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Abundance and Run Timing of Adult Pacific Salmon in the East Fork Andreafsky River, Yukon Delta National Wildlife Refuge, Alaska, 2014

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Cover Photo: USFWS East Fork Andreafsky River weir 2014 video footage.

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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 June 17 to July 31, 2014. Fish counting was conducted using a video monitoring system, which was installed at the beginning of the season. An estimated 5,949 Chinook Salmon *Oncorhynchus tshawytscha* migrated through the weir. Six age groups were identified from the 329 Chinook Salmon sampled, with age 1.3 (79%) predominant. The sex composition was 44% female. An estimated 37,793 summer Chum Salmon *O. keta* also migrated through the weir. Four age groups were identified from 660 summer Chum Salmon sampled, with ages 0.3 (72%) and 0.4 (20%) predominant. The sex composition was 33% female. Additionally, 58,995 Pink Salmon *O. gorbuscha*, and 223 Sockeye Salmon *O. nerka*, were counted passing through the weir. Other species counted during 2014 included 1,805 Whitefish (Coregoninae), 2 Dolly Varden *Salvelinus malma*, 13 Northern Pike *Esox lucius*, and 1 Arctic Grayling *Thymallus arcticus.*

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

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run timing or the estimated abundance of returning stocks, individual stocks may be incidentally over-harvested in the subsistence, commercial, or sport fisheries.

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, Pink Salmon, and 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 basin (Vania et al. 2002; Kruse 1998, JTC 2015). 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 2015). 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 2014 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; (5) identify and count other fish species passing through the weir; and (6) incorporate fish counting using video to the weir project.

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 13 to July 16, 2014, in the East Fork Andreafsky River (62^o 07'N, 162^o 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, 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) for in-season reporting. Additionally, a YSI 6920 (Yellow Springs, Ohio) sonde was installed to record water temperature, dissolved oxygen, conductivity, pH, and turbidity every 15 minutes.

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. A fish trap was installed on one passage chute 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 June 17 to July 31.

In 2014, a video weir monitoring system was installed and tested on the East Fork to count fish. The video monitoring proposal was funded by the USFWS Yukon River Salmon Research and Management Fund under project RM47-14 *"Incorporation of Video Recording Technology to* *the existing Weir Project on the East Fork Andreafsky River"*. The components of the system were fabricated at the Fairbanks Field Office between February and May 2014. The video system components consisted of a camera box and passage chute, which were attached to the upriver side of the fish trap. The camera, a CAM-AM070, was built by Applied MicroVideo (Wrightsville Beach, NC). This video camera box funneled fish into a narrow passage that enabled review of motion capture footage to identify species, and determine sex for Chinook Salmon, without handling fish in real time and for future assessment. Video determination of Chinook Salmon sex was not used for post season analysis. The system was enabled with motion capture software (Security Spy/ Bensoftware). The system was tested during the first 2 weeks of operation to ensure that traditional manual counts and video counts did not differ by more than 3% for Chinook Salmon and Chum Salmon. After the test period, fish counting from motion capture files was used for the remainder of the season.

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.

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 Salmon and summer Chum Salmon. Biological sampling of Chinook Salmon and summer 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 for age, length and sex.

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 fish 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 June 17 through July 31, 2014. The average river stage height during weir operations was 0.67 m and ranged from 0.46 m to 0.84 cm (Figure 2). Water temperature during weir operations averaged 15.3°C and ranged from 11.1 to 21.7°C (Figure 2, Appendix 9).

Biological Data

Counts at the weir included 5,949 Chinook Salmon, 37,793 summer Chum Salmon, 58,995 Pink Salmon, 223 Sockeye Salmon, and 23 Coho Salmon through the passage chute in 2014 (Table 1). Non-salmon species recorded moving through the passage chute included 1,805 Whitefish, 13 Northern Pike, 2 Dolly Varden, and 1 Arctic Grayling.

The East Fork Andreafsky River weir recorded above-average Chinook Salmon escapement in 2014 (Figure 3). However, productivity remained low across the Yukon River basin (JTC 2015). The summer Chum Salmon escapement recorded at the weir in 2014 was also below average (Figure 4), but the basin-wide escapements were above average (JTC 2015).

Chinook Salmon

The 2014 Chinook Salmon escapement estimate (5,949 fish) was above the 1994-2013 historical average of 4,104 fish (Figure 3; Appendix 2). Peak passage (2,555) occurred on July 8 (Table 1; Appendix 2); this was also the highest single day Chinook Salmon passage recorded at the weir since the projects inception in 1994. The 2014 run timing was near average. The first quartile passed on July 6 (historical average July 5), the mid-point of the run at the weir was July 8 (historical average July 9), and the third quartile passage date was July 9 (historical average July 15) (Appendix 2). Chinook Salmon passage calculations were not adjusted for differences in project duration among years.

Of the 5,949 Chinook Salmon that passed through the weir in 2014, 329 (6% of the run) were sampled for age, sex, and length composition. Female Chinook Salmon lengths ranged from 539 to 951 mm, and male Chinook Salmon ranged from 351 to 857 mm (Table 3). Of the 329 Chinook Salmon sampled for age composition, 12 (4%) were classified as unreadable, primarily due to scale regeneration. The weighted age composition of the remaining 317 sampled Chinook Salmon included six age groups: age-1.1 (0.01%) age-1.2 (7.6%), age-1.3 (79.0%), age-1.4 (12.0%), and ages 2.2 and 2.3 at (<0.01%) (Table 4). Females composed an estimated 44.2% of the overall escapement. This estimate is seven percentage points higher than the historical average sex ratio of 37% females (Appendices 7 and 8). The age distributions between female and male Chinook Salmon were both predominantly age-1.3, but females were somewhat older. Females were predominately ages 1.3 (76.0%) and 1.4 (23.6%), whereas males were predominately ages 1.2 (13.5%) and 1.3 (81.3%).

In 2014, the USFWS assisted ADF&G in the collection of egg samples from Chinook Salmon for use in a Yukon River basin-wide thiamine analysis project. This effort was funded by the North Pacific Research Board under the title "Exploration of AYK Chinook salmon egg thiamine levels as a potential mechanism contributing to recent low productivity patterns" (NPRB project 1422), submitted by Sean Larson of the ADF&G. The sampling was conducted from August 13-18, and covered both forks of the Andreafsky River, however eggs were only collected on the East Fork. Sampling occurred between points N62°14'27.59", W162°40'28.98" and N62°36'18.1", W162°6'35.56". This equates to a reach of the East Fork of the Andreafsky River that is 16 to 64 kilometers from the weir location. In total, 58 Chinook salmon were captured using hook and line. Samples were collected from 20 female Chinook Salmon. Of these, 18 produced at least 10 eggs, 1 female produced fewer than 10 eggs, and otoliths and eggs were taken from one fresh female carcass. One fish mortality was caused by hooking injuries. The report for these collections is included in Appendix 10.

Summer Chum Salmon

The 2014 summer Chum Salmon escapement estimate of 37,793, fish was below the 1994-2013 historical average of 72,594 (Figure 4; Appendix 1 and 3), and did not meet ADF&Gs Biological Escapement Goal (BEG) of >40,000 fish (JTC 2015). The 2014 run timing was average, and peak passage (4,943 fish) occurred on July 1 (Table 1; Figure 4). The first quartile passed on July 1 (historical average July 2), the mid-point of the run at the weir was July 6 (historical average July 6), and the third quartile passage date was July 11 (historical average July 12) (Appendix 3). Summer Chum Salmon passage calculations were not adjusted for differences in project duration among years.

Female summer Chum Salmon lengths ranged from 414 to 615 mm and males ranged from 256 to 686 mm (Table 2). There were 660 summer Chum Salmon sampled for age composition, with 30 (4.5%) classified as unreadable, primarily due to scale regeneration. The age composition of the remaining sampled summer Chum Salmon included four age groups: age-0.2 (01%), age-0.3 (72.3%), age-0.4 (20.2%) and age-0.5 (6.5%) (Table 5). Females comprised an estimated 33.2% of the overall escapement (Table 5). This estimate is 15 percentage points lower than the historical sex ratio (Appendix 8). Female summer Chum Salmon were predominantly age-0.3 (75.0%) and male summer Chum Salmon were also predominantly age 0.3 (71.0%).

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 2014 escapement through the weir (58,995 fish) was less than the 1994-2012 historical even-year average of 216,773. 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 13 (5,890 fish) (Table 1, Appendix 5).

Sockeye Salmon

The 2014 Sockeye Salmon escapement estimate of 223 fish was above the 1995-2013 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. Post season Chinook Salmon sampling in the Andreafsky led to the identification of a spawning congregation of Sockeye Salmon. This group contained approximately 100 individuals in a tributary of the East Fork located at 61° 36' 14.9"N, 162° 07' 07.1"W. A nomination to the Anadromous Waters Catalogue was submitted (report attached in Appendix 10).

Coho Salmon

The weir has not operated when Coho Salmon typically migrate on the Andreafsky River since 2005; subsequently only 23 were counted in 2014.

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 are 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.

An investigation of spawning and rearing locations for Sockeye Salmon, recommended in prior reports, was addressed to some degree in 2014 with the discovery of a large spawning aggregation. If possible, this spawning location should be surveyed again in 2015 to confirm annual usage of this site.

With the limited commercial fishery since 2003 for Arctic Lamprey *Lethenteron camschaticum* and the historical subsistence use, the East Fork Andreafsky River weir project has also collected important baseline biological data on lamprey spp.; 2014 was the third year for this data collection.

The use of video weir technology was largely successful and will continue for the foreseeable future. Prior to 2014, Whitefish had only been identified to the sub-family level. With the enhanced capabilities of video monitoring Whitefish will be identified to species. Additionally, if concerns about the Coho Salmon population in Yukon Drainage become a priority, the East Fork Andreafsky weir should be considered a suitable data collection site, as Coho Salmon data had been collected at this location prior to 2005.

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Table 1. — 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, 2014.

	Chinook Salmon		Summer Chum Salmon		Pink Salmon		Sockeye Salmon	Whitefish	Northern Pike	Arctic Grayling	Dolly Varden
Date	**Daily**	**Cum**	**Daily**	**Cum**	**Daily**	**Cum**	**Daily**	**Daily**	**Daily**	**Daily**	**Daily**
17-Jun	0	0	6	6	0	0	0	16	0	1	0
18-Jun	0	0	14	20	2	2	0	19	1	0	0
19-Jun	0	0	0	20	1	3	0	21	3	0	0
20-Jun	0	0	75	95	1	4	0	43	2	0	0
21-Jun	0	0	69	164	4	8	1	28	0	0	0
22-Jun	1	1	5	169	6	14	2	19	0	0	0
23-Jun	3	4	668	837	48	62	5	24	0	0	0
24-Jun	4	8	143	980	11	73	1	39	0	0	0
25-Jun	4	12	323	1,303	74	147	2	23	0	0	0
26-Jun	1	13	154	1,457	40	187	0	15	0	0	0
27-Jun	23	36	391	1,848	114	301	6	30	0	0	0
28-Jun	29	65	632	2,480	772	1,073	3	38	0	0	0
29-Jun	0	65	2	2,482	45	1,118	0	29	0	0	0
30-Jun	39	104	3,862	6,344	491	1,609	20	39	0	0	0
1-Jul	252	356	4,934	11,278	1,468	3,077	17	53	0	0	0
2-Jul	66	422	1,883	13,161	1,226	4,303	6	49	0	0	0
3-Jul	176	598	1,412	14,573	964	5,267	12	32	0	0	0
4-Jul	83	681	2,573	17,146	812	6,079	3	43	0	0	0
5-Jul	393	1,074	1,537	18,683	1,468	7,547	12	58	0	0	0
6-Jul	714	1,788	3,204	21,887	947	8,494	19	77	0	0	0
7-Jul	69	1,857	23	21,910	209	8,703	4	67	1	0	0
8-Jul	2,555	4,412	2,795	24,705	2,098	10,801	16	42	1	0	0
9-Jul	167	4,579	591	25,296	1,511	12,312	5	90	0	0	0
10-Jul	191	4,770	1,224	26,520	1,929	14,241	2	46	2	0	0
11-Jul	129	4,899	1,906	28,426	3,750	17,991	12	51	0	0	0
12-Jul	108	5,007	1,088	29,514	3,167	21,158	10	61	0	0	0
13-Jul	231	5,238	1,192	30,706	5,890	27,048	13	68	0	0	0
14-Jul	73	5,311	337	31,043	3,070	30,118	2	40	0	0	0
15-Jul	51	5,362	747	31,790	4,380	34,498	7	12	0	0	0
16-Jul	41	5,403	420	32,210	2,563	37,061	3	25	0	0	0
17-Jul	9	5,412	218	32,428	2,021	39,082	3	4	0	0	0
18-Jul	146	5,558	909	33,337	4,858	43,940	6	24	1	0	0
19-Jul	22	5,580	299	33,636	640	44,580	4	43	0	0	1
20-Jul	97	5,677	505	34,141	2,471	47,051	7	21	0	0	0
21-Jul	24	5,701	765	34,906	1,425	48,476	5	55	0	0	0
22-Jul	45	5,746	533	35,439	1,713	50,189	2	47	0	0	0
23-Jul	38	5,784	501	35,940	1,391	51,580	1	44	0	0	0
24-Jul	29	5,813	505	36,445	1,280	52,860	3	44	0	0	0
25-Jul	48	5,861	315	36,760	772	53,632	1	56	0	0	0
26-Jul	21	5,882	240	37,000	1,192	54,824	3	44	0	0	0
27-Jul	23	5,905	233	37,233	1,133	55,957	3	35	2	0	0
28-Jul	15	5,920	121	37,354	937	56,894	2	29	0	0	0
29-Jul	7	5,927	158	37,512	897	57,791	0	43	0	0	0
30-Jul	12	5,939	135	37,647	400	58,191	0	56	0	0	1
31-Jul	10	5,949	146	37,793	804	58,995	0	63	0	0	0
Total	5,949		37,793		58,995		223	1,805	13	1	2

Table 2. —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 in 2014 at the E.F. Andreafsky River weir, Alaska.

Female						Male					
Age	N	Mean	Median	SE	Range	Age	N	Mean	Median	SE	Range
Chinook Salmon											
1.2	0*					1.1	6	405	412	8.4	364-419
1.3	116	703	699	5.8	539-832	1.2	23	529	534	9.1	436-599
1.4	28	847	853	11.3	735-951	1.3	130	693	684	5	269-570
1.5	0	0	0	0	0	1.4	4	825	835	18.7	772-857
UNK	6					UNK	6				
All Ages	151					All Ages	178				
Chum Salmon											
0.2	3	460	483	23.2	414-484	0.2	2	398	398	141.5	256-539
0.3	147	508	507	2.4	442-592	0.3	271	542	539	2	437-686
0.4	45	548	546	5.3	457-611	0.4	100	576	577	3.6	459-650
0.5	15	563	562	5.7	520-615	0.5	47	600	597	5.2	509-657
UNK	11					UNK	19				
All Ages	221					All Ages	439				

*age 1.2 are considered male

Table 3. — Age and sex ratio estimates by stratum of Chinook Salmon sampled at East Fork Andreafsky River weir, Alaska, 2014. 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							
					2011	2010	2009		2008		2007	
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
Jun 17-Jun 29	65	16	0	56.3%(12.8)	6.7%(1.3)	13.3%(9.1)	73.3%(11.8)	0.0%(0.0)	6.7%(4.1)	0.0%(0.0)	0.0%(0.0)	0.0%(0.0)
Jun 30-Jul 6	1,723	159	9	48.4%(4.0)	2.7%(2.7)	14.0%(2.8)	78.0%(3.4)	0.01%(0.7)	4.0%(1.6)	0.01%(0.7)	0.0%(0.0)	0.0%(0.0)
Jul 7-Jul 14	3523	120	3	42.5%(4.5)	0.0%(0.0)	5.1%(2.0)	82.1%(3.6)	0.0%(0.0)	12.8%(3.1)	0.0%(0.0)	0.0%(0.0)	0.0%(0.0)
Jul 15-Jul 31	638	34	0	41.2%(8.6)	2.9%(2.9)	2.9%(2.9)	64.7%(8.3)	0.0%(0.0)	29.4%(7.9)	0.0%(0.0)	0.0%(0.0)	0.0%(0.0)
Total	5,949	329	12	44.2%(3.1)	1.2%(0.5)	7.5%(1.5)	78.9%(2.5)	0.0%(0.0)	12.0%(2.1)	0.01%(0.2)	0.0%(0.0)	0.0%(0.0)
Female	2,631	151	6	-	0.0%(0.0)	0.0%(0.0)	76.0%(3.9)	0.01%(0.2)	24.6%(3.9)	0.01%(0.0)	0.0%(0.0)	0.0%(0.0)
Male	3,318	178	6	-	2.1%(0.9)	13.5%(2.6)	81.3%(3.0)	0.01%(0.03)	2.7%(1.4)	0.0%(0.4)	0.0%(0.0)	0.0%(0.0)

Table 4. — Age and sex ratio estimates by stratum of summer Chum Salmon sampled at East Fork Andreafsky River weir, Alaska, 2014. 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 and age				
					2011	2010	2009	2008	2007
Strata Dates	Run Size (*N*)	Samples Size (*n*)	Unknown Age	Percent Female	0.2	0.3	0.4	0.5	0.6
Jun 17-Jun 26	1,457	174	11	30.5%(3.5)	0.0%(0.0)	45.4%(3.9)	31.9%(3.7)	22.7%(3.3)	0.0%(0.0)
Jun 27-Jul 04	15,689	160	9	28.8%(3.6)	1.0%(0.7)	71.5%(3.7)	19.9%(3.3)	8.0%(2.2)	0.0%(0.0)
Jul 05-Jul 12	12,368	173	5	33.5%(3.6)	1.0%(0.6)	76.2%(3.3)	17.9%(3.0)	5.3%(1.7)	0.0%(0.0)
Jul 13-Jul 31	8,279	153	5	41.8%(4.0)	2.0%(1.2)	73.0%(3.7)	22.3%(3.4)	2.7%(1.3)	0.0%(0.0)
Total	37,793	660	30	33.2%(2.1)	1.0%(0.4)	72.4%(2.0)	20.2%(1.8)	6.5%(1.1)	0.0%(0.0)
Female	12,564	221	11	-	1.5%(0.1)	75.0%(3.4)	19.1%(3.1)	4.5%(1.6)	0.0%(0.0)
Male	25,229	439	19	-	1.0%(0.7)	71.1%(2.5)	21.0%(2.3)	7.5%(1.5)	0.0%(0.0)

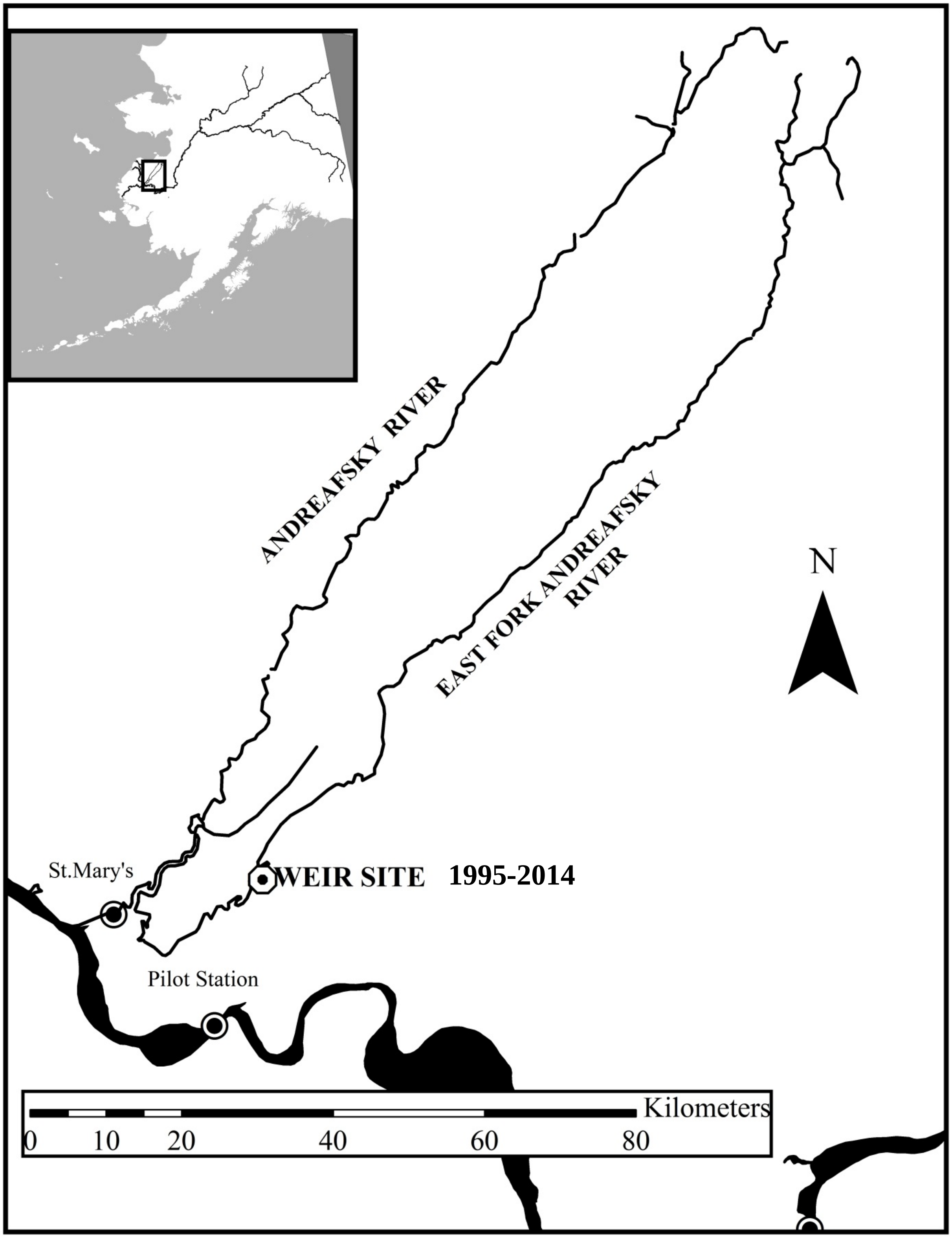


Figure 1. — Weir location on the East Fork Andreafsky River, Alaska, 1995-2014.

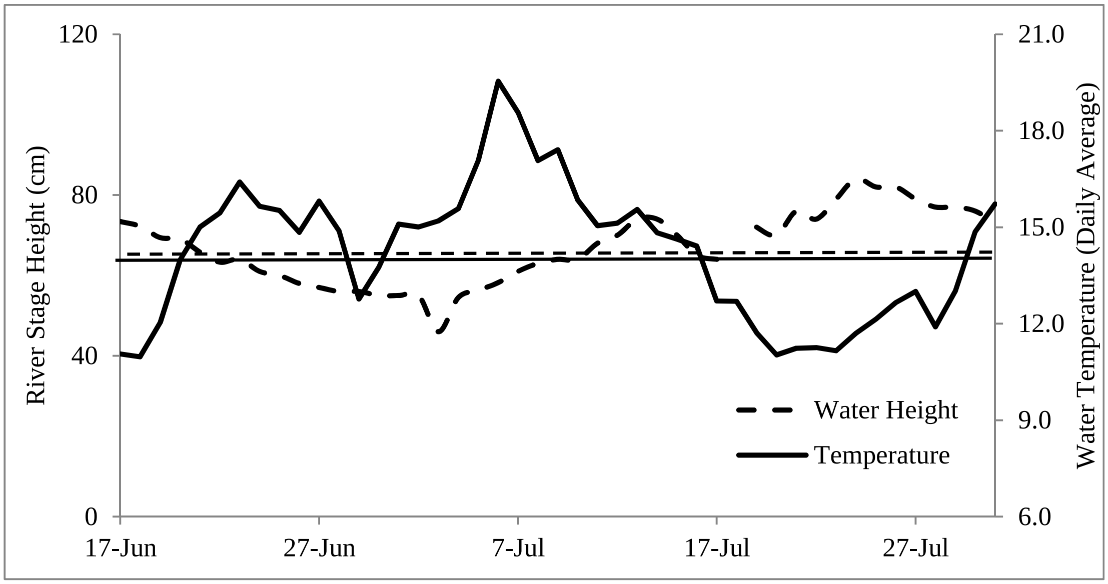


Figure 2. — River stage heights (cm) and water temperatures (°C) at the East Fork Andreafsky River weir, 2014, with seasonal averages. Solid line indicates seasonal average water temperature. Dashed line indicates seasonal average water height.

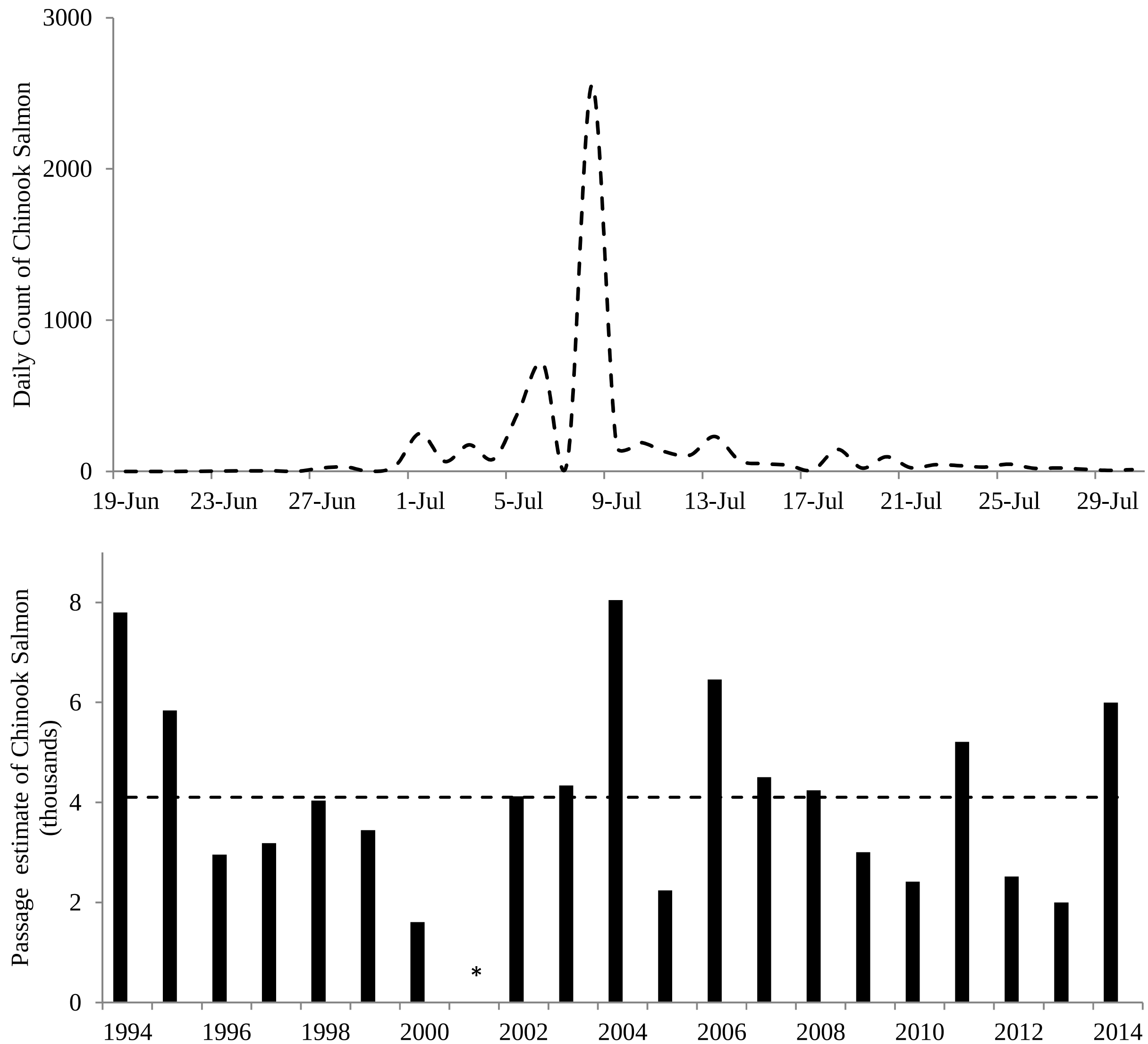


Figure 3. —Daily count (2014) and annual escapement (1994-2014) estimates of Chinook Salmon migrating through the East Fork Andreafsky River weir, Alaska. Historical average is represented by the dashed, horizontal line. Asterisk denotes missing annual count due to high water.

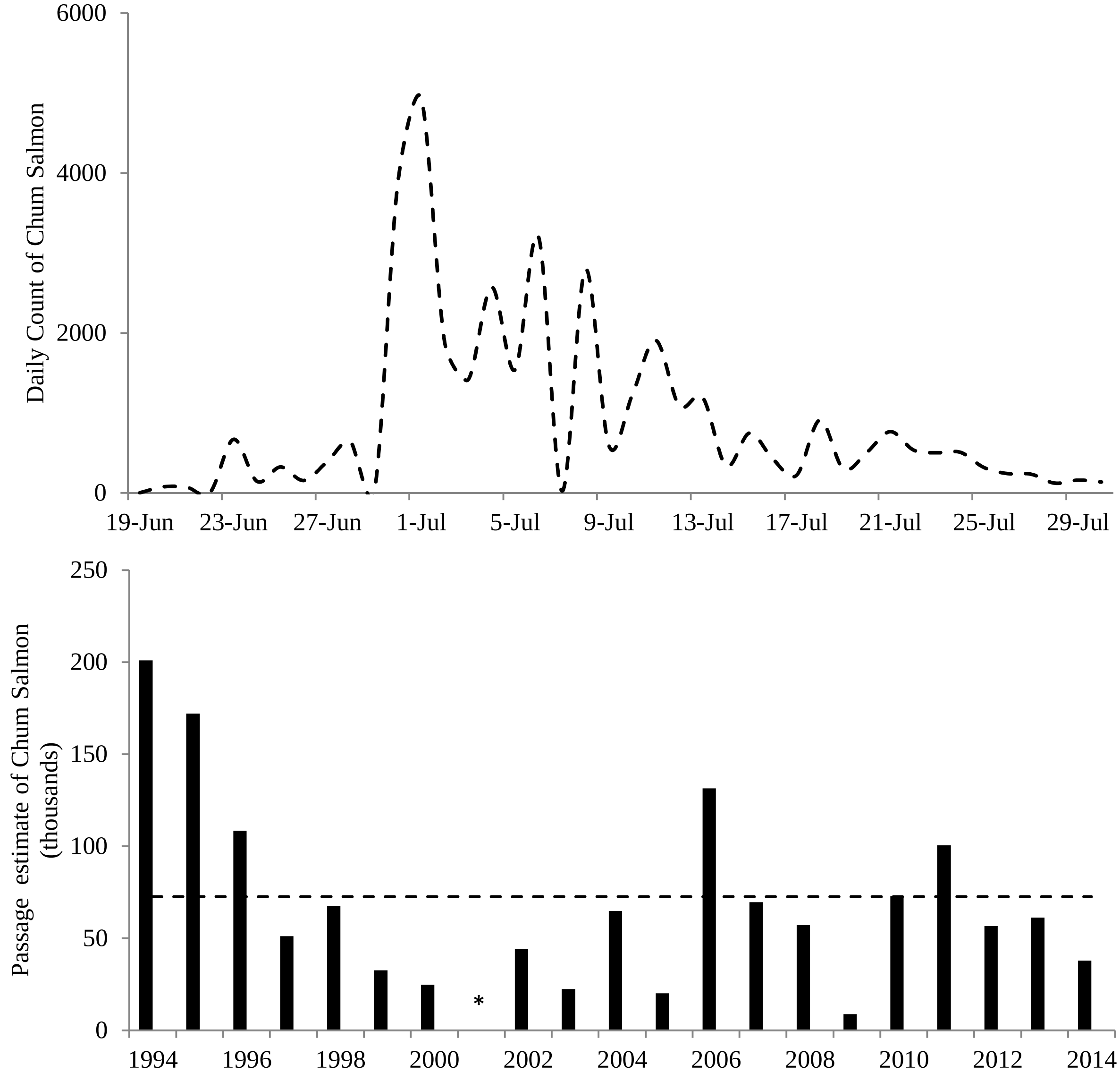


Figure 4. — Daily count (2014) and annual escapement (1994-2014) estimates of summer Chum Salmon migrating through the East Fork Andreafsky River weir, Alaska. Historical average is represented by the dashed, horizontal line. Asterisk denotes missing annual count due to high water.

Appendix 1. — Historical Chinook Salmon, summer Chum Salmon, and Coho Salmon escapement estimates recorded for the Andreafsky River, Alaska, 1954-2014. Data provided by ADF&G from JTC (2015).

	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		East Fork Andreafsky River						Main stem Andreafsky River		
		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		
1999		*b*			3,444	32,587	2,963	870		
2000		1,018	2,094		1,609	24,785	8,451	427 *b*	18,989	
2001		1,065			1,148 *f*	2,134 *f*	15,896 *e*	570 *b*		
2002		1,447			4,123	44,194	3,577	977		
2003		1,116 *b*			4,336	22,461	8,231	1,578		
2004		2,879			8,045	64,883	11,146	1,317		
2005		1,715			2,239	20,127	5,303	1,492 *b*		
2006		590 *b*	3,100		6,463	102,260	23 *g*	824	617	
2007		1,758			4,504	69,642	9 *g*	976		
2008		278 *b*	9,300		4,242	57,259	2 *g*	262	25,850	
2009		80 *b*	736		3,004	8,770	4 *g*	1,664	3,877	
2010		537 *b*	1,982		2,413	72,893	10 *g*	849 *b*	24,380	
2011		620	12,889		5,213	100,473	0 *g*	1,141	10,020	
2012		*b*			2,516	56,680	5 *g*	227		
2013		1,441	10,965		1,998	61,234	0 *g*	1,090	9,685	
2014		*b*			5,949	37,793	23 *g*	1,695 *b*		
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 1994-2014. 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- Sep		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	2014
15-Jun										
16-Jun										
17-Jun										0
18-Jun										0
19-Jun			0							0
20-Jun			0			0	0			0
21-Jun			0	0		0	0			0
22-Jun			0	0	0	0	0			1
23-Jun			0	0	0	0	0			3
24-Jun			0	0	0	0	0			4
25-Jun			7	1	0	0	1			4
26-Jun	16		2	0	0	1	1			1
27-Jun	2		0	5	0	3	1			23
28-Jun	42	0	0	1	0	0	0			29
29-Jun	88	6	4	10	0	13	9			0
30-Jun	238	51	7	7	0	16	25	13		39
1-Jul	11	40	134	14	1	18	29	3		252
2-Jul	89	13	197	44	1	41	41	12	24	66
3-Jul	135	51	75	41	2	54	33	2	9	176
4-Jul	114	128	277	50	0	25	19	10	37	83
5-Jul	111	276	141	133	0	41	20	24	18	393
6-Jul	154	437	476	301	3	124	261	117	34	714
7-Jul	271	574	442	610	15	16	149	30	91	69
8-Jul	169	392	157	777	7	36	385	101	82	2555
9-Jul	46	86	299	110	0	353	473	107	68	167
10-Jul	7	165	255	7	2	295	346	13	525	191
11-Jul	15	449	86	11	34	69	300	26	170	129
12-Jul	9	1,108	653	23	247	92	489	16	128	108
13-Jul	58	201	103	53	106	24	14	24	197	231
14-Jul	108	67	96	76	142	34	26	25	109	73
15-Jul	49	117	28	265	13	27	121	303	145	51
16-Jul	55	262	25	355	13	278	319	133	34	41
17-Jul	30	714	34	277	251	274	194	82	30	9
18-Jul	14	371	132	283	37	21	64	38	59	146
19-Jul	22	264	78	130	76	7	517	103	52	22
20-Jul	17	164	35	57	53	9	275	428	54	97
21-Jul	50	161	95	58	112	32	343	220	27	24
22-Jul	51	166	249	130	201	22	306	78	15	45
23-Jul	15	117	59	104	222	47	140	34	11	38
24-Jul	22	48	63	75	126	59	74	16	12	29
25-Jul	46	25	102	49	104	59	51	3	13	48
26-Jul	4	8	33	35	39	81	44	144	16	21
27-Jul	4	2	149	26	37	23	48	107	7	23
28-Jul	4		4	61	262	94	61	24	18	15
29-Jul	0		4	39	221	101	24	197	11	7
30-Jul	4		3	24	172	14	10	80	2	12
31-Jul	3				178	10		3		10
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- Sep	135									
Total	2,239	6,463	4,504	4,242	3,004	2,413	5,213	2,517	1,998	5,949

Appendix 3. — Historical daily summer Chum Salmon escapement estimates recorded at the East Fork Andreafsky River weir 1994-2014. 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-Sep		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	2014
15-Jun										
16-Jun										
17-Jun										6
18-Jun										14
19-Jun			0							0
20-Jun			0			0	146			75
21-Jun			0	1		0	19			69
22-Jun			2	57	0	0	2			5
23-Jun			0	30	0	2	21			668
24-Jun			29	73	6	0	1,294			143
25-Jun			1166	34	10	6	2,935			323
26-Jun	256		348	1160	0	410	381			154
27-Jun	9		70	902	5	285	1,088			391
28-Jun	424	1,272	362	865	19	53	684			632
29-Jun	473	2,822	1644	1920	289	5435	2,522			2
30-Jun	432	14,912	1785	1095	78	3088	4,900	3,773		3862
1-Jul	239	10,229	3581	1718	228	1534	5,090	698		4934
2-Jul	1,081	2,395	3463	2963	417	3196	7,241	1,728	3,082	1883
3-Jul	1,063	1,272	2694	2367	114	5269	6,694	366	1,988	1412
4-Jul	1,238	2,822	4834	4572	10	3338	1,486	3,536	6,132	2573
5-Jul	993	14,912	4725	8125	17	2689	2,975	5,011	3,444	1537
6-Jul	1,218	10,229	3852	5285	1137	7086	6,172	8,580	4,841	3204
7-Jul	1,839	2,395	1980	2598	583	1136	2,753	3,040	7,385	23
8-Jul	1,270	7,291	1919	2763	42	5336	5,628	4,313	4,760	2795
9-Jul	1,112	14,018	4559	1438	11	7921	8,644	2,657	2,582	591
10-Jul	1,370	9,389	6021	193	176	3878	4,639	1,615	6,777	1224
11-Jul	195	7,738	1455	300	549	1808	6,598	1,975	4,017	1906
12-Jul	197	4,225	2362	1276	634	1470	5,788	976	2,882	1088
13-Jul	1,458	3,614	1219	1955	269	702	683	989	2,731	1192
14-Jul	1,242	2,351	1394	2019	547	1391	1,725	1,829	1,034	337
15-Jul	557	3,478	860	2322	411	1405	4,069	4,181	476	747
16-Jul	449	2,631	1867	3646	498	4138	2,990	1,265	936	420
17-Jul	196	1,609	3294	1497	483	2378	3,911	1,027	614	218
18-Jul	246	725	3834	1324	224	281	1,006	470	1,028	909
19-Jul	141	330	1349	896	176	400	1,554	1,356	1,473	299
20-Jul	523	1,127	468	691	186	525	1,319	1,610	831	505
21-Jul	493	1,441	700	594	235	1189	1,498	952	851	765
22-Jul	182	2,564	1895	572	332	930	930	1,295	876	533
23-Jul	167	1,637	1417	535	175	785	581	539	616	501
24-Jul	54	1,294	1208	383	164	896	425	266	598	505
25-Jul	80	924	1784	335	113	1030	468	286	378	315
26-Jul	28	944	645	142	165	686	478	1,001	339	240
27-Jul	32	921	444	191	72	585	466	412	229	233
28-Jul	100		95	149	148	956	384	184	138	121
29-Jul	112		179	168	47	284	181	536	84	158
30-Jul	74		139	105	33	200	105	179	112	135
31-Jul	79				33	192		28		146
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-Sep	334									
Total	20,127	131,511	69,642	57,259	8,770	72,893	100,473	56,680	61,234	37,793

Appendix 4. — Historical daily Coho Salmon escapement estimates recorded at the East Fork Andreafsky River weir, 1995-2014. 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	2014
15-Jun - 4-Aug	2	23*	9*	2*	4*	10*	0*	5*	0*	23*
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	0	23

** = 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, 1994-2014. 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	1,228	
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	1,680	
10-Jul	4,744	33	10,290	1	1,169	10	897	
11-Jul	3,313	23	5,822	2	9,872	20	7,849	
12-Jul	8,447	100	4,662	4	21,28	17	2,726	
13-Jul	13,568	109	9,484	6	11,39	18	7,044	
14-Jul	24,842	94	11,760	1	5,846	7	1,468	
15-Jul	22,460	81	9,754	35	21,78	2	966	10
16-Jul	20,612	64	13,476	31	11,08	2	1,206	4
17-Jul	27,053	60	12,222	13	23,93	4	1,446	5
18-Jul	18,277	31	12,682	5	31,63	4	1,686	26
19-Jul	20,792	15	14,282	6	27,01	14	1,926	15
20-Jul	23,511	30	17,477	4	7,204	69	2,170	47
21-Jul	10,872	40	18,780	4	4,672	38	2,549	61
22-Jul	8,975	48	13,018	4	2,460	41	1,143	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	1,055	12
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-Sep		304	535	196	478	175	161	60
Total	316,53	1,972	214,837	429	227,2	743	43,491	82

(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-Sep	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	2014
15-Jun					
16-Jun					
17-Jun					0
18-Jun					2
19-Jun					1
20-Jun	0	0			1
21-Jun	0	0			4
22-Jun	2	0			6
23-Jun	0	0			48
24-Jun	2	2			11
25-Jun	8	11			74
26-Jun	69	0			40
27-Jun	105	0			114
28-Jun	8	0			772
29-Jun	1,756	0	0		45
30-Jun	2,641	0	568		491
1-Jul	1,284	0	198		1,468
2-Jul	8,021	0	271	3	1,226
3-Jul	7,348	0	51	0	964
4-Jul	3,307	0	534	2	812
5-Jul	1,633	0	1,756	4	1,468
6-Jul	4,088	0	3,492	2	947
7-Jul	246	0	2,018	11	209
8-Jul	3,532	1	3,435	7	2,098
9-Jul	25,726	0	2,385	6	1,511
10-Jul	28,744	0	1,091	14	1,929
11-Jul	12,550	1	1,258	24	3,750
12-Jul	10,095	0	2,303	45	3,167
13-Jul	6,127	0	3,183	20	5,890
14-Jul	5,145	0	2,109	14	3,070
15-Jul	6,053	7	4,607	13	4,380
16-Jul	37,603	10	979	21	2,563
17-Jul	42,852	11	2,062	7	2,021
18-Jul	12,174	8	1,219	25	4,858
19-Jul	10,984	76	4,173	22	640
20-Jul	13,445	48	8,378	12	2,471
21-Jul	12,256	103	7,618	29	1,425
22-Jul	15,201	132	8,040	47	1,713
23-Jul	11,412	77	2,915	29	1,391
24-Jul	6,490	79	2,700	48	1,280
25-Jul	10,558	67	2,389	37	772
26-Jul	9,282	93	1,747	32	1,192
27-Jul	9,708	183	1,056	31	1,133
28-Jul	7,151	165	978	38	937
29-Jul	2,908	86	648	29	897
30-Jul	4,733	59	305	17	400
31-Jul	3,811		161		804
1-Aug			55		
2-Aug					
3-Aug					
4-Aug					
5-Aug					
6-Aug					
7-Aug					
8-Aug - 23-Sep					
Total	339,058	1,219	74,682	589	58,995

Appendix 6. — Historical daily Sockeye Salmon estimates recorded at the East Fork Andreafsky River weir, 1994-2014. 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-Sep	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 not estimated
* = incomplete count, weir

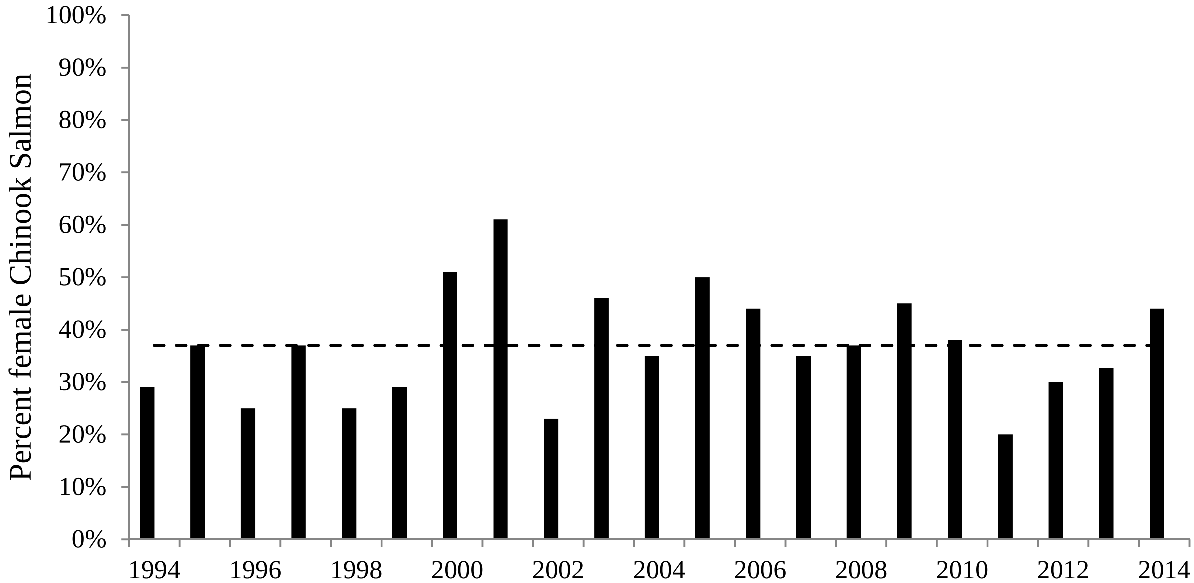
Appendix 6. — Continued.

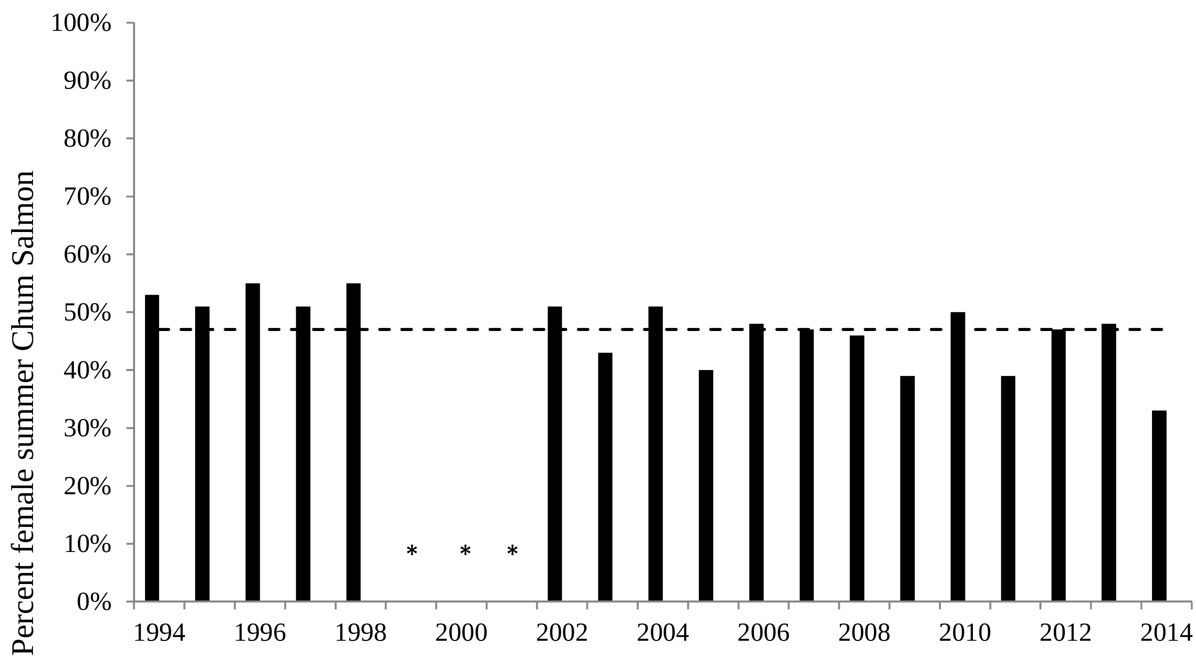
Date	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
15-Jun										
16-Jun										
17-Jun										0
18-Jun										0
19-Jun			0							0
20-Jun			0			0	1			0
21-Jun			0	0		0	0			1
22-Jun			0	0	0	0	0			2
23-Jun			0	0	0	1	3			5
24-Jun			0	0	0	0	5			1
25-Jun			0	0	0	1	12			2
26-Jun	0		0	0	0	2	10			0
27-Jun	0		1	0	0	0	16			6
28-Jun	0	0	0	0	0	0	18			3
29-Jun	0	0	0	0	0	9	31	0		0
30-Jun	1	0	0	0	1	1	33	0		20
1-Jul	1	0	6	1	0	1	42	0	0	17
2-Jul	0	0	8	16	0	2	33	2	0	6
3-Jul	0	9	2	10	0	2	24	1	23	12
4-Jul	0	50	17	29	0	6	6	4	10	3
5-Jul	0	15	5	27	0	10	15	13	17	12
6-Jul	0	27	0	15	5	5	24	6	57	19
7-Jul	0	16	6	18	3	3	15	6	25	4
8-Jul	0	12	6	25	0	6	16	3	37	16
9-Jul	0	13	9	3	1	9	36	2	43	5
10-Jul	0	12	6	2	3	15	23	3	19	2
11-Jul	0	16	2	2	5	5	16	1	19	12
12-Jul	1	20	6	5	9	2	8	2	8	10
13-Jul	0	4	2	5	2	3	4	3	2	13
14-Jul	15	3	1	3	5	1	8	3	2	2
15-Jul	0	7	1	15	2	1	15	2	4	7
16-Jul	1	5	2	6	2	7	11	5	6	3
17-Jul	0	18	4	5	6	2	5	1	12	3
18-Jul	0	21	5	2	3	2	2	0	10	6
19-Jul	0	26	5	5	4	5	13	5	2	4
20-Jul	0	21	3	6	1	5	3	4	9	7
21-Jul	2	32	1	5	2	5	14	2	4	5
22-Jul	0	12	4	2	2	3	7	1	6	2
23-Jul	0	31	4	9	5	12	4	1	6	1
24-Jul	5	19	4	3	4	3	10	1	4	3
25-Jul	5	15	8	5	3	6	1	0	4	1
26-Jul	2	13	8	12	6	9	4	4	2	3
27-Jul	5	9	4	12	1	7	7	3	1	3
28-Jul	4		5	7	4	3	1	0	1	2
29-Jul	7		5	7	2	3	2	2	2	0
30-Jul	1		1	10	1	3	2	1		0
31-Jul	1				0	9		3		0
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-Sep	94									
Total	151	426	141	272	84	169	500	84	335	223

Appendix 7. — Percent female by year for Chinook Salmon and summer 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	40%	48%
2014	44%	33%
Average	37%	47%

Appendix 8. — Annual estimates of percent female for Chinook Salmon and summer Chum Salmon from 1994-2014 at the East Fork Andreafsky River weir, Alaska. Dashed line denotes average percent female from 1994-2013.





*data unavailable

Appendix 9. —Water quality data at the E.F. Andreafsky River weir, Alaska, 2014. Reported values are the arithmetic mean for daily readings collected at 15 minute interavals.

Date	Water Temp(°C)	Height(cm)	Dissolved Oxygen(mg/L)	Conductivity(µs/cm)	pH
17-Jun	11.1	73	11.3	57.0	7.4
18-Jun	11.0	72	11.1	56.7	7.4
19-Jun	12.0	69	11.4	57.0	7.4
20-Jun	14.0	69	10.9	58.6	7.4
21-Jun	15.0	66	10.6	64.0	7.4
22-Jun	15.4	63	10.4	67.0	7.5
23-Jun	16.4	64	10.3	68.8	7.5
24-Jun	15.6	61	10.2	71.4	7.4
25-Jun	15.5	60	10.4	71.0	7.5
26-Jun	14.8	58	10.4	71.6	7.5
27-Jun	15.8	57	10.3	71.1	7.5
28-Jun	14.9	56	10.0	73.3	7.4
29-Jun	12.8	56	10.6	72.4	7.4
30-Jun	13.8	55	10.9	68.8	7.4
1-Jul	15.1	55	10.3	70.3	7.4
2-Jul	15.0	55	10.2	73.8	7.4
3-Jul	15.2	46	10.2	73.8	7.4
4-Jul	15.6	55	10.0	74.8	7.4
5-Jul	17.1	56	9.8	76.1	7.4
6-Jul	19.5	58	9.2	79.6	7.4
7-Jul	18.6	61	8.8	84.9	7.3
8-Jul	17.1	63	9.7	82.0	7.4
9-Jul	17.4	64	9.6	77.7	7.4
10-Jul	15.8	64	9.9	79.2	7.5
11-Jul	15.0	68	10.0	77.0	7.4
12-Jul	15.1	70	10.0	75.4	7.4
13-Jul	15.5	74	10.0	75.6	7.5
14-Jul	14.8	74	10.0	78.5	7.5
15-Jul	14.6	70	10.4	78.9	7.5
16-Jul	14.4	65	10.0	78.2	7.5
17-Jul	12.7	64	10.3	77.9	7.5
18-Jul	12.7	0	10.5	74.2	7.5
19-Jul	11.7	72	10.4	73.8	7.5
20-Jul	11.0	70	10.9	70.6	7.5
21-Jul	11.2	76	10.7	68.6	7.4
22-Jul	11.3	74	10.5	67.7	7.4
23-Jul	11.2	79	10.4	66.9	7.4
24-Jul	11.7	84	10.5	66.6	7.4
25-Jul	12.1	82	10.4	68.2	7.4
26-Jul	12.7	82	10.4	67.1	7.4
27-Jul	13.0	79	9.9	69.2	7.3
28-Jul	11.9	77	10.3	71.4	7.4
29-Jul	13.0	77	10.6	70.8	7.4
30-Jul	14.9	76	10.2	73.6	7.4
31-Jul	15.7	73	9.9	78.0	7.4
Average	14.2	65.4	10.3	71.8	7.4

Appendix 10.— In-House Report on USFWS collection of Chinook Salmon eggs, August 13-18, 2015

AYK Chinook Salmon Egg Thiamine exploration Sample Collection Report: Yukon River Drainage, East Fork Andreafsky River, August 13-18, 2014

Jeremy Mears

During August 13 to 18, 2014 surveys were flown along the East and West Forks of the Andreafsky River to collect Chinook Salmon eggs. The sampling on the Andreafsky was part of a broader project funded by North Pacific Research Board (NPRB) under the title "Exploration of AYK Chinook salmon egg thiamine levels as a potential mechanism contributing to recent low productivity patterns" (NPRB project 1422). The principle investigator is Sean Larson of the Alaska Department of Fish and Game (ADF&G). The project is a collaboration between ADF&G and the National Oceanic and Atmospheric Administration (NOAA), and supported by multiple agencies within the region. The Alaska Department of Fish and Game requested samples from throughout the Yukon River Basin to understand the variance in thiamine levels of Chinook eggs within the Yukon Drainage. The Andreafsky samples will be used to understand Lower Yukon River Chinook Salmon Thiamine levels. The cause of declining Yukon River Chinook salmon populations is still not well understood, and likely due to a multitude of factors. One of the potential factors may be a thiamine deficiency. Studies from the Great Lakes and Baltic Sea have shown that changes in prey species led to thiamine deficiency which increased juvenile mortality and reduced adult salmon vigor leading to declines in other salmonid species (Fischer et al. 1996; Marcquenski and Brown 1997; Norrgren et al 1998). Work will be conducted from 2014 through 2017 to understand interannual variability. The sample target goal was 10-20 eggs from a minimum of 20 Chinook Salmon.

All samples were collected on the East Fork Andreafsky after initial helicopter reconnaissance showed significantly more live Chinook Salmon in the East Fork. Sampling occurred between points N62°.24100, W162°.674717 and N62°.60503, W162°.10988 (Figure 1), which is 16 to 64 kilometers line of sight from the weir location. The upriver extent of the survey was N.62°.75644, W°162°162.10988; however, few Chinook Salmon were observed this high on the river. All samples were collected within the boundaries of the Yukon Delta National Wildlife Refuge and the Andreafsky Wilderness.

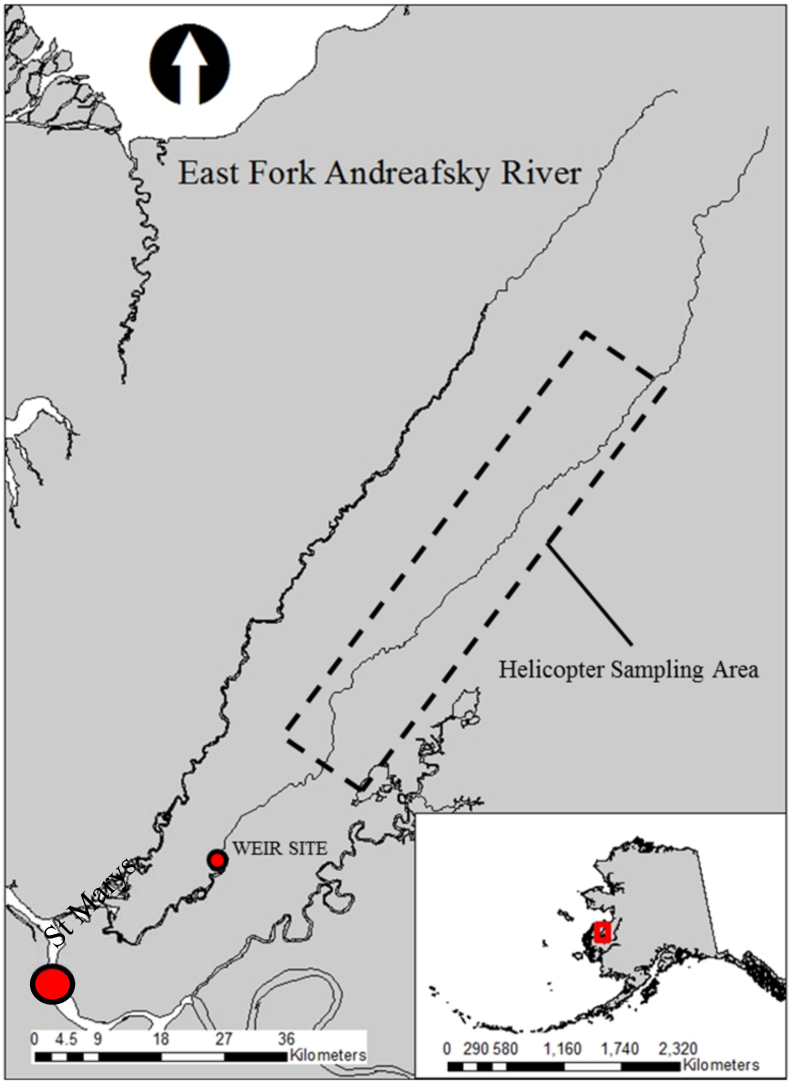


Figure 1. — 2014 East Fork Andreafsky River Helicopter Survey area August 2014.

All Chinook Salmon egg samples were collected by spotting live Chinook Salmon from the air, marking the points with GPS, and then landing and proceeding by foot. All fish were collected using fishing rods and snagging gear. Fishing poles were spooled with 60# test braided line. This limited the potential of losing gear. The hooks were 10/0 snagging hooks with bright colored yarn tied on to the braided fishing line just above the hook. Once hooked, all personnel would assist in landing the fish to reduce fish handling time. Eggs were massaged out of the female, and immediately placed in a Ziploc bag. The Ziploc bags were then placed in a thermos that had been partially filled with water and frozen. At the end of each day, samples were placed in a freezer.

The intent was to target Chinook Salmon after peak spawning. The historical midpoint of the Chinook Salmon run through the East Fork Andreafsky weir is July 9. The dates for egg collection were scheduled to occur as close to 30 days after the midpoint of the Chinook run at the weir. Greater than 50% of the female Chinook Salmon captured were spawned out. This made sampling more difficult, but suggested that Chinook Salmon were not being captured during peak spawning, and therefore reduced the effects of egg collection.

In total, 58 Chinook salmon were hooked and landed, of these, 18 were females that produced at least 10 eggs for collection. One female contained fewer than 10 eggs, and one sample was taken from a fresh female Chinook carcass from which otoliths and eggs were collected. Only one mortality occurred as a direct result of the egg collection.

Identifying males from females was key to efficiently sampling enough female Chinook. One of the key ways used to determine females from males, on the ground and from the air, was caudal fin coloration. This determination was based on field observations. Female Chinook Salmon caudal fins generally presented white with very little black coloration. Male caudal fins generally presented black and white, with the central portion of the tail being black, with white bands on the dorsal and ventral portions of the tail (Figure 2). This identifying feature has not been verified and no literature to support this has been found. However, using this selection criterion resulted in very few males being hooked during the egg collection. The difference in coloration appears to develop as the fish senesce, and has been not observed at the East Fork Andreafsky Weir.

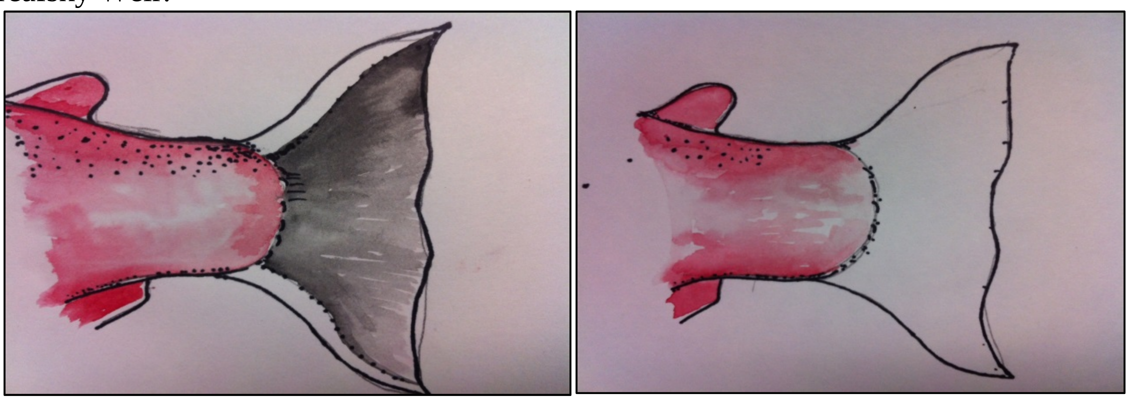


Figure 2.— Illustrations of male (left), and female (right) Chinook Salmon caudal fin coloration late in the spawning season, East Fork Andreafsky River, August 2014.

The total time needed to complete the sampling was 120 hours over four days with three personnel. The helicopter contract cost with Hermens Helicopters (Bethel, AK.) was $12,819.73, with a total flight time of 10.6 hours. One hundred and fifty seven gallons of fuel were used by the helicopter, which equates to 15 gallons per hour of flight time in the Robinson R44r Helicopter.

The samples were delivered to ADF&G on August 18, 2014 for analysis. These analyses are scheduled to be completed early 2015.

Additionally, in carrying out this sampling effort, a spawning aggregation of Sockeye Salmon was observed on the East Fork Andreafsky River. This group contained approximately 100 individuals in a tributary of the East Fork located at 61° 36’ 14.9”N, 162° 07’ 07.1”W. A nomination to the Anadromous Waters Catalogue was submitted. This is the first spawning aggregation documented on the Andreafsky River.

This sample collection in the Andreafsky River Watershed was funded with USFWS Wild Fish Health Center (FHC) Funds.

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