bridge (RM 5.2), 1996–2011.

DISCUSSION AND RECOMMENDATIONS

CREEL SURVEY

The early-run slot limit regulations (44–55 inches TL from 2003 to 2007, 46–55 inches TL from 2008 to 2011) have been effective at protecting ocean-age-5 Chinook salmon in the early run. Since the inception of the slot limit in 2003, only 2 early-run ocean-age-5 Chinook salmon have been sampled in the creel survey. Among early-run ocean-age-4 fish, females have been harvested at a higher rate than males because ocean-age-4 males are longer on average than ocean-age-4 females and more likely to be protected under the slot limit than females. As a result of the change to the lower bound of the early-run slot limit (from 44 inches to 46 inches TL in 2008), an additional 8% to 12% of sampled harvested Chinook salmon were between 44 and 46 inches TL; none of these were age-1.5 fish.

Harvest upstream of the Slikok Creek confluence area was restricted 29 June and 30 June. Inseason management actions were also taken during the late-run Chinook salmon fishery on 1 July to restrict harvest by prohibiting the use of bait upstream of the Slikok Creek confluence area, and from 25–31 July further prohibiting the use of bait upstream of the Kenai River mouth.

During 2011, late-run Monday estimates of unguided angler effort, catch, and harvest were generated using a recalibrated index (Perschbacher 2012c) and were included in season totals

(Table 3 and Figure 7). During the years 2002–2008, late-run Monday index estimates were generated but not included in season totals. The Monday fishery has grown in popularity although unguided harvest was only estimated to be 3% of total late-run harvest in 2011. Index estimates should continue to be included in season totals to monitor this portion of the fishery. Mondays should be included into the creel survey sampling schedule on a five-year cycle (beginning 2015) to ensure the accuracy of estimating angler effort based on a single index count, and the use of imputed HPUE and CPUE rates.

Currently, the Kenai River Chinook salmon creel survey CPUE rates were relied upon by fisheries managers with 4 other indices to gauge run strength and run timing of Kenai River Chinook salmon. The creel survey, coupled with management tools responsible for inseason estimates of run strength, timing, and abundance (such as the inriver gillnetting project, ESSN fishery, and DIDSON sonar project) are critical for inseason and postseason assessment of Kenai River Chinook salmon.

INRIVER GILLNETTING

In 2011, approximately 28% of all fish passed the Chinook salmon sonar site during the time when inriver gillnetting was conducted in the early run, and approximately 32% of all fish passed the Chinook salmon sonar site during the time when inriver gillnetting was conducted in the late run (Figure 6). During the 2011 early run, the inriver gillnetting schedule change resulted in a 3% decrease of fish interception compared to what would have been observed if the old inriver gillnetting schedule were still in effect, although in six out of the past eight years this was not the case. During the 2011 late run, the inriver gillnetting schedule change resulted in a 10% increase in fish interception compared to what would have been observed with the old inriver gillnetting schedule; the new schedule saw a higher percentage of fish passage than if the schedule had remained unchanged in eight out of the past eight years. It is recommended that the change to the inriver gillnetting sampling schedule be retained in future years.

In 2011, managers relied even more heavily on inseason inriver gillnetting CPUE as ADF&G transitioned from split-beam sonar to DIDSON sonar to estimate Kenai River Chinook salmon abundance. The inriver gillnetting program continues to be an integral part of Kenai River Chinook salmon stock assessment and is critical to both inseason and postseason management of Kenai River Chinook salmon.

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APPENDIX A: BOAT AND ANGLER COUNTS DURING THE KENAI RIVER CHINOOK SALMON FISHERY, 2011

Appendix A1.-Guided and unguided boat angler counts, by geographic strata, during the early-run Kenai River Chinook salmon fishery, 16 May–30 June 2011.

		Downstream[a]								Upstream[a]								Combined strata							
		Unguided anglers[b]				Guided anglers[b]				Unguided anglers[b]				Guided anglers[b]				Unguided anglers[b]				Guided anglers[b]			
Date	Day type[c]	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
17 May	wd	0	0	0	0	0	0	0		4	5	0	3	3	5	4		4	5	0	3	3	5	4	
19 May	wd	0	0	0	0	0	0	0		7	5	9	3	0	6	7		7	5	9	3	0	6	7	
21 May	we/hol	0	0	0	0	0	0	0		2	6	5	5	18	18	6		2	6	5	5	18	18	6	
22 May	we/hol	0	0	0	0					0	24	6	13					0	24	6	13				
25 May	wd	0	0	0	0	0	0	0		0	6	8	7	28	23	7		0	6	8	7	28	23	7	
26 May	wd	0	0	0	0	0	0	0		0	10	6	6	22	40	19		0	10	6	6	22	40	19	
28 May	we/hol	0	0	0	0	0	0	0		3	23	18	0	59	43	7		3	23	18	0	59	43	7	
29 May	we/hol	0	0	0	0					18	27	17	0					18	27	17	0				
31 May	wd	0	0	0	0	0	0	0		8	2	14	0	49	35	19		8	2	14	0	49	35	19	
3 Jun	wd	0	0	0	0	0	0	0		14	2	0	6	32	34	9		14	2	0	6	32	34	9	
4 Jun	we/hol	0	0	0	0	0	0	0		11	7	17	6	34	28	3		11	7	17	6	34	28	3	
5 Jun	we/hol	0	1	0	0	0	0			21	16	19	2	22	0			21	17	19	2	22	0		
8 Jun	wd	0	0	0	0	0	0	0		10	35	3	20	101	93	19		10	35	3	20	101	93	19	
9 Jun	wd	0	0	0	0	0	0	0		0	19	10	21	0	84	44		0	19	10	21	0	84	44	
11 Jun	we/hol	0	0	0	0	0	0	0		42	50	29	22	157	118	18		42	50	29	22	157	118	18	
12 Jun	we/hol	0	0	0	0					25	40	85	28					25	40	85	28				
14 Jun	wd	0	0	0	0	0	8			23	21	24	3	170	113			23	21	24	3	170	121		
16 Jun	wd	0	0	0	0		3	0		25	21	34	63		88	58		25	21	34	63		91	58	
18 Jun	we/hol	0	0	0	0	0	7	0		69	53	61	20	224	76	43		69	53	61	20	224	83	43	
19 Jun	we/hol	0	15	0	0					24	63	43	75					24	78	43	75				
22 Jun	wd	0	0	0	0	0	0	0		26	28	9	40	179	141	32		26	28	9	40	179	141	32	
24 Jun	wd	2	4	0	0	20	0			24	28	26	10	137	100			26	32	26	10	157	100		
25 Jun	we/hol	0	5	0	5	8	2	0		19	66	65	58	131	125	52		19	71	65	63	139	127	52	
26 Jun	we/hol	0	3	3	0					26	100	85	33					26	103	88	33				
28 Jun	wd	0	3	0	0	0	22	0		56	26	33	19	232	145	74		56	29	33	19	232	167	74	
Min (All A–D)			0				0				0				0				0				0		
Mean (All A–D)			0				1				22				60				23				61		
Max (All A–D)			15				22				100				232				103				232		

Note: Blank space in data fields = fishing was closed for guided anglers during the time of this count, therefore no data to present.

[a] "Downstream" = Kenai River reach from Warren Ames Bridge to Chinook salmon sonar site; "Upstream" = Kenai River reach from the sonar site to Soldotna Bridge.

[b] Angler count times: A = 0400–0859 hours; B = 0900–1359 hours; C = 1400–1959 hours; and D = 2000–2359 hours.

[c] "wd" = weekday; "we/hol" = weekend/holiday.

Appendix A2.-Guided and unguided boat angler counts, by geographic strata, during the late-run Kenai River Chinook salmon fishery, 1–31 July 2011.

		Downstream[a]								Upstream[a]								Combined strata							
		Unguided anglers[b]				Guided anglers[b]				Unguided anglers[b]				Guided anglers[b]				Unguided anglers[b]				Guided anglers[b]			
Date	Day type[c]	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1 Jul	wd	0	0	0	4		4	3		199	78	66	112		202	104		199	78	66	116		206	107	
2 Jul	w/h	0	0	0	0	0	4	0		121	60	72	86	279	130	46		121	60	72	86	279	134	46	
3 Jul	w/h	21	6	0	0					207	204	189	47					228	210	189	47				
4 Jul	Mon																		41						
6 Jul	wd	0	4	7	0		9	2		75	83	28	104		216	80		75	87	35	104		225	82	
7 Jul	wd	3	2	0	0	6	2	0		81	65	37	38	203	139	43		84	67	37	38	209	141	43	
9 Jul	w/h	29	4	4	0	97	0			174	127	100	72	246	264			203	131	104	72	343	264		
10 Jul	w/h	2	24	8	3					256	253	208	75					258	277	216	78				
11 Jul	Mon																		91						
12 Jul	wd	0	8	0	6		45	0		185	105	123	147		392	103		185	113	123	153		437	103	
14 Jul	wd	4	30	2	17	4	64	0		208	92	144	247	383	162	126		212	122	146	264	387	226	126	
16 Jul	w/h	19	40	0	0	14	121	0		384	166	158	118	425	132	130		403	206	158	118	439	253	130	
17 Jul	w/h	0	21	0	3					493	208	258	124					493	229	258	127				
18 Jul	Mon																		96						
20 Jul	wd	5	9	0	0	23	61			257	101	167	0	443	283			262	110	167	0	466	344		
22 Jul	wd	9	13	11	3		52	31		211	277	156	274		407	124		220	290	167	277		459	155	
23 Jul	w/h	65	8	19	0	128	27	45		267	211	141	89	329	289	71		332	219	160	89	457	316	116	
24 Jul	w/h	0	99	8	42					167	346	250	275					167	445	258	317				
25 Jul	Mon																		53						
26 Jul	wd	17	22	0	3	9	22	0		172	118	116	81	467	281	140		189	140	116	84	476	303	140	
27 Jul	wd	2	20	4	8	4	39	0		103	56	49	66	446	231	131		105	76	53	74	450	270	131	
30 Jul	w/h	3	0	0	0	10	4	0		90	82	114	142	244	234	143		93	82	114	142	254	238	143	
31 Jul	w/h	0	11	2	0					152	203	129	133					152	214	131	133				
Min (All A–D)		0				0				0				43				0				43			
Mean (All A–D)		9				23				150				224				154				247			
Max (All A–D)		99				128				493				467				493				476			

Note: Blank space in data fields = fishing was closed for guided anglers during the time of this count, therefore no data to present.

[a] "Downstream" = Kenai River reach from Warren Ames Bridge to Chinook salmon sonar site; "Upstream" = Kenai River reach from the sonar site to Soldotna Bridge.

[b] Angler count times: A = 0400–0859 hours; B = 0900–1359 hours; C = 1400–1959 hours; and D = 2000–2359 hours.

[c] "wd" = weekday; "w/h" = weekend/holiday; "Mon" = Monday index count (0800–1359 hours); Monday angler count not geographically stratified.

APPENDIX B: EFFORT, CATCH, AND HARVEST ESTIMATES BY GEOGRAPHIC STRATA DURING THE KENAI RIVER CHINOOK SALMON FISHERY, 2011.

Appendix B1.-Daily estimates of unguided boat angler CPUE, HPUE, angler effort, catch and harvest, by geographic strata, during the early-run Kenai River Chinook salmon fishery, 16 May–30 June 2011.

		Angler interview data[a]					Downstream[b]								Upstream[b]							
		Catch			Harvest		Counts		Effort		Catch		Harvest		Counts		Effort		Catch		Harvest	
Date	Day Type[c]	*n*[d]	CPUE	SE	HPUE	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE
17 May	wd	12	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	3.0	60	24	0	0	0	0
19 May	wd	7	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	6.0	120	31	0	0	0	0
21 May	we/hol	12	0.028	0.030	0.028	0.030	4	0	0	0	0	0	0	0	4	4.5	90	17	3	3	3	3
22 May	we/hol	24	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	10.8	215	126	0	0	0	0
25 May	wd	8	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	5.3	105	26	0	0	0	0
26 May	wd	17	0.032	0.023	0.032	0.023	4	0	0	0	0	0	0	0	4	5.5	110	44	4	3	4	3
28 May	we/hol	38	0.007	0.007	0.000	0.000	4	0	0	0	0	0	0	0	4	11.0	220	112	2	2	0	0
29 May	we/hol	40	0.021	0.012	0.021	0.012	4	0	0	0	0	0	0	0	4	15.5	310	89	7	4	7	4
31 May	wd	5	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	6.0	120	79	0	0	0	0
3 Jun	wd	13	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	5.5	110	55	0	0	0	0
4 Jun	we/hol	9	0.052	0.058	0.052	0.058	4	0	0	0	0	0	0	0	4	10.3	205	63	11	12	11	12
5 Jun	we/hol	17	0.000	0.000	0.000	0.000	4	0	5	6	0	0	0	0	4	14.5	290	73	0	0	0	0
8 Jun	wd	16	0.042	0.030	0.042	0.030	4	0	0	0	0	0	0	0	4	17.0	340	180	14	13	14	13
9 Jun	wd	5	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	12.5	250	97	0	0	0	0
11 Jun	we/hol	30	0.059	0.034	0.029	0.017	4	0	0	0	0	0	0	0	4	35.8	715	96	42	25	21	13
12 Jun	we/hol	39	0.026	0.016	0.000	0.000	4	0	0	0	0	0	0	0	4	44.5	890	303	23	16	0	0
14 Jun	wd	9	0.000	0.000	0.000	0.000	4	0	0	0	0	0	0	0	4	17.8	355	87	0	0	0	0
16 Jun	wd	11	0.065	0.036	0.021	0.022	4	0	0	0	0	0	0	0	4	35.8	715	131	47	27	15	16
18 Jun	we/hol	34	0.021	0.012	0.007	0.007	4	0	0	0	0	0	0	0	4	50.8	1,015	183	22	13	7	7
19 Jun	we/hol	55	0.028	0.012	0.024	0.011	4	3.8	75	87	2	3	2	2	4	51.3	1,025	222	29	14	24	12
22 Jun	wd	3	0.012	0.009	0.006	0.006	4	0	0	0	0	0	0	0	4	25.8	515	149	6	5	3	3
24 Jun	wd	25	0.013	0.009	0.006	0.007	4	1.5	30	18	0	0	0	0	4	22.0	440	68	6	4	3	3
25 Jun	we/hol	27	0.010	0.010	0.000	0.000	4	2.5	50	35	1	1	0	0	4	52.0	1,040	194	11	11	0	0
26 Jun	we/hol	19	0.000	0.000	0.000	0.000	4	1.5	30	17	0	0	0	0	4	61.0	1,220	374	0	0	0	0
28 Jun	wd	13	0.000	0.000	0.000	0.000	4	0.8	15	17	0	0	0	0	4	33.5	670	138	0	0	0	0
	Min	3	0.000		0.000		4	0	0		0		0		4	3.0	60		0		0	
	Mean	20	0.017		0.011		4	0	8		0		0		4	22.3	446		9		4	
	Max	55	0.065		0.052		4	3.8	75		2		2		4	61.0	1,220		47		24	

Note: "Catch" = fish harvested plus fish released; "Harvest" = fish kept; "Effort" = angler-hours; "CPUE" = catch per unit effort; "HPUE" = harvest per unit effort.

[a] Angler counts were geographically stratified, angler interviews were not. CPUE and HPUE are catch and harvest per hour.

[b] "Downstream" = Kenai River reach from Warren Ames Bridge to Chinook salmon sonar site; "Upstream" = Chinook salmon sonar site to Soldotna Bridge.

[c] "wd" = weekday; "we/hol" = weekend/holiday.

[d] On days with less than 5 angler interviews, pooled estimates of CPUE and HPUE from other days in the stratum were used.

Appendix B2.-Daily estimates of guided boat angler CPUE, HPUE, angler effort, catch and harvest, by geographic strata, during the early-run Kenai River Chinook salmon fishery, 16 May–30 June 2011.

		Angler interview data[a]					Downstream[b]								Upstream[b]							
		Catch			Harvest		Counts		Effort		Catch		Harvest		Counts		Effort		Catch		Harvest	
Date	Day type[c]	*n*[d]	CPUE	SE	HPUE	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE
17 May	wd	7	0.000	0.000	0.000	0.000	3	0	0	0	0	0	0	0	3	4.0	48	8	0	0	0	0
19 May	wd	6	0.000	0.000	0.000	0.000	3	0	0	0	0	0	0	0	3	4.3	52	21	0	0	0	0
21 May	we/hol	11	0.000	0.000	0.000	0.000	3	0	0	0	0	0	0	0	3	14.0	168	42	0	0	0	0
25 May	wd	13	0.060	0.037	0.038	0.032	3	0	0	0	0	0	0	0	3	19.3	232	58	14	9	9	8
26 May	wd	29	0.031	0.014	0.018	0.011	3	0	0	0	0	0	0	0	3	27.0	324	96	10	5	6	4
28 May	we/hol	27	0.012	0.009	0.012	0.009	3	0	0	0	0	0	0	0	3	36.3	436	136	5	4	5	4
31 May	wd	9	0.044	0.027	0.044	0.027	3	0	0	0	0	0	0	0	3	34.3	412	74	18	12	18	12
3 Jun	wd	10	0.017	0.016	0.000	0.000	3	0	0	0	0	0	0	0	3	25.0	300	87	5	5	0	0
4 Jun	we/hol	3	0.030	0.028	0.022	0.028	3	0	0	0	0	0	0	0	3	21.7	260	89	8	8	6	8
5 Jun	we/hol	0	0.030	0.028	0.022	0.028	2	0	0	0	0	0	0	0	2	11.0	132	132	4	5	3	5
8 Jun	wd	24	0.044	0.016	0.031	0.014	3	0	0	0	0	0	0	0	3	71.0	852	258	37	18	27	14
9 Jun	wd	16	0.049	0.021	0.029	0.018	3	0	0	0	0	0	0	0	3	64.0	768	240	38	20	22	15
11 Jun	we/hol	34	0.019	0.008	0.019	0.008	3	0	0	0	0	0	0	0	3	97.7	1,172	372	22	12	22	12
14 Jun	wd	40	0.052	0.015	0.052	0.015	2	4.0	48	48	2	3	2	3	2	141.5	1,698	342	88	31	88	31
16 Jun	wd	7	0.020	0.024	0.020	0.024	3	1.5	18	18	0	1	0	1	3	73.0	876	180	17	22	17	22
18 Jun	we/hol	4	0.044	0.030	0.044	0.030	3	2.3	28	34	1	2	1	2	3	114.3	1,372	525	61	48	61	48
22 Jun	wd	28	0.039	0.017	0.026	0.014	3	0	0	0	0	0	0	0	3	117.3	1,408	400	55	29	37	23
24 Jun	wd	17	0.000	0.000	0.000	0.000	2	10.0	120	120	0	0	0	0	2	118.5	1,422	222	0	0	0	0
25 Jun	we/hol	40	0.045	0.015	0.045	0.015	3	3.3	40	22	2	1	2	1	3	102.7	1,232	254	55	22	55	22
28 Jun	wd	37	0.008	0.006	0.008	0.006	3	7.3	88	108	1	1	1	1	3	150.3	1,804	389	15	11	15	11
	Min	0	0.000		0.000		2	0.0	0		0		0		2	4.0	48		0		0	
	Mean	18	0.027		0.022		3	1.4	17		0		0		3	62.4	748		23		20	
	Max	40	0.060		0.052		3	10.0	120		2		2		3	150.3	1,804		88		88	

Note: "Catch" = fish harvested plus fish released; "Harvest" = fish kept; "Effort" = angler-hours; "CPUE" = catch per unit effort; "HPUE" = harvest per unit effort.

[a] Angler counts were geographically stratified, angler interviews were not. CPUE and HPUE are catch and harvest per hour.

[b] "Downstream" = Kenai River reach from Warren Ames Bridge to Chinook salmon sonar site; "Upstream" = Chinook salmon sonar site to Soldotna Bridge.

[c] "wd" = weekday; "we/hol" = weekend/holiday.

[d] On days with less than 5 angler interviews, pooled estimates of CPUE and HPUE from other days in the stratum were used.

Appendix B3.-Daily estimates of unguided boat angler CPUE, HPUE, angler effort, catch and harvest, by geographic strata, during the late-run Kenai River Chinook salmon fishery, 1–31 July 2011.

		Angler interview data[a]					Downstream[b]								Upstream[b]							
		Catch			Harvest		Counts		Effort		Catch		Harvest		Counts		Effort		Catch		Harvest	
Date	Day type[c]	*n*	CPUE	SE	HPUE	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE
1 Jul	wd	47	0.105	0.037	0.060	0.020	4	1.0	20	16	2	2	1	1	4	113.8	2,275	531	240	102	138	56
2 Jul	we/hol	20	0.078	0.029	0.065	0.027	4	0	0	0	0	0	0	0	4	84.8	1,695	260	131	54	110	49
3 Jul	we/hol	80	0.027	0.009	0.024	0.009	4	6.8	135	66	4	2	3	2	4	161.8	3,235	583	89	33	79	31
4 Jul	Mon[d]		0.031		0.021																	
6 Jul	wd	34	0.035	0.021	0.017	0.010	4	2.8	55	35	2	2	1	1	4	72.5	1,450	384	51	33	25	17
7 Jul	wd	34	0.057	0.023	0.043	0.018	4	1.3	25	9	1	1	1	1	4	55.3	1,105	132	63	27	48	21
9 Jul	we/hol	50	0.057	0.020	0.024	0.010	4	9.3	185	103	11	7	5	3	4	118.3	2,365	249	136	50	58	25
10 Jul	we/hol	56	0.030	0.013	0.017	0.007	4	9.3	185	113	6	4	3	2	4	198.0	3,960	573	119	53	66	31
11 Jul	Mon[d]		0.055		0.033																	
12 Jul	wd	49	0.080	0.025	0.049	0.018	4	3.5	70	52	6	5	3	3	4	140.0	2,800	349	225	74	138	53
14 Jul	wd	61	0.087	0.019	0.059	0.015	4	13.3	265	168	23	16	16	11	4	172.8	3,455	668	302	88	205	66
16 Jul	we/hol	68	0.040	0.011	0.023	0.009	4	14.8	295	184	12	8	7	5	4	206.5	4,130	905	164	59	96	43
17 Jul	we/hol	64	0.147	0.032	0.102	0.021	4	6.0	120	122	18	18	12	13	4	270.8	5,415	1,302	797	260	554	176
18 Jul	Mon[d]		0.107		0.055																	
20 Jul	wd	31	0.067	0.037	0.008	0.008	4	3.5	70	40	5	4	1	1	4	131.3	2,625	971	176	118	22	24
22 Jul	wd	61	0.045	0.014	0.021	0.009	4	9.0	180	37	8	3	4	2	4	229.5	4,590	741	208	71	95	43
23 Jul	we/hol	34	0.047	0.017	0.034	0.015	4	23.0	460	249	22	14	16	11	4	177.0	3,540	423	168	64	119	55
24 Jul	we/hol	76	0.084	0.017	0.048	0.013	4	37.3	745	566	63	49	36	29	4	259.5	5,190	835	437	112	251	77
25 Jul	Mon[d]		0.055		0.037																	
26 Jul	wd	12	0.025	0.027	0.025	0.027	4	10.5	210	93	5	6	5	6	4	121.8	2,435	263	62	67	62	67
27 Jul	wd	9	0.026	0.029	0.026	0.029	4	8.5	170	100	4	6	4	6	4	68.5	1,370	206	35	40	35	40
30 Jul	we/hol	21	0.013	0.014	0.013	0.014	4	0.8	15	12	0	0	0	0	4	107.0	2,140	177	28	29	28	29
31 Jul	we/hol	28	0.063	0.022	0.054	0.021	4	3.3	65	59	4	4	4	3	4	154.3	3,085	367	196	72	167	68
	Min	9	0.013		0.008		4	0.0	0		0		0		4	55.3	1,105		28		22	
	Mean	44	0.059		0.037		4	8.6	172		10		6		4	149.6	2,993		191		121	
	Max	80	0.147		0.102		4	37.3	745		63		36		4	270.8	5,415		797		554	

Note: "Catch" = fish harvested plus fish released; "Harvest" = fish kept; "Effort" = angler-hours; "CPUE" = catch per unit effort; "HPUE" = harvest per unit effort.

[a] Angler counts were geographically stratified, angler interviews were not. CPUE and HPUE are catch and harvest per hour.

[b] "Downstream" = Kenai River reach from Warren Ames Bridge to the Chinook salmon sonar site; "Upstream" = Kenai River reach from the sonar site to Soldotna Bridge.

[c] "wd" = weekday; "we/hol" = weekend/holiday; "Mon" = Monday index estimates not geographically stratified.

[d] Monday CPUE and HPUE estimates were selected based on CPUE and HPUE estimates that occurred on adjacent power-boat days before and after each Monday.

Appendix B4.-Daily estimates of guided boat angler CPUE, HPUE, angler effort, catch and harvest, by geographic strata, during the late-run Kenai River Chinook salmon fishery, 1–31 July 2011.

		Angler interview data[a]					Downstream[b]								Upstream[b]							
		Catch			Harvest		Counts		Effort		Catch		Harvest		Counts		Effort		Catch		Harvest	
Date	Day type[c]	*n*	CPUE	SE	HPUE	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE	*n*	Mean	Est.	SE	Est.	SE	Est.	SE
1 Jul	wd	47	0.109	0.020	0.089	0.019	3	3.5	42	6	5	1	4	1	3	153.0	1,836	588	201	74	163	63
2 Jul	we/hol	60	0.063	0.015	0.057	0.013	3	1.3	16	20	1	1	1	1	3	151.7	1,820	593	114	46	104	42
6 Jul	wd	42	0.071	0.020	0.055	0.017	3	5.5	66	42	5	3	4	3	3	148.0	1,776	816	125	67	98	54
7 Jul	wd	7	0.043	0.021	0.043	0.021	3	2.7	32	15	1	1	1	1	3	128.3	1,540	400	66	37	66	37
9 Jul	we/hol	56	0.068	0.017	0.053	0.012	2	48.5	582	582	39	40	31	32	2	255.0	3,060	108	207	51	163	38
12 Jul	wd	109	0.067	0.011	0.051	0.009	3	22.5	270	270	18	18	14	14	3	247.5	2,970	1,734	199	120	150	91
14 Jul	wd	65	0.140	0.021	0.091	0.016	3	22.7	272	304	38	43	25	28	3	223.7	2,684	776	375	122	244	83
16 Jul	we/hol	24	0.082	0.041	0.035	0.015	3	45.0	540	560	44	51	19	21	3	229.0	2,748	1,015	226	140	96	53
20 Jul	wd	61	0.079	0.014	0.064	0.013	2	42.0	504	228	40	19	32	16	2	363.0	4,356	960	344	98	279	83
22 Jul	wd	73	0.060	0.012	0.042	0.010	3	41.5	498	126	30	10	21	7	3	265.5	3,186	1,698	192	109	133	77
23 Jul	we/hol	32	0.049	0.016	0.043	0.016	3	66.7	800	355	39	22	35	20	3	229.7	2,756	768	135	59	120	55
26 Jul	wd	42	0.051	0.015	0.040	0.013	3	10.3	124	89	6	5	5	4	3	296.0	3,552	809	179	68	141	56
27 Jul	wd	55	0.031	0.011	0.023	0.008	3	14.3	172	182	5	6	4	4	3	269.3	3,232	821	100	43	73	33
30 Jul	we/hol	53	0.048	0.012	0.027	0.009	3	4.7	56	25	3	1	2	1	3	207.0	2,484	317	119	34	67	25
	Min	7	0.031		0.023		2	1.3	16		1		1		2	128.3	1,540		66		66	
	Mean	52	0.069		0.051		3	23.7	284		20		14		3	226.2	2,714		184		135	
	Max	109	0.140		0.091		3	66.7	800		44		35		3	363.0	4,356		375		279	

Note: "Catch" = fish harvested plus fish released; "Harvest" = fish kept; "Effort" = angler-hours fished; "CPUE" = catch per unit effort; "HPUE" = harvest per unit effort.

[a] Angler counts were geographically stratified, angler interviews were not. CPUE and HPUE are catch and harvest per hour.

[b] "Downstream" = Kenai River reach from Warren Ames Bridge to the Chinook salmon sonar site; "Upstream" = Kenai River reach from the Chinook salmon sonar site to Soldotna Bridge.

[c] "wd" = weekday; "we/hol" = weekend/holiday.

APPENDIX C: EFFORT, CATCH, AND HARVEST ESTIMATES BY TEMPORAL AND GEOGRAPHIC STRATA DURING THE KENAI RIVER CHINOOK SALMON FISHERY, 2011.

Appendix C1.-Estimated effort, catch, and harvest, by geographic strata, during the early-run Kenai River Chinook salmon sport fishery, 16 May–30 June 2011.

	Downstream[a] creel estimates						Upstream[a] creel estimates								
			Chinook salmon						Chinook salmon						
	Effort		Catch		Harvest		Effort		Catch		Harvest		Downstream %		
Fishing periods	Hours fished	SE	No. fish	SE	No. fish	SE	Hours fished	SE	No. fish	SE	No. fish	SE	Effort	Catch	Harvest
17–22 May															
Guided weekdays	0	0	0	0	0	0	200	32	0	0	0	0	0.0%	N/A	N/A
Guided weekends	0	0	0	0	0	0	168	42	0	0	0	0	0.0%	N/A	N/A
Unguided weekdays	0	0	0	0	0	0	360	101	0	0	0	0	0.0%	N/A	N/A
Unguided weekends	0	0	0	0	0	0	305	127	3	3	3	3	0.0%	0.0%	0.0%
24–29 May															
Guided weekdays	0	0	0	0	0	0	1,112	205	48	16	30	13	0.0%	0.0%	0.0%
Guided weekends	0	0	0	0	0	0	872	193	10	6	10	6	0.0%	0.0%	0.0%
Unguided weekdays	0	0	0	0	0	0	430	73	7	6	7	6	0.0%	0.0%	0.0%
Unguided weekends	0	0	0	0	0	0	795	191	12	7	10	8	0.0%	0.0%	0.0%
31 May–5 June															
Guided weekdays	0	0	0	0	0	0	1,424	226	46	26	36	30	0.0%	0.0%	0.0%
Guided weekends	0	0	0	0	0	0	392	159	12	9	9	9	0.0%	0.0%	0.0%
Unguided weekdays	0	0	0	0	0	0	460	137	0	0	0	0	0.0%	N/A	N/A
Unguided weekends	5	6	0	0	0	0	495	97	11	12	11	12	1.0%	0.0%	0.0%
7–12 June															
Guided weekdays	0	0	0	0	0	0	3,240	512	151	38	98	30	0.0%	0.0%	0.0%
Guided weekends	0	0	0	0	0	0	1,172	372	22	12	22	12	0.0%	0.0%	0.0%
Unguided weekdays	0	0	0	0	0	0	1,180	316	29	27	29	27	0.0%	0.0%	0.0%
Unguided weekends	0	0	0	0	0	0	1,605	318	65	29	21	13	0.0%	0.0%	0.0%
14–19 June															
Guided weekdays	132	84	6	5	6	5	5,148	1,285	210	113	210	113	2.5%	2.6%	2.6%
Guided weekends	28	34	1	2	1	2	1,372	525	61	48	61	48	2.0%	2.0%	2.0%
Unguided weekdays	0	0	0	0	0	0	2,140	555	94	77	30	31	0.0%	0.0%	0.0%
Unguided weekends	75	87	2	3	2	2	2,040	287	51	19	31	14	3.5%	4.0%	5.3%

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Appendix C1.–Part 2 of 2.

	Downstream[a] creek estimates						Upstream[a] creek estimates								
			Chinook salmon						Chinook salmon						
	Effort		Catch		Harvest		Effort		Catch		Harvest				
Fishing periods	Hours fished	SE	No. fish	SE	No. fish	SE	Hours fished	SE	No. fish	SE	No. fish	SE	Downstream % Effort	Catch	Harvest
21–26 June															
Guided weekdays	240	240	0	0	0	0	5,660	647	111	88	73	61	4.1%	0.0%	0.0%
Guided weekends	40	22	2	1	2	1	1,232	254	55	22	55	22	3.1%	3.1%	3.1%
Unguided weekdays	60	50	1	1	0	0	1,910	254	24	9	12	6	3.0%	3.1%	3.0%
Unguided weekends	80	39	1	1	0	0	2,260	422	11	11	0	0	3.4%	4.6%	N/A
28–30 June															
Guided weekdays	264	187	2	2	2	2	5,412	674	45	19	45	19	4.7%	4.7%	4.7%
Unguided weekdays	45	30	0	0	0	0	2,010	239	0	0	0	0	2.2%	N/A	N/A
Day type subtotals															
Guided weekdays	636	315	8	5	8	5	22,196	1,697	610	153	493	137	2.8%	1.3%	1.6%
Guided weekends	68	41	3	2	3	2	5,208	737	160	55	157	55	1.3%	1.9%	1.9%
Unguided weekdays	105	58	1	1	0	0	8,490	751	153	82	78	42	1.2%	0.5%	0.5%
Unguided weekends	160	95	3	3	2	2	7,500	650	152	39	75	24	2.1%	1.7%	2.3%
Angler type subtotals															
Guided	704	318	11	6	11	6	27,404	1,850	771	162	650	148	2.5%	1.4%	1.7%
% Guided	72.7%		76.2%		83.6%		63.2%		71.6%		80.9%				
Unguided	265	112	3	3	2	2	15,990	994	305	91	153	49	1.6%	1.1%	1.4%
% Unguided	27.3%		23.8%		16.4%		36.8%		28.4%		19.1%				
Early-run total	969	337	14	6	13	6	43,394	2,100	1,076	186	803	156	2.2%	1.3%	1.6%

Note: "N/A" = not applicable.

[a] "Downstream" = Kenai River reach from Warren Ames Bridge to the Chinook salmon sonar site; "Upstream" = Kenai River reach from the Chinook salmon sonar site to Soldotna Bridge.

Appendix C2.–Estimated effort, catch, and harvest, by geographic strata, during the late-run Kenai River Chinook salmon sport fishery, 1–31 July 2011.

	Downstream[a] creek estimates						Upstream[a] creek estimates								
			Chinook salmon						Chinook salmon						
	Effort		Catch		Harvest		Effort		Catch		Harvest		Downstream %		
Fishing periods	Hours fished	SE	No. fish	SE	No. fish	SE	Hours fished	SE	No. fish	SE	No. fish	SE	Effort	Catch	Harvest
1–3 July															
Guided weekdays	42	6	5	1	4	1	1,836	588	201	74	163	63	2.2%	2.2%	2.2%
Guided weekends	16	20	1	1	1	1	1,820	593	114	46	104	42	0.9%	0.9%	0.9%
Unguided weekdays	20	16	2	2	1	1	2,275	531	240	102	138	56	0.9%	0.9%	0.9%
Unguided weekends	135	66	4	2	3	2	4,930	638	220	63	189	58	2.7%	1.7%	1.7%
5–10 July															
Guided weekdays	196	79	12	7	10	5	6,632	1,328	382	138	327	104	2.9%	3.1%	3.0%
Guided weekends	582	582	39	40	31	32	3,060	108	207	51	163	38	16.0%	16.0%	16.0%
Unguided weekdays	160	67	7	3	4	1	5,110	754	229	62	145	49	3.0%	2.9%	2.7%
Unguided weekends	370	153	16	8	8	4	6,325	625	255	73	124	40	5.5%	6.0%	5.8%
12–17 July															
Guided weekdays	1,084	575	112	72	77	47	11,308	2,717	1,148	348	788	219	8.7%	8.9%	8.9%
Guided weekends	540	560	44	51	19	21	2,748	1,015	226	140	96	53	16.4%	16.4%	16.4%
Unguided weekdays	670	371	58	34	38	23	12,510	1,412	1,054	196	685	153	5.1%	5.2%	5.3%
Unguided weekends	415	221	29	20	19	14	9,545	1,586	962	266	649	182	4.2%	3.0%	2.9%
19–24 July															
Guided weekdays	2,004	368	139	34	106	30	15,084	3,217	1,071	298	822	261	11.7%	11.5%	11.4%
Guided weekends	800	355	39	22	35	20	2,756	768	135	59	120	55	22.5%	22.5%	22.5%
Unguided weekdays	500	174	26	8	9	5	14,430	3,272	768	199	234	124	3.3%	3.2%	3.6%
Unguided weekends	1,205	619	85	51	52	31	8,730	937	605	129	370	95	12.1%	12.3%	12.2%
26–31 July															
Guided weekdays	592	294	23	11	18	8	13,568	1,692	560	159	427	132	4.2%	4.0%	4.0%
Guided weekends	56	25	3	1	2	1	2,484	317	119	34	67	25	2.2%	2.2%	2.2%
Unguided weekdays	760	201	19	12	19	12	7,610	1,578	194	117	194	117	9.1%	9.1%	9.1%
Unguided weekends	80	60	4	4	4	3	5,225	408	224	78	195	74	1.5%	1.9%	1.9%

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Appendix C2.–Part 2 of 2.

	Downstream[a] creel estimates						Upstream[a] creel estimates								
			Chinook salmon						Chinook salmon						
	Effort		Catch		Harvest		Effort		Catch		Harvest				
Fishing periods	Hours fished	SE	No. fish	SE	No. fish	SE	Hours fished	SE	No. fish	SE	No. fish	SE	Downstream % Effort	Downstream % Catch	Downstream % Harvest
Day type subtotals															
Guided weekdays	3,918	748	292	80	214	56	48,428	4,764	3,361	510	2,528	385	7.5%	8.0%	7.8%
Guided weekends	1,994	883	127	69	87	43	12,868	1,443	801	170	549	98	13.4%	13.6%	13.7%
Unguided weekdays	2,110	461	111	37	72	27	41,935	4,005	2,485	326	1,395	241	4.8%	4.3%	4.9%
Unguided weekends	2,205	680	138	56	85	34	34,755	2,087	2,265	321	1,527	229	6.0%	5.7%	5.3%
Angler type subtotals															
Guided	5,912	1,157	418	106	301	71	61,296	4,978	4,162	537	3,077	398	8.8%	9.1%	8.9%
% Guided	57.8%		62.6%		65.7%		44.4%		46.7%		51.3%				
Unguided	4,315	822	250	67	157	44	76,690	4,516	4,750	457	2,923	333	5.3%	5.0%	5.1%
% Unguided	42.2%		37.4%		34.3%		55.6%		53.3%		48.7%				
Late-run total	10,227	1,419	668	125	458	83	137,986	6,721	8,912	705	6,000	518	6.9%	7.0%	7.1%

[a] "Downstream" = Kenai River reach from Warren Ames Bridge to the Chinook salmon sonar site; "Upstream" = Kenai River reach from the Chinook salmon sonar site to Soldotna Bridge.

APPENDIX D: INRIVER GILLNETTING DAILY CATCH, CPUE, AND SPECIES PROPORTION DURING THE KENAI RIVER CHINOOK SALMON FISHERY, 2011.

Appendix D1.-Number of Chinook and sockeye salmon caught inriver in 5.0-inch and 7.5-inch mesh gillnets during the early-run Kenai River Chinook salmon sport fishery, 16 May–30 June 2011.

	Inriver drift gillnetting catch											
	5.0-inch mesh					7.5-inch mesh					Combined total[a]	
Date	No. drifts	Time fished (min)	Chinook salmon No. fish	Sockeye salmon No. fish	Total No. fish	No. drifts	Time fished (min)	Chinook salmon No. fish	Sockeye salmon No. fish	Total No. fish	Chinook salmon No. fish	Total No. fish
16 May	8	89	0	0	0	8	92	1	0	1	1	1
17 May	7	81	0	0	0	8	97	1	0	1	1	1
18 May	8	95	0	0	0	8	113	0	0	0	0	0
19 May	8	108	0	1	1	8	108	0	0	0	0	1
20 May	8	109	0	1	1	8	102	0	0	0	0	1
21 May	7	69	2	3	5	8	109	0	1	1	2	6
22 May	7	93	1	6	7	6	81	1	0	1	2	8
23 May	7	78	0	5	5	8	88	1	7	8	1	13
24 May	8	94	0	13	13	8	85	2	3	5	2	18
25 May	7	81	3	7	10	8	95	0	4	4	3	14
26 May	8	93	1	16	17	7	64	2	3	5	3	22
27 May	8	89	0	19	19	8	86	1	10	11	1	30
28 May	6	70	2	31	33	5	54	3	10	13	5	46
29 May	6	66	2	29	31	8	87	2	12	14	4	45
30 May	8	90	1	61	62	7	65	1	13	14	2	76
31 May	7	75	1	31	32	8	84	3	18	21	4	53
1 Jun	8	82	1	29	30	8	80	2	21	23	3	53
2 Jun	8	78	1	14	15	9	91	0	12	12	1	27
3 Jun	6	62	3	36	39	6	50	5	5	10	8	49
4 Jun	7	62	0	51	51	8	79	3	24	27	3	78
5 Jun	7	67	5	35	40	6	61	2	17	19	7	59
6 Jun	6	59	0	63	63	6	57	5	28	33	5	96
7 Jun	6	58	0	73	73	6	58	4	27	31	4	104
8 Jun	6	50	5	35	40	6	58	7	11	18	12	58
9 Jun	8	72	3	86	89	6	51	5	6	11	8	100
10 Jun	6	56	3	37	40	6	56	5	21	26	8	66
11 Jun	8	73	1	91	92	7	53	2	24	26	3	118

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Appendix D1.–Part 2 of 2.

	Inriver drift gillnetting catch											
	5.0-inch mesh					7.5-inch mesh					Combined total[a]	
Date	No. drifts	Time fished (min)	Chinook salmon No. fish	Sockeye salmon No. fish	Total No. fish	No. drifts	Time fished (min)	Chinook salmon No. fish	Sockeye salmon No. fish	Total No. fish	Chinook salmon No. fish	Total No. fish
12 Jun	6	50	3	51	54	7	59	6	14	20	9	74
13 Jun	8	68	3	63	66	7	55	2	14	16	5	82
14 Jun	7	63	0	54	54	8	68	3	25	28	3	82
15 Jun	6	56	3	67	70	6	58	8	28	36	11	106
16 Jun	6	55	3	55	58	7	64	5	18	23	8	81
17 Jun	8	68	1	56	57	6	60	4	11	15	5	72
18 Jun	6	53	4	29	33	7	61	2	11	13	6	46
19 Jun	8	67	4	34	38	7	59	3	8	11	7	49
20 Jun	9	80	2	19	21	10	86	1	7	8	3	29
21 Jun	8	74	4	19	23	8	71	3	5	8	7	31
22 Jun	8	72	2	16	18	8	80	4	2	6	6	24
23 Jun	8	80	4	9	13	7	72	4	4	8	8	21
24 Jun	7	71	2	14	16	8	84	5	0	5	7	21
25 Jun	8	83	8	6	14	7	66	2	2	4	10	18
26 Jun	8	80	3	8	11	9	100	2	5	7	5	18
27 Jun	8	75	0	8	8	8	73	4	3	7	4	15
28 Jun	9	73	3	4	7	10	82	5	2	7	8	14
29 Jun	8	69	5	6	11	8	75	4	2	6	9	17
30 Jun	6	57	7	11	18	6	59	6	4	10	13	28
Total	336	3,391	96	1,302	1,398	339	3,434	131	442	573	227	1,971
Min	6	50	0	0	0	5	50	0	0	0	0	0
Mean	7	74	2	28	30	7	75	3	10	12	5	43
Max	9	109	8	91	92	10	113	8	28	36	13	118

[a] Combined total is number of Chinook salmon and total number of fish caught in 5.0-inch and 7.5-inch mesh gillnets.

Appendix D2.-Catch and CPUE of Chinook and sockeye salmon, and proportion of Chinook salmon caught inriver in 5.0- and 7.5-inch mesh gillnets, for replicates with at least 1 drift from each mesh size, during the early-run Kenai River Chinook salmon sport fishery, 16 May–30 June 2011.

	Inriver drift gillnetting catch												
				Chinook salmon			Sockeye salmon			Total		Chinook salmon	
Date	Reps[a]	No. drifts	Time fished (min)	No. fish	CPUE[b]	SE	No. fish	CPUE[b]	SE	No. fish	CPUE[b]	Prop[c]	SE
16 May	4	16	181	1	0.004	0.004	0	0.000	0.000	1	0.006	1.00	0.00
17 May	4	15	179	1	0.007	0.007	0	0.000	0.000	1	0.006	1.00	0.00
18 May	4	16	208	0	0.000	0.000	0	0.000	0.000	0	0.000		
19 May	4	16	217	0	0.000	0.000	1	0.006	0.006	1	0.005	0.00	0.00
20 May	4	16	211	0	0.000	0.000	1	0.006	0.006	1	0.005	0.00	0.00
21 May	4	15	177	2	0.014	0.014	4	0.026	0.015	6	0.034	0.35	0.17
22 May	3	12	158	2	0.013	0.007	3	0.020	0.012	5	0.032	0.39	0.17
23 May	4	15	165	1	0.006	0.006	12	0.074	0.033	13	0.079	0.08	0.10
24 May	4	16	179	2	0.012	0.007	16	0.086	0.024	18	0.100	0.12	0.05
25 May	4	15	176	3	0.022	0.010	11	0.059	0.033	14	0.080	0.27	0.16
26 May	4	15	157	3	0.018	0.011	19	0.101	0.011	22	0.140	0.15	0.08
27 May	4	16	175	1	0.006	0.006	29	0.168	0.042	30	0.172	0.03	0.03
28 May	3	11	124	5	0.034	0.034	41	0.289	0.050	46	0.371	0.11	0.10
29 May	3	12	137	3	0.020	0.002	36	0.269	0.149	39	0.284	0.07	0.04
30 May	4	15	155	2	0.013	0.007	74	0.463	0.172	76	0.490	0.03	0.02
31 May	4	15	159	4	0.023	0.016	49	0.262	0.085	53	0.334	0.08	0.03
1 Jun	4	16	162	3	0.019	0.006	50	0.312	0.081	53	0.327	0.06	0.02
2 Jun	4	16	160	1	0.006	0.006	26	0.162	0.025	27	0.169	0.04	0.03
3 Jun	3	12	112	8	0.073	0.013	41	0.317	0.061	49	0.436	0.19	0.02
4 Jun	4	15	140	3	0.018	0.011	75	0.515	0.100	78	0.557	0.03	0.02
5 Jun	3	12	123	7	0.055	0.018	47	0.373	0.097	54	0.441	0.13	0.02
6 Jun	3	12	116	5	0.044	0.023	91	0.784	0.181	96	0.830	0.05	0.02
7 Jun	3	12	116	4	0.035	0.024	100	0.850	0.128	104	0.897	0.04	0.02
8 Jun	3	12	108	12	0.115	0.030	46	0.448	0.086	58	0.535	0.20	0.06
9 Jun	3	12	106	6	0.056	0.026	62	0.589	0.120	68	0.643	0.09	0.05
10 Jun	3	12	111	8	0.067	0.034	58	0.534	0.057	66	0.594	0.11	0.06
11 Jun	4	15	125	3	0.021	0.008	115	0.832	0.123	118	0.942	0.02	0.01
12 Jun	3	12	101	7	0.066	0.033	63	0.626	0.090	70	0.693	0.09	0.04
13 Jun	4	15	124	5	0.035	0.005	77	0.584	0.122	82	0.663	0.06	0.02
14 Jun	4	15	131	3	0.023	0.008	79	0.648	0.098	82	0.625	0.03	0.01
15 Jun	3	12	114	11	0.096	0.024	95	0.821	0.282	106	0.933	0.11	0.05
16 Jun	3	12	109	7	0.064	0.018	72	0.656	0.263	79	0.722	0.09	0.01
17 Jun	3	12	113	5	0.042	0.008	61	0.564	0.129	66	0.582	0.07	0.03

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Appendix D2.–Part 2 of 2.

	Inriver drift gillnetting catch												
				Chinook salmon			Sockeye salmon			Total		Chinook salmon	
Date	Reps[a]	No. drifts	Time fished (min)	No. fish	CPUE[b]	SE	No. fish	CPUE[b]	SE	No. fish	CPUE[b]	Prop[c]	SE
18 Jun	3	12	106	6	0.058	0.031	38	0.372	0.179	44	0.416	0.14	0.07
19 Jun	4	15	126	7	0.060	0.012	42	0.319	0.104	49	0.390	0.16	0.06
20 Jun	5	19	166	3	0.021	0.010	26	0.142	0.061	29	0.175	0.13	0.08
21 Jun	4	16	144	7	0.049	0.024	24	0.167	0.114	31	0.215	0.23	0.09
22 Jun	4	16	152	6	0.042	0.018	18	0.121	0.030	24	0.158	0.26	0.13
23 Jun	4	15	152	8	0.049	0.015	13	0.087	0.036	21	0.138	0.36	0.03
24 Jun	4	15	155	7	0.051	0.020	14	0.083	0.028	21	0.135	0.38	0.17
25 Jun	4	15	149	10	0.061	0.016	8	0.049	0.011	18	0.121	0.55	0.12
26 Jun	4	16	169	5	0.027	0.022	11	0.076	0.018	16	0.095	0.27	0.13
27 Jun	4	16	148	4	0.028	0.021	11	0.073	0.018	15	0.101	0.28	0.11
28 Jun	5	19	155	8	0.050	0.026	6	0.038	0.023	14	0.091	0.57	0.20
29 Jun	4	16	144	9	0.063	0.014	8	0.058	0.024	17	0.118	0.52	0.10
30 Jun	3	12	116	13	0.113	0.023	15	0.131	0.010	28	0.242	0.46	0.05
Total	170	662	6,711	221	1.700		1,688	13.162		1,909	0.284	NA	NA
Min	3	11	101	0	0.000		0	0.000		0	0.000	0.00	
Mean	4	14	146	5	0.037		37	0.286		42	0.284	0.21	
Max	5	19	217	13	0.115		115	0.850		118	0.545	1.00	

Note: "NA" = not applicable.

[a] A complete replicate (rep) consists of four drifts (two mesh sizes, two banks). Only reps that had at least one drift from each mesh size were used in this table.

[b] CPUE is catch per minute.

[c] Proportion of combined total catch = Chinook salmon CPUE / Combined total of all species CPUE.

Appendix D3.-Number of Chinook, sockeye, coho, and pink salmon, and Dolly Varden caught inriver in 5.0-inch and 7.5-inch mesh gillnets during the late-run Kenai River Chinook salmon sport fishery, 1 July–10 August 2011.

	Inriver drift gillnetting catch																	
	5.0-inch mesh								7.5-inch mesh								Combined total[a]	
Date	No. drifts	Time fished (min)	Chinook	Sockeye	Coho	Pink	Dolly Varden	Total fish	No. drifts	Time fished (min)	Chinook	Sockeye	Coho	Pink	Dolly Varden	Total fish	Chinook	Total fish
1 Jul	6	49	5	19	0	0	0	24	5	42	10	9	0	0	0	19	15	43
2 Jul	6	56	5	33	0	0	0	38	6	53	3	18	0	0	0	21	8	59
3 Jul	6	53	10	28	0	0	0	38	6	48	8	14	0	0	0	22	18	60
4 Jul	7	53	3	40	0	0	0	43	8	60	7	21	0	0	0	28	10	71
5 Jul	7	59	6	43	0	0	0	49	6	53	6	12	0	0	0	18	12	67
6 Jul	6	53	12	31	0	1	1	45	6	52	7	12	0	0	0	19	19	64
7 Jul	6	47	5	44	0	0	0	49	6	48	13	11	0	0	0	24	18	73
8 Jul	8	60	4	55	0	1	1	61	8	64	5	31	0	0	0	36	9	97
9 Jul	8	63	5	73	0	0	1	79	8	61	2	37	0	0	0	39	7	118
10 Jul	8	65	5	40	0	0	0	46	8	68	4	14	0	0	0	18	9	64
11 Jul	8	66	4	33	0	0	0	37	8	65	10	11	0	0	0	21	14	58
12 Jul	8	57	5	18	0	0	0	23	9	67	9	4	0	0	0	13	14	36
13 Jul	7	56	16	37	0	0	0	53	6	49	15	18	0	0	1	34	31	87
14 Jul	5	37	4	22	0	0	0	26	6	54	18	15	0	0	0	33	22	59
15 Jul	6	47	13	10	0	0	1	24	6	51	17	3	0	0	1	21	30	45
16 Jul	5	32	3	161	0	0	0	164	6	40	10	82	0	0	0	92	13	256
17 Jul	6	33	6	133	0	1	0	140	5	35	15	36	0	0	0	51	21	191
18 Jul	4	31	5	65	0	0	0	70	5	35	11	41	0	0	0	52	16	122
19 Jul	6	33	4	182	0	0	0	186	5	34	14	92	0	0	0	106	18	292
20 Jul	5	26	4	110	0	0	0	114	6	33	8	72	0	0	0	80	12	194
21 Jul	5	38	4	96	0	0	0	100	4	27	22	62	0	0	0	84	26	184
22 Jul	6	43	3	79	0	0	0	82	7	55	9	76	0	0	0	85	12	167
23 Jul	6	50	6	114	0	0	0	120	6	48	11	38	0	0	0	49	17	169
24 Jul	5	34	1	66	0	0	0	67	6	43	6	77	0	0	0	83	7	150
25 Jul	7	62	1	115	0	0	0	116	6	51	7	43	0	0	0	50	8	166
26 Jul	6	52	2	114	0	0	0	116	6	52	8	43	0	0	0	51	10	167
27 Jul	8	62	3	68	1	0	0	72	7	53	4	17	0	0	0	21	7	93

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Appendix D3.–Part 2 of 2.

	Inriver drift gillnetting catch																	
	5.0-inch mesh								7.5-inch mesh								Combined total[a]	
Date	No. drifts	Time fished (min)	Chinook	Sockeye	Coho	Pink	Dolly Varden	Total fish	No. drifts	Time fished (min)	Chinook	Sock.	Coho	Pink	Dolly Varden	Total fish	Chinook	Total fish
28 Jul	8	60	2	51	0	0	0	53	9	67	2	14	0	0	0	16	4	69
29 Jul	9	63	8	39	0	0	0	47	8	55	7	14	1	0	0	22	15	69
30 Jul	8	62	4	43	0	0	0	47	8	61	3	33	0	0	0	36	7	83
31 Jul	10	69	3	76	0	0	0	79	10	68	7	30	0	0	0	37	10	116
1 Aug	7	49	4	44	0	0	0	48	8	59	5	21	0	0	0	26	9	74
2 Aug	8	60	2	62	0	0	0	64	8	59	3	13	0	0	0	16	5	80
3 Aug	8	67	1	54	2	0	0	57	9	69	2	12	1	0	0	15	3	72
4 Aug	8	60	2	57	2	0	0	61	8	57	5	4	1	0	0	10	7	71
5 Aug	8	59	2	44	6	0	0	52	8	62	3	23	0	0	0	26	5	78
6 Aug	8	62	1	58	11	0	0	70	8	56	3	32	4	0	0	39	4	109
7 Aug	9	64	2	26	3	0	0	31	10	73	4	7	1	0	0	12	6	43
8 Aug	10	78	1	18	8	0	0	27	10	79	1	2	0	0	0	3	2	30
9 Aug	8	60	1	32	21	0	0	54	9	69	4	12	7	0	0	23	5	77
10 Aug	10	79	3	48	7	0	0	58	8	62	0	12	1	0	0	13	3	71
Total	290	2,208	180	2,481	61	3	4	2,730	292	2,238	308	1,138	16	0	2	1,464	488	4,194
Min	4	26	1	10	0	0	0	23	4	27	0	2	0	0	0	3	2	30
Mean	7	54	4	61	1	0	0	67	7	55	8	28	0	0	0	36	12	102
Max	10	79	16	182	21	1	1	186	10	79	22	92	7	0	1	106	31	292

[a] Combined total is number of Chinook salmon and total number of fish caught in 5.0-inch and 7.5-inch mesh gillnets.

Appendix D4.-Catch and CPUE of Chinook, sockeye, coho, and pink salmon, and Dolly Varden, and proportion of Chinook salmon caught inriver in 5.0-inch and 7.5-inch mesh gillnets, for replicates with at least 1 drift from each mesh size, during the late-run Kenai River Chinook salmon sport fishery, 1 July–10 August 2011.

				Inriver drift gillnetting catch[a]																
				Chinook salmon			Sockeye salmon			Coho salmon			Pink salmon			Dolly Varden			Total		Chinook salmon	
Date	R[b]	Drifts	Time (min)	N	CPUE	SE	N	CPUE	SE	N	CPUE	SE	N	CPUE	SE	N	CPUE	SE	N	CPUE	Prp.[c]	SE
1 Jul	3	11	91	15	0.160	0.015	28	0.353	0.035	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	43	0.471	0.13	0.06
2 Jul	3	12	109	8	0.069	0.035	51	0.482	0.091	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	59	0.541	0.23	0.09
3 Jul	3	12	100	18	0.179	0.016	42	0.417	0.084	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	60	0.597	0.04	0.02
4 Jul	4	15	112	10	0.102	0.037	61	0.551	0.068	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	71	0.633	0.08	0.03
5 Jul	3	12	104	10	0.101	0.029	55	0.541	0.134	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	65	0.622	0.14	0.07
6 Jul	3	12	105	19	0.184	0.039	43	0.418	0.103	0	0.000	0.000	1	0.010	0.010	1	0.010	0.010	64	0.61	0.19	0.01
7 Jul	3	12	95	18	0.190	0.009	55	0.571	0.136	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	73	0.769	0.07	0.05
8 Jul	4	16	124	9	0.072	0.023	86	0.710	0.035	0	0.000	0.000	1	0.008	0.008	1	0.008	0.008	97	0.785	0.06	0.01
9 Jul	4	16	124	7	0.057	0.028	110	0.887	0.037	0	0.000	0.000	0	0.000	0.000	1	0.007	0.007	118	0.95	0.09	0.02
10 Jul	4	16	132	9	0.073	0.025	54	0.405	0.041	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	64	0.484	0.04	0.02
11 Jul	4	16	131	14	0.113	0.026	44	0.320	0.069	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	58	0.444	0.06	0.02
12 Jul	4	16	114	13	0.113	0.026	19	0.170	0.047	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	32	0.28	0.09	0.05
13 Jul	3	12	97	27	0.275	0.014	55	0.580	0.044	0	0.000	0.000	0	0.000	0.000	1	0.011	0.011	83	0.854	0.04	0.02
14 Jul	3	11	91	22	0.215	0.134	37	0.360	0.123	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	59	0.647	0.07	0.05
15 Jul	3	12	98	30	0.325	0.088	13	0.123	0.051	0	0.000	0.000	0	0.000	0.000	2	0.019	0.010	45	0.458	0.06	0.03
16 Jul	3	11	72	13	0.230	0.132	243	3.165	1.359	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	256	3.561	0.14	0.03
17 Jul	3	11	68	21	0.295	0.048	169	2.710	1.179	0	0.000	0.000	1	0.017	0.017	0	0.000	0.000	191	2.804	0.06	0.01
18 Jul	2	8	61	13	0.216	0.013	106	1.754	0.376	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	119	1.965	0.06	0.04
19 Jul	3	11	67	18	0.263	0.043	274	4.361	1.266	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	292	4.382	0.08	0.04
20 Jul	3	11	59	12	0.185	0.101	182	2.955	0.853	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	194	3.277	0.13	0.02
21 Jul	2	8	58	25	0.456	0.112	136	2.348	0.808	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	161	2.785	0.07	0.04
22 Jul	3	12	91	8	0.088	0.031	142	1.590	0.351	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	150	1.653	0.03	0.01
23 Jul	3	12	98	17	0.178	0.061	152	1.534	0.337	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	169	1.721	0.08	0.03
24 Jul	3	11	77	7	0.079	0.025	143	1.876	0.340	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	150	1.948	0.03	0.01
25 Jul	3	12	106	8	0.079	0.023	135	1.283	0.248	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	143	1.354	0.02	0.02
26 Jul	3	12	104	10	0.096	0.029	157	1.540	0.307	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	167	1.608	0.10	0.02
27 Jul	4	15	115	7	0.058	0.022	85	0.726	0.100	1	0.007	0.007	0	0.000	0.000	0	0.000	0.000	93	0.807	0.07	0.01

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Appendix D4.–Part 2 of 2.

				Inriver drift gillnetting catch[a]																
				Chinook salmon			Sockeye salmon			Coho salmon			Pink salmon			Dolly Varden			Total		Chinook salmon	
Date	R[b]	Drifts	Time (min)	N	CPUE	SE	N	CPUE	SE	N	CPUE	SE	N	CPUE	SE	N	CPUE	SE	N	CPUE	Prp.[c]	SE
28 Jul	4	16	119	4	0.034	0.014	63	0.535	0.051	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	67	0.561	0.05	0.01
29 Jul	4	16	112	15	0.132	0.064	50	0.442	0.051	1	0.009	0.009	0	0.000	0.000	0	0.000	0.000	66	0.592	0.06	0.02
30 Jul	4	16	123	7	0.054	0.033	76	0.609	0.219	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	83	0.675	0.16	0.04
31 Jul	5	20	137	10	0.078	0.021	106	0.785	0.200	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	116	0.849	0.03	0.01
1 Aug	4	15	109	9	0.079	0.040	65	0.566	0.266	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	74	0.681	0.14	0.08
2 Aug	4	16	119	5	0.042	0.019	75	0.632	0.164	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	80	0.672	0.08	0.05
3 Aug	4	16	128	3	0.023	0.015	65	0.512	0.111	3	0.025	0.016	0	0.000	0.000	0	0.000	0.000	71	0.556	0.14	0.05
4 Aug	4	16	117	7	0.057	0.013	61	0.512	0.058	3	0.028	0.009	0	0.000	0.000	0	0.000	0.000	71	0.607	0.09	0.02
5 Aug	4	16	122	5	0.040	0.019	67	0.532	0.138	6	0.042	0.042	0	0.000	0.000	0	0.000	0.000	78	0.642	0.03	0.01
6 Aug	4	16	118	4	0.037	0.017	90	0.722	0.227	15	0.124	0.027	0	0.000	0.000	0	0.000	0.000	109	0.924	0.09	0.02
7 Aug	5	19	137	6	0.043	0.018	33	0.249	0.022	4	0.029	0.007	0	0.000	0.000	0	0.000	0.000	43	0.313	0.04	0.02
8 Aug	5	20	158	2	0.014	0.008	20	0.122	0.038	8	0.053	0.027	0	0.000	0.000	0	0.000	0.000	30	0.19	0.05	0.02
9 Aug	4	16	122	4	0.034	0.024	44	0.367	0.101	28	0.236	0.078	0	0.000	0.000	0	0.000	0.000	76	0.622	0.07	0.02
10 Aug	4	16	127	3	0.023	0.008	56	0.424	0.125	8	0.058	0.020	0	0.000	0.000	0	0.000	0.000	67	0.529	0.10	0.03
Total	145	569	4,349	472	5.140		3,548	39.739		77	0.611		3	0.035		6	0.055		4,107	0.944	NA	NA
Min	2	8	58	2	0.014		13	0.122		0	0.000		0	0.000		0	0.000		30	0.519	0.02	
Mean	4	14	106	12	0.125		87	0.969		2	0.015		0	0.001		0	0.001		100	0.944	0.08	
Max	5	20	158	30	0.456		274	4.361		28	0.236		1	0.017		2	0.019		292	1.850	0.23	

Note: NA = not applicable.

[a] CPUE is catch per minute.

[b] A complete replicate (R) consists of four drifts (two mesh sizes, two banks). Only reps that had at least one drift from each mesh size were used in this table.

[c] Proportion of combined total catch = Chinook salmon CPUE / Combined total of all species CPUE.