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Abundance and Run Timing of Adult Pacific Salmon in the East Fork Andreafsky River, Yukon Delta National Wildlife Refuge, Alaska, 2013

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Cover Photo: USFWS East Fork Andreafsky River weir 2013, photo by J. McGuire.

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Abstract

A resistance board weir was used to collect abundance, run timing, and biological data from salmon returning to the East Fork Andreafsky River, a tributary to the lower Yukon River, from July 2 to July 31, 2013. An estimated 1,998 Chinook salmon *Oncorhynchus tshawytscha* migrated through the weir. Five age groups were identified from the 477 Chinook salmon sampled, with age 1.2 (48%) predominant. The sex composition was 32.8% female. An estimated 61,234 summer chum salmon *O. keta* also migrated through the weir. Three age groups were identified from 654 summer chum salmon sampled, with ages 0.3 (19%) and 0.4 (80%) predominant. The sex composition was 48% female. Additionally, 589 pink salmon *O. gorbuscha*, and 335 sockeye salmon *O. nerka*, were counted passing through the weir. Other species counted during 2013 included 1,250 whitefish (Coregoninae), 10 Dolly Varden *Salvelinus malma,* and 7 northern pike *Esox lucius*. The weir counts started late due to high water, therefore, passage estimates are conservative.

Introduction

The Alaska National Interest Lands Conservation Act of 1980 (ANILCA), mandates that salmon populations and their habitats be conserved on National Wildlife Refuge lands, international treaty agreements be fulfilled, and a subsistence priority for rural residents be maintained (USFWS 1991). Compliance with ANILCA mandates require reliable data on salmon stocks originating from and returning to refuge lands. The Andreafsky River is one of several lower Yukon River tributaries on the Yukon Delta National Wildlife Refuge (Refuge). The Andreafsky River and its primary tributary, the East Fork Andreafsky River, provide important spawning and rearing habitat for Chinook salmon *Oncorhynchus tshawytscha*, summer chum salmon *O. keta*, coho salmon *O. kisutch*, pink salmon *O. gorbuscha*, and sockeye salmon *O. nerka* (USFWS 1991). The Andreafsky River supports one of the largest returns of Chinook salmon, the second largest return of summer chum salmon (Bergstrom et al. 1998), and is thought to have the largest return of pink salmon in the Yukon River drainage (USFWS 1991).

The Andreafsky River salmon stocks contribute to a large subsistence fishery in the lower Yukon River. Consequently, accurate and timely escapement estimates from tributaries like the Andreafsky River are required by managers to help determine exploitation rates, spawner-recruit relationships and maintain genetic diversity for the Yukon River basin (Labelle 1994). Throughout the Yukon River basin there is a limited number of monitoring projects that collect these data. Therefore, federal and state fishery managers utilize information from escapement projects, main-stem sonar stations, and test fisheries to distribute salmon harvest over time to avoid over-harvesting individual salmon stocks (Mundy 1982). However, due to differences in run timing or the estimated abundance of returning stocks, individual stocks may be incidentally over-harvested in the subsistence, commercial, or sport fisheries.

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Escapement monitoring on the East Fork Andreafsky River started with aerial surveys by the U.S. Fish and Wildlife Service (USFWS) from 1954-1960, and continued by the Alaska Department of Fish and Game (ADF&G) from 1961 to the present. Sonar and tower counts were added by ADF&G from 1981 through 1988 (Appendix 1). The present weir project (operated by the USFWS Kenai Fish and Wildlife Field Office from 1994-2002 and the USFWS Fairbanks Fish and Wildlife Field Office since 2003) has provided accurate escapement and biological data since 1994 for Chinook salmon, summer chum salmon, and pink salmon, and for coho salmon from 1995 to 2005. The Andreafsky River weir is one of the longest running escapement projects in the Yukon River drainage.

Periodic poor chum salmon returns and declining productivity for Chinook salmon have resulted in harvest restrictions, complete fishery closures, and spawning escapements below management goals on many tributaries in the Yukon River drainage (Vania et al. 2002; Kruse 1998, JTC 2013). Chinook salmon and summer chum salmon runs had harvestable surpluses from 2002-2006 (JTC 2007), but Chinook salmon runs have been low since 2007 (JTC 2014). This project provides information on tributary run strength and quality of escapement for in-season management decisions, especially during years with low returns. It is also downriver of where most harvest occurs on the Yukon River.

Objectives

The project objectives for 2013 were: (1) enumerate adult salmon escapement; (2) describe run timing of Chinook salmon and summer chum salmon returns; (3) estimate the age, sex, and length composition of the adult Chinook salmon population; (4) estimate age, sex, and length composition of the adult summer chum salmon population; and (5) identify and count other fish species passing through the weir.

Study Area

The Andreafsky River is located in the lower Yukon River drainage in western Alaska (Figure 1). The regional climate is subarctic with extreme temperatures ranging from 28˚C in summer and –42˚C in winter at St. Mary's, Alaska (Leslie 1989). Mean monthly high and low temperatures between 1976 and 2000 were 18˚C in July and –22˚C in February. Average yearly precipitation is approximately 48 cm of rain and 172 cm of snow. The Andreafsky River ice breakup typically occurs in May or early June, and usually begins to freeze in late October (USFWS 1991). Maximum discharge typically follows breakup. Sporadic high discharges generated by heavy rains occur between late July and early September.

The Andreafsky River is one of the three largest Yukon River tributaries within the Refuge boundaries (USFWS 1991) and drains a watershed of approximately 5,450 km^2. The main-stem Andreafsky River and the East Fork Andreafsky River parallel each other, flowing southwesterly for more than 200 river-kilometers (rkm) and converge 7 rkm upstream of their confluence with the Yukon River. The mouth of the Andreafsky River is approximately 160 rkm upstream from the mouth of the Yukon River. The main-stem Andreafsky River and East Fork Andreafsky River flow through the Andreafsky Wilderness Area and the portions of each river within Refuge boundaries are federally designated as Wild and Scenic Rivers.

The East Fork Andreafsky River originates in the Nulato Hills at approximately 700 m elevation and drains an area of about 1,950 km^2 (USFWS 1991). The river flows through alpine tundra at

an average gradient of 7.6 m/km for 48 rkm. It then flows 130 rkm through a forested river valley bordered by hills that rarely exceed 400 m elevation. Willow, spruce, alder, and birch dominate the riparian zone and much of the hillsides. This forested river section drops at an average rate of 1.4 m/km and is characterized by glides and riffles with gravel and rubble substrate. The river widens in the lowermost 38 rkm and the gradient drops to 0.14 m/km. The valley here is wetlands, interspersed with forest and tundra, and bordered by hills that are typically less than 230 m elevation. Aquatic vegetation grows in the slower flowing stream channels. Water level fluctuations on the Yukon River affect the stage height in the lower sections of the East Fork and main-stem Andreafsky Rivers.

Methods

Weir Operation

A modified resistance board weir (Tobin 1994; Tobin and Harper 1995; Zabkar and Harper 2003) spanning 105 m was installed from June 15 to July 1, 2013, in the East Fork Andreafsky River (62° 07'N, 162° 48.4'W) approximately 43 rkm upstream from the Yukon-Andreafsky River confluence and 26 air-km northeast of St. Mary's, Alaska (Figure 1). The weir site is located approximately 2.4 rkm downstream from the 1994 weir site described by Tobin and Harper (1995) and 2.1 rkm downstream from the 1981-1988 sonar and counting tower site described by Sandone (1989). Weir panel picket spacing (4.8 cm inside edge to inside edge) was designed to remain functional during higher water flow, but allowed smaller pink salmon and resident fish to pass through the weir undetected (Zabkar and Harper 2003).

A staff gauge was installed at the weir to measure daily water levels. Staff gauge measurements were calibrated to a monument with the three-foot mark on the staff gauge 12.5 feet below the horizontal from the monument. Two Onset Hobo Pro v2 (Bourne, Massachusetts) loggers collected water temperature data throughout the season, and were left on site to collect data year round; water temperature data loggers deployed in 2012 were not located in 2013. Water temperature, dissolved oxygen, conductivity, pH, and turbidity were collected twice daily at approximately 0730 hours and 1930 hours, using a YSI Professional Plus Multiprobe (Yellow Springs, Ohio); the data is presented in Appendix 9.

Two passage chutes were installed, one approximately one-third of the way across from the left bank, and the other centered between the banks, in water deep enough to allow fish passage in the event of low water conditions. Fish traps were installed on both passage chutes to facilitate biological sampling. All fish were enumerated and identified to species as they passed through the live trap, except whitefish spp., which were grouped under the subfamily Coregoninae. Fish were counted 24 hours per day and the numbers were recorded hourly from July 2 to July 30.

The weir was cleaned and its integrity visually checked daily. Cleaning consisted of raking debris from the upstream surface of the weir or walking across each panel to submerge it enough to allow the current to wash debris downstream. Repairs were made when necessary. A new substrate baserail was constructed and used in 2013.

Biological Data

Adult salmon counting and sampling occurred daily to determine run timing and escapement. A stratified random sampling design (Cochran 1977) was used to collect age, length, and sex data

for Chinook and summer chum salmon. Biological sampling of Chinook salmon and chum salmon occurred each week, with a sampling goal of 160 salmon/species spread throughout each week, and daily sampling spread throughout each 24-hour period. All target species within the trap were sampled to prevent bias. Non-target species were identified and counted but not sampled, except for opportunistic samples whitefish, which were sacrificed to construct a gonadosomatic index. The data from this sampling effort in 2013was limited to humpback whitefish, and are presented in Appendix 10, but are not be discussed in this report.

Sampling consisted of identifying salmon to species, determining sex, measuring fish lengths, collecting scales, and releasing fish upstream of the weir. Secondary external characteristics were used to determine sex. Lengths were measured from mid-eye to the fork of the caudal fin to the nearest 1 mm. Scales were removed from the area above the lateral line and posterior to the dorsal fin following the methods outlined by Koo (1962) and Devries and Frie (1996). Four scales were collected from each Chinook salmon sampled, and one scale was collected from each summer chum salmon sampled. Scales were sent to ADF&G post season for age determination, from impressions made on cellulose acetate cards using a heated scale press and examined with a microfiche reader (Zabkar and Harper 2003). Age was determined by an ADF&G biologist and reported according to the European method (Koo 1962). Daily sex ratios were collected by visually examining each fish for external morphological features when sampling for age and length. The escapement counts and sex ratios were reported daily to the USFWS Fairbanks Fish and Wildlife Field Office and forwarded to ADF&G staff.

Data Analysis

Calculations for age and sex information were calculated using a stratified random sample (Cochran 1977), with sampling weeks as the strata. Age-1.2 Chinook salmon were assumed to be males (Brady 1983; Bales 2007; Karpovich and DuBois 2007) regardless of their field determination. Each statistical week was defined as beginning on Sunday and ending the following Saturday. Incomplete weeks, or weeks with low passage, were collated with weeks before or after that week to maximize sample size in all strata. Within a stratum, the proportion of the samples composed of a given sex or age, $\hat{p}_{ij}$, was calculated as:

$$\hat{p}_{ij} = \frac{n_{ij}}{n_j},$$

where n_{ij} is the number of fish by sex i or age i sampled in week j, and n_j is the total number of fish sampled in week j. The variance of $\hat{p}_{ij}$ was calculated as:

$$\hat{v}(\hat{p}_{ij}) = \frac{\hat{p}_{ij}(1-\hat{p}_{ij})}{n_j - 1}.$$

Sex and age compositions for the total run of Chinook and summer chum salmon of a given sex or age, $\hat{p}_i$ were calculated as:

$$\hat{p}_i = \sum_{j-1} \hat{W}_j \hat{p}_{ij,}$$

where the stratum weight $\hat{W}_j$ was calculated as:

$$\hat{W}_j = \frac{N_j}{N},$$

and N_j equals the total number of fish of a given species passing through the weir during week j, and N is the total number of fish of a given species passing through the weir during the run. Variance, $\hat{v}(\hat{p}_i)$ of sex and age compositions for the run was calculated as:

$$\hat{v}(\hat{p}_i) = \sum_{j-1} \hat{W}_j^2 \hat{v}(\hat{p}_{ij}).$$

Results and Discussion

Weir Operation

The weir was operational from July 2 through July 31, 2013. High water in 2013 delayed installation of the weir. The average river stage height during weir operations was 98 cm and ranged from 62 cm to 167 cm (Figure 2). Water temperature during weir operations averaged 12.7°C and ranged from 8.6 to 19.7°C (Figure 2, Appendix 9).

Biological Data

An estimated 1,998 Chinook salmon, 61,234 summer chum salmon, 589 pink salmon, and 335 sockeye salmon migrated through the weir in 2013 (Table 1). Passage estimates for Chinook and summer chum salmon were conservative due to an unknown number of fish passing before the weir was operational. Non-salmon species recorded moving through the weir included 1,250 whitefish, and 7 northern pike.

The East Fork Andreafsky River weir recorded below-average Chinook salmon escapement in 2013 (Figure 3), similar to 2012 both at the weir and drainage wide. The summer chum salmon escapement recorded at the weir in 2013 was also below average (Figure 4), but the drainage wide escapements were above average (JTC 2014).

Chinook Salmon

The 2013 Chinook salmon escapement estimate (1,998 fish) was below the 1994-2012 historical average of 4,487 fish (Figure 3; Appendix 2). Peak passage (525) occurred on July 10 (Table 2; Figure 4). The 2013 run timing began late, but ended near average; the first quartile passed on July 10 (historical average July 5), the mid-point of the run at the weir was July 11 (historical average July 9), and the third quartile passage date was July 14 (historical average July 15) (Appendix 2). Chinook salmon passage calculations were not adjusted for differences in project duration among years.

Of the 1,998 Chinook salmon that passed through the weir in 2013, 477 (24.4% of the run) were sampled for age, sex, and length composition. Female Chinook salmon lengths ranged from 571 to 929 mm, and male Chinook salmon ranged from 373 to 869 mm (Table 3). Of the 477

Chinook salmon sampled for age composition 30 (6%) were classified as unreadable, primarily due to scale regeneration. The weighted age composition of the remaining 447 sampled Chinook salmon included five age groups: age-1.1 (0.01%) age-1.2 (47.9%), age-1.3 (21.6%), age-1.4 (29.3%), and age-1.5 (0.01%) (Table 4). Females composed an estimated 32.8% of the overall escapement. This estimate is four percentage points lower than the historical average sex ratio of 37% females (Appendices 7 and 8). The age distributions between female and male Chinook salmon differed. Females were predominately ages 1.3 (23.2%) and 1.4 (75.0%), and males were predominately ages 1.2 (71.5% and 1.3 (20.9%).

The 2013 ADF&G aerial survey on the Andreafsky River estimated 1,090 Chinook salmon for the West Fork Andreafsky River, and 1,441 for the East Fork (Appendix 1). In 2010, the East Fork aerial SEG was converted to a weir goal of 2,100-4,900 for Chinook salmon.

Summer Chum Salmon

The 2013 summer chum salmon escapement estimate of 61,234, fish was below the 1994-2012 historical average of 72,995 (Figure 4; Appendix 1 and 3), but met ADF&Gs' Biological Escapement Goal (BEG) of >40,000 fish (JTC 2014). However, weir operation began later than usual and fish passed before counting started. Peak passage (7,385 fish) occurred on July 7 (Table 1; Figure 4). The 2013 run timing was near average; the first quartile passed on July 6 (historical average July 2), the mid-point of the run at the weir was July 8 (historical average July 6), and the third quartile passage date was July 15 (historical average July 12) (Table 2). Summer chum salmon passage calculations a not adjusted for differences in project duration among years.

Female summer chum salmon lengths ranged from 420 to 599 mm and male summer chum salmon ranged from 465 to 678 mm (Table 3). There were 654 summer chum salmon sampled for age composition, with 34 (5.8%) classified as unreadable, primarily due to scale regeneration. The age composition of the remaining sampled summer chum salmon included three age groups: age-0.3 (19.7%), age-0.4 (80.1%), and age-0.5 (0.2%). The weighted proportions are presented in Table 5. Females comprised an estimated 48.1% of the overall escapement (Table 5). This estimate is equal to the historical sex ratio (Appendix 8). Female summer chum salmon were predominantly age-0.4 (76.9%), male summer chum were also predominantly age 0.4 (82.9%).

Pink Salmon

Pink salmon have strong runs to the East Fork Andreafsky River during even-numbered years and relatively weak runs during odd-numbered years (Appendix 5). The 2013 escapement through the weir (589 fish) was less than the odd-year 1995-2011 historical average of 6,778. Pink salmon counts on the Andreafsky River are not precise estimates, but are a measure of relative year-to-year abundance as smaller pink salmon are able to pass uncounted between the weir pickets. The highest single-day passage occurred on July 24 (48 fish) (Table 1, Appendix 5).

Sockeye Salmon

The 2013 sockeye salmon escapement estimate of 335 fish was above the 1995-2012 historical average of 181 (Appendix 6). Large populations of sockeye salmon are absent in the Yukon

River drainage (Bergstrom et al. 1995), but small populations have been identified in several Yukon River tributaries (Alt 1983; O'Brien 2006), including the Andreafsky River.

Coho Salmon

The weir has not operated during the period in which coho migrate on the Andreafsky River since 2005; subsequently none were counted in 2013. Coho likely continue to spawn in the Andreafsky.

Conclusion

The East Fork Andreafsky River weir is an important tool for monitoring salmon stocks originating on the Refuge, and in assisting both ADF&G and USFWS inseason managers with management of Yukon River fisheries. Due to the complexity of the Yukon River mixed-stock salmon fishery and the difficulty in managing specific stocks, it is vital to continue collecting information from individual salmon populations, including stocks in the Andreafsky River drainage. The East Fork Andreafsky River weir is unique because it is the only enumeration project in the lower river downstream of the Pilot Station sonar. The numerical, biological, and run timing information collected from the East Fork Andreafsky River weir project is assumed to represent other Lower Yukon River systems experiencing lower salmon exploitation due to their location in the lower portion of the Yukon River drainage. This project allows managers to evaluate escapement goals, analyze trends in population size, length, age, and gender, formulate run projections, determine harvest allocations, and monitor long-term changes associated with climate change, harvest fluctuations, diseases, and other stressors.

Investigations of spawning and rearing locations for sockeye salmon are recommended to ensure long-term viability of this small unique population. With the limited commercial fishery for Arctic lamprey since 2003 and historical subsistence use, the East Fork Andreafsky River weir project also collects baseline data to understand lamprey biology, relative abundance, and distribution, and to construct a sampling protocol for lamprey larvae. This ongoing effort began in 2012. The weir will also convert to a video counting system in 2014. Additionally, if concerns about coho salmon population become a priority, the East Fork Andreafsky weir should be considered a suitable data collection site, as coho data had been collected at this location prior to 2005.

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Table 1. — Salmon escapement estimates, by stratum, recorded at the East Fork Andreafsky River weir, Alaska, 2013.

Stratum Date	Chinook salmon	Chum salmon	Pink salmon	Sockeye salmon
July 02-July 10	363	31,632	49	212
July 11-July 15	1,129	20,023	116	50
July 16-July 21	374	6,209	116	43
July 22-July 30	132	3,370	308	30
Total	1,998	61,234	589	335

Table 2. — Daily and cumulative escapement estimates of Chinook salmon, summer chum salmon, pink salmon, and sockeye salmon, and daily and total escapement estimates of whitefish spp. and northern pike through the East Fork Andreafsky River weir, Alaska, 2013.

	Chinook salmon		Summer chum		Pink salmon		Sockeye	White fish	Pike	Grayling	Dolly Varden
Date	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Daily	Daily	Daily	Daily
2-Jul	24	24	3,082	3,082	3	3	0	9	1	0	0
3-Jul	9	33	1,988	5,070	0	3	0	21	0	0	0
4-Jul	37	70	6,132	11,202	2	5	23	12	0	0	0
5-Jul	18	88	3,444	14,646	4	9	10	12	0	0	0
6-Jul	34	122	4,841	19,487	2	11	17	11	1	0	0
7-Jul	91	213	7,385	26,872	11	22	57	42	0	0	1
8-Jul	82	295	4,760	31,632	7	29	25	29	0	0	0
9-Jul	68	363	2,582	34,214	6	35	37	36	0	0	0
10-Jul	525	888	6,777	40,991	14	49	43	46	0	0	2
11-Jul	170	1,058	4,017	45,008	24	73	19	36	0	0	0
12-Jul	128	1,186	2,882	47,890	45	118	19	96	0	0	5
13-Jul	197	1,383	2,731	50,621	20	138	8	82	0	0	0
14-Jul	109	1,492	1,034	51,655	14	152	2	80	0	0	0
15-Jul	145	1,637	476	52,131	13	165	2	40	1	0	0
16-Jul	34	1,671	936	53,067	21	186	4	13	0	0	0
17-Jul	30	1,701	614	53,681	7	193	6	26	2	0	0
18-Jul	59	1,760	1,028	54,709	25	218	12	63	1	0	0
19-Jul	52	1,812	1,473	56,182	22	240	10	45	0	0	0
20-Jul	54	1,866	831	57,013	12	252	2	37	0	0	0
21-Jul	27	1,893	851	57,864	29	281	9	31	0	0	0
22-Jul	15	1,908	876	58,740	47	328	4	55	0	0	0
23-Jul	11	1,919	616	59,356	29	357	6	66	0	0	0
24-Jul	12	1,931	598	59,954	48	405	6	39	0	0	0
25-Jul	13	1,944	378	60,332	37	442	4	67	0	0	0
26-Jul	16	1,960	339	60,671	32	474	4	58	1	0	1
27-Jul	7	1,967	229	60,900	31	505	2	87	0	0	0
28-Jul	18	1,985	138	61,038	38	543	1	48	0	0	0
29-Jul	11	1,996	84	61,122	29	572	1	52	0	0	1
30-Jul	2	1,998	112	61,234	17	589	2	11	0	0	0
Total	1,998		61,234		589		335	1,250	7	0	10

Table 3. —Lengths (in mm from mid-eye to fork in the caudal fin) at age of female and male Chinook salmon and summer chum salmon sampled at East Fork Andreafsky River weir, Alaska, 2013.

Female						Male					
Age	N	Mean	Median	SE	Range	Age	N	Mean	Median	SE	Range
Chinook salmon											
1.2	0*					1.1	2	387	387	14	373-401
1.3	37	744	751	10.4	603-831	1.2	199	526	529	3.4	410-634
1.4	111	832	830	4.2	713-937	1.3	71	687	686	7.8	539-800
1.5	2	889	889	40	851	1.4	25	777	790	13.4	600-869
UNK	10					UNK	20				
All Ages	160					All Ages	317				
Chum salmon											
0.3	108	506	510	2.4	440-560	0.3	73	543	543	3	485-601
0.4	207	530	530	1.9	420-599	0.4	224	570	569	2.3	465-678
0.5	3	506	488	21.9	481-550	0.5	1	500	500	0	500
UNK	19					UNK	19				
All Ages	337					All Ages	317				

*age-1.2 Chinook salmon are considered male regardless of field determination

Table 4. — Age and sex ratio estimates by stratum of Chinook salmon sampled at East Fork Andreafsky River weir, Alaska, 2013. Standard errors are shown in parentheses. Season totals are calculated from weighted weekly strata totals. Unknown age data are from unreadable scale samples and were included in percent female calculations.

					Brood year and age							
					2010	2009	2008		2007		2006	
Strata Dates	Run Size (N)	Samples Size (n)	Unknown Age	Percent Female	1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4
July 02-July 10	363	132	14	30.3%(4.0)	0.0%(0.0)	44.1%(4.6)	28.8%(4.2)	0.0%(0.0)	26.3%(4.1)	0.0%(0.0)	0.9%(0.8)	0.0%(0.0)
July 11-July 15	1,129	141	8	34.8%(4.0)	0.1%(0.8)	48.9%(4.4)	18.0%(3.3)	0.0%(0.0)	31.6%(4.0)	0.0%(0.0)	0.8%(0.8)	0.0%(0.0)
July 16-July 21	374	105	5	24.8%(4.2)	1.0%(1.0)	56.0%(5.0)	23.0%(4.2)	0.0%(0.0)	20.0%(4.0)	0.0%(0.0)	0.0%(0.0)	0.0%(0.0)
July 22-July 30	132	99	3	45.5%(5.0)	0.0%(0.0)	27.1%(4.6)	28.1%(4.6)	0.0%(0.0)	44.8%(5.1)	0.0%(0.0)	0.0%(0.0)	0.0%(0.0)
Total	1,998	477	30	32.8%(2.5)	0.6%(0.5)	47.9%(2.8)	21.6%(2.2)	0.0%(0.0)	29.3%(2.5)	0.0%(0.0)	0.6%(0.5)	0.0%(0.0)
Female	655	160	10	-	0.0%(0.0)	0.0%(0.0)	23.2%(4.0)	0.0%(0.0)	75.0%(4.1)	0.0%(0.0)	1.7%(1.4)	0.0%(0.0)
Male	1,343	317	20	-	1.0%(0.5)	71.4%(2.7)	20.8%(2.7)	0.0%(0.0)	7.0%(1.6)	0.0%(0.0)	0.0%(0.0)	0.0%(0.0)

Table 5. — Age and sex ratio estimates by stratum of summer chum salmon sampled at East Fork Andreafsky River weir, Alaska, 2013. Standard errors are shown in parentheses. Season totals are calculated from weighted weekly strata totals. Unknown age data are from unreadable scale samples are listed for informational purposes, and were not included in age calculations, but were used in the cumulative percent female calculation.

					Brood Year Age				
					2010	2009	2008	2007	2006
Strata Dates	Run Size (N)	Samples Size (n)	Unknown Age	Percent Female	0.2	0.3	0.4	0.5	0.6
July 02-July 10	31,632	160	16	49.4%(4.0)	0.0%(0.0)	12.5%(2.8)	88.0%(2.8)	0.0%(0.0)	0.0%(0.0)
July 11-July 15	20,023	161	9	41.6%(3.9)	0.0%(0.0)	23.0%(3.4)	77.0%(3.4)	0.0%(0.0)	0.0%(0.0)
July 16-July 21	6,209	160	8	56.9%(3.9)	0.0%(0.0)	30.3%(3.7)	68.4%(3.8)	1.3%(0.9)	0.0%(0.0)
July 22-July 30	3,370	173	5	57.8%(3.8)	0.0%(0.0)	48.8%(3.9)	50.0%(3.9)	1.2%(0.8)	0.0%(0.0)
Total	61,234	654	38	48.1%(2.5)	0.0%(0.0)	19.7%(1.9)	80.1%(1.9)	0.2%(0.1)	0.0%(0.0)
Female	29,430	337	19	-	0.0%(0.0)	22.7%(2.7)	76.9%(2.7)	0.3%(0.2)	0.0%(0.0)
Male	31,804	317	19	-	0.0%(0.0)	17.0%(2.6)	82.9%(2.6)	<.01%(0.1)	0.0%(0.0)

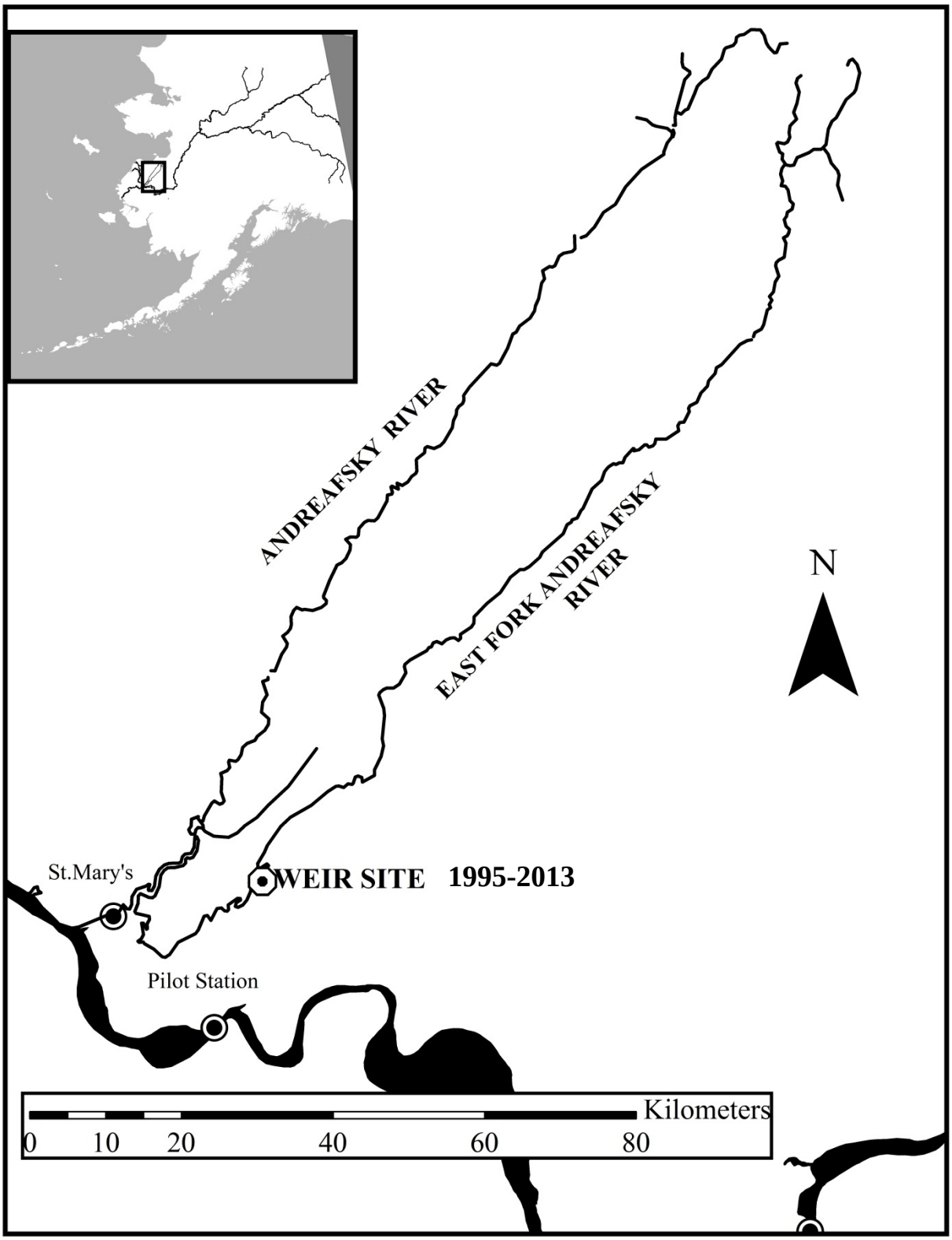


Figure 1. — Weir location on the East Fork Andreafsky River, Alaska, 1995-2013.

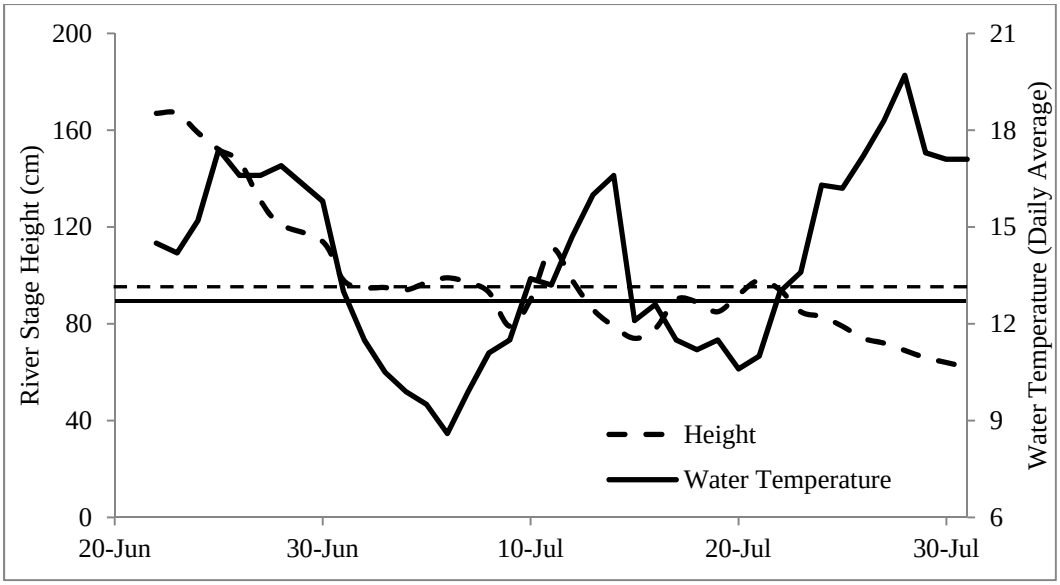


Figure 2. — River stage heights (cm) and water temperatures (°C) at the East Fork Andreafsky River weir, 2013, with seasonal averages. Solid line indicates seasonal average water temperature. Dashed line indicates seasonal average water height.

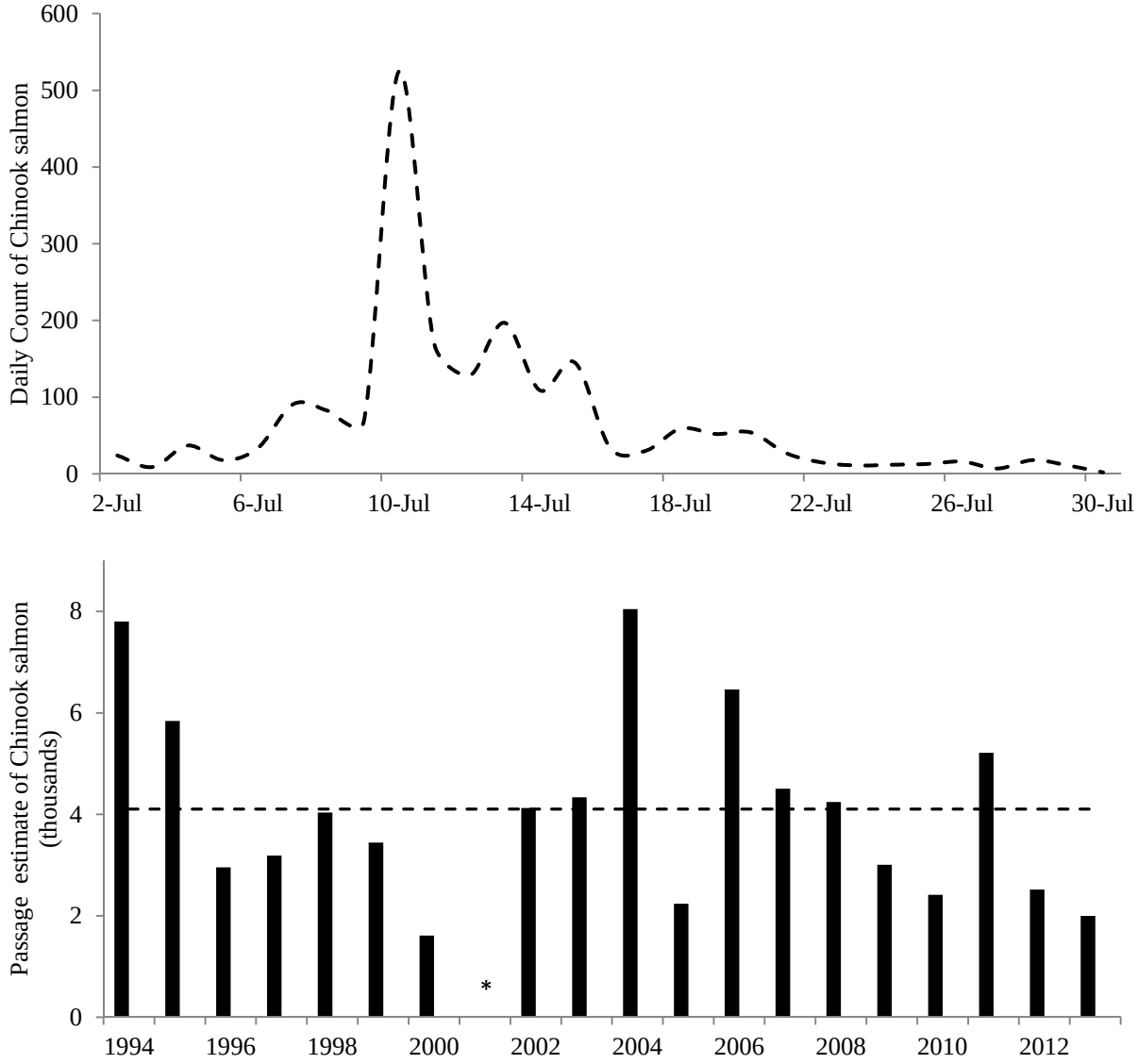


Figure 3. —Daily count (2013) and annual escapement (1994-2013) estimates of Chinook salmon migrating through the East Fork Andreafsky River weir, Alaska. Historical average is represented by the dashed, horizontal line. Asterisk denotes missing annual count due to high water.

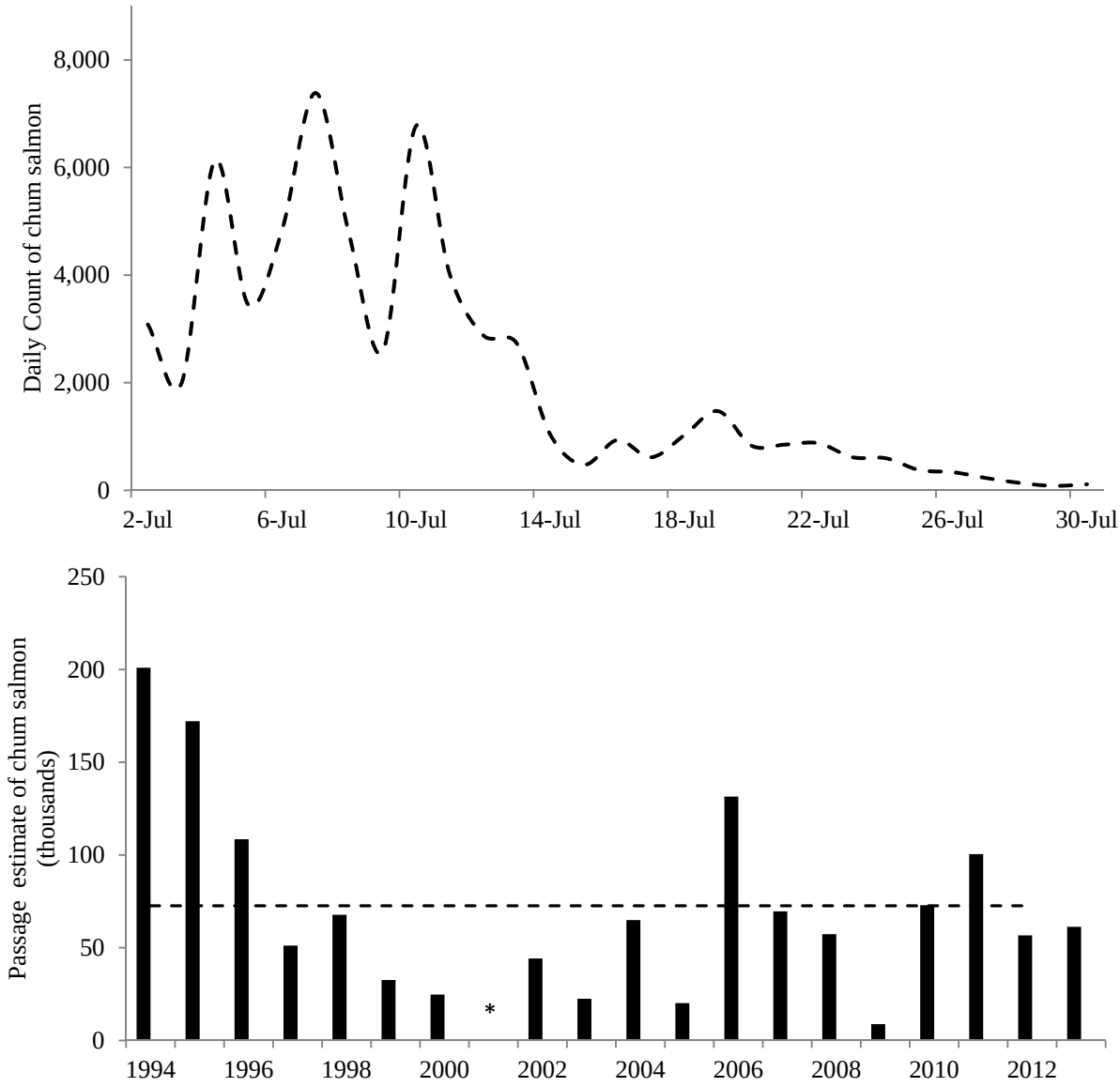


Figure 4. — Daily count (2013) and annual escapement (1994-2013) estimates of summer chum salmon migrating through the East Fork Andreafsky River weir, Alaska. Historical average is represented by the dashed, horizontal line. Asterisk denotes missing annual count due to high water.

Appendix 1. — Historical Chinook, summer chum, and coho salmon escapement estimates recorded for the Andreafsky River, Alaska, 1954-2013. Data provided by ADF&G from JTC (2014).

	East Fork Andreafsky River												Main stem Andreafsky River					
	Aerial Index Estimates						Sonar, Tower, or Weir						Aerial Index Estimates					
Year	Chinook salmon		Chum salmon		Coho salmon		Chinook salmon		Chum salmon		Coho salmon		Chinook salmon		Chum salmon		Coho salmon	
1954		*a*		*a*									2,000	*a*	7,000	*a*		
1955																		
1956	336	*b*	15,356	*b*														
1957																		
1958	50	*b*	3,500	*b*									150	*b*	30,000	*b*		
1959	150	*b*	4,000	*b*									300	*b*	7,000	*b*		
1960	1,020		10,530										1,220		6,016			
1961	1,003		8,110															
1962	675	*b*	18,040										762	*b*	19,530			
1963																		
1964	867		8,863										705		12,810			
1965													355	*b*	14,670	*b*		
1966	361		25,619	*b*									303		18,145			
1967													276	*b*	14,495	*b*		
1968	380		17,600										383	*b*	74,600	*b*		
1969	231	*b*	119,000										374	*b*	159,500	*b*		
1970	665		84,090										574	*b*	91,710	*b*		
1971	1,904		98,095										1,682		71,745			
1972	798	*b*	41,460	*b*									582	*b*	25,573			
1973	825		10,149	*b*									788		51,835			
1974			3,215	*b*									285		33,578			
1975	993		223,485										301		235,954			
1976	818		105,347										643		118,420			
1977	2,008		112,722										1,499		63,120			
1978	2,487		127,050										1,062		57,321			
1979	1,180		66,471										1,134		43,391			
1980	958	*b*	36,823	*b*									1,500		115,457			
1981	2,146	*b*	81,555		1,657	*b*	5,343	*c*	147,312	*c*			231	*b*				
1982	1,274		7,501	*b*					180,078	*c*			851		7,267	*b*		
1983							2,720	*c*	110,608	*c*								
1984	1,573	*b*	95,200	*b*					70,125	*c*			1,993		238,565			
1985	1,617		66,146										2,248		52,750			
1986	1,954		83,931				1,530	*d*	167,614	*d*			3,158		99,373			
1987	1,608		6,687	*b*			2,011	*d*	45,221	*d*			3,281		35,535			
1988	1,020		43,056		1,913		1,339	*d*	68,937	*d*			1,448		45,432		830	
1989	1,399		21,460	*b*									1,089					
1990	2,503		11,519	*b*									1,545		20,426	*b*		
1991	1,938		31,886										2,544		46,657			
1992	1,030	*b*	11,308	*b*									2,002	*b*	37,808	*b*		
1993	5,855		10,935	*b*									2,765		9,111	*b*		
1994	300	*b*					7,801		200,981				213	*b*				
1995	1,635						5,841		172,148		10,901		1,108					

(continued)

Appendix 1. — Continued.

Year	Aerial Index Estimates			Sonar, Tower, or Weir			Aerial Index Estimates		
	Chinook salmon	Chum salmon	Coho salmon	Chinook salmon	Chum salmon	Coho salmon	Chinook salmon	Chum salmon	Coho salmon
1996				2,955	108,450	8,037	624		
1997	1,140			3,186	51,139	9,472	1,510		
1998	1,027			4,034	67,720	5,417	*e* 1,249	*b*	
1999		*b*		3,444	32,587	2,963	870	*b*	
2000	1,018			1,609	24,785	8,451	427		
2001	1,065			1,148	*f* 2,134	*f* 15,896	*e* 570		
2002	1,447			4,123	44,194	3,577	977		
2003	1,116	*b*		4,336	22,461	8,231	1,578	*b*	
2004	2,879			8,045	64,883	11,146	1,317		
2005	1,715			2,239	20,127	5,303	1,492		
2006	590	*b*		6,463	102,260	23	*g* 824		
2007	1,758			4,504	69,642	9	*g* 976		
2008	278	*b*		4,242	57,259	2	*g* 262	*b*	
2009	80	*b*		3,004	8,770	4	*g* 1,664		
2010	537	*b*		2,413	72,893	10	*g* 849		
2011	620			5,213	100,473	0	*g* 1,141		
2012	NA			2,516	56,680	5	*g* 227	*b*	
2013	1,441			1,998	61,234	0	1,090		
SEG *h*	960 - 1,900			2,100 -4,900			640 - 1,600		
BEG *i*					>40,000				

a Counts for both forks were combined into Andreafsky River count.

b Incomplete survey and/or poor survey timing or conditions resulting in minimal or inaccurate count.

c Sonar count.

d Tower count.

e Incomplete count, missing data not estimated.

f Weir installed too late for an accurate count.

g Incomplete count, weir removed.

h Sustainable Escapement Goals.

i Biological Escapement Goals.

Appendix 2. — Historical daily Chinook salmon escapements recorded at the East Fork Andreafsky River weir 1994-2012. Data for 2001 were not used in calculations and are shown for informational purposes only. Boxes represent quartiles, highlighted boxes indicate midpoint in the run.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun				0							
16-Jun		0		0							
17-Jun		0		0		0					
18-Jun		0		0		0					
19-Jun		0	0	0		0			0	0	
20-Jun		1	0	0		0			0	0	
21-Jun		0	10	0		0			1	0	
22-Jun		1	0	0		0			20	0	
23-Jun		0	33	14	0	0			0	4	67
24-Jun		2	6	21	0	0			0	2	26
25-Jun		0	0	59	0	0			3	7	15
26-Jun		0	59	0	0	0			1	3	55
27-Jun		41	42	101	1	0			26	12	181
28-Jun		48	19	11	0	0			314	19	534
29-Jun	1	67	6	1	10	0			119	4	290
30-Jun	188	104	8	0	34	47	9		27	0	461
1-Jul	141	81	72	75	93	19	16		319	176	582
2-Jul	54	71	21	24	17	9	39		105	295	25
3-Jul	222	17	205	29	36	0	89		230	22	375
4-Jul	156	55	124	49	75	12	74		5	6	353
5-Jul	651	107	309	98	336	97	38		20	83	263
6-Jul	225	678	258	356	373	42	407		356	136	1,187
7-Jul	1,156	433	280	227	386	114	18		307	336	878
8-Jul	108	155	244	123	204	197	71		130	469	463
9-Jul	351	260	186	49	129	216	17		178	823	503
10-Jul	375	250	111	64	167	256	30		191	48	368
11-Jul	288	382	72	69	255	507	57		264	107	122
12-Jul	581	1,022	52	88	138	214	35		166	345	315
13-Jul	779	697	100	15	62	331	55		191	311	106
14-Jul	433	375	96	16	61	97	18		158	340	105
15-Jul	352	292	62	124	91	22	90	169	140	2	53
16-Jul	389	97	95	274	197	33	76	87	210	7	58
17-Jul	144	46	110	91	263	75	62	41	119	25	54
18-Jul	285	38	55	25	184	63	48	196	94	235	29
19-Jul	161	25	42	70	240	65	34	71	75	158	40
20-Jul	53	37	69	264	67	302	22	107	50	28	57
21-Jul	66	74	51	148	129	55	12	175	29	10	40
22-Jul	62	33	26	35	117	67	21	66	12	2	13
23-Jul	209	24	2	103	57	15	6	15	32	23	17
24-Jul	149	7	4	57	66	54	11	5	16	58	12
25-Jul	25	78	6	0	12	24	10	17	7	31	19
26-Jul	51	21	3	11	8	5	9	7	3	4	5
27-Jul	92	12	6	3	8	34	7	17	6	22	14
28-Jul	20	15	16	29	11	6	3	10	3	108	23
29-Jul	10	9	13	58	23	159	57	41	4	28	19
30-Jul	13	5	7	144	31	80	4	16	2	4	7
31-Jul	10	1	10	2	17	59	20	11	46	0	15
1-Aug	1	8	4	8	20	38	12	8	55	2	13
2-Aug		2	2	4	4	18	4	12	48	5	4
3-Aug		13	2	128	11	42	24	4	10	1	3
4-Aug		5	5	2	1	11	19	8	3	1	6
5-Aug		6	6	1	7	5	14	6	3	4	5
6-Aug		6	2	0	9	2	9	1	4	0	10
7-Aug		19	7	1	10	1	4	11	4	1	8
8-Aug - 23- Sept		121	37	115	74	51	58	47	17	29	247
Total	7,801	5,841	2,955	3,186	4,034	3,444	1,609	**	4,123	4,336	8,045

(continued)

Appendix 2. — Continued.

Date	2005	2006	2007	2008	2009	2010	2011	2012	2013
15-Jun									
16-Jun									
17-Jun									
18-Jun									
19-Jun			0						
20-Jun			0			0	0		
21-Jun			0	0		0	0		
22-Jun			0	0	0	0	0		
23-Jun			0	0	0	0	0		
24-Jun			0	0	0	0	0		
25-Jun			7	1	0	0	1		
26-Jun	16		2	0	0	1	1		
27-Jun	2		0	5	0	3	1		
28-Jun	42	0	0	1	0	0	0		
29-Jun	88	6	4	10	0	13	9		
30-Jun	238	51	7	7	0	16	25	13	
1-Jul	11	40	134	14	1	18	29	3	
2-Jul	89	13	197	44	1	41	41	12	24
3-Jul	135	51	75	41	2	54	33	2	9
4-Jul	114	128	277	50	0	25	19	10	37
5-Jul	111	276	141	133	0	41	20	24	18
6-Jul	154	437	476	301	3	124	261	117	34
7-Jul	271	574	442	610	15	16	149	30	91
8-Jul	169	392	157	777	7	36	385	101	82
9-Jul	46	86	299	110	0	353	473	107	68
10-Jul	7	165	255	7	2	295	346	13	525
11-Jul	15	449	86	11	34	69	300	26	170
12-Jul	9	1,108	653	23	247	92	489	16	128
13-Jul	58	201	103	53	106	24	14	24	197
14-Jul	108	67	96	76	142	34	26	25	109
15-Jul	49	117	28	265	13	27	121	303	145
16-Jul	55	262	25	355	13	278	319	133	34
17-Jul	30	714	34	277	251	274	194	82	30
18-Jul	14	371	132	283	37	21	64	38	59
19-Jul	22	264	78	130	76	7	517	103	52
20-Jul	17	164	35	57	53	9	275	428	54
21-Jul	50	161	95	58	112	32	343	220	27
22-Jul	51	166	249	130	201	22	306	78	15
23-Jul	15	117	59	104	222	47	140	34	11
24-Jul	22	48	63	75	126	59	74	16	12
25-Jul	46	25	102	49	104	59	51	3	13
26-Jul	4	8	33	35	39	81	44	144	16
27-Jul	4	2	149	26	37	23	48	107	7
28-Jul	4		4	61	262	94	61	24	18
29-Jul	0		4	39	221	101	24	197	11
30-Jul	4		3	24	172	14	10	80	2
31-Jul	3				178	10		3	
1-Aug	2				171			1	
2-Aug	2				94				
3-Aug	8				62				
4-Aug	4								
5-Aug	8								
6-Aug	4								
7-Aug	3								
8-Aug – 23- Sept	135								
Total	2,239	6,463	4,504	4,242	3,004	2,413	5,213	2,517	1,998

Appendix 3. — Historical daily summer chum salmon escapement estimates recorded at the East Fork Andreafsky River weir 1994-2012. Data for 2001 were not used in calculations and are shown for informational purposes only. Boxes represent quartiles, highlighted boxes indicate midpoint in the run.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun				0							
16-Jun		52		1							
17-Jun		332		4		0					
18-Jun		191		71		0					
19-Jun		423	62	539		0			0	0	
20-Jun		2,198	424	981		0			0	0	
21-Jun		861	3,315	192		0			117	2	
22-Jun		1,170	1,036	53		0			1,782	87	
23-Jun		228	11,195	3,141	13	1			0	564	3,045
24-Jun		1,951	798	1,620	18	1			6	182	1,062
25-Jun		364	303	1,422	264	0			522	484	985
26-Jun		504	7,306	208	175	7			694	183	2,467
27-Jun		12,620	3,435	1,691	535	8			2,448	396	4,638
28-Jun		11,201	1,463	1,196	65	0			6,754	546	8,461
29-Jun	609	9,256	2,335	61	3,153	331			1,765	219	3,807
30-Jun	19,254	10,938	314	80	4,585	4,459	837		836	271	7,081
1-Jul	12,435	8,654	9,164	1,537	4,003	765	1,725		4,403	928	1,590
2-Jul	2,840	5,553	3,326	619	652	459	1,460		2,467	339	153
3-Jul	4,973	2,710	8,973	756	1,687	24	1,750		2,291	713	5,689
4-Jul	13,321	10,678	10,018	1,264	3,561	3,000	2,070		28	175	3,940
5-Jul	12,552	10,026	7,355	831	7,996	4,605	2,300		347	484	2,011
6-Jul	4,043	23,584	3,351	3,428	6,030	1,185	3,717		4,423	1,051	1,791
7-Jul	27,527	8,514	3,124	2,980	4,696	1,619	72		2,254	1,376	2,474
8-Jul	5,251	732	4,771	2,440	3,088	1,569	1,548		845	2,476	2,096
9-Jul	3,883	4,808	3,500	1,799	845	1,754	942		2,265	2,025	1,990
10-Jul	12,416	6,473	2,303	3,195	1,003	2,135	727		1,732	244	2,069
11-Jul	6,896	6,072	1,275	1,792	4,003	1,897	855		1,221	412	1,609
12-Jul	8,424	3,973	1,497	1,738	4,401	501	477		1,099	1,762	1,815
13-Jul	14,628	4,552	1,680	1,062	829	710	911		1,055	586	1,071
14-Jul	11,611	2,990	1,038	1,302	1,248	1,223	352		544	254	896
15-Jul	8,275	2,874	935	3,222	2,160	412	638	196	1,014	33	605
16-Jul	4,690	3,449	1,280	2,441	2,747	507	551	133	581	123	569
17-Jul	4,886	2,739	774	1,150	3,038	547	464	95	420	445	465
18-Jul	4,532	1,495	852	715	1,580	494	377	229	492	1,078	326
19-Jul	2,977	651	1,848	624	1,365	666	290	102	392	708	217
20-Jul	1,091	1,150	1,721	1,220	370	816	206	74	192	681	276
21-Jul	1,351	807	1,116	800	335	242	424	228	153	283	142
22-Jul	2,228	591	605	668	304	240	280	72	61	47	59
23-Jul	1,320	742	246	405	248	201	116	29	201	306	77
24-Jul	868	290	291	313	200	173	84	32	98	222	116
25-Jul	1,349	1,214	196	121	220	131	159	155	26	348	171
26-Jul	1,977	521	365	339	166	73	130	116	22	218	85
27-Jul	2,196	605	278	400	130	132	64	110	60	220	69
28-Jul	841	265	738	219	202	92	43	88	123	389	73
29-Jul	564	211	334	234	145	245	173	78	17	220	52
30-Jul	524	248	272	131	115	242	70	37	36	61	37
31-Jul	410	94	260	86	140	200	172	10	119	80	34
1-Aug	239	160	93	134	191	158	89	24	81	104	17
2-Aug		81	158	81	91	118	125	40	33	111	21
3-Aug		147	91	182	76	124	109	28	36	40	28
4-Aug		59	192	48	56	117	83	17	40	91	22
5-Aug		77	132	101	73	45	57	13	3	182	25
6-Aug		115	215	77	71	17	31	2	7	52	31
7-Aug		76	163	29	104	11	5	7	13	85	33
8-Aug – 23-Sept		1,879	1,934	1,396	743	331	302	219	76	575	593
Total	200,981	172,148	108,450	51,139	67,720	32,587	24,785	**	44,194	22,461	64,883

(continued)

Appendix 3. — Continued.

Date	2005	2006	2007	2008	2009	2010	2011	2012	2013
15-Jun									
16-Jun									
17-Jun									
18-Jun									
19-Jun			0						
20-Jun			0			0	146		
21-Jun			0	1		0	19		
22-Jun			2	57	0	0	2		
23-Jun			0	30	0	2	21		
24-Jun			29	73	6	0	1,294		
25-Jun			1166	34	10	6	2,935		
26-Jun	256		348	1160	0	410	381		
27-Jun	9		70	902	5	285	1,088		
28-Jun	424	1,272	362	865	19	53	684		
29-Jun	473	2,822	1644	1920	289	5435	2,522		
30-Jun	432	14,912	1785	1095	78	3088	4,900	3,773	
1-Jul	239	10,229	3581	1718	228	1534	5,090	698	
2-Jul	1,081	2,395	3463	2963	417	3196	7,241	1,728	3,082
3-Jul	1,063	1,272	2694	2367	114	5269	6,694	366	1,988
4-Jul	1,238	2,822	4834	4572	10	3338	1,486	3,536	6,132
5-Jul	993	14,912	4725	8125	17	2689	2,975	5,011	3,444
6-Jul	1,218	10,229	3852	5285	1137	7086	6,172	8,580	4,841
7-Jul	1,839	2,395	1980	2598	583	1136	2,753	3,040	7,385
8-Jul	1,270	7,291	1919	2763	42	5336	5,628	4,313	4,760
9-Jul	1,112	14,018	4559	1438	11	7921	8,644	2,657	2,582
10-Jul	1,370	9,389	6021	193	176	3878	4,639	1,615	6,777
11-Jul	195	7,738	1455	300	549	1808	6,598	1,975	4,017
12-Jul	197	4,225	2362	1276	634	1470	5,788	976	2,882
13-Jul	1,458	3,614	1219	1955	269	702	683	989	2,731
14-Jul	1,242	2,351	1394	2019	547	1391	1,725	1,829	1,034
15-Jul	557	3,478	860	2322	411	1405	4,069	4,181	476
16-Jul	449	2,631	1867	3646	498	4138	2,990	1,265	936
17-Jul	196	1,609	3294	1497	483	2378	3,911	1,027	614
18-Jul	246	725	3834	1324	224	281	1,006	470	1,028
19-Jul	141	330	1349	896	176	400	1,554	1,356	1,473
20-Jul	523	1,127	468	691	186	525	1,319	1,610	831
21-Jul	493	1,441	700	594	235	1189	1,498	952	851
22-Jul	182	2,564	1895	572	332	930	930	1,295	876
23-Jul	167	1,637	1417	535	175	785	581	539	616
24-Jul	54	1,294	1208	383	164	896	425	266	598
25-Jul	80	924	1784	335	113	1030	468	286	378
26-Jul	28	944	645	142	165	686	478	1,001	339
27-Jul	32	921	444	191	72	585	466	412	229
28-Jul	100		95	149	148	956	384	184	138
29-Jul	112		179	168	47	284	181	536	84
30-Jul	74		139	105	33	200	105	179	112
31-Jul	79				33	192		28	
1-Aug	50				25			7	
2-Aug	25				64				
3-Aug	23				45				
4-Aug	5								
5-Aug	24								
6-Aug	30								
7-Aug	14								
8-Aug - 23-Sept	334								
Total	20,127	131,511	69,642	57,259	8,770	72,893	100,473	56,680	61,234

Appendix 4. — Historical daily coho salmon escapement estimates recorded at the East Fork Andreafsky River weir, 1995-2013. Data for 1998 and 2001 were not used in calculations and are shown for informational purposes only. From 2005 to 2013 all coho numbers are incomplete due to weir removal timing.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15-Jun - 4-Aug	1	85	0	16	9	52	0	1	12	11
5-Aug	0	20	0	8	4	14	0	0	2	8
6-Aug	0	10	0	5	4	13	0	0	4	10
7-Aug	1	26	1	16	0	12	0	0	28	14
8-Aug	1	20	0	9	0	35	0	0	25	16
9-Aug	3	26	0	5	1	79	0	0	27	98
10-Aug	8	138	0	8	2	125	0	1	5	62
11-Aug	12	105	0	3	2	89	0	0	9	115
12-Aug	5	50	10	4	5	51	0	0	19	86
13-Aug	3	16	47	111	1	211	0	0	40	78
14-Aug	3	11	35	71	1	137	1	0	194	71
15-Aug	9	19	6	9	0	64	22	0	146	63
16-Aug	5	276	8	61	5	34	33	0	98	56
17-Aug	11	92	7		2	23	5	0	50	48
18-Aug	24	179	12		0	137	5	0	2	163
19-Aug	41	1,052	13	8	0	108	51	1	7	384
20-Aug	24	100	50		1	333	532	0	21	170
21-Aug	95	149	414		42	303	270	0	11	185
22-Aug	246	9	222		48	59	312	3	3	150
23-Aug	305	32	22		0	10	343	6	24	80
24-Aug	414	12	16		26	44	583	3	263	185
25-Aug	245	1,539	577		8	533	217	7	1,744	243
26-Aug	692	449	150		4	1,401	857	0	634	453
27-Aug	1,436	5	10		4	1,643	382	0	288	17
28-Aug	368	1	24		3	279	403	2	197	4
29-Aug	938	179	2,335	371	0	626	103	0	243	38
30-Aug	335	1,489	2,714	618	2	278	1,078	0	552	178
31-Aug	265	374	122	568	1	192	2,264	0	729	490
1-Sep	444	374	73	336	411	358	1,576	0	172	505
2-Sep	863	147	53	17	162	238		14	107	897
3-Sep	14	100	421	80	1,255	162		29	9	234
4-Sep	29	250	355	490	704	160		43	646	167
5-Sep	6	337	219	228	122	39		640	275	609
6-Sep	21	78	514	591	40	46		738	14	1,550
7-Sep	164	84	435	12	0	52		413	42	1,011
8-Sep	2,403	24	169	0	14	48		345	459	578
9-Sep	854	16	223	94	19	55		103	268	337
10-Sep	391	1	52	555	41	94	85	237	9	535
11-Sep	127	0	83	1,104	20	31	30	117	211	259
12-Sep	95	0	64	6		79	20	726	231	13
13-Sep		0	16	13		30	43	113	399	57
14-Sep		0				22	21	35	8	37
15-Sep		3				16	16		4	201
16-Sep		160				28				240
17-Sep						19				241
18-Sep						3				42
19-Sep						5				157
20-Sep						5				
21-Sep						34				
22-Sep						32				
23-Sep						10				
Total	10,901	8,037	9,472	5,417	2,963	8,451	9,252	3,577	8,231	11,146

****** = incomplete count, missing data not estimated.

***** = incomplete count, weir removed.

(continued)

Appendix 4. — Continued.

Date	2005	2006	2007	2008	2009	2010	2011	2012	2013
15-Jun - 4-Aug	2	23	9	2	4	10	0	5	0
5-Aug	0								
6-Aug	0								
7-Aug	1								
8-Aug	4								
9-Aug	2								
10-Aug	2								
11-Aug	0								
12-Aug	0								
13-Aug	0								
14-Aug	4								
15-Aug	9								
16-Aug	37								
17-Aug	6								
18-Aug	173								
19-Aug	24								
20-Aug	4								
21-Aug	2								
22-Aug	2								
23-Aug	21								
24-Aug	101								
25-Aug	19								
26-Aug	102								
27-Aug	128								
28-Aug	1,084								
29-Aug	475								
30-Aug	647								
31-Aug	218								
1-Sep	23								
2-Sep	23								
3-Sep	476								
4-Sep	483								
5-Sep	77								
6-Sep	128								
7-Sep	207								
8-Sep	80								
9-Sep	194								
10-Sep	343								
11-Sep	202								
12-Sep									
13-Sep									
14-Sep									
15-Sep									
16-Sep									
17-Sep									
18-Sep									
19-Sep									
20-Sep									
21-Sep									
22-Sep									
23-Sep									
Total	5,303	23	9	2	4	10	0	5	

** = incomplete count, missing data not estimated.
* = incomplete count, weir removed.

Appendix 5. — Historical daily pink salmon escapement estimates recorded at the East Fork Andreafsky River weir, 1994-2011. Data for 2001 were not used in calculations and are shown for informational purposes only.

Date	1994	1995	1996	1997	1998	1999	2000	2001
15-Jun				0				
16-Jun		0		0				
17-Jun		0		0		0		
18-Jun		0		0		0		
19-Jun		0	12	0		0		
20-Jun		0	4	0		0		
21-Jun		0	40	0		0		
22-Jun		0	42	0		0		
23-Jun		0	157	0	0	0		
24-Jun		0	67	0	0	0		
25-Jun		0	24	0	8	0		
26-Jun		0	153	0	3	0		
27-Jun		1	218	1	22	0		
28-Jun		0	80	0	2	0		
29-Jun	8	2	78	0	112	0		
30-Jun	451	3	41	0	258	0	18	
1-Jul	409	13	184	2	750	0	5	
2-Jul	194	4	107	0	65	0	383	
3-Jul	305	4	347	0	704	0	52	
4-Jul	780	5	1,254	1	1,008	0	224	
5-Jul	1,027	9	6,678	0	3,595	0	162	
6-Jul	772	98	4,676	2	4,136	2	1,2	
7-Jul	4,026	77	3,834	0	4,292	2	354	
8-Jul	1,736	4	7,472	1	2,968	1	972	
9-Jul	4,263	18	8,905	2	1,382	2	1,6	
10-Jul	4,744	33	10,290	1	1,169	10	897	
11-Jul	3,313	23	5,822	2	9,872	20	7,8	
12-Jul	8,447	100	4,662	4	21,285	17	2,7	
13-Jul	13,568	109	9,484	6	11,399	18	7,0	
14-Jul	24,842	94	11,760	1	5,846	7	1,4	
15-Jul	22,460	81	9,754	35	21,785	2	966	10
16-Jul	20,612	64	13,476	31	11,087	2	1,2	4
17-Jul	27,053	60	12,222	13	23,930	4	1,4	5
18-Jul	18,277	31	12,682	5	31,639	4	1,6	26
19-Jul	20,792	15	14,282	6	27,014	14	1,9	15
20-Jul	23,511	30	17,477	4	7,204	69	2,1	47
21-Jul	10,872	40	18,780	4	4,672	38	2,5	61
22-Jul	8,975	48	13,018	4	2,460	41	1,1	19
23-Jul	17,692	77	4,744	5	3,512	25	454	18
24-Jul	15,120	25	3,778	2	7,181	23	609	38
25-Jul	3,566	216	2,473	0	5,278	22	1,0	124
26-Jul	10,225	88	3,365	6	3,496	11	335	53
27-Jul	13,821	37	3,768	13	1,186	24	731	68
28-Jul	15,302	20	5,036	9	1,496	11	612	94
29-Jul	9,736	14	1,035	20	1,134	26	415	56
30-Jul	6,159	29	205	26	982	13	202	22
31-Jul	2,476	11	706	2	1,315	2	244	10
1-Aug	996	22	169	7	962	-10	145	17
2-Aug		23	107	2	474	5	129	19
3-Aug		44	127	8	440	48	81	17
4-Aug		20	300	3	303	60	65	12
5-Aug		17	237	3	127	28	49	5
6-Aug		22	61	1	73	14	33	10
7-Aug		37	109	1	104	13	17	10
8-Aug - 23-Sept		304	535	196	478	175	161	60
Total	316,530	1,972	214,837	429	227,20	743	43,	820

(continued)

Appendix 5. — Continued.

Date	2002	2003	2004	2005	2006	2007	2008	2009
15-Jun								
16-Jun								
17-Jun								
18-Jun								
19-Jun	0	0				0		
20-Jun	0	0				0		
21-Jun	52	0				0	0	
22-Jun	462	0				0	10	0
23-Jun	0	0	19			0	13	0
24-Jun	22	0	15			0	5	0
25-Jun	148	3	24			0	83	0
26-Jun	338	0	102	0		0	214	0
27-Jun	431	6	189	2		0	343	0
28-Jun	7,808	4	341	10	43	0	393	0
29-Jun	5,076	3	374	27	54	3	964	0
30-Jun	1,509	0	1,671	97	314	2	580	0
1-Jul	6,192	16	1,049	15	281	5	883	0
2-Jul	3,345	12	140	89	134	38	2,197	2
3-Jul	6,876	13	1,186	453	326	36	1,969	2
4-Jul	257	13	2,327	652	1,431	143	4,814	0
5-Jul	1,626	16	5,175	985	281	184	19,968	1
6-Jul	13,433	24	4,203	2,334	134	251	19,672	6
7-Jul	10,268	94	17,994	3,071	326	164	24,204	26
8-Jul	4,815	172	13,079	2,443	1,431	125	16,687	38
9-Jul	8,765	259	16,044	1,692	1,325	278	4,900	9
10-Jul	12,942	16	22,171	1,266	3,092	461	331	9
11-Jul	10,764	43	15,664	1,453	8,096	112	247	57
12-Jul	9,207	185	15,661	385	13,219	315	645	73
13-Jul	9,161	173	15,313	2,865	7,941	74	1,351	84
14-Jul	7,819	189	25,780	5,106	11,605	129	1,559	94
15-Jul	6,958	28	16,578	2,489	13,327	103	3,432	94
16-Jul	8,224	13	22,322	1,992	14,844	367	6,532	74
17-Jul	6,724	96	16,143	678	7,204	518	6,793	90
18-Jul	8,701	702	14,713	945	1,117	843	7,304	125
19-Jul	6,058	459	15,635	450	2,858	524	7,461	99
20-Jul	1,983	288	28,631	1,140	2,816	642	5,356	94
21-Jul	1,239	98	19,851	1,852	8,969	342	6,588	239
22-Jul	564	18	12,446	814	17,205	1,040	2,759	133
23-Jul	1,060	107	9,880	723	18,690	393	2,995	183
24-Jul	1,092	107	9,973	256	18,357	306	5,388	191
25-Jul	385	124	12,352	158	13,319	1,231	2,986	83
26-Jul	429	43	12,184	425	16,186	475	2,450	104
27-Jul	232	47	10,978	307	11,435	403	4,106	107
28-Jul	305	130	9,686	889		143	7,982	156
29-Jul	49	140	7,911	744		206	8,201	45
30-Jul	62	29	5,421	687		236	7,543	32
31-Jul	232	65	4,258	341				38
1-Aug	131	69	2,669	430				28
2-Aug	61	54	2,342	140				50
3-Aug	73	33	1,206	79				29
4-Aug	34	34	843	55				
5-Aug	11	35	890	91				
6-Aug	13	17	729	114				
7-Aug	7	20	789	41				
8-Aug - 23-Sept	48	306	2,719	245				
Total	165,991	4,303	399,670	39,030	196,360	10,092	189,908	2,395

(continued)

Appendix 5. — Continued.

Date	2010	2011	2012	2013
15-Jun				
16-Jun				
17-Jun				
18-Jun				
19-Jun				
20-Jun	0	0		
21-Jun	0	0		
22-Jun	2	0		
23-Jun	0	0		
24-Jun	2	2		
25-Jun	8	11		
26-Jun	69	0		
27-Jun	105	0		
28-Jun	8	0		
29-Jun	1,756	0	0	
30-Jun	2,641	0	568	
1-Jul	1,284	0	198	
2-Jul	8,021	0	271	3
3-Jul	7,348	0	51	0
4-Jul	3,307	0	534	2
5-Jul	1,633	0	1,756	4
6-Jul	4,088	0	3,492	2
7-Jul	246	0	2,018	11
8-Jul	3,532	1	3,435	7
9-Jul	25,726	0	2,385	6
10-Jul	28,744	0	1,091	14
11-Jul	12,550	1	1,258	24
12-Jul	10,095	0	2,303	45
13-Jul	6,127	0	3,183	20
14-Jul	5,145	0	2,109	14
15-Jul	6,053	7	4,607	13
16-Jul	37,603	10	979	21
17-Jul	42,852	11	2,062	7
18-Jul	12,174	8	1,219	25
19-Jul	10,984	76	4,173	22
20-Jul	13,445	48	8,378	12
21-Jul	12,256	103	7,618	29
22-Jul	15,201	132	8,040	47
23-Jul	11,412	77	2,915	29
24-Jul	6,490	79	2,700	48
25-Jul	10,558	67	2,389	37
26-Jul	9,282	93	1,747	32
27-Jul	9,708	183	1,056	31
28-Jul	7,151	165	978	38
29-Jul	2,908	86	648	29
30-Jul	4,733	59	305	17
31-Jul	3,811		161	
1-Aug			55	
2-Aug				
3-Aug				
4-Aug				
5-Aug				
6-Aug				
7-Aug				
8-Aug - 23-Sept				
Total	339,058	1,219	74,682	589

Appendix 6. — Historical daily sockeye salmon estimates recorded at the East Fork Andreafsky River weir, 1994-2013. Data for 2001 were not used in calculations and are shown for informational purposes only.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
15-Jun				0						
16-Jun		0		0						
17-Jun		0		0		0				
18-Jun		0		0		0				0
19-Jun		0	0	0		0			0	0
20-Jun		0	0	0		0			0	0
21-Jun		0	0	0		0			0	0
22-Jun		0	0	0		0			0	0
23-Jun		0	0	0	0	0			0	0
24-Jun		0	0	0	0	0			0	0
25-Jun		0	0	0	0	0			0	0
26-Jun		0	0	0	0	0			0	0
27-Jun		0	0	0	0	0			0	0
28-Jun		0	0	0	0	0			0	0
29-Jun	0	0	0	1	3	1			0	1
30-Jun	0	0	0	0	0	0	0		0	0
1-Jul	0	2	0	1	0	0	0		0	0
2-Jul	0	0	6	0	0	0	0		0	0
3-Jul	0	1	9	0	0	0	0		0	0
4-Jul	0	0	16	0	0	1	0		0	1
5-Jul	0	1	6	0	0	8	0		0	4
6-Jul	0	4	1	0	0	1	0		1	4
7-Jul	2	0	7	1	0	2	0		0	4
8-Jul	1	0	0	0	3	6	0		0	2
9-Jul	0	0	10	0	0	2	0		0	2
10-Jul	0	1	6	1	0	0	0		0	13
11-Jul	1	1	6	0	4	7	1		0	14
12-Jul	0	0	8	0	8	0	0		1	4
13-Jul	0	0	7	0	3	0	0		0	4
14-Jul	0	0	9	2	0	0	1		0	1
15-Jul	1	0	4	1	10	0	0	0	0	8
16-Jul	2	0	5	2	7	1	0	0	3	13
17-Jul	0	0	4	1	5	5	0	0	1	23
18-Jul	2	3	8	1	13	2	0	1	2	0
19-Jul	0	0	7	0	17	0	0	0	3	9
20-Jul	3	1	6	1	3	2	0	0	1	3
21-Jul	2	2	3	0	1	0	0	0	1	1
22-Jul	0	0	4	2	6	0	0	4	1	8
23-Jul	0	0	4	1	3	0	0	1	2	11
24-Jul	1	0	1	0	1	0	0	2	4	11
25-Jul	1	8	1	0	9	1	0	1	0	2
26-Jul	1	2	3	0	0	0	0	0	0	15
27-Jul	5	1	3	0	0	0	0	2	1	25
28-Jul	4	0	2	3	6	0	0	0	2	19
29-Jul	3	1	0	3	5	0	0	0	0	9
30-Jul	2	3	0	2	5	1	1	0	0	18
31-Jul	0	0	5	0	4	1	1	0	4	7
1-Aug	2	4	1	3	5	0	0	0	3	16
2-Aug		0	1	2	1	0	0	0	3	4
3-Aug		3	1	1	6	0	1	1	0	11
4-Aug		0	4	0	4	1	1	0	0	40
5-Aug		0	1	0	3	0	1	0	0	5
6-Aug		0	4	0	2	2	0	0	1	11
7-Aug		1	3	0	5	0	0	0	0	9
8-Aug - 23-Sept	0	74	82	71	46	69	72	3	9	162
Total	33	113	248	100	188	113	79	15	43	494

(continued)

* * = incomplete count, missing data

* = incomplete count, weir

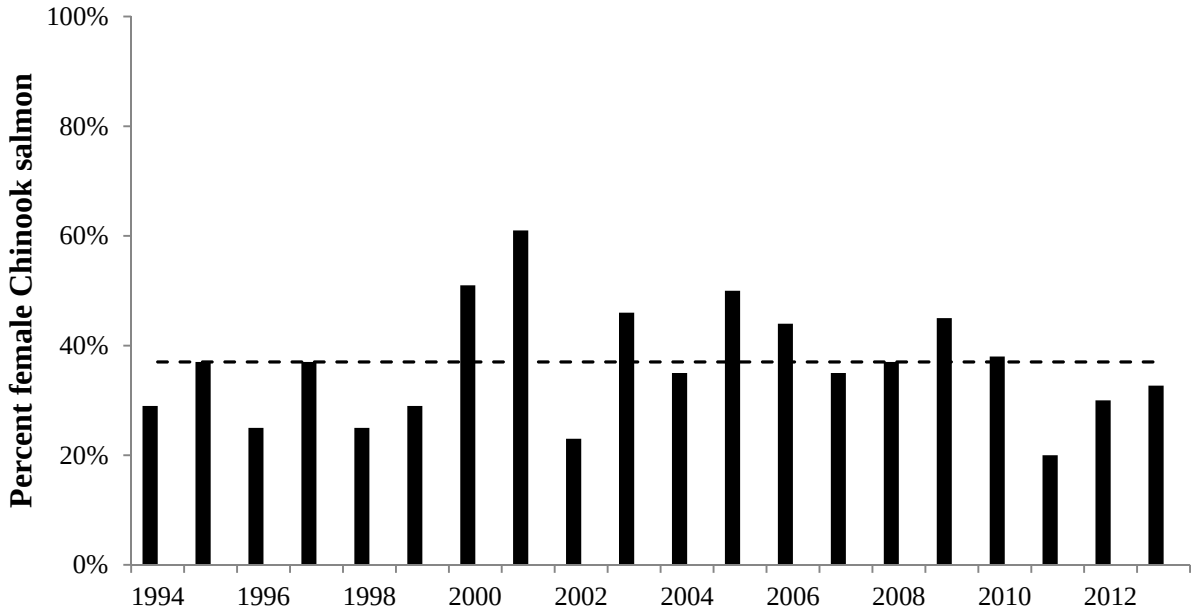
Appendix 6. — Continued.

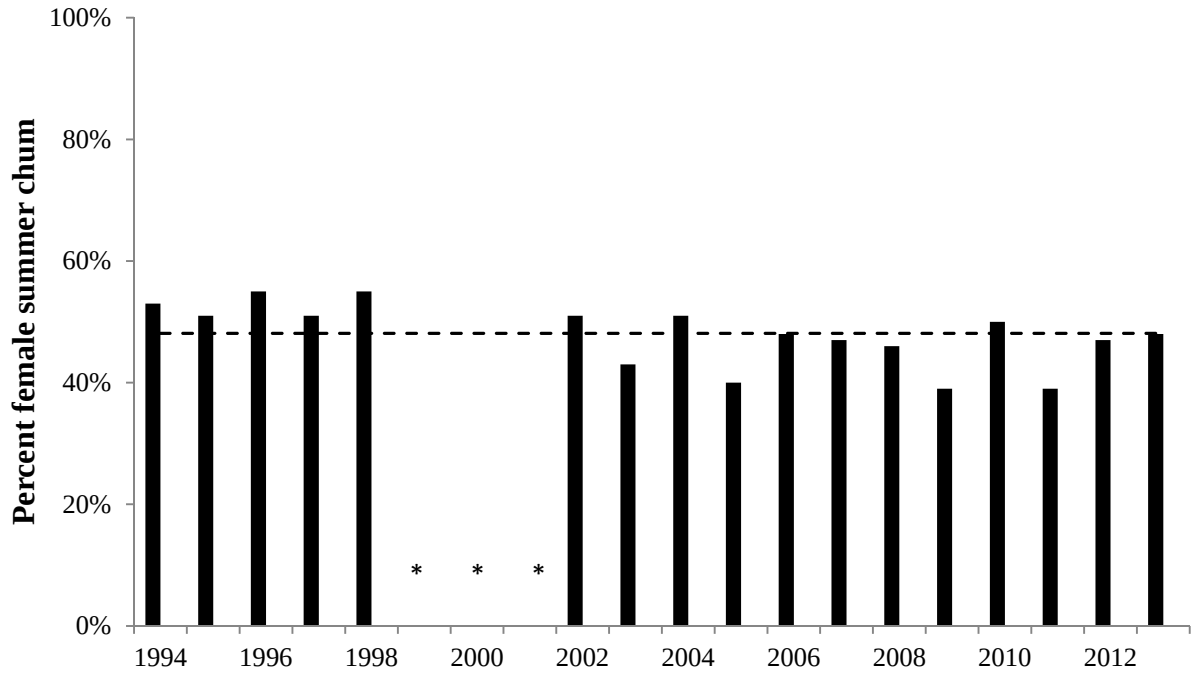
Date	2005	2006	2007	2008	2009	2010	2011	2012	2013
15-Jun									
16-Jun									
17-Jun									
18-Jun									
19-Jun			0						
20-Jun			0			0	1		
21-Jun			0	0		0	0		
22-Jun			0	0	0	0	0		
23-Jun			0	0	0	1	3		
24-Jun			0	0	0	0	5		
25-Jun			0	0	0	1	12		
26-Jun	0		0	0	0	2	10		
27-Jun	0		1	0	0	0	16		
28-Jun	0	0	0	0	0	0	18		
29-Jun	0	0	0	0	0	9	31	0	
30-Jun	1	0	0	0	1	1	33	0	
1-Jul	1	0	6	1	0	1	42	0	0
2-Jul	0	0	8	16	0	2	33	2	0
3-Jul	0	9	2	10	0	2	24	1	23
4-Jul	0	50	17	29	0	6	6	4	10
5-Jul	0	15	5	27	0	10	15	13	17
6-Jul	0	27	0	15	5	5	24	6	57
7-Jul	0	16	6	18	3	3	15	6	25
8-Jul	0	12	6	25	0	6	16	3	37
9-Jul	0	13	9	3	1	9	36	2	43
10-Jul	0	12	6	2	3	15	23	3	19
11-Jul	0	16	2	2	5	5	16	1	19
12-Jul	1	20	6	5	9	2	8	2	8
13-Jul	0	4	2	5	2	3	4	3	2
14-Jul	15	3	1	3	5	1	8	3	2
15-Jul	0	7	1	15	2	1	15	2	4
16-Jul	1	5	2	6	2	7	11	5	6
17-Jul	0	18	4	5	6	2	5	1	12
18-Jul	0	21	5	2	3	2	2	0	10
19-Jul	0	26	5	5	4	5	13	5	2
20-Jul	0	21	3	6	1	5	3	4	9
21-Jul	2	32	1	5	2	5	14	2	4
22-Jul	0	12	4	2	2	3	7	1	6
23-Jul	0	31	4	9	5	12	4	1	6
24-Jul	5	19	4	3	4	3	10	1	4
25-Jul	5	15	8	5	3	6	1	0	4
26-Jul	2	13	8	12	6	9	4	4	2
27-Jul	5	9	4	12	1	7	7	3	1
28-Jul	4		5	7	4	3	1	0	1
29-Jul	7		5	7	2	3	2	2	2
30-Jul	1		1	10	1	3	2	1	
31-Jul	1				0	9		3	
1-Aug	0				2			0	
2-Aug	0				0				
3-Aug	0				0				
4-Aug	0								
5-Aug	2								
6-Aug	4								
7-Aug	0								
8-Aug - 23-Sept	94								
Total	151	426	141	272	84	169	500	84	335

Appendix 7. — Percent female by year for Chinook and chum salmon. Asterisks denote unavailable data.

Year	Chinook	Summer chum
1994	29%	53%
1995	37%	51%
1996	25%	55%
1997	37%	51%
1998	25%	55%
1999	29%	*
2000	51%	*
2001	61%	*
2002	23%	51%
2003	46%	43%
2004	35%	51%
2005	50%	40%
2006	44%	48%
2007	35%	47%
2008	37%	46%
2009	45%	39%
2010	38%	50%
2011	20%	39%
2012	30%	47%
2013	33%	48%
Average	37%	48%

Appendix 8. — Annual estimates of percent female for Chinook salmon and summer chum salmon from 1994-2013 at the East Fork Andreafsky River weir, Alaska. Dashed line denotes average percent female from 1994-2012.





*data unavailable

Appendix 9. —Water quality data at the E.F. Andreafsky River weir, Alaska, 2013. Reported values are the arithmetic mean for daily readings.

Date	Water Temp(°C)	Height(cm)	Dissolved Oxygen(mg/L)	Conductivity(µs/cm)	pH
22-Jun	14.5	167	12.3	75.15	7.97
23-Jun	14.2	167	10.6	74.4	7.85
24-Jun	15.2	159	11.2	77.4	7.24
25-Jun	17.4	152	12.1	80.65	7.915
26-Jun	16.6	147	12.1	81.15	7.745
27-Jun	16.6	131	11.8	79.95	7.79
28-Jun	16.9	121	12.8	82.8	8.02
30-Jun	15.8	114	11.4	82.2	7.955
1-Jul	13	98	10.8	73.8	7.84
2-Jul	11.5	95	10.4	64	7.745
3-Jul	10.5	95	11.6	62.3	7.9
4-Jul	9.9	94	12.2	61.05	7.74
5-Jul	9.5	97	11.3	58.2	7.62
6-Jul	8.6	99	10.5	55.6	7.595
7-Jul	9.9	97	10.2	56.05	7.655
8-Jul	11.1	93	11	58.1	7.755
9-Jul	11.5	79	10.3	60.3	7.805
10-Jul	13.4	90	11	62.45	7.945
11-Jul	13.2	111	11.5	61	7.84
12-Jul	14.7	98	10	61	7.285
13-Jul	16	86	10.3	69.1	7.645
14-Jul	16.6	79	10.2	73.55	7.65
15-Jul	12.1	74	10.3	73.85	7.69
16-Jul	12.6	78	10	69.75	7.76
17-Jul	11.5	90	10	64.15	7.805
18-Jul	11.2	89	10.4	62.1	8.045
19-Jul	11.5	85	10	63.75	8.245
20-Jul	10.6	92	7.6	61.85	8.035
21-Jul	11	98	7.3	60.85	8.295
22-Jul	13	94	8	65.7	8.05
23-Jul	13.6	85	8.3	66.25	8.635
24-Jul	16.3	83	8.7	72.15	8.325
25-Jul	16.2	79	8	76	8.395
26-Jul	17.2	74	7. 5	78.65	8.46
27-Jul	18.3	72	7.5	82.2	8.075
28-Jul	19.7	69	7.5	86.3	8.075
29-Jul	17.3	66	7.3	85.1	8.12
30-Jul	17.1	64	6.7	84.45	8.595
Average	12.7	98	9.22	71.22	7.96

Appendix 10.— East Fork Andreafsky white fish gonadosomatic index data, 2013. Only humpback whitefish were collected in 2013.

Date	Species	Sex	Length (mm)	Total Weight(g)	Egg Weight(g)	Egg weight/Total weight*100=GSI
19-July	Humpback	Female	476	1590	110	6.92
21-July	Humpback	Female	477	1680	140	8.33
21-July	Humpback	Female	463	1530	110	7.19
21-July	Humpback	Female	417	1080	70	6.48
23-July	Humpback	Male	463	1440	-	-
23-July	Humpback	Female	480	1810	130	7.18
23-July	Humpback	Female	448	1280	80	6.25
23-July	Humpback	Female	464	1400	80	5.71
28-July	Humpback	Female	453	1320	94.5	7.16
29-July	Humpback	Female	460	1490	108	7.25
29-July	Humpback	Female	443	1235	78	6.32
29-July	Humpback	Female	449	1460	142	9.73
29-July	Humpback	Female	441	1200	64.5	5.38
29-July	Humpback	Male	450	1323	-	-