

Salcha River Chinook and Chum Salmon Counting Tower, 2011

R&M# 12-11

Project Proponent: Chris Stark, Bering Sea Fishermen's Association (BSFA), 110 W. 15th Avenue, Anchorage, AK 99501, tcstark@alaska.edu or Karen.gillis@bsfaak.org

Project Partners: None

1. Introduction:

Summary:

The Salcha River operation monitors and characterizes the largest escapement of Chinook salmon in the Yukon River drainage, as well as a significant chum salmon run. Salcha River tower counts have been successful 16 of the 17 years in estimating and characterizing Chinook salmon escapement. Escapement estimates by tower counts date to 1993, mark-recapture (M-R) methods from 1987–1992, and aerial surveys have been conducted, in most years, since 1973 by ADFG. BSFA has successfully operated the Salcha River tower since 1999.

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 in the Salcha River using tower counting techniques during the Chinook passage period (approximately August 15);

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

3. Methods:

Operations:

The Salcha River counting tower operation is located 1km upstream of the Richardson Highway Bridge, within the Salcha River State Park. Technicians count Chinook and chum salmon as they swim upstream over a white flash panel that spans the river (from one bank directly across (diagonal to stream flow) to the other bank). The flash panel is made up of nine 21 foot long and 10 feet wide fabric panels held on the stream bottom by 21 foot (3 inch diameter) steel pipe that are linked together end to end. Technicians count 20 minutes per hour, 24 hours a day from July through mid-August (24 counts per day every day). Total hourly escapement is calculated by multiplying each hourly 20-minute count by three, resulting in an expanded count estimate. The sum of each day's expanded hourly counts yields an estimated daily escapement total for Chinook and Chum salmon.

Results are phoned to ADF&G daily. Aerial surveys are at times done when tower counting operations are compromised (e.g. flooding). Carcass surveys are spread out over time (15-30 days) and space (each covers all 65 miles of stream of the historic index area) so as to account for the potential collection bias associated with different mortality periods (related to multiple issues such as fish size (large/small), sex (male/female) and environmental (floods, water temperature). Carcass survey data yields the age, sex and length information used to characterize the Chinook and chum salmon escapement composition. A minimum of three carcass surveys are done each year. Escapement and ASL analysis and summary estimates are then made and reported by ADFG.

4. Results:

The Salcha River 2011 Chinook salmon escapement estimate is 7,200 (table 1). The chum salmon escapement estimate is 120,000, assuming the 2011 chum run mid-point past the tower site was August 10 (table 2). Salcha River salmon counts were significantly compromised by high water much of the summer, limiting counts to 17 days of the 45 days of the historic Chinook salmon passage period. During front portion of the run, Chinook salmon were counted July 17, 20 and 23 from non-traditional locations (within two river miles of the tower site) due the high water keeping the tower out of operation. During these special counts, crews counted for eight-hour stretches during the best light of the day from cliffs, boats and/or overhanging trees in locations where we believed we could see all salmon passing. Desperate times called for desperate measurements.

During the latter portion of the Chinook run into the Salcha, tower count data was collected on 14 of 20 days, which are combined with the aerial survey count data (N=3,664) to produce a rough but reasonable season total Chinook salmon escapement of 7,200. Because the chum salmon run historically peaks Aug 10 or so, a rough minimum estimate could be made of 120,000 based solely on tower counts up to that mid-point multiplied by two. No counts were made after August 11, again due high water conditions preventing tower operations.

On July 21, the historic mid-point of Chinook salmon passing the Salcha tower site, BSFA Biologist Chris Stark flew a salmon survey of the entire Salcha with Quicksilver Air in an R-44 helicopter. The flying conditions were excellent (no wind, clear sky and water) and wherein we counted 3,664 Chinook and 340 chum salmon (table 3). The Chinook salmon aerial estimate should be pretty close to 100%. The chum aerial counts are surely not total count as many known chum salmon spawning areas were not surveyed being the focus of the survey was to count Chinook salmon.

Chinook carcass surveys, each covering the lower 65 miles of the Salcha (the usual carcass survey index area), were conducted July 31, August 2, 7-8 and 10. Seemingly few Chinook had died by July 24, roughly 25-50% by August 7, and most all by mid August, based on carcasses noted and fish seen still spawning. The relatively stable albeit high water conditions in 2011 made for excellent carcass recover. Carcass crews have noted in prior years that when the water level fluxuates often, the carcasses are either

washed out or left on the stream banks to dry up or be scavenged by birds and bears. Analyses of Chinook carcass data (N = 600 from which 527 had readable scales, by ADFG) yielded the portion of females (42%), 'normal' portions of age-6 fish (48%), and age-5 fish (35%). The estimated Chinook salmon escapement to the Salcha River in 2011 was above the BEG range (3,300 to 6,500). The 2011 Chinook escapement was below the 1993-2010 mean of 10,039, above the lowest recorded 4,595 (1999) and roughly 30-50% the largest escapement estimates of 15,000-20,000 (1993, 1997, 2003, 2004). Chum vertebra (N=160) were collected September 7-8 and subsequently given to ADFG for age analysis (results are not available to date). Chum salmon were found in most of the usual spawning areas in numbers seemingly about average compared to prior years of the authors involvement (1999 -2010). The abundance of juvenile Chinook, brood year 2010, was seemingly low early in the year (June), but very low late in the summer. Chinook carcasses collected during carcass surveys were noted via GPS.

Table 1. Chinook salmon Salcha River 2011 counting data. Total number counted (Daily N), daily total number of hourly counts, expanded counts (daily N *(total hourly counts/24)*3), and sum of expanded daily counts. Daily data in red are those collected from sites near but not at/on the tower. Expanded data in red are rough estimates using historic daily passage percentages from recent years with complete data sets (2009, 2010) and 2011 data (data in black) from days with data.

2011 Date	Daily N	# 20 min Counts	Expand Daily	Expand Cum
15-Jul-11				
16-Jul-11				
17-Jul-11	26	8	234	
18-Jul-11				
19-Jul-11				
20-Jul-11	33	8	297	
21-Jul-11			400	3664
22-Jul-11			400	4064
23-Jul-11	53	8	477	4541
24-Jul-11			400	4941
25-Jul-11	33	5	475	5416
26-Jul-11	120	24	360	5776
27-Jul-11	11	5	158	5935
28-Jul-11			250	6185
29-Jul-11			200	6385
30-Jul-11			150	6535
31-Jul-11			100	6635
1-Aug-11	10	16	45	6680
2-Aug-11	23	20	83	6762
3-Aug-11	7	20	25	6788
4-Aug-11	26	24	78	6866
5-Aug-11	30	24	90	6956
6-Aug-11	18	24	54	7010
7-Aug-11	16	24	48	7058
8-Aug-11	6	20	22	7079
9-Aug-11	9	24	27	7106
10-Aug-11	9	24	27	7133
11-Aug-11	2	10	14	7148
12-Aug-11			20	7168
13-Aug-11			20	7188
14-Aug-11			12	7200

Table 2. Chum salmon Salcha River 2011 counting data. Total number counted (Daily N), daily total number of hourly counts, expanded counts (daily N *(total hourly counts/24)*3), and sum of expanded daily counts. Daily data in red are those collected from sites near but not at/on the tower. Expanded data in red are rough estimates using historic daily passage percentages from years with complete data sets (2009, 2010) and 2011 data from days with data.

2011 Date	Daily N	# 20 min Counts	Expand Daily	Expand Cum
15-Jul				
16-Jul				
17-Jul				
18-Jul				
19-Jul				100
20-Jul	23	8	207	307
21-Jul			300	607
22-Jul			500	1107
23-Jul			700	1807
24-Jul			900	2707
25-Jul	86	5	1238	3945
26-Jul	480	24	1440	5385
27-Jul	238	5	3427	8813
28-Jul			3000	11813
29-Jul			3000	14813
30-Jul			3000	17813
31-Jul			3000	20813
1-Aug	583	16	2624	23436
2-Aug	1088	20	3917	27353
3-Aug	1313	20	4727	32080
4-Aug	1468	24	4404	36484
5-Aug	1556	24	4668	41152
6-Aug	1361	24	4083	45235
7-Aug	1569	24	4707	49942
8-Aug	1070	20	3852	53794
9-Aug	1501	24	4503	58297
10-Aug	1335	24	4005	62302
11-Aug	592	10	4262	66564
12-Aug				
13-Aug				
14-Aug				

Table 3. July 21, 2011 Aerial Survey Counts

	Large King	Small King	chum	Approximate River Mile
below				
mouth to Bridge	4	2	8	0-2
bridge to pipeline	242	253	66	2-8
pipeline to log jam	131	91	35	8-25
Log Jam to 98-Creek	123	122	75	25-40
98-Creek to canyon	712	509	87	40-50
Canyon to Caribou cr	129	95	5	50-65
Caribou to Camp Creek	767	475	64	65-90
Camp Creek to Splits	5	4	0	90-100
Above Splits	0	0	0	100-125
Large, Small Chinook and Chum Totals	2113	1551	340	
All Chinook adult Total		3664		

Salcha River carcass survey, Chinook salmon escapement age and sex composition and mean length (mm), 2011.																										
Sample Dates	Sample Size	Sample	Brood Year (Age)												Total											
			2008		2007		2006		2005		2004		2003													
			(1.1)	(1.2)	(2.1)	(1.3)	(2.2)	(1.4)	(2.3)	(1.5)	(2.4)	(1.6)	(2.5)	N	%											
7/31, 8/2 stratum 1	97	Male	0	0.0	5	5.2	0	0.0	41	42.3	0	0.0	14	14.4	2	2.1	1	1.0	0	0.0	0	0.0	0	0.0	63	64.9
		Female	0	0.0	0	0.0	0	0.0	3	3.1	0	0.0	31	32.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	34	35.1
		Subtotal	0	0.0	5	5.2	0	0.0	44	45.4	0	0.0	45	46.4	2	2.1	1	1.0	0	0.0	0	0.0	0	0.0	97	100.0
		Male Mean Length	-		580		-		698		-		845		633		940		-		-		-			
		SE	-		9		-		7		-		20		23		-		-		-		-			
		Range	-		555-610		-		585-790		-		760-1015		610-655		-		-		-		-			
		n	-		5		-		41		-		14		2		1		-		-		-			
		Female Mean Length	-		-		-		748		-		853		-		-		-		-		-			
		SE	-		-		-		35		-		8		-		-		-		-		-			
		Range	-		-		-		680-795		-		765-935		-		-		-		-		-			
		n	-		-		-		3		-		31		-		-		-		-		-			
8/7-8 stratum 2	284	Male	1	0.4	54	19.0	0	0.0	89	31.3	0	0.0	20	7.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	165	58.1
		Female	0	0.0	0	0.0	0	0.0	8	2.8	0	0.0	105	37.0	0	0.0	6	2.1	0	0.0	0	0.0	0	0.0	119	41.9
		Subtotal	1	0.4	54	19.0	0	0.0	97	34.2	0	0.0	125	44.0	1	0.4	6	2.1	0	0.0	0	0.0	0	0.0	284	100.0
		Male Mean Length	360		544		-		686		-		815		720		-		-		-		-			
		SE	-		6		-		6		-		16		-		-		-		-		-			
		Range	-		450-625		-		515-795		-		715-965		-		-		-		-		-			
		n	1		54		-		89		-		20		1		-		-		-		-			
		Female Mean Length	-		-		-		778		-		850		-		868		-		-		-			
		SE	-		-		-		25		-		4		-		9		-		-		-			
		Range	-		-		-		695-935		-		740-945		-		845-910		-		-		-			
		n	-		-		-		8		-		105		-		6		-		-		-			
8/10 stratum 3	146	Male	0	0.0	18	12.3	0	0.0	45	30.8	0	0.0	14	9.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	77	52.7
		Female	0	0.0	0	0.0	0	0.0	1	0.7	0	0.0	67	45.9	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	69	47.3
		Subtotal	0	0.0	18	12.3	0	0.0	46	31.5	0	0.0	81	55.5	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	146	100.0
		Male Mean Length	-		549		-		678		-		839		-		-		-		-		-			
		SE	-		12		-		7		-		11		-		-		-		-		-			
		Range	-		450-680		-		555-775		-		780-915		-		-		-		-		-			
		n	-		18		-		45		-		14		-		-		-		-		-			
		Female Mean Length	-		-		-		835		-		842		-		890		-		-		-			
		SE	-		-		-		-		-		5		-		-		-		-		-			
		Range	-		-		-		-		-		740-940		-		-		-		-		-			
		n	-		-		-		1		-		67		-		1		-		-		-			
Salcha River carcass survey, Chinook salmon escapement age and sex composition and mean length (mm), 2011.																										
Sample Dates	Sample Size	Sample	Brood Year (Age)												Total											
			2008		2007		2006		2005		2004		2003													
			(1.1)	(1.2)	(2.1)	(1.3)	(2.2)	(1.4)	(2.3)	(1.5)	(2.4)	(1.6)	(2.5)	N	%											
Total	527	Male	1	0.2	77	14.6	0	0.0	175	33.2	0	0.0	48	9.1	3	0.6	1	0.2	0	0.0	0	0.0	0	0.0	305	57.9
		Female	0	0.0	0	0.0	0	0.0	12	2.3	0	0.0	203	38.5	0	0.0	7	1.3	0	0.0	0	0.0	0	0.0	222	42.1
		Total	1	0.2	77	14.6	0	0.0	187	35.5	0	0.0	251	47.6	3	0.6	8	1.5	0	0.0	0	0.0	0	0.0	527	100.0
		Male Mean Length	360		548		-		687		-		831		662		940		-		-		-			
		SE	-		5		-		4		-		9		32		-		-		-		-			
		Range	-		450-680		-		515-795		-		715-1015		610-720		-		-		-		-			
		n	1		77		-		175		-		48		3		1		-		-		-			
		Female Mean Length	-		-		-		775		-		848		-		871		-		-		-			
		SE	-		-		-		19		-		3		-		8		-		-		-			
		Range	-		-		-		680-935		-		740-945		-		845-910		-		-		-			
		n	-		-		-		12		-		203		-		7		-		-		-			

Table 5. Historic Chinook salmon Salcha River escapement and female proportion estimates.

Year	Number Fish	Percent Female
1986		
1987	4,771	52.0
1988	4,562	45.3
1989	3,294	43.8
1990	10,728	36.2
1991	5,608	40.7
1992	7,862	36.0
1993	10,007	22.9
1994	18,399	40.4
1995	13,643	48.4
1996	7,570	26.2
1997	18,514	41.8
1998	5,027	26.1
1999	9,198	44.6
2000	4,595	34.3
2001	13,328	32.1
2002	9,000	29.8
2003	15,500	36.6
2004	15,761	54.2
2005	5,988	47.5
2006	10,679	38.1
2007	6,425	31.0
2008	5,415	33.7
2009	12,774	33.9
2010	6,135	26.6
2011	7,200	42.1