Fishery Data Series No. 07-90

Late-run Kasilof River Chinook Salmon Sport Harvest, 2002-2003

by

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and

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

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
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)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

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

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ABSTRACT

The magnitude of the Kasilof River Chinook salmon *Oncorhynchus tshawytscha* sport fishery harvest prompted concerns that the late-run wild stock might not sustain current exploitation levels. In response, the Alaska Department of Fish and Game conducted a shorebased sport harvest monitoring survey to examine the characteristics of the late-run fishery in July 2002 and 2003.

Angler harvest of Chinook salmon in 2002 from the Statewide Harvest Survey (SWHS) was 451 (SE = 100). The late-run Chinook salmon recreational harvest was composed of 3% age-.1 fish, 32% age-.2 fish, 38% age-.3 fish, 26% age-.4 fish and 1% age-.5 fish. Of the harvest, Chinook salmon of hatchery origin comprised 23% of the age-.1 fish, 1% of the age-.2 fish, and 12% of the age-.3 fish.

Angler harvest of Chinook salmon in 2003 from the SWHS was 1,144 (SE = 166). The late-run Chinook salmon recreational harvest was composed of 35% age-.2 fish, 45% age-.3 fish and 20% age-.4 fish. Of the harvest, Chinook salmon of hatchery origin comprised 1% of the age-.2 fish and 2% of the age-.3 fish.

Mean mideye-to-fork (MEF) length was 370 mm, 657 mm, 803 mm, 941 mm, and 1,058 mm for ages .1, .2, .3, .4, and .5, respectively, in 2002. Mean MEF length was 668 mm, 824 mm, and 979 mm for ages .2, .3, and .4, respectively, in 2003.

Key words: Kasilof River, *Oncorhynchus tshawytscha*, Chinook salmon, adipose fin clip, recreational harvest, hatchery origin, coded wire tag.

INTRODUCTION

The Kasilof River flows 30 km from Tustumena Lake to Cook Inlet (Figure 1). Its glacial origin in the Kenai Mountains makes it turbid throughout the year. Four species of Pacific salmon (Chinook *Oncorhynchus tshawytscha*, coho *O. kisutch*; sockeye *O. nerka*, and pink *O. gorbuscha*) are present in the drainage, as well as anadromous and resident rainbow trout (*O. mykiss)* and Dolly Varden (*Salvelinus malma*) and resident lake trout (*S. namaycush*). The drainage supports one of the largest sockeye salmon returns in Cook Inlet (Davis 2002).

Sport fisheries exist for all Pacific salmon species, although most fishing effort is directed at Chinook salmon. The Chinook salmon fishery began in 1974, concurrent with the first returns of hatchery-produced smolt released in Crooked Creek, a clearwater tributary entering the mainstem at river kilometer 11 (Todd Unpublished). These fish are targeted by the early-run sport fishery, which occurs from mid-May to the end of June, in the Kasilof River from its confluence with Crooked Creek to Cook Inlet. Crooked Creek is closed to fishing for Chinook salmon. This fishery was initially shorebased, but drift boat use in recent years has increased.

There is also a late-run sport fishery that targets mainstem spawning Chinook salmon entering the Kasilof River in July. The late-run fishery occurs from the Sterling Highway Bridge to Cook Inlet July 1-31, unless closed by regulation. The fishery is conducted primarily out of drift boats.

The Division of Sport Fish (SFD) conducts an annual mail survey, the Statewide Harvest Survey (SWHS) which has been used to estimate the total annual harvest of Chinook salmon in the Kasilof River since 1978 (Mills 1979; 1980-1981a-b, 1982-1994; Howe et al. 1995; Howe et al. 1996; Howe et al. 2001a, 2001b, 2001c, 2001d; Walker et al. 2003; Jennings et al. 2004, 2006a; Jennings et al. 2006b). A historical summary of harvest by user type (guided and unguided, boat and shorebased) can be found in Gamblin et al. (2004). In the first 18 years of the fishery, no attempts were made to separate harvest of fish bound for Crooked Creek (early run) from that of the mainstem Kasilof River (late run). Management at that time assumed the late-run harvest was 10% of the total, of which, Crooked Creek fish made up about half.

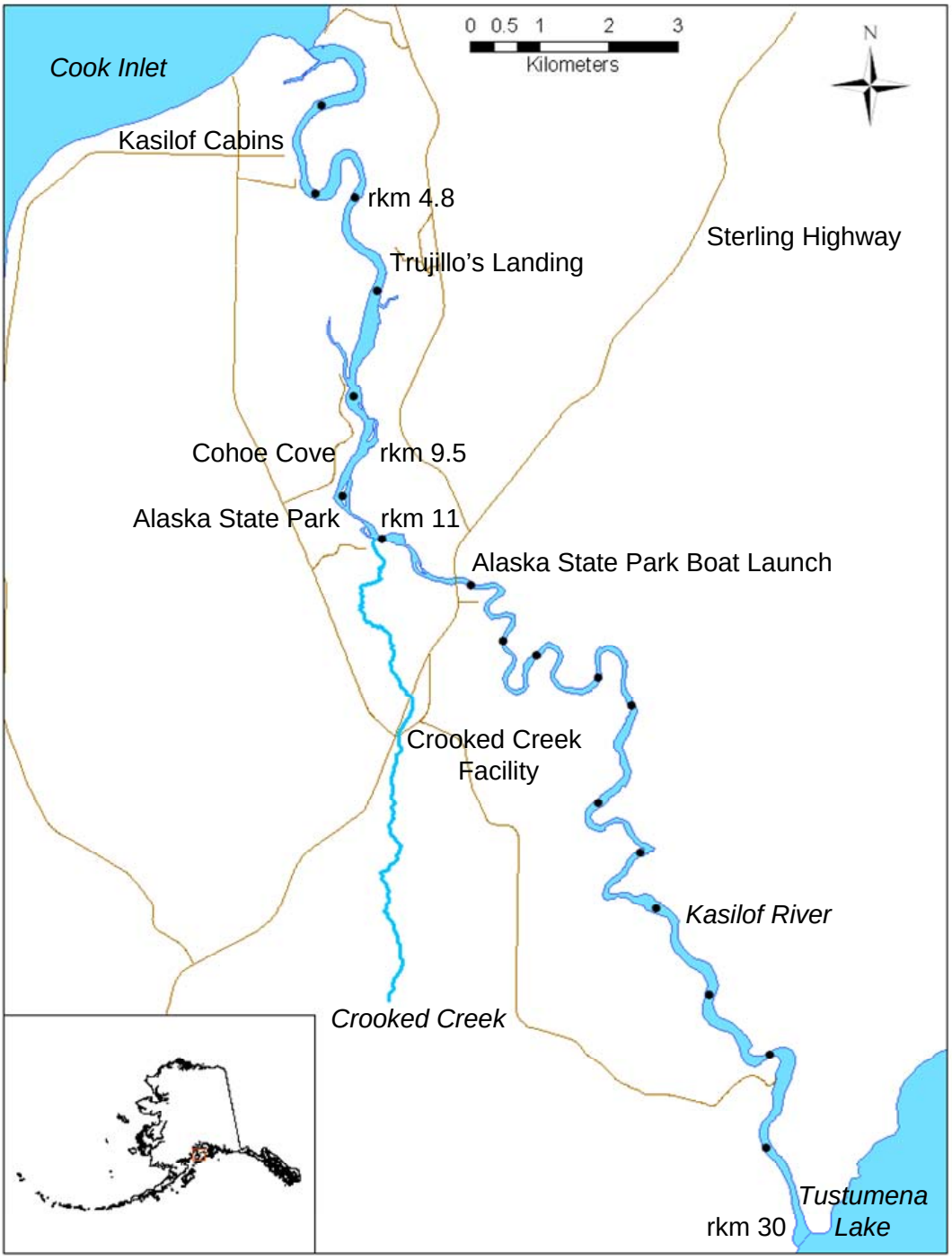

Figure 1.–Crooked Creek, Kasilof River, and river access locations.

Annual Chinook salmon harvest levels that exceeded 7,000 (Table 1) in the early 1990s prompted concerns about the sustainability of the late-run component, and led to collection of harvest information by run. Since 1996, when the SWHS began estimating annual Chinook salmon harvest before and after July 1, the average late-run harvest has been approximately 950 fish, or 13% of the season total (Table 1).

Table 1.–Kasilof River Chinook salmon sport fishery harvest, 1978-2003.

Return Year	Small Chinook[a]	Large Chinook[b]	Early-Run Chinook[c]	% of Total	Late-Run Chinook[c]	% of Total	Total[d]
1978	-	-	-	-	-	-	251
1979	-	-	-	-	-	-	283
1980	-	-	-	-	-	-	310
1981	65	1,242	-	-	-	-	1,307
1982	51	2,316	-	-	-	-	2,367
1983	336	2,853	-	-	-	-	3,189
1984	584	3,964	-	-	-	-	4,548
1985	522	2,986	-	-	-	-	3,508
1986	911	7,071	-	-	-	-	7,982
1987	472	4,461	-	-	-	-	4,933
1988	511	4,953	-	-	-	-	5,464
1989	206	3,767	-	-	-	-	3,973
1990	275	2,852	-	-	-	-	3,127
1991	627	5,055	-	-	-	-	5,682
1992	1,111	6,049	-	-	-	-	7,160
1993	1,048	8,695	-	-	-	-	9,743
1994	-	7,217	-	-	-	-	7,217
1995	-	6,681	-	-	-	-	6,681
1996	-	6,128	5,295	86%	833	14%	6,128
1997	-	6,728	5,627	84%	1,101	16%	6,728
1998	-	4,839	4,202	87%	637	13%	4,839
1999	-	8,255	7,597	92%	658	8%	8,255
2000	-	9,901	8,815	89%	1,086	11%	9,901
2001	-	8,866	7,488	84%	1,378	16%	8,866
2002	1,633	3,609	4,791	91%	451	9%	5,242
2003	1,529	2,705	3,090	73%	1,144	27%	4,234

[a] Small Chinook <20" TL, 1981-1986; <16" TL, 1987-1993; length not specified, 1994-2003 (<20" TL were considered jacks, 2002-2003).

[b] Large Chinook >20" TL, 1981-1986; >16" TL, 1987-1993; length not specified, 1994-1995 (only total number published). SWHS estimates before 1996 include unknown number of early- and late-run fish.

[c] Only total number of Chinook salmon early/late published, 1996-2003.

[d] Data from (Mills 1979; Mills 1980-1981a-b, 1982-1994; Howe et al. 1995; Howe et al. 1996; Howe et al. 2001a, b, c, d; Walker et al. 2003; Jennings et al. 2004, 2006a; 2006b).

Harvest of late-run Chinook salmon in July is a concern. Both the number of mainstem spawning stock and the proportion of the late-run harvest of Crooked Creek origin are unknown. This project surveyed anglers harvesting[1] late-run Chinook salmon downstream of the Sterling Highway Bridge in July 2002 and 2003.

The primary objectives were to estimate:

1. the relative contribution of hatchery-stocked Chinook salmon to the harvest, such that the estimate is within 0.05 of the true value 95% of the time; and
2. the proportion by age, sex, and length of Chinook salmon harvested, such that each proportion is within 0.05 of the true value 95% of the time.

Using previous sport harvest survey data (Gamblin et al. 2004) and hatchery statistics (Loopstra et al. 2002), we estimated that these objectives could be achieved by inspecting 650 sport-harvested Chinook salmon.

An additional objective of the project in 2002 was to assess the feasibility of capturing enough fish with drift gillnets in the lower river during July for a possible population estimate study using radio-telemetry.

METHODS

SPORT HARVEST MONITORING SURVEY

A shorebased sport harvest monitoring survey was conducted downstream of the Sterling Highway Bridge. Because access to the river is limited, survey sampling focused on three boat pullouts (Cohoe Cove, Trujillo's, Kasilof Cabins) and one bank fishing area (Alaska State Park) available to recreational fishermen (Figure 1). Sampling occurred 5-7 days per week July 1-31. The survey sampling was designed to maximize angler contact while attempting to achieve a representative sample of the harvest. Because the sampling sites are short distances apart, survey crews moved to different sites when no anglers or boat trailers were present.

HATCHERY CONTRIBUTION

The harvested Chinook salmon were inspected for an adipose fin clip (AFC), which indicated the presence of an internal coded wire tag (CWT). All Chinook salmon were inspected for an AFC and recorded, but no heads were collected to verify the presence of a CWT. We assumed that all Chinook salmon with an AFC were of Crooked Creek hatchery origin.

The contribution of hatchery-raised fish (r) from cohort j to (post-) stratum i of the harvest was estimated as follows (adapted from Bernard and Clark 1996):

$$\hat{r}_{ij} = \hat{H}_i \left(\frac{m_{ij}}{n_i} \right) \theta_j^{-1} = \hat{H}_i \hat{p}_{ij} \theta_j^{-1} = \hat{H}_i \hat{u}_{ij}, \qquad (1)$$

where:

[1] Harvest is defined as fish legally hooked and retained by anglers as part of their creel.

H_i = the harvest of Chinook salmon in stratum i, estimated from the SWHS (Jennings et al. *In prep*)

m_{ij} = number of AFCs recovered from cohort j in stratum i,

n_i = number of fish harvested in stratum i examined for a missing adipose fin,

θ_j = proportion of cohort *j* marked and released with CWTs at the hatchery, and

$u_{ij} = p_{ij} / \theta_j$ = the relative contribution (proportion) of hatchery fish to the harvest.

The variance of $\hat{r}_{ij}$ was estimated as (Goodman 1960):

$$\hat{V}\left[\hat{r}_{ij}\right] = \left(\hat{H}_i^2 \hat{V}\left[\hat{p}_{ij}\right] + \hat{p}_{ij}^2 \hat{V}\left[\hat{H}_i\right] - \hat{V}\left[\hat{H}_i\right]\hat{V}\left[\hat{p}_{ij}\right]\right)\theta_j^{-2}, \tag{2}$$

and of the relative contributions $\hat{u}_{ij}$ as:

$$\hat{V}\left[\hat{u}_{ij}\right] = \hat{V}\left[\hat{p}_{ij}\right]\theta_j^{-2}, \tag{3}$$

where:

$$\hat{V}\left[\hat{p}_{ij}\right] = \frac{\hat{p}_{ij}\left(1-\hat{p}_{ij}\right)}{n_i - 1}. \tag{4}$$

The total contribution of hatchery fish from all cohorts to stratum i of the harvest was estimated by summing across cohorts:

$$\hat{R} = \sum_j \hat{r}_{ij} \tag{5}$$

with variance:

$$\hat{V}\left[\hat{R}_i\right] = \sum_j \hat{V}\left[\hat{r}_{ij}\right] + 2\sum_j \sum_{k \neq j} \hat{\mathrm{cov}}\left[\hat{r}_{ij}, \hat{r}_{ik}\right] \tag{6}$$

where (Bernard and Clark 1996):

$$\hat{\mathrm{cov}}\left[\hat{r}_{ij}, \hat{r}_{ik}\right] = \hat{r}_{ij}\hat{r}_{ik}\frac{\hat{V}\left[\hat{H}\right]}{\hat{H}} \tag{7}$$

AGE, SEX, AND LENGTH COMPOSITION

All sampled Chinook salmon lengths were measured MEF (to the nearest 1 mm), sex was identified based on external characteristics and recorded, and three scales were collected. Scales were taken from the left side of the body of each sampled fish, at a point on a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, two rows above the lateral line (Welander 1940). Age was estimated from scale annuli following Mosher (1969). Because most Chinook salmon smolt at freshwater-age-1, we did not analyze freshwater ages.

The proportion of adult Chinook salmon in the late-run harvests of age/sex class *j* and its variance was estimated as a binomial proportion (Cochran 1977) by:

$$\hat{q}_j = \frac{x_j}{n} \tag{4}$$

where:

x_j = the number of adult Chinook salmon of age/sex class j, and

n = the total number of adult Chinook salmon scale samples that could be aged.

The variance of $\hat{q}_j$ was estimated by:

$$\hat{V}\left(\hat{q}_j\right) = \frac{\hat{q}_j\left(1-\hat{q}_j\right)}{n-1}. \tag{5}$$

INRIVER RETURN GILLNETTING FEASIBILITY

To assess the feasibility of capturing adult Chinook salmon for possible future radio-telemetry studies we drifted gillnets between river kilometer 4.8 and 9.5 from July 3 to 31, 2002 (Figure 1). Two mesh sizes (mainly 12.1 cm and some 19.1 cm stretch measurement) were used for drift gillnetting.

RESULTS AND DISCUSSION

HATCHERY CONTRIBUTION

2002

The SWHS estimated that 451 (SE = 100) Chinook salmon were harvested in the Kasilof River in July (Table 1). We collected age, sex, and length (ASL) information 307 Chinook salmon, which constituted 68% of the estimated July harvest. Seven Chinook salmon with an AFC were observed in the harvest, all during the first week of July (Table 2).

Three AFC Chinook salmon were age-.1 males, one was an age-.2 female, and three were age-.3 females (Table 3). The absolute contribution of hatchery fish to the estimated harvest was 26 Chinook salmon (SE = 13), which constituted about 6% of the total sport harvest. Overall, the estimated harvest was 23% (SE = 12%) of the age-.1, 1% (SE = 1%) of the age-.2 and 12% (SE = 7%) of the age-.3 Chinook salmon in July were of hatchery origin (Table 3).

2003

The SWHS estimated that 1,144 (SE = 166) Chinook salmon were harvested in the Kasilof River in July (Table 1). We collected age, sex, and length information from 429 Chinook salmon, 38% of the July harvest. Six AFC Chinook salmon were sampled in the harvest, five during the first week of July and one during the third week (Table 4).

Two AFC Chinook salmon were age-.2 males, one was an age-.3 male, two were age-.3 females, and one female could not be aged (Table 5). The absolute contribution of hatchery fish to the estimated harvest was 14 Chinook salmon (SE = 6), approximately 1% of the total sport harvest. Approximately 1% (SE = 1%) of the age-.2 and 2% (SE = 1%) of the age-.3 Chinook salmon estimated harvest in July were of hatchery origin (Table 5).

Table 2.–Number of Adipose Fin Clipped (AFC) and non-AFC Chinook salmon by sex, time strata, and ocean age in the late-run Kasilof River sport fishery harvest, 2002.

		Ocean Age												
		1		2		3		4		5		All Ages		
Sex	Dates	Non-AFC	AFC	Non-AFC	AFC	Non-AFC	AFC	Non-AFC	AFC	Non-AFC	AFC	Non-AFC	AFC	Both
Female	July 1-7	0	0	1	1	11	3	6	0	0	0	18	4	22
	July 8-14	0	0	15	0	10	0	6	0	1	0	32	0	32
	July 15-21	0	0	3	0	14	0	12	0	0	0	29	0	29
	July 22-31	0	0	1	0	19	0	14	0	0	0	34	0	34
	July 1-31	0	0	20	1	54	3	38	0	1	0	113	4	117
Male	July 1-7	10	3	9	0	3	0	3	0	0	0	25	3	28
	July 8-14	0	0	23	0	4	0	4	0	0	0	31	0	31
	July 15-21	0	0	27	0	27	0	11	0	1	0	66	0	66
	July 22-31	0	0	16	0	27	0	21	0	1	0	65	0	65
	July 1-31	10	3	75	0	61	0	39	0	2	0	187	3	190
Total	July 1-7	10	3	10	1	14	3	9	0	0	0	43	7	50
	July 8-14	0	0	38	0	14	0	10	0	1	0	63	0	63
	July 15-21	0	0	30	0	41	0	23	0	1	0	95	0	95
	July 22-31	0	0	17	0	46	0	35	0	1	0	99	0	99
	July 1-31	10	3	95	1	115	3	77	0	3	0	300	7	307

Table 3.–Contribution of Crooked Creek origin hatchery-produced Chinook salmon to the late-run Kasilof River sport fishery, July 1-31, 2002.

Sex			Ocean Age 1	2	3	4	5	Total[1]
Female	No. inspected	n	0	21	57	38	1	117
	Sex/age proportion	q^	-	6.8%	18.6%	12.4%	0.3%	38.1%
		se(q)	-	1.4%	2.2%	1.9%	0.3%	2.8%
	Harvest	H^	0	31	84	56	1	172
		se(H^)	-	9	21	15	1	40
	No. AFC fish	m	0	1	3	0	0	4
	Hatchery Marked Fraction	q	-	0.984	0.222	0.310	0.310	-
	Relative Contribution	u^	-	4.8%	23.7%	0.0%	0.0%	12.4%
		se(u^)	-	4.8%	13.5%	0.0%	0.0%	-
	Absolute Contribution	r^	0	1	20	0	0	21
		se(r^)	-	1	12	0	0	12
Male	No. inspected	n	13	75	61	39	2	190
	Sex/age proportion	q^	4.2%	24.4%	19.9%	12.7%	0.7%	61.9%
		se(q)	1.2%	2.5%	2.3%	1.9%	0.5%	2.8%
	Harvest	H^	19	110	90	57	3	279
		se(H^)	7	27	22	15	2	63
	No. AFC fish	m	3	0	0	0	0	3
	Hatchery Marked Fraction	q	0.989	0.984	0.222	0.310	0.310	-
	Relative Contribution	u^	23.3%	0.0%	0.0%	0.0%	0.0%	1.6%
		se(u^)	12.3%	0.0%	0.0%	0.0%	0.0%	-
	Absolute Contribution	r^	4	0	0	0	0	4
		se(r^)	3	0	0	0	0	3
All	No. inspected	n	13	96	118	77	3	307
	Sex/age proportion	q^	4.2%	31.3%	38.4%	25.1%	1.0%	100.0%
		se(q)	1.2%	2.7%	2.8%	2.5%	0.6%	0.0%
	Harvest	H^	19	141	173	113	4	451
		se(H^)	7	33	40	27	3	100
	No. AFC fish	m	3	1	3	0	0	7
	Hatchery Marked Fraction	q	0.989	0.984	0.222	0.310	0.310	-
	Relative Contribution	u^	23.3%	1.1%	11.5%	0.0%	0.0%	5.7%
		se(u^)	12.3%	1.1%	6.6%	0.0%	0.0%	-
	Absolute Contribution	r^	4	1	20	0	0	26
		se(r^)	3	1	12	0	0	13

[a] Individual age estimates do not sum to total age estimates due to rounding errors.

Table 4.–Number of Adipose Fin Clipped (AFC) and non-AFC Chinook salmon by sex, time strata, and ocean age in the late-run Kasilof River sport fishery harvest, 2003.

		Ocean Age								
		2		3		4		All Ages		
Sex	Dates	Non-AFC	AFC	Non-AFC	AFC	Non-AFC	AFC	Non-AFC	AFC[a]	Total
Female	July 1-7	5	0	6	1	6	0	17	2	19
	July 8-14	2	0	8	0	2	0	12	0	12
	July 15-21	7	0	23	1	18	0	48	1	49
	July 22-31	8	0	39	0	33	0	80	0	80
	July 1-31	22	0	76	2	59	0	157	3	160
Male	July 1-7	10	2	12	1	2	0	24	3	27
	July 8-14	23	0	12	0	5	0	40	0	40
	July 15-21	47	0	38	0	8	0	93	0	93
	July 22-31	47	0	53	0	10	0	110	0	110
	July 1-31	127	2	115	1	25	0	267	3	270
Total	July 1-7	15	2	18	2	8	0	41	5	46
	July 8-14	25	0	20	0	7	0	52	0	52
	July 15-21	54	0	61	1	26	0	141	1	142
	July 22-31	55	0	92	0	43	0	190	0	190
	July 1-31	149	2	191	3	84	0	424	6	430

[a] Includes one AFC female Chinook salmon of unknown age due to unreadable scales (July 1-7).

Table 5.–Contribution of Crooked Creek origin hatchery-produced Chinook salmon to the late-run Kasilof River sport fishery, July 1-31, 2003.

Sex			2	3	4	Total[a,b]
Female	Number inspected	n	22	76	59	157
	Sex/age proportion	q^	5.2%	17.9%	13.9%	37.0%
		se(q)	1.1%	1.9%	1.7%	2.3%
	Harvest	H^	59	205	159	424
		se(H^)	15	36	30	67
	No. AFC fish	m	0	2	0	3
	Hatchery Marked Fraction	q	0.984	0.973	0.222	-
	Relative Contribution	u^	0.0%	2.7%	0.0%	1.3%
		se(u^)	0.0%	1.9%	0.0%	-
	Absolute Contribution	r^	0	6	0	6
		se(r^)	0	4	0	0
Male	No. inspected	n	127	115	25	267
	Sex/age proportion	q^	30.0%	27.1%	5.9%	63.0%
		se(q)	2.2%	2.2%	1.1%	2.3%
	Harvest	H^	343	310	67	720
		se(H^)	56	51	16	108
	No. AFC fish	m	2	1	0	3
	Hatchery Marked Fraction	q	0.984	0.973	0.222	
	Relative Contribution	u^	1.6%	0.9%	0.0%	1.1%
		se(u^)	1.1%	0.9%	0.0%	-
	Absolute Contribution	r^	5	3	0	8
		se(r^)	4	3	0	0
All	No. inspected	n	149	191	84	424
	Sex/age proportion	q^	35.1%	45.0%	19.8%	100.0%
		se(q)	2.3%	2.4%	1.9%	0.0%
	Harvest	H^	402	515	227	1144
		se(H^)	64	80	40	166
	No. AFC fish	m	2	3	0	6
	Hatchery Marked Fraction	q	0.984	0.973	0.222	-
	Relative Contribution	u^	1.4%	1.6%	0.0%	1.2%
		se(u^)	1.0%	0.9%	0.0%	-
	Absolute Contribution	r^	5	8	0	14
		se(r^)	4	5	0	0

[a] One harvested AFC Chinook salmon was of unknown age due to unreadable scales.
[b] Individual harvest estimates do not sum to total harvest estimates due to rounding errors.

In summary, it appears that early-run hatchery Chinook salmon comprise a small fraction of the late-run harvest, and that few or no hatchery fish are harvested after the first week of July.

AGE, SEX, AND LENGTH COMPOSITION

2002

The late-run Chinook salmon recreational harvest was composed of 3% (SE = 1%) age-.1 fish, 32% (SE = 3%) age-.2 fish, 38% (SE = 3%) age-.3 fish, 26% (SE = 3%) age-.4 fish and 1% (SE = 1%) age-.5 fish (Table 6). No age-.1 Chinook salmon were sampled after the first week of July (Table 6). Chinook salmon mean MEF lengths ranged from 370 mm (SD = 35) for age-.1 to 1058 mm (SD = 68) for age-.5 (Table 7, Figure 2).

Table 6.–Age and sex composition, by time stratum, of the Kasilof River late-run wild Chinook salmon harvest, 2002.

			Ocean Age					
Dates	Sex		1	2	3	4	5	Total[a]
July 1-7	Female	n	0	1	11	6	0	18
	Sex/age proportion	q^	-	2.3%	25.6%	14.0%	-	41.9%
		se(q^)	-	2.3%	6.7%	5.3%	-	7.6%
	Male	n	10	9	3	3	0	25
	Sex/age proportion	q^	23.3%	20.9%	7.0%	7.0%	-	58.1%
		se(q^)	6.5%	6.3%	3.9%	3.9%	-	7.6%
	All	n	10	10	14	9	0	43
	Sex/age proportion	q^	23.3%	23.3%	32.6%	20.9%	-	100.0%
		se(q^)	6.5%	6.5%	7.2%	6.3%	-	0%
July 8-31	Female	n	0	19	43	32	1	95
	Sex/age proportion	q^	-	7.4%	16.7%	12.5%	0.4%	37.0%
		se(q^)	-	1.6%	2.3%	2.1%	0.4%	3.0%
	Male	n	0	66	58	36	2	162
	Sex/age proportion	q^	-	25.7%	22.6%	14.0%	0.8%	63.0%
		se(q^)	-	2.7%	2.6%	2.2%	0.5%	3.0%
	All	n	0	85	101	68	3	257
	Sex/age proportion	q^	-	33.1%	39.3%	26.5%	1.2%	100.0%
		se(q^)	-	2.9%	3.1%	2.8%	0.7%	0%
July 1-31	Female	n	0	20	54	38	1	113
	Sex/age proportion	q^	-	6.7%	18.0%	12.7%	0.3%	37.7%
		se(q^)	-	1.4%	2.2%	1.9%	0.3%	2.8%
	Male	n	10	75	61	39	2	187
	Sex/age proportion	q^	3.3%	25.0%	20.3%	13.0%	0.7%	62.3%
		se(q^)	1.0%	2.5%	2.3%	1.9%	0.5%	2.8%
	All	n	10	95	115	77	3	300
	Sex/age proportion	q^	3.3%	31.7%	38.3%	25.7%	1.0%	100.0%
		se(q^)	1.0%	2.7%	2.8%	2.5%	0.6%	0%

[a] Total includes only non-AFC harvested Chinook salmon.

Table 7.–Mideye-to-fork lengths (MEF, mm) for the late-run harvest of Kasilof River Chinook salmon, 2002.

		Ocean Age					
		1	2	3	4	5	Total[a]
Female	n	0	21	55	38	1	115
	Minimum MEF	-	584	604	840	1,083	
	Maximum MEF	-	713	900	1,081	1,083	
	Mean MEF	-	656	810	936	1,083	
	Std Dev MEF	-	34	63	49	0	
Male	n	13	75	61	39	2	190
	Minimum MEF	309	550	700	745	981	
	Maximum MEF	427	727	900	1,040	1,110	
	Mean MEF	370	657	797	946	1,046	
	Std Dev MEF	35	41	58	65	91	
All	n	13	96	116	77	3	305
	Minimum MEF	309	550	604	745	981	
	Maximum MEF	427	727	900	1,081	1,110	
	Mean MEF	370	657	803	941	1,058	
	Std Dev MEF	35	39	61	58	68	

[a] Total includes all AFC and non-AFC harvested Chinook salmon.

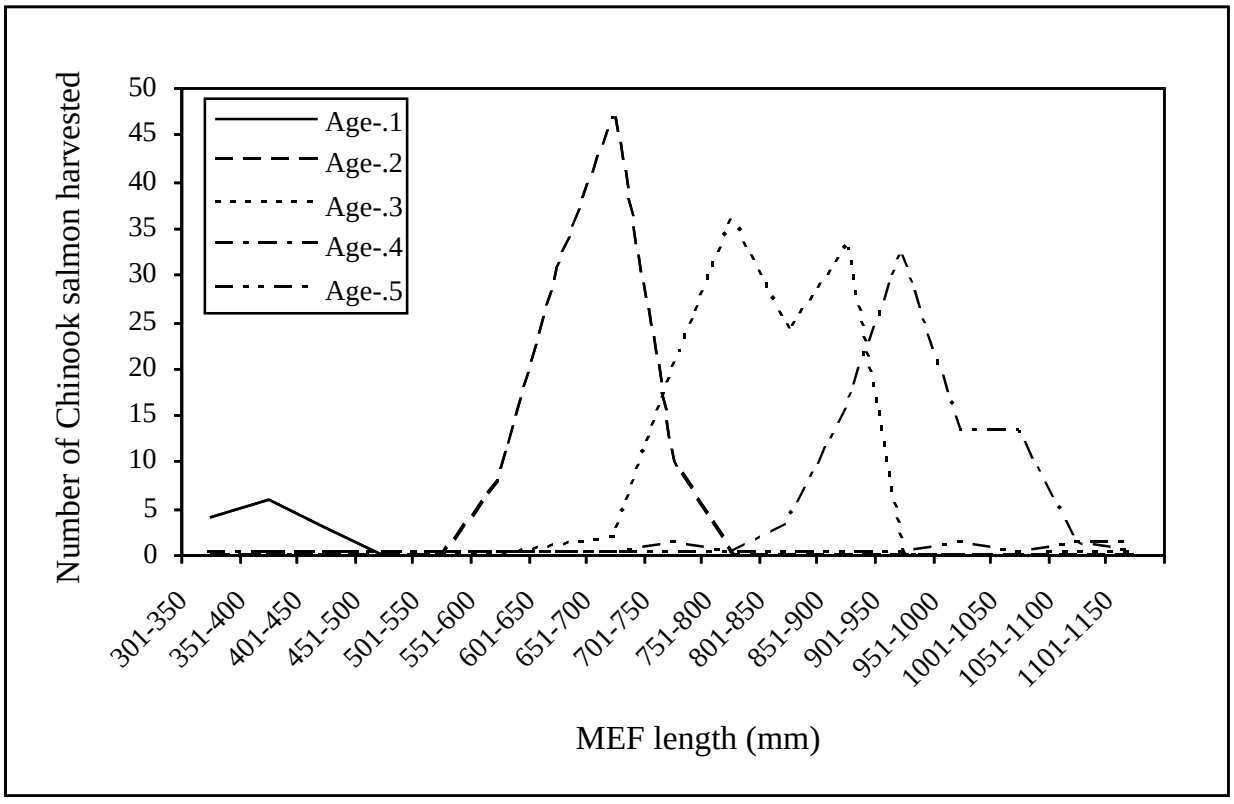

Figure 2.–Length frequency distribution of all Chinook salmon harvested from the Kasilof River, July 2002.

2003

The late-run Chinook salmon recreational harvest was composed of 35% (SE = 2%) age-.2 fish, 45% (SE = 2%) age-.3 fish and 20% (SE = 2%) age-.4 fish (Table 8). No age-.1 Chinook salmon or age-.5 fish were sampled in 2003 (Table 8). Chinook salmon mean MEF lengths ranged from 668 mm (SD = 46) for age-.2 to 979 mm (SD = 62) for age-.4 (Table 9, Figure 3).

Table 8.–Age and sex composition, by time stratum, of the Kasilof River late-run wild Chinook salmon harvest, 2003.

			Ocean Age			
Dates	Sex		2	3	4	Total[a]
July 1-7	Female	n	5	6	6	17
	Sex/age proportion	q^	12.2%	14.6%	14.6%	41.5%
		se(q^)	5.2%	5.6%	5.6%	7.8%
	Male	n	10	12	2	24
	Sex/age proportion	q^	24.4%	29.3%	4.9%	58.5%
		se(q^)	6.8%	7.2%	3.4%	7.8%
	All	n	15	18	8	41
		q^	36.6%	43.9%	19.5%	100.0%
		se(q^)	7.6%	7.8%	6.3%	0%
July 8-31	Female	n	17	70	53	140
	Sex/age proportion	q^	4.4%	18.3%	13.8%	36.6%
		se(q^)	1.1%	2.0%	1.8%	2.5%
	Male	n	117	103	23	243
	Sex/age proportion	q^	30.5%	26.9%	6.0%	63.4%
		se(q^)	2.4%	2.3%	1.2%	2.5%
	All	n	134	173	76	383
	Sex/age proportion	q^	35.0%	45.2%	19.8%	100.0%
		se(q^)	2.4%	2.5%	2.0%	0%
July 1-31	Female	n	22	76	59	157
	Sex/age proportion	q^	5.2%	17.9%	13.9%	37.0%
		se(q^)	1.1%	1.9%	1.7%	2.3%
	Male	n	127	115	25	267
	Sex/age proportion	q^	30.0%	27.1%	5.9%	63.0%
		se(q^)	2.2%	2.2%	1.1%	2.3%
	All	n	149	191	84	424
	Sex/age proportion	q^	35.1%	45.0%	19.8%	100.0%
		se(q^)	2.3%	2.4%	1.9%	0%

[a] Total includes only non-AFC harvested Chinook salmon.

Table 9.–Mideye-to-fork lengths (MEF, mm) for the late-run harvest of Kasilof River Chinook salmon, 2003.

		Ocean Age			
		2	3	4	Total[a]
Female	n	22	78	58	158
	Minimum MEF	594	704	840	
	Maximum MEF	729	925	1,081	
	Mean MEF	677	841	965	
	Std Dev MEF	41	59	59	
Male	n	129	116	25	270
	Minimum MEF	504	649	893	
	Maximum MEF	757	945	1,135	
	Mean MEF	660	807	992	
	Std Dev MEF	47	65	66	
All	n	151	194	83	428
	Minimum MEF	549	677	867	
	Maximum MEF	743	935	1,108	
	Mean MEF	668	824	979	
	Std Dev MEF	46	64	62	

[a] Total includes all AFC and non-AFC harvested Chinook salmon.

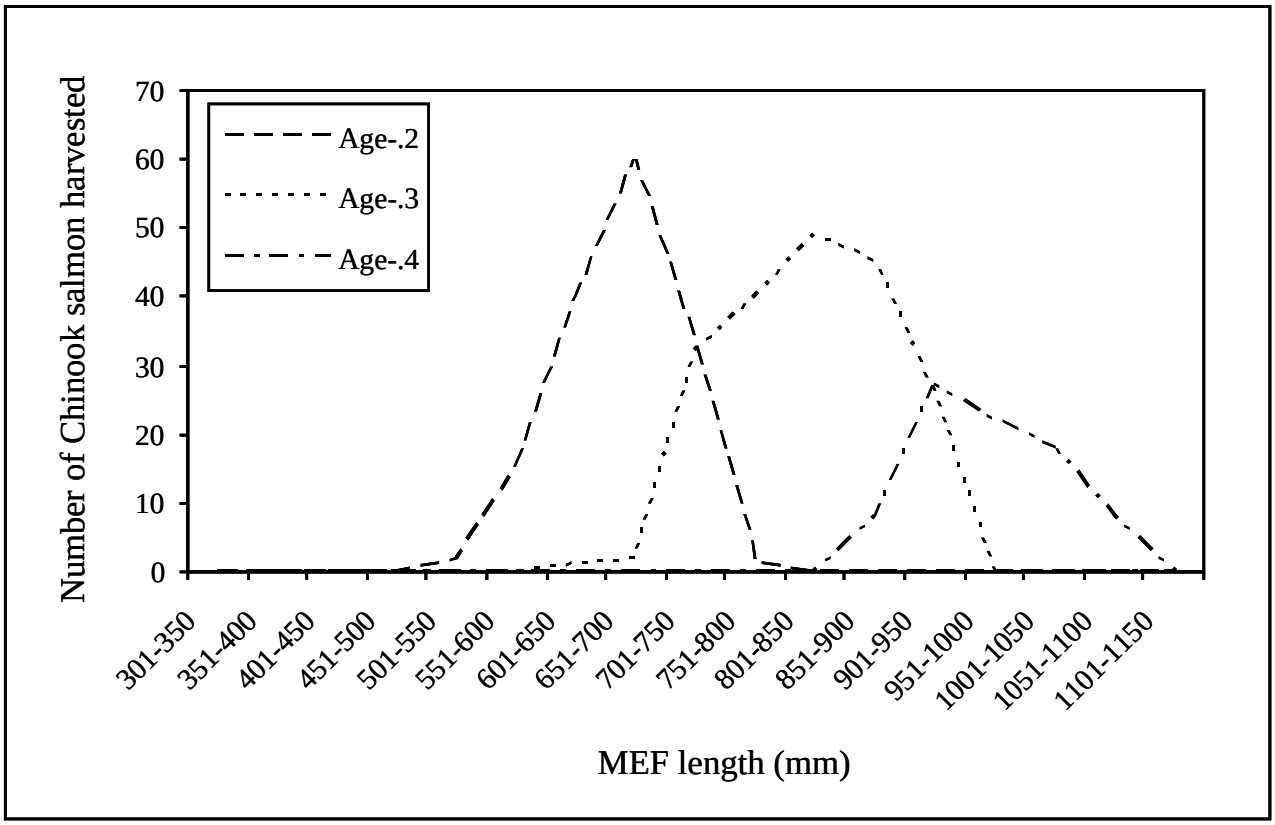

Figure 3.–Length frequency distribution of all Chinook salmon harvested from the Kasilof River, July 2003.

INRIVER RETURN GILLNETTING FEASIBILITY

We captured and tagged 48 Chinook salmon during 6.1 hours of drift gillnetting. Although there was no effort to look for recaptures, at least two of these fish passed through the Crooked Creek weir and two were harvested. One of the harvested fish was caught in the Kasilof River and the other was caught in the Kenai River. Sampling in the lower part of the study area during rising and high tides was not feasible. However, gillnetting could be an effective capture method in the lower river during low and falling tides.

LATE-RUN HARVEST MONITORING RECOMMENDATION

Most late-run sport fishermen exited the Kasilof River at Trujillo's Boat Landing (85%) compared to the Alaska State Park (6.6%), Cohoe Cove (5.2%), and Kasilof Cabins (3.2%). During this two-year study, we conducted 1,162 (85%) interviews and sampled 754 (87%) Chinook salmon at Trujillo's Boat Landing. If future sport harvest surveys are planned, a study design that concentrates more sampling effort at Trujillo's Boat Landing would increase the proportion of anglers interviewed and fish sampled.

The large annual harvest levels of Chinook salmon during the early 1990s prompted concerns about the sustainability of the late-run fishery. Based on the SWHS and the unknown number of mainstem spawning wild stock, the harvest of late-run Chinook salmon is still a concern. However, the harvest of early-run Chinook salmon in July is no longer a concern because few are harvested and the escapement levels of naturally-produced Crooked Creek Chinook salmon returning to spawn are sustainable.

Based on the drift gillnetting results and the ongoing concern about the harvest of mainstem spawning wild stock, we recommend a population estimate study be done using radio-telemetry.

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