AYK REGION
YUKON SALMON ESCAPEMENT
REPORT #34

ANVIK AND ANDREAFSKY RIVER SALMON STUDIES, 1987

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TABLE OF CONTENTS

	Page
LIST OF TABLES	ii
LIST OF FIGURES	iii
LIST OF APPENDICES	vi
INTRODUCTION	1
ANVIK RIVER SALMON STUDY	3
Methods and Materials	5
Results and Discussion	6
ANDREAFSKY RIVER SALMON STUDY	23
Methods and Materials	23
Results and Discussion	25
CONCLUSIONS AND RECOMMENDATIONS	39
LITERATURE CITED	42
APPENDICES	43

LIST OF TABLES

Table		Page
1.	Anvik River summer chum salmon sonar counts by date, 1987	10
2.	Oscilloscope and visual calibration of salmon sonar counts at the Anvik River west bank site, 1987	15
3.	Oscilloscope and visual calibration of salmon sonar counts at the Anvik River east bank site, 1987	17
4.	East Fork Andreafsky River expanded tower counts of salmon escapement by species and date, 1987	29

LIST OF FIGURES

Figure		Page
1.	Map of the Yukon River, showing fishing districts and major summer chum salmon spawning areas	2
2.	Map of the Anvik River	4
3.	Map of the Anvik River sonar site, and river depth profiles as measured on 21 June, 1987. Shaded areas show approximate range of insonification, and weirs are indicated with cross hatching. Unequal scale of the axes distorts the presentation	7
4.	Air temperature (daily minimum and maximum), water temperature, and relative water depth measured at noon daily at the Anvik River sonar site, 1987	9
5.	Anvik River summer chum salmon sonar counts by day, 1979-1987. Mean date of run passage (calculated with Day 1 = 16 June) is indicated by shaded bar, and standard deviation (SD) of the mean is given	11
6.	Anvik River summer chum salmon escapement estimated by combined tower and aerial survey count, 1972-1978, and by side-scanning sonar, 1979-1987	14
7.	Anvik River summer chum salmon sonar counts by hour of the day for the early (21 June-4 July), middle (5-14 July), and late (15 - 25 July) portion of the season, and for the entire 1987 season combined. Total sonar counts (n) used for this analysis are given for each period	18
8.	Anvik River summer chum salmon sonar counts by sonar sector for the early (21 June-4 July), middle (5 - 14 July), and late (15 - 25 July) portion of the season, and for the entire 1987 season combined. Sector 1 is west bank sector 1, 12 is west bank sector 12, 13 is east bank sector 12, and 24 is east bank sector 1. Total sonar counts (n) used for this analysis are given for each period	19
9.	Age and sex composition of Anvik River summer chum salmon, 1972-1987, presented as proportion of total sample for each year by age class. Note different scale for age 6	20

LIST OF FIGURES (CONTINUED)

Figure — Page

10. Age and sex composition of Anvik River chinook salmon, 1972-1987, presented as proportion of total sample for each year by age class. Note different scale for age 7 22

11. Map of the Andreafsky River, and of the tower site (inset) located at river mile 20 of the East Fork 24

12. River depth profiles of the East Fork Andreafsky River tower site as measured on 29 June and 18 July, 1987. Cross hatching indicates weirs. Shallow slough eastward of the inshore end of the east bank weir did not result in uncounted salmon passage. Unequal scale of the axes distorts the presentation. 26

13. Air temperature (daily minimum and maximum), water temperature, and relative water depth measured at noon daily at the East Fork Andreafsky River tower site, 1987 27

14. East Fork Andreafsky River summer chum salmon sonar or tower counts by day, 1981-1987. Mean date of run passage (calculated with Day 1 =16 June) is indicated by shaded bar, and standard deviation (SD) of the mean is given 30

15. East Fork Andreafsky River summer chum salmon escapement as estimated by aerial survey, 1972-1980 and 1985, by side-scanning sonar, 1981-1984, and by tower counts, 1986-1987 32

16. Cumulative proportion of season total summer chum, chinook, and pink salmon tower counts by date at the East Fork Andreafsky River, 1987 34

17. Distribution of summer chum, chinook, and pink salmon tower counts by hour of the day for the East Fork Andreafsky River, 1987. Counts obtained during the hours of 0800-1600 on 7-8 July and 14-15 July were not included 35

18. Age and sex composition of East Fork Andreafsky River summer chum salmon,1981-1987, presented as proportion of total sample for each year by age class. Note different scale for ages 3 and 6 36

LIST OF FIGURES (CONTINUED)

Figure Page

19. Age and sex composition of Andreafsky River chinook salmon, 1981-1987, presented as proportion of total sample for each year by age class. Note different scale for age 7 38

20. Run timing of Yukon River summer chum salmon in 1987 as indicated by catches, sonar counts, or tower counts at four sites. Mean date of run passage is indicated by shaded bar, and standard deviation (SD) of the mean is given 40

LIST OF APPENDICES

Appendix Table — Page

1. Anvik River salmon beach seine catch by species, sex, and date, 1987 43

2. Age and sex composition of Anvik River summer chum salmon escapement samples, 1972-1987 44

3. Age and sex composition of Anvik River chinook salmon escapement samples, 1972-1987 45

4. East Fork Andreafsky River summer chum salmon tower counts by hour and date, 1987 46

5. East Fork Andreafsky River chinook salmon tower counts by hour and date, 1987 47

6. East Fork Andreafsky River pink salmon tower counts by hour and date, 1987 48

7. East Fork Andreafsky River salmon beach seine catch by species, sex, and date, 1987 49

8. Age and sex composition of East Fork Andreafsky River summer chum salmon escapement samples, 1981-1987 50

9. Age and sex composition of Andreafsky River chinook salmon escapement samples, 1981-1987 51

INTRODUCTION

The Anvik and Andreafsky Rivers are the two largest producers of summer chum salmon (Oncorhynchus keta) in the Yukon River drainage (Figure 1). Buklis (1982) estimated that the Anvik River alone accounts for 35% of the total production. Other known major spawning populations occur in the Rodo, Nulato, Gisasa, Hogatza, Melozitna, Tozitna, Chena, and Salcha Rivers. Summer chum salmon spawn in lesser numbers in other tributaries of the Yukon River. Chinook (O. tshawytscha) and pink (O. gorbuscha) salmon occur in the Anvik and Andreafsky Rivers coincidentally with summer chum salmon, while coho salmon (O. kisutch) are known to occur in small numbers in the fall, but their abundance is not monitored.

Commercial and subsistence fisheries that harvest Anvik and Andreafsky River summer chum salmon occur throughout the mainstem Yukon River from the coast of the delta to the mouths of the respective tributary streams. Set and drift gillnets are the legal fishing gear in Districts 1, 2, and 3, while set gillnets and fishwheels may be used in District 4. Most of the effort and harvest occurs in Districts 1 and 2, and in the lower portion of District 4. Fish taken commercially in the lower three districts are fresh frozen, while District 4 is primarily a roe fishery due to market conditions and flesh quality. Commercial and subsistence summer chum salmon fisheries in the remainder of District 4 and in District 6 are supported by stocks other than those of the Andreafsky and Anvik Rivers. Very few summer chum salmon are harvested in District 5 due to the lack of significant spawning populations in that portion of the drainage.

Stock identification studies on Yukon River summer chum salmon using scale patterns analysis and protein electrophoresis techniques are being conducted by the Alaska Department of Fish and Game (ADF&G) and the United States Fish and Wildlife Service (USFWS), respectively. These studies were initiated in 1987, and results are not yet available.

Chinook salmon are the target species of the lower Yukon River (Districts 1, 2, and 3) commercial fishery during June and early July. Fishing is usually permitted with unrestricted mesh size gillnets until changeover to 6 inch maximum mesh size is required by Emergency Order. In most years the majority of the summer chum salmon run has passed through the lower river districts before the changeover to chum salmon gear. As a result, most of the summer chum salmon commercial harvest in the lower Yukon is usually taken from the later portion of the run.

The Board of Fisheries directed that, beginning with the 1985 season, there may be special small mesh gear openings during the chinook salmon season to optimize harvest of summer chum salmon. This would require that a relatively large summer chum salmon run

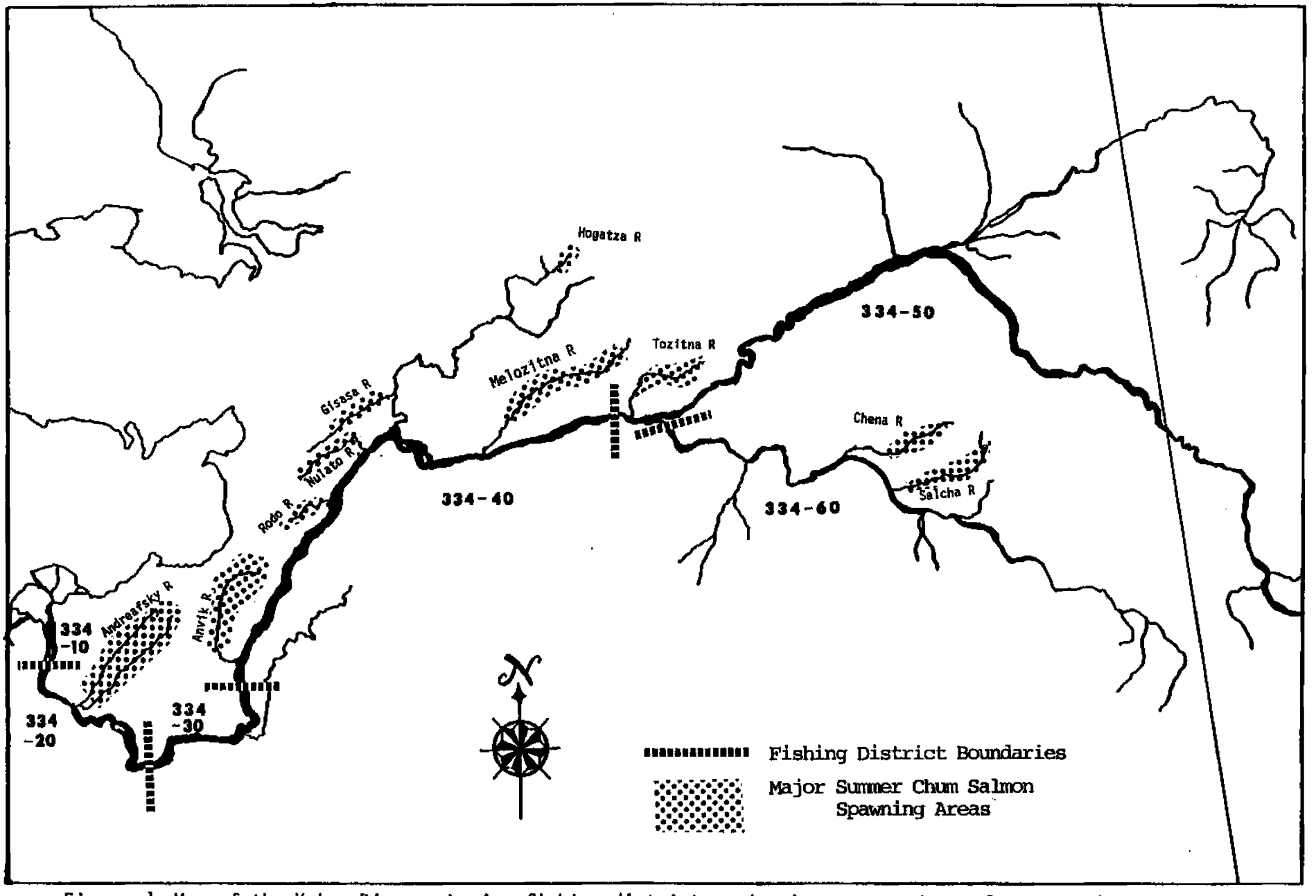


Figure 1. Map of the Yukon River, showing fishing districts and major summer chum salmon spawning areas.

is in progress, and that the incidental harvest of chinook salmon would not be substantial enough to have an adverse affect on the management of that species. The District 4 commercial fishery is directed primarily at chum salmon. Subsistence fisheries in all four districts take summer chum salmon primarily for sled dog food.

Summer chum salmon escapements to the major spawning areas in the Yukon River drainage have been estimated by aerial survey from fixed wing aircraft on a consistent basis since the early 1970's. Aerial surveys are subject to error and variability due to weather and stream conditions, timing of the survey relative to spawning stage, and subjectivity and experience on the part of the observer. The counts obtained are only indices of abundance since not all salmon present on the day of the survey are usually seen, and earlier and later spawners are not present. However, these indices, if obtained under standardized conditions, can be used to monitor the relative abundance of spawning escapements. Aerial surveys are the most feasible method of assessing salmon escapements in terms of cost and staff limitations in a watershed as immense and remote as that of the Yukon River. Escapement objectives have been established for both chinook and chum salmon in selected tributary streams for which there is a sufficient historical data base (ADF&G 1987).

Intensive studies are conducted for a few important and representative tributary stream salmon spawning populations in addition to the aerial survey program. The Anvik and Andreafsky Rivers were chosen for summer chum salmon research studies in 1972 and 1981, respectively. This report presents results of these studies for the 1987 field season, and provides recommendations for 1988 project operations.

ANVIK RIVER SALMON STUDY

The Anvik River (Figure 2) originates at an elevation of 1,300 feet and flows in a southerly direction approximately 120 miles to its mouth at mile 318 of the Yukon River. It is a narrow runoff stream with a substrate of gravel and cobble, except in the upper reach where bedrock is exposed. The Yellow River is a major tributary of the Anvik and is stained with tannic acid runoff. Downstream of the Yellow River confluence the Anvik River changes from a moderate gradient system to a low gradient system meandering through a much broader flood plain. Water clarity is reduced downstream of the Yellow River. Numerous oxbows, old channel cutoffs and sloughs are found throughout the lower river.

Salmon escapement was enumerated from counting towers located above the Yellow River from 1972 to 1978. A site 5-1/2 miles above the Yellow River was used from 1972 to 1975, and a site at Robinhood Creek, 2-1/2 miles above the Yellow River, was used from 1976 to 1978. Aerial surveys were flown each year (except

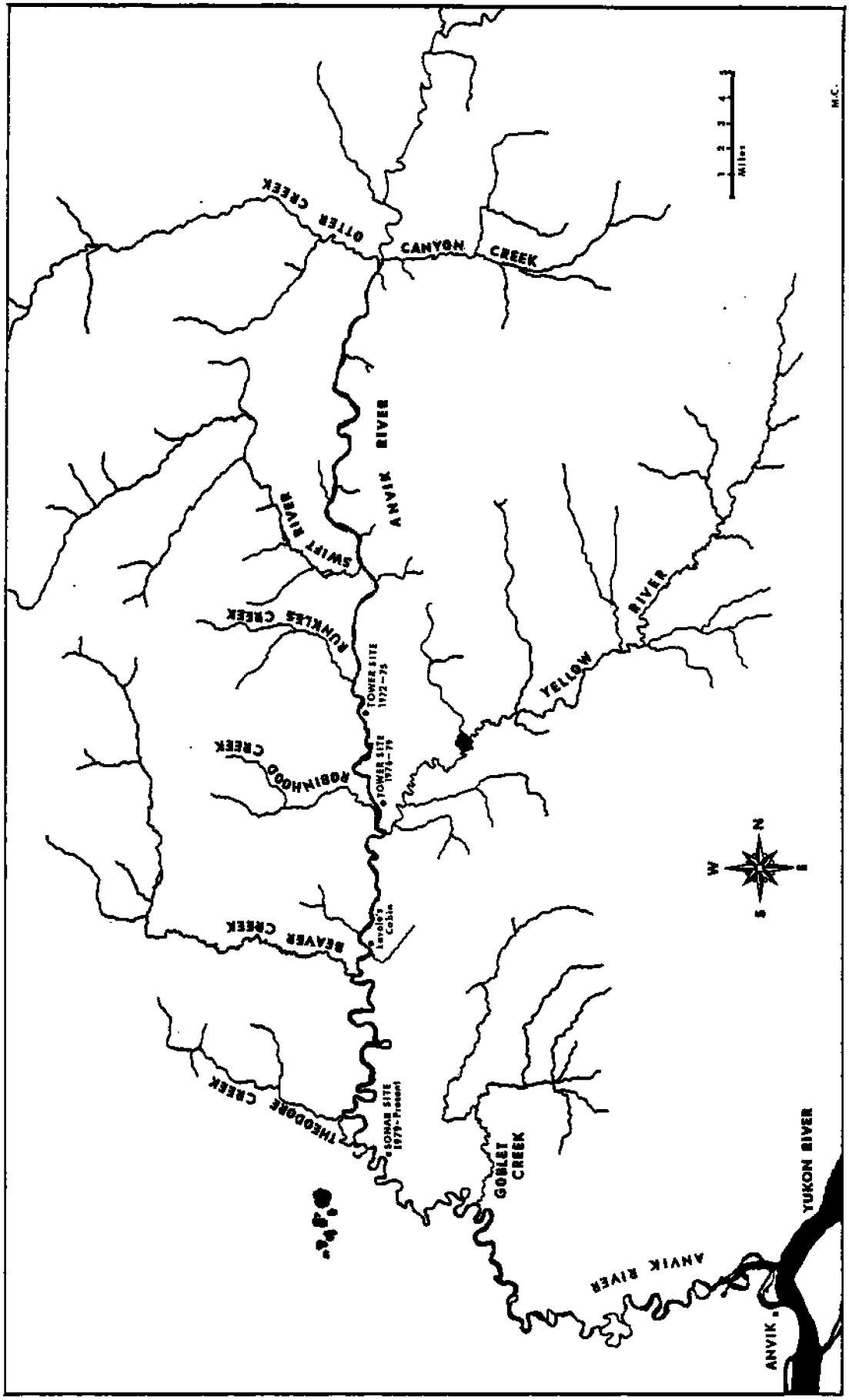


Figure 2. Map of the Anvik River.

1974) in fixed-wing aircraft to estimate salmon abundance below the tower site. High and turbid water often affects the accuracy of visual salmon enumeration from counting towers and aircraft.

The Electrodynamics Division of the Bendix Corporation developed a side-scanning sonar counter during the 1970's capable of detecting and counting salmon migrating along the banks of tributary streams. The sonar counter is designed to transmit a sonic beam along a 60 foot aluminum tube, or substrate. Echoes from salmon passing through the beam are reflected back to the transducer. The system electronics interpret the strength and number of the echoes, and tally salmon counts. Criteria for strength and frequency of the echoes are designed to optimize counting of salmon and minimize any non-salmon counts (ie debris or other fish species). Salmon escapement was enumerated by sonar beginning in 1979, replacing and proving superior to the tower counting method. One sonar counter has been installed on each bank of the Anvik River near Theodore Creek each year. Aerial survey data indicates that virtually all summer chum salmon spawners are found upstream of this site.

Methods and Materials

Two 1978 model sonar counters were operated without artificial aluminum substrate tubes throughout the season for the third consecutive year. Each sonar transducer was mounted on a rectangular aluminum frame. The east and west bank sites used in previous years were probed to locate uniform river bottom gradients that would provide optimum surfaces for insonification. Two steel pipes were set into the river bottom on each side of the river, onto which the transducer frames were guided by side mounted steel sleeves. Counting ranges were initially set to 60 ft. Weirs prevented salmon passage inshore of the transducer on each bank. Transducers were moved inshore or offshore as required by fluctuating water levels.

Sonar counts were totaled electronically in twelve sectors for each bank and printed hourly. Sector counts missing as a result of debris or printer malfunction were estimated by averaging the counts in the same sector for the hour before and after the sector count in question. Counts were totaled daily for each bank using an electronic calculator, and the east and west bank totals summed to obtain the unadjusted daily escapement estimate. Since summer chum salmon greatly outnumber chinooks and pinks, and the counters do not distinguish between species of salmon, all sonar counts were attributed to summer chum salmon. A separate escapement estimate for chinook salmon was obtained by aerial survey.

Each sonar counter was calibrated four times daily by observing fish passage with an oscilloscope for a 15 minute period. Salmon passing through the sonar beam produce a distinct oscilloscope trace. Sonar and oscilloscope counts for each calibration period were related in the formula: $Q=SS/SC$, where SS = side scan sonar

counts, and SC = oscilloscope counts. The existing fish velocity setting was multiplied by Q to obtain the correct new setting if the difference between the counts was greater than 15%. The system was then recalibrated at the new setting. A record was kept of all adjustments to the sonar equipment. Fish passage was visually enumerated from 10 ft counting towers during sonar calibration periods as a further check on sonar accuracy whenever water and light conditions allowed. Polaroid sunglasses were worn to reduce water surface glare.

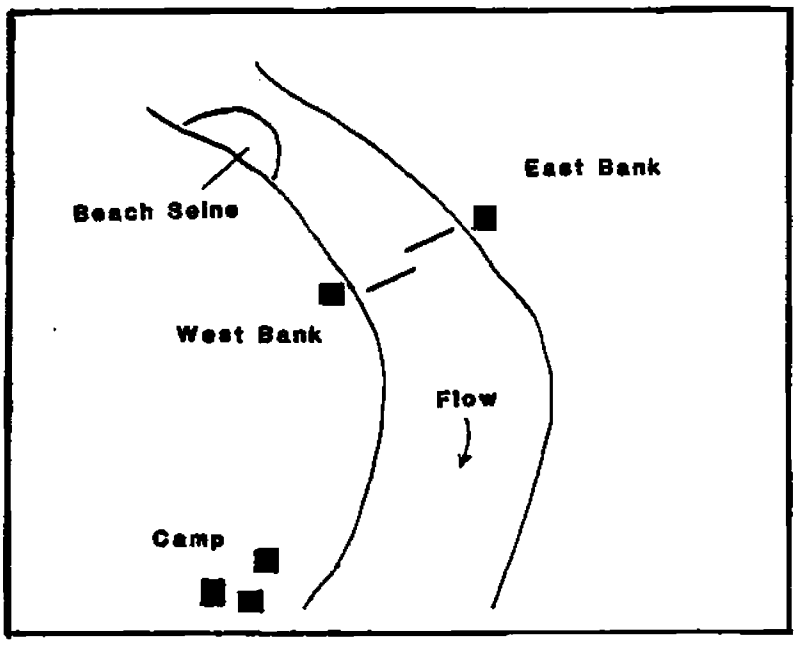
Daily sonar counts were adjusted based on the calibration data. The daily adjustment factor is the sum of calibration oscilloscope counts for that day divided by the sum of calibration sonar counts for that day. Daily sonar counts were multiplied by the daily adjustment factor to obtain corrected daily sonar counts. Mean and standard deviation of date of passage were calculated following the method presented by Mundy (1982).

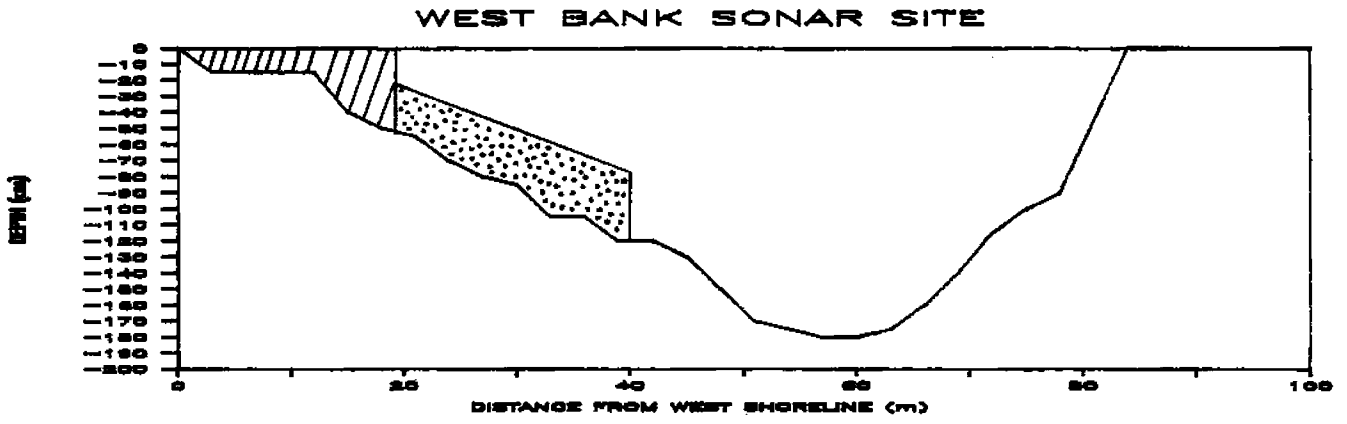
Water depth profile at the sonar site was measured at 3 m intervals across the width of the river by probing with a pole marked in 1 cm increments. Climatological data were collected at noon each day at the campsite. A pole marked in 1 cm increments was set in the river. Changes in water depth are presented as negative or positive from the initial reading of 0 cm. Water temperature was measured in degrees centigrade near shore, at a depth of about 0.5 m. Daily maximum and minimum air temperatures were recorded in degrees centigrade. Subjective notes were kept by the crew describing wind speed and direction, cloud cover, and precipitation.

A beach seine (100 ft long, 66 meshes deep, 2-1/2 in mesh) was set near the sonar site to capture chum and chinook salmon for age, sex, and size measurements. Chum and chinook salmon were placed in a holding pen, identified by sex, measured from mid-eye to fork of tail in mm, and one scale was taken for age determination. Scales were removed from an area posterior to the base of the dorsal fin and above the lateral line on the left side of the fish. The adipose fin was clipped on each fish before release to prevent resampling. Chinook salmon carcasses were sampled in August to supplement the beach seine sample. Three scales were taken from each carcass. Scale samples were later pressed on acetate cards and the resulting impressions viewed on a microfiche reader for age determination.

Results and Discussion

Two sonar counters were operated from 21 June through 26 July, at approximately the same sites used in previous years (Figure 3). The east bank transducer was located along a cutbank, 2 m offshore and at a depth of 70 cm. The west bank transducer was located along a gradually sloping gravel bar, approximately 60 m downstream from the east bank site. The transducer was 20 m offshore and at a depth of 55 cm. It is estimated that 10 m of





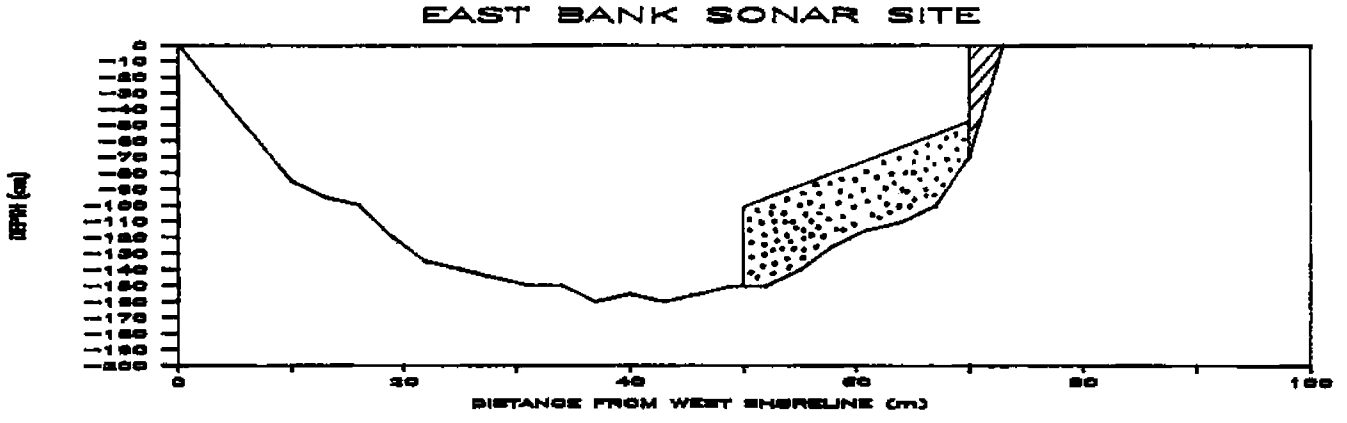


Figure 3. Map of the Anvik River sonar site, and river depth profiles as measured on 21 June, 1987. Shaded areas show approximate range of insonification, and weirs are indicated with cross hatching. Unequal scale of the axes distorts the presentation.

the river width was not insonified in the center of the channel when sonar counting was initiated on 21 June. River bottom gradient was smooth, with no obstructions to the sonar beams. Width of the river at the sonar site was 84 m, and maximum depth was 180 cm as measured on 21 June (Figure 3).

River water level was high for the time of year when the crew arrived to begin project operations. Water level declined in an irregular manner, with several sharp rises due to frequent rainfall throughout sonar project operation (Figure 4). The high water levels on 1 July, 11 July, and 21 July, however, never exceeded the initial level recorded at the start of the project. Water temperature ranged from a low of 9 C on 20 June to a high of 16 C on 15 July, while air temperature ranged from a low daily minimum of 3 C on 20 June to a high daily maximum of 26 C on 28 July.

The adjusted escapement count for the period 21 June through 26 July was 455,876 summer chum salmon (Table 1). Peak adjusted daily counts of 36,536 and 35,855 fish occurred on 6 and 15 July, respectively. These daily counts each represented approximately 8% of the total season sonar count. Escapement timing appeared to be relatively late, as it had been in 1980, 1982, 1984, and 1985 (Figure 5). Mean date of run passage was 11 July, with a standard deviation of 7.02 days. The daily escapement counts were bimodally distributed, as they were in 1979 and 1983.

Historical escapement timing patterns were used on an in-season basis to project the season escapement estimate for fishery management purposes. Sonar counts for the period 21 June - 3 July input into the average timing curve for a late escapement timing pattern (based on 1980, 1982, 1984, and 1985) resulted in an escapement projection of 408,600 summer chum salmon. This projection is 16% below the sonar count escapement objective of 487,000 fish for the Anvik River. The low projection, along with poor run indicators for other summer chum salmon stocks, resulted in restrictions being imposed on the commercial fisheries in Districts 1 through 4 during the later portion of the run.

Buklis (1982) expanded the season escapement estimates for 1972 through 1978, making it possible to more directly compare visual count estimates from those years with the more recent sonar count estimates (Figure 6). The 1987 escapement estimate of 455,876 summer chum salmon was 26% greater than the parent year escapement in 1983, but was 6% below the escapement objective of 487,000 fish and 27% below the long term (1972-1986) average of 628,000 fish.

A total of 34.67 hours of sonar calibration was conducted over a 35 day period at the west bank site, and sonar accuracy (sonar count/oscilloscope count) averaged 1.04 (Table 2). Although visual counts were not used to directly calibrate the sonar electronics due to frequently poor visual counting conditions, they did provide a measure of salmon species composition and an assessment of sonar aiming and counting accuracy. A net upstream

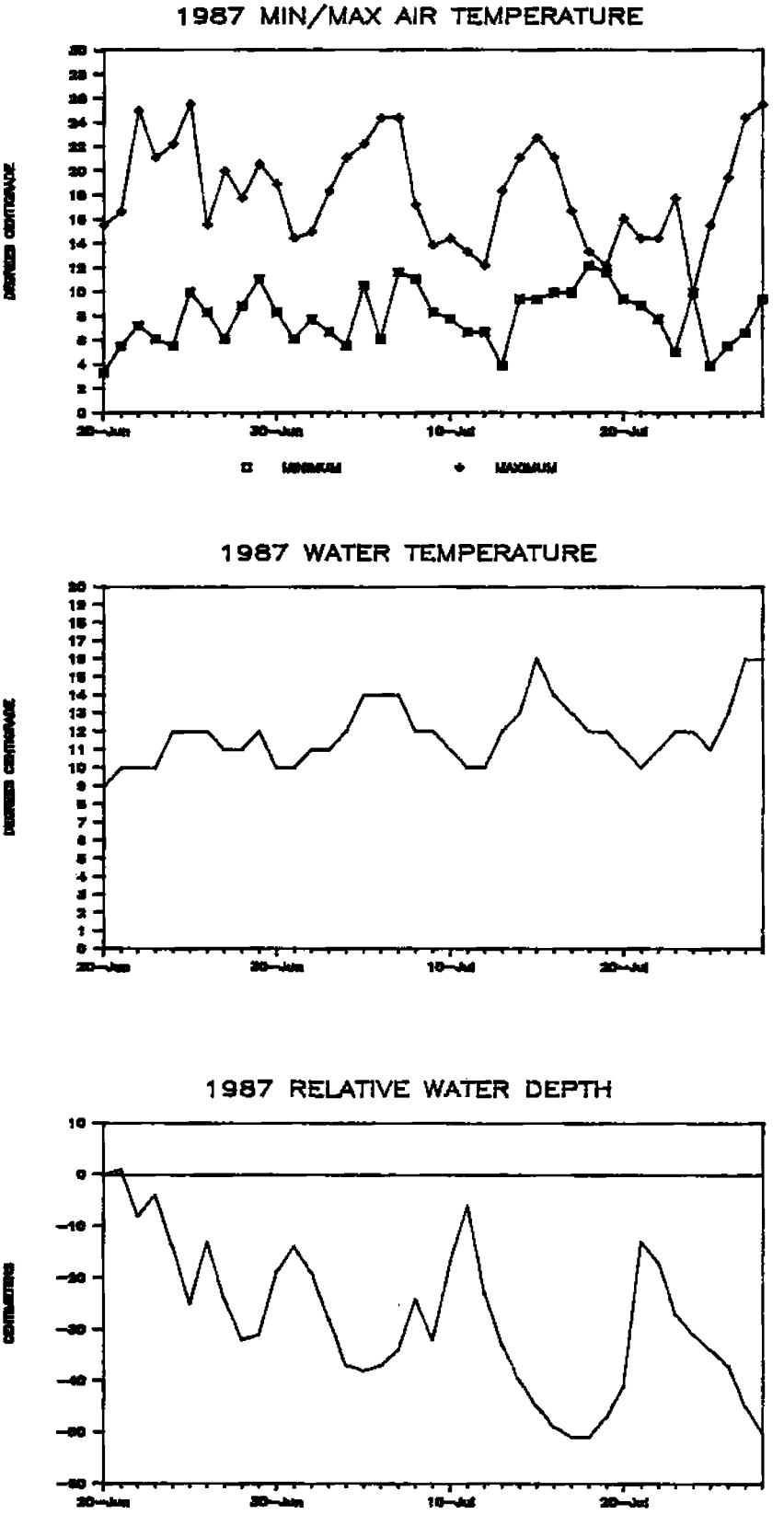
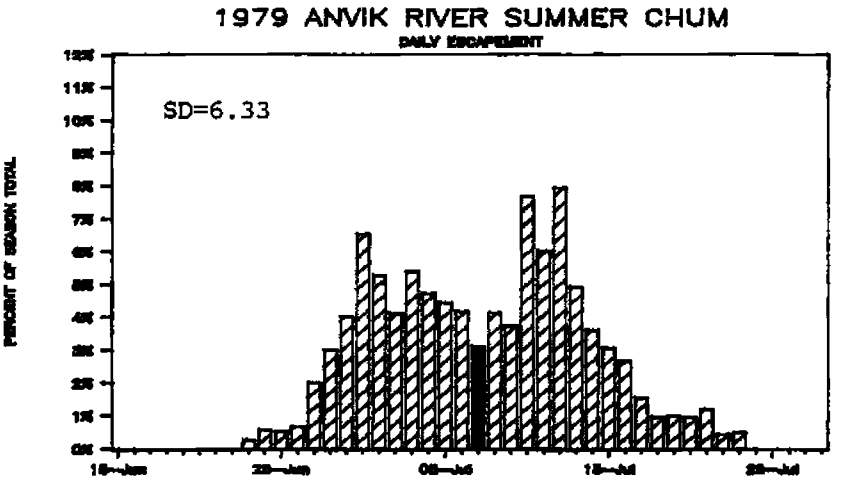


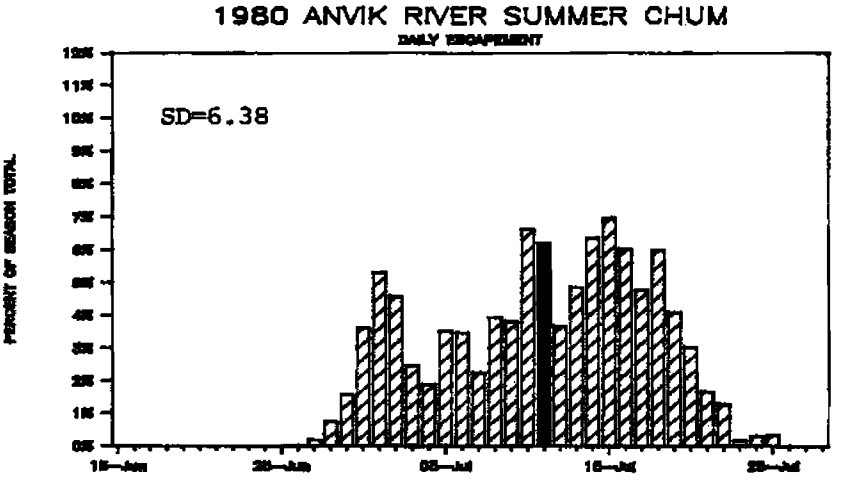
Figure 4. Air temperature (daily minimum and maximum), water temperature, and relative water depth measured at noon daily at the Anvik River sonar site, 1987.

Table 1. Anvik River summer chum salmon sonar counts by date, 1987.

Date	West Bank Raw Daily	West Bank Adjust Factor a	West Bank Correct Daily	East Bank Raw Daily	East Bank Adjust Factor a	East Bank Correct Daily	Entire River Daily Count	Entire River Season Count	Entire River Daily Prop	Entire River Season Prop
21-Jun	178	0.92 b	164	40	0.95 b	38	202	202	0.0004	0.0004
22-Jun	236	0.92 b	217	128	0.95 b	122	339	541	0.0007	0.0012
23-Jun	380	0.92 b	350	79	0.95 b	75	425	966	0.0009	0.0021
24-Jun	420	0.92 b	386	85	0.95 b	81	467	1,433	0.0010	0.0031
25-Jun	536	0.92 b	493	118	0.95 b	112	605	2,038	0.0013	0.0045
26-Jun	1,185	0.99	1,173	435	0.95 b	413	1,586	3,624	0.0035	0.0079
27-Jun	1,727	1.48	2,556	513	0.95 b	487	3,043	6,667	0.0067	0.0146
28-Jun	3,073	1.12	3,442	304	0.95 b	289	3,731	10,398	0.0082	0.0228
29-Jun	4,070	1.39	5,657	543	1.37	744	6,401	16,799	0.0140	0.0368
30-Jun	11,458	1.16	13,291	1,706	0.75	1,280	14,571	31,370	0.0320	0.0688
01-Jul	5,757	1.28	7,369	1,057	1.20	1,268	8,637	40,007	0.0189	0.0878
02-Jul	10,952	0.89	9,747	2,183	1.52	3,318	13,065	53,072	0.0287	0.1164
03-Jul	15,216	0.89 c	13,542	942	1.52 c	1,432	14,974	68,046	0.0328	0.1493
04-Jul	10,575	1.92	20,304	627	1.47	922	21,226	89,272	0.0466	0.1958
05-Jul	18,946	1.25	23,683	2,027	0.89	1,804	25,487	114,759	0.0559	0.2517
06-Jul	39,859	0.80	31,887	3,251	1.43	4,649	36,536	151,295	0.0801	0.3319
07-Jul	20,729	0.96	19,900	4,294	1.22	5,239	25,139	176,434	0.0551	0.3870
08-Jul	14,755	0.87	12,837	4,343	0.75	3,257	16,094	192,528	0.0353	0.4223
09-Jul	5,456	0.91	4,965	973	1.14	1,109	6,074	198,602	0.0133	0.4356
10-Jul	12,226	0.82	10,025	1,657	0.91	1,508	11,533	210,135	0.0253	0.4609
11-Jul	10,343	0.97	10,033	1,607	0.99	1,591	11,624	221,759	0.0255	0.4864
12-Jul	8,597	1.33	11,434	1,914	1.05	2,010	13,444	235,203	0.0295	0.5159
13-Jul	22,917	0.79	18,104	3,748	1.43	5,360	23,464	258,667	0.0515	0.5674
14-Jul	18,285	1.17	21,393	7,982	0.97	7,743	29,136	287,803	0.0639	0.6313
15-Jul	35,320	0.86	30,375	5,768	0.95	5,480	35,855	323,658	0.0787	0.7100
16-Jul	21,629	1.16	25,090	3,099	1.25	3,874	28,964	352,622	0.0635	0.7735
17-Jul	14,187	0.97	13,761	727	1.95	1,418	15,179	367,801	0.0333	0.8068
18-Jul	14,400	0.87	12,528	1,336	0.91	1,216	13,744	381,545	0.0301	0.8369
19-Jul	13,018	0.96	12,497	841	1.31	1,102	13,599	395,144	0.0298	0.8668
20-Jul	17,703	0.86	15,225	1,748	0.82	1,433	16,658	411,802	0.0365	0.9033
21-Jul	15,162	0.86	13,039	387	1.27	491	13,530	425,332	0.0297	0.9330
22-Jul	7,005	0.96	6,725	2,472	0.98	2,423	9,148	434,480	0.0201	0.9531
23-Jul	5,389	1.18	6,359	1,765	1.10	1,942	8,301	442,781	0.0182	0.9713
24-Jul	4,866	1.08	5,255	929	1.36	1,263	6,518	449,299	0.0143	0.9856
25-Jul	2,982	0.88	2,624	772	1.54 d	1,189	3,813	453,112	0.0084	0.9939
26-Jul	2,100 e	0.89	1,869	581 e	1.54 d	895	2,764 e	455,876	0.0061	1.0000

a Adjustment factor is the daily sum of calibration oscilloscope counts divided by the daily sum of calibration sonar counts. See Tables 2 and 3 for sonar calibration data.
b Sonar calibration data were pooled for 21-25 June for the west bank and 21-28 June for the east bank adjustment factor calculation due to low numbers of fish counted during calibration periods on these dates.
c Adjustment factor for 2 July was applied to 3 July counts for each bank due to scheduled crew day off for State holiday.
d Sonar calibration data were pooled for 24-26 July for the east bank adjustment factor calculation for 25-26 July due to low numbers of fish counted during calibration periods on these dates.
e Sonar counters operated from 0000 hours to 1200 hours only, therefore resulting count is only a partial daily escapement estimate.





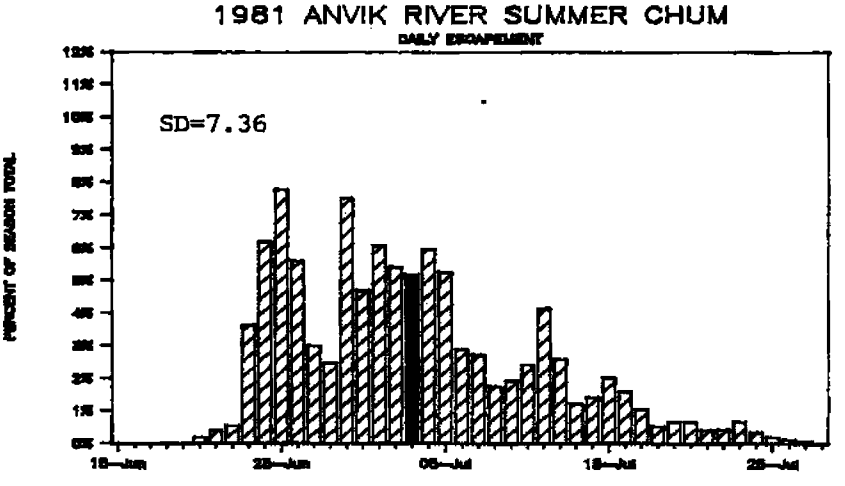
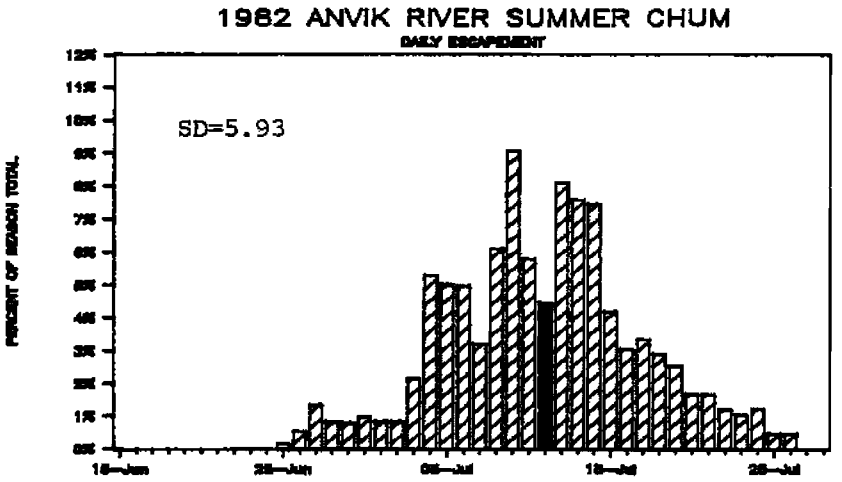
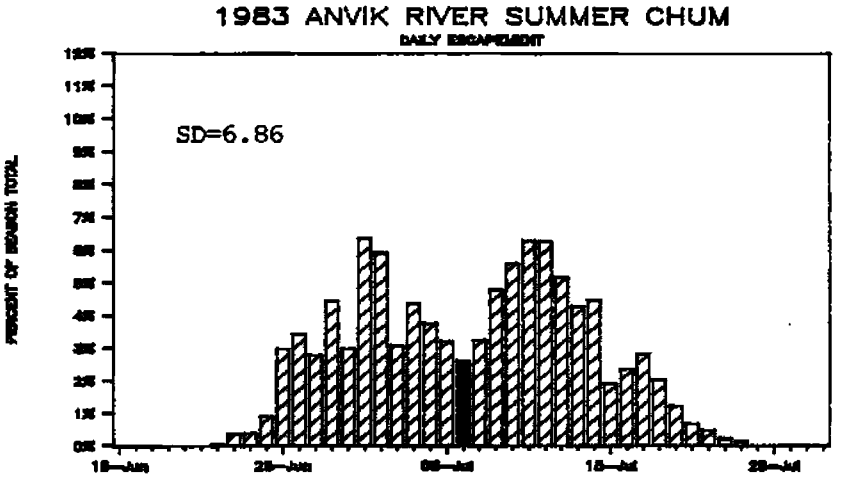


Figure 5. Anvik River summer chum salmon sonar counts by day, 1979-1987. Mean date of run passage (calculated with Day 1=16 June) is indicated by shaded bar, and standard deviation (SD) of the mean is given.





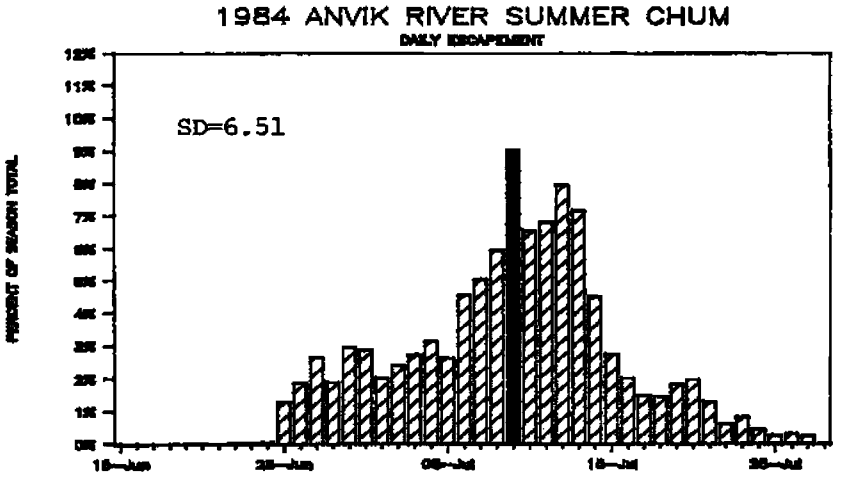
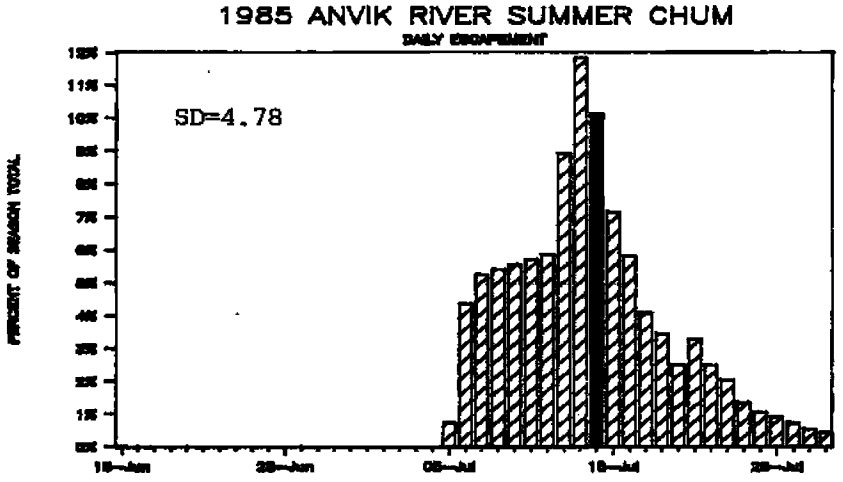
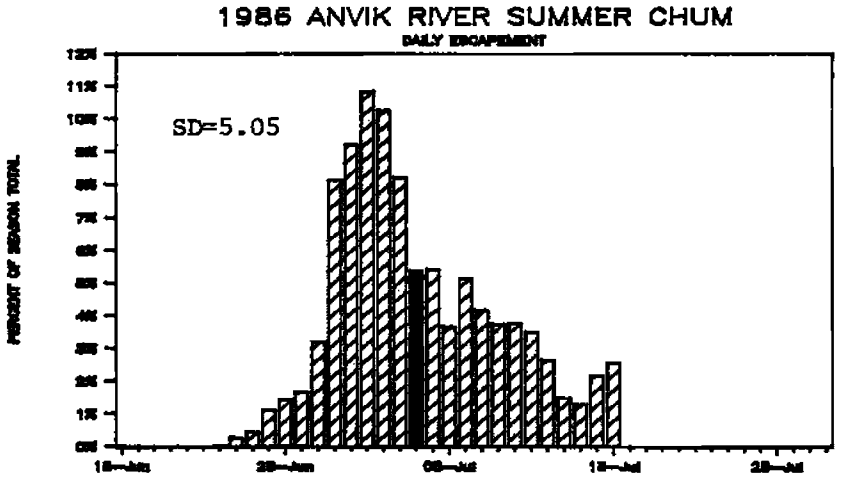


Figure 5. (Continued) Anvik River summer chum salmon sonar counts by day, 1979-1987. Mean date of run passage (calculated with Day 1=16 June) is indicated by shaded bar, and standard deviation (SD) of the mean is given.





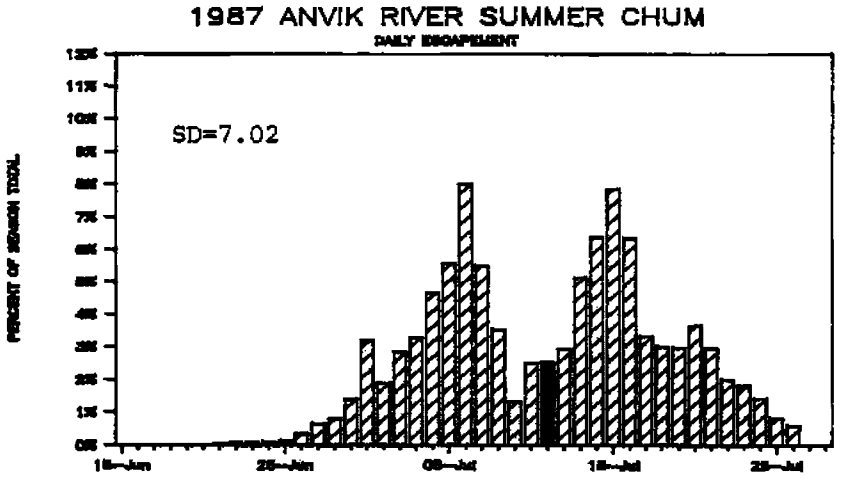


Figure 5. (Continued) Anvik River summer chum salmon sonar counts by day, 1979-1987. Mean date of run passage (calculated with Day 1=16 June) is indicated by shaded bar, and standard deviation (SD) of the mean is given.

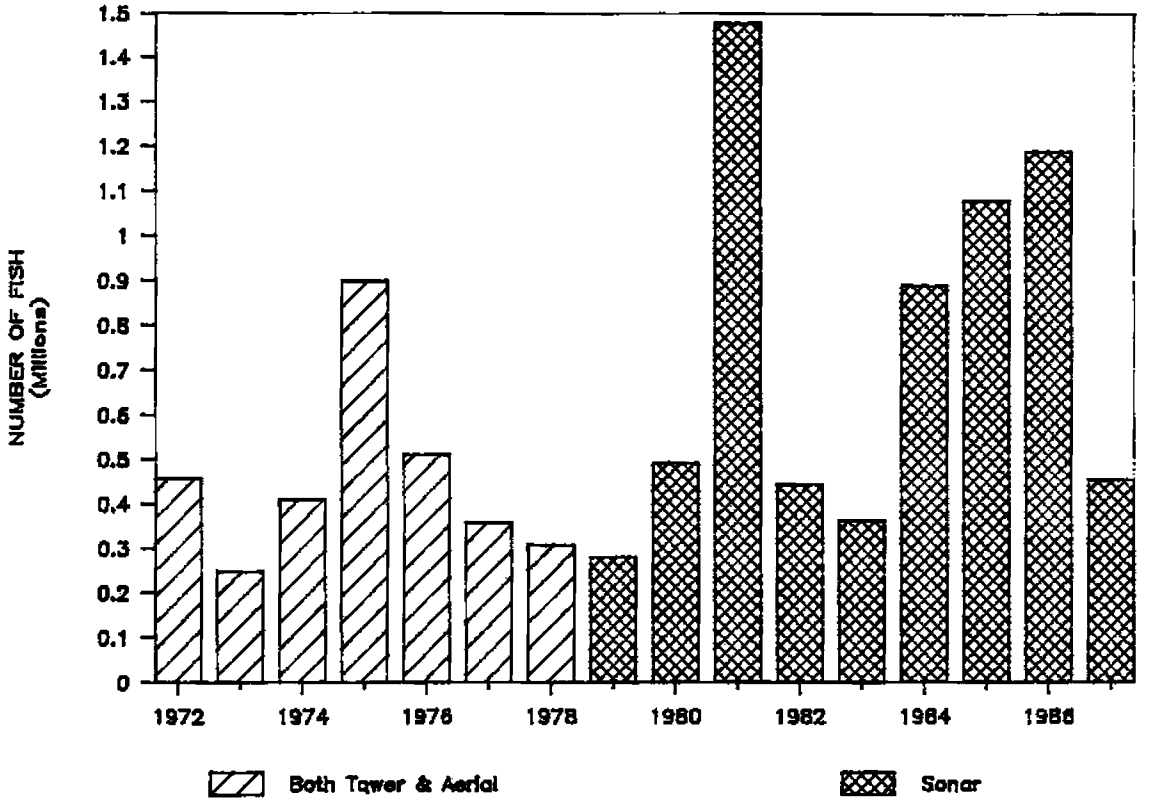


Figure 6. Anvik River summer chum salmon escapement estimated by combined tower and aerial survey count, 1972-1978, and by side-scanning sonar, 1979-1987.

Table 2. Oscilloscope and visual calibration of salmon sonar counts at the Anvik River west bank site, 1987.

Date	Hours Count	Sonar Count	Scope Count	Sonar/ Scope	Visual Count a								
					Chum			Chinook			Pink		
					Up	Down	Net	Up	Down	Net	Up	Down	Net
22-Jun	0.25	0	0	0.00									
23-Jun	1.00	15	1	15.00									
24-Jun	1.00	15	10	1.50	7	0	7						
25-Jun	1.00	45	58	0.78	39	0	39						
26-Jun	1.00	71	70	1.01	42	0	42						
27-Jun	1.00	85	126	0.67	45	0	45						
28-Jun	1.00	194	218	0.89	141	0	141	1	0	1			
29-Jun	0.58	111	154	0.72	116	0	116						
30-Jun	1.75	440	512	0.86	532	2	530						
01-Jul	1.08	158	203	0.78	110	0	110						
02-Jul	0.67	471	419	1.12	30	0	30						
03-Jul	0.00	0	0	0.00									
04-Jul	1.08	96	184	0.52	131	0	131						
05-Jul	0.92	369	463	0.80	595	0	595						
06-Jul	1.18	1,149	917	1.25	142	0	142						
07-Jul	1.25	769	735	1.05	26	0	26						
08-Jul	1.08	598	519	1.15									
09-Jul	1.25	280	256	1.09	75	0	75						
10-Jul	1.08	495	404	1.23									
11-Jul	1.17	409	395	1.04									
12-Jul	0.92	190	252	0.75	30	2	28						
13-Jul	1.08	775	612	1.27	140	0	140						
14-Jul	1.08	443	519	0.85	300	0	300	1	0	1			
15-Jul	1.33	1,469	1,266	1.16									
16-Jul	1.17	463	537	0.86									
17-Jul	1.00	507	492	1.03									
18-Jul	1.08	490	425	1.15									
19-Jul	1.17	580	557	1.04									
20-Jul	1.17	814	697	1.17									
21-Jul	0.50	307	265	1.16									
22-Jul	1.00	367	354	1.04									
23-Jul	1.08	192	227	0.85									
24-Jul	1.17	193	208	0.93									
25-Jul	1.33	201	176	1.14									
26-Jul	0.25	38	34	1.12									
Totals	34.67	12,799	12,265	1.04	2,501	4	2,497	2	0	2	0	0	0

a Visual counts are listed as upstream or downstream with "net" being the difference between the two. Errors in species identification or enumeration of fish may have been made due to poor water clarity, surface glare, oblique angle of vision, and lack of background contrast against the natural river bottom. In addition, visual counting was not conducted during all calibration periods due to the offshore movement of fish under certain conditions when a tower observer was present.

total of 2,497 chum salmon and 2 chinook salmon was visually enumerated at the west bank site during all calibration periods combined. Sonar accuracy averaged 0.95 for 34.87 hours of oscilloscope calibration at the east bank site over a period of 35 days (Table 3). A net upstream total of 1,389 chum salmon and 8 chinook salmon was visually enumerated during these calibration periods. Daily calibration oscilloscope and sonar counts for each bank were used to adjust the daily sonar counts for that bank, which were then summed to obtain corrected daily escapement estimates.

Temporal distribution of the combined east and west bank unadjusted sonar counts by hour indicates a distinct diel pattern (Figure 7). Counts were lowest during 1900-2000 (2.6% of daily total) and greatest during 0200-0300 (7.0% of daily total) for the entire season combined. This pattern was relatively consistent throughout the season.

Spatial distribution of sonar counts by sector indicates that most of the salmon passage occurred in the first three sectors of both the west bank and, to a lesser extent, the east bank (Figure 8). Salmon distribution became more bank oriented as the season progressed. For the entire season and both banks combined, west bank sectors 1 through 3 accounted for 82% of all unadjusted sonar counts, while east bank sectors 1 through 3 accounted for 13%. The remaining 5% of the counts were distributed across the other 18 sonar counting sectors.

An aerial survey of the Anvik River (including Otter Creek, Beaver Creek, Swift River, and Yellow River) was flown on 30 July under fair survey conditions. Survey timing was late due to poor weather and stream conditions earlier in the optimal survey period of 20 to 31 July. A total of 1,179 chinook salmon was enumerated. This was the largest chinook salmon escapement count for the Anvik River drainage since 1980. The count of 879 chinook salmon in the mainstem Anvik River between Yellow River and McDonald Creek achieved the aerial survey escapement objective of 300 to 500 chinook salmon for this index area. A peak summer chum salmon escapement count could not be obtained due to the late timing of the survey.

Twenty-six (26) beach seine sets were made from 27 June to 24 July, and a total of 1,006 chum salmon was captured (Appendix Table 1). No chinook salmon were captured by beach seine. However, chinook salmon carcass samples were collected by boat survey in August.

Of the 592 chum salmon sampled for age-sex-size data, 545 (92%) later proved to have ageable scales. Age composition was 2% age 3, 66% age 4, 29% age 5, and 3% age 6 (Appendix Table 2). Females accounted for 65% of the sample. Age 4 usually accounts for the majority of the Anvik River chum salmon escapement. Age 5 was stronger in 1972, 1976, 1981, and 1986, but in all other years since 1972 age 4 has been the predominant age class (Figure 9). Age composition of the District 1 commercial catch in 1987 varied

Table 3. Oscilloscope and visual calibration of salmon sonar counts at the Anvik River east bank site, 1987.

Date	Hours	Sonar Count	Scope Count	Sonar/ Scope	Visual Count a								
					Chum			Chinook			Pink		
					Up	Down	Net	Up	Down	Net	Up	Down	Net
22-Jun	0.25	0	0	0.00									
23-Jun	1.00	7	2	3.50									
24-Jun	1.00	0	0	0.00									
25-Jun	1.00	1	1	1.00	13	0	13						
26-Jun	1.00	42	20	2.10	5	0	5						
27-Jun	1.08	18	27	0.67	23	0	23						
28-Jun	1.50	14	28	0.50	15	0	15						
29-Jun	1.00	38	52	0.73	21	0	21						
30-Jun	1.00	64	48	1.33	44	0	44						
01-Jul	1.08	46	55	0.84	35	0	35						
02-Jul	0.92	46	70	0.66	63	2	61						
03-Jul	0.00	0	0	0.00									
04-Jul	1.00	15	22	0.68	23	0	23						
05-Jul	0.75	57	51	1.12	53	0	53						
06-Jul	1.08	79	113	0.70	48	0	48						
07-Jul	0.92	72	88	0.82	51	2	49						
08-Jul	1.25	287	216	1.33									
09-Jul	1.08	35	40	0.88	12	0	12						
10-Jul	1.00	127	115	1.10									
11-Jul	1.05	74	73	1.01									
12-Jul	1.00	83	87	0.95	28	0	28						
13-Jul	1.08	123	176	0.70	71	0	71						
14-Jul	1.08	282	273	1.03	313	0	313	2	0	2			
15-Jul	1.17	294	280	1.05	150	0	150	1	0	1			
16-Jul	1.08	120	150	0.80	140	0	140	1	0	1			
17-Jul	1.33	42	82	0.51	45	2	43						
18-Jul	0.92	82	75	1.09	79	0	79						
19-Jul	1.25	72	94	0.77	75	0	75	3	0	3			
20-Jul	1.33	112	92	1.22	33	0	33	1	0	1			
21-Jul	0.58	52	66	0.79									
22-Jul	1.17	135	132	1.02									
23-Jul	1.33	59	65	0.91	28	0	28						
24-Jul	1.17	28	38	0.74	13	1	12						
25-Jul	1.17	8	17	0.47	19	4	15						
26-Jul	0.25	1	2	0.50									
Totals	34.87	2,515	2,650	0.95	1,400	11	1,389	8	0	8	0	0	0

a Visual counts are listed as upstream or downstream with "net" being the difference between the two. Errors in species identification or enumeration of fish may have been made due to poor water clarity, surface glare, oblique angle of vision, and lack of background contrast against the natural river bottom. In addition, visual counting was not conducted during all calibration periods due to the offshore movement of fish under certain conditions when a tower observer was present.

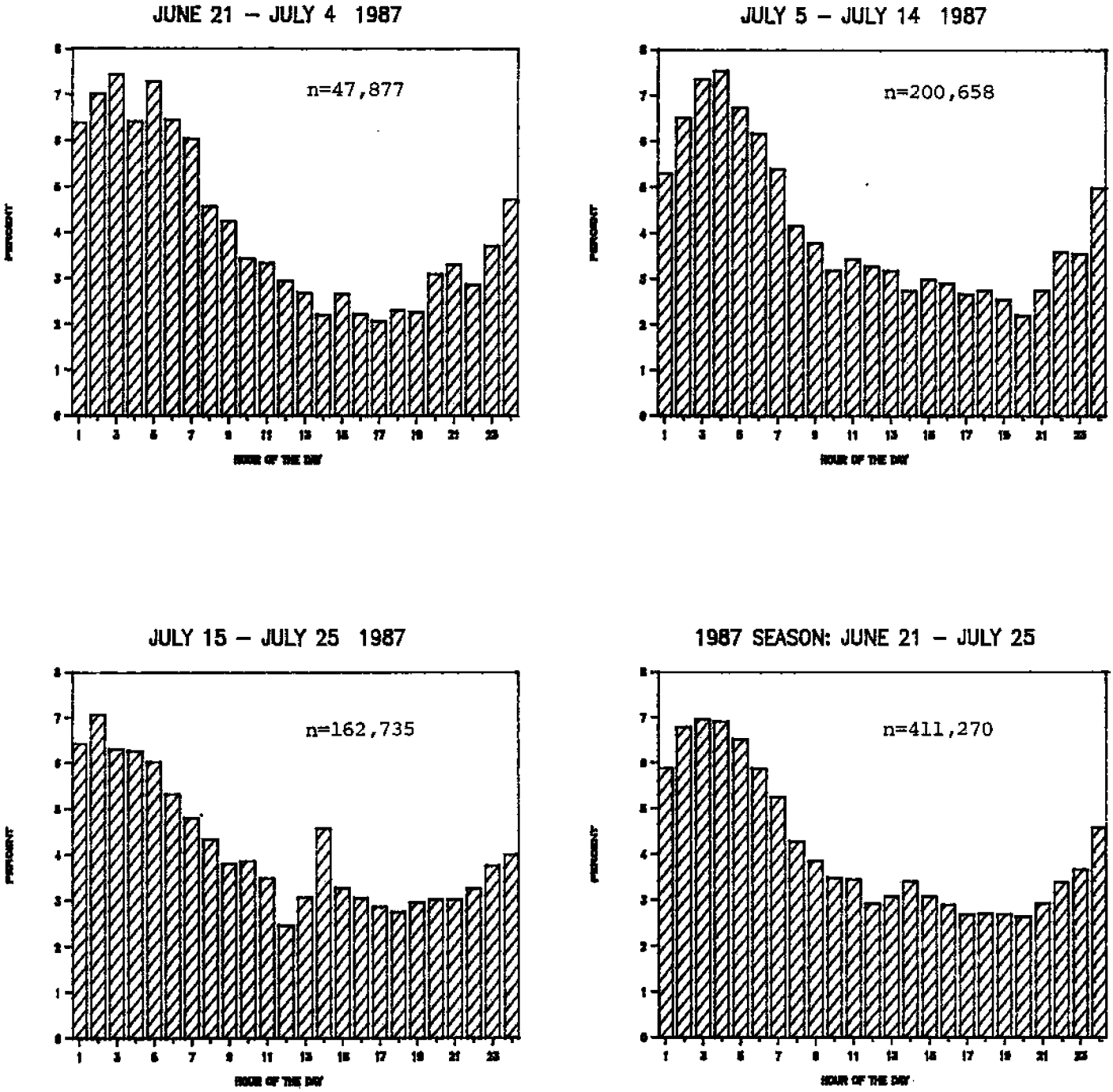


Figure 7. Anvik River summer chum salmon sonar counts by hour of the day for the early (21 June–4 July), middle (5–14 July), and late (15–25 July) portion of the season, and for the entire 1987 season combined. Total sonar counts (n) used for this analysis are given for each period.

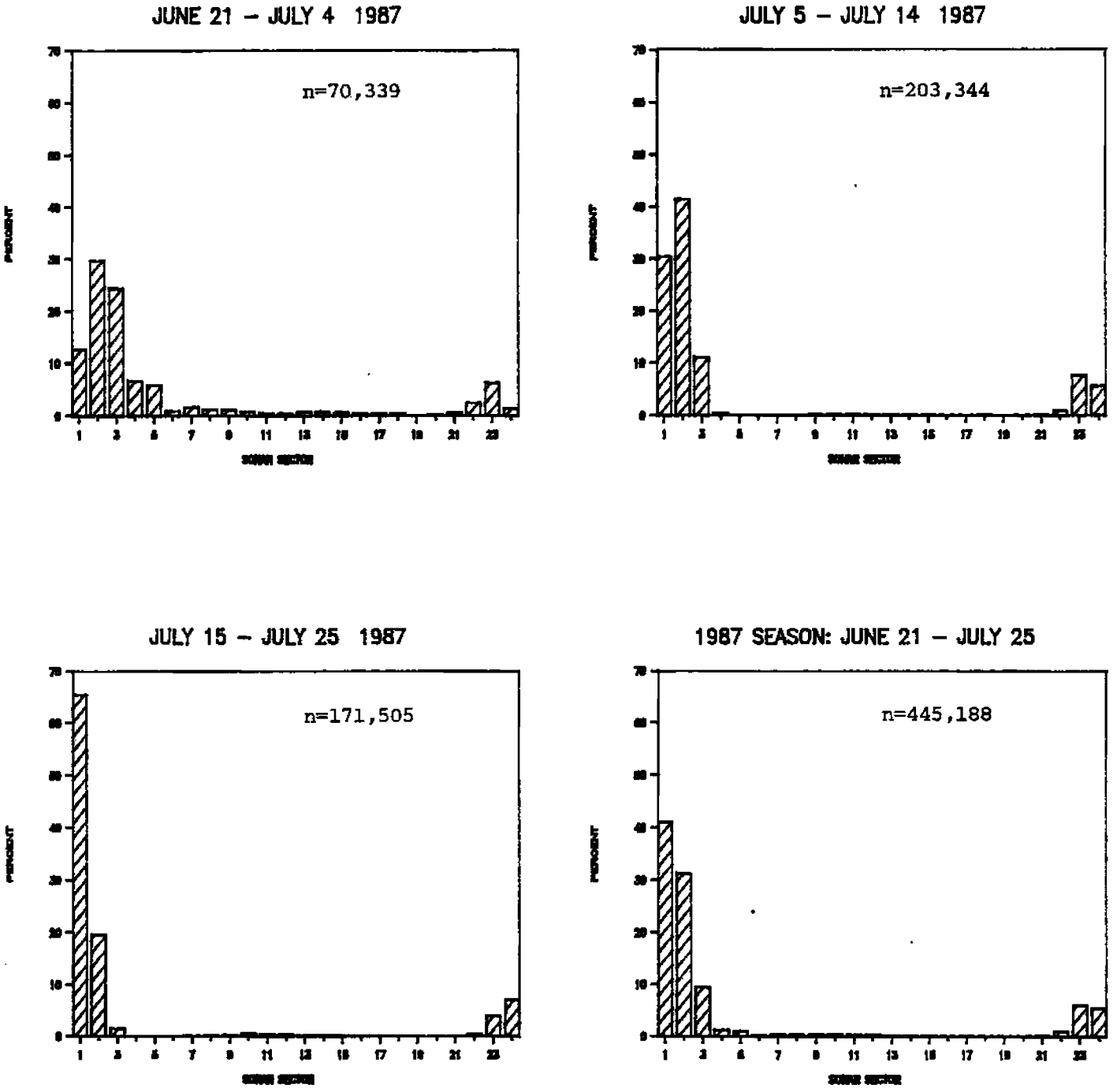


Figure 8. Anvik River summer chum salmon sonar counts by sonar sector for the early (21 June-4 July), middle (5-14 July), and late (15-25 July) portion of the season, and for the entire 1987 season combined. Sector 1 is west bank sector 1, 12 is west bank sector 12, 13 is east bank sector 12, and 24 is east bank sector 1. Total sonar counts (n) used for this analysis are given for each period.

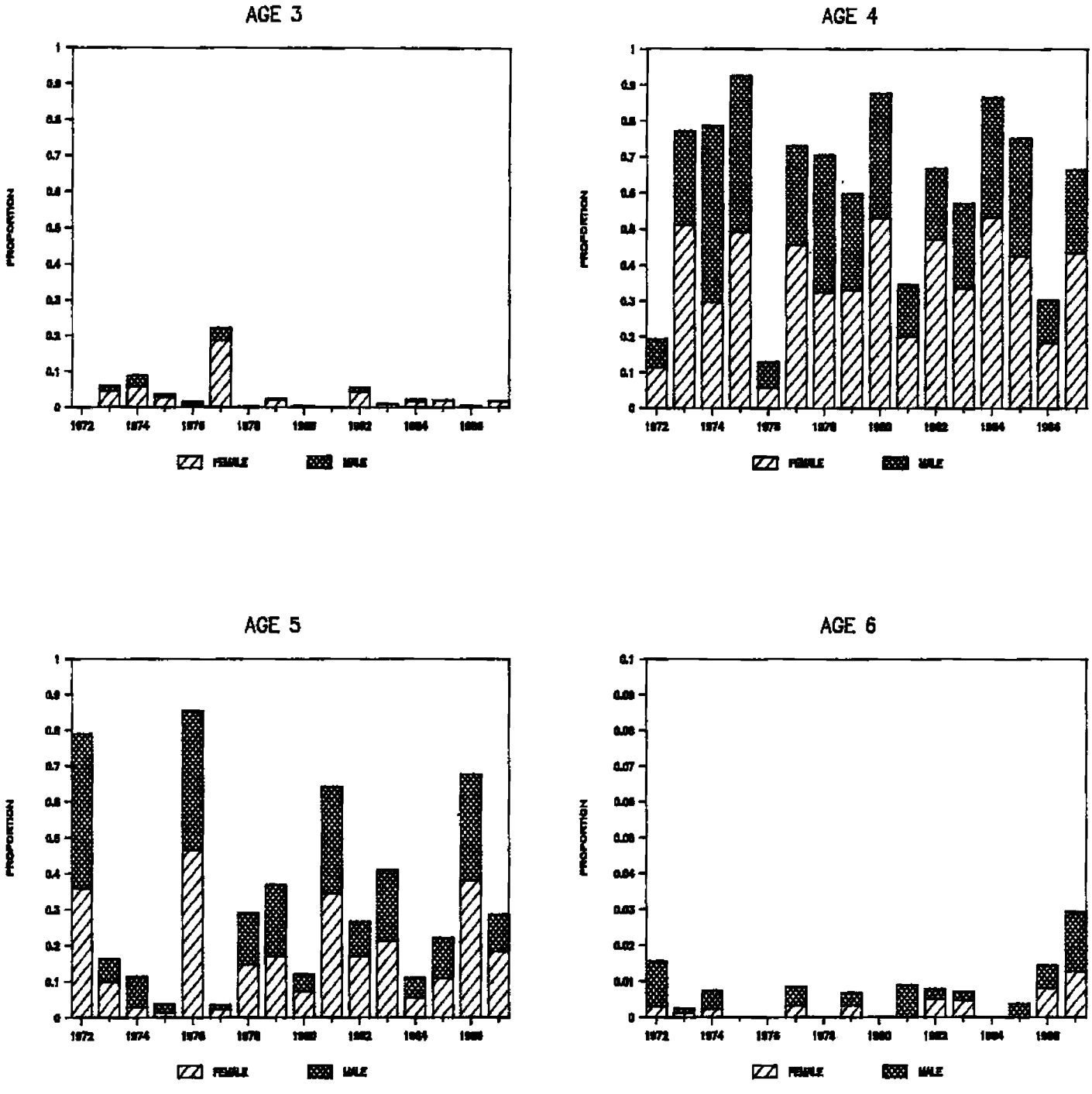


Figure 9. Age and sex composition of Anvik River summer chum salmon, 1972-1987, presented as proportion of total sample for each year by age class. Note different scale for age 6.

by mesh size and progression of the run, but the preliminary estimate for the entire season is 0.3% age 3, 54% age 4, 38% age 5, and 8% age 6 (Buklis In Prep). The age composition of the District 1 commercial catch and of the Anvik River escapement sample were similar in 1987, as has been observed in previous years.

Of the 277 chinook salmon sampled for age-sex-size data, 222 (80%) were identifiable by sex and later proved to have ageable scales. Age composition was 9% age 4, 13% age 5, 74% age 6, and 4% age 7 (Appendix Table 3). Females accounted for 59% of the sample. Age 5 contribution to the total sample, on a percentage basis, was the smallest, and age 6 contribution the second largest, since Anvik River escapement sampling was initiated in 1972 (Figure 10). These age compositions correspond closely with the age composition of the District 1 commercial harvest, which was approximately 78% age 6 and 7% age 5 (Buklis In Prep). The percentage of females in the escapement sample was in the upper end of the 20% to 63% range observed in previous years for the Anvik River.

The relatively strong age 6 female component of the Anvik River chinook salmon escapement sample, together with the magnitude of the aerial survey count estimate, indicates that there may be good production from the 1987 brood year for this stock.

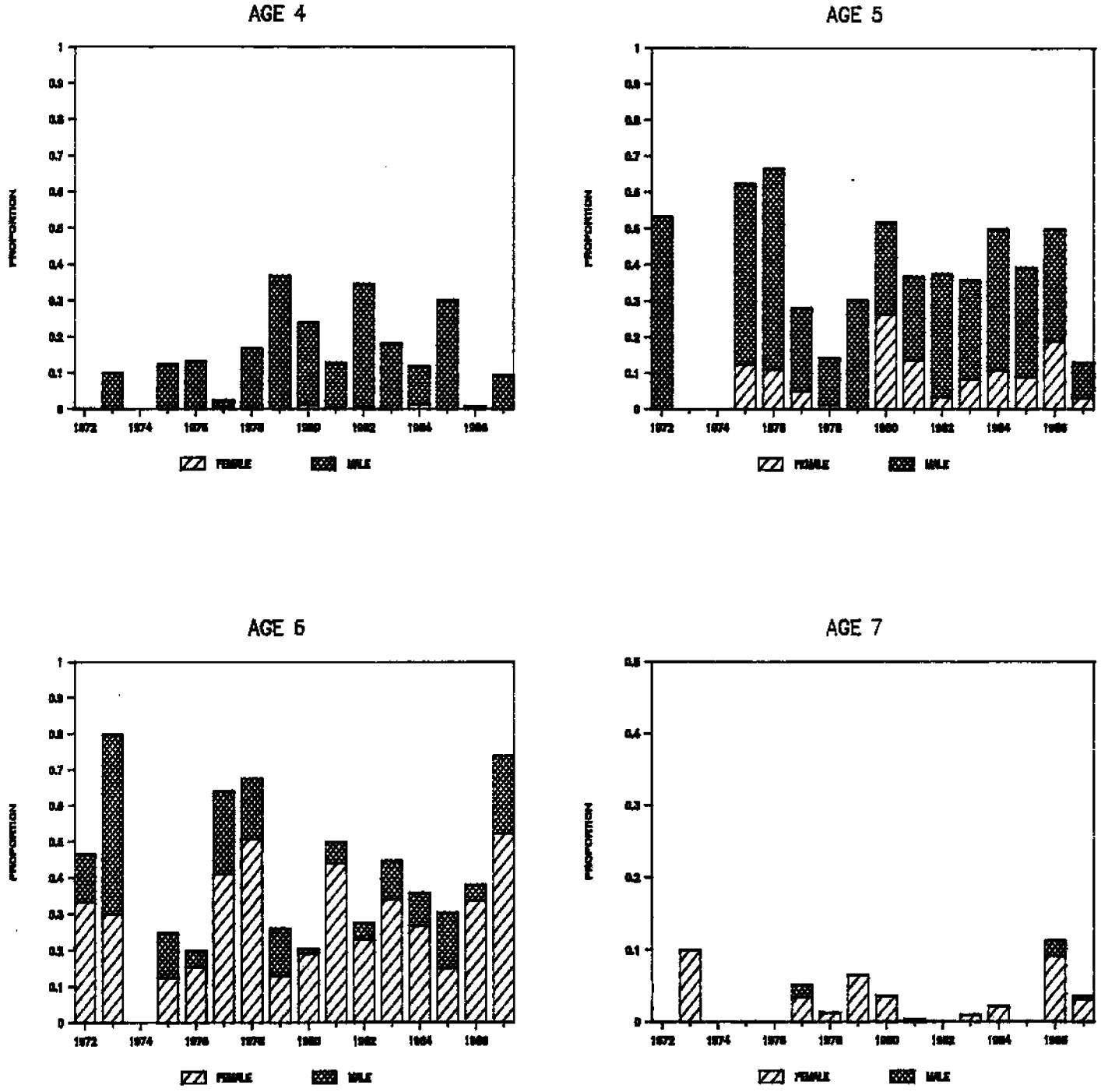


Figure 10. Age and sex composition of Anvik River chinook salmon, 1972-1987, presented as proportion of total sample for each year by age class. Note different scale for age 7.

ANDREAFSKY RIVER SALMON STUDY

The Andreafsky River (Figure 11) includes two main branches, the East and West Forks, and is located 100 miles upstream from the mouth of the Yukon River. It typically ranks second to the Anvik River in summer chum salmon escapement, second to the Salcha River in chinook salmon escapement, and supports the largest pink salmon population in the Yukon River drainage. Salmon escapements were estimated annually in each fork by aerial survey from fixed wing aircraft prior to 1981. A side-scanning sonar counter was installed in the East Fork for the first time in 1981 to obtain more complete and accurate escapement information than could be obtained by aerial survey.

The mainstem Andreafsky River, below the confluence of the East and West Forks, is not suitable for escapement enumeration due to its width and slack current. The East Fork was chosen for sonar enumeration in 1981 because it supports a greater average summer chum salmon escapement than the West Fork, based on historical aerial survey data. In addition, a feasible sonar site could be located lower on the East Fork than on the West Fork, potentially enumerating a greater proportion of the spawners and simplifying logistics. There is also less recreational use of the East Fork by the residents of St Marys, a village of 500 people located near the confluence of the Andreafsky and Yukon Rivers.

Sonar was used to enumerate summer chum salmon escapements to the East Fork Andreafsky River from 1981 through 1984. Flood conditions in 1985 prohibited accurate sonar enumeration with the transducer deployment methods available at that time (Buklis 1985). As a result, an improved transducer deployment method was developed and was available for use on the Andreafsky River beginning in 1986 (Buklis 1986).

Large pink salmon escapements in 1982 and 1984 affected the accuracy of estimating summer chum salmon escapement using side-scanning sonar. A contingency plan was developed for 1986, whereby visual counting from towers would be used instead of sonar to estimate the 1986 escapement by species to the East Fork Andreafsky River if water conditions permitted. Water levels and clarity were favorable, and tower counting was successfully applied for the entire season for the first time in 1986. The tower counting method was repeated in 1987 due to the success of the 1986 project, and the desire to obtain daily salmon escapement counts by species.

Methods and Materials

The same site used previously for sonar and counting tower enumeration was selected for the tower site in 1987. A weir was

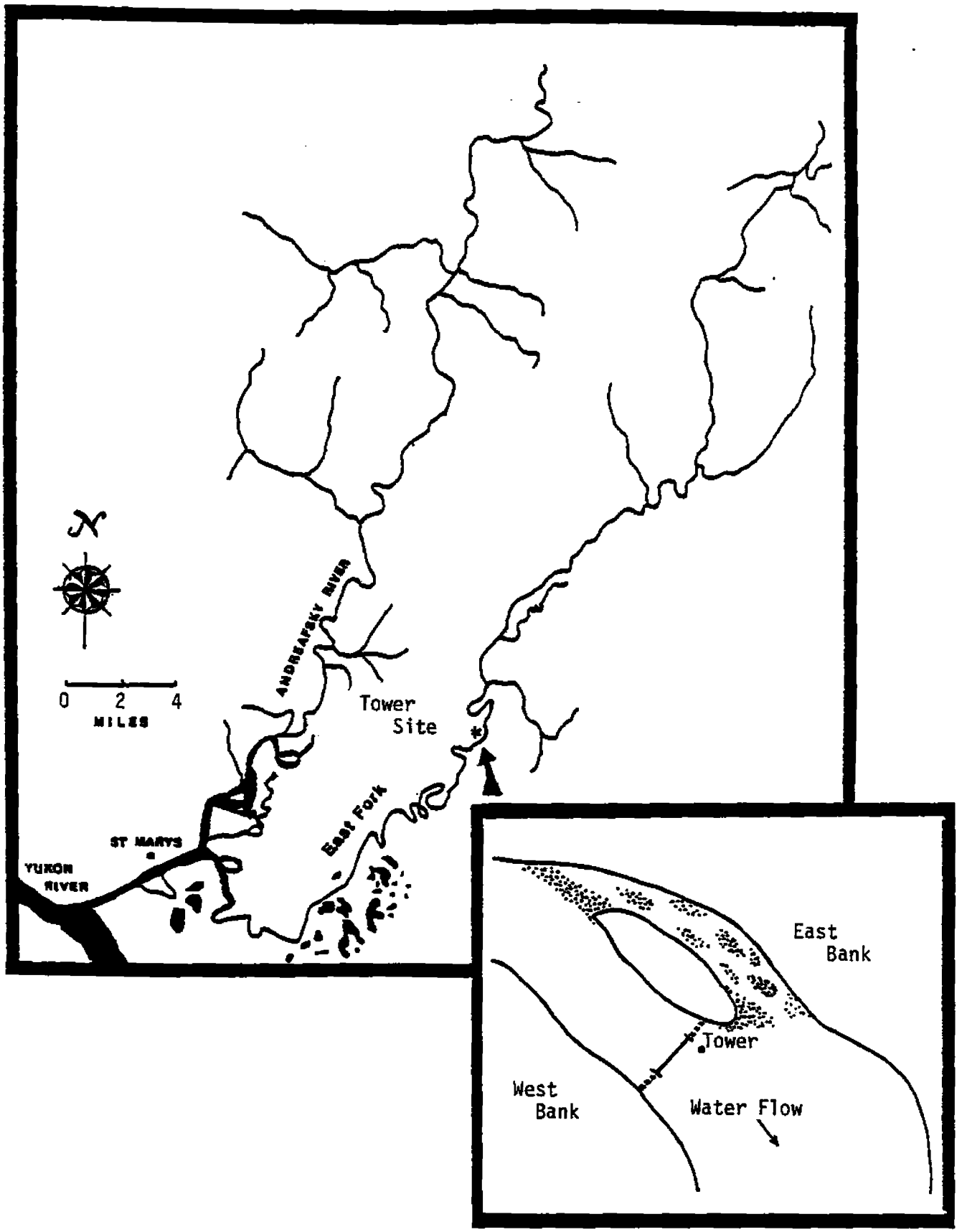


Figure 11. Map of the Andreafsky River, and of the tower site (inset) located at river mile 20 of the East Fork.

built from each shore, with an initial opening of approximately 18 m in the center for fish passage. The 20 ft counting tower was placed on the west side of the weir opening. A blue plastic tarp was set on the river bottom across the weir opening to provide contrast for fish species identification and enumeration purposes. Polaroid sunglasses were worn during daylight hours, and 12 volt lamps were used to illuminate the weir opening during hours of darkness.

Daily counting shifts were from 0000 to 0800 and from 1600 to 2400. Counts for 0800 to 1600 were estimated as described below. Each of the two persons on the crew was assigned one 8 hr daily shift, for which that person would be responsible for six consecutive days. No counting was conducted on the seventh day. The crewmembers were then permitted to switch counting shifts for the next six day period. Escapement counts were interpolated for the missing day using the counts for the preceding and following day.

Each hour on the half hour during his daily counting shift the observer counted fish passage by species and direction (ie upstream or downstream moving) for a 20 minute period using hand held tally counters. These counts were entered on a data form, and net upstream counts by species were multiplied by 3 to obtain an hourly passage estimate for each salmon species. The resulting 16 hourly salmon counts were then multiplied by an expansion factor for each species derived from 1986 project results (Buklis 1986) to obtain a daily escapement estimate for in-season management purposes. Counts were conducted for all 24 hrs with the help of a third crewmember on 7-8 and 14-15 July. These data were used to derive daily count expansion factors on a post-season basis.

Methods for measuring stream profile, recording climatological data, and sampling fish for age, sex, and size data were the same as those described previously for the Anvik River study.

Results and Discussion

The tower counting project was operational from 25 June through 25 July. Maximum water depth was 77 cm on 29 June and 70 cm on 18 July (Figure 12). River water level was high for the time of year when the crew arrived to begin project operations. Water level declined in an irregular manner, reaching a season low on 17 July of 30 cm below the initial reading, before rising to a season high on 22 July of 1 cm above the initial reading due to heavy rainfall (Figure 13). Water clarity was generally not as good in 1987 as it had been in 1986, primarily due to frequent rain and resulting water depth and turbidity. However, the ability to visually enumerate fish from the counting tower was not prohibited by water conditions at any time during the season. Water temperature ranged from a low of 10 C on 1 July to a high of 15 C on 5 July, while air temperature ranged from a low daily minimum of 5 C on 2 July to a high daily maximum of 26 C on 6

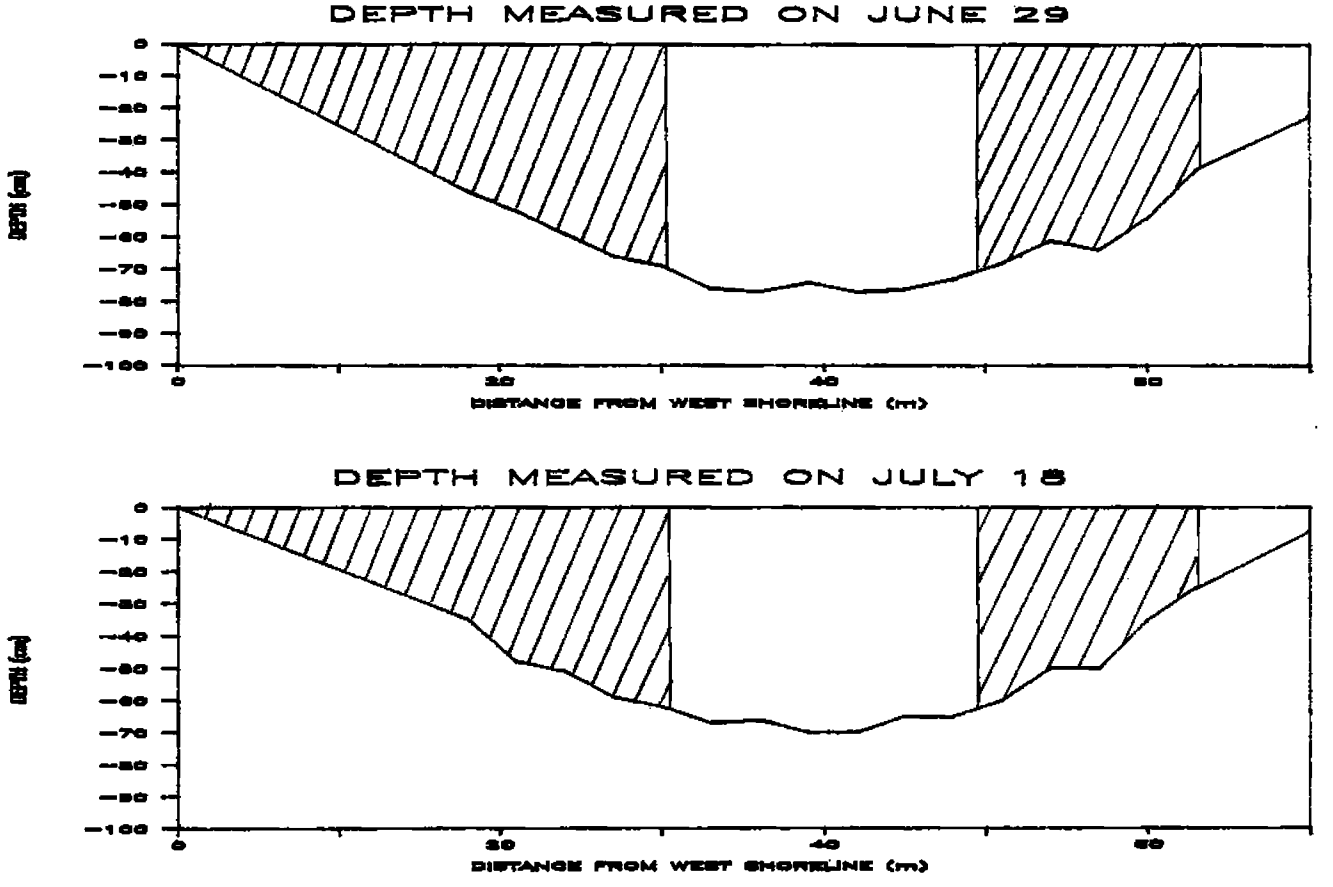


Figure 12. River depth profiles of the East Fork Andreafsky River tower site as measured on 29 June and 18 July, 1987. Cross hatching indicates weirs. Shallow slough eastward of the inshore end of the east bank weir did not result in uncounted salmon passage. Unequal scale of the axes distorts the presentation.

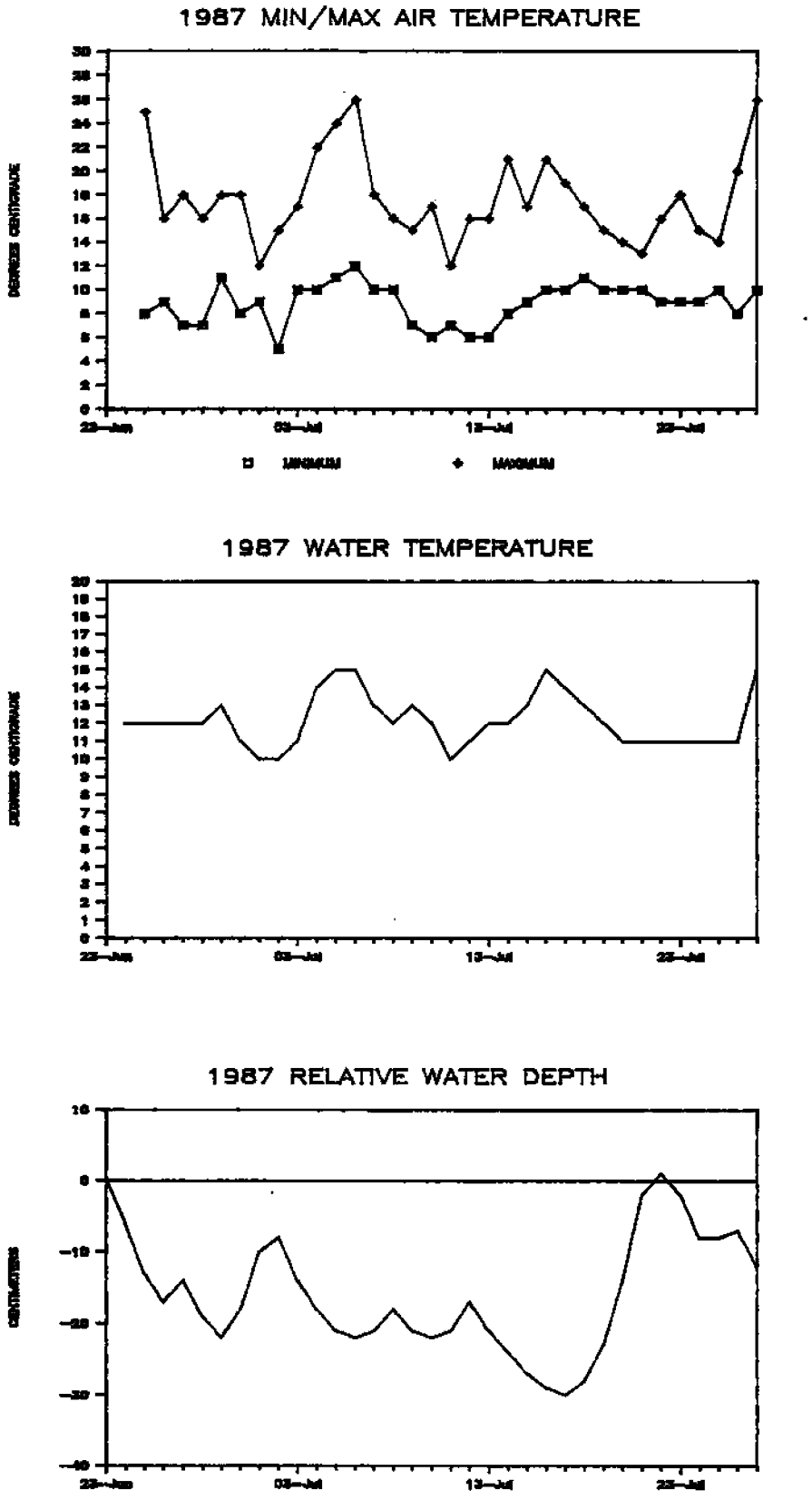


Figure 13. Air temperature (daily minimum and maximum), water temperature, and relative water depth measured at noon daily at the East Fork Andreafsky River tower site, 1987.

July.

The expanded escapement estimate for the period 25 June through 25 July was 45,221 summer chum salmon, 2,011 chinook salmon, and 676 pink salmon (Table 4). Expansion factors of 1.16 for summer chum salmon, 1.13 for chinook salmon, and 1.08 for pink salmon were derived to convert 16 hour counts to 24 hr estimates on a post-season basis (Appendix Tables 4-6).

The peak expanded daily summer chum salmon count of 5,474 fish (12% of season total) occurred on 4 July, the peak daily chinook salmon count of 271 fish (13% of season total) occurred on 20 July, while the peak daily pink salmon count of 113 fish (17% of season total) occurred on 17 July. Escapement timing appeared to be relatively late for summer chum salmon, as it had been in 1982 and 1984 (Figure 14). Mean date of run passage was 9 July, with a standard deviation of 5.17 days.

Historical summer chum salmon escapement timing patterns were used on an in-season basis to project the season escapement estimate for fishery management purposes. Expanded tower counts for the period 25 June - 8 July input into the average timing curve for a late escapement timing pattern (based on 1982 and 1984) resulted in an escapement projection of 45,600 summer chum salmon. This projection is 58% below the aerial survey escapement objective of 109,000 fish for the East Fork Andreafsky River. The low projection, along with poor run indicators for other summer chum salmon stocks, resulted in restrictions being imposed on the commercial fisheries in Districts 1 through 4 during the later portion of the run. The final escapement estimate of 45,221 summer chum salmon is within 1% of the in-season projection. It is not known how many fish escaped to the Andreafsky River spawning grounds as a direct result of the fishery restrictions. However, it had been hoped that these restrictions might result in an escapement substantially greater than projected.

It is of interest to note that the low daily counts of 543 summer chum salmon on 7 July and 348 summer chum salmon on 8 July may have been an effect of the commercial fishery in Districts 1 and 2. Approximately 118,000 summer chum salmon were harvested in District 1 during 48 hrs of commercial fishing between 29 June and 3 July. An additional 79,000 fish were subsequently harvested in District 2 during 30 hrs of commercial fishing between 1 and 6 July. Although stock composition of these catches is not presently known, significant contribution by the Andreafsky River stock may account for the low escapement counts on 7 and 8 July.

The season escapement estimate of 45,221 summer chum salmon was the smallest total season count recorded for this stream since the study was initiated in 1981, and 67% below the previous average of 135,400 fish. In fact, the 1987 estimate was even smaller than the unexpanded peak aerial survey index counts for each year, 1973-1980, and those counts are known to be conservative estimates of total season escapement (Figure 15). The chinook salmon season escapement estimate of 2,011 fish

Table 4. East Fork Andreafsky River expanded tower counts of salmon escapement by species and date, 1987. a

Date	Summer Chum Salmon				Chinook Salmon				Pink Salmon			
	Daily Count	Total Count	Daily Prop	Total Prop	Daily Count	Total Count	Daily Prop	Total Prop	Daily Count	Total Count	Daily Prop	Total Prop
25-Jun	0 b	0	0.0000	0.0000	0 b	0	0.0000	0.0000	0 b	0	0.0000	0.0000
26-Jun	57 b	57	0.0013	0.0013	0 b	0	0.0000	0.0000	3 b	3	0.0044	0.0044
27-Jun	139	196	0.0031	0.0043	3	3	0.0015	0.0015	0	3	0.0000	0.0044
28-Jun	286 c	482	0.0063	0.0107	2 c	5	0.0010	0.0025	0 c	3	0.0000	0.0044
29-Jun	432	914	0.0096	0.0202	0	5	0.0000	0.0025	0	3	0.0000	0.0044
30-Jun	111	1,025	0.0025	0.0227	0	5	0.0000	0.0025	0	3	0.0000	0.0044
01-Jul	84	1,109	0.0019	0.0245	0	5	0.0000	0.0025	0	3	0.0000	0.0044
02-Jul	508	1,617	0.0112	0.0358	0	5	0.0000	0.0025	0	3	0.0000	0.0044
03-Jul	2,991 c	4,608	0.0661	0.1019	8 c	13	0.0040	0.0065	3 c	6	0.0044	0.0089
04-Jul	5,474	10,082	0.1210	0.2229	17	30	0.0085	0.0149	6	12	0.0089	0.0178
05-Jul	5,206 c	15,288	0.1151	0.3381	16 c	46	0.0080	0.0229	3 c	15	0.0044	0.0222
06-Jul	4,938	20,226	0.1092	0.4473	14	60	0.0070	0.0298	0	15	0.0000	0.0222
07-Jul	543 d	20,769	0.0120	0.4593	9 d	69	0.0045	0.0343	0 d	15	0.0000	0.0222
08-Jul	348 d	21,117	0.0077	0.4670	3 d	72	0.0015	0.0358	3 d	18	0.0044	0.0266
09-Jul	2,485	23,602	0.0550	0.5219	54	126	0.0269	0.0627	3	21	0.0044	0.0311
10-Jul	4,270	27,872	0.0944	0.6164	44	170	0.0219	0.0845	10	31	0.0148	0.0459
11-Jul	1,869	29,741	0.0413	0.6577	31	201	0.0154	0.1000	6	37	0.0089	0.0547
12-Jul	3,198	32,939	0.0707	0.7284	54	255	0.0269	0.1268	6	43	0.0089	0.0636
13-Jul	2,683	35,622	0.0593	0.7877	129	384	0.0641	0.1909	19	62	0.0281	0.0917
14-Jul	1,620 d	37,242	0.0358	0.8236	159 d	543	0.0791	0.2700	39 d	101	0.0577	0.1494
15-Jul	1,335 d	38,577	0.0295	0.8531	150 d	693	0.0746	0.3446	39 d	140	0.0577	0.2071
16-Jul	2,857	41,434	0.0632	0.9163	156	849	0.0776	0.4222	100	240	0.1479	0.3550
17-Jul	1,413	42,847	0.0312	0.9475	186	1,035	0.0925	0.5147	113	353	0.1672	0.5222
18-Jul	675	43,522	0.0149	0.9624	122	1,157	0.0607	0.5753	84	437	0.1243	0.6464
19-Jul	592 c	44,114	0.0131	0.9755	196 c	1,353	0.0975	0.6728	55 c	492	0.0814	0.7278
20-Jul	508	44,622	0.0112	0.9868	271	1,624	0.1348	0.8076	26	518	0.0385	0.7663
21-Jul	240	44,862	0.0053	0.9921	241	1,865	0.1198	0.9274	32	550	0.0473	0.8136
22-Jul	101	44,963	0.0022	0.9943	41	1,906	0.0204	0.9478	26	576	0.0385	0.8521
23-Jul	115	45,078	0.0025	0.9968	47	1,953	0.0234	0.9712	16	592	0.0237	0.8757
24-Jul	73	45,151	0.0016	0.9985	27	1,980	0.0134	0.9846	55	647	0.0814	0.9571
25-Jul	70	45,221	0.0015	1.0000	31	2,011	0.0154	1.0000	29	676	0.0429	1.0000

a All daily escapement estimates are expanded from 16 hourly count estimates unless indicated otherwise. Hourly tower counts and daily expansion factors are presented by species in Appendix Tables 4-6.
b Counting was conducted for only 5 hours on 25 June and 10 hours on 26 June. These counts were not expanded to 24 hour estimates.
c Daily count estimated by interpolation of counts for preceding and following day due to scheduled crew day off.
d Counting was conducted for 24 hours, therefore no daily expansion factor was applied.

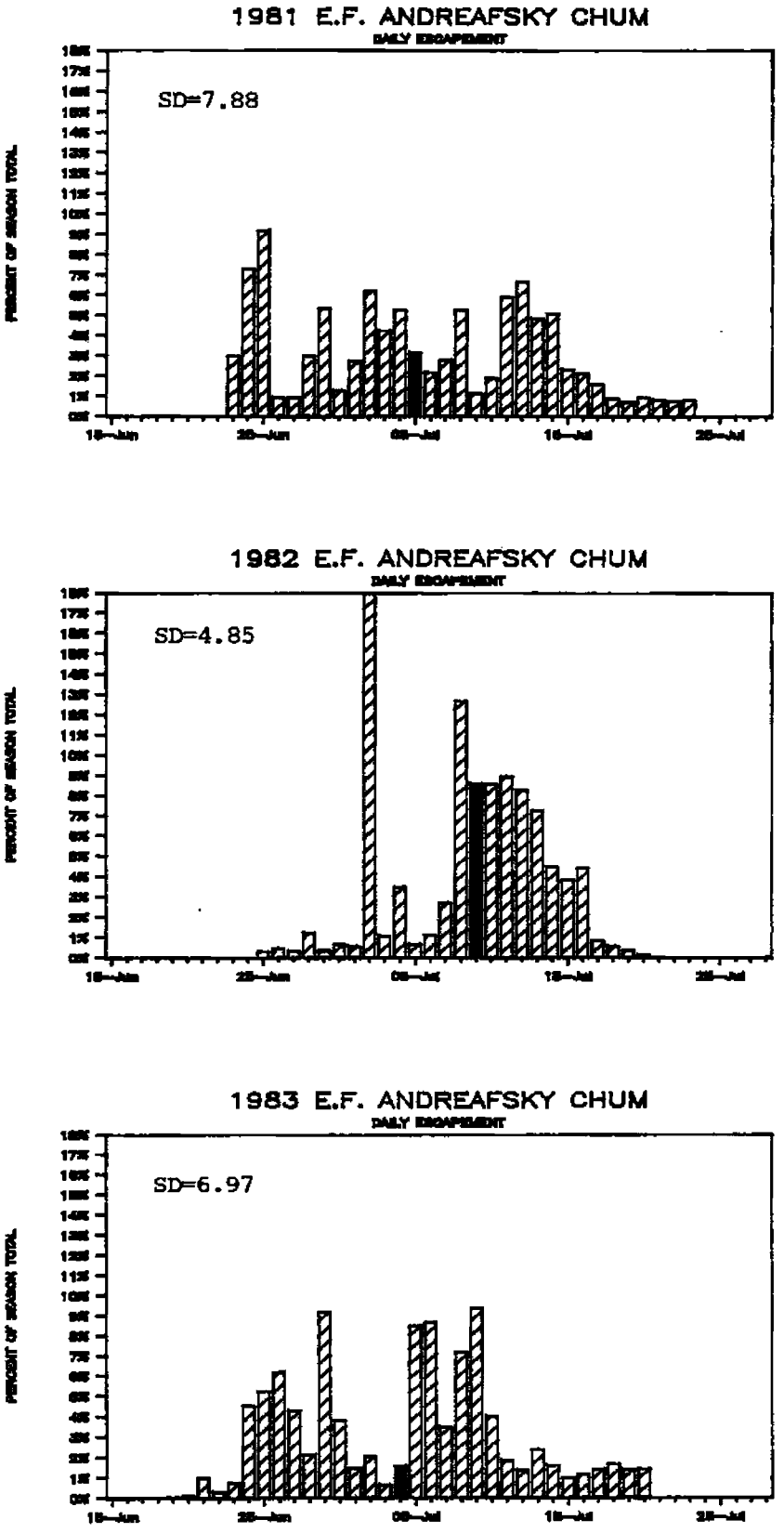
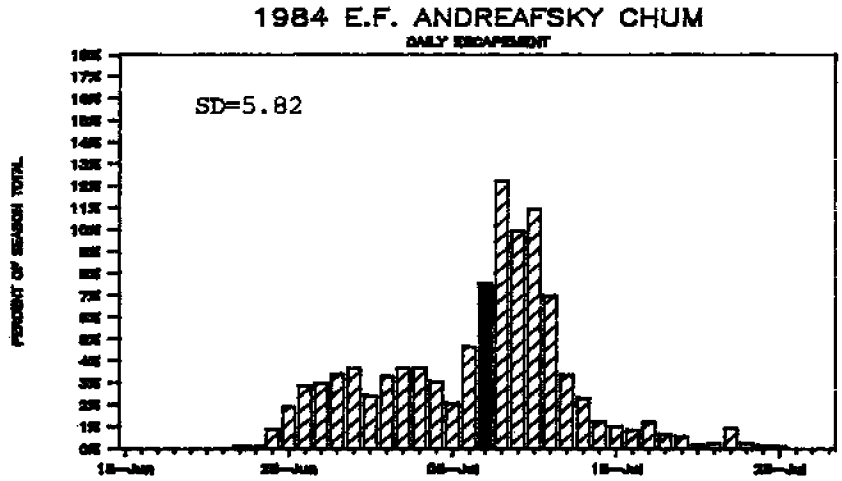
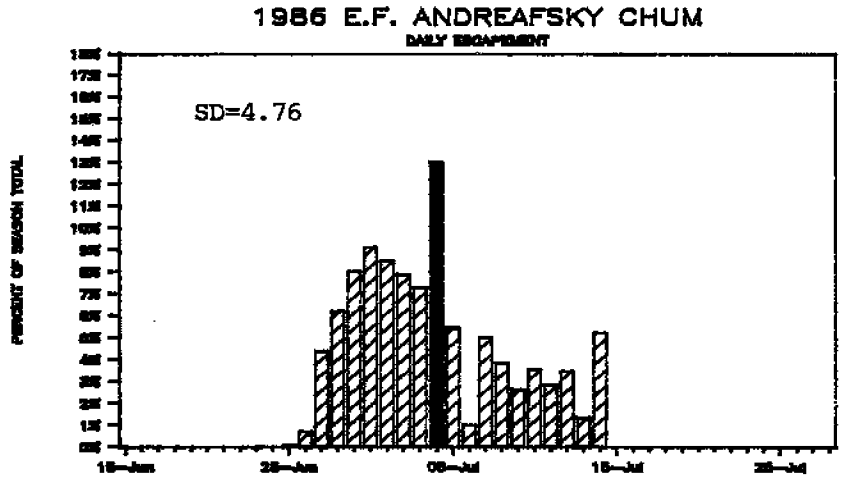


Figure 14. East Fork Andreafsky River summer chum salmon sonar or tower counts by day, 1981-1987. Mean date of run passage (calculated with Day 1=16 June) is indicated by shaded bar, and standard deviation (SD) of the mean is given.





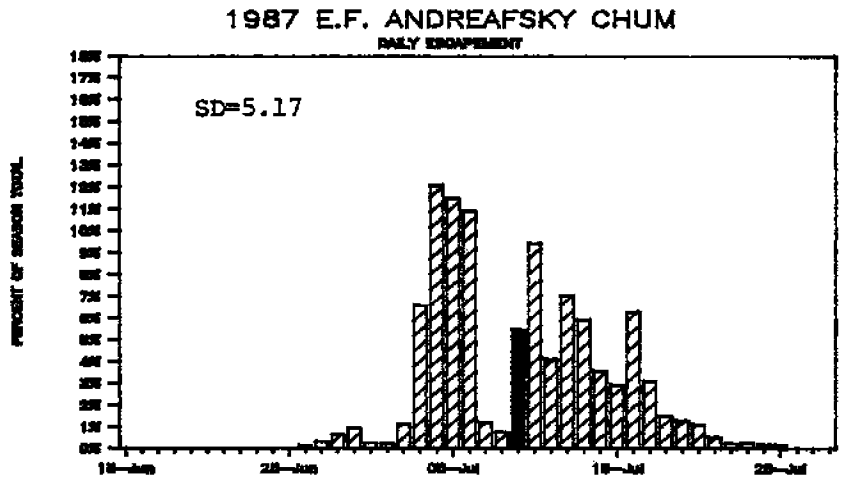


Figure 14. (Continued) East Fork Andreafsky River summer chum salmon sonar or tower counts by day, 1981-1987. Mean date of run passage (calculated with Day 1=16 June) is indicated by shaded bar, and standard deviation (SD) of the mean is given.

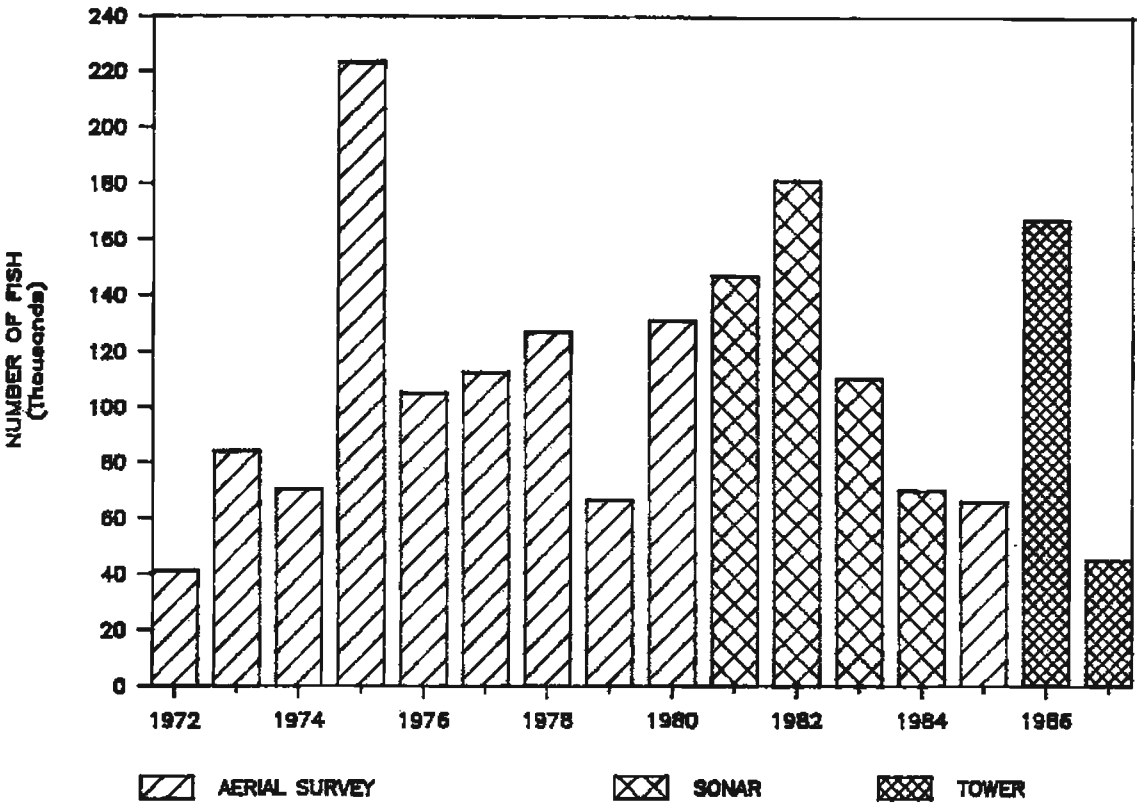


Figure 15. East Fork Andreafsky River summer chum salmon escapement as estimated by aerial survey, 1972-1980 and 1985, by side-scanning sonar, 1981-1984, and by tower counts, 1986-1987.

exceeded the incomplete estimate of 1,530 fish in 1986, and the aerial survey escapement objective of 1,100 to 1,600 fish. Pink salmon are more abundant in the Yukon River drainage in even-numbered years. The pink salmon season escapement estimate of 676 fish was less than 1% of the incomplete estimate of 124,618 fish in 1986.

Summer chum salmon demonstrated the earliest salmon escapement timing at the tower site, followed by chinook salmon and pink salmon, which were later but similar to each other (Figure 16). Peak summer chum salmon hourly passage occurred during 2200-2300 (13% of season total), chinook salmon during 1800-1900 (13% of season total), and pink salmon during 2200-2300 (14% of season total) (Figure 17).

An aerial survey was flown of the West Fork and East Fork of the Andreafsky River on 26 July and 27 July, respectively. Both surveys were flown under good survey conditions, although late in the optimal timing range of 20 to 31 July due to poor weather and water conditions earlier in the period. A total of 35,535 summer chum salmon and 3,281 chinook salmon was counted on the West Fork (including the lower 7 miles of Allen Creek), and 1,608 chinook salmon were counted above the tower site on the East Fork. A peak summer chum salmon escapement count could not be obtained for the East Fork due to the late timing of the survey. The West Fork chum salmon count was 69% below the aerial survey escapement objective of 116,000 fish. The West Fork chinook salmon count, however, was the largest ever recorded for this stream, and was more than three times greater than the aerial survey escapement objective of 700 to 1,000 fish.

Fifty-five (55) beach seine sets were made from 4 to 27 July, and a total of 402 chum salmon, 18 chinook salmon, and 37 pink salmon was captured (Appendix Table 7). Additional chinook salmon samples were obtained by carcass survey of both the East and West Fork in August.

Of the 393 chum salmon sampled for age-sex-size data, 362 (92%) later proved to have ageable scales. Age composition was 0.8% age 3, 29% age 4, 67% age 5, and 4% age 6 (Appendix Table 8). Females accounted for 59% of the sample. Age 4 accounted for the majority of samples in 1982, and 1984-1986, while age 5 was predominant in 1981 and 1983 (Figure 18). The strong age 5 component in 1987 is attributable to the differential abundance of parent year escapements in 1982 and 1983.

The predominance of age 5 fish for the East Fork Andreafsky River differs from the predominance of age 4 fish for both the District 1 commercial fishery and Anvik River escapement in 1987. Differences in age class contributions to Anvik and Andreafsky River escapements are related to differences in relative strength of the contributing parent year escapements for each stock. It has been noted previously that summer chum salmon escapement abundance to the Anvik and Andreafsky Rivers does not always trend together (Buklis 1985). While the Anvik River consistently

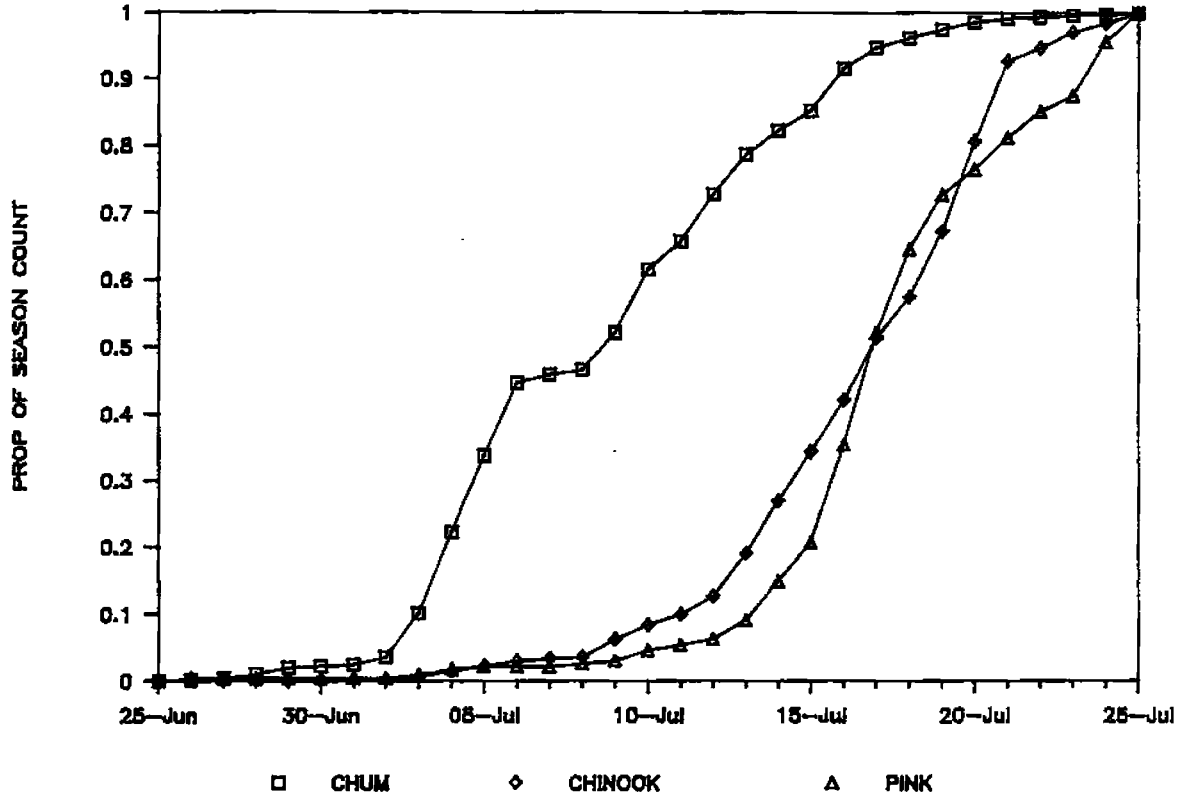
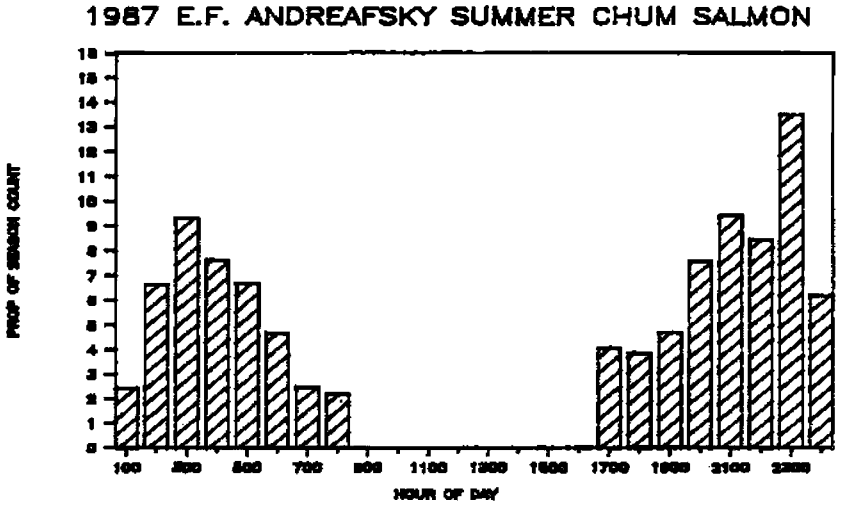
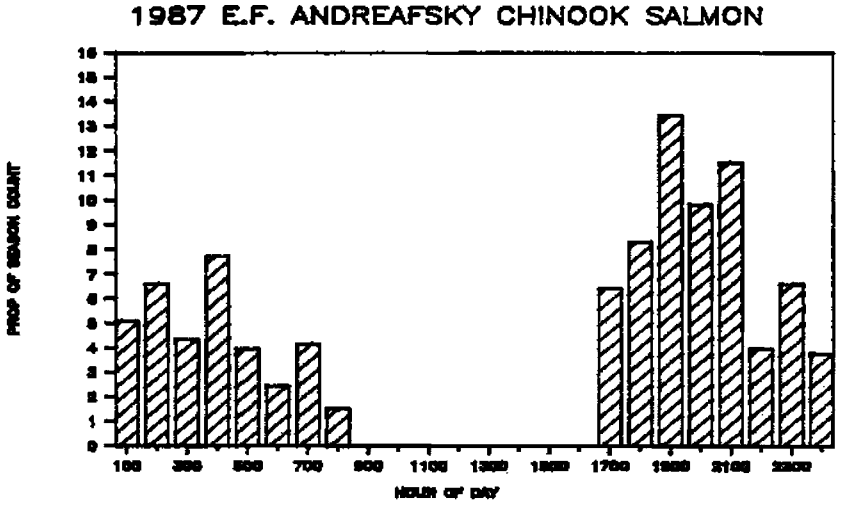


Figure 16. Cumulative proportion of season total summer chum, chinook, and pink salmon tower counts by date at the East Fork Andreafsky River, 1987.





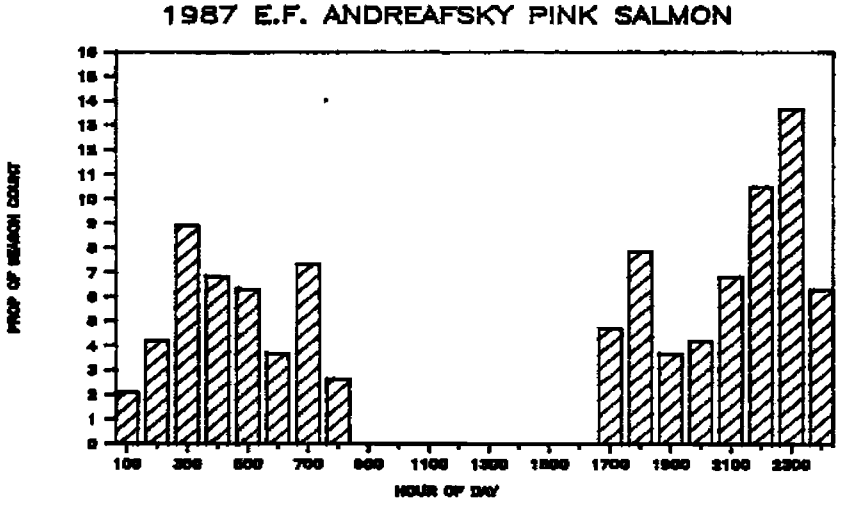


Figure 17. Distribution of summer chum, chinook, and pink salmon tower counts by hour of the day for the East Fork Andreafsky River, 1987. Counts obtained during the hours of 0800-1600 on 7-8 July and 14-15 July were not included.

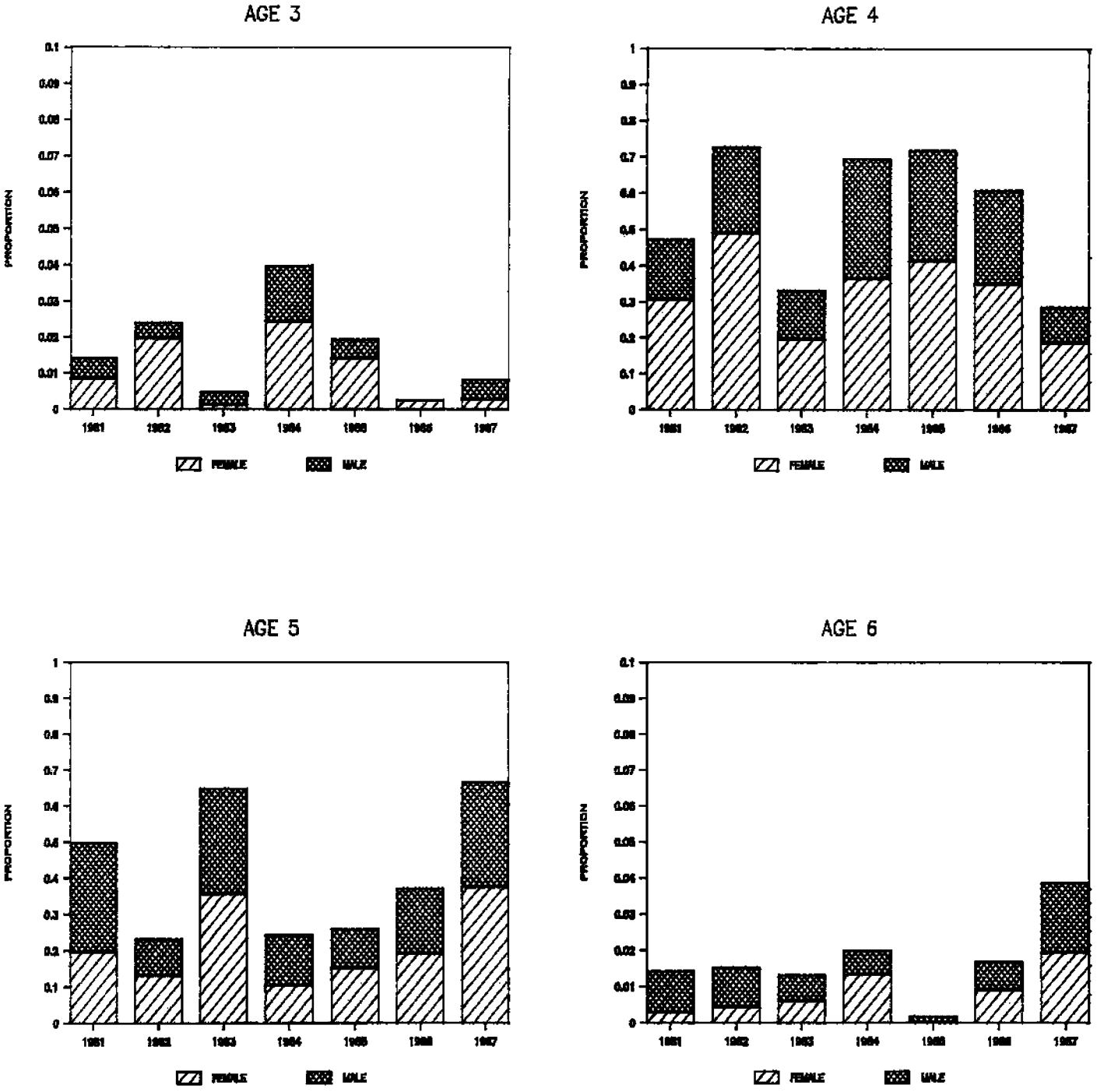


Figure 18. Age and sex composition of East Fork Andreafsky River summer chum salmon, 1981-1987, presented as proportion of total sample for each year by age class. Note different scale for ages 3 and 6.

supports substantially larger escapements than the East Fork Andreafsky River, in some years escapements are relatively strong for one stock and weak for the other, as compared to the long term average for that stock.

Of the 400 chinook salmon sampled for age-sex-size data, 383 (96%) were identifiable by sex and later proved to have ageable scales. Age composition was 5% age 4, 9% age 5, 84% age 6, and 2% age 7 (Appendix Table 9). Females accounted for 56% of the sample. Age composition of the Andreafsky River escapement sample in 1987 was similar to that for the Anvik River escapement and the District 1 commercial catch, as discussed previously. Age 5 contribution to the total sample, on a percentage basis, was the smallest, and age 6 contribution the largest, since sampling of the Andreafsky River stock was initiated in 1981 (Figure 19). The percentage of females was larger than for any previous year.

The relatively strong age 6 female component of the Andreafsky River chinook salmon escapement sample, together with the magnitude of the aerial survey count estimate, indicates that there may be good production from the 1987 brood year for this stock.

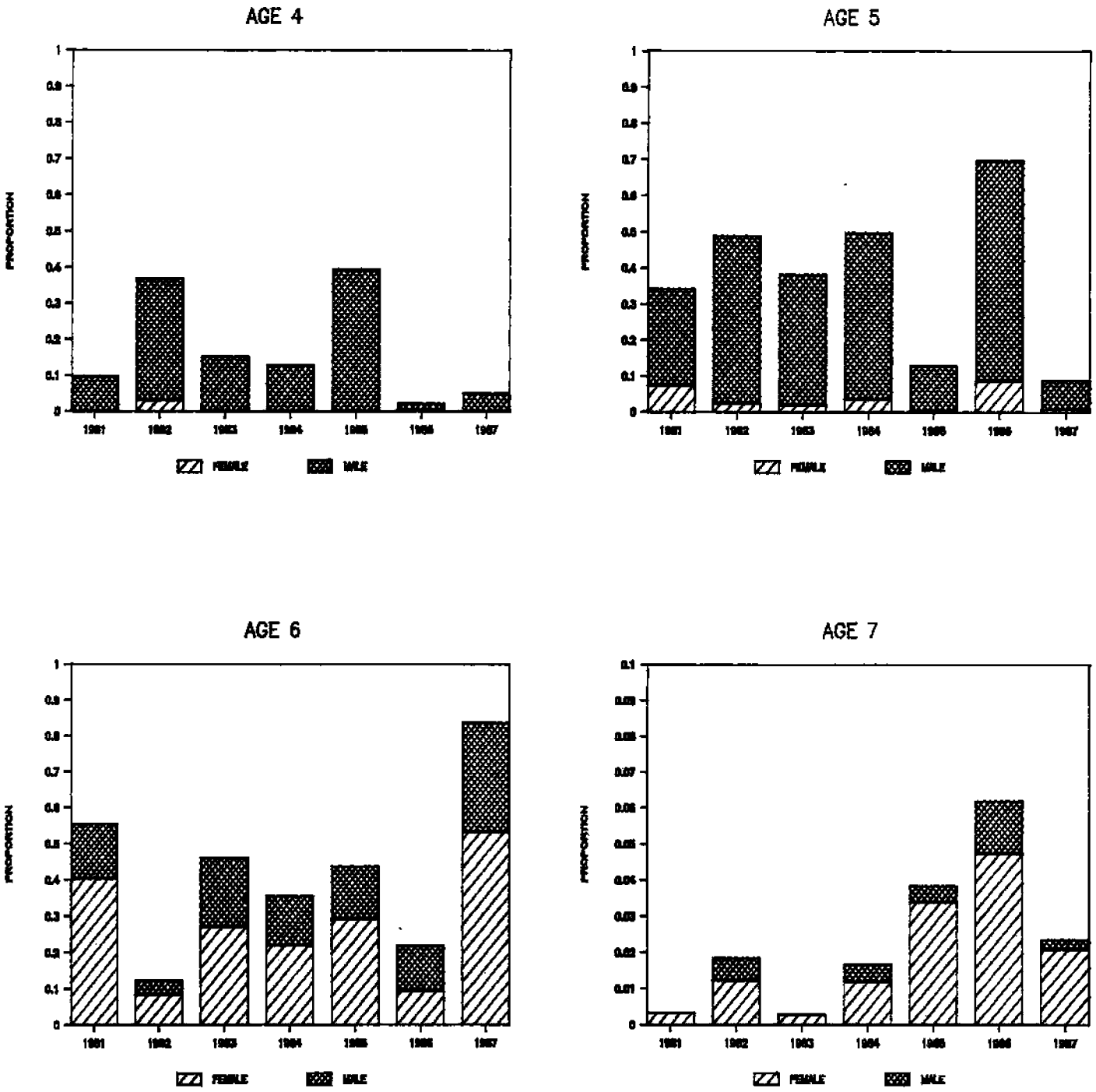


Figure 19. Age and sex composition of Andreafsky River chinook salmon, 1981-1987, presented as proportion of total sample for each year by age class. Note different scale for age 7.

CONCLUSIONS AND RECOMMENDATIONS

Escapement to the Anvik River was estimated by side-scanning sonar to be 455,876 summer chum salmon in 1987, which is 6% below the sonar count escapement objective of 487,000 fish. Escapement to the East Fork Andreafsky River was estimated by tower count to be 45,221 summer chum salmon, which is 67% below the 1981-1986 average escapement count (excluding 1985) of 135,400 fish. Chinook salmon escapement objectives were achieved in both systems. Pink salmon were present in small numbers in the Andreafsky River, with a total season tower count in the East Fork of 676 fish.

There is no stock identification data presently available for the Yukon River summer chum salmon fisheries. Stock specific run timing through these fisheries is not known. However, if the Anvik River stock does move through the lower river districts relatively early, it may support only a moderate exploitation rate during the large mesh chinook salmon season. Conversely, if the East Fork Andreafsky River stock enters the Yukon River relatively late, it may sustain a significantly higher exploitation rate in the targeted chum salmon fishery. In addition, a high concentration of commercial and subsistence set gillnet gear in and near the mouth of the Andreafsky River further increases the exploitation rate on this stock.

Summer chum salmon run timing at the lower Yukon River set gillnet test fishery (mile 20), at the Yukon River sonar site (mile 123), at the East Fork Andreafsky River tower site (mile 125), and at the Anvik River sonar site (mile 365) can be compared to provide a qualitative assessment of probable stock timing through the lower river fisheries (Figure 20). Given that the mean dates of passage at each of these four sites in 1987 was 24 June, 4 July, 9 July, and 11 July, respectively, it is probable that the Anvik River stock entered the Yukon River earlier than the Andreafsky River stock. It should be noted that problems with unstable river conditions during the early portion of the season resulted in incomplete summer chum salmon counts at the Yukon River sonar site prior to 3 July, which was a crew day off. The calculated mean date for the Yukon River sonar site is shifted later as a result.

Comparing mean dates of passage and river miles between sites results in calculated swimming speeds of 20.3 miles per day between the test fishery and the Anvik River sonar site, and only 7.0 miles per day between the test fishery and the East Fork Andreafsky River tower site. Differential swimming speeds and milling behaviors by the two stocks are possible explanations, but later entry by the Andreafsky River stock seems more probable.

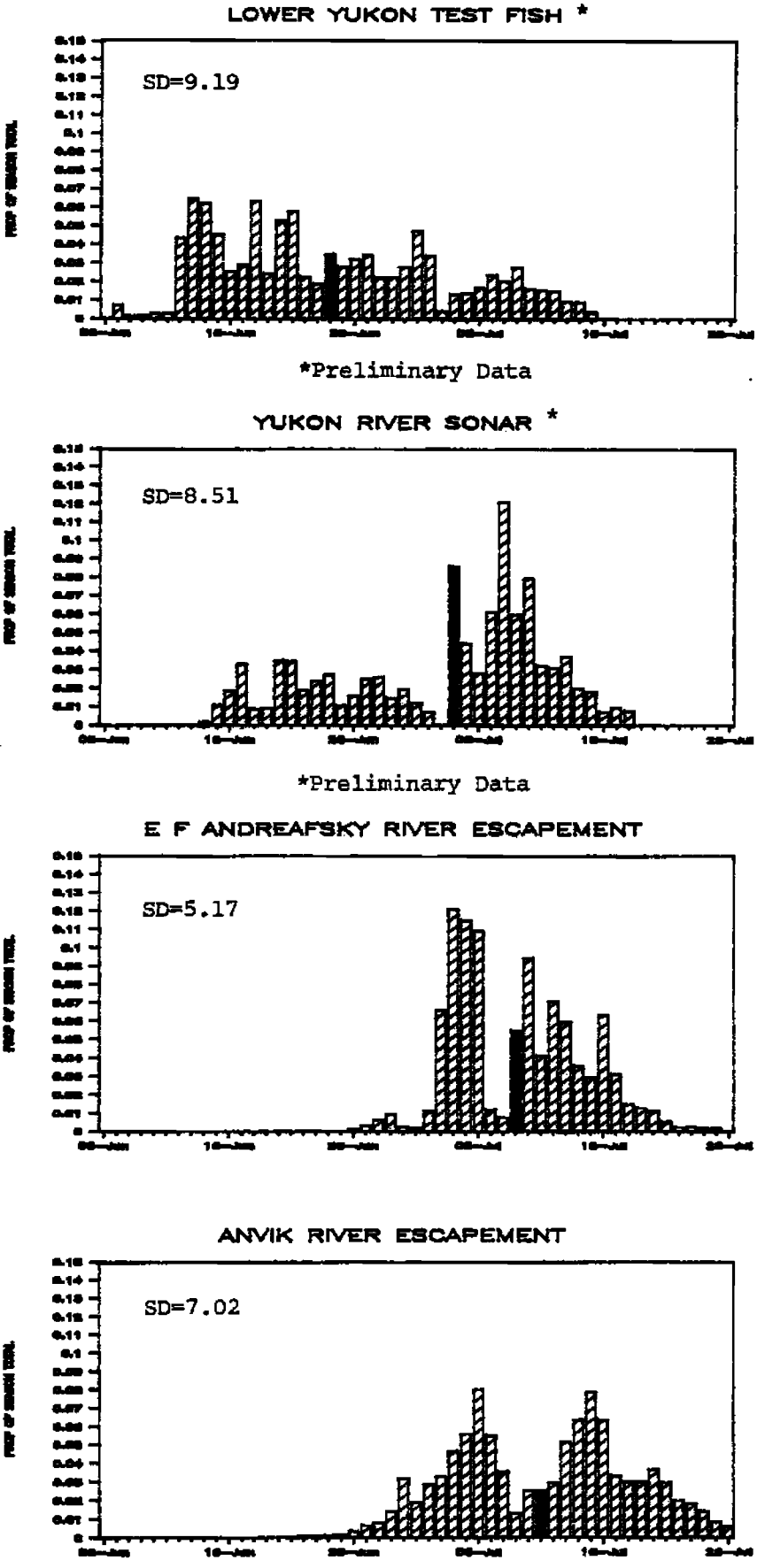


Figure 20. Run timing of Yukon River summer chum salmon in 1987 as indicated by catches, sonar counts, or tower counts at four sites. Mean date of run passage is indicated by shaded bar, and standard deviation (SD) of the mean is given.

Although the Andreafsky summer chum salmon stock may support a greater exploitation rate in the lower river fishery, it is probable that the Anvik River stock contributes a greater number of fish. The similarity in age compositions between the District 1 commercial fishery and the Anvik River escapement, even in years when the Andreafsky River escapement age composition is very different, suggests that the Anvik River stock may account for a large component of the harvest.

For chinook salmon, the relatively strong contribution of age 6 females to both the Andreafsky and Anvik River escapement samples, together with the magnitude of the aerial survey count estimates, indicates that there may be good production from the 1987 brood year for these stocks.

The method of deploying sonar transducers on the Anvik River, first used in 1986, was once again effective in 1987. The method should perform well even in very high water conditions, as were encountered in 1985. A similar set of transducer deployment assemblies is available for use on the East Fork Andreafsky River if sonar is used to enumerate salmon escapement in that stream in the future.

Tower counting proved to be a feasible method of obtaining daily salmon escapement counts by species for the East Fork Andreafsky River in 1987 for the second consecutive year. It is recommended that escapement to this system should be estimated by tower counting in 1988, with sonar equipment available in reserve in case of high and turbid water conditions.

A third crew member and three 8 hr counting shifts per day would eliminate the need to estimate fish passage for the period 0800-1600. If funding limitations prohibit a three person crew, counting should be conducted for 24 hrs on at least 4 to 6 days during the run to determine a post-season count expansion factor for each species. The count expansion factors presented in this report for 1987 should be used to generate in-season daily escapement estimates in 1988.

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Appendix Table 1. Anvik River salmon beach seine catch by species, sex, and date, 1987. a

Date	Number Of Sets	Chum			Chinook			Pink		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
27-Jun	1	4	1	5						
28-Jun	2	7	1	8						
29-Jun										
30-Jun										
01-Jul										
02-Jul	2	26	39	65						
03-Jul										
04-Jul	2	4	7	11						
05-Jul										
06-Jul	2	1	7	8						
07-Jul	3	13	10	23						
08-Jul	3	30	38	68						
09-Jul	1	37	40	77						
10-Jul										
11-Jul										
12-Jul	1	57	59	116						
13-Jul										
14-Jul	3	15	22	37						
15-Jul										
16-Jul	1	38	118	156						
17-Jul										
18-Jul	1	53	144	197						
19-Jul										
20-Jul	2	11	40	51						
21-Jul										
22-Jul	1	25	91	116						
23-Jul										
24-Jul	1	4	64	68						
Totals	26	325	681	1,006	0	0	0	0	0	0

a Beach seining was conducted at a site on the west bank approximately 200 meters upstream from the sonar site from 27 June through 6 July. A site approximately 2 miles upstream from the sonar site was tested on 7 July due to low catches at the original site. An effective site was located 50 meters upstream from the original site on 8 July, and this site was used through 24 July.

Appendix Table 2. Age and sex composition of Anvik River summer chum salmon escapement samples, 1972-1987. a

NUMBERS OF FISH

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 0.2 MALE	AGE 0.2 FEMALE	AGE 0.2 TOTAL	AGE 0.3 MALE	AGE 0.3 FEMALE	AGE 0.3 TOTAL	AGE 0.4 MALE	AGE 0.4 FEMALE	AGE 0.4 TOTAL	AGE 0.5 MALE	AGE 0.5 FEMALE	AGE 0.5 TOTAL
1972	167	153	320	0	0	0	25	37	62	138	115	253	4	1	5
1973	265	518	783	11	37	48	204	401	605	49	79	128	1	1	2
1974	245	157	402	12	24	36	197	120	317	34	12	46	2	1	3
1975	270	314	584	4	17	21	253	288	541	13	9	22	0	0	0
1976	281	320	601	5	4	9	43	35	78	233	281	514	0	0	0
1977	191	398	589	20	111	131	161	270	431	7	15	22	3	2	5
1978	289	263	552	0	1	1	210	180	390	79	82	161	0	0	0
1979	273	306	579	2	12	14	154	193	347	115	99	214	2	2	4
1980	167	258	425	0	1	1	147	226	373	20	31	51	0	0	0
1981	151	182	333	0	0	0	49	67	116	99	115	214	3	0	3
1982	117	265	382	4	17	21	75	181	256	37	65	102	1	2	3
1983	183	238	421	0	4	4	99	142	241	83	90	173	1	2	3
1984	138	215	353	2	6	8	117	189	306	19	20	39	0	0	0
1985	233	294	527	0	11	11	172	225	397	59	58	117	2	0	2
1986	205	281	486	0	2	2	59	89	148	143	186	329	3	4	7
1987	190	355	545	0	10	10	125	238	363	56	100	156	9	7	16

PERCENT OF TOTAL SAMPLE b

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 0.2 MALE	AGE 0.2 FEMALE	AGE 0.2 TOTAL	AGE 0.3 MALE	AGE 0.3 FEMALE	AGE 0.3 TOTAL	AGE 0.4 MALE	AGE 0.4 FEMALE	AGE 0.4 TOTAL	AGE 0.5 MALE	AGE 0.5 FEMALE	AGE 0.5 TOTAL
1972	52.19%	47.81%	100.00%	0.00%	0.00%	0.00%	7.81%	11.56%	19.38%	43.13%	35.94%	79.06%	1.25%	0.31%	1.56%
1973	33.84%	66.16%	100.00%	1.40%	4.73%	6.13%	26.05%	51.21%	77.27%	6.26%	10.09%	16.35%	0.13%	0.13%	0.26%
1974	60.95%	39.05%	100.00%	2.99%	5.97%	8.96%	49.00%	29.85%	78.86%	8.46%	2.99%	11.44%	0.50%	0.25%	0.75%
1975	46.23%	53.77%	100.00%	0.68%	2.91%	3.60%	43.32%	49.32%	92.64%	2.23%	1.54%	3.77%	0.00%	0.00%	0.00%
1976	46.76%	53.24%	100.00%	0.83%	0.67%	1.50%	7.15%	5.82%	12.98%	38.77%	46.76%	85.52%	0.00%	0.00%	0.00%
1977	32.43%	67.57%	100.00%	3.40%	18.85%	22.24%	27.33%	45.84%	73.17%	1.19%	2.55%	3.74%	0.51%	0.34%	0.85%
1978	52.36%	47.64%	100.00%	0.00%	0.18%	0.18%	38.04%	32.61%	70.65%	14.31%	14.86%	29.17%	0.00%	0.00%	0.00%
1979	47.15%	52.85%	100.00%	0.35%	2.07%	2.42%	26.60%	33.33%	59.93%	19.86%	17.10%	36.96%	0.35%	0.35%	0.69%
1980	39.29%	60.71%	100.00%	0.00%	0.24%	0.24%	34.59%	53.18%	87.76%	4.71%	7.29%	12.00%	0.00%	0.00%	0.00%
1981	45.35%	54.65%	100.00%	0.00%	0.00%	0.00%	14.71%	20.12%	34.83%	29.73%	34.53%	64.26%	0.90%	0.00%	0.90%
1982	30.63%	69.37%	100.00%	1.05%	4.45%	5.50%	19.63%	47.38%	67.02%	9.69%	17.02%	26.70%	0.26%	0.52%	0.79%
1983	43.47%	56.53%	100.00%	0.00%	0.95%	0.95%	23.52%	33.73%	57.24%	19.71%	21.38%	41.09%	0.24%	0.48%	0.71%
1984	39.09%	60.91%	100.00%	0.57%	1.70%	2.27%	33.14%	53.54%	86.69%	5.38%	5.67%	11.05%	0.00%	0.00%	0.00%
1985	44.21%	55.79%	100.00%	0.00%	2.09%	2.09%	32.64%	42.69%	75.33%	11.20%	11.01%	22.20%	0.38%	0.00%	0.38%
1986	42.18%	57.82%	100.00%	0.00%	0.41%	0.41%	12.14%	18.31%	30.45%	29.42%	38.27%	67.70%	0.62%	0.82%	1.44%
1987	34.86%	65.14%	100.00%	0.00%	1.83%	1.83%	22.94%	43.67%	66.61%	10.28%	18.35%	28.62%	1.65%	1.28%	2.94%

a Samples collected by carcass survey 1972-1981, by beach seine 1983-1987, and by both methods combined in 1982.
b Sample percentages not weighted by time period or escapement counts.

Appendix Table 3. Age and sex composition of Anvik River chinook salmon escapement samples, 1972-1987. a

NUMBERS OF FISH

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 4 MALE	AGE 4 FEMALE	AGE 4 TOTAL	AGE 5 MALE	AGE 5 FEMALE	AGE 5 TOTAL	AGE 6 MALE	AGE 6 FEMALE	AGE 6 TOTAL	AGE 7 MALE	AGE 7 FEMALE	AGE 7 TOTAL
1972	10	5	15	0	0	0	8	0	8	2	5	7	0	0	0
1973	6	4	10	1	0	1	0	0	0	5	3	8	0	1	1
1974	NO SAMPLES COLLECTED														
1975	6	2	8	1	0	1	4	1	5	1	1	2	0	0	0
1976	33	12	45	6	0	6	25	5	30	2	7	9	0	0	0
1977	58	59	117	2	1	3	27	6	33	27	48	75	2	4	6
1978	36	41	77	13	0	13	10	1	11	13	39	52	0	1	1
1979	37	9	46	17	0	17	14	0	14	6	6	12	0	3	3
1980	41	42	83	19	1	20	21	22	43	1	16	17	0	3	3
1981	109	154	263	33	1	34	61	36	97	15	116	131	0	1	1
1982	100	38	138	47	1	48	47	5	52	6	32	38	0	0	0
1983	173	133	306	56 b	0	56	84	26	110	33	104	137	0	3	3
1984	162	114	276	29	4	33	108	30	138	25	74	99	0	6	6
1985	25	8	33	10	0	10	10	3	13	5	5	10	0	0	0
1986	53	89	142	0	1	1	44	27	71	6	48	54	3	13	16
1987	92	130	222	21	0	21	22	7	29	48	116	164	1	7	8

PERCENT OF TOTAL SAMPLE c

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 4 MALE	AGE 4 FEMALE	AGE 4 TOTAL	AGE 5 MALE	AGE 5 FEMALE	AGE 5 TOTAL	AGE 6 MALE	AGE 6 FEMALE	AGE 6 TOTAL	AGE 7 MALE	AGE 7 FEMALE	AGE 7 TOTAL
1972	66.67%	33.33%	100.00%	0.00%	0.00%	0.00%	53.33%	0.00%	53.33%	13.33%	33.33%	46.67%	0.00%	0.00%	0.00%
1973	60.00%	40.00%	100.00%	10.00%	0.00%	10.00%	0.00%	0.00%	0.00%	50.00%	30.00%	80.00%	0.00%	10.00%	10.00%
1974	NO SAMPLES COLLECTED														
1975	75.00%	25.00%	100.00%	12.50%	0.00%	12.50%	50.00%	12.50%	62.50%	12.50%	12.50%	25.00%	0.00%	0.00%	0.00%
1976	73.33%	26.67%	100.00%	13.33%	0.00%	13.33%	55.56%	11.11%	66.67%	4.44%	15.56%	20.00%	0.00%	0.00%	0.00%
1977	49.57%	50.43%	100.00%	1.71%	0.85%	2.56%	23.08%	5.13%	28.21%	23.08%	41.03%	64.10%	1.71%	3.42%	5.13%
1978	46.75%	53.25%	100.00%	16.88%	0.00%	16.88%	12.99%	1.30%	14.29%	16.88%	50.65%	67.53%	0.00%	1.30%	1.30%
1979	80.43%	19.57%	100.00%	36.96%	0.00%	36.96%	30.43%	0.00%	30.43%	13.04%	13.04%	26.09%	0.00%	6.52%	6.52%
1980	49.40%	50.60%	100.00%	22.89%	1.20%	24.10%	25.30%	26.51%	51.81%	1.20%	19.28%	20.48%	0.00%	3.61%	3.61%
1981	41.44%	58.56%	100.00%	12.55%	0.38%	12.93%	23.19%	13.69%	36.88%	5.70%	44.11%	49.81%	0.00%	0.38%	0.38%
1982	72.46%	27.54%	100.00%	34.06%	0.72%	34.78%	34.06%	3.62%	37.68%	4.35%	23.19%	27.54%	0.00%	0.00%	0.00%
1983	56.54%	43.46%	100.00%	18.30%	0.00%	18.30%	27.45%	8.50%	35.95%	10.78%	33.99%	44.77%	0.00%	0.98%	0.98%
1984	58.70%	41.30%	100.00%	10.51%	1.45%	11.96%	39.13%	10.87%	50.00%	9.06%	26.81%	35.87%	0.00%	2.17%	2.17%
1985	75.76%	24.24%	100.00%	30.30%	0.00%	30.30%	30.30%	9.09%	39.39%	15.15%	15.15%	30.30%	0.00%	0.00%	0.00%
1986	37.32%	62.68%	100.00%	0.00%	0.70%	0.70%	30.99%	19.01%	50.00%	4.23%	33.80%	38.03%	2.11%	9.15%	11.27%
1987	41.44%	58.56%	100.00%	9.46%	0.00%	9.46%	9.91%	3.15%	13.06%	21.62%	52.25%	73.87%	0.45%	3.15%	3.60%

a Samples collected by carcass survey each year, with a very few fish also taken by beach seine or hook and line in some years.
b Includes one age 3 male.
c Sample percentages not weighted by time period or escapement counts.

Appendix Table 4. East Fork Andreafsky River summer chum salmon tower counts by hour and date, 1987. a

DATE	EXPANDED HOURLY COUNT (3X ACTUAL 20 MINUTE COUNT) FOR HOUR ENDING:																							TOTAL
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	
25-Jun																	0	0	0	0	0				0
26-Jun	0	0	0														0	0	0	0	27	0	30	0	57
27-Jun	0	0	9	0	12	12	0	12									0	3	0	48	0	3	0	21	120
28-Jun																									0
29-Jun	0	138	18	57	93	24	3	6									0	0	12	9	3	0	9	0	372
30-Jun	24	30	18	3	0	6	0	6									0	0	9	0	0	0	0	0	96
01-Jul	0	0	9	0	12	9	0	0									0	9	0	0	0	9	3	21	72
02-Jul	9	0	18	15	9	0	21	9									0	60	84	12	24	75	102	0	438
03-Jul																									0
04-Jul	36	45	93	84	105	90	57	51									393	309	183	798	873	789	525	288	4,719
05-Jul																									0
06-Jul	42	810	918	402	720	651	240	333									48	12	3	3	15	0	15	45	4,257
07-Jul	45	18	72	90	60	6	45	18	0	3	3	6	0	0	0	0	3	0	39	18	45	3	0	69	543
08-Jul	0	6	18	12	0	9	0	15	3	9	0	15	12	15	6	3	12	54	12	99	36	9	3	0	348
09-Jul	12	51	96	45	135	81	51	21									42	45	51	48	324	294	762	84	2,142
10-Jul	132	615	843	927	519	255	42	66									51	30	39	84	12	15	39	12	3,681
11-Jul	18	48	258	309	210	72	117	48									39	24	3	6	75	171	120	93	1,611
12-Jul	9	0	0	0	6	0	0	0									75	15	33	180	300	273	1,422	444	2,757
13-Jul	264	21	6	33	0	12	0	0									6	84	420	444	447	165	237	174	2,313
14-Jul	21	63	12	9	21	21	51	27	12	0	30	12	0	18	12	258	393	162	84	171	105	63	30	45	1,620
15-Jul	42	42	30	45	0	21	0	0	3	3	12	15	3	15	51	24	18	141	210	51	21	15	357	216	1,335
16-Jul	6	15	174	33	42	96	51	15									81	51	105	216	318	555	417	288	2,463
17-Jul	36	54	57	240	3	18	6	6									15	39	93	114	216	90	108	123	1,218
18-Jul	9	66	204	9	6	3	18	6									24	117	36	6	21	48	6	3	582
19-Jul																									0
20-Jul	24	9	36	24	63	51	18	15									51	12	24	18	54	15	21	3	438
21-Jul	36	12	0	18	45	0	45	21									0	12	6	0	0	9	3	0	207
22-Jul	0	18	6	0	12	3	0	0									0	9	3	6	3	0	27	0	87
23-Jul	0	6	0	12	6	0	0	6									9	15	3	6	18	18	0	0	99
24-Jul	0	0	3	9	0	6	3	0									0	0	0	12	21	9	0	0	63
25-Jul	0	0	6	0	0	9	0	6									6	0	12	12	3	3	0	3	60
TOTAL	765	2,067	2,904	2,376	2,079	1,455	768	687	18	15	45	48	15	48	69	285	1,266	1,203	1,464	2,361	2,961	2,631	4,236	1,932	31,698

a Counts obtained for all 24 hours on 7-8 July and 14-15 July were used to develop an expansion factor for days with 16 hourly counts. The 24 hourly counts for these four days combined was 3,846 summer chum salmon, while the combined count for the hours 0000-0800 and 1600-2400 was 3,303 summer chum salmon, resulting in an expansion factor of 1.16. This factor is used in Table 4 to obtain daily estimates of summer chum salmon escapement for days with 16 hourly counts.

Appendix Table 5. East Fork Andreafsky River chinook salmon tower counts by hour and date, 1987. a

DATE	EXPANDED HOURLY COUNT (3X ACTUAL 20 MINUTE COUNT) FOR HOUR ENDING:																								
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	TOTAL
25-Jun																	0	0	0	0	0				0
26-Jun	0	0	0															0	0	0	0	0	0	0	0
27-Jun	0	0	0	0	3	0	0	0									0	0	0	0	0	0	0	0	3
28-Jun																									0
29-Jun	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
30-Jun	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
01-Jul	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
02-Jul	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
03-Jul																									0
04-Jul	0	0	3	0	0	3	0	0									0	0	0	6	3	0	0	0	15
05-Jul																									0
06-Jul	0	3	0	9	0	0	0	0									0	0	0	0	0	0	0	0	12
07-Jul	0	3	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
08-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
09-Jul	0	0	12	0	6	0	0	0									0	24	3	0	3	0	0	0	48
10-Jul	0	9	0	6	15	0	3	0									0	0	0	6	0	0	0	0	39
11-Jul	3	0	3	12	3	0	3	0									0	0	0	0	0	3	0	0	27
12-Jul	0	0	0	0	0	0	0	0									0	0	3	0	18	0	21	6	48
13-Jul	3	0	0	0	0	0	0	0									3	3	15	15	27	12	18	18	114
14-Jul	0	3	0	0	0	0	3	6	0	3	6	0	0	18	0	9	21	6	12	24	21	15	0	12	159
15-Jul	6	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	6	45	63	12	6	6	0	150
16-Jul	0	0	0	15	3	3	3	0									9	0	21	15	36	0	18	15	138
17-Jul	0	6	9	18	3	9	36	0									0	39	9	15	6	0	6	9	165
18-Jul	0	9	6	3	12	0	6	0									9	27	15	0	0	15	6	0	108
19-Jul																									0
20-Jul	12	0	6	21	0	3	3	0									42	24	66	0	33	12	18	0	240
21-Jul	57	72	21	30	9	6	0	15									0	0	3	0	0	0	0	0	213
22-Jul	0	0	6	0	3	9	0	0									0	0	0	6	6	0	6	0	36
23-Jul	0	0	3	0	3	0	0	0									0	0	12	3	15	0	6	0	42
24-Jul	0	0	0	0	3	6	6	0									0	0	3	3	3	0	0	0	24
25-Jul	0	0	0	3	0	0	0	0									18	0	6	0	0	0	0	0	27
TOTAL	81	105	69	123	63	39	66	24	0	3	6	0	0	18	0	9	102	132	213	156	183	63	105	60	1,620

a Counts obtained for all 24 hours on 7-8 July and 14-15 July were used to develop an expansion factor for days with 16 hourly counts. The 24 hourly counts for these four days combined was 321 chinook salmon, while the combined count for the hours 0000-0800 and 1600-2400 was 285 chinook salmon, resulting in an expansion factor of 1.13. This factor is used in Table 4 to obtain daily estimates of chinook salmon escapement for days with 16 hourly counts.

Appendix Table 6. East Fork Andreafsky River pink salmon tower counts by hour and date, 1987. a

	EXPANDED HOURLY COUNT (3X ACTUAL 20 MINUTE COUNT) FOR HOUR ENDING:																							
DATE	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	TOTAL
25-Jun																	0	0	0	0	0				0
26-Jun	0	0	0															0	0	0	3	0	0	0	3
27-Jun	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
28-Jun																									0
29-Jun	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
30-Jun	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
01-Jul	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
02-Jul	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
03-Jul																									0
04-Jul	6	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	6
05-Jul																									0
06-Jul	0	0	0	0	0	0	0	0									0	0	0	0	0	0	0	0	0
07-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08-Jul	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
09-Jul	0	0	0	0	0	0	0	0									3	0	0	0	0	0	0	0	3
10-Jul	0	6	0	0	0	0	0	0									0	0	0	0	0	0	3	0	9
11-Jul	0	0	0	3	0	0	3	0									0	0	0	0	0	0	0	0	6
12-Jul	0	0	0	0	0	0	0	0									0	0	3	0	3	0	0	0	6
13-Jul	0	0	0	0	0	0	0	0									0	0	0	0	6	6	0	6	18
14-Jul	0	3	0	3	3	0	0	0	0	0	3	0	0	0	0	0	6	9	0	0	6	0	6	0	39
15-Jul	0	0	6	3	0	0	15	0	0	0	0	3	0	0	0	0	0	0	3	0	0	3	6	0	39
16-Jul	0	3	0	0	6	9	3	3									0	3	6	0	0	9	39	12	93
17-Jul	3	6	15	3	6	3	6	9									0	15	0	6	0	6	12	15	105
18-Jul	3	0	18	0	0	0	3	0									0	6	0	0	21	27	0	0	78
19-Jul																									0
20-Jul	0	0	9	0	3	0	3	0									0	0	0	6	0	3	0	0	24
21-Jul	0	6	0	9	0	0	3	3									0	0	6	0	0	3	0	0	30
22-Jul	0	0	3	0	3	0	0	0									0	6	3	3	3	0	3	0	24
23-Jul	0	0	0	6	0	0	0	0									3	6	0	0	0	0	0	0	15
24-Jul	0	0	0	9	15	9	6	0									6	0	0	0	0	0	6	0	51
25-Jul	0	0	0	0	0	0	0	0									9	0	0	9	0	3	3	3	27
TOTAL	12	24	51	39	36	21	42	15	0	0	3	3	0	0	0	0	27	45	21	24	42	60	78	36	579

a Counts obtained for all 24 hours on 7-8 July and 14-15 July were used to develop an expansion factor for days with 16 hourly counts. The 24 hourly counts for these four days combined was 81 pink salmon, while the combined count for the hours 0000-0800 and 1600-2400 was 75 pink salmon, resulting in an expansion factor of 1.08. This factor is used in Table 4 to obtain daily estimates of pink salmon escapement for days with 16 hourly counts.

Appendix Table 7. East Fork Andreafsky River salmon beach seine catch by species, sex, and date, 1987. a

Date	Number Of Sets	Chum			Chinook			Pink		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
04-Jul	8	5	9	14						
05-Jul	6	7	6	13						
06-Jul	4	1	2	3						
07-Jul	2	1	1	2						
08-Jul	2	5	1	6						
09-Jul										
10-Jul	3	23	35	58						
11-Jul	3	2	6	8						
12-Jul	3	11	16	27						
13-Jul										
14-Jul	1	39	53	92	2	1	3	7	0	7
15-Jul	3	9	16	25	1	1	2	1	1	2
16-Jul										
17-Jul	1	7	11	18	4	3	7	1	0	1
18-Jul	2	47	40	87	0	2	2	3	2	5
19-Jul										
20-Jul	3	1	10	11	0	1	1	4	1	5
21-Jul	3	1	4	5	0	1	1	2	0	2
22-Jul	2	2	5	7				1	3	4
23-Jul	3	5	6	11	0	1	1	2	2	4
24-Jul										
25-Jul	1	2	4	6				3	1	4
26-Jul	3	2	6	8				2	0	2
27-Jul	2	0	1	1	0	1	1	0	1	1
Totals	55	170	232	402	7	11	18	26	11	37

a Beach seining was conducted at a site located approximately 1/8 mile below the tower site.

Appendix Table 8. Age and sex composition of East Fork Andreafsky River summer chum salmon escapement samples, 1981-1987. a

NUMBERS OF FISH

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 0.2 MALE	AGE 0.2 FEMALE	AGE 0.2 TOTAL	AGE 0.3 MALE	AGE 0.3 FEMALE	AGE 0.3 TOTAL	AGE 0.4 MALE	AGE 0.4 FEMALE	AGE 0.4 TOTAL	AGE 0.5 MALE	AGE 0.5 FEMALE	AGE 0.5 TOTAL
1981	170	181	351	2	3	5	58	108	166	106	69	175	4	1	5
1982	161	295	456	2	9	11	108	224	332	46	60	106	5	2	7
1983	366	468	834	3	1	4	114	164	278	243	298	541	6	5	11
1984	222	229	451	7	11	18	149	165	314	63	47	110	3	6	9
1985	237	329	566	3	8	11	172	235	407	61	86	147	1	0	1
1986	346	429	775	0	2	2	200	272	472	140	148	288	6	7	13
1987	150	212	362	2	1	3	36	68	104	105	136	241	7	7	14

PERCENT OF TOTAL SAMPLE b

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 0.2 MALE	AGE 0.2 FEMALE	AGE 0.2 TOTAL	AGE 0.3 MALE	AGE 0.3 FEMALE	AGE 0.3 TOTAL	AGE 0.4 MALE	AGE 0.4 FEMALE	AGE 0.4 TOTAL	AGE 0.5 MALE	AGE 0.5 FEMALE	AGE 0.5 TOTAL
1981	48.43%	51.57%	100.00%	0.57%	0.85%	1.42%	16.52%	30.77%	47.29%	30.20%	19.66%	49.86%	1.14%	0.28%	1.42%
1982	35.31%	64.69%	100.00%	0.44%	1.97%	2.41%	23.68%	49.12%	72.81%	10.09%	13.16%	23.25%	1.10%	0.44%	1.54%
1983	43.88%	56.12%	100.00%	0.36%	0.12%	0.48%	13.67%	19.66%	33.33%	29.14%	35.73%	64.87%	0.72%	0.60%	1.32%
1984	49.22%	50.78%	100.00%	1.55%	2.44%	3.99%	33.04%	36.59%	69.62%	13.97%	10.42%	24.39%	0.67%	1.33%	2.00%
1985	41.87%	58.13%	100.00%	0.53%	1.41%	1.94%	30.39%	41.52%	71.91%	10.78%	15.19%	25.97%	0.18%	0.00%	0.18%
1986	44.65%	55.35%	100.00%	0.00%	0.26%	0.26%	25.81%	35.10%	60.90%	18.06%	19.10%	37.16%	0.77%	0.90%	1.68%
1987	41.44%	58.56%	100.00%	0.55%	0.28%	0.83%	9.94%	18.78%	28.73%	29.01%	37.57%	66.57%	1.93%	1.93%	3.87%

a Samples collected by carcass survey in 1981, by beach seine in 1983 and 1986-87, and by both methods combined in 1982 and 1984-85.
b Sample percentages not weighted by time period or escapement counts.

Appendix Table 9. Age and sex composition of Andreafsky River chinook salmon escapement samples, 1981-1987. a

NUMBERS OF FISH

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 4 MALE	AGE 4 FEMALE	AGE 4 TOTAL	AGE 5 MALE	AGE 5 FEMALE	AGE 5 TOTAL	AGE 6 MALE	AGE 6 FEMALE	AGE 6 TOTAL	AGE 7 MALE	AGE 7 FEMALE	AGE 7 TOTAL
1981	154	143	297	29	0	29	80	22	102	45	120	165	0	1	1
1982	276	49	325	110 b	10	120	151	8	159	13	27	40	2	4	6
1983	251	104	355	54	0	54	129	7	136	68	96	164	0	1	1
1984	307	112	419	54 c	0	54	194	15	209	57	92	149	2	5	7
1985	296	147	443	175	0	175	55	2	57	64	130	194	2	15	17
1986	211	64	275	5	1	6	168	24	192	34	26	60	4	13	17
1987	168	215	383	19 c	0	19	31	3	34	117	204	321	1	8	9

PERCENT OF TOTAL SAMPLE d

YEAR	SAMPLE MALE	SAMPLE FEMALE	SAMPLE TOTAL	AGE 4 MALE	AGE 4 FEMALE	AGE 4 TOTAL	AGE 5 MALE	AGE 5 FEMALE	AGE 5 TOTAL	AGE 6 MALE	AGE 6 FEMALE	AGE 6 TOTAL	AGE 7 MALE	AGE 7 FEMALE	AGE 7 TOTAL
1981	51.85%	48.15%	100.00%	9.76%	0.00%	9.76%	26.94%	7.41%	34.34%	15.15%	40.40%	55.56%	0.00%	0.34%	0.34%
1982	84.92%	15.08%	100.00%	33.85%	3.08%	36.92%	46.46%	2.46%	48.92%	4.00%	8.31%	12.31%	0.62%	1.23%	1.85%
1983	70.70%	29.30%	100.00%	15.21%	0.00%	15.21%	36.34%	1.97%	38.31%	19.15%	27.04%	46.20%	0.00%	0.28%	0.28%
1984	73.27%	26.73%	100.00%	12.89%	0.00%	12.89%	46.30%	3.58%	49.88%	13.60%	21.96%	35.56%	0.48%	1.19%	1.67%
1985	66.82%	33.18%	100.00%	39.50%	0.00%	39.50%	12.42%	0.45%	12.87%	14.45%	29.35%	43.79%	0.45%	3.39%	3.84%
1986	76.73%	23.27%	100.00%	1.82%	0.36%	2.18%	61.09%	8.73%	69.82%	12.36%	9.45%	21.82%	1.45%	4.73%	6.18%
1987	43.86%	56.14%	100.00%	4.96%	0.00%	4.96%	8.09%	0.78%	8.88%	30.55%	53.26%	83.81%	0.26%	2.09%	2.35%

a Samples collected by carcass survey of the East Fork and West Fork each year, with additional samples collected by beach seine from the East Fork for the years 1982 through 1987.
b Includes 7 age 3 males.
c Includes 1 age 3 male.
d Sample percentages not weighted by time period or escapement counts.