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Abundance and Run Timing of Adult Pacific Salmon in the East Fork Andreafsky River, Yukon Delta National Wildlife Refuge, Alaska, 2003

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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, between June 19 and September 15, 2003. In 2003, an estimated total of 4,336 Chinook salmon *Oncorhynchus tshawytscha* migrated through the weir. The run timing was one day early compared to the 1994-2002 average. Five age groups were identified from 534 Chinook salmon sampled with age 1.3 (50%) dominating. The sex ratio was 46% female, 54% male. The mean length for females was 781 mm, range 410 mm to 955 mm, and the mean length for males was 677 mm, range 380 mm to 1,010 mm. An estimated total of 22,461 chum salmon *O. keta* migrated through the weir. The run timing was 4 days late compared to the 1994-2002 average. Four age groups were identified from 1,128 chum salmon sampled, with age 0.3 (75%) dominating. The sex ratio was 43% female, 57% male. The mean length for females was 522 mm, range 425 to 625 mm, and the mean length for males was 568 mm, range 475 mm to 685 mm. An estimated total of 8,231 coho salmon *O. kisutch* migrated through the weir. The run timing was comparable to the 1995-2002 average. Three age groups were identified from 602 coho salmon sampled, with age 2.1 (78%) dominating. The sex ratio was 51% female, 49% male. The mean length for females was 556 mm, range 400 to 670 mm, and the mean length for males was 558 mm, range 385 mm to 670 mm. An estimated total of 494 sockeye salmon *O. nerka* and 4,303 pink salmon *O. gorbuscha* migrated through the weir. Other species counted through the weir during 2003 included 1,936 whitefish Coregoninae, 16 Dolly Varden *Salvelinus malma*, 4 Arctic grayling *Thymallus arcticus*, and 1 northern pike *Esox lucius*.

Introduction

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 *Oncorhynchus tshawytscha*, chum *O. keta*, coho *O. kisutch*, pink *O. gorbuscha*, and sockeye *O. nerka* salmon (USFWS 1991). The Andreafsky River supports one of the largest returns of Chinook salmon, has the second largest return of summer chum salmon (Bergstrom et al. 1998), and is believed to have the largest return of pink salmon in the Yukon River drainage (USFW1991). These Andreafsky River salmon stocks contribute to a large subsistence fishery in the lower Yukon River.

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The Alaska National Interest Lands Conservation Act (ANILCA) mandates that salmon populations and their habitats be conserved within National Wildlife Refuge lands, international treaty obligations be fulfilled, and subsistence opportunities for local residents be maintained (USFWS 1991). Compliance with ANILCA mandates cannot be ensured without reliable data on salmon stocks originating from within Refuge boundaries. It is the goal of the USFWS to conserve fish and wildlife populations, maintain habitats in their natural diversity, and provide the opportunity for continued subsistence use by local residents.

Due to recent declines in Yukon River salmon runs, particularly summer and fall chum salmon, there have been harvest restrictions, complete fishery closures, and spawning escapement below management goals on many tributaries in the Yukon River drainage (Vania et al. 2002; Kruse 1998). The need to collect accurate escapement estimates is required to maintain genetic diversity, determine exploitation rates and spawner recruit relationships (Labelle 1994). Data on escapement counts, which are necessary for effective management, are lacking for many individual stocks in the Yukon River drainage. Individual stocks of various salmon species returning in low numbers or having early and late run timing may be incidentally over-harvested depending on when subsistence or commercial openings occur. Federal and State fishery managers attempt to distribute salmon harvest over time to avoid over-harvesting individual salmon stocks. This type of management conserves salmon stocks, as each may have distinct migratory timing (Mundy 1982).

In compliance with ANILCA mandates, the U.S. Fish and Wildlife Service (USFWS), Kenai Fish and Wildlife Field Office operated a weir on the East Fork Andreafsky River from 1994 to 2002. The Fairbanks Fish and Wildlife Field Office (FFWFO) assumed responsibility for weir operations in 2003. Specific objectives of the project were to: (1) enumerate adult salmon escapement; (2) describe run timing of Chinook, chum, and coho salmon returns; (3) estimate age, sex, and length composition of adult Chinook, chum and coho salmon populations; and (4) 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 reaching 28˚ and – 42˚C at St. Mary's, Alaska (Leslie 1989). Mean July high and February low temperatures between 1976 and 2000 were 18˚ and –22˚C respectively. 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 is most often reached following breakup with sporadic high discharge periods generated by the heavy rains prevalent between late July and early September.

The Andreafsky River is one of the three largest Yukon River tributaries within Refuge boundaries (USFWS 1991) and drains a watershed of about 5,450 km^2. The Andreafsky River and the East Fork Andreafsky River parallel each other in a southwesterly direction for more than 200 river-kilometers (rkm) before converging 7 rkm above its confluence with the Yukon River. The mouth of the Andreafsky River is approximately 160 rkm upstream from the mouth of the Yukon River. The East Fork Andreafsky River and the Andreafsky River flow through the Andreafsky Wilderness and the portions of each river within Refuge boundaries are 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 cuts through alpine tundra at an average gradient of 7.6 m per km for 48 rkm. It then flows through a forested river valley 130 rkm long bordered by hills that rarely exceed 400 m elevation. Willow, spruce, alder, and birch dominate the riparian zone and much of the hillsides. This section drops at an average rate of 1.4 m per km and is characterized by glides and riffles with a gravel and rubble substrate. The East Fork Andreafsky River widens in the lowermost 38 rkm and meanders through a wet lowland valley interspersed with forest and tundra and bordered by hills that are typically less than 230 m elevation. The gradient in the lower river changes to 0.14 m per km. Smaller substrate particles allow an abundance of aquatic vegetation to grow in the lower stream channel. Water level fluctuations on the Yukon River also affect the stage height in the lower sections of the East Fork Andreafsky River and the Andreafsky River.

Methods

Weir Operation

A modified (Zabkar and Harper 2003) resistance board weir (Tobin 1994; Tobin and Harper 1995) spanning 105 m was installed in the East Fork Andreafsky River (62E07'N, 162E48'W) approximately 43 rkm upstream from the Yukon-Andreafsky River confluence and 26 air-km NE 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 sonar and counting tower site described by Sandone (1989). The weir was moved downstream to a wider section of river in June 1995 to enhance its performance during high water conditions. Weir operation was extended in 1995 into September to collect coho salmon data.

A staff gauge was installed upstream of the weir to measure daily water levels. Staff gauge measurements were calibrated to correspond with the average water depth across the river channel at the upstream edge of the weir. Water temperatures were generally collected once daily between 0800 and 0900 hours.

Two passage chutes were installed, one on river right and one on river left. A fish trap was installed on the river right passage chute to facilitate efficient fish sampling during various river stage heights. The river left passage chute was for use during extreme low water levels or when large numbers of fish began stacking up below the weir. It was not used in 2003. All fish, except whitefish Coregoninae, were enumerated to species as they passed through the live trap (Tobin and Harper 1995). Picket spacing was variable (3.5 and 4.8 cm) because new and recycled weir panels were used. Panels with wider picket intervals were designed to remain functional during higher flows. Small salmon and resident fish that passed through the gaps between pickets were not counted. Fish were counted generally between 0800 hours and midnight each day. The duration of each counting session varied depending on the intensity of fish passage through the weir and was recorded to the nearest 1/4 hour.

The weir integrity was visually inspected for holes and cleaned 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.

Biological Data

Adult salmon were identified and counted as they migrated through the weir each day to determine run timing and escapement. A stratified random sampling design was used to collect

age, length, and sex ratio information for Chinook, chum, and coho salmon sampled. Calculations for age, length, and sex information were treated as a stratified random sample (Cochran 1977) with single statistical weeks being defined as strata. Sample weeks or strata began on a Sunday and ended the following Saturday. Sampling generally commenced at the beginning of the week, and an effort was made to obtain a weekly quota of 140 Chinook, 160 chum, and 140 coho salmon as quickly as possible to approximate a pulse or snapshot sample (Geiger et al. 1990). All target species within the trap were sampled to prevent bias. Non-salmon species were identified and counted but not sampled. Whitefish species were grouped together under the subfamily Coregoninae.

Fish sampling consisted of identifying salmon species, determining sex, measuring length, collecting scales and fin clips from Chinook salmon, and then releasing the fish upstream of the weir. Length was measured from mid-eye to the fork of the caudal fin and rounded to the nearest 5 mm. Scales were removed from the preferred area for age determination (Koo 1962; Devries and Frie 1996). Three scales were collected from each Chinook and coho salmon. One scale was collected from each chum salmon. Scale impressions were 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 Alaska Department of Fish and Game (ADF&G) biologist and reported according to the European Method (Koo 1962). Daily sex ratios were collected by the sexing of each fish when sampling for age and length. Crew members physically handled and identified the sex of each fish using secondary sex characteristics. The daily escapement counts and sex ratios were reported daily to the FFWFO and ADF&G.

Days when the weir was operational with no fish counted were reported as zero counts. Escapement estimates were calculated post season for those days in 2003 when the weir was not operational and were based on a linear interpolation of the counts before and after the missed day(s) of counting. Historical data (Appendices 2, 3, 4, and 5) were not corrected for days when the weir was not operational. In Appendix 4, missing data for 2001 coho salmon were estimated using the average daily proportion of passage collected from 1995 to 2000 (Zabkar and Harper 2003). The annual counts are a minimum estimate of escapement for those years when the weir had periods it was not operational.

High water conditions in 2001 caused the weir to be installed late. Chinook, chum, pink, and sockeye salmon counts started on July 15, after the average dates when 3/4 of the run has passed. Because of the propensity of missing counts, the data were not used in any comparisons.

Data Analysis

Strata generally were one week long and began on Sunday and ended the following Saturday. Strata at the beginning and end of the season contain more than seven days of data due to combining weeks when few fish were present. Within a stratum, the proportion of the samples composed of a given sex or age, p_{ij}, was calculated as:

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

where n_{ij} is the number of fish of 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 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, chum, and coho salmon of a given sex/age, p_i, were calculated as:

$$\hat{p}_i = \sum \left(\frac{N_j}{N} \right) \hat{p}_{ij} ,$$

where 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. Variances of sex and age compositions for the run were calculated as:

$$\hat{v}(\hat{p}_i) = \sum \left(\frac{N_j}{N} \right)^2 \hat{v}(\hat{p}_{ij}) .$$

Results

Weir Operation

The weir was operational on June 19 and operated until September 15, 2003, except from August 15-17 when high water submerged portions of the weir. Turbid water prevented accurate counts during this time period. The average stage height was 50 cm with a range between 23 and 111 cm (Figure 2). Water temperatures averaged 11°C from June 18 to September 15 (Figure 2) and ranged between 5° and 20°C.

Biological Data

An estimated 4,336 Chinook, 22,461 chum, 8,231 coho, 4,303 pink, and 494 sockeye salmon migrated through the weir (Table 1). Non-salmon species recorded moving through the weir include 1,936 whitefish, 16 Dolly Varden *Salvelinus malma*, 4 Arctic grayling *Thymallus arcticus*, and 1 northern pike *Esox lucius*.

Chinook Salmon—An estimated escapement of 4,336 Chinook salmon passed the weir between June 23 and September 15 (Table 2). Peak passage (*N*=2,264) occurred during the week of July 6 to 12 (Table 1; Figure 3). The median run passage date at the weir was July 9 (Table 2), one day earlier than the historical average. The daily passage rate did not exceed 1% of run total after July 28.

The average female Chinook salmon length was 781 mm with a range from 410 to 955 mm and the average male Chinook salmon length was 677 mm with a range from 380 to 1,010 mm (Table 3). Females composed an estimated 46% of the overall escapement, and were predominant after July 20 (Table 4; Figure 4). A total of 586 Chinook salmon were sampled for age composition and 52 (10%) were unreadable. Five age groups were identified from a sample of 534 Chinook salmon between June 23 and September 15 (Table 4). Age 1.3 Chinook salmon

were most abundant (50%), followed by age 1.4 (32%) and age 1.2 (16%). The age distributions of female and male Chinook salmon were different with age class 1.4 (55%) dominating for females and age 1.3 (63%) dominating for males (Table 4).

Chum Salmon—An estimated escapement of 22,461 chum salmon passed the weir between June 21 and September 15 (Table 2). Peak passage (*N*=9,346) occurred during the week of July 6 to 12 (Table 1; Figure 3), and the median run passage date was July 9 (Table 2), three days later than the historical average. The daily passage rate did not exceed 1% of run total after July 29.

The average female chum salmon length was 522 mm with a range from 425 to 625 mm and the average male chum salmon length was 568 mm with a range from 475 to 685 mm (Table 3). Females composed an estimated 43% of the overall escapement, and were predominant after July 20 (Table 5; Figure 4). A total of 1,343 chum salmon were sampled for age composition and 215 (19%) were classified as unreadable. Four age groups were identified from a sample of 1,128 chum salmon between June 21 and September 15 (Table 5). Age 0.3 chum salmon were most abundant (75%), followed by age 0.4 (23%) fish. The age distributions of female and male chum salmon were similar with age class 0.3 dominating for females (81%) and males (69%; Table 5).

Coho Salmon—An estimated escapement of 8,231 coho salmon passed the weir between July 8 and September 15 (Table 2). Peak passage (*N*=3,921) occurred during the week of August 24 to 30 (Table 1; Figure 3). The median run passage date was August 30 (Table 2), one day earlier than the historical average.

The average female coho salmon length was 556 mm with a range from 400 to 670 mm and the average male coho salmon length was 558 mm with a range from 385 to 670 mm (Table 3). Females composed an estimated 51% of the overall escapement, and were predominate between August 17 and September 6 (Table 6; Figure 4). A total of 717 coho salmon were sampled for age composition and 115 (16%) were unreadable. Three age groups were identified from a sample of 602 coho salmon between July 8 and September 15 (Table 6). The age distributions for female and male coho salmon were similar with age 2.1 dominating females (78%) and males (79%), followed by age 1.1 for both (13%).

Pink Salmon—An estimated escapement of 4,303 pink salmon passed through the weir between June 25 and September 15 (Table 7). Small pink salmon were able to pass uncounted between the pickets in the panels due to picket spacing. Peak passage (*N*=1,660) occurred during the week of July 13 to 19 (Table 1; Figure 3).

Sockeye Salmon—An estimated escapement of 494 sockeye salmon passed through the weir between June 30 and September 15 (Table 7). Peak passage (*N*=109) occurred during the week of July 27 to August 2 (Table 1).

Discussion

Weir Operations

The 2003 weir operations were interrupted during a flood event occurring from August 15-17. The gates to the trap were left open to prevent salmon from stacking up below the weir. Escapement counts for missing data were estimated using a linear interpolation of the preceding and subsequent days' counts.

Picket spacing in the weir panels allowed smaller pink salmon and resident fish to pass upstream yet effectively block passage of other salmon species and larger fish (Zabkar and Harper 2003). Consequently, pink salmon, whitefish, Dolly Varden, Arctic grayling, and northern pike counts are conservative.

Biological Data

In general, Yukon River Chinook and chum salmon runs have improved during the years 2000 to 2002 (JTC 2002). Chinook salmon started entering the Yukon River a week earlier than normal in 2003 and monitoring projects throughout the drainage indicated relatively high numbers of Chinook salmon returning. Escapement goals were generally met or exceeded to near record levels in some systems. Preliminary ADF&G reports indicated the 2003 summer chum run would be similar to 2002, but other projects in the drainage indicated a lower abundance. The 2003 East Fork Andreafsky River summer chum run was at a record low.

The Andreafsky River Chinook salmon stock shows some improvement since the low escapement of 2000, both at the weir and by aerial survey (Appendix 1). Chum salmon stocks have fluctuated widely over the past four years and have been decreasing since 1994 (Zabkar and Harper 2003; Figure 5; Appendix 1). In 2001, the East Fork Andreafsky River weir was installed after the average third quartile passage dates for Chinook and chum salmon due to high water. Therefore, the 2001 counts were not included in analytical computations for Chinook and chum salmon.

Ten years of data have been collected from the East Fork Andreafsky River weir, which allows for short term trends to be analyzed. Chinook salmon escapement counts show a trend where the escapement counts alternate between high and low production cycles (Figure 5). Chum salmon escapement counts could possibly represent a longer cyclical pattern. The 1994 and 1995 escapement counts could represent the high levels of a declining production trend, and starting in 1997 and continuing to the present represent declining production (Figure 5). A longer time series data set is needed to fully understand the high-low production cycle of the East Fork Andreafsky River salmon stocks.

Chinook Salmon—The estimated 2003 Chinook salmon escapement (*N*=4,336) is 6% above the 1994-2002 (excluding 2001) average (*N*=4,076). Chinook salmon escapement estimates ranged from 1,344 to 7,801 fish between 1994 and 2002 (Figure 5; Appendix 1). Chinook salmon run timing in 2003 was generally early compared to average (Tobin and Harper 1995; 1996; 1997; 1998; Zabkar and Harper 2003; Appendix 2). The first fish migrated through on June 23. The first quartile passed two days later than the July 5 average. The median run passage date at the weir was July 9, one day early; and the third quartile passage date was July 14 (Table 2), two days before the July 16 historical average. The proportion of females in the 2003 escapement (46%) was high compared to previous weir escapement counts (range 23-51%; Zabkar and Harper 2003; Table 4).

The 2003 ADF&G aerial survey estimate for the East Fork Andreafsky River was not conducted because of inclement weather. An aerial survey was conducted on the Andreafsky River with an estimated Chinook salmon escapement of 1,578 (Appendix 1). This count was above the escapement objective of >1,500. ADF&G considered the 2003 count minimal due to poor survey conditions and timing. The escapement objective was revised in January 2004 to a sustainable escapement goal of 960-1,700 Chinook salmon.

Chum Salmon—Chum salmon escapement (*N*=22,461) to the East Fork Andreafsky River in 2003 was the lowest since weir counts began being documented in 1994 (excluding 2001) where escapement counts have ranged from 22,918 to 200,981 fish (Appendix 1). While the average escapement count (80,235) exceeds the minimum biological escapement goal (BEG) of 65,000 set in 2001, the escapement count has only once exceeded the BEG since 1996 (Figure 5). Chum salmon run timing in 2003 was later than average. The first quartile passed five days later than the July 1 average. The median run passage date at the weir was three days later than the July 6 average, and the third quartile passage date was seven days later than the July 11 average (Table 2).

The Yukon River drainage escapement data indicate summer chum salmon returns were below average during 2003. Poor escapement during 2003 may be linked to continued changes in the marine ecosystem, which were thought to have adversely affected salmon growth and survival during 1997 and 1998 (Kruse 1998) and may also have affected current populations. Parent year escapement counts for the 2003 returns were primarily 1999 (age 0.3) and 1998 (0.4), both below average years (Table 5; Figure 5, Appendix 1).

Coho Salmon—The East Fork Andreafsky River weir is one of two escapement projects, and the only weir, currently providing escapement data for coho salmon on the Yukon River. A high water event caused portions of the weir to flood during August 15-17, 2003. No fish were observed passing over the weir. Coho salmon run timing during 2003 was earlier than average. The first quartile passed three days earlier than the August 28 average. The median run passage date at the weir was one day earlier than the August 31 average, and the third quartile passage date was the same as the September 4 average (Table 2). Coho salmon escapement during 2003 (*N*=8,231) was 1% over the 1995-2002 (excluding 1998) average (*N*=8,112). The escapement counts ranged from 2,963 (1999) to 13,650 (2001) fish between 1995 and 2002 (Figure 5; Appendix 1, Appendix 4). The year 1998 was excluded from average computations due to an incomplete count.

Pink Salmon—Pink salmon have strong returns to the East Fork Andreafsky River during even years and relatively weak returns during odd years. Escapement to the East Fork Andreafsky River during 2003 was the strongest odd year return since the weir was installed. The pink salmon escapement for 2003 (*N*=4,303) was over four times the average (*N*=1,051) and two times the previous high (*N*=1,972) in 1995 (Figure 5; Appendix 5). The run median passed on July 19, while the first quartile passed on July 14, and the third quartile passed on July 25 (Table 7).

Picket interval spacing on half of the weir panels from 1994 to 2000 was designed to allow passage of smaller pink salmon and remain functional during higher water flows. In 2001, 90% of the weir panels were replaced with narrower panels with picket spacing being equal to the largest spacing found in the older panels. Pink salmon counts are a measure of relative abundance in all years of operation with the possibility of a larger number of small pink salmon passing through the panels after 2000.

Sockeye Salmon—Large populations of sockeye salmon are absent in the Yukon River drainage (Bergstrom et al. 1995). The East Fork Andreafsky River escapement did not exceed 248 sockeye salmon between 1994 and 2002. Sockeye salmon escapement during 2003 (*N*=494) was the highest observed escapement returning to the East Fork Andreafsky River. The run median

passed on August 2, while the first quartile passed on July 24, and the third quartile passed on August 15 (Table 7).

Recommendations

The East Fork Andreafsky River weir has been an important tool for monitoring refuge-originating salmon stocks and assisting both ADF&G and USFWS in-season managers with management of Yukon River fisheries. This project continues to build a long-term database that cannot be replicated in any other lower Yukon River drainage. The present weir project provides accurate escapement and biological data that date back to 1994 for Chinook, chum, pink, and sockeye salmon, and 1995 for coho salmon. Prior data from 1981 through 1988 using sonar and tower methodologies add to this important database. USFWS started aerial surveys of the Andreafsky River system in 1954 (Barton 1984), also adding to the historical information. Recent literature (Beamish et al. 1998; Kruse 1998; Meyers et al. 1998) indicates that current and future maritime conditions may adversely affect salmon populations. Continued operation of the East Fork Andreafsky River weir will be of key importance as part of a system to monitor the impacts of the environment and various fisheries on the Andreafsky and Yukon Rivers salmon stocks.

It is recommended to continue weir operation for long term monitoring of all salmon species. It is also recommended that spawning and rearing locations for sockeye salmon should be investigated to assure long term viability of this unique population.

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Table 1. Escapement estimates, by stratum, recorded at the East Fork Andreafsky River weir, Alaska, 2003.

Stratum dates	Chinook salmon	Chum salmon	Coho salmon	Pink salmon	Sockeye salmon
Jun 19-21	0	2	0	0	0
Jun 22-28	47	2,442	0	13	0
Jun 29-Jul 5	586	3,129	0	73	2
Jul 6-12	2,264	9,346	1	793	43
Jul 13-19	1,078	3,227	2	1,660	53
Jul 20-26	156	2,105	3	785	45
Jul 27-Aug 2	169	1,185	4	534	109
Aug 3-9	11	515	88	156	84
Aug 10-16	12	239	511	87	44
Aug 17-23	6	143	118	69	50
Aug 24-30	5	84	3,921	42	43
Aug 31-Sep 6	0	11	1,952	35	17
Sep 7-13	1	29	1,619	49	2
Sep 14-15	1	4	12	7	2
Total	4,336	22,461	8,231	4,303	494

Table 2. Daily and cumulative estimates, and cumulative proportion of Chinook, chum, and coho salmon escapement through the East Fork Andreafsky River weir, Alaska, 2003.

	Chinook salmon			Chum salmon			Coho salmon		
Date	Daily count	Cumulative count	Proportion of run	Daily count	Cumulative count	Proportion of run	Daily count	Cumulative count	Proportion of run
19-Jun	0	0	0.000	0	0	0.000	0	0	0.000
20-Jun	0	0	0.000	0	0	0.000	0	0	0.000
21-Jun	0	0	0.000	2	2	0.000	0	0	0.000
22-Jun	0	0	0.000	87	89	0.004	0	0	0.000
23-Jun	4	4	0.001	564	653	0.029	0	0	0.000
24-Jun	2	6	0.001	182	835	0.037	0	0	0.000
25-Jun	7	13	0.003	484	1,319	0.059	0	0	0.000
26-Jun	3	16	0.004	183	1,502	0.067	0	0	0.000
27-Jun	12	28	0.006	396	1,898	0.085	0	0	0.000
28-Jun	19	47	0.011	546	2,444	0.109	0	0	0.000
29-Jun	4	51	0.012	219	2,663	0.119	0	0	0.000
30-Jun	0	51	0.012	271	2,934	0.131	0	0	0.000
1-Jul	176	227	0.052	928	3,862	0.172	0	0	0.000
2-Jul	295	522	0.120	339	4,201	0.187	0	0	0.000
3-Jul	22	544	0.125	713	4,914	0.219	0	0	0.000
4-Jul	6	550	0.127	175	5,089	0.227	0	0	0.000
5-Jul	83	633	0.146	484	5,573	0.248	0	0	0.000
6-Jul	136	769	0.177	1,051	6,624	0.295	0	0	0.000
7-Jul	336	1,105	0.255	1,376	8,000	0.356	0	0	0.000
8-Jul	469	1,574	0.363	2,476	10,476	0.466	1	1	0.000
9-Jul	823	2,397	0.553	2,025	12,501	0.557	0	1	0.000
10-Jul	48	2,445	0.564	244	12,745	0.567	0	1	0.000
11-Jul	107	2,552	0.589	412	13,157	0.586	0	1	0.000
12-Jul	345	2,897	0.668	1,762	14,919	0.664	0	1	0.000
13-Jul	311	3,208	0.740	586	15,505	0.690	0	1	0.000
14-Jul	340	3,548	0.818	254	15,759	0.702	0	1	0.000
15-Jul	2	3,550	0.819	33	15,792	0.703	2	3	0.000
16-Jul	7	3,557	0.820	123	15,915	0.709	0	3	0.000
17-Jul	25	3,582	0.826	445	16,360	0.728	0	3	0.000
18-Jul	235	3,817	0.880	1,078	17,438	0.776	0	3	0.000
19-Jul	158	3,975	0.917	708	18,146	0.808	0	3	0.000
20-Jul	28	4,003	0.923	681	18,827	0.838	1	4	0.000
21-Jul	10	4,013	0.926	283	19,110	0.851	0	4	0.000
22-Jul	2	4,015	0.926	47	19,157	0.853	0	4	0.000
23-Jul	23	4,038	0.931	306	19,463	0.867	0	4	0.000
24-Jul	58	4,096	0.945	222	19,685	0.876	2	6	0.001
25-Jul	31	4,127	0.952	348	20,033	0.892	0	6	0.001
26-Jul	4	4,131	0.953	218	20,251	0.902	0	6	0.001
27-Jul	22	4,153	0.958	220	20,471	0.911	0	6	0.001
28-Jul	108	4,261	0.983	389	20,860	0.929	0	6	0.001
29-Jul	28	4,289	0.989	220	21,080	0.939	0	6	0.001
30-Jul	4	4,293	0.990	61	21,141	0.941	1	7	0.001
31-Jul	0	4,293	0.990	80	21,221	0.945	2	9	0.001
1-Aug	2	4,295	0.991	104	21,325	0.949	0	9	0.001
2-Aug	5	4,300	0.992	111	21,436	0.954	1	10	0.001

Table 2. Continued.

	Chinook salmon			Chum salmon			Coho salmon		
Date	Daily count	Cumulative count	Proportion of run	Daily count	Cumulative count	Proportion of run	Daily count	Cumulative count	Proportion of run
3-Aug	1	4,301	0.992	40	21,476	0.956	1	11	0.001
4-Aug	1	4,302	0.992	91	21,567	0.960	1	12	0.001
5-Aug	4	4,306	0.993	182	21,749	0.968	2	14	0.002
6-Aug	0	4,306	0.993	52	21,801	0.971	4	18	0.002
7-Aug	1	4,307	0.993	85	21,886	0.974	28	46	0.006
8-Aug	3	4,310	0.994	44	21,930	0.976	25	71	0.009
9-Aug	1	4,311	0.994	21	21,951	0.977	27	98	0.012
10-Aug	0	4,311	0.994	21	21,972	0.978	5	103	0.013
11-Aug	1	4,312	0.994	27	21,999	0.979	9	112	0.014
12-Aug	1	4,313	0.995	40	22,039	0.981	19	131	0.016
13-Aug	2	4,315	0.995	21	22,060	0.982	40	171	0.021
14-Aug	3	4,318	0.996	52	22,112	0.984	194	365	0.044
15-Aug	3	4,321	0.997	43	22,155	0.986	146	511	0.062
16-Aug	2	4,323	0.997	35	22,190	0.988	98	609	0.074
17-Aug	1	4,324	0.997	27	22,217	0.989	50	659	0.080
18-Aug	1	4,325	0.997	19	22,236	0.990	2	661	0.080
19-Aug	2	4,327	0.998	32	22,268	0.991	7	668	0.081
20-Aug	2	4,329	0.998	22	22,290	0.992	21	689	0.084
21-Aug	0	4,329	0.998	21	22,311	0.993	11	700	0.085
22-Aug	0	4,329	0.998	10	22,321	0.994	3	703	0.085
23-Aug	0	4,329	0.998	12	22,333	0.994	24	727	0.088
24-Aug	2	4,331	0.999	11	22,344	0.995	263	990	0.120
25-Aug	2	4,333	0.999	24	22,368	0.996	1,744	2,734	0.332
26-Aug	1	4,334	1.000	13	22,381	0.996	634	3,368	0.409
27-Aug	0	4,334	1.000	11	22,392	0.997	288	3,656	0.444
28-Aug	0	4,334	1.000	5	22,397	0.997	197	3,853	0.468
29-Aug	0	4,334	1.000	14	22,411	0.998	243	4,096	0.498
30-Aug	0	4,334	1.000	6	22,417	0.998	552	4,648	0.565
31-Aug	0	4,334	1.000	2	22,419	0.998	729	5,377	0.653
1-Sep	0	4,334	1.000	1	22,420	0.998	172	5,549	0.674
2-Sep	0	4,334	1.000	1	22,421	0.998	107	5,656	0.687
3-Sep	0	4,334	1.000	5	22,426	0.998	9	5,665	0.688
4-Sep	0	4,334	1.000	0	22,426	0.998	646	6,311	0.767
5-Sep	0	4,334	1.000	0	22,426	0.998	275	6,586	0.800
6-Sep	0	4,334	1.000	2	22,428	0.999	14	6,600	0.802
7-Sep	0	4,334	1.000	4	22,432	0.999	42	6,642	0.807
8-Sep	0	4,334	1.000	2	22,434	0.999	459	7,101	0.863
9-Sep	1	4,335	1.000	3	22,437	0.999	268	7,369	0.895
10-Sep	0	4,335	1.000	1	22,438	0.999	9	7,378	0.896
11-Sep	0	4,335	1.000	0	22,438	0.999	211	7,589	0.922
12-Sep	0	4,335	1.000	16	22,454	1.000	231	7,820	0.950
13-Sep	0	4,335	1.000	3	22,457	1.000	399	8,219	0.999
14-Sep	0	4,335	1.000	1	22,458	1.000	8	8,227	1.000
15-Sep	1	4,336	1.000	3	22,461	1.000	4	8,231	1.000

= indicates dates at which 25, 50, and 75 percent of the run had passed the weir.
= estimated counts due to high water submerging portions of weir.

Table 3. Mid-eye to fork length (mm) at age of female and male Chinook, chum, and coho salmon sampled at East Fork Andreafsky River weir, Alaska, 2003.

	Female					Male				
Age	N	Mean	Median	SE	Range	N	Mean	Median	SE	Range
Chinook salmon										
1.1	0					2	383	383	2.5	380-385
1.2	17	514	510	13.6	410-650	69	533	520	5.8	455-680
1.3	92	731	720	6.2	600-860	177	710	710	4.5	530-980
1.4	139	844	840	4.7	520-955	32	826	820	10.7	705-1,010
1.5	6	860	880	21.1	785-905	0				
Total	254	781	810	6.6	410-955	280	677	700	6.6	380-1,010
Chum salmon										
0.2	5	473	480	10.8	445-495	3	542	525	30.0	500-600
0.3	452	518	518	1.4	425-610	398	556	560	1.7	475-650
0.4	95	543	545	3.5	465-625	166	595	600	2.6	480-685
0.5	3	533	530	20.3	500-570	6	592	598	22.8	525-665
Total	555	522	520	1.4	425-625	573	568	565	1.6	475-685
Coho salmon										
1.1	37	533	560	2.5	450-600	40	556	560	8.0	420-670
2.1	230	544	550	6.1	400-670	241	558	570	3.3	385-655
3.1	28	555	565	2.9	425-620	25	564	570	8.1	475-635
Total	296	556	562	7.4	400-670	306	558	565	2.9	385-670

Table 4. Age and sex ratio estimates by stratum of Chinook salmon sampled at East Fork Andreafsky River weir, Alaska, 2003. Standard errors are in parentheses. Season totals are calculated from weighted strata totals. Beginning and ending strata have combined weeks due to small numbers of fish at the beginning and end of run. Unknown age fish are listed for information and were not included in calculations.

					Brood year and age				
					1996	1997	1998	1999	2000
Strata	Run size (N)	Sample size (n)	Unknown age	Percent female	1.5	1.4	1.3	1.2	1.1
Jun 19-28	47	26	1	42 (9.9)	0 (0.0)	8 (5.3)	62 (9.7)	27 (8.9)	4 (3.8)
Jun 29-Jul 5	586	93	12	38 (5.1)	1 (1.1)	6 (2.6)	71 (4.7)	22 (4.3)	0 (0.0)
Jul 6-12	2,264	120	20	46 (4.6)	0 (0.0)	31 (4.2)	53 (4.6)	16 (3.3)	1 (0.8)
Jul 13-19	1,078	128	13	46 (4.4)	2 (1.1)	34 (4.2)	49 (4.4)	15 (3.2)	0 (0.0)
Jul 20-26	156	121	3	56 (4.5)	2 (1.4)	49 (4.6)	37 (4.4)	12 (2.9)	0 (0.0)
Jul 27-Aug 2	169	29	1	59 (9.3)	0 (0.0)	41 (9.3)	45 (9.4)	14 (6.5)	0 (0.0)
Aug 3-Sep 15	36	17	2	53 (12.5)	0 (0.0)	65 (11.9)	18 (9.5)	18 (9.5)	0 (0.0)
Total	4,336	534	52	46 (2.7)	1 (0.5)	32 (2.0)	50 (2.2)	16 (1.6)	0 (0.3)
Female	1,988	254	18		2 (1.0)	55 (3.1)	36 (3.0)	7 (1.6)	0 (0.0)
Male	2,348	280	34		0 (0.0)	11 (1.9)	63 (2.9)	25 (2.6)	1 (0.5)

Table 5. Age and sex ratio estimates by stratum of chum salmon sampled at East Fork Andreafsky River weir, Alaska, 2003. Standard errors are in parentheses. Season totals are calculated from weighted strata totals. Beginning and ending strata have combined weeks due to small numbers of fish at the beginning and end of run. Unknown age fish are listed for information and were not included in calculations.

					Brood year and age			
					1997	1998	1999	2000
Strata	Run size (N)	Sample size (n)	Unknown age	Percent female	0.5	0.4	0.3	0.2
Jun 19-28	2,444	129	42	35 (4.2)	2 (1.1)	57 (4.4)	42 (4.4)	0 (0.0)
Jun 29-Jul 5	3,129	129	31	39 (4.3)	1 (0.8)	44 (4.4)	53 (4.4)	2 (1.1)
Jul 6-12	9,346	146	14	36 (4.0)	0 (0.0)	30 (3.8)	70 (3.8)	0 (0.0)
Jul 13-19	3,227	143	25	48 (4.2)	1 (1.0)	13 (2.8)	85 (3.0)	1 (1.0)
Jul 20-26	2,105	119	41	59 (4.5)	0 (0.0)	6 (2.2)	94 (2.2)	0 (0.0)
Jul 27-Aug 2	1,185	144	19	61 (4.1)	0 (0.0)	10 (2.5)	90 (2.5)	0 (0.0)
Aug 3-9	515	144	16	60 (4.1)	1 (1.0)	14 (2.9)	82 (3.2)	3 (1.4)
Aug 10-16	239	93	13	56 (5.2)	2 (1.5)	20 (4.2)	77 (4.4)	0 (0.0)
Aug 17-23	143	52	11	52 (7.0)	0 (0.0)	15 (5.1)	85 (5.1)	0 (0.0)
Aug 24-Sep 15	128	29	3	48 (9.4)	0 (0.0)	3 (3.4)	97 (3.4)	0 (0.0)
Total	22,461	1,128	215	43 (2.0)	1 (0.3)	23 (1.3)	75 (1.3)	1 (0.2)
Female	9,558	555	113		1 (0.3)	17 (1.6)	81 (1.7)	1 (0.4)
Male	12,903	573	102		1 (0.4)	29 (1.9)	69 (1.9)	1 (0.3)

Table 6. Age and sex ratio estimates by stratum of coho salmon sampled at East Fork Andreafsky River weir, Alaska, 2003. Standard errors are in parentheses. The totals are calculated from weighted strata totals. Beginning and ending strata have combined weeks due to small numbers of fish at the beginning of the run and an incomplete week at the end of the run. Unknown age fish are listed for information and were not included in calculations.

					Brood year and age		
					1998	1999	2000
Strata	Run size (N)	Sample size (n)	Unknown age	Percent female	3.1	2.1	1.1
Jun 19-Aug 9	98	74	13	43 (5.8)	18 (4.5)	77 (4.9)	5 (2.6)
Aug 10-16	511	116	21	46 (4.6)	9 (2.7)	81 (3.7)	9 (2.7)
Aug 17-23	118	43	12	67 (7.2)	12 (4.9)	77 (6.5)	12 (4.9)
Aug 24-30	3,921	123	18	54 (4.5)	10 (2.7)	77 (3.8)	13 (3.0)
Aug 31-Sep 6	1,952	126	19	52 (4.5)	5 (1.9)	81 (3.5)	14 (3.1)
Sep 7-15	1,631	120	32	41 (4.5)	5 (2.0)	76 (3.9)	19 (3.6)
Total	8,231	602	115	51 (2.6)	9 (1.2)	78 (1.7)	13 (1.4)
Female	4,180	296	67		9 (1.7)	78 (2.4)	13 (1.9)
Male	4,051	306	48		8 (1.6)	79 (2.3)	13 (1.9)

Table 7. Daily and cumulative estimates, and cumulative proportions of pink and sockeye salmon escapements through the East Fork Andreafsky River weir, Alaska, 2003.

	Pink salmon			Sockeye salmon		
Date	Daily count	Cumulative count	Proportion of run	Daily count	Cumulative count	Proportion of run
19-Jun	0	0	0.000	0	0	0.000
20-Jun	0	0	0.000	0	0	0.000
21-Jun	0	0	0.000	0	0	0.000
22-Jun	0	0	0.000	0	0	0.000
23-Jun	0	0	0.000	0	0	0.000
24-Jun	0	0	0.000	0	0	0.000
25-Jun	3	3	0.001	0	0	0.000
26-Jun	0	3	0.001	0	0	0.000
27-Jun	6	9	0.002	0	0	0.000
28-Jun	4	13	0.003	0	0	0.000
29-Jun	3	16	0.004	0	0	0.000
30-Jun	0	16	0.004	1	1	0.002
1-Jul	16	32	0.007	0	1	0.002
2-Jul	12	44	0.010	0	1	0.002
3-Jul	13	57	0.013	0	1	0.002
4-Jul	13	70	0.016	0	1	0.002
5-Jul	16	86	0.020	1	2	0.004
6-Jul	24	110	0.026	4	6	0.012
7-Jul	94	204	0.047	4	10	0.020
8-Jul	172	376	0.087	4	14	0.028
9-Jul	259	635	0.148	2	16	0.032
10-Jul	16	651	0.151	2	18	0.036
11-Jul	43	694	0.161	13	31	0.063
12-Jul	185	879	0.204	14	45	0.091
13-Jul	173	1,052	0.244	4	49	0.099
14-Jul	189	1,241	0.288	4	53	0.107
15-Jul	28	1,269	0.295	1	54	0.109
16-Jul	13	1,282	0.298	8	62	0.126
17-Jul	96	1,378	0.320	13	75	0.152
18-Jul	702	2,080	0.483	23	98	0.198
19-Jul	459	2,539	0.590	0	98	0.198
20-Jul	288	2,827	0.657	9	107	0.217
21-Jul	98	2,925	0.680	3	110	0.223
22-Jul	18	2,943	0.684	1	111	0.225
23-Jul	107	3,050	0.709	8	119	0.241
24-Jul	107	3,157	0.734	11	130	0.263
25-Jul	124	3,281	0.762	11	141	0.285
26-Jul	43	3,324	0.772	2	143	0.289
27-Jul	47	3,371	0.783	15	158	0.320
28-Jul	130	3,501	0.814	25	183	0.370
29-Jul	140	3,641	0.846	19	202	0.409
30-Jul	29	3,670	0.853	9	211	0.427
31-Jul	65	3,735	0.868	18	229	0.464
1-Aug	69	3,804	0.884	7	236	0.478
2-Aug	54	3,858	0.897	16	252	0.510

Table 7. Continued.

	Pink salmon			Sockeye salmon		
Date	Daily count	Cumulative count	Proportion of run	Daily count	Cumulative count	Proportion of run
3-Aug	33	3,891	0.904	4	256	0.518
4-Aug	34	3,925	0.912	11	267	0.540
5-Aug	35	3,960	0.920	40	307	0.621
6-Aug	17	3,977	0.924	5	312	0.632
7-Aug	20	3,997	0.929	11	323	0.654
8-Aug	9	4,006	0.931	9	332	0.672
9-Aug	8	4,014	0.933	4	336	0.680
10-Aug	9	4,023	0.935	2	338	0.684
11-Aug	6	4,029	0.936	6	344	0.696
12-Aug	10	4,039	0.939	6	350	0.709
13-Aug	14	4,053	0.942	3	353	0.715
14-Aug	21	4,074	0.947	12	365	0.739
15-Aug	16	4,090	0.950	8	373	0.755
16-Aug	11	4,101	0.953	7	380	0.769
17-Aug	6	4,107	0.954	6	386	0.781
18-Aug	1	4,108	0.955	5	391	0.791
19-Aug	14	4,122	0.958	8	399	0.808
20-Aug	18	4,140	0.962	8	407	0.824
21-Aug	10	4,150	0.964	17	424	0.858
22-Aug	8	4,158	0.966	0	424	0.858
23-Aug	12	4,170	0.969	6	430	0.870
24-Aug	13	4,183	0.972	11	441	0.893
25-Aug	10	4,193	0.974	10	451	0.913
26-Aug	9	4,202	0.977	5	456	0.923
27-Aug	2	4,204	0.977	1	457	0.925
28-Aug	4	4,208	0.978	6	463	0.937
29-Aug	3	4,211	0.979	6	469	0.949
30-Aug	1	4,212	0.979	4	473	0.957
31-Aug	0	4,212	0.979	2	475	0.962
1-Sep	10	4,222	0.981	2	477	0.966
2-Sep	2	4,224	0.982	2	479	0.970
3-Sep	6	4,230	0.983	1	480	0.972
4-Sep	8	4,238	0.985	1	481	0.974
5-Sep	5	4,243	0.986	5	486	0.984
6-Sep	4	4,247	0.987	4	490	0.992
7-Sep	8	4,255	0.989	0	490	0.992
8-Sep	12	4,267	0.992	0	490	0.992
9-Sep	7	4,274	0.993	1	491	0.994
10-Sep	5	4,279	0.994	0	491	0.994
11-Sep	6	4,285	0.996	0	491	0.994
12-Sep	4	4,289	0.997	1	492	0.996
13-Sep	7	4,296	0.998	0	492	0.996
14-Sep	3	4,299	0.999	1	493	0.998
15-Sep	4	4,303	1.000	1	494	1.000

= indicates dates at which 25, 50, and 75 percent of the run had passed the weir.
= estimated counts due to high water submerging portions of weir.

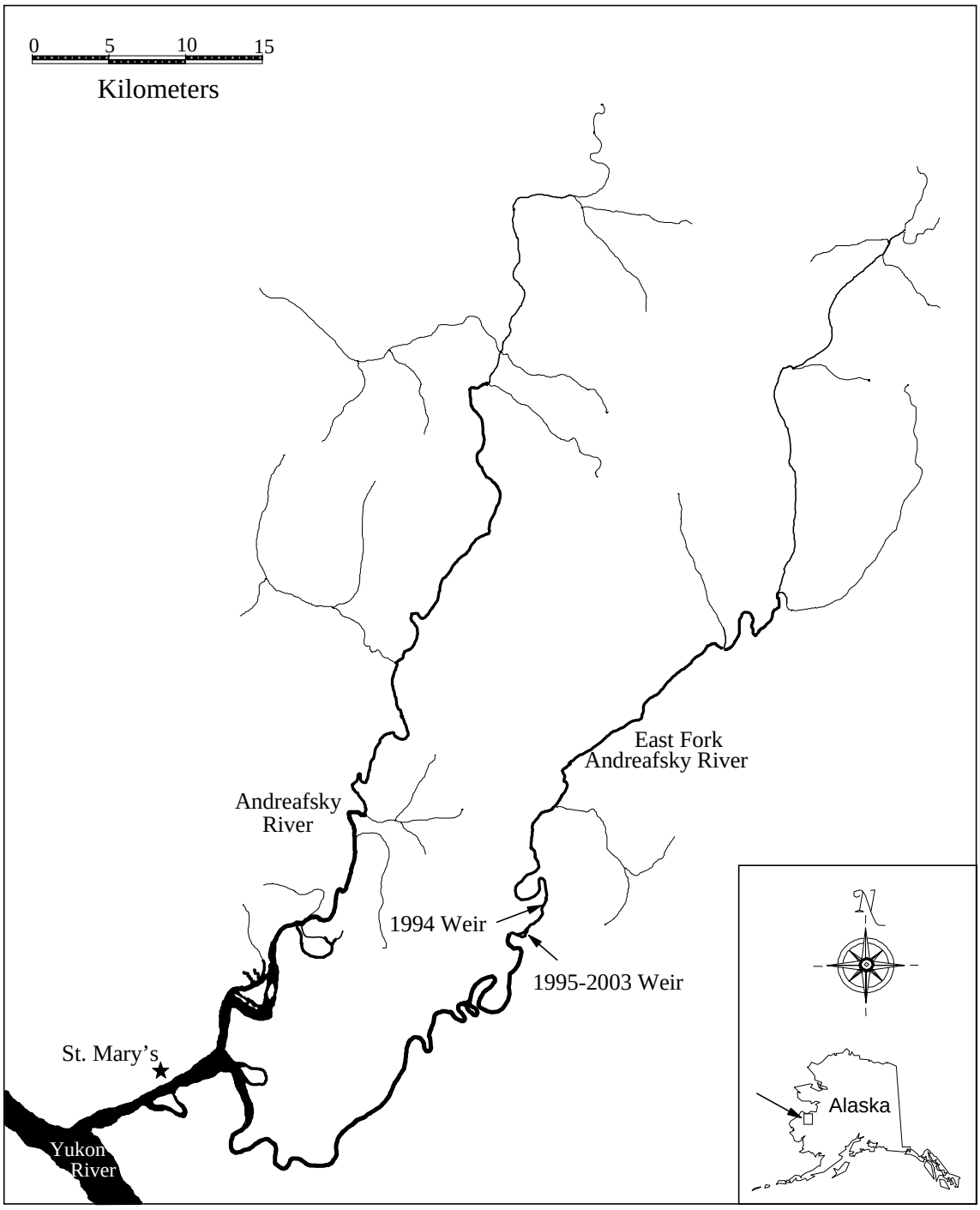

Figure 1. Weir locations in the East Fork Andreafsky River, Alaska, 1994-2003.

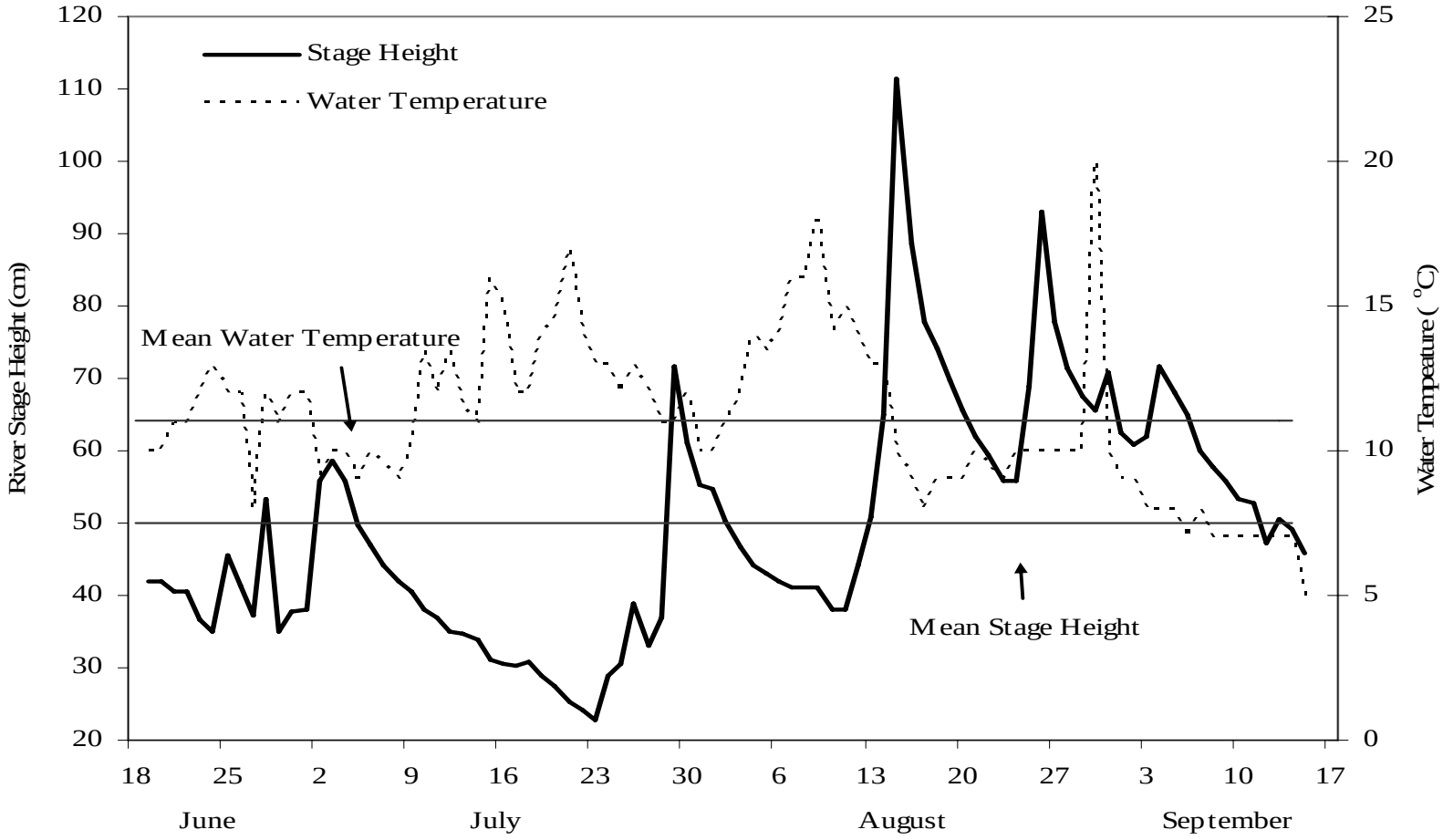

Figure 2. River stage heights and water temperatures at the East Fork Andreafsky River weir, 2003.

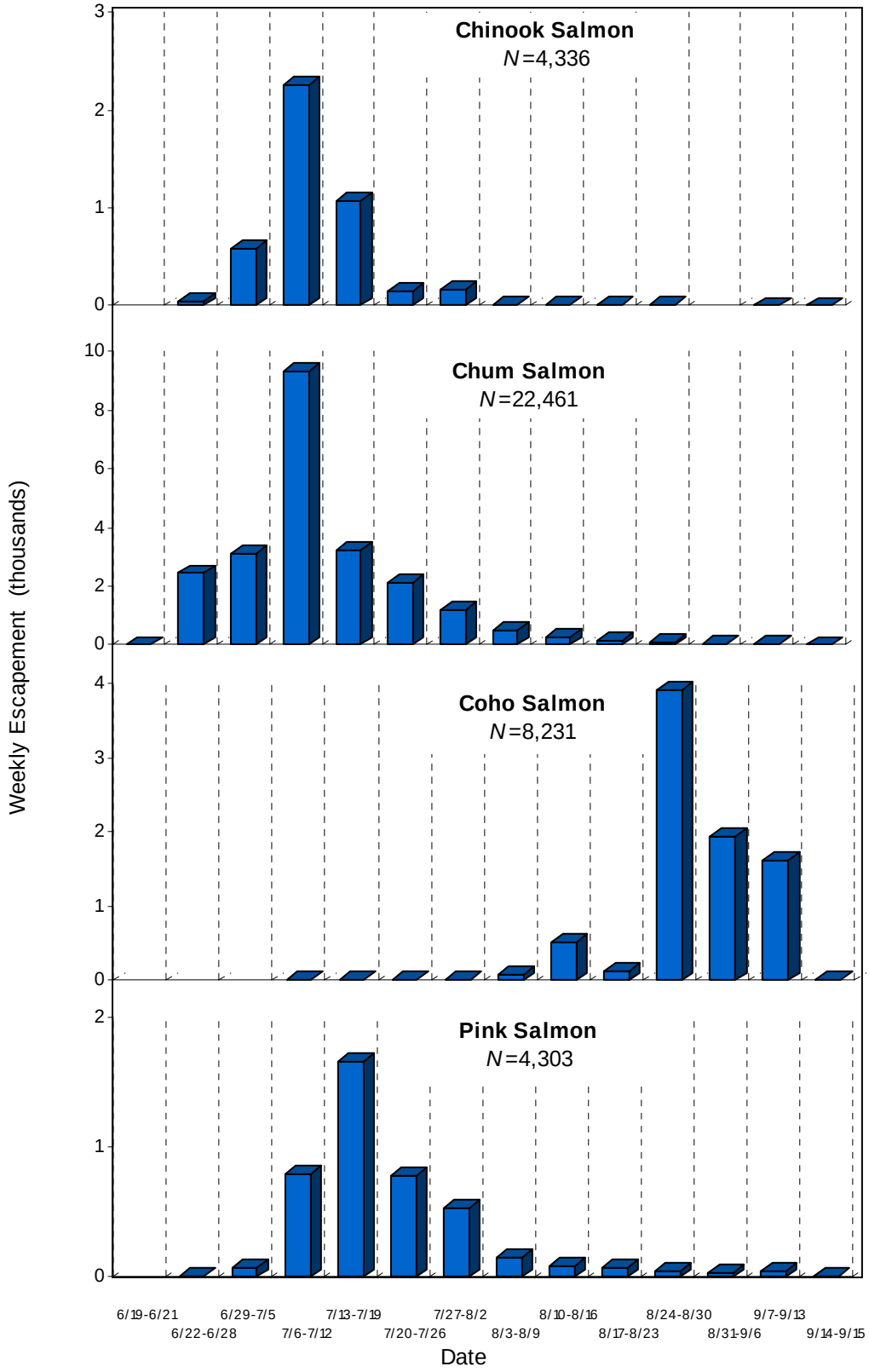

Figure 3. Weekly Chinook, chum, coho, and pink salmon escapement estimates through the East Fork Andreafsky River weir, Alaska, 2003.

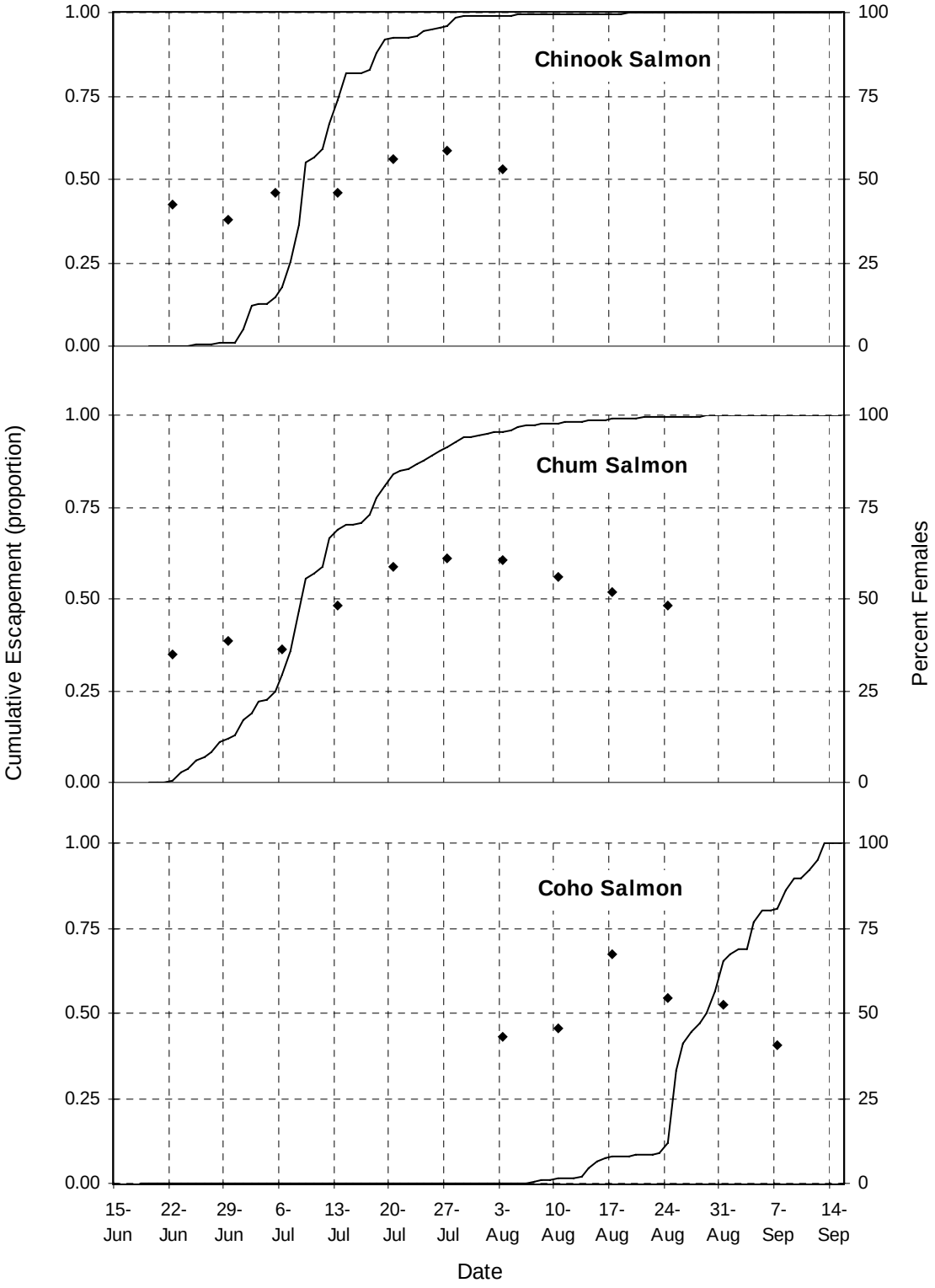

Figure 4. Cumulative escapement expressed as a proportion of total run (solid line) and the percent females of weekly samples (diamonds) of Chinook, chum, and coho salmon escapement through the East Fork Andreafsky River weir, Alaska, June 19 to September 15, 2003.

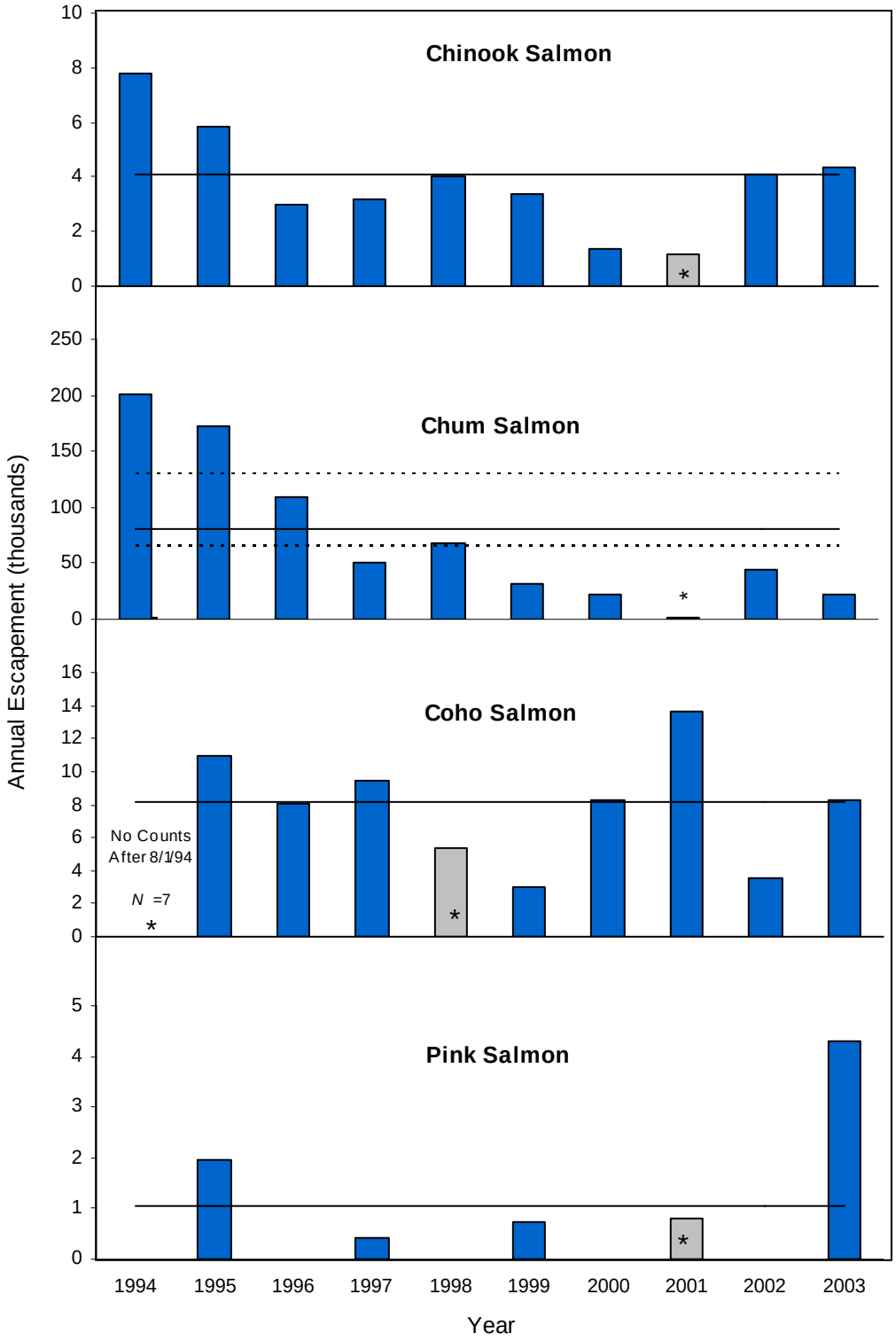

Figure 5. Annual escapement estimates of Chinook, chum, coho, and pink salmon migrating through the East Fork Andreafsky River weir, Alaska. Dotted lines represent the minimum and maximum Biological Escapement Goal. Solid lines represent the average escapement from 1994 through 2002. Years with an asterisk were not included in the average.

Appendix 1. Historical Chinook, chum, and coho salmon escapement estimates recorded for the Andreafsky River, Alaska, 1954-2003.

	East Fork Andreafsky River						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	7,000	
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 *b*		213 *b*		
1995	1,635			5,841	172,148	10,901	1,108		
1996				2,955	108,450	8,037	624		
1997	1,140			3,186	51,139	9,472	1,510		
1998	1,027			4,011	67,591	5,417 *b*	1,249		
1999				3,347 *e*	32,229 *e*	2,963			

Appendix 1. Continued.

	East Fork Andreafsky River						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
2000	1,018 *g*			1,344 *e*	22,918 *e*	8,225 *e*	427		
2001	1,065 *g*			1,148 *f*	2,086 *f*	9,252 *eh*	570		
2002	1,447 *g*			4,123	44,194	3,534 *e*	977		
2003				4,330 *ei*	22,356 *ei*	7,937 *ei*	1,578 *bg*		
I.O. *j*	>1,500	>109,000					>1,400	>116,000	

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 Data missing for one or more days.
f Weir installed to late for an accurate count.
g Personal communication with Tracy Lingnau, ADF&G.
h Adjusted count for coho 13,650.
i Adjusted count for Chinook 4,336, chum 22,461, and coho 8,231.
j Interim aerial index objective.

Appendix 2. Historical daily Chinook salmon escapements recorded at the East Fork Andreafsky River weir 1994 -2003. Missing daily counts in 2003 were estimated using a linear interpolation of the preceding and subsequent days' counts.

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

Appendix 2. Continued.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
29-Jul	10	9	13	58	23	159	57	41	4	28
30-Jul	13	5	7	144	31	80	4	16	2	4
31-Jul	10	1	10	2	17		20	11	46	0
1-Aug	1	8	4	8	20		12	8	55	2
2-Aug		2	2	4	4	18	4	12	48	5
3-Aug		13	2	128	11	42	24	4	10	1
4-Aug		5	5	2	1	11		8	3	1
5-Aug		6	6	1	7	5		6	3	4
6-Aug		6	2	0	9	2		1	4	0
7-Aug		19	7	1	10	1	4	11	4	1
8-Aug		20	3	2	3	4	7	0	0	3
9-Aug		25	2	2	5	0	10	4	0	1
10-Aug		25	5	1	7	1	3	2	0	0
11-Aug		7	2	1	1	2	8	1	4	1
12-Aug		4	3	7	8	5	4	1	0	1
13-Aug		11	0	14	7	3	1	10	1	2
14-Aug		2	0	18	1	9		0	1	3
15-Aug		2	0	26	0	2	6	11	0	3
16-Aug		3	3	2	12	4	2	8	0	2
17-Aug		3	0	4		7	1	2	3	1
18-Aug		3	2	3		3	2	2	0	1
19-Aug		2	2	3	2	0	2	2	1	2
20-Aug		1	3	2		6	3	1	0	2
21-Aug		2	3	1		0	1	0	0	0
22-Aug		0	0	4		1	1	1	5	0
23-Aug		1	2	2		0	0	0	0	0
24-Aug		1	0	1		0	1	1	1	2
25-Aug		0	0	4		0	0	0	0	2
26-Aug		0	1	0		1	2	0	0	1
27-Aug		0	0	0		1	0	0	0	0
28-Aug		3	0	1		0	0	0	0	0
29-Aug		1	2	2	0	0	0	0	0	0
30-Aug		0	1	3	1	0	0	0	1	0
31-Aug		0	2	1	1	0	0	0	0	0
1-Sep		1	0	0	0	0	0	0	0	0
2-Sep		0	0	0	0	1	1			0
3-Sep		0	0	4	0	0	0			0
4-Sep		0	0	0	0	0	0		0	0
5-Sep		1	0	1	0	1	0		0	0
6-Sep		0	1	1	0	0			0	0
7-Sep		0	0	0	1	0	0		0	0
8-Sep		3	0	2	0	0	0		0	0
9-Sep		0	0	1	1	0	0		0	1
10-Sep		0	0	0	0	0	0	0	0	0
11-Sep		0	0	0	1	0	0	0	0	0
12-Sep		0	0	2	0		0	0	0	0

Appendix 2. Continued.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
13-Sep			0	0	0		0	0	0	0
14-Sep			0				0	0	0	0
15-Sep			0				0	1		1
16-Sep			0				0			
17-Sep			0				0			
18-Sep							0			
19-Sep							0			
20-Sep							0			
21-Sep							0			
22-Sep							0			
23-Sep							0			
Total	7,801	5,841	2,955	3,186	4,011	3,347	1,344	1,148	4,123	4,336

= no counts, no estimates made.
= estimated escapement count.

Appendix 3. Historical daily chum salmon estimates recorded at the East Fork Andreafsky River weir 1994-2003. Missing daily counts in 2003 were estimated using a linear interpolation of the preceding and subsequent days' counts.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
14-Jun										
15-Jun				0						
16-Jun		52		1						
17-Jun		332		4		0				
18-Jun		191		71		0				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
24-Jun		1,951	798	1,620	18	1			6	182
25-Jun		364	303	1,422	264	0			522	484
26-Jun		504	7,306	208	175	7			694	183
27-Jun		12,620	3,435	1,691	535	8			2,448	396
28-Jun		11,201	1,463	1,196	65	0			6,754	546
29-Jun	609	9,256	2,335	61	3,153	331			1,765	219
30-Jun	19,254	10,938	314	80	4,585	4,459	837		836	271
1-Jul	12,435	8,654	9,164	1,537	4,003	765	1,725		4,403	928
2-Jul	2,840	5,553	3,326	619	652	459	1,460		2,467	339
3-Jul	4,973	2,710	8,973	756	1,687	24	1,750		2,291	713
4-Jul	13,321	10,678	10,018	1,264	3,561	3,000	2,070		28	175
5-Jul	12,552	10,026	7,355	831	7,996	4,605	2,300		347	484
6-Jul	4,043	23,584	3,351	3,428	6,030	1,185	3,717		4,423	1,051
7-Jul	27,527	8,514	3,124	2,980	4,696	1,619	72		2,254	1,376
8-Jul	5,251	732	4,771	2,440	3,088	1,569	1,548		845	2,476
9-Jul	3,883	4,808	3,500	1,799	845	1,754	942		2,265	2,025
10-Jul	12,416	6,473	2,303	3,195	1,003	2,135	727		1,732	244
11-Jul	6,896	6,072	1,275	1,792	4,003	1,897	855		1,221	412
12-Jul	8,424	3,973	1,497	1,738	4,401	501	477		1,099	1,762
13-Jul	14,628	4,552	1,680	1,062	829	710	911		1,055	586
14-Jul	11,611	2,990	1,038	1,302	1,248	1,223	352		544	254
15-Jul	8,275	2,874	935	3,222	2,160	412	638	196	1,014	33
16-Jul	4,690	3,449	1,280	2,441	2,747	507		133	581	123
17-Jul	4,886	2,739	774	1,150	3,038	547		95	420	445
18-Jul	4,532	1,495	852	715	1,580	494		229	492	1,078
19-Jul	2,977	651	1,848	624	1,365	666		102	392	708
20-Jul	1,091	1,150	1,721	1,220	370	816	206	74	192	681
21-Jul	1,351	807	1,116	800	335	242	424	228	153	283
22-Jul	2,228	591	605	668	304	240	280	72	61	47
23-Jul	1,320	742	246	405	248	201	116	29	201	306
24-Jul	868	290	291	313	200	173	84	32	98	222
25-Jul	1,349	1,214	196	121	220	131	159	155	26	348
26-Jul	1,977	521	365	339	166	73	130	116	22	218
27-Jul	2,196	605	278	400	130	132	64	110	60	220
28-Jul	841	265	738	219	202	92	43	88	123	389

Appendix 3. Continued.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
29-Jul	564	211	334	234	145	245	173	78	17	220
30-Jul	524	248	272	131	115	242	70	37	36	61
31-Jul	410	94	260	86	140		172	10	119	80
1-Aug	239	160	93	134	191		89	24	81	104
2-Aug		81	158	81	91	118	125	40	33	111
3-Aug		147	91	182	76	124	109	28	36	40
4-Aug		59	192	48	56	117		17	40	91
5-Aug		77	132	101	73	45		13	3	182
6-Aug		115	215	77	71	17		2	7	52
7-Aug		76	163	29	104	11	5	7	13	85
8-Aug		78	54	31	77	16	12	7	5	44
9-Aug		70	110	44	34	10	10	7	5	21
10-Aug		61	137	17	57	32	13	4	13	21
11-Aug		35	63	14	39	14	10	4	11	27
12-Aug		60	65	65	77	29	9	3	2	40
13-Aug		73	26	36	100	16	22	15	0	21
14-Aug		62	35	33	58	6		9	0	52
15-Aug		49	59	31	34	10	4	9	1	43
16-Aug		95	80	46	32	13	4	11	6	35
17-Aug		64	35	37		10	5	6	1	27
18-Aug		83	33	58		6	13	6	2	19
19-Aug		41	110	43	16	3	5	10	0	32
20-Aug		45	33	95		3	3	7	2	22
21-Aug		47	64	54		19	0	7	0	21
22-Aug		43	27	37		2	1	3	2	10
23-Aug		35	37	31		6	2	10	3	12
24-Aug		35	26	41		5	4	5	3	11
25-Aug		56	103	41		5	6	4	3	24
26-Aug		53	35	18		2	19	2	1	13
27-Aug		57	26	20		9	17	3	0	11
28-Aug		31	39	38		7	13	3	1	5
29-Aug		53	78	57	2	5	10	1	0	14
30-Aug		34	66	73	4	11	9	4	0	6
31-Aug		63	31	21	11	13	2	11	0	2
1-Sep		48	38	14	8	18	6	10	0	1
2-Sep		75	40	13	4	19	5			1
3-Sep		36	49	53	5	15	4			5
4-Sep		25	48	28	8	5	2		0	0
5-Sep		30	37	38	1	4	1		0	0
6-Sep		50	29	31	8	4			0	2
7-Sep		60	50	51	6	3	1		1	4
8-Sep		96	39	28	4	2	0		0	2
9-Sep		42	32	22	3	2	0		0	3
10-Sep		42	32	24	9	3	9	2	2	1
11-Sep		37	24	48	10	4	3	0	1	0
12-Sep		15	16	42	3		5	1	8	16

Appendix 3. Continued.

Date	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
13-Sep			18	23	4		1	1	2	3
14-Sep			39				2	3	1	1
15-Sep			33				5	3		3
16-Sep			38				18			
17-Sep							3			
18-Sep							6			
19-Sep							4			
20-Sep							8			
21-Sep							10			
22-Sep							1			
23-Sep							1			
Total	200,981	172,148	108,450	51,139	67,591	32,229	22,918	2,086	44,194	22,461

= no counts, no estimates made.
= estimated escapement count.

Appendix 4. Historical daily coho salmon estimates recorded at the East Fork Andreafsky River weir, 1995-2003. Missing daily counts in 2003 were estimated using a linear interpolation of the preceding and subsequent days' counts. Estimates for 2001 were made using historical percent passage data from 1995 to 2000.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003
14-Jun									
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	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	0	0			0	0
30-Jun	0	0	0	0	0	0		0	0
1-Jul	0	0	0	0	0	0		0	0
2-Jul	0	0	0	0	0	0		0	0
3-Jul	0	0	0	0	0	0		0	0
4-Jul	0	0	0	0	0	0		0	0
5-Jul	0	0	0	0	0	0		0	0
6-Jul	0	0	0	0	0	0		0	0
7-Jul	0	0	0	0	0	0		0	0
8-Jul	0	0	0	0	0	0		0	1
9-Jul	0	0	0	0	0	0		0	0
10-Jul	0	0	0	0	0	0		0	0
11-Jul	0	0	0	0	0	0		0	0
12-Jul	0	0	0	0	0	0		0	0
13-Jul	0	0	0	0	0	0		0	0
14-Jul	0	0	0	0	0	0		0	0
15-Jul	0	0	0	0	0	0	0	0	2
16-Jul	0	0	0	0	0		0	0	0
17-Jul	0	0	0	0	0		0	0	0
18-Jul	0	0	0	0	0		0	0	0
19-Jul	0	0	0	0	0		0	0	0
20-Jul	0	0	0	0	0	0	0	0	1
21-Jul	0	0	0	0	0	0	0	0	0
22-Jul	0	0	0	0	0	0	0	0	0
23-Jul	0	11	0	0	0	0	0	0	0
24-Jul	0	2	0	0	0	0	0	0	2
25-Jul	0	1	0	0	0	0	0	0	0
26-Jul	0	4	0	0	0	0	0	0	0
27-Jul	0	0	0	0	0	0	0	0	0
28-Jul	0	3	0	1	0	0	0	0	0

Appendix 4. Continued.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003
29-Jul	0	3	0	0	0	0	0	0	0
30-Jul	0	9	0	1	0	1	0	0	1
31-Jul	0	25	0	0		1	0	0	2
1-Aug	0	1	0	0		7	0	0	0
2-Aug	0	7	0	1	0	9	0	0	1
3-Aug	1	4	0	5	0	18	0	0	1
4-Aug	0	15	0	8	9		0	1	1
5-Aug	0	20	0	8	4		0	0	2
6-Aug	0	10	0	5	4		0	0	4
7-Aug	1	26	1	16	0	12	0	0	28
8-Aug	1	20	0	9	0	35	0	0	25
9-Aug	3	26	0	5	1	79	0	0	27
10-Aug	8	138	0	8	2	125	0	1	5
11-Aug	12	105	0	3	2	89	0	0	9
12-Aug	5	50	10	4	5	51	0	0	19
13-Aug	3	16	47	111	1	211	0	0	40
14-Aug	3	11	35	71	1		1	0	194
15-Aug	9	19	6	9	0	64	22	0	146
16-Aug	5	276	8	61	5	34	33	0	98
17-Aug	11	92	7		2	23	5	0	50
18-Aug	24	179	12		0	137	5	0	2
19-Aug	41	1,052	13	8	0	108	51	1	7
20-Aug	24	100	50		1	333	532	0	21
21-Aug	95	149	414		42	303	270	0	11
22-Aug	246	9	222		48	59	312	3	3
23-Aug	305	32	22		0	10	343	6	24
24-Aug	414	12	16		26	44	583	3	263
25-Aug	245	1,539	577		8	533	217	7	1,744
26-Aug	692	449	150		4	1,401	857	0	634
27-Aug	1,436	5	10		4	1,643	382	0	288
28-Aug	368	1	24		3	279	403	2	197
29-Aug	938	179	2,335	371	0	626	103	0	243
30-Aug	335	1,489	2,714	618	2	278	1,078	0	552
31-Aug	265	374	122	568	1	192	2,264	0	729
1-Sep	444	374	73	336	411	358	1,576	0	172
2-Sep	863	147	53	17	162	238	432		107
3-Sep	14	100	421	80	1,255	162	1,174		9
4-Sep	29	250	355	490	704	160	953	43	646
5-Sep	6	337	219	228	122	39	349	640	275
6-Sep	21	78	514	591	40		429	738	14
7-Sep	164	84	435	12	0	52	182	413	42
8-Sep	2,403	24	169	0	14	48	573	345	459
9-Sep	854	16	223	94	19	55	306	103	268
10-Sep	391	1	52	555	41	94	85	237	9
11-Sep	127	0	83	1,104	20	31	30	117	211
12-Sep	95	0	64	6		79	20	726	231

Appendix 4. Continued.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003
13-Sep		0	16	13		30	43	113	399
14-Sep		0				22	21	35	8
15-Sep		3				16	16		4
16-Sep		160				28			
17-Sep						19			
18-Sep						3			
19-Sep						5			
20-Sep						5			
21-Sep						34			
22-Sep						32			
23-Sep						10			
Total	10,901	8,037	9,472	5,417	2,963	8,225	13,650	3,534	8,231

= no counts, no estimates made.
= estimated escapement count.

Appendix 5. Historical daily pink salmon odd year escapement estimates recorded at the East Fork Andreafsky River weir, 1995-2003. Missing daily counts in 2003 were estimated using a linear interpolation of the preceding and subsequent days' counts.

Date	1995	1997	1999	2001	2003
14-Jun					
15-Jun		0			
16-Jun	0	0			
17-Jun	0	0	0		
18-Jun	0	0	0		
19-Jun	0	0	0		0
20-Jun	0	0	0		0
21-Jun	0	0	0		0
22-Jun	0	0	0		0
23-Jun	0	0	0		0
24-Jun	0	0	0		0
25-Jun	0	0	0		3
26-Jun	0	0	0		0
27-Jun	1	1	0		6
28-Jun	0	0	0		4
29-Jun	2	0	0		3
30-Jun	3	0	0		0
1-Jul	13	2	0		16
2-Jul	4	0	0		12
3-Jul	4	0	0		13
4-Jul	5	1	0		13
5-Jul	9	0	0		16
6-Jul	98	2	2		24
7-Jul	77	0	2		94
8-Jul	4	1	1		172
9-Jul	18	2	2		259
10-Jul	33	1	10		16
11-Jul	23	2	20		43
12-Jul	100	4	17		185
13-Jul	109	6	18		173
14-Jul	94	1	7		189
15-Jul	81	35	2	10	28
16-Jul	64	31	2	4	13
17-Jul	60	13	4	5	96
18-Jul	31	5	4	26	702
19-Jul	15	6	14	15	459
20-Jul	30	4	69	47	288
21-Jul	40	4	38	61	98
22-Jul	48	4	41	19	18
23-Jul	77	5	25	18	107
24-Jul	25	2	23	38	107
25-Jul	216	0	22	124	124
26-Jul	88	6	11	53	43
27-Jul	37	13	24	68	47
28-Jul	20	9	11	94	130

Appendix 5. Continued.

Date	1995	1997	1999	2001	2003
29-Jul	14	20	26	56	140
30-Jul	29	26	13	22	29
31-Jul	11	2		10	65
1-Aug	22	7		17	69
2-Aug	23	2	5	19	54
3-Aug	44	8	48	17	33
4-Aug	20	3	60	12	34
5-Aug	17	3	28	5	35
6-Aug	22	1	14	10	17
7-Aug	37	1	13	10	20
8-Aug	20	5	19	0	9
9-Aug	29	1	7	3	8
10-Aug	46	4	16	6	9
11-Aug	18	7	15	10	6
12-Aug	11	6	17	3	10
13-Aug	12	4	8	8	14
14-Aug	32	3	5	6	21
15-Aug	20	0	3	2	16
16-Aug	19	3	17	1	11
17-Aug	17	5	1	1	6
18-Aug	6	4	6	1	1
19-Aug	7	2	0	6	14
20-Aug	4	4	1	1	18
21-Aug	7	1	1	0	10
22-Aug	6	2	3	1	8
23-Aug	4	2	2	3	12
24-Aug	8	8	7	1	13
25-Aug	3	10	1	0	10
26-Aug	5	3	4	1	9
27-Aug	9	1	1	0	2
28-Aug	0	9	6	0	4
29-Aug	7	15	6	0	3
30-Aug	5	16	2	3	1
31-Aug	0	1	3	0	0
1-Sep	0	1	1	0	10
2-Sep	2	0	1	0	2
3-Sep	1	20	8	0	6
4-Sep	0	13	2	0	8
5-Sep	1	5	4	0	5
6-Sep	1	2	2	0	4
7-Sep	1	3	3	0	8
8-Sep	1	3	0	0	12
9-Sep	0	5	0	0	7
10-Sep	1	4	0	0	5
11-Sep	0	12	3	0	6
12-Sep	1	6		0	4

Appendix 5. Continued.

Date	1995	1997	1999	2001	2003
13-Sep		6		2	7
14-Sep				0	3
15-Sep				1	4
16-Sep					
17-Sep					
18-Sep					
19-Sep					
20-Sep					
21-Sep					
22-Sep					
23-Sep					
Total	1,972	429	751	820	4,303

= estimated escapement count.
= no counts, no estimates made.