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YUKON STATE/FED REPORT #7

YUKON RIVER ANADROMOUS FISH INVESTIGATIONS  
1970-1972

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## TABLE OF CONTENTS

	Page
LIST OF TABLES . . . . .	i
LIST OF FIGURES . . . . .	iii
LIST OF APPENDICES . . . . .	iv
ABSTRACT . . . . .	vi
INTRODUCTION . . . . .	1
TAG AND RECOVERY STUDIES . . . . .	6
King Salmon . . . . .	9
Summer Chum Salmon . . . . .	9
Fall Chum Salmon . . . . .	12
Discussion . . . . .	12
ESCAPEMENT ENUMERATION . . . . .	15
Anvik River . . . . .	16
Salcha River . . . . .	21
Whitehorse Dam Fishway . . . . .	22
Aerial Surveys . . . . .	22
TEST FISHING . . . . .	26
AGE AND SEX . . . . .	26
King Salmon . . . . .	28
Summer Chum Salmon . . . . .	33
CATCH STATISTICS . . . . .	33
RECOMMENDATIONS . . . . .	33

TABLE OF CONTENTS (Cont.)

	Page
SUMMARY . . . . .	38
LITERATURE CITED . . . . .	42
APPENDIX . . . . .	43

LIST OF TABLES

	Page
Table 1. Salmon tag-recovery summary, Yukon River, 1970-1971 . . .	10
Table 2. Distribution and migration rates of tagged king salmon, Yukon River, 1970 . . . . .	11
Table 3. Distribution and migration rates of tagged summer chum salmon, Yukon River, 1970-1971 . . . . .	13
Table 4. Distribution and migration rates of tagged fall chum salmon, Yukon River, 1971 . . . . .	14
Table 5. Summer chum and king salmon enumeration summary, Anvik River tower, 1972 . . . . .	18
Table 6. King salmon abundance and distribution, Salcha River, 1972 . . . . .	24
Table 7. Daily king salmon mortality based on carcass observations, Salcha River, 1972 . . . . .	25
Table 8. Comparative age and sex composition of Yukon River king salmon, commercial catch sample taken with gill nets on the lower river, 1965-1972 . . . . .	29
Table 9. Comparative age and sex composition of Yukon River king salmon, Flat Island test fishing catch samples taken with 5-1/2" and 8-1/2" mesh gill nets, 1970-1972 . . . . .	30
Table 10. Age and sex composition of Yukon River king salmon sampled at Whitehorse, 1970-1972 . . . . .	31
Table 11. Age and sex composition of Yukon River king salmon escapements from carcass sampling, 1972 . . . . .	32
Table 12. Comparative age and sex composition of Yukon River summer chum salmon test fishery catch sample, taken with 5-1/2" mesh gill nets, at Flat Island, 1965-1972 . . .	34
Table 13. Comparative age and sex composition of Yukon River summer chum salmon, Flat Island test fishing catch sample taken with 5-1/2" and 8-1/2" mesh gill nets, 1970, 1972 . . . .	35

LIST OF TABLES (Cont.)

	Page
Table 14. Age and sex composition summary of summer chum salmon sample, Yukon River, 1972 . . . . .	36

LIST OF FIGURES

	Page
Figure 1. Yukon River map . . . . .	2
Figure 2. Lower Yukon River map . . . . .	3
Figure 3. Mid-Yukon River map . . . . .	4
Figure 4. Upper Yukon River map . . . . .	5
Figure 5. Ohogamiut tagging and Kakamiut recovery areas, Yukon River, 1970-1971 . . . . .	7
Figure 6. Fishwheel used to capture salmon, Ohogamiut, Yukon River, 1971 . . . . .	8
Figure 7. Anvik River map -- Swift River to Yellow River . . . . .	17
Figure 8. Daily summer chum and king salmon migration (expanded), Anvik River tower, 1972 . . . . .	19
Figure 9. Hourly summer chum and king migration (expanded), Anvik River tower, 1972 . . . . .	20
Figure 10. King salmon redd locations, Salcha River, 1972 . . . . .	23
Figure 11. Flat Island test fishing area, Yukon River, 1970-1972 . . . . .	27

## LIST OF APPENDICES

	Page
Appendix Table 1. King salmon population estimate data and calculations, Yukon River, 1970 . . . . .	44
Appendix Table 2. Summer chum salmon population estimate data and calculations, Yukon River, 1970 . . . . .	45
Appendix Table 3. Summer chum salmon population estimate data and calculations, Yukon River, June 22-July 23, 1971 . . . . .	46
Appendix Table 4. Summer chum salmon hourly enumeration log, Anvik River tower, 1972 . . . . .	47
Appendix Table 5. King salmon hourly enumeration log, Anvik River tower, 1972 . . . . .	48
Appendix Table 6. Comparative Whitehorse Dam cumulative king salmon counts, 1965-1972 . . . . .	49
Appendix Table 7. Comparative Yukon River drainage king salmon escapement counts, 1959-1972 . . . . .	50
Appendix Table 8. Comparative Yukon River drainage chum salmon escapement estimates, 1958-1972 . . . . .	51
Appendix Table 9. King salmon catch data from 8-1/2 inch mesh set gill nets at Flat Island, Yukon River, 1963-1972 . . . . .	52
Appendix Table 10. Chum salmon catch data from 8-1/2 inch mesh set gill nets at Flat Island, Yukon River, 1967-1972 . . . . .	53
Appendix Table 11. King and summer chum salmon run timing information at three sites, Yukon River, 1970-1972 . . . . .	54
Appendix Table 12. Estimated age and sex composition of the 1970 Yukon River king salmon run (based on a population estimates of 226,740) . . . . .	55
Appendix Table 13. Estimated age and sex composition of the 1970 Yukon River summer chum salmon run (based on a population estimate of 3,629,594) . . . . .	56

LIST OF APPENDICES (Cont.)

	Page
Appendix Table 14. Estimated age and sex composition of the 1971 Yukon River salmon chinook run (based on a population estimate of 1,560,157) . . . . .	57
Appendix Table 15. Commercial salmon catches by species and sub-district, Yukon district, 1960-1972 . . . . .	58
Appendix Table 16. Yukon River consecutive subsistence catch and effort data, 1961-1972 (numbers per fishing family are in parenthesis) . . . . .	59

## ABSTRACT

The Yukon River Anadromous Fish Investigations were initiated to determine: (1) the magnitude and effect of the commercial and subsistence harvest on the various stocks of king and chum salmon; (2) develop estimates or indices of the magnitude and quality of king and chum salmon runs and escapements; and (3) relate collected data to long-term trends in the salmon stocks and evaluate management procedures needed to maintain them at their level of maximum sustained yield.

A summer chum and king salmon tag and recovery project to determine the population size of these two species was conducted in 1970. In 1971 only a summer chum salmon population estimate was made. Calculations based on a simple Peterson estimate, known escapements and commercial and subsistence catches indicated that the total population of the Yukon River was 226,740 king salmon and 3,629,594 summer chum salmon in 1970 and 1,560,157 summer chum salmon in 1971.

King salmon recoveries migrated an average rate of 26.3 miles per day, while summer chums (1970 and 1971) migrated at an average rate of 11.24 miles per day and fall chum salmon recoveries migrated at an average rate of 21.1 miles per day. All of the summer and fall chums and 89 percent of the king salmon were recovered in the Alaskan portion of the Yukon River.

Escapement was monitored at several locations from 1970-1972. In 1972 an estimated 108,342 chum salmon and 1,104 king salmon migrated past the counting tower on the Anvik River. An aerial survey of the entire river on July 22 enumerated 211,633 chum salmon and 418 king salmon. Combining aerial survey counts below the tower with tower counts, the minimum total escapement for the Anvik was 245,857 chum and 1,176 king salmon.

A boat survey was made on the Salcha River in 1972 to obtain information on the escapement by sampling carcasses, located king salmon redds for life history studies and locate a suitable site for a counting tower. An aerial survey was made on the Salcha River in 1972 which indicated a minimum escapement of 1,193 king salmon, 143 of which were spawning below the proposed trans-Alaska pipeline crossing.

Alaska Department of Fish and Game employees have sampled the escapement at the Whitehorse fishway each year since 1970. Aerial surveys have been made on key spawning streams in the Yukon drainage each year.

A test fishing site has been operated at Flat Island to obtain information on species composition and run timing of the Yukon River salmon runs.

Age and sex information was obtained at several locations on the Yukon River drainage to determine the potential productivity of specific brood years and the effects of gear selectivity on escapements. The collection and compilation of commercial catch statistics has provided data which is readily comparable with previous years' catches and provides a valuable tool in the management of the Yukon River fishery. Annual surveys to determine the magnitude of the annual subsistence salmon catch are important in: (1) determining the total salmon catch in the Yukon, and (2) reapportioning the salmon catch as the importance of subsistence fishing declines.

## INTRODUCTION

The Yukon River, the largest river in Alaska, originates in British Columbia within 30 miles of the Gulf of Alaska and flows over 2,300 miles to its mouth on the Bering Sea draining an area of approximately 330,000 square miles (Figure 1). All five species of eastern Pacific salmon are indigenous to the river with chum salmon being the most abundant. King salmon rank second in abundance followed in order by coho, pink and sockeye salmon. The latter two species are found in limited numbers and there is no significant fishery for them. It is believed that the Yukon River is the greatest single king and chum salmon producing system in Alaska.

Figures 2 through 4 are detailed maps of the lower, middle and upper portions of the river. As indicated on these maps, the Alaskan portion of the drainage is divided into four statistical areas for commercial fishery management and regulatory purposes. The major commercial fisheries are found in the lower 150 miles, although limited commercial fishing is widely dispersed over 900 river miles in the upper Yukon and lower Tanana rivers. Tributary streams of the Yukon and Tanana rivers are closed to commercial fishing.

During 1970-1972 the average annual commercial salmon harvest was 416,000 compared to only 174,000 during 1961-1969. Commercial fishing effort in terms of registered fishing vessels has nearly doubled, from 350 in 1961 to 634 in 1972. The majority of the commercial fishermen are Eskimo and Indian residents of the drainage who use small (16-20 foot) outboard powered skiffs to operate gill nets and fishwheels.

Although still important, the subsistence salmon fishery has declined in importance during recent years. During 1970-1972 the average annual salmon harvest was 208,000 compared to 450,000 during 1961-1965.

The Yukon River Anadromous Fish Investigations was initiated in 1967 to determine: (1) the size and effect of commercial and subsistence harvests on the various stocks of king and chum salmon, (2) develop estimates or indices of the magnitudes and quality of king and chum salmon runs and escapements, and (3) relate collected data to long-term trends in the salmon stocks and evaluate management procedures needed to maintain them at their level of maximum yield. The project was funded in part by the Anadromous Fish Act (P.L. 89-304) from July 1970 to June 30, 1972. The report will review all the pertinent data collected during 1970-1972. In some cases comparative data collected prior to the project period are included for reference. Due to personnel and funding limitation the main emphasis of the program was on the main Yukon and a few important tributaries, recognizing that other tributaries

Figure 1. Yukon River map.

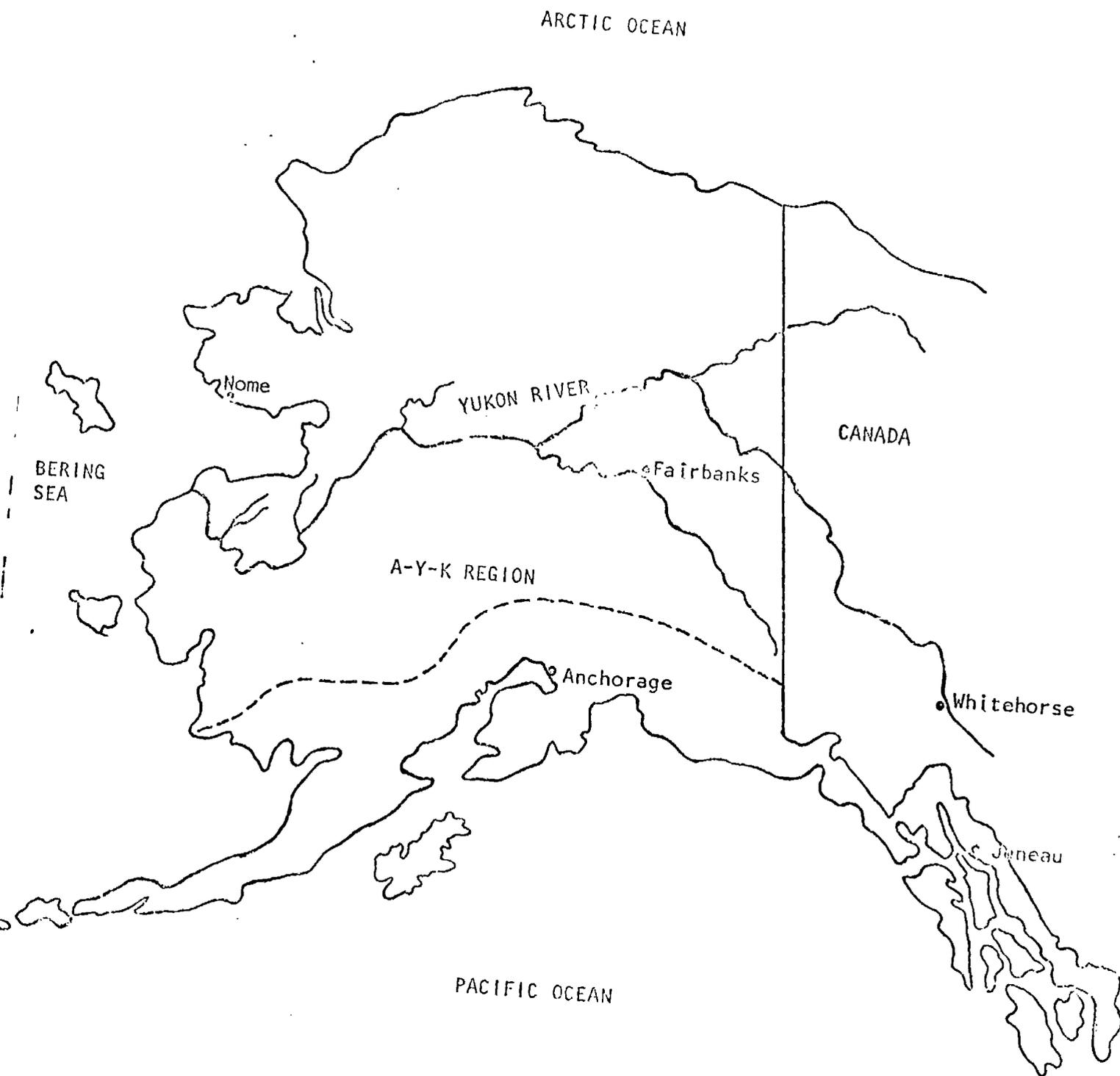


Figure Lower Yukon River map.

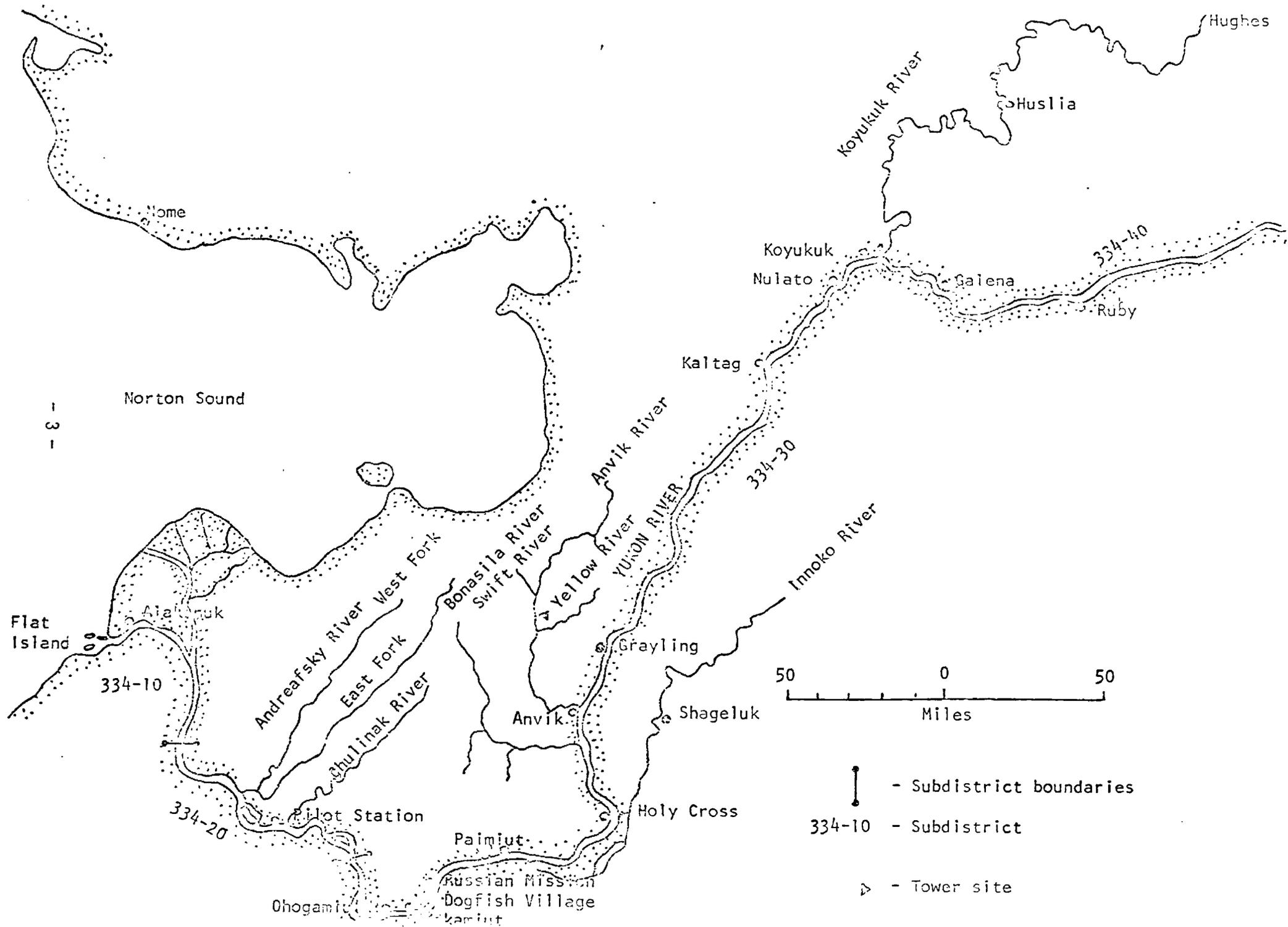


Figure 3. Mid-Yukon River map.

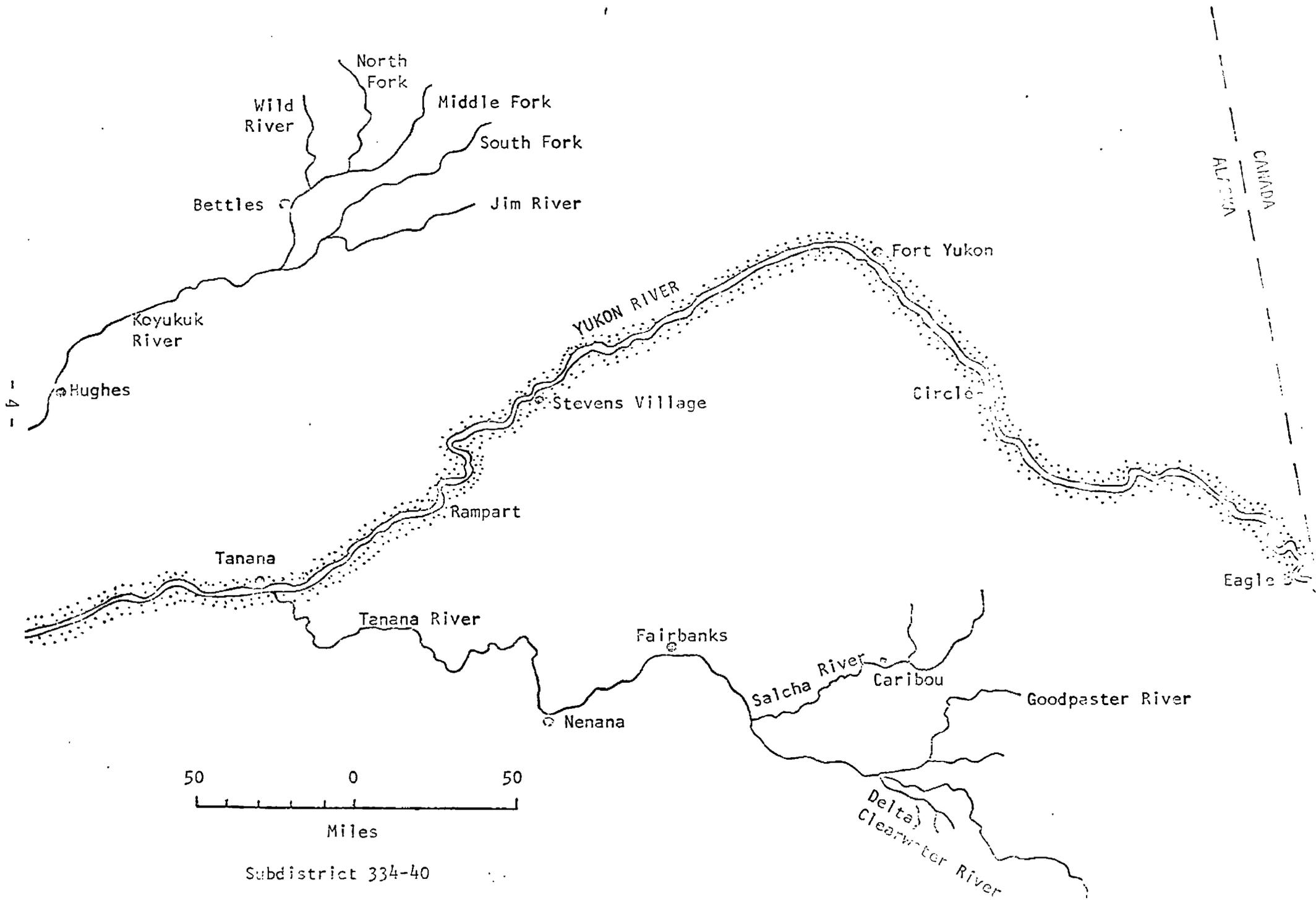
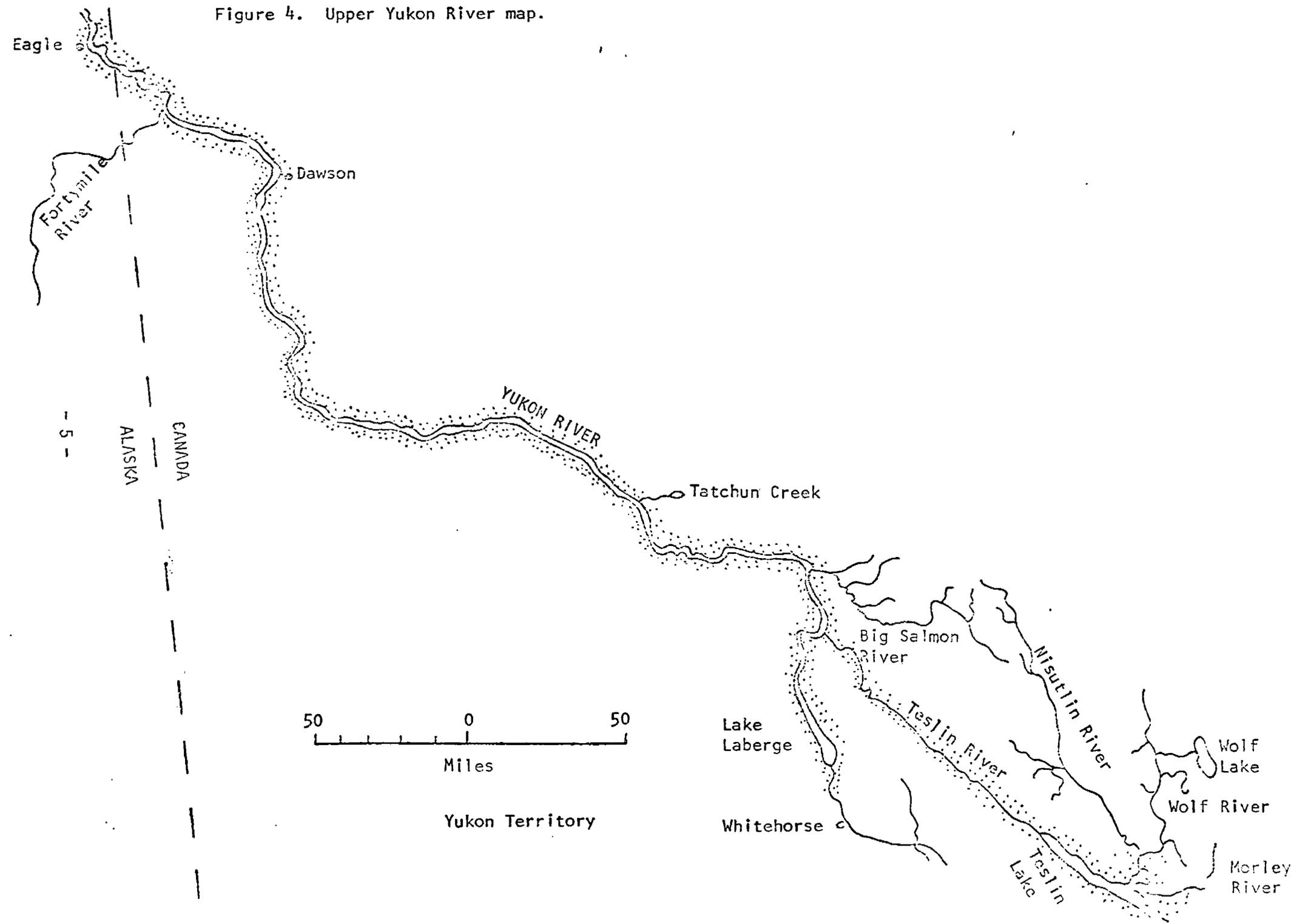


Figure 4. Upper Yukon River map.



also contribute large numbers of king and chum salmon to the fishery.

An extensive subsistence and commercial fishery has been in existence on the Yukon River since the early 1900's. Although heavy demands were made on the resources, little was known about the magnitude of the king and chum salmon runs in the river. Because of recent increases in commercial fishing, one of the most urgent needs was to determine the population levels of these two species to ensure over-fishing and depletion did not occur.

In 1970 it appeared that sufficient numbers of chum and king salmon could be captured with fishwheels and tagged to meet the requirements for a valid Peterson mark and recapture population estimate. A population estimate was made in 1970 for chum and king salmon and in 1971 for chum salmon only. Population estimates were obtained, but were not considered completely valid for a variety of reasons. This project was phased out after the 1971 season.

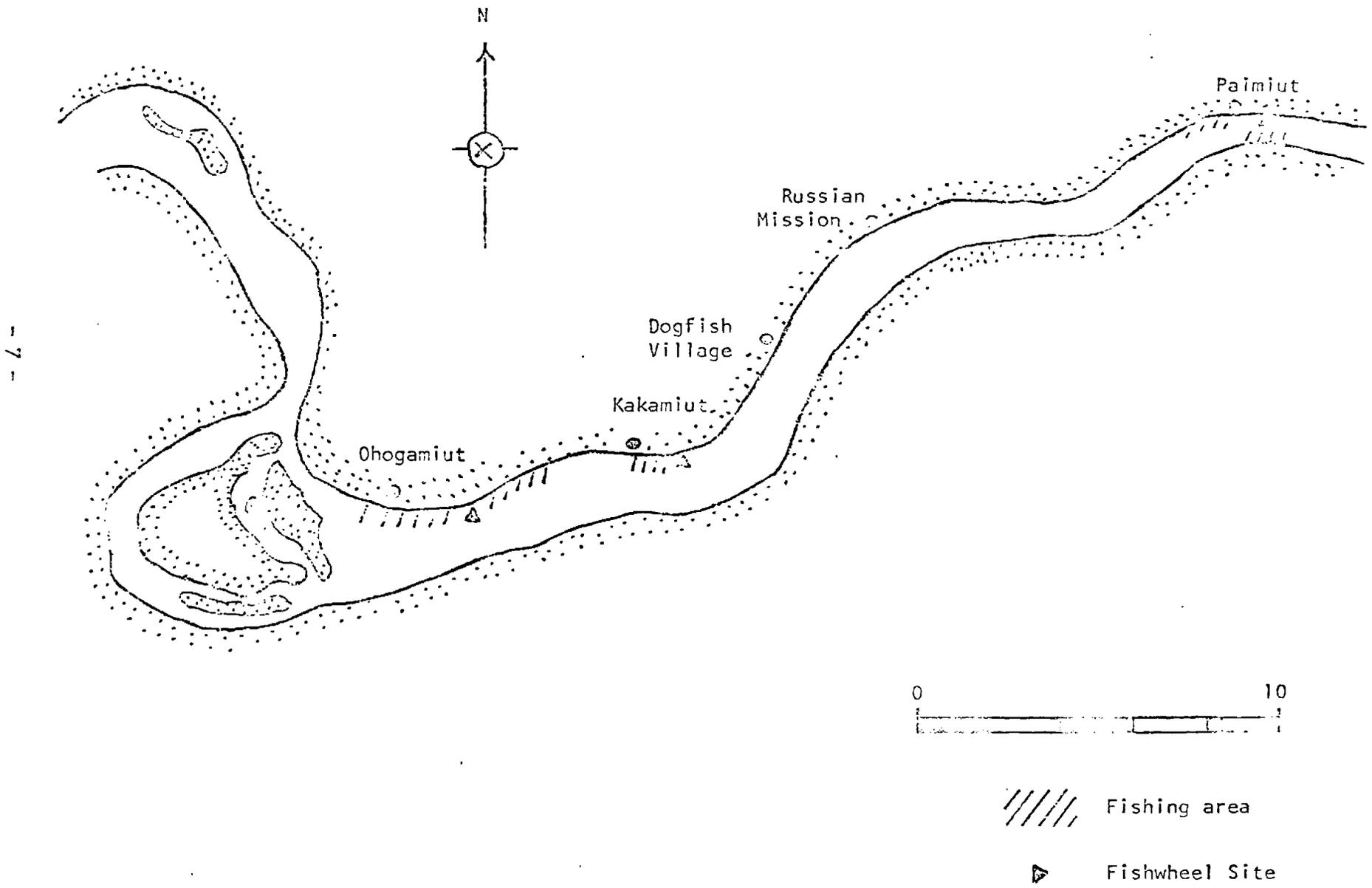
After 1971 program emphasis was shifted to escapement enumeration in several key tributaries to obtain annual comparative escapement indices for management purposes. This has been accomplished by aerial surveys, a counting tower on the Anvik River and a sampling station on the Whitehorse Dam fish ladder. A preliminary survey was made on the Salcha River in 1972 to determine the feasibility of establishing a counting tower station on that stream.

A test fishing site has been operated at Flat Island in the south mouth of the Yukon River since 1965. It has been used to give advance information on the relative size, timing and year class makeup of the salmon runs before entering the main fishery. In conjunction with this, the commercial catch has been sampled each fishing period to obtain the age, sex and size composition of the runs. Catch statistics have been compiled after each fishing period to determine magnitude of the catch and the fishing effort. Carcass surveys have been made in several important tributaries to obtain age, sex and species composition of the salmon escapement. Extensive annual surveys are made to document the subsistence salmon catch and any changes in its importance.

#### TAG AND RECOVERY STUDIES

King and chum salmon in 1970 and chum salmon in 1971 were tagged at Ohogamiut, river mile 185 (Figure 5), for the purpose of obtaining population estimates and information on migration rates and run timing. Salmon were captured with two fishwheels and one 8-1/2 inch mesh set gill net in 1970 and a single fishwheel in 1971 (Figure 6). All salmon were tagged with either Floy anchor or spaghetti tags.

Figure 5. Ohogamiut tagging and Kakamiut recovery areas, Yukon River, 1970-1971.



Recoveries were made at Department recovery sites and from returns by commercial and subsistence fishermen throughout the drainage. A tag reward program was publicized and fishermen were paid 1 dollar for each recovery. Department recovery sites were located at Paimiut, river mile 251, in 1970 and at Kakamiut, river mile 193, in 1971 (Figure 5). Recovery gear at these sites consisted of one fishwheel and up to eight gill nets of 8-1/2 inch mesh in 1970 and a single fishwheel and 5-1/2 inch mesh gill net in 1971.

Table 1 presents a summary of 1970-1971 tagging and recovery data for king, summer chum and fall chum salmon.

King Salmon: Of 340 king salmon tagged and released in 1970, 49, or 14.4 percent, were recovered (Table 1). Since only one recovery was obtained at the Department's recovery site, all catch and recovery information from the area upstream of the tagging site was utilized in the population estimate. There were 19,329 unmarked king salmon taken above Ohogamiut along with 45 marked fish (tag recoveries). A simple Peterson estimate using these data produced a population estimate of 146,041 king salmon passing Ohogamiut. Adding the catch and escapement information recorded in areas below the tagging site resulted in a total population estimate of 226,740 king salmon in 1970 (Appendix Table 1).

Table 2 shows the distribution and migration rates of all king salmon recoveries by recovery location. The farthest upstream recoveries were made at Dawson, 1,319 river miles upstream from the mouth. A single recovery at the mouth of Wild River extended the known range of king salmon in the upper Koyukuk River system. Eighty-nine percent of all recoveries were made in the Alaskan portion of the Yukon River with the remaining 11 percent coming from Yukon Territory. The average time before recapture was 17.1 days and the average migration rate was 26.3 miles per day.

Summer Chum Salmon: In 1970 a total of 3,049 summer chum salmon was tagged during June 16-July 15 and 129 or 4.2 percent were recovered (Table 1). All catches and recoveries made upriver from Ohogamiut were utilized in the 1970 population estimate. An estimated upriver catch of 118,391 unmarked fish was made along with 111 marked fish. A Peterson estimate based on these data produced a population estimate of 3,133,628 summer chums passing Ohogamiut and a total population of 3,629,594 which includes the catches and escapements in areas below Ohogamiut (Appendix Table 2).

In 1971 a total of 6,153 summer chum salmon was tagged and released during June 22-July 23 with 131, or 2.1 percent, being recovered (Table 1). A total of 3,891 unmarked summer chums was captured at the Kakamiut site

Table 1. Salmon tag-recovery summary, Yukon River, 1970-1971.

	King Salmon 1970	Summer Chum Salmon 1970	Fall Chum Salmon 1971	
Fishing Effort (Hrs.)	1,715	1,621	1,243	420
Number Captured	492	9,340	6,383	485
Number Tagged	340	3,049	6,153	485
Number Recovered	49	129	131	17
Percent Recovery	14.4	4.2	2.1	3.5

TABLE 2. Distribution and migration rates of tagged king salmon, Yukon River, 1970.

Area of recovery	Miles from tagging site	Recoveries		Tagging dates (range)	Recovery dates (range)	Mean days out	Mean miles per day
		No.	%				
Below Ohogamiut	-	4	8.2	6/21-7/3	6/25-7/12	5.3	-
Russian Mission	28	4	8.2	6/18-29	6/25-7/5	5.8	4.8
Paimiut	66	1	2.0	7/2	7/6	4.0	16.5
Holy Cross	94	3	6.1	6/18-7/7	6/22-7/16	5.3	17.7
Nulato	299	1	2.0	7/5	7/?	?	?
Galena	345	1	2.0	7/1	7/14	13.0	26.5
Ruby	396	4	8.2	6/18-7/1	6/30-7/13	14.5	27.3
Tanana	510	4	8.2	6/18-30	7/4-25	20.5	24.9
Rampart	578	4	8.2	6/15-24	6/31-7/15	17.3	33.4
Stevens Village	662	4	8.2	6/18-7/10	?	?	?
Nenana (Tanana R.)	675	9	18.4	6/14-29	7/6-25	25.6	26.4
Fort Yukon	817	2	4.1	6/14-22	7/6-19	24.5	33.3
Circle	876	1	2.0	7/1	8/?	?	?
Mouth of Wild River (Koyukuk R.)	831	1	2.0	7/1	8/11	41.0	20.3
Mouth of Forty Mile River, Y.T.	1,084	1	2.0	6/29	8/5	37.0	29.3
Dawson, Y.T.	1,134	<u>5</u>	<u>10.2</u>	6/22-7/1	7/27-8/15	43.6	26.0
<b>TOTAL</b>		49	100.0	6/14-7/10	6/22-8/15	17.1	26.3

along with 23 tag recoveries or "marked" fish. Utilizing these data in a Peterson estimate produced a population estimate of 1,047,000 summer chums passing Chogamit. Addition of the downriver catches and escape-ments produced a total population estimate of 1,560,157 summer chums in 1971 (Appendix Table 3).

Table 3 shows the distribution and migration rates of all summer chum recoveries by recovery location for 1970 and 1971. All recoveries were made in Alaska. The highest percentage of recoveries were made in the Anvik and Granting areas along the main river. The farthest upstream recovery was made at Nenana on the Tanana River, 1,045 river miles upstream from the mouth. The mean migration rate for all recoveries during both years was 11.2 miles per day.

Fall Chum Salmon: In 1971 a total of 485 fall chum salmon was tagged and released during July 27-August 13 with 17, or 3.5 percent, being recovered (Table 1). A population estimate was not made due to the small numbers tagged. All fall chum recoveries were made in Alaska (Table 4). The farthest upstream recovery was made at Rampart, a distance of 948 river miles from the mouth. The mean migration rate for all recoveries was 21.1 miles per day.

Discussion: Although population estimates were made for king and summer chum salmon they are not considered entirely valid. Many inherent problems made it impossible to satisfy Ricker's (1948) assumptions that are fundamental to valid population estimates. In many instances it was difficult to quantify the following factors (and their effect on the population estimates):

1. tag loss
2. unreported tag recoveries
3. accuracy of reported subsistence catch data
4. some segments of the population may not have been sampled, i.e., fish tagged in 1970 and 1971 and recovered in 1971 were captured only along the north bank of the river.

Of the three estimates, only the 1970 summer chum estimate had sufficient numbers of fish tagged and examined for marks to have a 95 percent chance of being within  $\pm .10$  of the actual population size. The 1970 king salmon estimate met the requirements for  $\pm .50$  at the 95 percent level and the 1971 chum salmon estimate, which used the most reliable recovery data, could not meet the requirements for numbers tagged and examined for marks to be within  $\pm .50$  at the 95 percent confidence level (Robson and Regier, 1964).

Table 3. Distribution and migration rates of tagged summer chum salmon, Yukon River, 1970-1971.

Area of Recovery	Miles from tagging site	1970			1971			Both Years		
		Recoveries No.	%	Migration rate (miles/day)	Recoveries No.	%	Migration rate (miles/day)	Recoveries No.	%	Migration rate (miles/day)
Below Ohogamiut	-	18	14.0	-	11	8.4	-	29	11.2	-
Kakamiut <sup>3/</sup>	8	-	-	-	20	15.3	6.7	20	7.7	6.7
Russian Mission	28	14	10.9	5.1	9	6.9	7.0	23	8.8	5.5
Paimiut	66	8	6.2	11.4	8	6.1	22.0	16	6.2	16.7
Holy Cross	94	8	6.2	9.9	1	.8	-	9	3.5	9.9
Anvik	132	21 <sup>1/</sup>	16.3	15.3	30 <sup>1/</sup>	22.9	8.6	51	19.6	11.4
Anvik River <sup>4/</sup>	132	-	-	-	8	6.1	-	8	3.1	-
Shageluk	143	-	-	-	1	.8	14.3	1	.4	14.3
Grayling	151	29 <sup>2/</sup>	22.5	6.6	21	16.0	12.5	50	19.2	9.1
Kaltag	265	8	6.2	25.5	5	3.8	11.0	13	5.0	19.9
Rapids Creek	-	-	-	-	1	.8	8.0	1	.4	8.0
Nulato	299	17	13.2	14.9	13	9.9	12.0	30	11.5	13.6
Bishop Rock	317	-	-	-	2	1.5	-	2	.8	-
Koyukuk	317	4	3.1	21.6	-	-	-	4	1.5	21.6
Tanana	510	1	0.7	24.3	-	-	-	1	.4	24.3
Huslia (Koyukuk R.)	526	1	0.7	25.0	-	-	-	1	.4	25.0
Menana (Tanana R.)	860	-	-	-	1	.8	-	1	.4	-
Totals		129	100.0	12.8	131	100.0	11.1	260	100.0	111.4

1/ Many of the returns were probably recaptured in the Anvik River spawning area.

2/ Of these, 10 returns are known taken in Blueberry Creek, a small tributary stream.

3/ Department recovery site.

4/ Department carcass survey recoveries.

Table 4. Distribution and migration rates of tagged fall chum salmon, Yukon River, 1971.

Area of recovery	Miles from tagging site	Recoveries		Tagging dates	Recovery dates	Mean days out	Mean miles per day
		No.	Percent				
Below Ohogamiut	--	5	29.4	7/30; 8/2; 8/6; 8/6; 8/9	8/3; 8/16; ?; 8/11; 8/21	--	--
Russian Mission	28	1	5.9	8/8	?	?	?
Paimiut	66	1	5.9	8/8	8/?	?	?
Anvik	132	3	17.6	7/28; 8/5; 8/13	8/12; 8/15; 8/21	11	12.0
Grayling	151	2	11.7	7/27; 8/6	7/?; 8/12	?	?
Kaltag	265	1	5.9	8/8	8/26	18	14.7
Nulato	299	1	5.9	8/7	8/25	18	16.6
Bishop Rock (Koyukuk)	320	1	5.9	8/4	8/15	11	24.4
Tanana	695	1	5.9	7/27	8/18	22	31.6
Rampart	763	1	5.9	8/5	9/3	28	27.2
Totals		17	100.0	7/27-8/13	7/?-8/21	18.0	21.1

The type of capture gear used induces other possible biases. As discussed later in this report, large mesh gill nets (9-1/2") selectively harvest the larger sized king salmon (5 and 7 year olds), while fishwheels selectively harvest the smaller sized fish (3, 4 and 5 year olds). Eighty-four and 16 percent of king salmon tagged in 1971 were captured with fishwheels and 8-1/2 inch mesh gill nets respectively. It was not possible to accurately determine the type of gear used to capture king salmon in the upriver fishery. The vast majority of the chum salmon captured at the tagging site and in upriver areas were taken with fishwheels which are not size selective for chum salmon (Lobida, 1970).

Even with the aforementioned problems, these estimates are considered the best approximation of the magnitudes of the king and summer chum runs during the study period. The relative magnitudes of the king and summer chum runs, as indicated by these estimates, have been instrumental in formulating a new fisheries management policy of maximizing summer chums and minimizing king salmon commercial harvesting.

After the 1971 season tagging and recovery studies were discontinued and the emphasis shifted to other aspects because: (1) working population estimates had been made and (2) with the available funds and personnel, it was impossible to eliminate enough of the shortcomings of the project to significantly increase the accuracy of the population estimates.

## ESCAPEMENT ENUMERATION

The Yukon River salmon fishery in recent years has been regulated largely on the basis of obtaining and analyzing comparative commercial and test fishing catch information which indicates the relative sizes of runs as they enter the river and move through the major fishing areas. Monitoring of spawning escapements has not played an important role in formulating in-season management decisions since the data available comes from tributaries too far from the fishery and too late in the season. Obtaining total annual escapement information is not possible under present funding or technology due to the vast size of the drainage and turbid water conditions that prevail along approximately 1,500 miles of the main river and in many tributaries.

Regardless of these limitations, obtaining improved escapement information in several key tributary streams throughout the drainage appears feasible and is essential in evaluating escapement trends in order to formulate long-range management procedures. Several projects were designed and implemented during the study period in order to upgrade this kind of escapement information. These include studies in the Anvik River, Salcha River and in the upper Yukon

River at Whitehorse.

Anvik River: In 1971 a preliminary survey was made of the Anvik River, which is one of the most important king and summer chum salmon spawning streams in the Yukon drainage, to determine the feasibility of establishing a salmon counting tower site. After initially encountering problems with high water, a suitable site was located and a preliminary count was made.

Based on experience gained in 1971, a second tower was constructed on the east bank of the river across from the original tower in 1972 (Figure 7). A 1250 watt generator and a light string were used to illuminate the river bottom during the few hours of darkness each night. A 20-foot weir was erected across from the tower to lead fish closer to the tower.

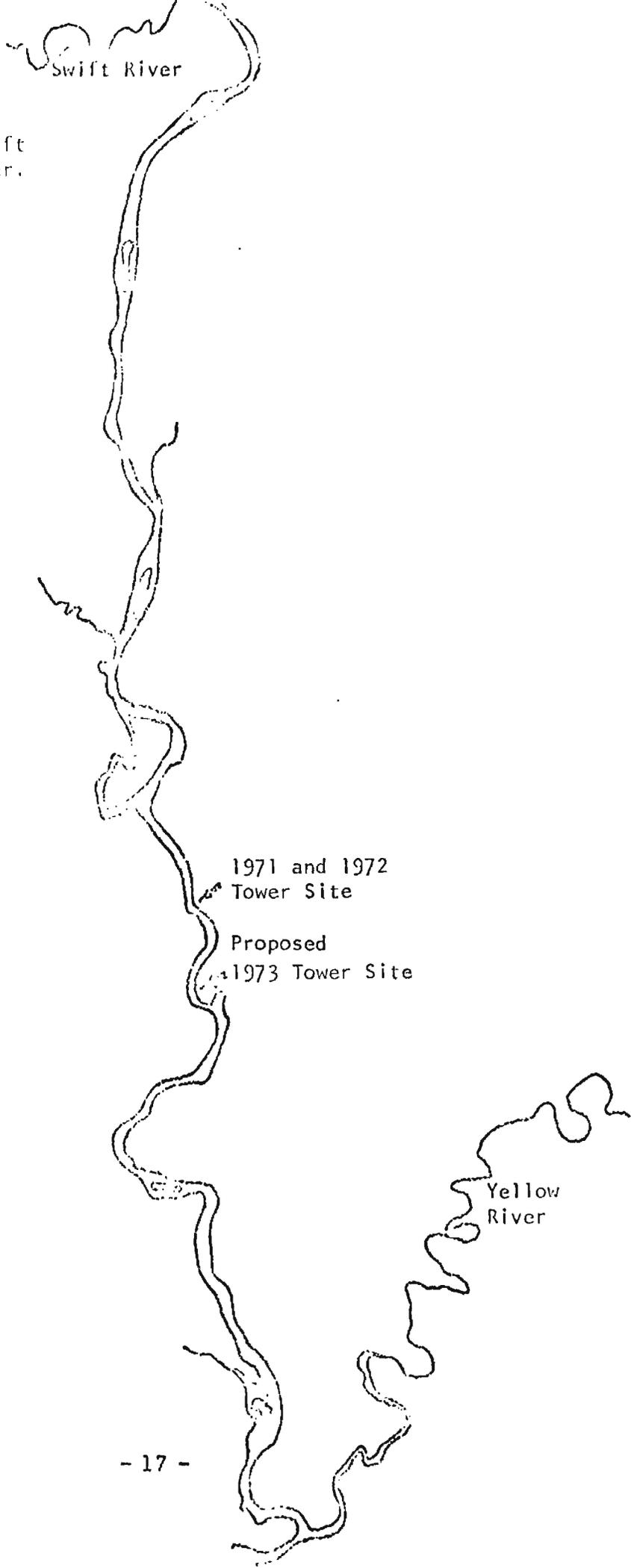
Counting operations began on July 5 and terminated activities on July 31. Sixteen-hour counts were made from 1000 until 0200 hours the following day. Counts were recorded for both hourly totals and the first 10 minutes of each hour.

Lack of adequate personnel prevented complete 16-hour counts from being conducted. Occasional unfavorable weather and water conditions plus faulty generators further reduced daily enumeration periods. Missing counts were estimated by averaging the last complete hourly count with the next complete hourly count.

Over a period of 290 hours during the 27-day counting period a total of 65,202 summer chum salmon and 527 king salmon was enumerated past the tower. Based on this data the expanded total escapements above the tower were calculated to be 108,342 chums and 1,104 kings (Table 5). Estimates made from 10-minute counts for the same hours were within 0.9 percent of the expanded counts for chum salmon and 5.9 percent for king salmon. A summary of hourly counts and estimates are presented for summer chum and king salmon in Appendix Tables 4 and 5 respectively.

The main summer chum salmon migration peak past the tower occurred on July 12, while the king salmon migration peaked on July 16 and 26 (Figure 8). The daily chum run was heaviest from 2100 to 0100 hours with the majority of fish migrating upstream from 2100 to 2300 hours. The king migration was greatest from 1300 to 1800 hours with the peak occurring between 1600 to 1800 hours with the peak occurring between 1600 to 1700 hours (Figure 9).

A proposed tower and weir site was selected for future use a mile downstream from the present site (Figure 7). The river is shallower and narrower at this point and water conditions are better for enumerating salmon.



Swift River

Figure 7. Anvik River map, Swift River to Yellow River.

1971 and 1972  
Tower Site

Proposed  
1973 Tower Site

Yellow  
River

Table 5. Summer chum and king salmon enumeration summary, Anvik River tower, 1972

Date	Summer Chums				Kings				
	Hours counted	Actual Counts		Expanded Counts		Actual Counts		Expanded Counts	
		10 minute	Hourly	Hourly	Cumulative	10 minute	Hourly	Hourly	Cumulative
7/ 5	2	-	310	3,104	3,104	-	-	-	-
6	16	264	1,559	2,351	5,455	1	9	9	9
7	17	761	4,861	6,070	11,525	1	1	1	10
8	15	893	5,036	6,938	18,463	0	2	2	12
9	15	474	2,655	4,335	22,798	1	3	3	15
10	8	733	3,777	7,145	29,943	3	7	15	30
11	16	1,943	11,685	15,893	45,836	1	29	45	75
12	15	1,769	11,036	16,899	62,735	10	46	55	130
13	16	1,109	7,355	10,875	73,610	8	53	69	139
14	16	978	5,933	9,119	82,729	11	71	75	274
15	15	580	3,468	5,199	87,928	12	52	67	341
16	6	163	1,110	4,274	92,202	4	24	97	438
17	16	402	2,163	3,273	95,475	1	21	35	423
18	9	197	1,237	3,348	98,823	1	11	40	513
19	4	40	252	1,725	100,548	0	5	32	545
20	6	90	467	1,659	102,207	3	14	42	537
21	12	150	1,009	2,002	104,209	13	36	54	641
22	9	64	335	1,245	105,454	6	14	24	665
23	6	28	173	725	106,179	4	20	70	735
24	8	50	260	778	106,957	4	19	73	808
25	7	24	124	404	107,361	1	7	59	867
26	2	7	29	249	107,610	0	8	94	961
27	5	7	69	278	107,888	0	11	49	1,010
28	16	28	96	170	108,058	3	22	34	1,044
29	15	4	64	102	108,160	3	17	18	1,062
30	13	6	38	104	108,264	1	15	25	1,037
31	5	6	31	31	108,342	1	10	17	1,104
TOTAL	290	10,770	65,202	108,342		93	527	1,104	

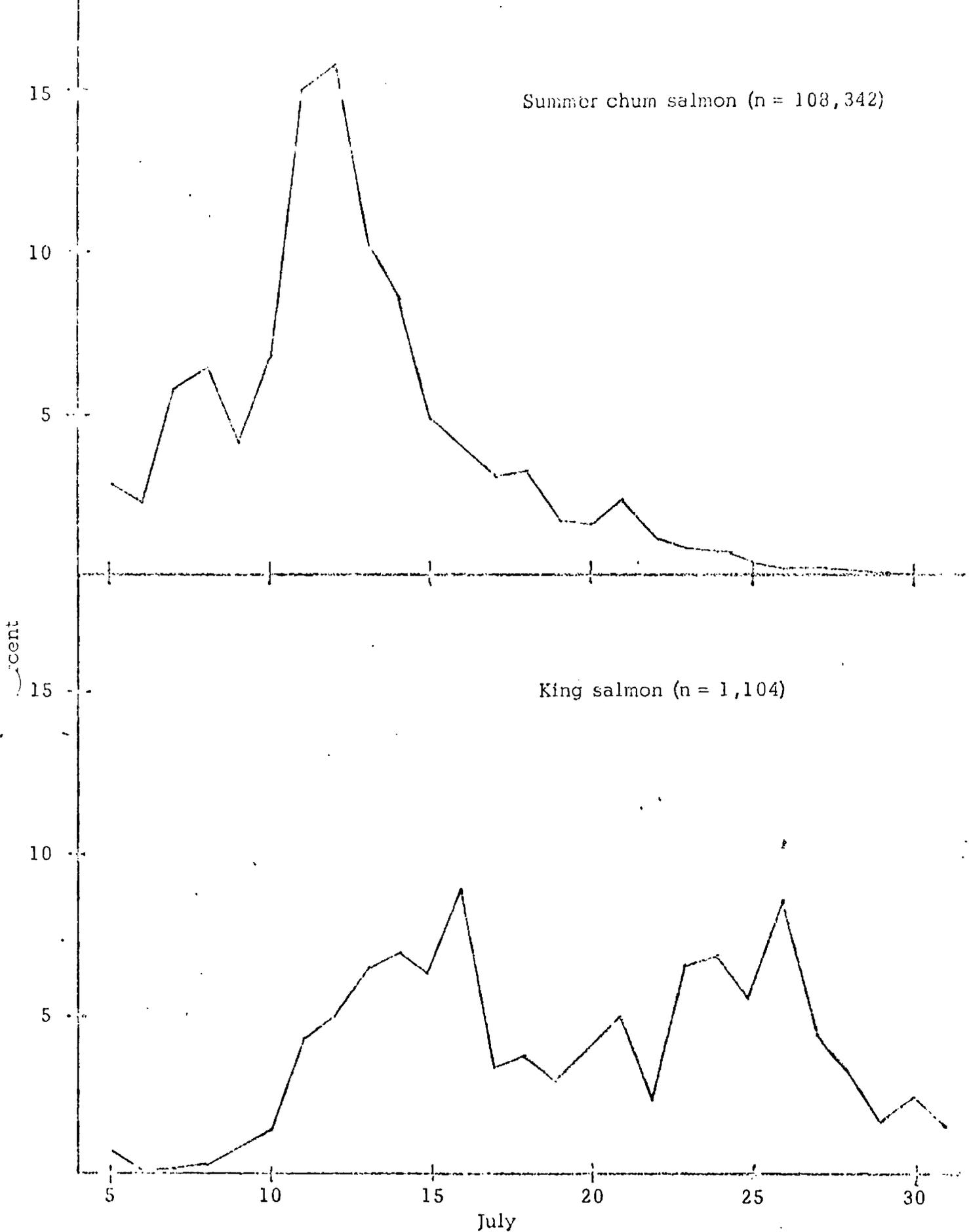


Figure 8. Daily summer chum and king salmon migration (expanded), Anvik River tower, 1972.

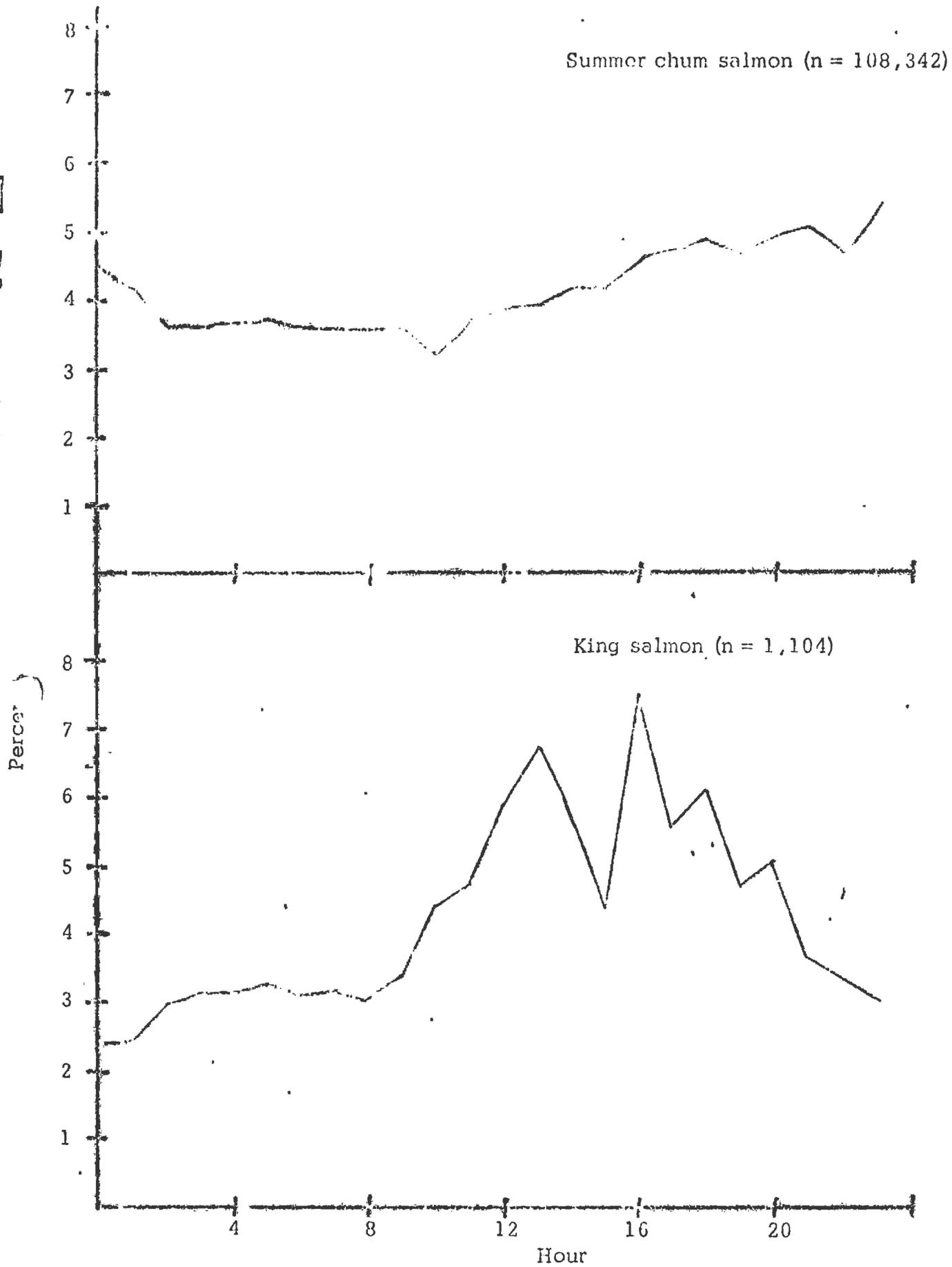


Figure 9. Hourly summer chum and king salmon migration (expanded), Anvik River tower, 1972.

Carcass sampling and enumeration surveys were conducted between July 20 and August 5 by boat and included the area from the mouth of Otter Creek to the river mouth. The objective was to obtain age and sex data of spawned out king and summer chum salmon plus obtain salmon species composition specifically to determine if a significant pink salmon population utilized the lower river for spawning. Age and sex data obtained from carcasses are discussed in a later section of this report.

During August 4-5, a carcass survey was conducted from the tower site to the river mouth. A total of 1 pink, 44,585 summer chum and 46 king carcasses was counted. Observations indicated that king salmon in the lower river were still actively spawning.

An aerial survey of the Anvik River was conducted on July 22 utilizing a float equipped Cessna 180 aircraft. A count of 211,633 summer chum and 418 king salmon was obtained from the headwaters to the river mouth which included 74,118 chums and 346 kings in that portion of the river above the counting tower. The cumulative expanded tower count through that date was 105,454 summer chums and 665 kings with the aerial survey accounting for approximately 70 percent of the chum and 52 percent of the king salmon escapement past the tower.

Based on the aerial survey data obtained below the tower and tower count data, the minimum total estimated escapement into the Anvik River was 245,857 chum and 1,176 king salmon. It was determined that few pink salmon spawned in the Anvik River during 1972.

Salcha River: In 1972 an extensive exploratory survey was conducted on the Salcha River (Figure 3) by a two-man crew in a riverboat. This survey was made from July 12 to August 18 to determine the abundance and distribution of king and summer chum salmon plus select and identify potential counting tower/weir sites. The proposed Prudhoe Bay to Valdez hot oil pipeline is scheduled to cross the lower Salcha River which gives these studies an even higher priority.

The area surveyed extended from the river mouth to the South Fork, a distance of 68 river miles. The shallow nature of the river necessitated the use of a flat bottom 24-foot riverboat powered by two 40-horsepower outboard motors equipped with jet units. All observations of salmon were recorded with spawning areas located and marked on maps. A number of king salmon redds were identified to specific locations by landmarks for possible future incubation studies. A six-foot wooden step ladder was fastened inside the boat and used as a tower to aid in observing salmon.

Throughout the study period all available salmon carcasses were sampled for age and sex data. All sampled carcasses were immediately disposed of into the brush on either side of the river to eliminate data duplication on subsequent sampling surveys.

A suitable tower site and the major king salmon spawning areas were identified (Figure 10). Three king salmon redds were marked and their position accurately mapped for possible future egg and larval development and survival studies. As a rule kings were observed spawning at the heads of riffles in 2-4 feet of water.

Numerous king salmon fry were located throughout the length of the main river upstream to No Grub Creek. Fry were concentrated along the shore, especially in cutback areas, near feeder streams and in slack water eddies.

An aerial survey made on August 3 accounted for 1,193 king salmon, the majority of which were spawning, in the main river from the mouth to the North Fork. A total of 143 or 12 percent of the count was obtained downstream from the proposed pipeline crossing. The greatest numbers of spawners were observed between Redmond and Butte creeks.

A total of 293 king salmon carcasses was enumerated during the boat surveys. Table 6 compares the distribution of live fish, carcasses and redds observed during the study. As expected, carcasses exhibited a downstream shift in abundance compared to live fish and redd distribution.

Carcass survey information also indicated that post spawning mortality is greater for females at an earlier period of time compared to males (Table 7). This differential post spawning mortality is significant when attempting to accurately assess the age, sex and size composition of the escapement through carcass sampling. Carcass age and sex data is presented in a later section of this report.

Whitehorse Dam Fishery: Each year since 1970 the Department of Fish and Game has supplied a fishery technician to sample king salmon at this fishery for age and sex and obtain daily escapement information. This information has been of considerable value in providing an escapement index for the upper Yukon basin (Figure 4). Comparative escapements are shown in Appendix Table 6. Age and sex data is summarized in a later section of this report.

Aerial Surveys: Because of the vast distances involved and the large number of salmon spawning streams present in the Yukon River system, the aerial survey method is used to enumerate escapement in certain key streams which are felt to be indicative of overall escapement in that area of the Yukon basin. During the peak of spawning, when water and light conditions are

Figure 10. King salmon redd locations, Salcha River, 1972.

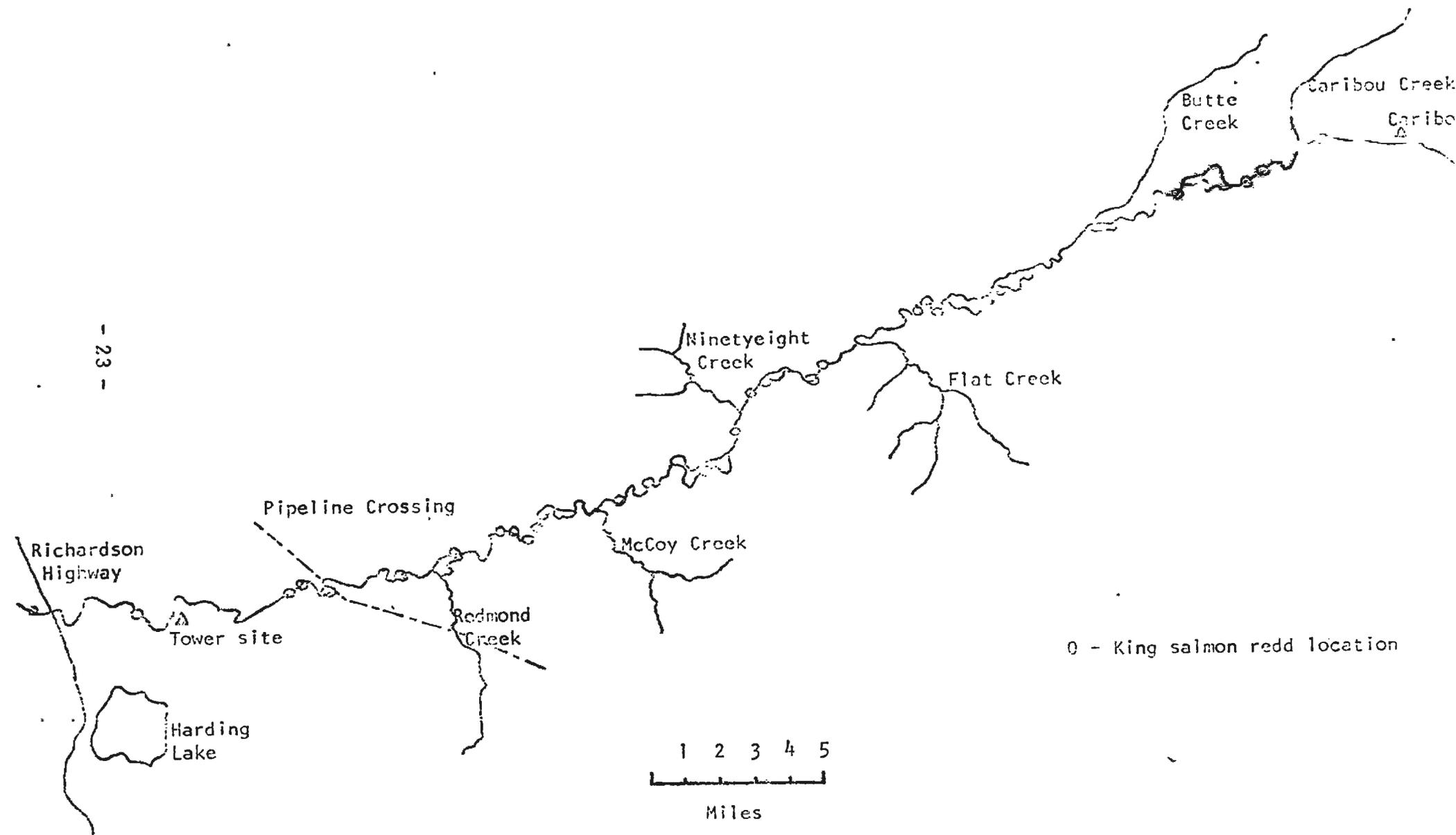


Table 6. King salmon abundance and distribution, Salcha River, 1972.

Area <sup>1/</sup>	Aerial survey (8/3)		Carcass Survey (8/4-18)						Boat Survey (8/4-18)	
	Number	%	Males		Females		Combined		Totals	
			Number	%	Number	%	Number	%	Number	%
100	241	20.2	49	48.5	52	51.5	101	34.5	7	16.3
200	333	27.9	72	47.7	79	52.3	151	51.5	12	27.9
300	60	5.0	5	19.2	21	80.8	26	8.9	7	16.3
400	485	40.7	5	35.7	9	64.3	14	4.8	11	25.6
500	74	6.2	-	-	1	100.0	1	0.3	6	13.9
TOTAL	1,193	100.0	131	44.7	162	55.3	293	100.0	43	100.0

- <sup>1/</sup> 100 - River mouth to mouth of Redmond Creek  
 200 - Mouth of Redmond Creek to mouth of Ninety-eight Creek.  
 300 - Mouth of Ninety-eight Creek to mouth of Flat Creek.  
 400 - Mouth of Flat Creek to mouth of Butte Creek.  
 500 - Mouth of Butte Creek to mouth of North Fork.

Table 7. Daily king salmon mortality based on carcass observations, Salcha River, 1972.

Date	<u>Males</u>		<u>Females</u>		<u>Combined</u>	
	Number	%	Number	%	Number	%
8/ 4	4	1.4	7	2.4	11	3.8
5	2	0.7	15	5.1	17	5.8
6	7	2.4	15	5.1	22	7.5
7	6	2.0	10	3.4	16	5.4
9	4	1.4	8	2.7	12	4.1
10	8	2.7	16	5.5	24	8.2
11	19	6.5	25	8.5	44	15.0
12	21	7.1	9	3.1	30	10.2
13	12	4.1	21	7.2	33	11.3
14	16	5.5	15	5.1	31	10.6
16	21	7.2	14	4.8	35	12.0
17	5	1.7	2	0.7	7	2.4
18	6	2.0	5	1.7	11	3.7
TOTAL	131	44.7	162	55.3	293	100.0

optimum for viewing, these streams are surveyed by Department biologists in single engine aircraft. While not precise, aerial surveys are an important management tool when no other means of assessing escapements are available. Comparative annual aerial survey escapement counts made in index streams for king and summer chum salmon are presented in Appendix Table 7 and 8 respectively.

## TEST FISHING

A test fishing site has been operated since 1963 at Flat Island which is located near the outlet of the south mouth of the Yukon River (Figure 11). Information has been obtained regarding relative abundance, species composition and timing of the Yukon River salmon runs needed for in-season management of the commercial fishery. Two 8-1/2 inch mesh set gill nets and one 5-1/2 inch mesh set gill net, all 25 fathoms in length, were fished 24 hours a day at three different sites during the study period.

Comparative catch figures for 8-1/2 inch gear for 1963-1972 are shown in Appendix Tables 9 and 10. Appendix Table 11 gives comparative run timing information of king and chum salmon at three locations during 1970-1972.

The test fishing catches are affected by environmental factors, (i.e., tides, wind, debris), different fishing methods and other factors not necessarily connected with salmon abundance. However, even with these limitations, test fishing catch data are felt to be the best representation of run timing and magnitude. Commercial catch data is not as desirable for this analysis because of the gaps in the data caused by closed fishing periods.

A serious limitation of the Flat Island program is that the salmon run enters the three major mouths and the proportion using each mouth changes from year to year. The data, therefore, cannot always be used as an index of abundance for the entire system.

## AGE AND SEX COMPOSITION

Age and sex composition information is used to determine returns from specific brood years and effects of gear selectivity on escapement productivity.

For purposes of this report, age  $4\frac{1}{2}$  salmon returning to spawn in 1972 would be the progeny of the 1968 run that migrated from freshwater to the ocean

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

Figure 11. Flat Island test fishing area, Yukon River, 1970-J72.



in the spring of 1970. It has been impossible to determine whether a few king salmon scale samples (usually less than 10 percent) have one or two freshwater annuli. This cannot be resolved until adequate samples of smolt are obtained for age and size examination.

King Salmon: Table 8 presents age and sex composition of commercial catch samples obtained in the lower river since 1965. Age composition may change considerably from year to year due to the differences of survival and return of the various brood year stocks. Age composition also greatly influences sex composition since ages 3-5 are predominately males and ages 6-7 are predominately females. Therefore, an unusually large return and catch of 4 and 5 year olds normally produces a catch sex ratio in favor of males. In addition, it is believed that a preponderance of males exists naturally in most inshore runs due to the earlier age of male maturity which results in less exposure to natural mortality.

Ages in the Yukon king salmon runs have ranged from 3 to 8 years. Because of fishing gear selectivity for different sized fish, the various age and sex classes are not captured in proportion to their real abundance. It has been shown that 8-1/2 inch mesh gill nets are selective to age 6<sub>2</sub> and 7<sub>2</sub> fish while fishwheels are selective to age 3<sub>2</sub>, 4<sub>2</sub> and 5<sub>2</sub> fish (Geiger et al, 1968). Comparative age and sex compositions of test fishing catch samples taken with 5-1/2 and 8-1/2 inch mesh gill nets during 1970-1972 are presented in Table 9.

The age and sex compositions of the resultant spawning escapements are influenced by gear selectivity of the intensive commercial fishery. Age and sex of king salmon sampled at the Whitehorse fishway since 1970 are shown in Table 10. Table 11 presents age and sex composition of carcasses from the Anvik and Salcha River escapements in 1972. The effect of gear selectivity upon the 1970 run is illustrated by the 1.4:1 male to female ratio in the commercial catch compared to the 7:1 ratio in the escapement sample at Whitehorse. The 1970 run was composed of unusually high percentages of 4<sub>2</sub> and 5<sub>2</sub> fish, the majority of which were males, that were not effectively harvested by the large mesh gill nets used by the commercial fishery.

The estimated age and sex composition of the 1970 king salmon run is presented in Appendix Table 12. The Peterson tag and recovery population estimate was used in conjunction with age and sex sampling information from various areas for this analysis.

The optimum sex ratio for spawning king salmon is not known, but a surplus of age 3<sub>2</sub>-5<sub>2</sub> males contributes little to run productivity. A 1:1 sex ratio or even a surplus of females would be best for productivity. The importance of assessing the quality (age and sex composition) as well as the quantity

Table 8. Comparative age and sex composition of Yukon River king salmon, commercial catch sample taken with gill nets on the lower river, 1965-1972.<sup>1/</sup>

Year	Sample Size	Males Percent	Females Percent	3 <sub>2</sub>	4 <sub>2</sub>	Age-Percent			
						5 <sub>2</sub>	6 <sub>2</sub>	7 <sub>2</sub>	8 <sub>2</sub>
1965	534	56.2	43.8	-	1.0	19.0	56.0	23.5	0.5
1966	983	53.5	46.5	-	0.8	13.5	72.3	13.4	-
1967	991	49.2	50.8	-	0.8	10.0	73.4	15.5	0.3
1968	1,335	45.0	55.0	-	2.6	12.8	64.5	20.1	-
1969	1,255	47.3	52.7	-	1.6	17.2	70.4	10.8	-
1970	1,231	58.7	41.3	-	10.0	42.5	42.4	5.1	-
1971	961	52.8	47.2	0.1	0.6	29.1	68.9	1.3	-
1972	723	37.2	62.8	-	0.8	13.0	79.5	6.7	-

<sup>1/</sup> Majority of gear 8 1/2" mesh, but some smaller mesh gear also used.

Table 9. Comparative age and sex composition of Yukon River king salmon, Flat Island test fishing catch sample taken with 5 1/2" and 8 1/2" mesh gill nets, 1970-1972.

Year	Sample Size	Males Percent	Females Percent	5 1/2" Mesh				
				3 <sub>2</sub>	4 <sub>2</sub>	5 <sub>2</sub>	6 <sub>2</sub>	7 <sub>2</sub>
1970	103	87.4	12.6	-	61.2	26.2	10.7	1.9
1971	32	43.7	56.3	-	15.6	25.0	56.3	3.1
1972	18	61.1	38.9	-	5.6	44.4	44.4	5.6
Year	Sample Size	Males Percent	Females Percent	8 1/2" Mesh				
				3 <sub>2</sub>	4 <sub>2</sub>	5 <sub>2</sub>	6 <sub>2</sub>	7 <sub>2</sub>
1970	605	66.4	33.6	0.2	10.0	45.8	40.0	4.0
1971	213	52.6	47.4	-	2.4	28.6	68.5	0.5
1972	532	44.0	56.0	-	1.2	21.2	70.7	6.9

Table 10. Age and sex composition of Yukon River king salmon sampled at Whitehorse, 1970-1972.

Year	Combined Age Classes		Age 3 <sub>2</sub>		Age 4 <sub>2</sub>		Age 5 <sub>2</sub>		Age 6 <sub>2</sub>		Age 7 <sub>2</sub>		
	Sex	No.	%										
1970	Male	86	86.8			29	29.3	46	46.4	9	9.1	2	2.0
	Female	13	13.2					6	6.1	6	6.1	1	1.0
	Total	99	100.0			29	29.3	52	52.5	15	15.2	3	3.0
1971	Male	132	48.7			1	0.4	90	33.2	40	14.7	1	0.4
	Female	139	51.3			-		28	10.3	111	41.0	-	
	Total	271	100.0			1	0.4	118	43.5	151	55.7	1	0.4
1972	Male	24	46.2					7	13.5	15	28.9	2	3.8
	Female	28	53.8					3	5.8	23	44.2	2	3.8
	Total	52	100.0					10	19.3	38	73.1	4	7.6

Table 11. Age and sex composition of Yukon River king salmon escapements from carcass sampling, 1972.

Salcha River											
Date of Samples	Combined Sex	No.	Class %	Age 4 <sub>2</sub>		Age 5 <sub>2</sub>		Age 6 <sub>2</sub>		Age 7 <sub>2</sub>	
				No.	%	No.	%	No.	%	No.	%
8/4-9	Male	23	29.5	3	3.8	4	5.1	14	18.0	2	2.6
	Female	55	70.5	-	-	1	1.3	48	61.5	6	7.7
	Subtotal	78	100.0	3	3.8	5	6.4	62	79.5	8	10.3
8/10-13	Male	60	45.8	15	11.5	10	7.6	33	25.2	2	1.5
	Female	71	54.2	-	-	3	2.3	68	51.9	-	-
	Subtotal	131	100.0	15	11.5	13	9.9	101	77.1	2	1.5
8/14-18	Male	48	57.2	4	4.8	2	2.4	42	50.0	-	-
	Female	36	42.8	-	-	2	2.4	34	40.4	-	-
	Subtotal	84	100.0	4	4.8	4	4.8	76	90.4	-	-
Totals	Male	131	44.7	22	7.5	16	5.5	89	30.3	4	1.4
	Female	162	55.3	-	-	6	2.0	150	51.3	6	2.0
	Total	293	100.0	22	7.5	22	7.5	239	81.6	10	3.4
Anvik River											
7/31-8/5	Male	10	67.0	-	-	8	53.0	2	13.0	-	-
	Female	5	33.0	-	-	-	-	5	33.0	-	-
	Total	15	100.0	-	-	8	53.0	7	46.0	-	-

of spawning escapements is illustrated by comparing the Whitehorse fishway escapements for 1970 and 1972. The 1970 escapement was 625 compared to only 393 in 1972. Sampling indicated that 13 percent or only 83 fish in 1970 were females compared to 53.8 percent or 211 females in 1972. Thus the smaller 1972 escapement had a significantly more reproductive potential than the 1970 escapement.

Decreasing the commercial gill net mesh size by regulation has been recently initiated to reduce the harvest of the more productive females in older age groups and increase the harvest of the younger age groups which are predominately males.

Summer Chum Salmon: Table 12 presents age and sex composition of test fishing samples taken with 5-1/2 inch mesh gill nets since 1965. Age composition may change considerably from year to year, especially between the 4<sub>1</sub> and 5<sub>1</sub> age classes.

Comparative age and sex compositions of test fishing samples taken with 5-1/2 and 8-1/2 inch mesh gill nets during 1970-1972 are shown in Table 13. All 8-1/2 inch mesh samples contained a significantly higher percentage of males. Differences in age class composition between the two gear types were relatively minor with the 8-1/2 inch samples having a greater percentage of 5<sub>1</sub> and a lesser percentage of 4<sub>1</sub> fish. The age and sex composition of fishwheel samples are similar to fish captured with 5-1/2 inch mesh gill nets (Lehida, 1970).

Table 14 presents a summary of all age and sex composition data obtained in 1972. The Anvik River data was the first large sampling of the summer chum escapement. This samples contained a sex ratio slightly in favor of males, but contained higher percentage of 5<sub>1</sub> fish and lower percentage of 4<sub>1</sub> fish compared to the downriver catch samples. These differences in age class composition cannot be explained at this time.

The estimated age and sex composition of the 1970 and 1971 summer chum runs are presented in Appendix Tables 13 and 14 respectively. Peterson tag and recovery population estimates were used in conjunction with age and sex sampling information from various areas in these analyses. Due to a lack of information it was assumed that the age and sex compositions of the escapements were similar to that of the combined catch samples.

## CATCH STATISTICS

Yukon River commercial catch statistics are recorded on fish tickets

) Table 12. Comparative age and sex composition of Yukon River summer chum salmon, test fishery catch sample, taken with 5-1/2" mesh gill nets, at Flat Island, 1965-1972.

Year	No. of sa.	Males percent	Females Percent	Age-Percent			
				3 <sub>1</sub>	4 <sub>1</sub>	5 <sub>1</sub>	6 <sub>1</sub>
1965 <sup>1/</sup>	486	57.6	42.4	0.2	97.3	2.5	-
1966	300	28.0	72.0	3.3	70.3	26.4	-
1967	140	31.4	68.6	1.4	78.6	20.0	-
1968 <sup>2/</sup>	413	59.5	40.5	4.4	43.1	51.8	0.7
1969	528	62.9	37.1	5.5	87.3	7.2	-
1970	396	53.5	46.5	1.2	91.2	7.6	-
1971	279	55.6	44.4	0.7	59.5	39.8	-
1972	456	40.4	59.6	2.4	46.1	51.3	0.2

<sup>1/</sup> Various mesh sizes used--majority of samples from 5-1/2" and 8-1/2" mesh gill nets.

<sup>2/</sup> 5-1/2" and 8-1/2" mesh gill net samples combined.

Table 13. Comparative age and sex composition of Yukon River summer chum salmon, Flat Island test fishing catch sample taken with 5-1/2" and 8-1/2" mesh gill nets, 1970-1972.

Year	Sample Size	Males (%)	Females (%)	5-1/2" Mesh			
				Age-Percent			
				3 <sub>1</sub>	4 <sub>1</sub>	5 <sub>1</sub>	6 <sub>1</sub>
1970	396	53.5	46.5	1.2	91.2	7.6	-
1971	279	55.6	44.4	0.7	59.5	39.8	-
1972	456	40.4	59.6	2.4	46.1	51.3	0.2
				8-1/2" Mesh			
1970	437	72.3	27.7	0.7	86.7	12.6	-
1971	264	71.6	28.4	0.4	57.9	41.3	0.4
1972	556	48.7	51.3	1.5	42.9	55.0	0.6

Table 14. Age and sex composition summary of summer chum salmon samples, Yukon River, 1972.

Location	Gear	Age Group				Total
		3 <sub>1</sub>	4 <sub>1</sub>	5 <sub>1</sub>	6 <sub>1</sub>	
<u>Males</u>						
Flat Island	G.N.--5 1/2"	5 (1.1) <sup>1/</sup>	86 (18.9)	93 (20.4)	- -	184 (40.4)
	G.N.--8 1/2"	6 (1.1)	102 (18.3)	163 (29.3)	1 (0.2)	271 (48.7)
Emmonak-Alakanuk	G.N.--5 1/2"	4 (7.0)	23 (40.4)	2 (3.5)	- -	29 (50.1)
	G.N.--8 1/2"	46 (3.8)	295 (24.3)	263 (21.6)	- -	604 (49.7)
Anvik River	Carcasses	- -	25 (7.8)	138 (43.1)	4 (1.3)	167 (52.1)
TOTAL		61 (2.3)	531 (20.39)	639 (25.3)	5 (1.0)	1,235 (46.2)
Percent total--males		(4.9)	(42.3)	(52.5)	(0.4)	(100.0)
<u>Females</u>						
Flat Island	G.N.--5 1/2"	6 (1.3)	124 (27.2)	141 (30.9)	1 (0.2)	272 (59.6)
	G.N.--8 1/2"	2 (0.4)	137 (24.6)	143 (25.7)	2 (0.4)	285 (51.3)
Emmonak-Alakanuk	G.N.--5 1/2"	4 (7.0)	20 (35.1)	4 (7.0)	- -	28 (49.1)
	G.N.--8 1/2"	46 (3.8)	348 (28.6)	215 (17.7)	2 (0.2)	611 (50.3)
Anvik River	Carcasses	- -	37 (11.6)	115 (35.9)	1 (0.3)	153 (47.8)
TOTAL		58 (2.2)	666 (25.6)	618 (23.7)	6 (0.2)	1,349 (51.8)
Percent total--females		(4.3)	(49.4)	(45.8)	(0.4)	(100.0)
<u>Combined Sexes</u>						
Flat Island	G.N.--5 1/2"	11 (2.4)	210 (46.1)	234 (51.3)	1 (0.2)	456 (100.0)
	G.N.--8 1/2"	8 (1.4)	239 (43.0)	306 (55.0)	3 (0.5)	556 (100.0)
Emmonak-Alakanuk	G.N.--5 1/2"	8 (14.0)	43 (75.4)	6 (10.5)	- -	57 (100.0)
	G.N.--8 1/2"	92 (7.6)	643 (52.9)	478 (39.3)	2 (0.2)	1,215 (100.0)
Anvik River	Carcasses	- -	62 (19.4)	253 (79.1)	5 (1.6)	320 (100.0)
TOTAL		119 (4.6)	1,197 (46.0)	1,277 (49.0)	11 (0.4)	2,604 (100.0)

<sup>1/</sup> Percent

when the fish are purchased from the fishermen. The fish tickets are collected from the processors by Department personnel soon after the end of each fishing period and the total catch, catch-per-unit effort and number of fishermen are compiled and recorded on a master sheet. This data is readily comparable with previous years' catches and allows the Yukon area management biologist at Umanak to make management decisions based on this information. Comparative salmon catches by species and subdistrict are presented in Appendix Table 15.

In addition to commercial fishing, a considerable number of salmon are taken for subsistence use on the Yukon River. Each year the Alaska Department of Fish and Game conducts a survey by boat of the entire river stopping at each village and interviewing the fishermen there to obtain the total number of each species taken and other related data (Appendix Table 16). Subsistence calendars are sent to each family in the spring to record their catch during the summer fishing season. Fishermen who are not interviewed on the surveys are sent catch questionnaires after the fishing season ends.

Subsistence information is valuable because, as the catch of salmon for winter food and dog food becomes less important on the Yukon, it means that more fish are available for the commercial fishery and the catch can be reapportioned as this information becomes available.

## RECOMMENDATIONS

1. Initiate another test fishing site in the middle mouth of the Yukon River.
2. Expand the aerial survey coverage to include all the major tributaries of the Yukon, including the Chandalar, Koyukuk and Porcupine.
3. Move Anvik River counting tower site approximately 1 mile downriver where the river is shallower and narrower to facilitate counting salmon.
4. Initiate at least one salmon enumeration project (counting tower, etc.) on each major system contributing to the Yukon salmon run.
5. Initiate early life history studies for king and chum salmon in the Yukon basin.

## SUMMARY

### Tagging and Recovery Studies

#### King Salmon

1. Of 492 king salmon captured, 340 (69.1 percent) were tagged and released in 1970.
2. Overall tag recovery was 49 (14.4 percent).
3. Approximately 89 percent of all recoveries were made in the Alaskan portion of the Yukon River. The remaining 11 percent were taken in Yukon Territory. One tagged fish was recaptured at the mouth of the Wild River, the first reported for this system. The furthest recovery occurred at Dawson, 1,319 river miles upstream from the mouth of the Yukon.
4. The mean migration rate of recovered fish was 26.3 miles per day.
5. A simple Peterson type population estimate was made using the tag and recovery data. Results indicated an escapement of 127,951 king salmon past the tagging site and a total run estimate of 226,740.

#### Summer Chum Salmon

1. In 1970, 3,049 and in 1971, 6,153 summer chum salmon were tagged and released.
2. In 1970, 129 (4.2 percent) of the tagged fish were recovered from upstream commercial and subsistence catches. In 1971, 131 (2.1 percent) of the tagged fish were recovered at the Kakamiut recovery site.
3. The greatest percentage (62) of recoveries occurred in the Russian Mission to Grayling area in 1970, and in the Anvik area in 1971. The furthest upstream recovery was made at Nenana, 1,045 river miles from the mouth.
4. The mean migration rate for both years was 11.2 miles/day.
5. A simple Peterson estimate using tag and recovery data, plus commercial, subsistence catches and escapement produced a

total population estimate for the Yukon River of 3,629,594 in 1970 and 1,560,157 summer chum salmon in 1971.

#### Fall Chum Salmon

1. A total of 485 fall chum salmon was tagged in 1971. A total of 17 or 3.5 percent was recovered.
2. All fall chum recoveries were made in Alaska. The furthest upstream recovery was made at Rampart, a distance of 948 river miles from the mouth.
3. The mean migration rate for all recoveries was 21.1 miles/day.

#### Escapement Enumeration

##### Anvik River

1. In 1972 an estimated 108,342 chum salmon and 1,104 king salmon migrated past the Anvik River counting tower.
2. The chum salmon migration peaked on July 12 while the king salmon migration peaked on July 16 and 28.
3. An aerial survey of the Anvik on July 22 enumerated 211,633 chum salmon and 418 king salmon from the river's mouth to the headwaters.
4. A new tower site was surveyed for 1973.
5. Combining aerial survey estimates below the counting tower and tower counts for that portion of the river above the tower produced a minimum escapement estimate of 245,857 chum salmon and 1,176 king salmon in the Anvik River.

##### Salcha River

1. A boat survey was made on the Salcha River in 1972 to sample the spawning population of king salmon, locate king salmon redds and find a suitable site for a counting tower.
2. A 1972 aerial survey indicated that 1,193 king salmon were spawning in the Salcha River of which 443 were spawning below the proposed trans-Alaska pipeline crossing.

3. In the Sitka female king salmon die sooner after spawning than males.

#### Whitehorse Dam Fishway

1. Each year since 1970 an Alaska Department of Fish and Game technician has enumerated and sampled the king salmon escapement at the Whitehorse fishway. These data are presented.

#### Air Survey

1. Key spawning streams in the Yukon drainage were surveyed using single engine aircraft in 1970, 1971 and 1972 and these data are presented.

#### Test Fishing

1. Test fishing site data collected since 1963 is presented.
2. Information is presented on species composition and run timing of the Yukon River salmon runs.

#### Age and Sex Composition

1. Samples from the 1970-72 king salmon runs indicate that they were composed of 3<sub>2</sub>-7<sub>2</sub> fish with 5<sub>2</sub> and 6<sub>2</sub> age classes making up the majority of the run. The majority of 4<sub>2</sub> and 5<sub>2</sub> fish are males, while females predominate in the 6<sub>2</sub> and 7<sub>2</sub> age groups.
2. Age composition of the king salmon run varies considerably from year to year due to differential survival of the various year classes.
3. Eight and one-half inch gill nets are selective for the large age 6<sub>2</sub> and 7<sub>2</sub> king salmon, while fishwheels are selective for 3<sub>2</sub>-5<sub>2</sub> king salmon.
4. Gear selectivity for the larger 6<sub>2</sub> female king salmon may have had a detrimental effect on the age and sex composition of the Whitehorse fishway escapement in 1970 which was made up primarily of 4<sub>2</sub> and 5<sub>2</sub> male king salmon.
5. Eight and one-half inch gill nets have a tendency to take a greater

proportion of the larger male chum salmon than the 5-1/2" mesh gill nets, however, there did not seem to be a significant difference in age class composition between 8-1/2" and 5-1/2" gill nets. .

6. The age and sex composition of chum salmon samples taken from fishwheels was similar to the catch from 5-1/2" gill nets.
7. The age and sex composition of the entire 1970 Yukon River king and summer chum salmon runs and the 1971 summer chum salmon run was computed.

#### Catch Statistics

1. The collection and compilation of catch statistics after each fishing period had assisted the area management biologist in managing the Yukon River salmon fishery.
2. Subsistence catch information is gathered each year to (1) determine the total salmon catch in the river, (2) reapportion the catch as subsistence fishing declines.

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APPENDIX

Appendix Table 1.

King salmon population estimate data and calculations, Yukon River, 1970.

	<u>Subsistence and commercial</u>	<u>Subsistence and commercial</u>	<u>Total</u>
334-10	57,680	2,250	59,930
334-20	17,210	2,168	19,378
334-30	3,712	3,781	7,493
334-40	1,666	5,543	7,209
Yukon Territory	<u>2,575</u>	<u>2,052</u>	<u>4,627</u>
TOTAL	82,843	15,794	98,637

Test fishery catches

Ohogamiut = 152

Aerial survey escapement estimates below tagging site<sup>1/</sup>

Andreafsky River = 1,239

Estimated number of kings passed tagging area (6/13-7/14)

Number tagged = 340

Subdistrict 334-30, 334-40 and Yukon Territory subsistence and commercial catches = 19,329

Number of recoveries <sup>2/</sup> = 45

Population estimate =  $\frac{(340)(19,329)}{45} = 146,041$

Estimates of escapement above tagging area

Population estimate 146,041

Upriver catches -19,329

Estimated escapement 126,712

Total estimate of Yukon River king salmon run

Subdistrict 334-10 and 334-20 subsistence and commercial catch 79,308

Test fish catch 152

Andreafsky River Aerial survey escapement estimate 1,239

Population estimate above tagging site 146,041

TOTAL ESTIMATE OF KING SALMON RUN 226,740

<sup>1/</sup> Chulinak River, a small spawning stream located downstream from the tagging site, was not surveyed.

<sup>2/</sup> Does not include 4 tag recoveries made below the tagging site.

Appendix Table 2. Summer chum salmon population estimate data and calculations, Yukon River, 1970.

Subdistrict	Subsistence Catch	Subsistence Catch	Total
334-10	119,747 <sup>1/</sup>	27,940	147,687
334-20	17,536 <sup>2/</sup>	30,261	47,797
334-30	0	72,484 <sup>3/</sup>	72,484
334-40	907	45,000 <sup>3/</sup>	45,907
Yukon Territory	0	0	0
<b>Total</b>	<b>138,190</b>	<b>175,685</b>	<b>313,875</b>

Test Fish Catch

Omooniat = 6,291

Aerial survey escapement estimates below tagging site<sup>4/</sup>

Andreafsky River = 175,800

Estimated number of chum passed tagging area (6/16-7/15)

Number tagged = 3,049

Subdistrict 334-30, 334-40 and Yukon Territory subsistence and commercial catches - 118,391

Number of recoveries<sup>5/</sup> = 111

Population estimate =  $\frac{(3,049)(118,391)}{111} = 3,252,019$

Estimates of escapement above tagging area

Population estimate	3,252,019
Upriver catches	- 118,391
Estimated escapement	<u>3,133,628</u>

Total estimate of Yukon River chum salmon run

Subdistrict 334-10 and 334-20 subsistence and commercial catch	195,484
Test fish catch	6,291
Andreafsky River aerial survey escapement estimate	175,800
Population estimate above tagging site	<u>3,252,019</u>
<b>TOTAL ESTIMATE OF SUMMER CHUM SALMON RUN</b>	<b>3,629,594</b>

- 1/ Include catches through July 18; after this date majority of chums assumed to be fall run.
- 2/ Includes catches through July 3; after this date majority of chums assumed to be fall run.
- 3/ Recorded catch totaled 90,000 of which 50 percent are estimated as summer chums.
- 4/ Chulinak River, a small spawning stream located downstream from the tagging site, was not surveyed.
- 5/ Does not include 18 tag recoveries made below the tagging site.

Appendix Table 3. Summer chum salmon population estimate data and calculations, Yukon River, June 22-July 23, 1971.

<u>Subdistrict</u>	<u>Commercial Catch</u>	<u>Subsistence Catch</u>	<u>Total</u>
334-10	282,045	17,890	299,935
334-20	6,096	28,711	34,807
334-30	50	47,022	47,072
334-40	534	104,948	105,482
Yukon Territory	0	100	100
TOTAL	288,725	198,671	487,396

Test fishing catches

Chogamiut = 230

Aerial survey escapement estimates below tagging site

Andreafsky River = 169,840<sup>1/</sup>  
 Chulinak River = 8,265<sup>1/</sup>  
178,105

Estimated number of chums passed tagging area (6/22-7/27)

Number tagged = 6,153  
 Number unmarked captures (Kakamiut site) = 3,891  
 Number of recoveries (Kakamiut site) = 23<sup>2/</sup>  
 Population estimate =  $\frac{6,153 (3,891 + 23)}{23} = 1,047,080$

Estimate of escapement above tagging area

Population estimate 1,047,080  
 Upriver catches - 152,654  
Estimated escapement 894,426

Total estimate of Yukon River chum salmon run

Lower river catches--334-10, 334-20 334,742  
 Test fish catch 230  
 Andreafsky and Chulinak aerial survey escapement estimate  
 below tagging site 178,105  
 Population estimate above tagging site 1,047,080  
 TOTAL ESTIMATE OF SUMMER CHUM SALMON RUN 1,560,157

1/ Considered a poor survey and represents a minimum figure.

2/ Includes three fish recovered with positive tag loss.



Appendix Table 5. King salmon hourly enumeration log, Anvik River tower, 1972 <sup>1/</sup>.

Hour/ Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Expanded		Actual		
																								Total	%	Total	%		
7/ 6	-	-	-	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	1	5	-	-	-	-	-	9	.8	9	1.7
7	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	.1	1	.2
8	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	2	.2	2	.4
9	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-	-	-	-	-	-	3	.3	3	.6
10	-	-	-	-	-	-	-	-	-	-	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	3	2	-	-	1	1	15	1.4	7	1.3
11	-	-	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	4	1	3	3	2	1	3	2	1	1	3	4	-	1	-	45	4.1	29	5.5
12	-	-	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2	3	7	1	4	5	5	3	7	2	(1)	3	2	2	-	55	5.0	46	8.7
13	1	1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	3	-	4	2	9	4	6	5	6	5	3	1	3	-	-	69	6.3	53	10.1
14	1	-	-	(1)	(1)	(1)	-	(1)	-	(1)	1	3	3	8	7	3	15	5	9	1	12	1	-	2	-	75	6.8	71	13.5
15	-	-	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	3	4	5	7	1	4	5	4	(3)	3	8	3	4	1	-	67	6.1	52	9.9
16	-	-	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	9	6	(5)	(5)	(5)	4	(4)	(4)	5	(3)	(3)	-	97	8.8	24	4.6
17	(3)	(3)	-	-	2	1	2	2	-	1	4	(2)	(2)	2	1	3	(1)	(1)	-	3	(1)	(1)	-	-	-	35	3.2	21	4.0
18	-	-	-	-	-	1	-	-	1	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	5	1	2	1	(1)	(1)	-	40	3.6	11	2.1
19	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1	(2)	(2)	(2)	(2)	(2)	(2)	3	1	(1)	(1)	(1)	(1)	-	32	2.9	5	0.9
20	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	2	(3)	(3)	(3)	4	(2)	1	(1)	2	3	2	(2)	(2)	(2)	-	42	3.8	14	2.7
21	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	3	1	6	2	4	2	3	8	3	3	1	-	-	-	-	-	54	4.9	36	6.8
22	-	-	-	-	-	-	-	-	-	-	1	2	2	2	-	-	4	2	1	(2)	(2)	(2)	(2)	(2)	-	24	2.2	14	2.7
23	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	4	2	2	5	-	7	(4)	(4)	(4)	(4)	(4)	(4)	(4)	-	70	6.3	20	3.8
24	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	1	-	2	2	5	3	4	(2)	(2)	(2)	(2)	(2)	(2)	-	73	6.6	19	3.6
25	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	1	1	1	-	-	1	3	(5)	(5)	(5)	(5)	(5)	(5)	-	59	5.3	7	1.3
26	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	7	1	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	-	94	8.5	8	1.5
27	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	2	(2)	(2)	(2)	(2)	(2)	3	2	2	2	(2)	(2)	-	49	4.4	11	2.1
28	(2)	(2)	(2)	(2)	(2)	(2)	2	1	1	2	1	2	4	5	-	-	1	3	-	-	-	-	-	-	-	34	3.1	22	4.2
29	-	-	-	-	-	-	-	-	-	1	1	-	-	4	-	1	3	4	-	1	-	-	1	(1)	-	18	1.6	17	3.2
30	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1	1	3	8	1	-	-	1	-	-	-	-	-	-	-	25	2.3	15	2.8
31	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	6	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)	-	17	1.5	10	1.9
TOTAL	27	26	32	34	34	36	34	35	33	40	47	52	64	74	63	48	92	61	67	51		40	36	33		1,104	100.0	527	
$\bar{x}$	2.4	2.4	2.9	3.1	3.1	3.3	3.1	3.2	3.0	3.6	4.3	4.7	5.8	6.7	5.7	4.3	7.4	5.5	6.1	4.8	5.0	3.6	3.3	3.0					

<sup>1/</sup> Figures in parenthesis indicate estimates of missing counts made by averaging the last complete hourly count with the next complete hourly count.

<sup>2/</sup> Counts each hour alternated between 1 and 2, to get a total for estimated hourly counts.

Appendix Table 6. Comparative Whitehorse Dam cumulative king salmon escape-  
ment counts, 1965-1972.

	1965	1966	1967 <sup>1/</sup>	1968	1969 <sup>2/</sup>	1970	1971	1972
8/ 1	5	4	38	4				
2	9	10	53	5	8	1		
3	16	24	67	11	16	4		
4	30	40	87	18	28	5		1
5	49	54	106	43	43	6		3
6	58	74	121	70	99	12		9
7	93	97	136	107	118	18	3	20
8	124	120	172	152	149	24	5	24
9	150	139	196	173	181	47	7	31
10	197	188	233	173	187	77	10	33
11	282	214	263	174	210	108	27	47
12	382	248	306	180	239	136	36	61
13	510	304	344	205	260	202	60	105
14	542	357	397	239	273	284	87	139
15	583	388	417	267	297	313	127	184
16	630	427	429	290	316	346	195	233
17	670	478	454	339	322	415	287	269
18	688	500	478	359	324	436	358	293
19	738	518	494	363	324	511	447	300
20	785	532	506	369	324	560	493	316
21	817	536	516	376	328	576	534	347
22	843	548	520	389	328	595	607	355
23	864	554	526	392	328	610	643	369
24	883	557	530	405	328	617	683	382
25	893	560	532	405	331	622	727	386
26	898	562	-	405	334	624	762	386
27	902	-	533	405		625	788	388
28	903	-		405			212	393
29		563		406			835	
30				406			841	
31				406			842	
9/ 1				406			849	
2				407			855	
3							856	
Total	13,544	8,596	8,454	8,754	5,695	7,774	12,176	5,071

<sup>1/</sup> First fish on 7/25.

<sup>2/</sup> First fish on 7/27.

Appendix Table 7. Comparative Yukon River drainage king salmon escapement counts 1959-1972 <sup>1/</sup>.

Year	Andreafsky River (East fork)	Andreafsky River (West fork)	Anvik River	
			Aerial	Tower
1960	1,020	1,220	1,950	
1961	1,003		1,226	
1962	675 <sup>2/</sup>	762 <sup>2/</sup>		
1963				
1964	867	705		
1965		355 <sup>2/</sup>	650 <sup>2/</sup>	
1966	361	303	638	
1967		276 <sup>2/</sup>	336 <sup>2/</sup>	
1968	380	383	297 <sup>2/</sup>	
1969	231 <sup>2/</sup>	274 <sup>2/</sup>	296 <sup>2/</sup>	
1970	665	574 <sup>2/</sup>	368 <sup>2/</sup>	
1971	1,904	1,284		
1972	798	582 <sup>2/</sup>	414	1,104

Year	Salcha River	Nisutlin River (Sidney-100 Mile Cr.)	Whitehorse Dam Fishway
1959			1,054
1960	1,660		660
1961	2,878		1,068
1962	937		1,500
1963			484
1964	450		587
1965	408		903
1966	800		563
1967			533
1968	735	407	407
1969	461 <sup>2/</sup>	105	334
1970	1,882	615	625
1971	159 <sup>2/</sup>	640 <sup>3/</sup>	856
1972	1,193	317	393

<sup>1/</sup> With exception of Whitehorse fishway counts, the data was obtained from aerial surveys which were made only of the main stem of each river listed.

<sup>2/</sup> Incomplete survey or poor survey conditions resulting in a very minimal count.

<sup>3/</sup> Canadian Department of Fisheries survey.

Appendix Table 8. Comparative Yukon River drainage chum salmon escapement estimates, 1958-73.

Year	SUMMER CHUMS					FALL CHUMS		
	Andreafsky River (East fork)	Andreafsky River (West fork)	Anvik River	Chena River	Salcha River	Tanana River	Delta River	Porcupine River
1958			100-200,000					
1959			200,000					
1960	3,830		11,110		670			
1961	8,110				1,152			
1962	18,040	19,530	20,600	402	1,161	862	46 <sup>1/</sup>	
1963				898				
1964		12,810	12-14,000 <sup>1/</sup>		250 <sup>1/</sup>			
1965		14,670 <sup>1/</sup>	100,000		2,375			
1966	25,619	18,145	37,500		2,200			
1967		14,495 <sup>2/</sup>	116,000					
1968	17,600 <sup>2/</sup>	74,600 <sup>2/</sup>	51,580		3,790			
1969	119,000	159,500			425 <sup>1/</sup>			
1970	84,090	91,710 <sup>1/</sup>	232,780		7,879	800	800	
1971	98,095	71,745			306 <sup>1/</sup>			115,000+
1972	41,460	25,573	245,851 <sup>3/</sup>	670	947 <sup>1/</sup>	19,657	3,650	35,326
1973	10,149 <sup>1/</sup>	51,835	71,445 <sup>4/</sup>	79	290			

<sup>1/</sup> Poor survey conditions.

<sup>2/</sup> Includes some pinks.

<sup>3/</sup> Combined tower and aerial survey estimates.

<sup>4/</sup> Tower count for 1/2 river.

Appendix Table 9. King salmon catch data from 8-1/2 inch mesh set gill nets at Flat Island, Yukon River, 1963-1972.

Year	Site #1 (one 25 fathom net)				All gill nets <sup>1/</sup>			
	Fishing <sup>2/</sup> dates	Gill net hours	Catch	Catch per gill net hour	Fishing <sup>2/</sup> dates	Gill net hours	Catch	Catch per gill net hour
1963	6/8-6/26	456.0	637	1.40				
1964	6/18-7/13	132.3	211	1.59				
1965	6/6-7/4	654.9	586	0.89				
1966	6/16-7/4	446.0	441	0.99				
1967	6/3-7/7	817.0	282	0.35	6/3-7/7	1,140.0	367	0.32
1968	6/5-7/6	713.0	521	0.73	6/4-7/6	1,584.0	1,029	0.65
1969	6/4-7/7	792.0	571	0.72	6/2-7/7	1,680.0	1,171	0.70
1970	6/6-7/9	735.5	607	0.83	6/6-7/9	1,539.5	1,038	0.67
1971	6/15-7/13	681.0	640	0.94	6/13-7/15	1,440.0	1,240	0.86
1972	6/11-7/13	755.0	359	0.48	6/11-7/13	1,516.5	621	0.41

<sup>1/</sup> Only the Site #1 net was operated during 1963-66; from 1-3 nets operated in 1967; since 1967 two nets have been operated each season.

<sup>2/</sup> Data includes only those dates between which the first and last fish captured.

Appendix Table 10. Chum salmon catch data from 8-1/2 inch mesh set gill nets at Flat Island, Yukon River, 1967-1972.

Year	Site #1 (one fathom net)				All gill nets 1/			
	Fishing 2/ dates	Gill net hours	Catch	Catch per gill net hour	Fishing 2/ dates	Gill net hours	Catch	Catch per gill net hour
1967	6/12-7/7	601.0	283	0.47	6/12-7/7	902.0	580	0.64
1968	6/9-7/5	481.0	166	0.35	6/8-7/5	1,104.0	484	0.44
1969	6/5-7/7	792.0	726	0.92	6/4-7/7	1,584.0	1,147	0.72
1970	6/8-7/9	687.5	388	0.56	6/8-7/9	1,443.5	1,011	0.70
1971	6/16-7/13	657.0	629	0.96	6/14-7/15	1,438.0	1,188	0.83
1972	6/11-7/13	755.0	362	0.48	6/11-7/14	1,540.5	627	0.41

1/ From 1-3 nets were operated in 1967; since 1967 two nets have been operated each season.

2/ Data includes only those dates between which the first and last fish were captured.

Appendix Table 11. King and summer chum salmon run timing information at three sites, Yukon River, 1970-1972.

	1970			1971			1972		
	Flat Island <sup>1/</sup>	Ohogamiut <sup>2/</sup>	Whitehorse <sup>3/</sup>	Flat Island	Ohogamiut	Whitehorse	Flat Island	Ohogamiut <sup>4/</sup>	Whitehorse
<u>King Salmon</u>									
Earliest reported fish	6/6	6/13	8/2	6/13	6/16	8/17	6/11	6/20	8/4
Date when 50 percent catch (run) obtained	6/19	6/29	8/15	6/27	6/27 7/13	8/19	6/26	6/28	8/15
Peak of abundance	6/12-15 6/23-25	6/23 6/29	8/14 8/19	6/27	6/27 7/3	8/17 8/19	6/19 7/5	6/30 7/4	
<u>Summer Chum Salmon</u>									
Earliest reported fish	6/8	6/16	-	6/14	6/22	<u>5/</u>	6/11	-	-
Date when 50 percent catch (run) obtained	6/26	6/30	-	7/4	7/17	-	6/28	-	-
Peak of abundance	6/24 6/26	6/29-30	-	6/30 7/10	7/16	-	6/23-28 7/5-10	-	-

<sup>1/</sup> Test fishing site located at south mouth (river mile 0), 8 1/2" gear.

<sup>2/</sup> Tagging site located at river mile 185.

<sup>3/</sup> Fishway located at river mile 1745.

<sup>4/</sup> Commercial catch data from subdistrict 3 of Yukon district.

<sup>5/</sup> No data available.

Appendix Table 12. Estimated age and sex composition of the 1970 Yukon River king salmon run (based on population estimate of 226,740).

Sample	Sample Size	Units of Run	Combined Ages		3 <sub>2</sub>		4 <sub>2</sub>		5 <sub>2</sub>		6 <sub>2</sub>		7 <sub>2</sub>		
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Commercial Catches at Alakanuk (8 1/2" gill nets)	1,230	Comm. and subs. catches in sub-districts 334-10 and 334-20	Male	(46,643)	58.7	-	-	(7,946)	10.0	(26,460)	33.3	(10,171)	12.8	(2,066)	2.6
			Female	(32,817)	41.3	-	-	-	-	(7,311)	9.2	(23,520)	29.6	(1,987)	2.5
				(79,460)	100.0	-	-	(7,946)	10.0	(33,771)	42.5	(33,691)	42.4	(4,052)	5.1
Commercial and subsistence catches at Rampart, Tanana and Nenana (5 1/2" gill nets and fishwheels)	224	Comm. and subs. catches in sub-districts 334-30, 334-40 and Yukon Territory.	Male	(18,382)	95.1	(174)	.9	(12,603)	65.2	(4,910)	25.4	(599)	3.1	(77)	.4
			Female	(947)	4.9	-	0	-	-	(348)	1.8	(541)	2.8	(77)	.4
				(19,329)	100.0	(174)	.9	(12,603)	65.2	(5,258)	27.2	(1,140)	5.9	(154)	.8
Salcha River and Whitehorse Fishway escapements	289	Escapement to all areas	Male	(104,792)	81.9	-	-	(48,621)	38.0	(45,679)	35.7	(7,165)	5.6	(3,327)	2.6
			Female	(23,159)	18.1	-	-	-	-	(10,102)	7.9	(11,004)	8.6	(2,047)	1.6
				(127,951)	100.0	-	-	(48,621)	38.0	(55,781)	43.6	(18,169)	14.2	(5,374)	4.2
Totals	1,743	Totals	Male	(169,817)	73.7	(174)	.08	(69,170)	30.5	(77,049)	33.9	(17,935)	7.9	5,470	2.4
			Female	(56,923)	26.3	-	-	-	-	(17,767)	7.8	(35,065)	15.5	4,111	1.8
				(226,740)	100.0	174	.08	(69,170)	30.5	(94,816)	41.7	(53,000)	23.4	(9,581)	4.2

Appendix Table 13. Estimated age and sex composition of the 1970 Yukon River summer chum salmon run (based on a population estimate of 3,629,594).

Sample	Sample Size	Units of Run	Combined Age Class		3 <sub>1</sub>		4 <sub>1</sub>		5 <sub>1</sub>		
			No.	%	No.	%	No.	%	No.	%	
Commercial catches at Alakanuk (8 1/2"-5 1/2") gill nets	421	Comm. and subs. catches 334-10 and 334-20	Male	(109,160)	54.1	(404)	.2	(104,519)	51.8	(4,237)	2.1
			Female	(92,615)	45.9	(2,018)	1.0	(88,579)	43.9	(2,018)	1.0
			Total	(201,775)	100.0	(2,422)	1.2	(193,098)	95.7	(6,255)	3.1
Nenana fishwheel and gill net commercial samples	226	Comm. sample in subdistricts 334-30 and 334-40 and Yukon Territory	Male	(61,800)	52.2	(473)	.4	(58,722)	49.6	(2,605)	2.2
			Female	(56,591)	47.8	(1,539)	1.3	(53,986)	45.6	(1,066)	.9
			Total	(118,391)	100.0	(2,012)	1.7	(112,708)	95.2	(3,671)	3.1
Alakanuk (8 1/2"-5 1/2") gill nets and Nenana commercial samples combined	647	Escapement to all areas	Male	(1,333,883)	53.5	(10,283)	.3	(1,748,168)	51.0	(75,412)	2.2
			Female	(1,593,936)	46.5	(37,706)	1.1	(1,525,379)	44.5	(30,850)	.9
			Total	3,427,819		(47,989)	1.4	(3,273,567)	95.5	(106,262)	3.1
Totals	647		Male	(1,941,833)	53.5	(10,889)	.3	(1,851,093)	51.0	(79,851)	2.2
			Female	(1,687,761)	46.5	(39,926)	1.1	(1,615,169)	44.5	(32,666)	.9
			Total	(3,629,594)	100.0	(50,814)	1.4	(3,466,262)	95.5	(112,517)	3.1

50

Appendix Table 14. Estimated age and sex composition of the 1971 Yukon River summer chum salmon run (based on a population estimate of 1,560,157).

Sample	Sample Size	Units of Run	Combined age classes		3 <sub>1</sub>		4 <sub>1</sub>		5 <sub>1</sub>		
			No.	%	No.	%	No.	%	No.	%	
Commercial catches at Alakanuk (3 1/2" -5 1/2") gill nets	338	Comm. and subs. catches 334-10 and 334-20	Male	(225,101)	67.2	(1,005)	.3	(133,654)	39.9	90,442	27.0
			Female	(109,871)	32.8	-	-	(72,354)	21.6	37,517	11.2
			Total	334,972	100.0	(1,005)	.3	(206,008)	61.5	127,959	38.2
Nenana fishery commercial sample	187	Comm. sample in subdistrict 334-30 and 334-40 and Yukon Territory	Male	(87,052)	55.6	-	-	(41,257)	31.0	12,111	24.6
			Female	(69,516)	44.4	(783)	.5	(42,743)	27.3	(21,000)	16.6
			Total	(156,568)	100.0	(783)	.5	(84,000)	53.3	33,111	41.7
Alakanuk and Nenana commercial samples combined	525	Escapement to all areas	Male	(678,572)	63.5	(2,137)	.2	(353,459)	37.1	(279,578)	26.2
			Female	(390,045)	36.5	(2,137)	.2	(250,056)	23.4	(137,852)	12.9
			Total	(1,068,617)	100.0	(4,274)	.4	(603,515)	60.5	(417,430)	39.7
Alakanuk and Nenana commercial samples combined	525	Totals	Male	(990,700)	63.5	(3,120)	.2	(578,818)	37.1	(403,761)	26.2
			Female	(569,457)	36.5	(3,120)	.2	(353,077)	23.4	(201,260)	12.9
			Total	(1,560,157)	100.0	(6,240)	.4	(943,895)	60.5	(610,021)	39.7

Appendix Table 15. Commercial salmon catches by species and area, 1960-1972

Year	King salmon					Coho salmon				
	334-10	334-20	334-30	334-40	Total	334-10	334-20	334-30	334-40	Total
1960	50,713	15,994	-	884	67,591	-	-	-	-	-
1961	84,463	29,028	4,965	1,804	120,260	2,855	-	-	-	2,855
1962	67,099	22,224	4,687	724	94,734	22,926	-	-	-	22,926
1963	85,004	24,211	6,976	803	116,994	5,572	-	-	-	5,572
1964	67,555	20,246	4,705	1,081	93,587	2,446	-	-	-	2,446
1965	89,268	23,763	3,204	1,863	118,098	350	-	-	-	350
1966	70,783	16,927	3,612	1,988	93,315	19,254	-	-	-	19,254
1967	104,350	20,289	3,618	1,449	129,706	9,925	-	1,122	-	11,047
1968	79,465	21,392	4,543	1,126	106,526	13,153	-	150	-	13,303
1969	70,862	14,799	3,577	985	90,223	14,041	-	845	95	14,981
1970	57,681	17,210	3,712	1,666	80,269	12,245	-	-	-	12,245
1971	65,042	19,226	3,490	1,749	110,507	12,165	-	-	38	12,203
1972	70,052	17,955	3,841	1,092	92,940	21,705	506	-	22	22,233

Year	Chum salmon					Total salmon				
	334-10	334-20	334-30	334-40	Total	334-10	334-20	334-30	334-40	Total
1960	-	-	-	-	-	50,713	15,994	-	884	67,591
1961	42,577 <sup>1/</sup>	-	-	-	42,577 <sup>1/</sup>	129,895	29,028	4,965	1,804	165,692
1962	53,160 <sup>1/</sup>	-	-	-	53,160 <sup>1/</sup>	143,185	22,224	4,687	724	170,820
1963	-	-	-	-	-	90,576	24,211	6,976	803	122,566
1964	8,347	-	-	-	8,347	78,348	20,246	4,705	1,081	104,380
1965	22,936	-	-	381	23,317	112,554	23,763	3,204	2,244	141,765
1966	69,236	-	1,209	-	71,045	159,873	16,927	4,821	1,988	183,614
1967	46,148	1,425	1,880	-	49,453	160,423	21,714	6,620	1,449	190,206
1968	62,852 <sup>1/</sup>	1,407	3,136	-	67,395	155,470	22,799	7,829	1,126	187,224
1969	184,411	5,024	1,722	703	191,860	269,314	19,823	6,144	1,783	297,064
1970	320,138	22,394	3,285	907	346,724	390,064	39,604	6,997	2,573	439,238
1971	282,461	6,112	50	1,061	289,684	380,668	25,338	3,540	2,843	412,394
1972	250,945	33,805	1,840	1,254	287,844	342,702	52,166	5,681	2,368	402,917

<sup>1/</sup> includes small numbers of pink or red salmon

Appendix Table 16. Yukon River comparative subsistence catch and effort data, 1961-1972 (numbers per fishing family are in parenthesis)

Year	Total catch		Equivalent catch <sup>1/</sup>		Mean equivalent catch per family <sup>1/</sup>	
	King salmon	Other salmon <sup>2/</sup>	King salmon	Other salmon <sup>2/</sup>	King salmon	Other salmon <sup>2/</sup>
1961	23,719	407,814	23,719	405,632	38	659
1962	19,910	353,441	13,010	329,144	23	577
1963	32,656	421,625	26,141	372,578	44	625
1964	22,817	485,630	19,480	460,712	32	703
1965	19,723	438,379	16,950	436,306	31	696
1966	14,817	214,236	11,507	204,913	23	416
1967	19,661	288,595	16,306	256,926	35	545
1968 <sup>3/</sup>	14,832	189,607	11,883	170,522	25	319
1969	14,946	213,725	13,916	195,476	30	426
1970	15,926	223,237	13,474	199,163	34	493
1971	24,755	200,568	21,670	171,247	51	399
1972	19,541	140,102	17,079	119,335	43	299

Year	Fishing families surveyed <sup>1/</sup>	People in fishing families <sup>1/</sup>	Snow machines <sup>1/</sup>	Sled dogs <sup>1/</sup>	Gear employed <sup>1/</sup>	
					Gill nets	Plein rods
1961	624	3,626(5.8)		4,806(7.7)	577	169
1962	564	3,279(5.8)		3,848(6.8)	613	133
1963	597	3,460(6.9)		4,155(7.0)	716	156
1964	602	3,524(6.0)		4,003(6.6)	840	153
1965	541	3,453(7.3)		3,974(7.3)	647	127
1966	494	3,144(6.4)		3,112(6.3)	578	116
1967	471	2,756(5.9)	192(0.4)	2,752(5.8)	530	87
1968	476	3,109(6.5)	262(0.6)	2,719(5.7)	565	71
1969	459	2,974(6.3)	349(0.8)	2,442(5.3)	594	63
1970	409	2,679(6.7)	346(0.9)	2,214(5.5)	647	55
1971	429	2,795(6.5)	414(1.0)	1,894(4.4)	683	56
1972	401	2,503(6.3)	423(1.1)	1,375(3.4)	698	57

<sup>1/</sup> Data from villages surveyed each year since 1961: mouth to Fort Yukon and Tanana River (does not include Fairbanks area)

<sup>2/</sup> Mostly chin salmon, some pinks and cohos.

<sup>3/</sup> Total king and other salmon catches have been corrected.