

**Regional Operational Plan SF.1J.2014.13**

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# **Situk River Chinook Salmon Creel Survey, 2014**

by

**Brian Marston**

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September 2014

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the *Système International d'Unités* (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

<b>Weights and measures (metric)</b>		<b>General</b>		<b>Mathematics, statistics</b>	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	$H_A$
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	$e$
hectare	ha	at	@	catch per unit effort	CPUE
kilogram	kg	compass directions:		coefficient of variation	CV
kilometer	km	east	E	common test statistics	(F, t, $\chi^2$ , etc.)
liter	L	north	N	confidence interval	CI
meter	m	south	S	correlation coefficient (multiple)	R
milliliter	mL	west	W	correlation coefficient (simple)	r
millimeter	mm	copyright	©	covariance	cov
		corporate suffixes:		degree (angular)	$^\circ$
<b>Weights and measures (English)</b>		Company	Co.	degrees of freedom	df
cubic feet per second	ft <sup>3</sup> /s	Corporation	Corp.	expected value	$E$
foot	ft	Incorporated	Inc.	greater than	>
gallon	gal	Limited	Ltd.	greater than or equal to	$\geq$
inch	in	District of Columbia	D.C.	harvest per unit effort	HPUE
mile	mi	et alii (and others)	et al.	less than	<
nautical mile	nmi	et cetera (and so forth)	etc.	less than or equal to	$\leq$
ounce	oz	exempli gratia		logarithm (natural)	ln
pound	lb	(for example)	e.g.	logarithm (base 10)	log
quart	qt	Federal Information Code	FIC	logarithm (specify base)	log <sub>2</sub> , etc.
yard	yd	id est (that is)	i.e.	minute (angular)	'
		latitude or longitude	lat. or long.	not significant	NS
<b>Time and temperature</b>		monetary symbols		null hypothesis	$H_0$
day	d	(U.S.)	\$, ¢	percent	%
degrees Celsius	°C	months (tables and figures): first three letters	Jan, ..., Dec	probability	P
degrees Fahrenheit	°F	registered trademark	®	probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
degrees kelvin	K	trademark	™	probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
hour	h	United States (adjective)	U.S.	second (angular)	"
minute	min	United States of America (noun)	USA	standard deviation	SD
second	s	U.S.C.	United States Code	standard error	SE
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	variance	
<b>Physics and chemistry</b>				population sample	Var var
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				

***REGIONAL OPERATIONAL PLAN SF.1J.2014.13***

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Brian Marston

Alaska Department of Fish and Game, Sport Fish, Yakutat

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Division of Sport Fish

September 2014

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**SIGNATURE PAGE**

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**Approval**

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## **ABSTRACT**

The primary goals of this project are to estimate Chinook salmon (*Oncorhynchus tshawytscha*) harvest by sport anglers on the Situk River and the age composition of that harvest in 2014. A creel survey will be used to document harvest and age composition and a weir will be used to enumerate inriver run. This information will be used for management of sport and commercial fisheries to ensure the Chinook salmon biological escapement goal is achieved as directed by the Situk-Ahrnklin and Lost River Chinook salmon Management Plans. Secondary goals of this study include the estimate of sockeye salmon (*Oncorhynchus nerka*) harvest and angler use patterns directed at both Chinook and Sockeye salmon on the Situk River in Southeast Alaska.

Keywords: Chinook salmon, sockeye salmon, harvest, creel survey, Situk River, escapement, Yakutat, weir.

## **PURPOSE**

Creel sampling techniques will be used to estimate the Chinook salmon harvest by sport anglers on the Situk River, and the age composition of that harvest. Additionally, sockeye salmon harvest will be estimated, and various angler use patterns will be recorded. A weir will be used to enumerate the Chinook salmon inriver run (separately funded project), and escapement will be calculated by subtracting the above-weir sport harvest from the weir count. This information will be used for management of sport and commercial fisheries to ensure the Chinook salmon biological escapement goal (BEG) is achieved per the Situk-Ahrnklin and Lost River Chinook salmon Management Plan (5AAC 30.365). Additionally, the age composition information collected by this project will be used in stock assessment models to predict the following year's run, upon which preseason management regulations will be set.

## **BACKGROUND**

The Situk River is located approximately 10 km east of Yakutat, Alaska and flows into the Gulf of Alaska (Figure 1). It is 35.2 km long and drains 3 lakes that have a combined surface area of 397 hectares. The Situk River and many other Yakutat vicinity streams support sport fisheries for salmon (*Oncorhynchus* spp.) and char (*Salvelinus malma*) in addition to commercial and subsistence fisheries for salmonids. The majority of freshwater angling effort for Chinook salmon in the Yakutat vicinity occurs in the Situk River. Since 1999, Chinook salmon (*Oncorhynchus tshawytscha*) harvest and age data gathered with a creel survey on the Situk River are used for inseason harvest management and cohort analyses. This document details plans for the Chinook salmon creel survey at primary exit locations for sport anglers on the Situk River during the 2014 field season (June and July).

Since 1995, the total run of all ages of Chinook salmon to the Situk River has declined to very low abundance levels. The 1996 to 2003 average run size was greater than 6,500 fish, and a historic high of 18,045 fish occurred in 1995 (Pahlke 2007). Between 2003 and 2007, the average total run size has been <2,100 fish (Pahlke 2007). Total run size of large Chinook salmon only (= or > 3 ocean age) has also declined in that time period as well as in subsequent years (Figure 2). Likewise, Statewide Harvest Survey (SWHS) estimates of sport angler harvests of Chinook salmon have declined from over 400 in 2003 to 101 in 2005, although historically, sport harvest has been highly variable since 1976 (Pahlke 2007). From 2006 through 2008, the Chinook salmon sport fishery was closed to retention of fish >20 inches in length by emergency order, and no large Chinook were harvested. In 2009, 3 fish were sport harvested during a restricted season. In 2010 a small number (preliminary estimate = 32) of Chinook salmon ≤28 inches were harvested in a restricted season.



Figure 1.-Map of the Situk River drainage and locaiton of the Situk weir and the three access sites of the Situk River creel survey, near Yakutat, Southeast Alaska.

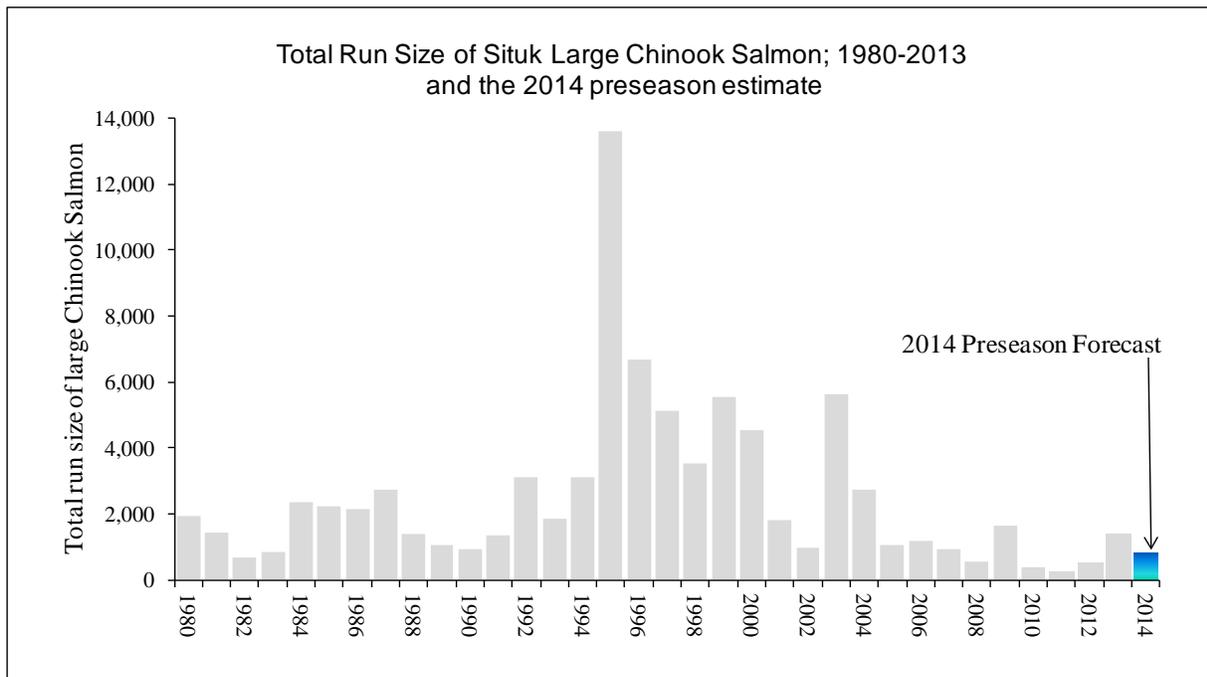


Figure 2.—Total run of large Chinook salmon (solid bars) on the Situk River in Southeast Alaska, 1980–2013 and the 2014 forecast (shaded bar).

In 2012 all sport angling for adult Chinook salmon was closed, no adults were reported as harvested and 27 jacks were harvested. In 2013 all sport angling for adult Chinook salmon was again closed until July 16 when escapement goals were met. After that date, approximately 35 large Chinook were harvested (preliminary 2013 data). Commercial fishery harvest has also declined since 2003, but the small subsistence catch has been more stable. Commercial harvest was limited to no sale from 2006 through 2009, and the subsistence fishery operated normally; together these fisheries typically harvest 250–400 fish. In 2010 the subsistence fishery was closed later than the other fisheries, but 140 fish were taken. In 2012 no net fisheries targeted at Chinook salmon were allowed, although concurrent sockeye net fisheries occurred within an area of the inlet closed to all net fishing for Chinook conservation. This limited the Chinook take to 89 adult fish in incidental commercial harvests in 2012. In 2013, 387 fish were harvested in similar but less restrictive openings of the net fisheries (subsistence and commercial).

The Situk River Chinook salmon sport fishery is managed inseason and can potentially be altered by emergency order to achieve a BEG of 450 to 1,050 age-.3+ Chinook salmon (McPherson et al. 2005). The inriver run of Chinook salmon is counted on the Situk River at a weir 2.5 km from saltwater by the Alaska Department of Fish and Game (ADF&G), Division of Commercial Fisheries (DCF). Average weir count data of Chinook salmon from past years are used to predict daily weir counts prior to the potential sport harvest above the weir. The weir is also used to collect scales from Chinook salmon to estimate the proportion that are age .3+ for stock-recruit analysis and BEG assessment. Sport harvest (when the sport fishery is open) above the weir must be removed from the weir counts to calculate daily escapement and determine if the BEG will be met. Inseason estimates of sport harvest, obtained with the creel survey, will be critical to the management of sport and commercial fisheries in 2014 to ensure the escapement goal is

achieved. Additionally, the weir count plus all sport harvest (above and below weir) indicates how many fish have escaped commercial and subsistence fisheries, if these fisheries are open.

In addition to inseason management, a preseason forecast of the total run is made. The preseason estimate allows the ADF&G to plan for directed fisheries that catch Situk River Chinook salmon. The 2014 (Figure 2) preseason run estimate of 475 age-.3+ fish (range of 173 to 769) suggests that a sport fishery is unlikely, unless the upper end of the range is achieved. Sport fisheries for Chinook salmon will be closed in 2014 until weir counts are sufficient to predict at least 750 large fish will escape the fisheries.

Since 1999, the Division of Sport Fish (DSF) has conducted a creel survey to calculate an inseason sport harvest estimate of all Chinook salmon taken below and above the weir. Weekly sport harvest estimates from above the weir are calculated and subtracted from weir counts (inriver run) to estimate escapement. Inseason management decisions for Situk River fisheries are based on the resulting escapement calculation and its progress towards attaining the BEG. In addition, creel survey scale samples are used to reconstruct age-size composition as part of the calculation of the preseason run estimate for the next year.

This project has used a single sampler to collect harvest information at the Lower Landing boat ramp, traditionally the most popular access point on the river. Expansion factors have then been used to expand estimates to assess total harvest (see Data Analysis section). In recent years evidence has been gathered that shows significantly more angler effort has been shifting to the Nine Mile Bridge and Maggie John Trail access points, potentially changing the relationship between the expansion factors and total harvest (unpublished data, available at the Yakutat ADF&G office). In 2014 this project will continue with a new second sampler to survey harvest at these additional access points, and assess harvest more directly for comparison to the expansion factor method.

Several other tasks are accomplished by this project. The creel survey also provides an inseason estimate of Chinook salmon harvested below the weir. Additionally, a sockeye salmon (*Oncorhynchus nerka*) sport harvest estimate is calculated that can be subtracted from weir counts of sockeye salmon to assess daily escapement, and the proportions of each species harvested by guided or unguided anglers are estimated. Angler residency, effort, and catch are also estimated for both species. The creel samplers also provide departmental presence on the river and information to the angling public and others.

## OBJECTIVES

1. To provide 2014 inseason estimates of the number of large ( $\geq 28$  in TL, typically age .3+) Chinook salmon harvested above the weir by anglers exiting the Situk River access locations such that, by the end of the season, the resulting estimate of total escapement is within 25%<sup>1</sup> of the true value 95% of the time.
2. To estimate the age composition of Chinook salmon harvested by the recreational fishery in the Situk River in 2014 above and below the weir, such that the proportion of fish age .3 or older is within 0.15 of the true value 90% of the time.

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<sup>1</sup> Formerly (2007 plan) within 10% of the true value 95% of the time, when only a single expansion of the harvest estimate was applied.

## **SECONDARY OBJECTIVES**

1. Estimate the harvest of Chinook salmon below the weir, plus total angler effort and catch, by anglers exiting the Situk River access locations in the Situk River from 9 June through 31 July 2014, between the hours of 10:00 – 23:00.
2. Estimate the harvest of sockeye salmon above and below the weir, plus total angler effort and catch, by anglers exiting the Situk River Lower Landing access location from 9 June through 31 July 2014, between the hours of 10:00 – 23:00.
3. Estimate the proportions of guided versus unguided trips, type of access used by the angler, residency status of the angler (resident or nonresident), and in the event that the angler is guided, the guide's logbook number.

## **METHODS**

### **OBJECTIVE 1, SECONDARY OBJECTIVES 1, 2 AND 3: INSEASON HARVEST, CATCH, AND EFFORT**

Chinook and sockeye salmon angling on the Situk River originates via 3 access points. These points are the Lower Landing, Maggie John Trail, and the bridge at Nine Mile of Forest Highway 10 (Figure 1). Anglers do float trips from the Nine Mile Bridge downstream to the Lower Landing, boat upstream from the Lower Landing then return, or hike in from all three access points. A stratified two-stage "direct expansion" survey of anglers exiting the Situk River will be used to estimate angler effort, as well as Chinook and sockeye salmon catch and harvest.

The sampling schedule used since 2006 will remain in place during 2014 and includes two shifts: 10:00-16:30 and 16:30-23:00. The two-stage survey design has "days" within each location/time of day (TOD) stratum as primary sampling units and "anglers within days" as secondary sampling units. Once a "day" is selected for sampling within each location/TOD stratum, the entire sampling period will be covered. All anglers exiting the Situk River fishery at the three access points between the start and stop hours defining each period will either be counted or interviewed on each sampled "day". An attempt will be made to interview all individuals exiting the fishery for effort, catch, and harvest information (nearly every exiting angler has been interviewed in past surveys). All individuals seen leaving the fishery who are not interviewed will also be counted.

Large Chinook salmon are defined as those  $\geq 28$  inches TL, and Chinook salmon less than 28 inches are primarily males that have spent 1 or 2 years in the ocean. Situk River is managed for escapement of large Chinook  $\geq 28$  inches; however, the 2-ocean (20.1–27.9 inches), and 1-ocean ( $\leq 20$  inches) fish will also be recorded in the survey.

### **Single Location Sampler Methodology for Lower Landing**

One sampling method for this project is a "1-technician" survey and, as such, constraints exist on the sampling design. Plots of angler effort, catch, and harvest of Chinook salmon from 1999 showed clear differences in effort and catch/harvest per unit effort between TOD strata for both guided and unguided anglers at the Lower Landing access point. There was little evidence of a significant type-of-day (i.e., weekday/ weekend) effect for guided anglers and mild evidence for type-of-day effects for unguided anglers around the 4<sup>th</sup> of July (near the peak of the Chinook salmon fishery). Thus, a TOD stratified design (Bernard et al. 1998) has and will continue to be used.

The logistics of scheduling a single-technician survey necessitate a tradeoff between unbiased estimates and precision (Bernard et al. 1998). Since 2000, we have allocated equal sampling effort between mid- and late-day strata. Because the mid-day stratum has had slightly greater harvest on average, it was sampled systematically, every third day, with a random starting day. Sampling of the late-day stratum was constrained to preserve back-to-back days off for the technician (as required under the State labor contract), which led to sampling 2 consecutive days with 4 days in between (“quasi”-systematic sampling). The 2014 sampling schedule is presented in Appendix 1. Table 1 shows the summary of stratification structure for the Lower Landing.

Table 1.–Summary of stratification structure and sampling characteristics for the 2014 Situk River Chinook salmon creel survey at Lower Landing, Southeast Alaska, June 9–July 31.

Stratum	Time of day	Number of days	Days sampled	Sampling method <sup>a</sup>
Mid-day	1000–1630	53	17	SYS
Late-day	1630–2300	53	18	q-SYS

<sup>a</sup> SYS = systematic sampling, q-SYS = “quasi” systematic sampling.

### Expansion Factor Methodology for Entire River Harvest

The creel survey at Lower Landing captures a large fraction, but not 100%, of the Chinook and sockeye salmon harvest. Additional fish are harvested before 9 June by anglers exiting at Nine Mile Bridge and those that use the Maggie John Trail, as well as before and after the hours of the survey at Lower Landing. Comparison of SWHS and creel survey estimates from 2000 to 2007 indicate that the survey encompasses approximately 74% (SE = 8%) of the Chinook salmon harvest (Figure 3). The fitted linear relationship was obtained using a model that considered the measurement error in both variables. When there is a need to obtain inseason estimates of Chinook salmon harvest above the weir for projecting escapement, the creel survey harvest will be multiplied by  $0.74^{-1} = 1.35$ . The standard error of the estimated expansion factor, considering the measurement error in each variable, is 0.15.

Because this expansion factor is germane to the systemwide harvest of Chinook salmon of all sizes and managers require above-weir estimates for large fish, the expanded harvest estimate must also be multiplied by the mean proportion of Chinook harvest taken above the weir (50%, SD = 9%; based on historical SWHS estimates), and by the mean proportion of age-.3 and older fish in the creel (65%, SD = 24%; 2000–2005 data). Cumulative harvest estimates will be generated on a weekly basis and subtracted from the weir count to estimate escapement.

Past performance of the creel survey with respect to the precision of the resulting end-of-the-season estimate of escapement is detailed in Table 2. The sampling error of the large Chinook harvest above the weir incorporates the additional uncertainty about the value of the spatial/temporal expansion factor (Figure 3), as well as the variability in the proportion of harvest above the weir (0.50, SD = 0.09) and in the proportion of harvest comprised of large Chinook salmon (0.65, SD = 0.24).

Table 2.—Hypothetical end-of-season estimates of sport harvest above the weir, escapement, and relative precision (RP,  $\alpha = 0.05$ ) of large Situk River Chinook salmon, 2000–2005.

Year	Creel, all Chinook above/ below	CV	Expanded to SWHS	CV	All Chinook above only	CV	Large Chinook above only	CV	Inriver run (weir count)	Escapement	CV	RP	Harvest rate of large fish above the weir
2000	1,176	0.13	1,505	0.17	759	0.24	493	0.43	2,518	2,025	0.11	21%	0.20
2001	405	0.23	518	0.26	261	0.31	170	0.47	696	526	0.15	30%	0.24
2002	129	0.26	165	0.29	83	0.33	54	0.48	1,024	970	0.03	5%	0.05
2003	1,050	0.11	1,344	0.16	677	0.24	440	0.43	2,615	2,175	0.09	17%	0.17
2004	396	0.10	507	0.15	255	0.23	166	0.43	798	632	0.11	22%	0.21
2005	210	0.16	269	0.20	135	0.26	88	0.44	613	525	0.07	15%	0.14

*Note:* Creel estimates of all Chinook salmon above and below the weir are spatially/temporally expanded by a factor of 1.28 (SE = 0.15) derived from a comparison with the Statewide Harvest Survey for 2000–2005, multiplied by 0.50 (SD = 0.09) to convert to harvest above the weir, and multiplied by 0.65 (SD = 0.24) to convert to large Chinook salmon only.

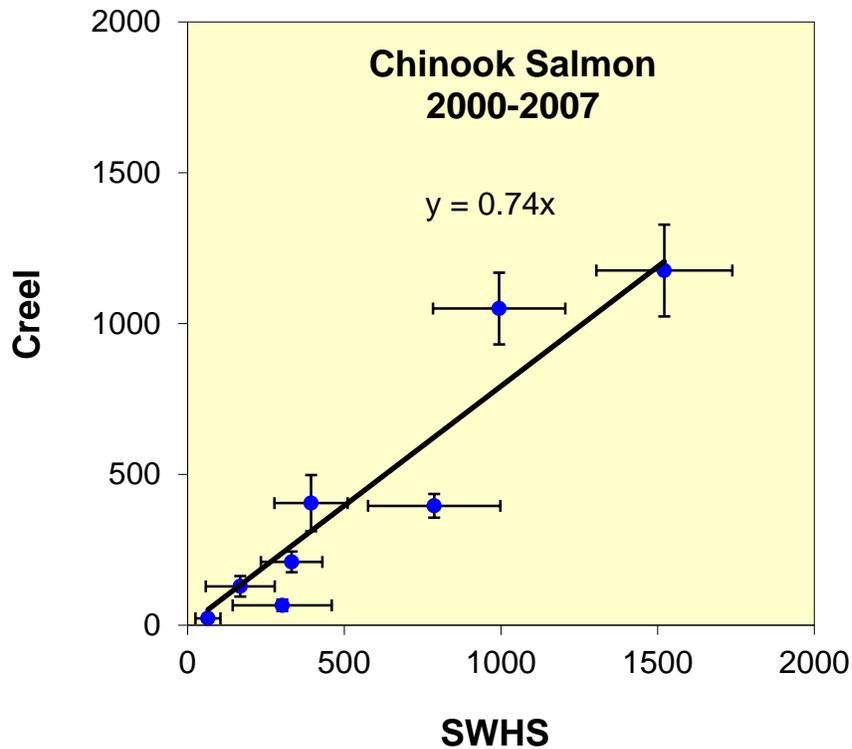
*Note:* The Chinook salmon sport fishery has been closed to retention of fish greater than 20 inches in all years since 2006.

*Note:* There has been restricted and limited harvests in 2009, 2010, and 2013 when base escapement goals were met late in the season.

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The coefficient of variation of the harvest of large Chinook above the weir is very stable at 43–48%, translating to 5–30% relative precision (RP) of the resulting estimates of escapement. Hypothetically this would have resulted in meeting the current Objective 1 criterion in 5 of 6 years from 2000 to 2005. Note that the RP of the escapement estimate is closely tied to the estimated harvest of large Chinook above the weir: higher harvests cause greater uncertainty in the escapement<sup>2</sup>. There was no harvest of large Chinook salmon in 2006 through 2008 because the Situk River was closed to the harvest of large Chinook salmon, and in 2009 one fish was sampled in a largely restricted season; the fishery was again closed to the harvest of large Chinook salmon in 2010–2012. The 2014 forecast for the total run of age-.3+ Chinook salmon is 475 fish, which requires that no sport fishery will occur until at least 450 fish pass the weir.

<sup>2</sup> During high harvest years, the amount of uncertainty could probably be reduced somewhat by analyzing the harvest age composition data inseason, enabling current-year estimates of the proportion of large fish, rather than relying on the multi-year average, as has been done above.



*Note:* Bars represent standard errors.

Figure 3.—Creel survey harvest estimates versus Statewide Harvest Survey (SWHS) estimates for Chinook salmon, all sizes above and below the weir, 2000–2007.

### **Second Sampler Methodology for Other Locations**

As for 2010 through 2013, two samplers will be used in 2014 utilizing a similar sampling schedule and general method, but the samplers will rotate between Lower Landing, the Nine Mile Bridge and Maggie John Trailhead. The rotation schedule involves systematically sampling the Nine Mile Bridge and Maggie John Trailhead locations every other day (except the scheduled days off) after randomly selecting which area will be sampled on the first day. Alternating two samplers between locations will be employed in 2014 to introduce some diversity and boost the morale of sampling personnel. This change preserves the systematic nature of the sampling design. The resulting estimate of harvest from those locations will be added to the estimate from the Lower Landing to create an entire river harvest estimate. The entire river estimate using the second sampler will be compared to the old expansion factor method estimate to determine which method is more precise and accurate. Table 3 shows the summary of stratification structure for the Nine Mile Bridge and Maggie John Trailhead access points.

### **OBJECTIVE 2; AGE COMPOSITION OF CHINOOK SALMON**

Age, sex, and length composition of the harvest in the Situk River recreational fishery will be estimated from samples collected during the creel survey. The harvest of all interviewed anglers will be sampled.

Because age, sex, and length composition does not vary between the TOD strata, the data collected can be treated as if it were from a simple random sample. Accordingly, a sample of 35 fish is needed to meet the Objective 2 criterion for a binomial proportion, assuming 15% scale regeneration (Cochran 1977). Under the current design, between 1 and 174 harvested fish were sampled either above or below the weir in years 2000–2005. In 10 of 12 year-location combinations, the sample size goal of 35 fish was achieved. In 2006 through 2008, Chinook salmon >20 inches TL were prohibited from retention, so scale samples were not collected. In 2009–2013 seasons that were restricted in some way, few fish were collected. We expect that the objective criterion for age composition will be met in 2014 unless inseason management actions cause a restriction in the daily bag limit. The projected Chinook salmon run of 475 large fish for 2014 suggests a sport fishery is unlikely. Small sample sizes in the event of a restricted fishery do not present a problem because correspondingly few fish are harvested, and the harvest then represents a very small fraction of the total run. The age composition of fish passing the weir is estimated by the DCF via sampling fish at the Situk weir.

Table 3.–Summary of stratification structure and sampling characteristics for the 2014 Situk River Chinook salmon creel survey at Nine Mile Bridge and Maggie John Trailhead, June 9–July 31.

Location <sup>a</sup>	TOD <sup>b</sup> stratum	Time of day	Number of days	Sampling method for days <sup>c</sup>	Days sampled
MJT	Mid-day	1000–1630	53	SYS	9
	Late-day	1630–2300	53	SYS	9
NMB	Mid-day	1000–1630	53	SYS	9
	Late-day	1630–2300	53	SYS	9

<sup>a</sup> MJT = Maggie John Trailhead, NMB = Nine Mile Bridge.

<sup>b</sup> TOD = time of day.

<sup>c</sup> SYS = systematic sampling.

## DATA COLLECTION

During each sampling period, the technicians will record the number of anglers who have completed their fishing trips in the identified area. If possible, every angler completing a fishing trip during the sampling period will be interviewed. If not interviewed, however, a counted angler will be identified by recording a valid interview number without additional interview information.

Data to be recorded during each interview will include the following, which is further described in Appendix 2:

- time of interview;
- the number of Chinook and sockeye salmon kept;
- the number of Chinook and sockeye salmon released;
- angler effort to the nearest 0.25 hour;
- whether Chinook and sockeye salmon were caught above or below the ADF&G weir;
- whether Chinook salmon harvested or released were  $\leq 20$  in (small),  $>20$  in and  $<28$  in (medium), or  $\geq 28$  in (large) TL;

- whether the trip was guided or unguided;
- what type of access was used by the angler;
- residency status of the angler, resident or nonresident; and
- in the event that the angler is guided, the guide's logbook number.

Data are to be recorded for individual anglers, and not pooled into a single interview for a "fishing party". Field data will be entered onto the Situk River Creel Survey Form (Appendix 3), and then transferred to a custom Excel<sup>®3</sup> spreadsheet for final editing and analysis.

Each Chinook salmon observed (all size groups included) will be "sampled" by measuring the mid-eye to fork (MEF) length, and recording the sex of the fish. Four scales will be sampled near the preferred area on each Chinook salmon at a point on a diagonal line from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, 2 rows above the lateral line (Welander 1940). If the scales in the preferred location cannot be obtained, another set of scales will be taken from as close to the preferred scale area as possible. However, scales will only be taken from the area bounded dorsally by the fourth row of scales above the lateral line, ventrally by the lateral line, and between lines drawn vertically from the posterior insertion of the dorsal fin and the anterior insertion of the anal fin. If no scales are available in the preferred area on the left side of the fish, scales will be collected from the preferred area on the right side of the fish. Scales will then be mounted on gum cards and sex, and lengths in millimeters (MEF) of Chinook salmon recorded on Alternate Age-Weight-Length (AWL) mark-sense forms and coded wire tag (CWT) sampling forms (see Appendices 4–7). Gum cards will be taped to mark-sense forms and sent to the scale aging laboratory in Douglas. Scale impressions will then be made in cellulose acetates (Clutter and Whitesel 1956) and aged using procedures designed by Van Alen (B. Van Alen, Fishery Biologist-retired, ADF&G-DCF, Douglas, personal communication) and McPherson (S. McPherson, Chinook Advisor, ADF&G-DSF, Douglas, personal communication). Methods identified in Olsen (1992) may also be incorporated.

All harvested Chinook salmon will be checked for adipose fin clips (a standard procedure in Southeast Alaska to provide information on straying). In addition, any incidental steelhead harvested by anglers will be checked for an adipose fin clip as well. If an adipose-finclipped fish is found, the head will be collected, a cinch strap inserted, and a CWT sampling form filled out. Adipose-clipped sockeye salmon may also be found in angler's catches. When possible, heads will be collected, a cinch strap inserted, and a CWT form filled out (this is not a priority duty). This form will be filled out by the crew leader for the Yakutat marine harvest study project (separately funded) from information collected at the time of interview.

If an angler comes in with a trophy-sized Chinook salmon with an adipose fin clip and prefers to keep it intact, then as much information as possible will be recorded, such as name and address of the person, and where they are going to have it mounted. The importance of eventually obtaining the head will be stressed, and, if possible, permission to retrieve it from the taxidermist will be obtained; thus a CWT recovery form will be filled out (Appendices 6 and 7) and a cinch-strap inserted (to permit identification if retrieving the head from the taxidermist).

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<sup>3</sup> This and subsequent product names are included for a complete description of the process and do not constitute product endorsement.

## DATA REDUCTION

The technician will first check the data forms and then turn them in to the area office on a weekly basis. The project leader or technician will then enter the completed Situk River creel data into a custom Excel® spreadsheet. This electronic data file will then be rechecked for obvious mistakes and omissions before processing to estimate angler effort, catch, and harvest. Chinook salmon scales will be pressed onto acetates, and then read by DSF personnel. Ages will be recorded onto the matching Alternate AWL mark-sense forms and the forms will be submitted to marine harvest study staff in Douglas for opscan reading, and then returned to the project leader in Yakutat for editing and data analysis.

A final, edited copy of the data, along with a data map, will be sent with the final report to Research and Technical Services (RTS, DSF Anchorage) electronically for archiving. The data map will include a description of all electronic files contained in the data archive, all data fields and details of where hard copies of any associated data are to be archived, if not with RTS. The original hard copies of the data forms will be logged and stored in the Yakutat ADF&G DSF office, and scale gum cards and acetates will be logged and stored in the Region 1 scale data archives, located in the Douglas regional office.

## DATA ANALYSIS

### EFFORT, CATCH AND HARVEST

Angler effort (in hours), harvest, and catch of Chinook and sockeye salmon in each stratum will be estimated using procedures for a stratified two-stage sample survey (Cochran 1977 ) where "days" (mid- or late-day periods) are first stage sampling units and "anglers" are second stage sampling units. Location and TOD will be considered their own strata. First, the mean harvest (or catch or effort) is obtained over all anglers interviewed within each sampled day and location:

$$\bar{n}_{hi} = \frac{\sum_{j=1}^{m_{hi}} n_{hij}}{m_{hi}} \quad (1)$$

where  $n_{hij}$  is the number of Chinook salmon harvested (or caught, etc.) by interviewed person  $j$  during sampled day  $i$  for location/TOD stratum  $h$ , and  $m_{hi}$  is the number of people interviewed during each day. This estimate is then expanded by the number of people (counted) who exit the site during the day ( $M_{hi}$ ) to estimate a total for each sampled day:

$$\hat{N}_{hi} = M_{hi} \bar{n}_{hi} \quad (2)$$

The mean harvest over all days sampled within each stratum  $h$  is then estimated:

$$\hat{N}_h = \frac{\sum_{i=1}^{d_h} \hat{N}_{hi}}{d_h} \quad (3)$$

where  $d_h$  is the number of days sampled in each stratum. Finally, this estimate is expanded by the number of days in the stratum ( $D_h$ ) to estimate a total for each stratum:

$$\hat{N}_h = D_h \overline{\hat{N}_h} \quad (4)$$

Estimates of catch and angler effort will be obtained similarly by substituting the appropriate statistics (catch or effort) into equations (1) through (4), above. Similar substitutions will be obtained to estimate residency, guided versus unguided trips, and type of access used by the angler.

The variance of the stratum estimates is estimated:

$$\hat{V}[\hat{N}_h] = (1 - f_{1h}) D_h^2 \frac{S_{1h}^2}{d_h} + \frac{D_h}{d_h} \sum_{i=1}^{d_h} \hat{V}[\hat{N}_{hi}] \quad (5)$$

where  $f_{1h} = d_h/D_h$  is the sample fraction for “days”,  $S_{1h}^2$  is sample variance among “days”, and  $d_h$  is the number of days in which  $s_{2hi}^2$  (see below) are estimable (i.e., when at least 2 people are interviewed or the number interviewed equals the number counted). The among-day sample variance for days selected systematically for sampling (the mid-day stratum for all locations and late-day stratum for Maggie John Trailhead and Nine Mile Bridge) is estimated using an approximation proposed by Wolter (1985):

$$S_{1h}^2 \approx \frac{\sum_{i=2}^{d_h} (\hat{N}_{hi} - \hat{N}_{h(i-1)})^2}{2(d_h - 1)} \quad (6)$$

The among-angler variance component (usually 0 in this survey because all anglers exiting the fishery are interviewed) is estimated by:

$$\hat{V}[\hat{N}_{hi}] = \left(1 - \frac{m_{hi}}{M_{hi}}\right) M_{hi}^2 \frac{s_{2hi}^2}{m_{hi}} \quad (7)$$

where  $s_{2hi}^2$  is the among-angler sample variance:

$$s_{2hi}^2 = \frac{\sum_{j=1}^{m_{hi}} (n_{hij} - \bar{n}_{hi})^2}{m_{hi} - 1} \quad (8)$$

Sampling in the late-day stratum at Lower Landing is “quasi”-systematic, i.e., it has irregular sampling intervals between sampling days. However, if 2 consecutive days are considered as a single sampling unit (see sampling schedule in Appendix 1), then sampling becomes systematic with respect to the new 2-day sampling units. In this case equations (2) – (8) can still be used for the late-day stratum at Lower Landing with the appropriate substitutions. For example,  $n_{hij}$  becomes the number of Chinook salmon harvested (or caught, etc.) by interviewed person  $j$  during sampled 2-day period  $i$  for late-day stratum; the number of days sampled,  $d_h$ , becomes the number of 2-day units sampled; the total for each sampled day,  $\hat{N}_{hi}$ , becomes the total for each 2-day sampling unit; the number of days in the stratum,  $D_h$ , becomes the number of 2-day units in the late-day stratum; etc.

Variances of the stratum estimates of catch by species and angler effort will be obtained similarly, by substituting the appropriate catch and effort statistics into equations (5) through (8), above.

Estimates of angler effort, catch, and harvest by species and their variances across all strata, or select combinations of strata, will be obtained by summing the individual stratum estimates (assuming independence). Similarly, total estimates of catch and harvest above and below the weir across the TOD strata will be obtained by summing the individual stratum estimates. Standard errors of the stratum and total estimates are obtained by taking the square root of the variance estimate.

Expanded harvest estimates for inseason escapement projections will be obtained by multiplying  $\hat{N}$  in turn by an expansion factor ( $\hat{E}_1 = 1.35$ ,  $SE = 0.15$ , Figure 3) to account for harvest outside the framework of the creel survey design, by the mean annual proportion of Chinook harvested above the weir ( $\hat{E}_2 = 0.50$ ,  $SD = 0.09$ ), and by the mean annual proportion of large fish among harvested Chinook salmon ( $\hat{E}_3 = 0.65$ ,  $SD = 0.24$ ), all obtained from analyses of historical data:

$$\hat{H}_{EXP} = \hat{N} \hat{E}_1 \hat{E}_2 \hat{E}_3 \quad (9)$$

where the variance is calculated by recursive application of Goodman's (1960) formula:

$$\hat{V}[\hat{H}_{EXP}] = \hat{N}^2 \hat{V}[\hat{E}] + \hat{E}^2 \hat{V}[\hat{N}] - \hat{V}[\hat{E}] \hat{V}[\hat{N}] \quad (10)$$

To calculate total harvest utilizing the second sampler method and data, the estimates from both samplers will be summed. In future years this second sampler method estimate will be compared to the SWHS (as in  $E_1$  above) to account for fish harvested outside the sample days, and then compared to the expansion method estimate. Also, since 2014 marks a fourth full year of having a second sampler, the data from this year can be analyzed to determine if there is a difference between the two locations on the upper river (Maggie John Trail and the Nine Mile Bridge) and the two time periods. Changes in the design or analysis may change based on the results.

## AGE COMPOSITION OF CHINOOK SALMON

The age composition of the harvested Chinook salmon will be estimated as follows:

$$\hat{p}_z = \frac{n_z}{n_a} \quad (11)$$

$$\hat{V}[\hat{p}_z] = \left(1 - \frac{n_a}{\hat{N}}\right) \frac{\hat{p}_z(1 - \hat{p}_z)}{n_a - 1} \quad (12)$$

where  $\hat{p}_z$  is the estimated proportion of Chinook salmon in age category  $z$ ,  $n_a$  is the number of sampled fish classified by age,  $n_z$  is the subset of  $n_a$  belonging to category  $z$ .

Harvests by age are estimated by multiplying  $\hat{p}_z$  by the appropriate harvest estimate from the SWHS:

$$\hat{H}_z = \hat{H} \hat{p}_z \quad (13)$$

$$\hat{V}[\hat{H}_z] = \hat{H}^2 \hat{V}[\hat{p}_z] + \hat{p}_z^2 \hat{V}[\hat{H}] - \hat{V}[\hat{p}_z] \hat{V}[\hat{H}] \quad (14)$$

where the variance follows Goodman (1960).

All age composition estimates will be conducted separately for fish harvested above and below the weir.

It had been suggested by the final reviewer of this operational plan to adapt the data analysis procedure for estimating age composition to the study design of the creel survey. This approach, usually possible when all creels encountered by technicians are sampled, poststratifies the total harvest into different age categories and then estimates the harvest for each category following the standard access point survey methodology (Bernard et al. 1998). We considered implementing this approach for data analysis in 2014 (and 2011–2013), but after joint discussion (between Brian Marston, Sarah Power, and Anton Antonovich) decided against it for the following reasons.

1) Due to variable and recent low run abundance and restricted sport fisheries, very low harvest has occurred since 2007. Only 1 adult fish was sampled in 2009, 6 adults in 2010, 14 jacks in 2011, 7 jacks in 2012, and in 2013, 3 adult Chinook were sampled. The sport fishery will be closed again in 2014 for at least a significant part of the early run due to low predicted run size. The projection in 2014 is for a run larger than previous years (B. Marston, Sport Fish Biologist, ADF&G, Yakutat, personal communication), but it is still unlikely a significant fishery will occur. Small expected sample sizes combined with the large number of age categories (as many as 10 for Situk Chinook salmon) can prevent us from taking a full advantage of the proposed approach, especially when it comes to obtaining estimates of variability.

2) The potential analytical approach can be done with the current data gathering methods. As of 2008, interview numbers are now assigned to each angler in an interview. If sufficient fish are harvested we may then use that approach, but given low sample sizes, committing to that approach may not succeed.

## **SCHEDULE AND DELIVERABLES**

Field activities will be initiated shortly before the creel survey begins 9 June 2014 and will conclude on 31 July 2014.

Final estimates will be completed by November 2014 and incorporated into a Fishery Data Series report for the years 2012 to 2015 to be drafted by spring 2016. A draft Fishery Data Series report with the 2008–2011 results is currently in statistical review, and publication is anticipated to occur in August of 2014.

## **RESPONSIBILITIES**

Brian Marston, Project Leader. Supervises project personnel. Writes operational plan in conjunction with biometrician, including objectives, study design, and sampling schedule. Performs and coordinates data analyses in conjunction with biometrician. Lead author for final report.

Anton Antonovich, Biometrician III; Sarah Power, Biometrician III. Provide input in sampling design and allocation, designs scheduling procedures and incorporates into operational plan. Provide procedures for calculation of harvest estimates and confidence intervals. Assist in report writing. Also reviews operational plan and final report.

Matt Catterson, Fishery Technician II. Conducts creel surveys as schedule dictates.

Chet Woods, Fishery Technician III. Conducts creel surveys as schedule dictates and provides summaries of data on a weekly basis.

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## **APPENDICES**



Appendix 2.–Instructions for completing the Situk River creel survey form during the 2014 Situk River Chinook salmon creel survey.

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Date and period - **Today's date and period number 2 or 3. (2 for mid-day and 3 for late-day)**

Interview Number - **Start with number one (1) at the beginning of each sampling period (day) and number consecutively.**

**Time of Interview** – Record the time the interview started.

**Guided?** Ask if the person was guided today. Mark a Y for yes, N for no.

**Logbook Number** – Mark the guide logbook number if the angler was on a guided trip.

**Resident?** Is the person an Alaska state resident? Mark a Y for yes, N for no.

**Target Species.** What was the person primarily fishing for?

Mark 1 for Chinook

Mark 2 for sockeye

Mark 3 for both

Mark the appropriate box regarding the primary mode of angler access

Mark the actual amount of time spent *fishing*, not walking, traveling, sleeping, etc.

Enter the total number of fish caught and/or kept by species upstream of the weir.

Enter the total number of fish caught and/or kept by species downstream of the weir.

JK-K= jack king, kept. King salmon harvested less than or equal to **20 inches**.

JK-R= jack king, released. King salmon harvested less than or equal to **20 inches**.

SK-K= small king, kept. King salmon harvested **greater than 20 inches** but less than **28 inches**

SK-R= small king, released. King salmon released **greater than 20 inches** but and less than **28 inches** in length.

KS-K= king salmon, kept. King salmon harvested **28 inches or greater in length**

KS-R= king salmon, released. King salmon released **28 inches or greater in length**

RS-K= sockeye (red) salmon kept, any size.

RS-R= sockeye (red) salmon released, any size.

**Please take the effort to stress that "released" means "fair hooked" (in the mouth), and not snagged, broken off, or otherwise not legally harvestable.**



Appendix 4.–Instructions for completing the Alternate Age-Weight-Length mark-sense forms to be used during the 2014 Situk River Chinook salmon creel survey.

## **MARK-SENSE ALTERNATE AGE-WEIGHT-LENGTH FORM**

Biological information recorded on the age-weight-length (AWL) forms will be limited. Lengths and scales will be taken only from Chinook salmon. The object of biological sampling is to get information from a representative sample of fish from the fishery. As there are lines for only 9 fish on the front side of the AWL form, scales from a maximum of 9 Chinook salmon should be placed on each scale card. Only one scale card should match with each AWL form. The 5-digit number on the AWL form will be recorded on the scale card next to "Card Number". Mount scales onto gum cards and tape onto the front of the AWL form. Be sure your scales are mounted correctly with the rough side of the scale up.

Scales should not be taken from adipose-finclipped salmon voluntarily (select fish) brought in by anglers not contacted during the sampling period while leaving the Situk River fishery. Adipose-finclipped Chinook salmon observed during the creel survey should be sampled for age, sex, and length. Any adipose-finclipped steelhead observed during the creel survey should also be sampled for age, sex, and length information with this data recorded on a separate mark-sense form (since each page of the mark-sense form is associated with only one species at a time).

Line by line instructions for use of the AWL forms follow.

### **HEADER FIELDS:**

Fishery and Name Fishery should be filled in as "**Situk River KS Creel**", and you should put your name in the Name blank.

Page

**Leave Blank**

Year, Month and Day

Record using leading zeros on month and day. Note that these are additive binary fields.

Survey Area, Site, and Sublocation

**Leave Blank**, since forms will be grouped over the season, it can be filled in on the first sheet and repeated for the entire batch.

Period - **Leave Blank**

Species

Chinook = **410**

Steelhead = **540**

**(Do Not Fill Out This Form For Sockeye)**

Last 4 header fields - **Leave Blank**

## **BIOLOGICAL INFORMATION LINES:**

### Sex

Mark "M" or "F" if known, leave blank if uncertain

### Length

Record length of fish from middle of eye to fork of tail to the nearest 5 millimeters.

### Tag Number

Record cinch strap number used for adipose fin-clipped Chinook salmon or steelhead if a head was collected. Note the additive fields in the 10,000's and 1,000's columns. If a steelhead is sampled the information should be recorded on a separate form.

### Weight Variable- **Leave Blank**

### Rest of fields - **Leave Blank**

### **Examples (see AWL form attached):**

Example 1: During interview 1, scales and lengths were taken from Chinooks with fork lengths of 820 mm (male), 850 mm (male, adipose-clipped and given cinch strap #62358), 790 mm (female), and 1011 mm (female).



Appendix 6.-Instructions for filling out coded wire tag sampling forms.

All harvested Chinook and coho salmon need to be checked for adipose clips. If an adipose-clipped fish is found, the head will be collected, a cinch strap inserted, and a coded wire tag (CWT) sampling form filled out. Adipose-clipped pink, chum, and sockeye salmon, and steelhead may also be found in anglers' catches, so heads should be collected and a CWT form will also need to be filled in for these fish (This is not a priority duty, however).

If someone comes in with a trophy, adipose-clipped fish and doesn't want to give you the head, record as much information as possible -- such as name and address of person, and where they are going to have it mounted. Stress the importance of finally getting the head and then try to get permission to retrieve it from the taxidermist, if possible. You should fill out a CWT form and record the cinch tag number on the age-weight-length (AWL) mark-sense form anytime that you see a missing adipose fin on a Chinook salmon, regardless of whether you obtain the head.

Line by line instructions for CWT data forms follow (see the CWT manual from the ADF&G Mark, Tag, and Age Laboratory for further information):

INTERVIEWER INFORMATION:

**Sample Number** - leave blank (will be filled in at office)

**Source** - circle "SPORT."

**Survey Site** - record "Yakutat."

**Sample Type** - circle "random" if the fish is randomly sampled during a creel survey or CWT sampling, circle "select" if the head is voluntarily brought in by a fisherman , or circle "voluntary" if the fish was taken from an unsampled fishery.

**Sampler** - record your last name

**Name of Place Sampled** - use for random heads only. Record "Lower Landing."

**Date Sampled** - record month and day the fish was sampled for random heads, otherwise for select head, when it was caught.

STRATIFICATION INFORMATION

**Sport Harvest Code** - record for randomly sampled heads only. Record FF

Fishing Site - Leave blank unless otherwise instructed

ANGLER INFORMATION:

**Name & Mailing Address** - record name and address of angler.

CATCH INFORMATION:

**Date Caught** - record month and day that the fish was caught

**Water Type** - circle freshwater.

**Name of Place Fished** - record Situk River.”

**Area Information (District-Subdistrict)** – record “182-70.”

**Anadromous Stream#** - record “182-70-10100.”

SAMPLING INFORMATION:

**Do not use in SE. Note gray box w/ arrow at bottom of page!**

HEAD RECOVERY INFORMATION:

**Head Number** - record 6-digit cinch strap number assigned to head of fish. Hint: check cinch strap number with paperwork. They may not be used in numerical order. It is very important the correct paperwork matches the correct fish head.

**Species Code** - record appropriate species number: **410** for Chinook (king) salmon >28”, **411** for small (<28”) Chinook salmon, **430** for coho (silver) salmon, **440** for pink (humpy) salmon, **450** for chum (dog) salmon, **420** for sockeye (red) salmon, or **540** for steelhead trout.

**Mideye-to-Fork Length** - record length from mideye-to-fork of tail to the nearest 5 mm.

**Clip Status** - circle "Good" if the adipose looks to be cleanly sliced off and healed, circle "???" if the adipose looks like it may have been torn off or looks questionable, or circle "Unkn" if only the head is seen

**Chinook Flesh Color** - leave blank unless the fish is a Chinook-then circle the appropriate flesh color

**IMPORTANT NOTE:** It is very important that we account for every fish head this year. We will be shipping heads weekly to the ADF&G Mark, Tag, and Age Laboratory, so there should be plenty of room in the freezers provided. In the odd event, however, that you put a fish head elsewhere - we must know where it is!

If you turn in a form for a fish head that you did not put it in the usual place please note **WHERE** this head is in the upper right hand corner of the form: e.g. fish head lost by angler at cleaning table, or fish head in Comm Fish freezer.

