

# Salcha River Chinook and Chum Salmon Counting Tower, 2010

## R&M# 12-10

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### 1. Introduction:

#### *Summary:*

The Salcha River counting tower provides estimates of the number and composition of two important Yukon River salmon escapements. The Salcha River has the largest Chinook salmon (*Oncorhynchus tshawytscha*) escapements in the Yukon River basin as well as the largest spawning escapement of Tanana River summer chum salmon (*Oncorhynchus keta*) (JTC 2010). The Salcha River salmon stock are harvested in commercial, subsistence and personal-use fisheries throughout the lower and middle Yukon and Tanana Rivers, and support a popular in-river sport fishery. Management of these fisheries is based upon achieving the escapement goals which are based on salmon escapement estimates. The Salcha salmon escapement data dates to 1993 (tower) and 1986-1992 (mark/recapture).

#### *Objectives:*

- Estimate the total escapement of Chinook salmon in the Salcha River using tower counting techniques such that the estimates are within 15% of the actual value 95% of the time;
- Estimate age, sex, and length compositions of the escapement of Chinook salmon in the Salcha River such that all estimated proportions are within 5 percentage points of the actual proportions 95% of the time;
- Estimate the escapement of Chum salmon through the Salcha River using tower counting techniques during the Chinook passage period (approximately August 10);

**2. Study Area:** Salcha River, 45 miles east of Fairbanks, AK

### 3. Methods:

The number of Chinook and chum salmon returning to the Salcha River to spawn—the escapement—are estimated by counting adult salmon as they pass by the counting tower. Most all salmon spawning activity for both species occurs upstream of the tower site, thus, this estimate is a total escapement during monitored periods. Counting operations began in early July and ended August 15.

Technicians conducting counts rely on visual observation to count salmon. Light, white colored panels are placed across the width of the river channel adjacent the tower in order to make fish more visible. Lights are suspended adjacent the counting structure on independent towers across the entire channel, and used during periods of low ambient light. Salmon often will avoid areas with unusual substrate, or illuminated with artificial lighting. Therefore, once the artificial lighting is turned on it is not shut off until the ambient light level is high enough to observe salmon without the aid of artificial lighting. The lighting must be left on between counts because salmon may hide below the illuminated area, and move upstream only when the lights are turned off at the end of each counting period. Counts are scheduled throughout the entire day, every hour, in order to monitor 24-hr migration patterns.

Crew members each work one of three 8-hour shifts, per day, during operations. Personnel count salmon during 20 minutes of every hour of their shift. The start time for all counts during each shift will be chosen randomly between the top of the hour and 20 minutes past. Counts will be conducted from a scaffolding tower placed beside the river.

Each technician's day will consist of one of three possible 8-hour shifts. Shift I begins at 0000 h (midnight) and ends at 0800 h; Shift II begins at 0800 h and ends at 1600 h; Shift III begins at 1600 h and ends at 2400 h. Counting schedules for the project leader and technicians will be developed in June, so that each technician works 40 hours in a 7-day period, works a mixture of Shifts I, II and III, has some weekends off, and has an opportunity to participate in carcass sampling.

### **Sampling Strategy**

BSFA, using hourly 20-minute counts, will sample 33% of each day during the chum and Chinook salmon counting period. Seibel (1967) examined the error associated with 10-minute counts from counting towers, and found relative errors were less than 10% in estimates of the total number of migrating salmon. Ten-minute counts every hour sample 17% of the daily passage. Relative errors during previous seasons (Chena and Salcha Rivers during 1993, 1994, and 1997, and Salcha River during 1995 and 1997) have ranged from 6%-20% (Skaugstad 1994; Evenson 1995, 1996; Evenson and Stuby 1997, 1998; and Stuby 1999), when as much as 27% of the run time was sampled.

BSFA uses 20-minute counts per hour to maximize accuracy, and reduce the likelihood of errors in expansion while still maintaining technician morale. Twenty-minute counting periods were used by BSFA in 1999–2010. The tower technicians report, over all years, that this schedule worked for them, and caused no noticeable stress.

### **Data Collection**

Tower counts of Chinook and chum salmon will be recorded on field forms at the end of each counting period, the count data will be telephoned to ADF&G, DNR, and USFWS once a day, and subsequently entered into an Excel spreadsheet. Field recorded data will include name of counter, date and time of counting shift, stream visibility conditions, and numbers of each species counted, moving up and down stream, during each 20-minute

counting period. Both air and water temperatures will be recorded using remote probes. Water level data is collected by USGS at a site just downstream of the tower site.

### **Abundance Estimates**

Estimates of abundance are performed by ADF&G Sport Fish staff, and reported in various agency (ADF&G, USFWS, JTC) documents and reports. BSFA produces an annual report for the funding agency.

## **4. Results:**

The Salcha River 2010 Chinook salmon escapement estimate is 6,900. This estimate is the sum of the ADFG estimate (6,135) plus the PI's estimate of fish (750) not counted during high water events. The chum salmon escapement estimate is 39,000, assuming the 2010 chum run mid-point was August 10. Salcha River tower counts began July 1 and ended August 15. Nearer August 10, ADFG requested, and funded, tower operations on August 11-15. R&M funding ended August 10. The first Chinook salmon was counted July 9, a day or two later than expected given the 2010 in-season information. However, though tower counting conditions were greatly affected by high, muddy river water July 5-8, historic average Chinook passage prior to July 9 (1993-2009 tower counts) is less than 1% of the escapement. In recent years, the Yukon River Chinook runs, including the Salcha, have been trending to arrive later, and 2010 was similar if not even more extreme. Yukon Chinook run monitoring programs in 2010 though-out the drainage indicated a later than average first fish arrival date, a weak early portion, poor Canadian returns and total run strength, and a later than average general run timing. High water in the Salcha drainage July 19-20 and 23 likely resulted in an under count of fish by tower staff, perhaps as much as 500 to a 1,000 Chinook. The estimated Chinook salmon escapement of 6,900 to the Salcha River in 2010 is slightly above the BEG range (3,300 to 6,500).

Chinook carcass surveys, each covering the lower 65 miles of the Salcha (the usual carcass survey index area), were conducted July 22, July 26-28, July 30-August 1, August 7-8, 11-12, 17-18 and 25-26. Few Chinook were noted to have died by July 22, roughly 25-50% by August 7, and most all by August 18, based on carcasses noted and fish seen alive. A few hundred were seen alive on the August 25-26 survey, approximately the last 1% or so alive. Analyses of Chinook carcass data (N = 459 collected, 412 read) collected July 22 through August 19 (scales to be processed by ADFG) yielded a low portion of females (30%) and an unusually high portion (57.5%) of 5 year old fish (brood year 2005) and a very low portion (14.1%) of 6 year old fish.

Chum vertebra (N=160) were collected September 3, 7, 16, and 23. All tissues and data were given to ADFG for age analysis. Age-4 chum (brood year 2006) were the dominate age class (47%) with age-5 chum comprising 39% of the vertebra examined. Usually these age classes are about equal and dominate the escapement age composition. Chum salmon were found in most of the usual spawning areas in numbers seemingly average compared to prior years of the authors involvement (1999 -2010). The abundance of juvenile Chinook, brood year 2009, was very high throughout the summer. Flow volume

was moderate and negatively effected counts approximately 10% (4-5 days of the 45 day counting period). Water temperatures were also moderate and within salmon tolerance limits. These data and other relevant information (i.e. flow volume, air and water temperature) were collected by (or with their instrumentation deployed by the PI) and data are stored with USGS and ARRI (a private consultant) respectively.

**2010 Salcha River Daily Counts**

**Chinook**

**Chum**

<b>Date</b>	<b># 20 min Counts</b>	<b>Daily N</b>	<b>Expand Daily</b>	<b>Expand Cum</b>	<b>Daily N</b>	<b>Expand Daily</b>	<b>Expand Cum</b>
1-Jul	8	0	0	0	0	0	0
2-Jul	24	0	0	0	0	0	0
3-Jul	24	0	0	0	0	0	0
4-Jul	24	0	0	0	0	0	0
5-Jul	13	0	0	0	0	0	0
6-Jul	24	0	0	0	0	0	0
7-Jul	24	0	0	0	0	0	0
8-Jul	24	0	0	0	0	0	0
9-Jul	24	5	15	15	0	0	0
10-Jul	24	7	21	36	0	0	0
11-Jul	24	19	57	93	0	0	0
12-Jul	24	27	81	174	0	0	0
13-Jul	24	34	102	276	0	0	0
14-Jul	24	27	81	357	0	0	0
15-Jul	24	32	96	453	0	0	0
16-Jul	24	89	267	720	0	0	0
17-Jul	24	153	459	1,179	0	0	0
18-Jul	24	292	876	2,055	6	18	18
19-Jul	24	77	231	2,286	10	30	48
20-Jul	24	63	189	2,475	12	36	84
21-Jul	24	129	387	2,862	26	78	162
22-Jul	24	166	498	3,360	82	246	408
23-Jul	24	90	270	3,630	69	207	615
24-Jul	24	125	375	4,005	50	150	765
25-Jul	24	34	102	4,107	77	231	996
26-Jul	24	86	258	4,365	157	471	1,467
27-Jul	24	40	120	4,485	163	489	1,956
28-Jul	24	56	168	4,653	262	786	2,742
29-Jul	24	36	108	4,761	403	1,209	3,951
30-Jul	24	63	189	4,950	482	1,446	5,397
31-Jul	24	45	135	5,085	506	1,518	6,915
1-Aug	24	26	78	5,163	511	1,533	8,448
2-Aug	24	27	81	5,244	476	1,428	9,876
3-Aug	24	24	72	5,316	508	1,524	11,400
4-Aug	24	31	93	5,409	516	1,548	12,948

<b>5-Aug</b>	24	22	66	5,475	196	588	13,536
<b>6-Aug</b>	24	8	24	5,499	115	345	13,881
<b>7-Aug</b>	24	6	18	5,517	274	822	14,703
<b>8-Aug</b>	24	24	72	5,589	322	966	15,669
<b>9-Aug</b>	24	39	117	5,706	380	1,140	16,809
<b>10-Aug</b>	24	27	81	5,787	336	1,008	17,817
<b>11-Aug</b>	24	25	75	5,862	244	732	18,549
<b>12-Aug</b>	24	44	132	5,994	219	657	19,206
<b>13-Aug</b>	24	11	33	6,027	327	981	20,187
<b>14-Aug</b>	24	15	45	6,072	222	666	20,853
<b>15-Aug</b>	24	21	63	6,135	444	1,332	22,185

D. There were no significant problems.

**Appendix xx.-Yukon River Chinook salmon from the Salcha River 0 Handpicked or carcass General Escapement project age and sex composition and mean length (mm), 2010.**

Sample Dates	Sample Size	Sex	Brood Year (Age)												Total							
			2007		2006		2005		2004		2003		2002									
			(1.1)	(1.2)	(1.3)	(2.2)	(1.4)	(2.3)	(1.5)	(2.4)	(1.6)	(2.5)	N	%								
7/29, 7/30 stratum 1	20	Male	0	0.0	2	10.0	6	30.0	0	0.0	2	10.0	0	0.0	0	0.0	0	0.0	10	50.0		
		Female	0	0.0	0	0.0	4	20.0	0	0.0	5	25.0	0	0.0	1	5.0	0	0.0	10	50.0		
		Subtotal	0	0.0	2	10.0	10	50.0	0	0.0	7	35.0	0	0.0	1	5.0	0	0.0	20	100.0		
	Male Mean Length		-	-	560	-	755	-	860	-	-	-	-	-	-	-	-	-				
	SE		-	-	0	-	25	-	60	-	-	-	-	-	-	-	-	-				
	Range		-	-	-	-	645-800	-	800-920	-	-	-	-	-	-	-	-	-				
	n		-	-	2	-	6	-	2	-	-	-	-	-	-	-	-	-				
	Female Mean Length		-	-	-	-	793	-	852	-	-	-	800	-	-	-	-	-				
	SE		-	-	-	-	14	-	19	-	-	-	-	-	-	-	-	-				
	Range		-	-	-	-	760-820	-	790-910	-	-	-	-	-	-	-	-	-				
n		-	-	-	-	4	-	5	-	-	-	1	-	-	-	-	-					
8/07, 8/08 stratum 2	218	Male	1	0.5	61	28.0	91	41.7	2	0.9	5	2.3	1	0.5	0	0.0	0	0.0	0	0.0	161	73.9
		Female	0	0.0	1	0.5	36	16.5	0	0.0	19	8.7	0	0.0	1	0.5	0	0.0	0	0.0	57	26.1
		Subtotal	1	0.5	62	28.4	127	58.3	2	0.9	24	11.0	1	0.5	1	0.5	0	0.0	0	0.0	218	100.0
	Male Mean Length		470	-	545	-	735	-	520	-	856	-	735	-	-	-	-	-				
	SE		-	-	7	-	6	-	40	-	28	-	-	-	-	-	-	-				
	Range		-	-	440-700	-	610-860	-	480-560	-	760-905	-	-	-	-	-	-	-				
	n		1	-	61	-	91	-	2	-	5	-	1	-	-	-	-	-				
	Female Mean Length		-	-	535	-	794	-	850	-	-	-	930	-	-	-	-	-				
	SE		-	-	-	-	7	-	11	-	-	-	-	-	-	-	-	-				
	Range		-	-	-	-	670-860	-	740-920	-	-	-	-	-	-	-	-	-				
n		-	-	1	-	36	-	19	-	-	-	1	-	-	-	-	-					
8/10-11, 8/17 stratum 3	172	Male	1	0.6	38	21.8	66	38.5	0	0.0	8	4.6	2	1.1	0	0.0	0	0.0	0	0.0	115	66.7
		Female	0	0.0	3	1.7	33	19.0	0	0.0	19	10.9	0	0.0	1	0.6	2	1.1	0	0.0	57	33.3
		Subtotal	1	0.6	41	23.6	99	57.5	0	0.0	27	15.5	2	1.1	1	0.6	2	1.1	0	0.0	172	100.0
	Male Mean Length		430	-	528	-	726	-	-	-	791	-	740	-	-	-	-	-				
	SE		-	-	7	-	7	-	-	-	21	-	20	-	-	-	-	-				
	Range		-	-	450-600	-	550-850	-	-	-	735-930	-	720-760	-	-	-	-	-				
	n		1	-	38	-	65	-	-	-	8	-	2	-	-	-	-	-				
	Female Mean Length		-	-	577	-	789	-	814	-	-	-	895	-	730	-	-	-				
	SE		-	-	59	-	8	-	13	-	-	-	-	-	0	-	-	-				
	Range		-	-	490-690	-	680-875	-	-	-	680-895	-	-	-	-	-	-	-				
n		-	-	3	-	33	-	19	-	-	-	1	-	2	-	-	-					
Season	412	Male	2	0.5	101	24.5	163	39.8	2	0.5	15	3.6	3	0.7	0	0.0	0	0.0	0	0.0	286	69.7
		Female	0	0.0	4	1.0	73	17.7	0	0.0	43	10.4	0	0.0	2	0.5	3	0.7	0	0.0	124	30.3
		Total	2	0.5	104	25.5	236	57.5	2	0.5	58	14.1	3	0.7	2	0.5	3	0.7	0	0.0	410	100.0
	Male Mean Length		450	-	539	-	732	-	520	-	822	-	738	-	-	-	-	-				
	SE		20	-	5	-	4	-	40	-	18	-	12	-	-	-	-	-				
	Range		430-470	-	440-700	-	550-860	-	480-560	-	735-930	-	720-760	-	-	-	-	-				
	n		2	-	101	-	162	-	2	-	15	-	3	-	-	-	-	-				
	Female Mean Length		-	-	566	-	791	-	834	-	-	-	913	-	753	-	-	-				
	SE		-	-	43	-	5	-	8	-	-	-	18	-	23	-	-	-				
	Range		-	-	490-690	-	670-875	-	-	-	680-920	-	-	-	895-930	-	730-800	-	-	-		
n		-	-	4	-	73	-	-	-	43	-	-	-	2	-	3	-	-	-			

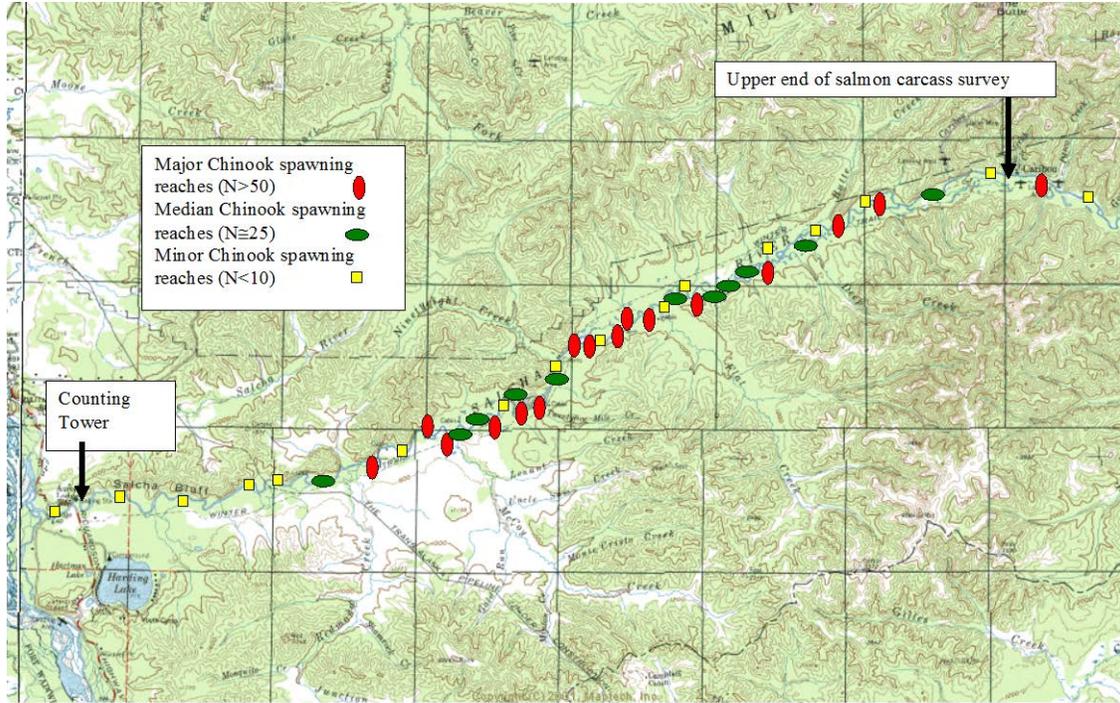


Figure 1. Salcha river counting tower location and carcass survey area ( 65 river miles) (USGS map ref:64144-A1-TF-250).