

AYK REGION
YUKON ESC. REPORT # 9

ANVIK RIVER SALMON ESCAPEMENT STUDIES

1974

(From Yukon River Anadromous Fish Investigations)
Technical Report for July 1, 1974 to June 30, 1975

Lance Trasky

Alaska Department Of Fish and Game
Division of Commercial Fisheries
Anchorage, Alaska

ANVIK RIVER SALMON ESCAPEMENT STUDIES

Introduction

For the third consecutive year a salmon enumeration project was conducted to yield indices to the magnitude of king and summer chum salmon escapements in the Anvik River system (Figure 5). The objectives of this project were to: (1) determine the daily and seasonal timing and magnitude of the salmon runs, (2) evaluate aerial survey methods by comparing aerial survey estimates with tower counts, (3) determine age, sex and size composition of the king and chum salmon escapement, (4) determine if there is a difference in the timing of the post-spawning die-off between male and female salmon, (5) evaluate an 18-hour counting period and (6) measure climatological and hydrological data.

Due to funding limitations in 1974, it was necessary to reduce the daily counting period from 24 to 18 hours. A decision was made to count during those hours in which the greatest percentage of chum migration was documented in 1973: 12 midnight to 0700, 1300-12 midnight. In 1973 these hours included 81 percent of the chum and 73 percent of the king salmon daily migration past the tower. Studies by Hurd (1970) indicated that the daily migration pattern for chum salmon did not change significantly from year to year.

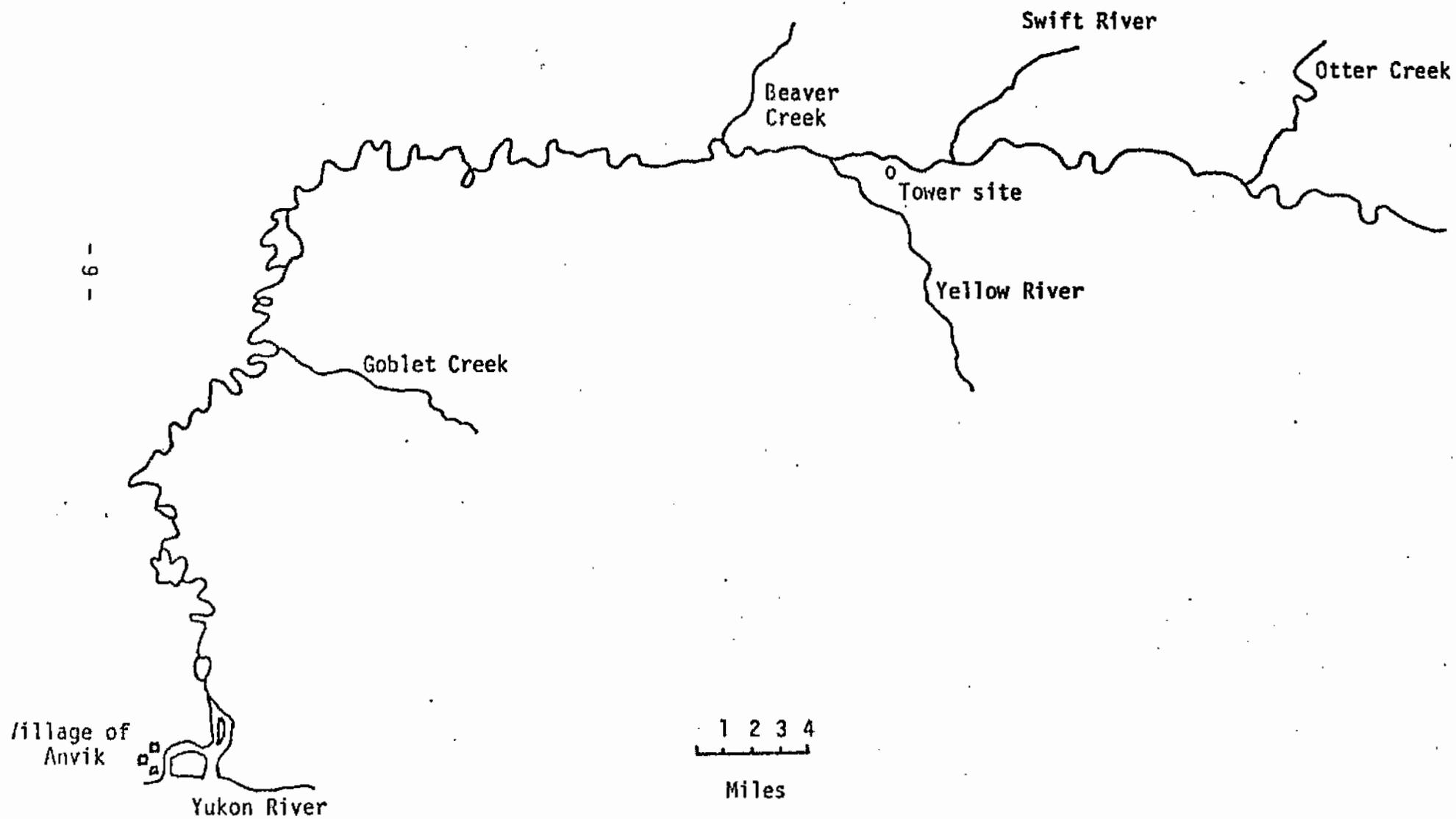
Methods and Materials

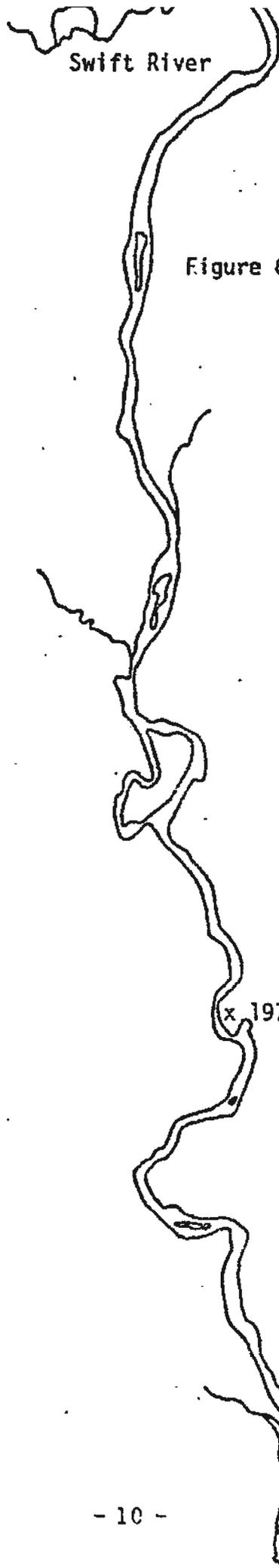
A 22-foot prefabricated aluminum tower was erected on the east bank of the Anvik River about 5-1/2 river miles upstream from its confluence with the Yellow River (Figure 6). An 80-foot weir was constructed out from the west bank, directly opposite the tower, to direct the salmon into the area which could be readily observed from the tower.

A power line, incorporating four 300-watt light bulbs housed in 18-inch diameter reflectors, was strung across the river to provide illumination during darkness. A 1500-watt generator provided electric current for the lights.

A background panel was provided by laying an 80-foot x 3-foot panel of herculite upholster cloth across the stream bottom between the tower and the weir. The panel was attached to a cable running across the bottom and weighted down with sandbags.

Figure 5. Anvik River Map





Swift River

Figure 6. Anvik River map, Swift River to Yellow River.

x 1974 tower site

Yellow River



A three-man crew began 18-hour counting operations on June 24. Operations were terminated on July 19 because of high water. Each crew member enumerated salmon for two 3-hour periods each day. No counts were made between 0700 and 1300 hours. Counts were recorded for both hourly totals and the first 10 minutes of each hour. Salmon swimming downstream were subtracted from the upstream migrants to obtain a net count.

Missing hourly counts were estimated by computing the percentage (P) of the total count made during the missing hour(s) for all other days over the entire season. This percentage (P) was subtracted from 100 percent (1-P) and divided into the daily count (A) to produce an expanded 18-hour total (E) or:

$$\frac{A}{1-P} = E$$

Hourly counts were calculated by taking the same percentage (P) of the expanded daily total and substituting it for the missing hourly counts (Appendix Table 4). The 1974 daily 18-hour count was then expanded by 27 percent for king and 19 percent for chum to give a 24-hour total.

The size of king salmon passing the tower was estimated by comparison with models attached to the background panel. The size classifications were <50 cm (trout size), 50-60 cm (chum size), 60-80 cm (average king), and >80 cm (large king). These estimates were used to determine the approximate size and age composition of the Anvik king salmon escapement.

Carcass sampling and enumeration surveys were conducted upstream and downstream of the tower site from July 11 to July 25. A scale smear for age determination was taken from each fish examined, the length (mid-eye to fork of tail) measured, and sex of each carcass was recorded. Spawning success was determined by examining the gonads of carcasses.

No aerial survey could be made of the Anvik River because of high water conditions during the peak of spawning. Climatological information was recorded daily. Stream flows and limnological data were taken periodically.

Results

Over the period June 24 to July 19, when counting was suspended due to high water, an expanded seasonal total of 201,277 chum salmon, 471 king salmon, and 167 pink salmon was enumerated past the Anvik River tower (Table 2, Appendix Tables 5 & 6). Estimates of hourly counts made from 10-minute counts (expanded by 6) were within 8 percent of the seasonal total for chum

Table 2. Daily expanded salmon counts, Anvik River^{1/}.

1974

Date	King		Chum	
	No.	% Total	No.	% Total
June 24	3	.6	1,166	.5
25	0	0	1,639	.8
26	0	0	3,001	1.5
27	0	0	2,410	1.2
28	0	0	2,736	1.3
29	0	0	4,216	2.1
30	0	0	5,711	2.8
July 1	1	-	7,185	3.6
2	3	.6	8,243	4.1
3	13	2.8	10,860	5.4
4	13	2.8	14,868	7.4
5	20	4.2	12,627	6.3
6	22	4.6	13,981	6.9
7	38	8.0	10,704	5.3
8	20	4.2	9,538	4.7
9	27	5.7	9,488	4.7
10	70	14.9	13,255	6.6
11	32	6.7	7,572	3.8
12	14	2.9	8,494	4.2
13	13	2.8	11,731	5.8
14	28	5.9	14,967	7.4
15	69	14.6	14,397	7.2
16	29	6.1	4,511	2.2
17	19	4.0	3,237	1.6
18	38	8.0	2,691	1.3
19	-		2,047	1.0
Total	471	100.0	201,277	100.0

^{1/} Expansion figures: King: 1.27
Chum: 1.19

salmon and 16 percent for king salmon (Table 3).

The summer chum migration peaked during July 4 through July 15 and king salmon migration peaked on July 10 and 15 (Figure 7). The daily chum migration, during the 18 hours counted, was greatest from 2100 to 0400 hours and the king migration from 1300 to 1700 hours (Figures 8 and 9).

The 402 chum salmon carcasses sampled were composed of 61 percent males. Age classes 3_1 to 6_1 ^{1/} were represented with age class 4_1 fish comprising 78.9 percent of the sample (Table 4). Male chums composed the greatest percentage of the sample before July 18 and females comprised a greater percentage after that date (Table 5).

Ninety-eight percent of the female and 94 percent of the male chum carcasses examined were partially or completely spent. An average of 46 eggs were retained per female (Table 6).

Based on size estimates made from the tower, the net upstream migration of king salmon was composed of 1.4 percent less than 50 cm in length, 34.4 percent between 50 to 60 cm, 41.9 percent between 60 and 80 cm, and 22.3 percent over 80 cm.

Climatological and limnological data are presented in Appendix Table 7.

Discussion

The 1974 expanded seasonal totals for chum and king salmon were the highest and lowest counts respectively in the 3 years the project has been conducted. Both of the totals would probably have been greater if high water had not forced suspension of the counts on July 19. In 1972, 4.6 percent of the expanded total chum migration and 36.6 percent of the king migration passed the Anvik tower after July 19 (Lebida, 1972). In 1973, 4.1 percent of the chums and 41.5 percent of the kings passed the tower after July 19 (Trasky, 1973). In view of this data, the expanded count for 1974 probably included most of the chum salmon. The expanded king salmon count may have been as much as 40 percent greater if counting could have been continued through July 31.

^{1/} Gilbert-Rich Formula - Total years of life at maturity (large type) - year of life at outmigration from fresh water (subscript).

Table 3. Comparison of hourly counts estimated from 10-minute counts (expanded by 6) with unexpanded hourly counts, Anvik River, 1974

		Chums			Kings		
		10 min.	expanded	actual	10 min.	expanded	actual
June	24	114	684	542	-	-	2
	25	180	1,080	982	-	-	-
	26	404	2,424	2,522	-	-	-
	27	269	1,614	2,025	-	-	-
	28	427	2,562	2,299	-	-	-
	29	690	4,140	3,543	-	-	-
	30	638	3,828	4,799	-	-	-
July	1	1,059	6,234	6,038	-	-	1
	2	1,093	6,558	6,927	1	6	2
	3	1,693	10,158	9,126	1	6	10
	4	1,966	11,796	12,494	5	30	10
	5	2,264	13,584	10,611	4	24	16
	6	2,055	12,330	11,749	8	48	17
	7	1,494	8,964	8,995	2	12	30
	8	1,689	10,134	8,015	5	30	16
	9	1,790	10,740	7,973	1	6	21
	10	1,937	11,622	11,139	15	90	55
	11	1,126	6,756	6,064	3	18	19
	12	1,080	6,480	6,010	4	24	11
	13	-	-	-	-	-	10
	14	1,117	6,702	6,981	3	18	10
	15	2,343	14,058	12,098	7	42	54
	16	728	4,368	3,791	3	18	23
	17	509	3,054	2,720	1	6	15
	18	291	1,746	1,923	4	24	26
	19	64	384	387	-	-	-
		<u>27,000</u>	<u>162,000</u>	<u>149,753</u>	<u>67</u>	<u>402</u>	<u>348</u>

difference 12,247
percentage difference 8%

difference 54
percentage difference 16%

Figure 7. Daily chum and king salmon migration, Anvik River, 1974.

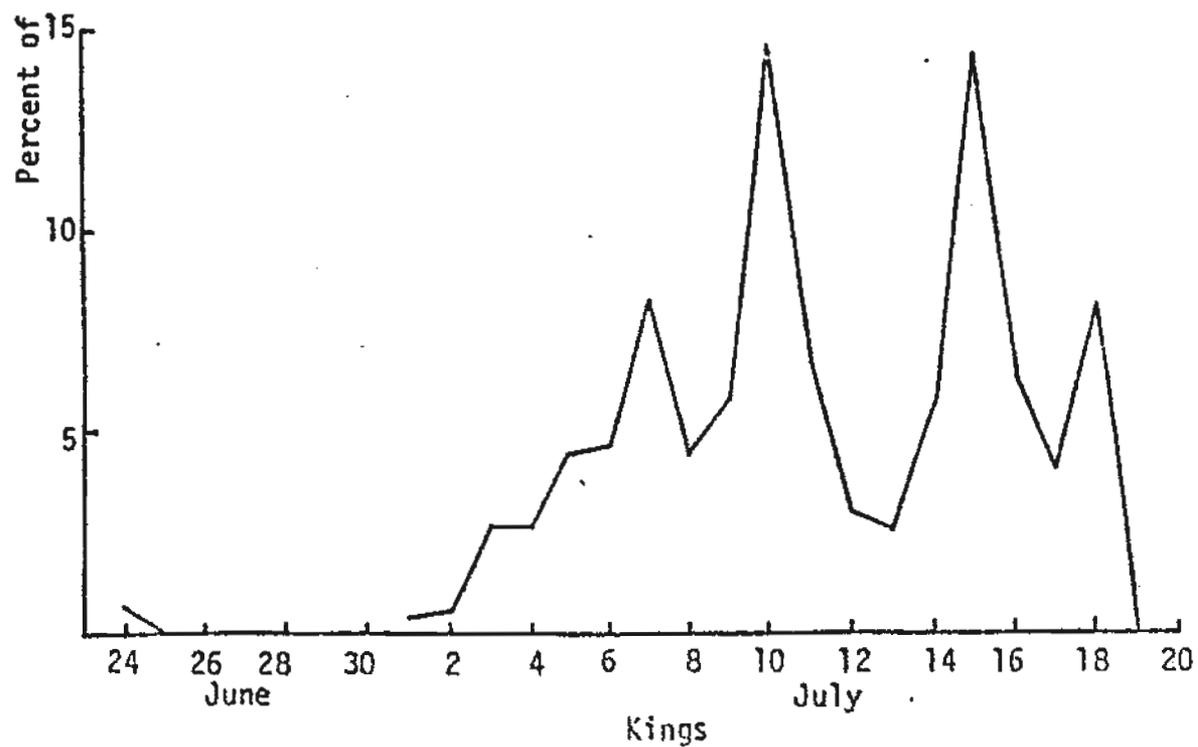
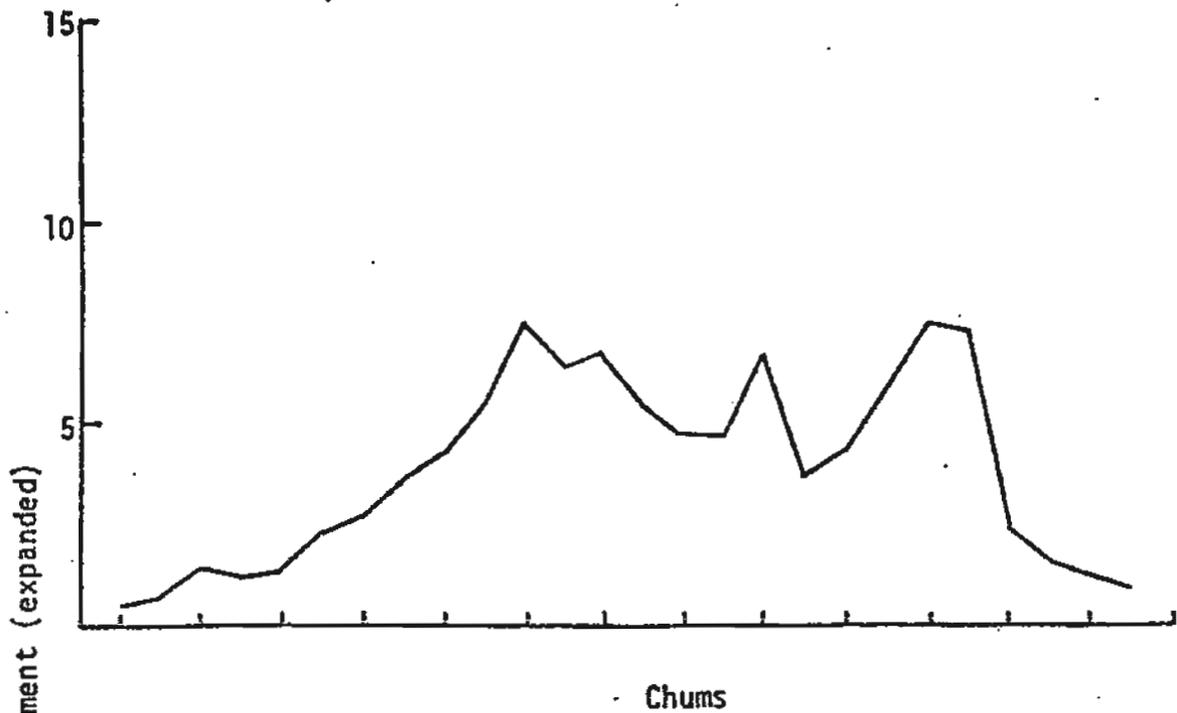
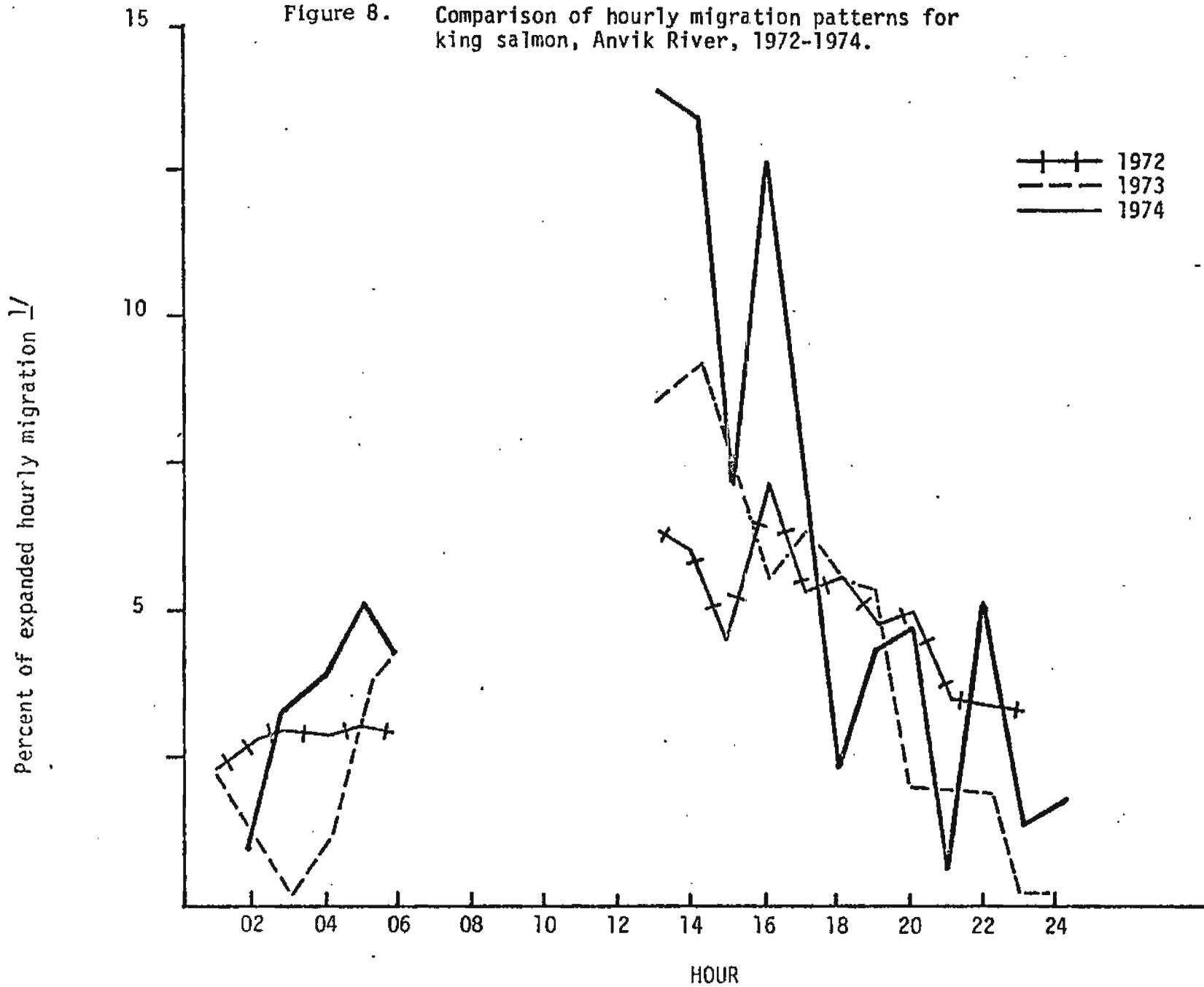
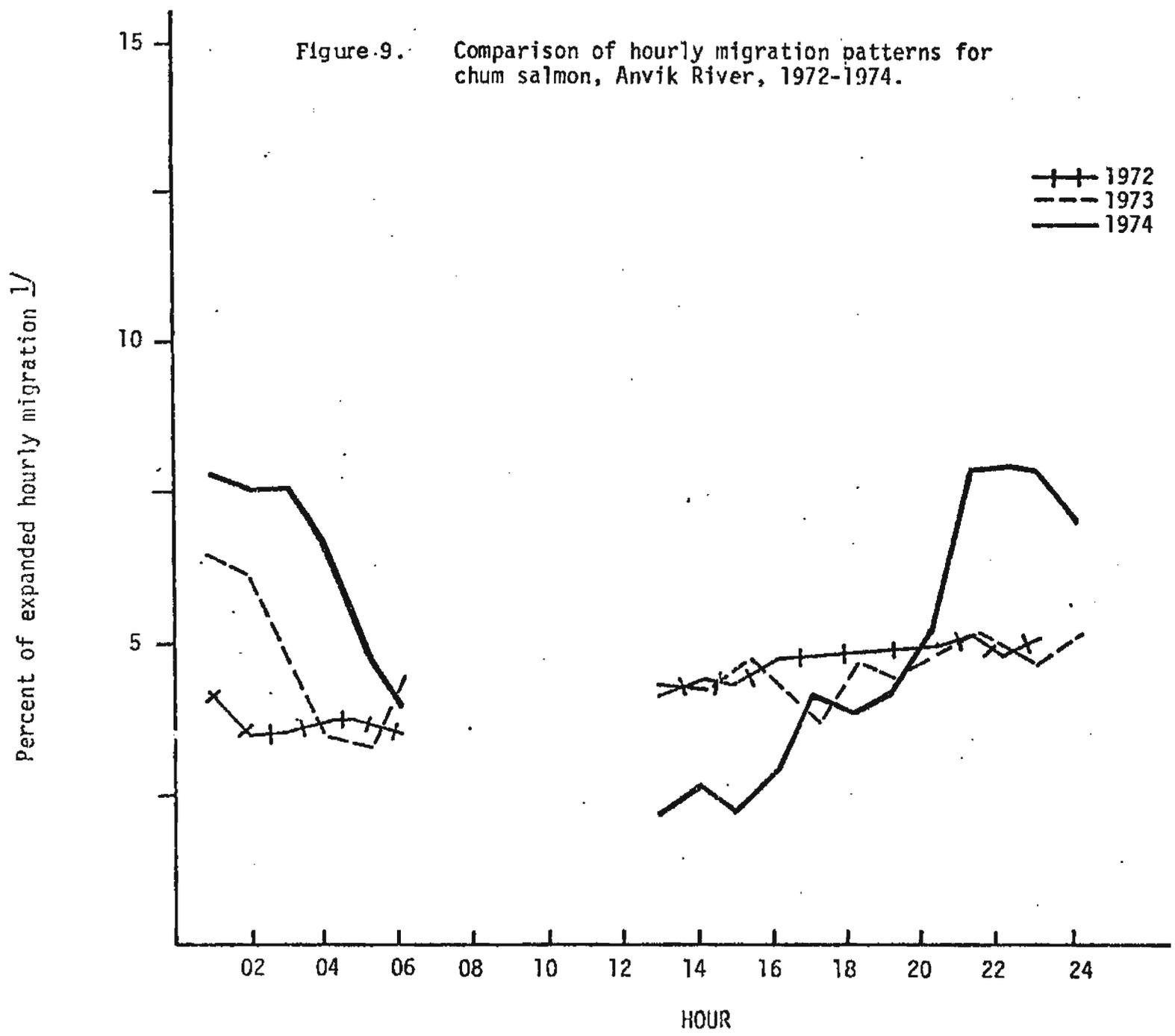


Figure 8. Comparison of hourly migration patterns for king salmon, Anvik River, 1972-1974.



1/ Based on expanded 18 hour percent.

Figure 9. Comparison of hourly migration patterns for chum salmon, Anvik River, 1972-1974.



1/ Based on expanded 18 hour percent.

Table 4. Age, sex and size composition of summer chum salmon, carcass sample, Anvik River, 1974.

	Age Class ^{1/}				Totals
	3 ₁	4 ₁	5 ₁	6 ₁	
Males					
Number	12	197	34	2	245
Percent	3.0	49.0	8.5	.5	61.0
Mean length (mm) ^{2/}	520	590	605	570	585
Females					
Number	24	120	12	1	157
Percent	6.0	29.9	3.0	.1	39.0
Mean length (mm)	515	545	560	580	540
Combined sexes					
Number	36	317	46	3	402
Percent	9.0	78.9	11.5	.6	100.0
Mean length (mm)	515	570	590	575	570

^{1/} Gilbert-Rich Formula - Total years of life at maturity (large type) - year of life at outmigration from freshwater (subscript).

^{2/} All lengths mideye to fork of tail measurement.

Table 5. Comparative sex composition of chum salmon carcass sample by date, Anvik River, 1974.

Date of survey	Males		Females	
	No.	Percent	No.	Percent
July 11	74	27	16	9
July 12	82	30	24	14
July 18	65	24	35	20
July 25	51	19	99	57
Total	272	100	174	100

Table 6. Post-spawning condition of summer chum salmon, Anvik River, 1974.

Sex	Spawmed out	Partially spent	Did not spawn	Total	Average no. of eggs retained per female
Males	165 (61%)	91 (33%)	16 (6%)	272 (100%)	-
Females	140 (81%)	30 (17%)	3 (2%)	173 (100%)	46
Totals	305 (69%)	121 (27%)	19 (4%)	445 (100%)	-

The decision to reduce the daily counting period to 18 hours was partially based on data from other studies which indicate that the hourly chum and king migration pattern did not change significantly from year to year (Hurd, 1970). Based on 24-hour counts made in 1973, it was estimated that 27 percent of the kings and 19 percent of the chums passed the tower site during the time period 0700 to 1300. Limited data available from 1972 indicated that 21 percent of chum and 25 percent of king migration occurred during this time period.

In Figures 8 and 9 hourly migration patterns for the same 18-hour period during 1972, 1973 and 1974 are shown for king and chum salmon respectively. Slight variations between seasonal migration patterns can be noted.

The seasonal chum salmon migration pattern in 1974 was similar to that of 1973 which peaked during July 3-12. The seasonal migration pattern for king salmon could not be adequately determined due to early termination of counts. In 1973 the king salmon migration peaked during July 17-23.

Age composition of both 1973 and 1974 carcass samples were similar and dominated by the 4₁ age class; 77 percent in 1973 and 79 percent in 1974. The 1974 sample was composed of 61 percent males compared to 34 percent males in 1973 (Appendix Table 8). The average size of chum salmon sampled in 1974 was 570 mm and 550 mm in 1973.

The fact that male chum carcasses predominated in the early surveys and the females in the latter surveys may be significant since it indicates that in order to obtain an unbiased sex composition from carcasses, it may be necessary to sample during the entire post-spawning dieoff. It is recommended that this be investigated further in 1975.

Since the project was initiated in 1972, very few king salmon carcasses have been sampled and virtually no data has been obtained on the age, sex, and size composition of the Anvik run. The primary problem has been that Anvik River king salmon carcasses are not available in any numbers until the first week in August. Funding limitations have made it necessary to terminate the project before that date. As this information is important in the scientific management of the commercial fishery, it is recommended that a sampling crew be sent in to sample king salmon carcasses after August 1, in 1975.

Due to the lack of comparative data from a known age and total length sample, no age analysis was made of the estimated size (total length) of king salmon passing the Anvik tower in 1974. In 1974 22.3 percent of the king salmon observed were in the >80 cm size range, compared to 62.6 percent in 1973 (Appendix Table 9). This indicates that the portion of the 1974 run which was observed was composed of smaller, and possibly younger salmon than in 1973.

In 1974, heavy rainfall and rising water levels forced termination of the project on July 19 when it washed out the weir and threatened the counting tower. Since the high water coincided with the peak of chum spawning, it is also possible that it may have had a detrimental effect on spawning success.