

YUKON RIVER SALMON TAGGING STUDIES
1970-1972

(From Yukon River Anadromous Fish Investigations)
Completion Report for July 1, 1970 to June 30, 1972

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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 225,740 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 Selcha 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 Selcha 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.

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.

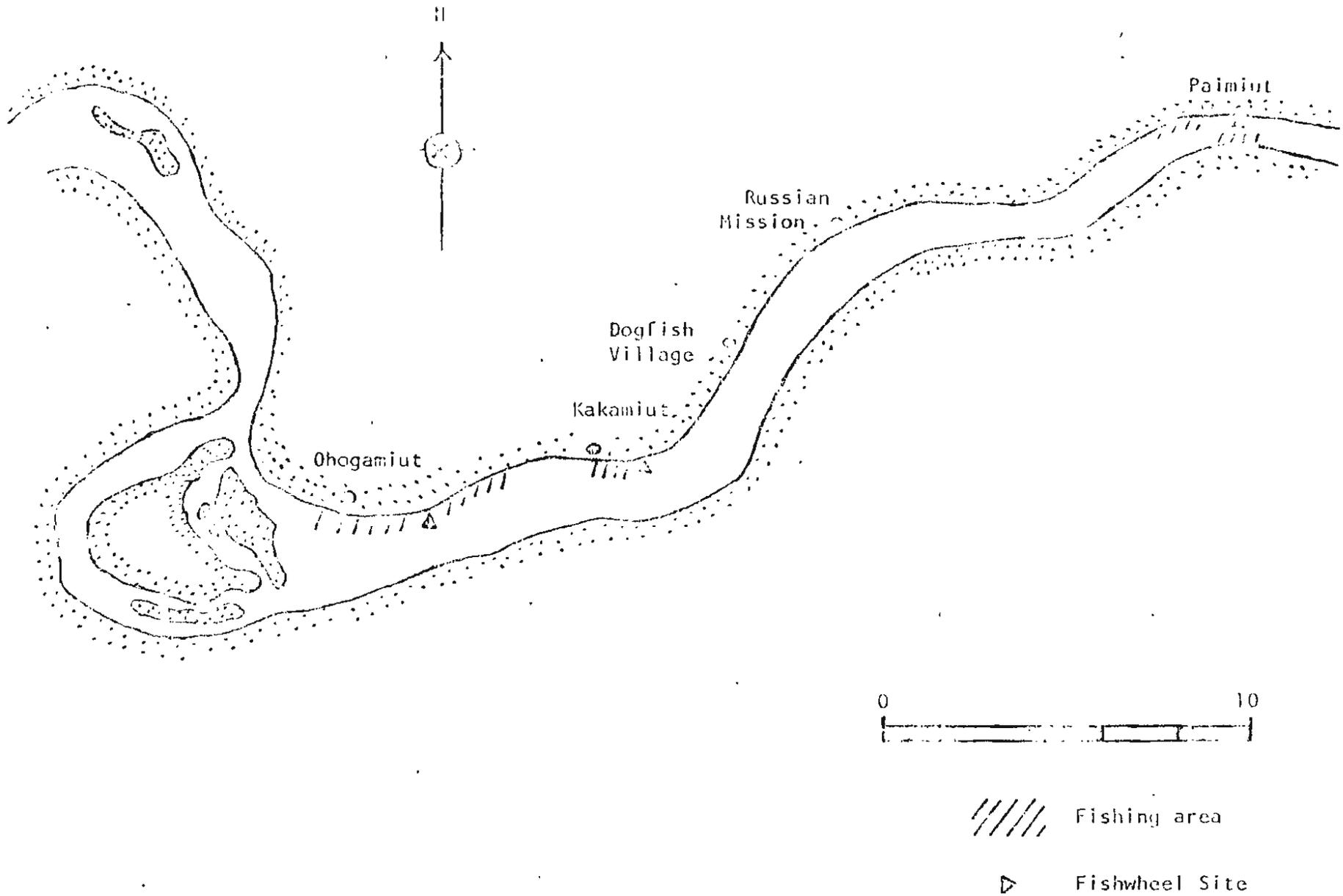


TABLE 2. Distribution and migration rates of tagged king salmon, Yukon River, 1970.

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
Palmiut	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
Julato	299	1	2.0	7/5	7/?	?	?
Salena	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	?	?	?
Tanana (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	5	10.2	6/22-7/1	7/27-8/15	43.6	26.0
TOTAL		49	100.0	6/14-7/10	6/22-8/15	17.1	26.3

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 3,133,623 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	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

along with 23 tag recoveries or "marked" fish. Utilizing these data in a Peters method to produce a population estimate of 1,047,000 summer chum passing Unogavut. Addition of the downriver catches and escapements produced a total population estimate of 1,560,157 summer chum in 1971 (Appendix Table 3).

Table 2 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 Crayling 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.

Date 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)
Lower Ohogamiut	-	18	14.0	-	11	8.4	-	29	11.2	-
Ohogamiut ^{3/}	8	-	-	-	20	15.3	6.7	20	7.7	6.7
St. Ignace Mission	28	14	10.9	5.1	9	6.9	7.0	23	8.8	5.8
Ohogamiut	66	8	6.2	11.4	8	6.1	22.0	16	6.2	16.7
St. Ignace Cross	94	8	6.2	9.9	1	.8	-	9	3.5	9.9
Ohogamiut	132	21 ^{1/}	16.3	15.3	30 ^{1/}	22.9	8.6	51	19.6	11.4
Ohogamiut River ^{4/}	132	-	-	-	8	6.1	-	8	3.1	-
St. Ignace	143	-	-	-	1	.8	14.3	1	.4	14.3
St. Ignace	151	29 ^{2/}	22.5	6.6	21	16.0	12.5	50	19.2	9.1
St. Ignace	265	8	6.2	25.5	5	3.8	11.0	13	5.0	19.9
St. Ignace	-	-	-	-	1	.8	8.0	1	.4	8.0
St. Ignace	299	17	13.2	14.9	13	9.9	12.0	30	11.5	13.6
St. Ignace	317	-	-	-	2	1.5	-	2	.8	-
St. Ignace	317	4	3.1	21.6	-	-	-	4	1.5	21.6
St. Ignace	510	1	0.7	24.3	-	-	-	1	.4	24.3
St. Ignace (Koyukuk R.)	526	1	0.7	25.0	-	-	-	1	.4	25.0
St. Ignace (Tanana R.)	860	-	-	-	1	.8	-	1	.4	-
Totals		129	100.0	12.8	131	100.0	11.1	260	100.0	11.4

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

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	?	?	?
Palmiut	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	8/6	9/3	28	27.2
Totals		17	100.0	7/27-8/13	7/?-8/21	18.0	21.1

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The type of capture gear used induces other possible biases. As discussed later in this report, large mesh gill nets (0-1/2") selectively harvest the larger sized king salmon (6 and 7 year olds), while fishweels 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 fishweels and 3-1/2 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 fishweels which are not size selective for chum salmon (Lisjida, 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.

Fig King salmon daily catches at Flat Island Ohogamiut, Yukon River, 1969.

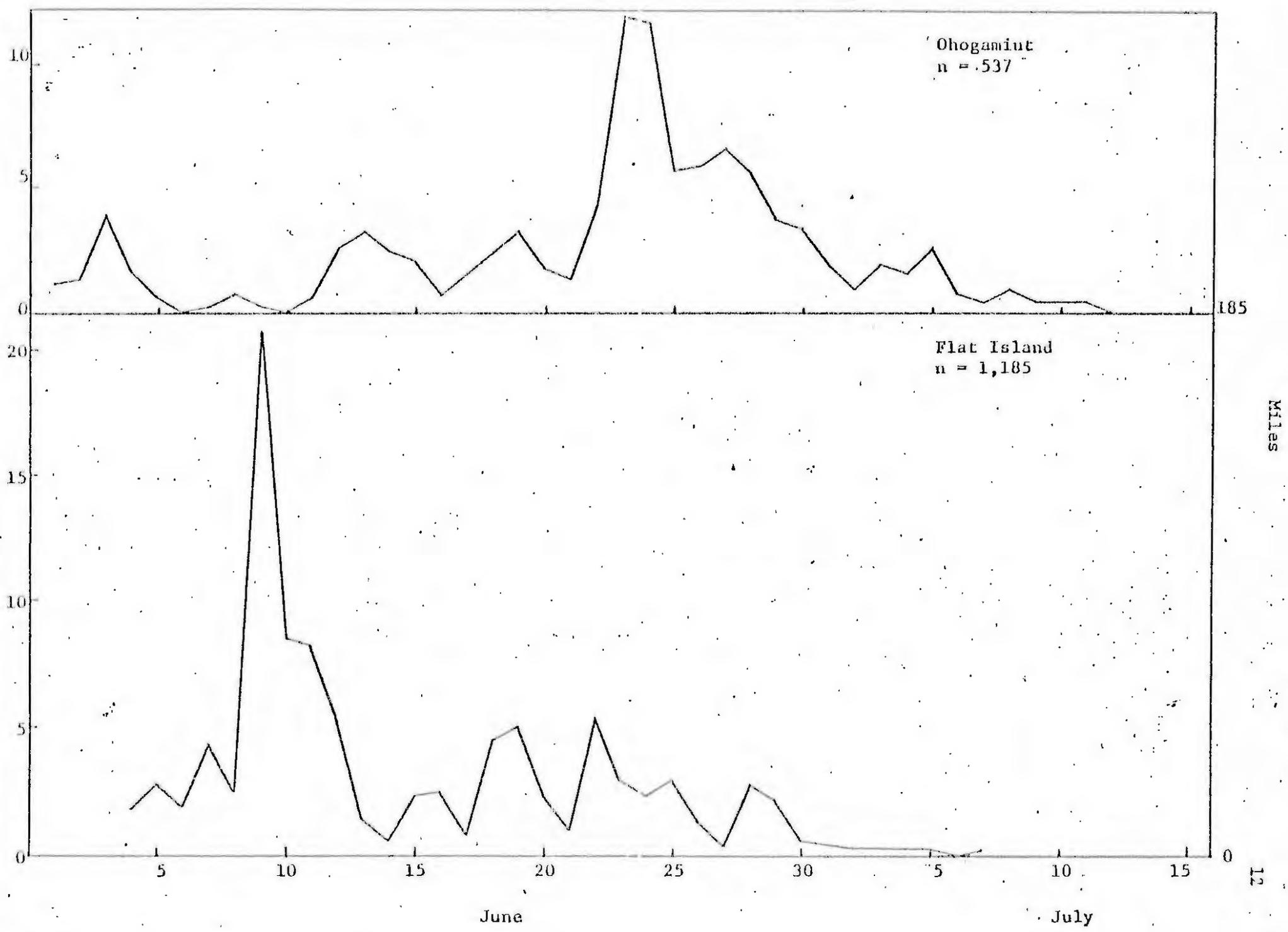


Table 4. Percent by date of king salmon commercial catch (Statistical area 334-12) and Flat Island test fishing catches, Yukon River, 1969^{1/}

Date	Percent catch	
	Commercial (n=21,894)	Test fishing ^{2/} (n=528)
6/ 4	9	1
6/ 7	9	13
6/11	36	37
6/14	22	6
6/18	4	9
6/20	10	9
6/24	9	14
6/28	1	12

^{1/} Test fishing date from a single 25 fathom gill net of 8-1/2 inch mesh.

^{2/} Does not include 41 kings taken after the close of the commercial fishing season (6/28).

Since intensive fishing effort and excellent fishing conditions prevailed in the south mouth area, an excessive commercial harvest was made and escapement of this run segment was judged very poor. This is indicated by the relatively poor catches made at the Ohogamiut site prior to June 22. Because of the poor escapement, fishing time was reduced from 3-1/2 to 2 days during the week of June 19-25 in subdistrict 334-10 and June 22-28 in subdistrict 334-20.

Catch data indicated that after June 19, a majority of the king salmon run began utilizing the Kwiguk mouth, middle mouth and north mouth entry routes. There is less fishing effort in these areas compared to the south mouth and since this run of fish was coincidental with reduced fishing time, escapement through the lower 150 miles of river was considered good. This segment of the run produced the peak catches made at the Ohogamiut site during June 23-24.

Population estimate considerations

A reliable population estimate was not feasible due to fishwheel construction and exploratory fishing which limited the number of king salmon tagged and the resulting lack of sufficient data. However, a population estimate of king salmon passing through the tagging area was calculated utilizing a simple Peterson formula based on upriver subsistence and commercial fishing recoveries (Appendix C). Results indicated an escapement estimate of 52,599 and total run estimate of 160,564 king salmon.

Age, sex and size composition

A total of 322 king salmon was sampled for age, sex or size information from June 1 through July 12. Of these, 100 were captured by a fishwheel and the remaining 222 by gill nets.

Fishwheel. Age 4₂ kings comprised 68.0 percent of the fishwheel catch while age 5₂ fish (15.0%) were second in abundance. The 7₂ age group was absent from the catch. Sex differentiation by external means was not feasible with the sampled fish which were tagged and released. The mean length (mid-eye to fork of tail) of the total fish sampled was 588 mm. Age and size data for fishwheel caught kings are presented in Table 5.

Gillnet. The age, sex and size composition of 222 king salmon captured in 8-1/2 inch mesh gill nets is presented in Table 6. The 6₂ age group represented 41.0 percent of the sample, followed by the 4₂ (36.0%), 5₂ (12.1%) 7₂ (10.4%) and 3₂ (0.5%) age groups. The sample contained 67.6 percent males and 32.4 percent females. Age 3₂ females were not encountered, but females were more abundant than males in the 6₂ and 7₂ age groups. Males were dominant in the 4₂ and 5₂ age groups. Females had greater mean lengths than males for all age categories, except for the 4₂ age group; a possible result of sample size. A conversion table for mid-eye - snout to fork length for male and female king salmon captured at river mile 185 was calculated using linear regression methods (Table 7.).

Chum salmon

Table 3 summarizes the summer chum salmon tag-recovery data. Of 2,677 chums captured at the tagging site, 1,508 (56.4%) were tagged and released. A single fishwheel accounted for 2,229 (83.3%) chums. Gill nets of 8-1/2 inch mesh were essentially ineffective as chum salmon gear and caused considerable mortality (74.8%) on captured fish. The overall tag recovery rate was 5.9 percent. The low rate is attributed to a decline in effort and subsistence fishing.

Table 5. Age and size composition of king salmon taken with fishwheel at Ohogamiut, Yukon River, 1969.

	3_2	<u>Age group</u>		6_2	Total
		4_2	5_2		
Combined sexes					
Number	8	68	15	9	100
Percent	8.0	68.0	15.0	9.0	100.0
Mean length (mm) ^{1/}	380	563	656	350	588

^{1/} Mid-eye to fork of tail.

Table 6. Age, sex and size composition of untagged king salmon taken with gill nets^{1/} at Ohogamiut, Yukon River, 1969.

	<u>Age group</u>					Total
	3 ₂	4 ₂	5 ₂	6 ₂	7 ₂	
Males						
Number	1	78	24	37	10	150
Percent	0.5	35.1	10.8	16.7	4.5	67.6
Mean length (mm) ^{2/}	359	575	663	869	1,019	690
Females						
Number	0	2	3	54	13	72
Percent	-	0.9	1.3	24.3	5.9	32.4
Mean length (mm)	-	568	781	893	997	898
Combined sexes						
Number	1	80	27	91	23	222
Percent	0.5	36.0	12.1	41.0	10.4	100.0
Mean length (mm)	359	575	676	883	1,006	757

^{1/} 8-1/2 inch mesh.

^{2/} Mid-eye to fork of tail.

Table 7. King salmon fork length conversion table; mid-eye to snout, Yukon River, mile 185.

Mid-eye to fork length			Mid-eye to fork length		
Male (n=72)	Female (n=45)	Snout to fork length	Male (n=72)	Female (n=45)	Snout to fork length
33.3	-	36.0	75.1	76.0	81.0
34.2	-	37.0	76.0	76.8	82.0
35.2	-	38.0	76.9	77.7	83.0
36.1	-	39.0	77.7	78.6	84.0
37.0	-	40.0	78.6	79.5	85.0
39.0	-	41.0	79.4	80.4	86.0
38.9	-	42.0	80.3	81.3	87.0
39.8	-	43.0	81.2	82.2	88.0
40.7	-	44.0	82.0	83.1	89.0
41.6	-	45.0	82.9	84.0	90.0
42.5	-	46.0	83.7	84.9	91.0
43.5	-	47.0	84.6	85.8	92.0
44.4	-	48.0	85.5	86.6	93.0
45.3	-	49.0	86.3	87.5	94.0
46.2	-	50.0	87.2	88.4	95.0
47.1	-	51.0	88.0	89.3	96.0
48.1	-	52.0	88.9	90.2	97.0
49.0	-	53.0	89.8	91.1	98.0
49.9	-	54.0	90.6	92.0	99.0
50.8	-	55.0	91.5	92.9	100.0
51.7	-	56.0	92.3	93.8	101.0
52.7	-	57.0	93.2	94.6	102.0
53.6	-	58.0	94.1	95.5	103.0
54.5	-	59.0	94.9	96.4	104.0
55.4	-	60.0	95.8	97.3	105.0
56.3	-	61.0	96.6	98.2	106.0
57.3	-	62.0	97.5	99.1	107.0
58.3	-	63.0	98.4	100.0	108.0
59.1	-	64.0	99.2	100.9	109.0
60.0	-	65.0	100.1	101.8	110.0
60.9	-	66.0	100.9	102.7	111.0
61.9	-	67.0	101.8	103.6	112.0
62.8	-	68.0	102.7	104.4	113.0
63.7	-	69.0	103.5	105.3	114.0
64.6	-	70.0	104.4	106.2	115.0
65.5	-	71.0	105.2	107.1	116.0
66.5	-	72.0	106.1	108.0	117.0
67.4	-	73.0	107.0	108.9	118.0
68.3	-	74.0	107.8	109.8	119.0
69.2	-	75.0	108.7	110.7	120.0
70.1	-	76.0	109.5	111.6	121.0
71.1	-	77.0	110.4	112.4	122.0
72.0	-	78.0	111.3	113.3	123.0
72.9	-	79.0	112.1	114.2	124.0
73.8	-	80.0	113.0	115.1	125.0

Table 8. Chum salmon tag-recovery summary, Ohogamiut, Yukon River, 1969.

Gear	Effort (days)	Number captured	Percent captured	Number released	Mortality		Tagged			Recovered		
					Number	Percent	Number	Percent	Percent total	Number	Percent	Percent total
Wheel	21	2,229	83.3	320	475	21.3	1,434	64.3	95.1	101	7.0	97.1
1 net	42	<u>448</u>	<u>16.7</u>	<u>39</u>	<u>335</u>	74.8	<u>74</u>	16.5	<u>4.9</u>	<u>3</u>	4.0	<u>2.9</u>
Total	42 ^{1/2}	2,677	100.0	359	810	30.2	1,508	56.4	100.0	104	6.9	100.0

¹Maximum number of days gear operated.

The daily number of chum salmon captured, tagged and recovered by tagging date are presented in Appendix D. Tag-recovery data for recoveries (3) made by tagging site nets within 24 hours of the date of tagging are not included.

Distribution of recoveries by area

The number and percentage distribution of chum salmon tag recoveries by recovery area are presented in Table 9. All recoveries were made within the Alaska portion of the main Yukon River. The greatest percentage (67.1%) of recoveries occurred in the Mountain Village to Russian Mission area. Recoveries below the tagging site (50.8%) were probably due to disorientation, a result of retaining fish within a live box for an extended period of time prior to tagging. Immediate tagging and release of fish soon after capture should minimize this problem. The furthest recovery was made in the Koyukuk River at Huslia, a distance of 711 miles upstream from the mouth of the Yukon. Tag and recovery data are presented in Appendix E.

Migration rates

Migration rates of Yukon River chum salmon recovered at various locations are presented in Table 9. Average rates ranged from 0.3 to 33.1 miles per day. Wide fluctuations occurred due to the inherent tag and recovery limitations. No distinguishable migration rate patterns were recognized.

Based on peak catches in the Flat Island and Ohogamiut areas, the migration rate of untagged fish was approximately 22.0 miles per day with the majority of fish entering the river through the south mouth (Figure 4).

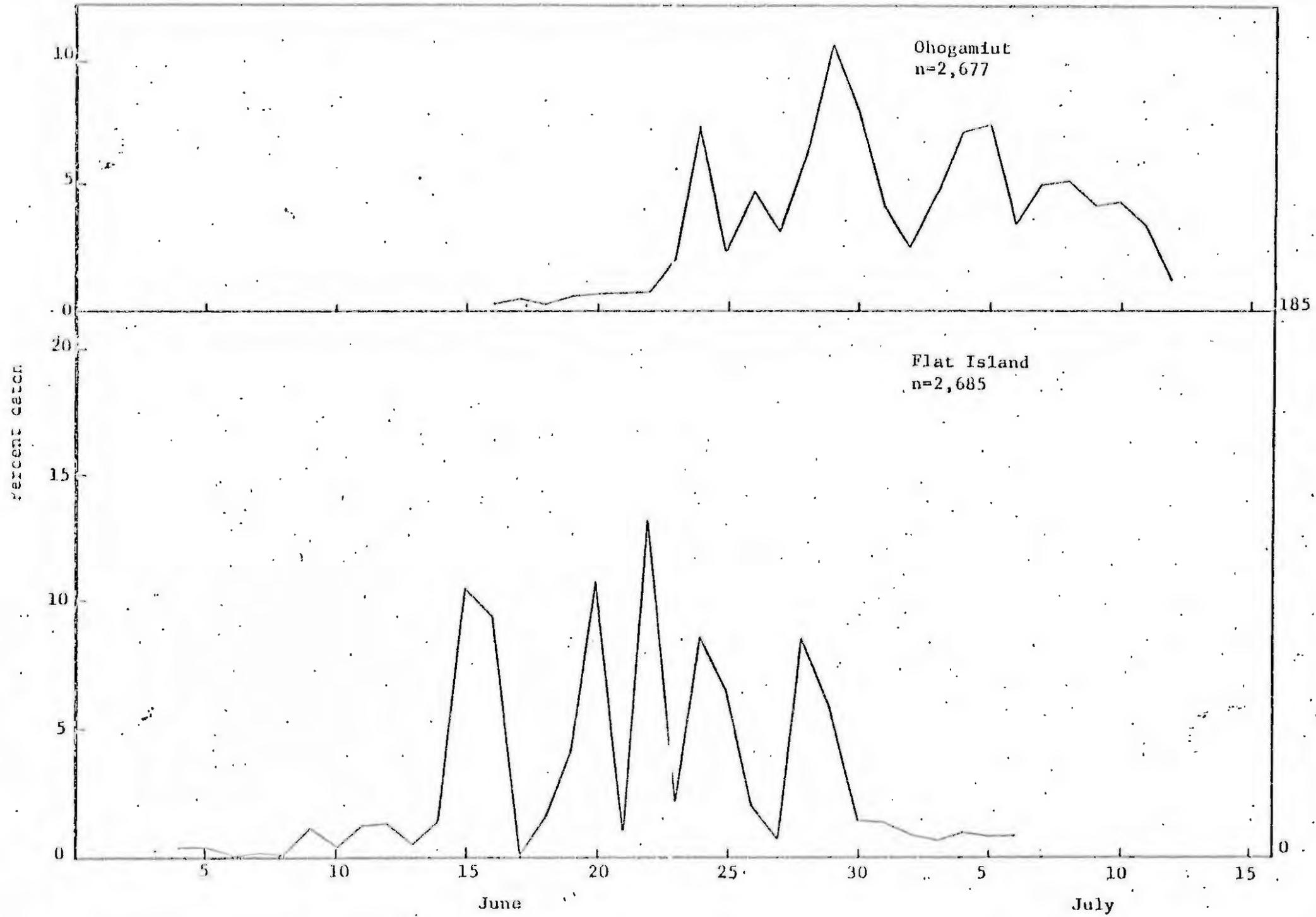
General run timing

The daily catches of chum salmon are listed in Appendix D. The first chum salmon was captured June 12. The peak catch occurred June 29 (Figure 4).

Table 9. Distribution and migration rates of tagged chum salmon, Yukon River, 1969.

Area of recovery	Miles from tagging site	Recoveries		Tagging dates (range)	Recovery dates (range)	Mean days out	Mean miles per day
		No.	%				
Yukon Pass	150	2	1.9	6/27-30	7/4-7	7.0	-
Chukchee Village	133	1	1.0	6/24	6/30	6.0	-
Mountain Village	98	4	3.8	6/23-7/6	6/25-7/24	7.8	-
North, Andreafsky River	81	9	8.6	6/24-7/8	6/28-7/12	5.8	-
Fort Station	63	15	14.4	6/29-7/8	7/6-19	8.2	-
Marsh	24	18	17.3	6/24-7/10	7/4-23	7.6	-
Griglak	15	4	3.8	7/4-12	7/6-30	18.0	-
Ugamiut (mile 185)	0	7	6.7	6/24-7/8	6/26-7/10	4.8	-
Russian Mission	28	13	12.5	6/24-7/11	7/2-30	6.9	4.1
Imiut	66	1	1.0	7/10	7/12	2.0	33.0
Uve Palmiut	76	1	1.0	7/5	7/10	5.0	15.2
North, Innoko River	89	4	3.8	6/24-7/3	7/5-9	8.8	10.1
Ly Cross	94	6	5.8	6/24-7/1	7/2-8	7.6	12.4
Uvik	132	4	3.8	6/19-7/4	6/23-20	10.5	12.6
Ageluk (Innoko R.)	143	1	1.0	6/27	7/12	15.0	9.5
Uyaling	151	6	5.8	6/24-7/3	7/2-10	8.7	17.4
Utag	265	1	1.0	6/18	6/26	8.0	33.1
Uato	299	4	3.8	7/2-11	7/15-30	16.0	18.7
Uyukuk	317	1	1.0	7/10	7/20	10.0	31.7
Uana	510	1	1.0	6/25	7/12	17.0	30.0
Ullia (Koyukuk R.)	526	1	1.0	6/23	8/15	53.0	9.9

Figure 4. Chum salmon daily catches at Flat Island and Ohogamiut, Yukon River, 1969.



Smaller catch peaks were attributed to entry magnitude of chums into the river mouth as evidenced by the Flat Island catches.

Population estimate considerations

As a result of the small number of recoveries (104), a population estimate of chum salmon was not considered feasible.

Age, sex and size composition

The age, sex and size structure of 789 summer chum salmon captured in a fishwheel and 8-1/2 inch mesh gill nets is presented in Table 10. Fishwheel and gill net catches were combined because of the relative uniformity in fish size, total catches and age groups represented. Age 4₁ (84.0%) chums were most abundant for both sexes followed by age 5₁ (11.0%) and age 3₁ (5.0%) fish. Males exhibited greater mean lengths than females for all age groups. A conversion table for mid-eye - snout to fork length for male and female summer chum salmon captured at river mile 185 was calculated using linear regression methods (Table 11.).

The age structure of summer chum salmon sampled by weekly time period of migration is summarized in Table 12. Migration patterns for both sexes of each age group were similar. The June 29 to July 5 period experienced the peak run of all age groups. Age 4₁ and 5₁ fish appeared in catches during June 8-14 period, while age 3₁ chums appeared during the June 22-28 period. Migration timing of males advanced that of females. Of 390 males sampled, 23.0 percent were captured prior to the run peak of June 29 as compared to 18.4 percent of the 399 females captured during the same period.

Table 10. Age, sex and size composition of summer chum salmon taken with fishwheel and gill nets^{1/} at Ohogamiut, Yukon River, 1969.

	<u>Age group</u>			Total
	<u>3</u> ₁	<u>4</u> ₁	<u>5</u> ₁	
Males				
Number	18	327	45	390
Percent	2.3	41.4	5.7	49.4
Mean length (mm) ^{2/}	502	580	624	581
Females				
Number	21	336	42	399
Percent	2.7	42.6	5.3	50.6
Mean length (mm)	494	548	585	549
Combined sexes				
Number	39	663	87	789
Percent	5.0	84.0	11.0	100.0
Mean length (mm)	498	564	605	565

^{1/} 8-1/2 inch mesh.

^{2/} Mid-eye to fork of tail.

Table 11. Chum salmon fork length conversion table;
mid-eye to snout, Yukon River, mile 185.

Mid-eye to fork length		
Male (n=315)	Female (n=367)	Snout to fork length
39.0	39.5	41.0
39.8	40.4	42.0
40.6	41.2	43.0
41.5	42.1	44.0
42.3	42.9	45.0
43.2	43.8	46.0
44.0	44.7	47.0
44.8	45.5	48.0
45.7	46.4	49.0
46.5	47.3	50.0
47.4	48.1	51.0
48.2	49.0	52.0
49.0	49.9	53.0
49.9	50.7	54.0
50.7	51.6	55.0
51.5	52.5	56.0
52.4	53.3	57.0
53.2	54.2	58.0
54.1	55.1	59.0
54.9	55.9	60.0
55.7	56.8	61.0
56.6	57.7	62.0
57.4	58.5	63.0
58.2	59.4	64.0
59.1	60.2	65.0
59.9	61.1	66.0
60.8	62.0	67.0
61.6	62.9	68.0
62.4	63.7	69.0
63.3	64.6	70.0
64.1	65.4	71.0
64.9	66.3	72.0
65.8	67.2	73.0
66.6	68.0	74.0
67.4	68.9	75.0
68.3	69.8	76.0
69.1	70.6	77.0
70.0	71.5	78.0
70.8	72.4	79.0
71.6	73.2	80.0

Table 12. Age composition of summer chum salmon sampled by weekly time period of migration with a fishwheel and gill nets^{1/} at Ohogamiut, Yukon River, 1969.

Date	Number of fish by age group			Total	Percent total
	3 1	4 1	5 1		
<u>Males</u>					
6/1-7	0	0	0	0	0.0
6/8-14	0	1	0	1	0.1
6/15-21	0	24	2	26	3.3
6/22-28	2	132	21	155	19.5
6/29-7/5	9	131	17	157	19.9
7/6-7/12	<u>7</u>	<u>39</u>	<u>5</u>	<u>51</u>	<u>6.5</u>
Total	18	327	45	390	49.4
<u>Females</u>					
6/1-7	0	0	0	0	0.0
6/8-14	0	0	0	0	0.0
6/15-21	0	17	2	19	2.4
6/22-28	2	110	14	126	16.0
6/29-7/5	14	167	17	198	25.1
7/6-7/12	<u>5</u>	<u>42</u>	<u>9</u>	<u>56</u>	<u>7.1</u>
Total	21	336	42	399	50.6
<u>Combined sexes</u>					
6/1-7	0	0	0	0	0.0
6/8-14	0	1	0	1	0.1
6/15-21	0	41	4	45	5.7
6/22-28	4	242	35	281	35.6
6/29-7/5	23	298	34	355	45.0
7/6-7/12	<u>12</u>	<u>81</u>	<u>14</u>	<u>107</u>	<u>13.6</u>
Total	39	663	87	789	100.0

^{1/} 8-1/2 inch mesh.

FD-67 Anchor Tag Evaluation

Table 13 summarizes the FD-67 tagging data. In all, 67 king salmon and 6 chum salmon were tagged with 33 (49.2%) and 1 (16.7%) respectively recovered. Accidental breakage of the tagging gun prevented application of additional tags. No tag losses were reported. Since this information is voluntary, tag loss evaluation is difficult. Three tags were recovered over 1,000 miles from the tagging site. The furthest tag recovery occurred at Pelly Crossing (Pelly River), Yukon Territory, a distance of 1,395 miles. The maximum period of time a tag was attached to a live salmon was 44 days.

Based on the limited data available, FD-67 anchor tags appear suitable for in river short term tag-recovery studies. Evaluation of this equipment will continue in 1970.

Sheefish

During 1969, five sheefish were captured at Ohogamiut during the period of June 1-July 12. Maximum effort was directed toward the salmon project. Of the sheefish captured, 4 were tagged and released. No recoveries were recorded for the 1969 or previous years tagging efforts.

A summary of the 1967-1969 tagging results is presented in Table 14. It is expected that additional recoveries from the sheefish tagging projects will be made in future years. In 1970, sheefish will again be tagged and released incidental to the salmon projects. As additional recoveries are reported in the future, important information on the movements and distribution of sheefish in the Yukon River drainage will be obtained.

Table 13. Tag-recovery summary of Floy FD-67 anchor tags, Yukon River, 1969.

Species	Number tagged	Number recovered	Percent recovered	Miles traveled (range)	Days out (range)
King salmon	67	33	49.2	28-1,395	3-44
Chum salmon	<u>6</u>	<u>1</u>	16.7	132	4
Total	73	34	46.6	28-1,395	3-44

Table 14. Sheefish tag-recovery summary, Yukon River, 1967-1969.

Year	<u>Tagged</u> Number	Year	<u>Recovered</u>		Cumulative percent	Percent remaining
			Number	Percent		
1967	10	1967	0	0.0	0.0	100.0
		1968	1	10.0	10.0	90.0
		1969	0	0.0	10.0	90.0
1968	154	1968	10	6.5	16.5	83.5
		1969	0	0.0	16.5	83.5
1969	<u>4</u>	1969	<u>0</u>	0.0	16.5	83.5
Total	168		11	6.5	6.5	93.5

Subsistence Surveys

The 1969 subsistence catches recorded for the Yukon district are presented in Table 15. A minimum of 14,921 king salmon and 208,327 salmon of other species were taken. Catches were below average. The recorded subsistence catches represent minimum figures for salmon consumed prior to the surveys and ~~others~~^{catches} made after the completion of surveys are not always recorded.

Subsistence catches of Yukon River chum salmon have declined markedly during recent season. Although adverse fishing conditions and the immediate employment situation have had some effect, the decline is largely the result of a lack of dependence on subsistence fishing. As shown in Table 16, there has been a decline in fishermen, sled dogs and the number of fishwheels for the Yukon River.

Aerial Survey Estimates of Salmon Escapements

Approximately 20 hours were spent conducting aerial surveys of salmon spawning streams in the Yukon district during 1969. Selected streams of the Yukon, Koyukuk and Teslin River systems were surveyed. Results are summarized in Table 17.

DISCUSSION AND FUTURE PLANS

Although population estimates were unattainable in 1969, the tag and recovery project demonstrated the feasibility of capturing king and chum salmon with fishwheels in suitable condition for tagging. Disregarding any unknown delayed mortality, data revealed a significant reduction in catch mortality

Table 15. Subsistence salmon catches, Yukon district, 1969.^{1/}

Year	Kings	Other salmon ^{2/}
1961	23,719	407,814
1962	19,910	358,441
1963	32,656	421,625
1964	22,317	485,630
1965	19,723	458,379
1966	14,017	214,236
1967	19,661	288,595
1968	14,832	139,607
1969 ^{3/}	14,921	208,827

^{1/} Includes Yukon Territory (Canada) catches.

^{2/} Mostly chum salmon.

^{3/} Data is preliminary.

Table 16. Decline in subsistence fishing effort, Yukon River, 1961-1969.

Selected year	Number of fishing families surveyed	Number of dogs owned	Number of fishwheels operated
1961	624	4,806	169
1963	597	4,155	156
1965	541	3,974	127
1967	471	2,752	87
1968	476	2,719	71
1969	458	2,442	63

Table 17. Aerial survey estimates of salmon escapements, Yukon district, 1969.^{1/}

Stream	Date	Aerial survey rating	Kings	Chums
Andreafsky River				
West Fork	7/21	Poor-Fair	231	159,500 ^{2/}
East Fork	7/21	Poor-Fair	274	119,000 ^{3/}
Total			505	278,500
Anvik River	7/23	Poor	296	- 4 ^{4/}
Salcha River	8/1	Poor	461	425
Nisutlin River	8/15	Fair	205	-
Big Salmon River	8/15	Fair	286	-
Northern Lake outlet ^{5/}	8/15		5	
Little Salmon River	8/17	Fair	120	-

^{1/} If more than one survey of a stream was flown, only the high count is presented.

^{2/} Includes an estimated 14,500 carcasses.

^{3/} Includes an estimated 11,000 carcasses.

^{4/} Impossible to count.

^{5/} Foot survey of upper 1/2 mile.

induced by fishwheels as compared to gill nets, however, fishwheel catch figures were considered extremely low for king salmon. An outside lead that will shunt fish toward the fishwheel is believed a satisfactory method of increasing the total catch.

The test fishing catch data presented in this report were affected by environmental conditions, varying fishing methods and other factors which are not necessarily related to salmon abundance. Even with these limitations, the test fishing data is thought to be the best representation of run timing and magnitude into the river. Commercial catches are not adequate for this analysis because of gaps in the data caused by periodic closed fishing periods.

One serious limitation of the study is that the Flat Island catch data cannot be used as an abundance index for the entire Yukon River run. Salmon enter the Yukon River by several mouths, and the proportion of the run entering each mouth varies considerably from year to year. For example, there were 25,326 and 27,202 king salmon taken commercially in the south and middle mouths respectively during 1967 (Geiger et. al. 1967). With similar fishing effort, there were only 6,600 kings taken in the middle mouth during 1968 compared to 27,898 kings taken in the south mouth (Geiger et. al. 1968). In 1969, south and middle mouth catches totaled 21,394 and 12,875 kings respectively (Regnart et. al. 1969). Another test fishing site should probably be established above the confluences of the major mouths or channels (near Fish Village) in order to establish abundance indices for the entire run.

Although the sex and size characteristics of commercial salmon catches are readily attainable, little information is known regarding these characteristics for the total run or for the spawning escapement. The effect of an

intensive commercial fishery on the quality, as well as the quantity of the spawning escapement should be of great concern to the fishery management biologist.

Age composition of salmon runs can be expected to vary from year to year because of differences in the survival and return of various brood year stocks. Sex ratios of any particular run, especially for king salmon, may vary from 1:1 depending on the relative abundance of the various age classes. For example, an unusually large return of age 4_2 and 5_2 king salmon could produce an overall sex ratio in favor of males.

Yukon River king salmon runs consist of fish ranging from 3 to 7 (possibly 8) years of age. Because of 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 (approximate) gill nets, which are operated in the commercial fishery, are selective on age 6_2 and 7_2 females (Geiger, et. al. 1968). Fishwheel test catches indicate a selectivity of the younger age classes. Because of the intensive and selective nature of the fishery, the resultant king salmon spawning escapements ~~and selective nature of the fishery, the resultant king salmon spawning escapements~~ are suspected to be normally composed of a majority of males with relatively high percentage of the 3_2 , 4_2 and 5_2 age groups.

The optimum sex ratio for spawning king salmon is not known, but a surplus of age 3_2 to 5_2 males in the spawning escapement contributes little to run productivity. A 1:1 sex ratio, or even a majority of females on the spawning grounds would be best for maximum production. Preliminary data obtained during the past several years indicates that differences of one or two inches in gill

net mesh size can considerably alter the age, sex and size composition of the catch. The use of gill nets of a smaller mesh size would reduce the harvest of the more productive females in the older age groups and increase the harvest of the younger age groups which are predominantly males. The catch would then spread out to include some harvest of all of the available age groups.

Other considerations involving the use of smaller mesh gill nets to harvest king salmon would be the effect on the marketability of the catch, increased incidental catch of chum and sockeye salmon and the possible drop-out problem associated with the larger sized king salmon.

The 1969 study also shows the occurrence of seasonal changes in age, sex and size compositions of the 1969 king and summer chum salmon runs. If these trends exhibit similar and distinct patterns from year to year, then it may be possible to alter the characteristics of the catch by altering the fishing season.

The subsistence fishery rivals the commercial fishery as the most important utilization of salmon in the Arctic-Yukon-Kuskokwim area. Chum salmon have always been the backbone of the subsistence fishery, with most of the catch being fed to sled dogs. King salmon are reserved almost exclusively for human consumption, although substantial numbers of chum salmon are also eaten. Minor utilization of pink, coho and red salmon is made.

Increased welfare payments and more employment opportunities have resulted in a general decline in fishing effort throughout the A-Y-K area. Snow vehicles are beginning to replace sled dogs and this is expected to speed up the decline of the subsistence fishery in the future as less dog food is needed.

The documentation of catches and associated fishery data (amount of gear, number of fishermen, etc.) by subsistence surveys may indicate relative run magnitudes, escapements and trends in the dependence on subsistence fishing. The

surveys are also insurance against a large number of unreported tag recoveries by subsistence fishermen.

Aerial surveys are the most commonly used salmon escapement enumeration methods since a relatively large number of streams can be observed in a short period. However, inherent weather and water conditions limit accuracy. It should also be emphasized that aerial survey determination of spawning salmon is considered an estimate or index of escapement and not the actual or total number of spawners in a stream. If aerial survey procedures are standardized and environmental conditions do not vary much, then estimates (indices) of salmon escapements made at the same stage of the run can be compared from year to year. The high count or estimate of escapement usually made at the peak of spawning is considered as the best index of the total escapement. Annual escapement indices of major streams, plus accurate commercial and subsistence catch data, are of extreme importance to the management biologist in evaluating run magnitudes of various stocks. These techniques are being applied annually in the Yukon District.

During the 1970 field season, three improved fishwheels with deeper baskets, floating pillow block bearings and outside leads will be operated in the Ohogamiut area. All salmon will be tagged and then released. A recovery site will be established 40-50 miles upriver of Ohogamiut. If good fishing sites are available, large numbers of salmon in suitable condition for tagging can be obtained and should contribute sufficient data for a reliable population estimate.

It is recommended that age, sex and size studies be continued for all species of salmon with more emphasis placed on assessing age, sex and size characteristics of spawning populations. Future research effort should include a

comprehensive gill net selectivity experiment which should be continued for several years to include runs of varying magnitudes and age characteristics.

SUMMARY

King Salmon

1. Of 537 king salmon captured, 293 (54.6%) were tagged and released.
2. Gill nets accounted for 437 (81.4%) kings while 100 (18.6%) were captured with a fishwheel. Gill net and fishwheel mortality was 53.5 and 10.0 percent respectively.
3. The overall recovery rate was 26.3 percent. Nearly all recoveries were made by commercial and subsistence fishermen.
4. Over 93 percent of all recoveries occurred in the Russian Mission-Holy Cross area. The furthest recovery occurred 1,580 miles upstream in the Pelly River, Yukon Territory.
5. Data indicates a substantial harvest of the early portion of the run.
6. The maximum migration rate recorded for tagged fish was 38.4 miles per day while the average rate was 24.2 miles per day. In general, migration rates increased as the distance traveled upstream increased.
7. The first king salmon was captured June 1. One notable peak of abundance occurred during June 23-24 in the Ohogamiut area.
8. Although a relatively small number of king salmon were tagged, a population estimate was calculated based on a simple Peterson formula. Results indicated an escapement estimate of 52,599 and total run estimate of 160,564 king salmon.

9. Age composition of 100 Yukon River king salmon sampled from fishwheel catches was 68.0 percent 4_2 fish followed by the 5_2 (15.0%), 6_2 (9.0%) and 3_2 (3.0%) age groups.
10. Age composition of 222 king salmon sampled from 8-1/2 inch mesh gill net catches was 41.0 percent 6_2 fish followed by the 4_2 (36.0%), 5_2 (12.1%), 7_2 (1.04%) and 3_2 (0.5%) age groups.
11. Males were dominant in the 4_2 and 5_2 age groups, and overall, composed 67.6 percent of the sample. A majority of the 6_2 and 7_2 age groups were females.
12. The age and sex composition of the sample showed little change as the season progressed.
13. Limited information indicates that the intensive and selective nature of commercial fisheries using 8-1/2 inch mesh gill nets results in spawning escapements of king salmon having an excess of males with relatively high percentages of 3_2 , 4_2 and 5_2 age groups.
14. The use of gill nets of smaller mesh sizes would probably reduce the harvest of the more productive females and increase the harvest of the younger age groups which are predominantly males.

Chum Salmon

1. Of 2,677 chum salmon captured, 1,508 (56.4%) were tagged and released.
2. Gill nets accounted for 448 (16.7%) chums while 2,229 (83.3%) were captured with a fishwheel. Gill net and fishwheel mortality was 74.3 and 21.3 percent respectively.
3. The overall recovery rate was 6.9 percent. Nearly all recoveries were made by subsistence fishermen.

4. The greatest percentage (67.1) of recoveries occurred in the Mountain Village-Russian Mission area. Over 50 percent of the recoveries occurred below the tagging site. The furthest recovery was made 711 miles upstream in the Koyukuk River.
5. Migration rates varied considerably, ranging from 0.8 to 33.1 miles per day.
6. The first chum salmon was captured June 12. The peak catch occurred June 29.
7. Of 789 summer chum salmon captured in a fishwheel and 8-1/2 inch mesh gill nets, age 4₁ (84.0%) chums were most abundant for both sexes followed by the 5₁ (11.0%) and 3₁ (5.0%) age groups.
8. The sex ratio was approximately equal.
9. The age and sex composition changed slightly as the season progressed. Age 3₁ fish appeared in catches nearly two weeks later than the 4₁ or 5₁ age groups. Migration timing of males advanced that of females.

Tag Evaluation

1. Based on limited data, Floy FD-67 anchor tags appeared suitable for ^{in river} short ~~and long~~ term tag-recovery studies.

Sheefish

1. Five sheefish were tagged and released at the Ohogamiut area. No recoveries were recorded.
2. Of 168 sheefish tagged and released during a three year period, only 11 (6.5%) have been recovered.

Subsistence Surveys

1. A minimum total subsistence catch of 14,921 kings and 208,827 other species, mostly chums, was recorded in the Yukon area.
2. Yukon River chum salmon catches for 1966-1969 have declined markedly as a result of a decline in the dependence on subsistence fishing.

Aerial Surveys

1. Selected streams of the Yukon, Koyukuk and Teslin River systems were surveyed.

Number of king salmon captured, tagged and recovered by date and gear, Yukon River, 1969.

Date	Number tagged			Number untagged			Total catch	Recoveries
	Fishwheel	Gill net	Total	Fishwheel	Gill net	Total		
6/1	-	3	3	-	3	3	6	1
6/2	-	5	5	-	2	2	7	2
6/3	-	15	15	-	6	6	21	7
6/4	-	3	3	-	6	6	9	1
6/5	-	1	1	-	2	2	3	1
6/6	-	0	0	-	0	0	0	-
6/7	-	1	1	-	0	0	1	-
6/8	-	1	1	-	3	3	4	1
6/9	-	0	0	-	1	1	1	-
6/10	-	0	0	-	0	0	0	-
6/11	-	2	2	-	1	1	3	1
6/12	-	10	10	-	4	4	14	4
6/13	-	14	14	-	3	3	17	8
6/14	-	7	7	-	6	6	13	3
6/15	-	5	5	-	6	6	11	3
6/16	-	1	1	-	2	2	3	-
6/17	-	1	1	-	7	7	8	1
6/18	-	8	8	-	5	5	13	2
6/19	-	10	10	-	7	7	17	0
6/20	-	3	3	-	6	6	9	1
6/21	-	3	3	-	4	4	7	0
6/22	1	9	10	0	13	13	23	3
6/23	4	33	37	0	26	26	63	15
6/24	4	27	31	0	31	31	62	6
6/25	8	8	16	0	14	14	30	3
6/26	16	4	20	0	11	11	31	2
6/27	30	2	32	0	3	3	35	5
6/28	7	4	11	7	7	14	25	1
6/29	4	4	8	1	11	12	20	1
6/30	3	5	8	0	10	10	18	1
7/1	0	2	2	1	7	8	10	-
7/2	2	0	2	0	3	3	5	0
7/3	0	4	4	0	6	6	10	3
7/4	3	2	5	0	3	3	8	1
7/5	5	3	8	0	6	6	14	-
7/6	0	0	0	1	3	4	4	-
7/7	0	1	1	0	0	0	1	-
7/8	1	0	1	0	4	4	5	-
7/9	0	2	2	0	0	0	2	-
7/10	1	0	1	0	1	1	2	-
7/11	1	0	1	0	1	1	2	-
7/12	0	-	0	0	-	0	0	-
Totals	90	203	293	10	234	244	537	77

APPENDIX B

King salmon tag-recovery data, Yukon River, 1969.

Tagging date	Tag number	Recovery area (mi.)	Recovery date	Miles traveled	Days out
6/1	444	261	7/2	76	31
6/2	443	261	6/11	76	9
	23350	283	6/9	98	7
6/3	446	274	6/6	89	3
	448	725 ✓	6/29	540	26
	449	283	6/6	98	3
	606	213	6/7	28	4
	607	251	6/6	66	3
	611	725 ✓	6/26	540	23
	613	283	6/7	98	4
6/4	601	82	6/16	-103 ^{4/}	-
6/5	617	261	6/14	76	9
6/8	620	283	6/26	98	18
6/11	442	487	7/2	299	21
6/12	603	251	6/19	66	7
	618	475	6/28	290	16
	622	725 ✓	6/30	540	18
	625	1,580 ^{1/} ✓	7/26	1,395	44
6/23	628	695 ✓	7/25	510	12
	630	251	6/16	66	3
	632	141	6/19	-44	-
	633	10	6/28	-175	-
	634	283	7/14	98	31
	636	251	6/20	66	7
	637	261	6/24	76	11
	23358	261	6/24	76	11
6/14	641	261	6/20	76	6
	643	261	6/27	76	13
	644	261	6/22	76	3
6/15	645	103	6/28	-82	-
	648	1,259 ^{2/} ✓	7/13	1,074	28
	651	763 ✓	7/1	578	16
6/17	657	453	6/28	268	11
6/18	660	1,551 ✓	7/28	1,366	40
	662	261	6/21	76	3
6/20	23379	279	6/26	94	6
6/22	23393	860 ^{3/} ✓	7/13	675	21
	23403	269	6/25	84	3
	23404	279	6/26	94	4

(Continued)

APPENDIX B (continued)

Tagging date	Tag number	Recovery area (mi.)	Recovery date	Miles traveled	Days out
6/23	23407	213	6/24	28	1
	23412	141	6/27	-44	-
	23421	763 ✓	7/6	578	13
	23425	283	6/26	98	3
	23435	512 ✓	7/6	327	13
	23438	720 ✓	7/5	535	12
	23439	775 ✓	7/11	590	18
	23441	170	6/24	-15	-
	23444*	606 ✓	7/20	421	27
	23452	289	6/25	104	2
	23454	279	6/26	94	3
	23463	251	6/27	66	4
	23464	180	6/26	-5	-
	23466	279	7/6	94	13
	23467	695 ✓	7/8	510	15
6/24	24031	213	6/25	28	1
	24035	251	6/26	66	2
	24039	860 ^{3/} ✓	7/23	675	29
	24050*	912 ^{3/} ✓	7/20	727	26
	24072	261	6/25	76	1
	24075	336	7/2	131	8
6/25	24176*	<u>283</u>	6/29	98	4
	24177*	283	7/26	98	31
	24201	695 ✓	7/9	510	14
6/26	24234*	860 ^{3/} ✓	7/23	675	27
	24331*	496 ✓	7/20	311	24
6/27	24371*	103	7/1	-82	-
	24419*	860 ^{3/} ✓	7/23	675	26
	24432	213	7/5	28	8
	24442*	1,551	8/17	1,366	51
	24452*	1,002	7/20	817	23
6/28	24462	-1,580	8/7	1,395	40
6/29	24478	763	7/15	578	16
6/30	22184	170	7/6	-15	-
7/3	22412	512 ✓	7/26	327	23
	22416	512 ✓	7/10	327	7
	22433	606 ✓	7/15	421	12
7/4	21375	606 ✓	7/15	421	11

* Fishwheel

1/ Pelly River, Y.T.

2/ Porcupine River

3/ Tanana River

4/ Negative values indicate miles below tagging site.

APPENDIX C

King salmon population estimate data and calculations, Yukon River, 1969.

<u>Subdistrict</u>	<u>Commercial catch</u>	<u>Subsistence catch</u>	<u>Total</u>
334-10	70,858	3,154	74,012
334-20	14,799	2,225	17,024
334-30	3,577	3,845	7,422
334-40	985	4,723	5,708
Yukon Territory	<u>1,640</u>	<u>974</u>	<u>2,614</u>
TOTAL	91,859	14,921	106,780

Test fishing catches

Flat Island = 1,185

Aerial survey escapement estimates^{1/}Andreafsky River = 505^{2/}Estimated number of kings passed tagging area

Number tagged = 293

Subdistrict 334-30, 334-40 and Yukon Territory subsistence and commercial catches = 15,744

Number of recoveries^{3/} = 68Population estimate = $\frac{(293)(15,744)}{68} = 67,838$ Estimates of escapement above tagging area

Population estimate 67,838

Upriver catches -15,744

Estimated escapement 52,094

Total estimate of Yukon River king salmon run

Subdistrict 334-10 and 334-20 subsistence and commercial catch 91,036

Test fish catch 1,185

Aerial survey escapement estimate 505

Population estimate 67,838

TOTAL ESTIMATE OF KING SALMON RUN 160,564

^{1/} Chulinak River located downstream from the tagging site was not surveyed.^{2/} This is considered a minimum count due to unfavorable survey conditions.^{3/} Does not include 9 tag recoveries made below the tagging site.

APPENDIX D

Number of chum salmon captured, tagged and recovered by date and gear,
Yukon River, 1969.

Date	Number tagged			Number untagged			Total catch	Recoveries
	Fishwheel	Gill net	Total	Fishwheel	Gill net	Total		
6/1	-	0	0	-	0	0	0	-
6/2	-	0	0	-	0	0	0	-
6/3	-	0	0	-	0	0	0	-
6/4	-	0	0	-	0	0	0	-
6/5	-	0	0	-	0	0	0	-
6/6	-	0	0	-	0	0	0	-
6/7	-	0	0	-	0	0	0	-
6/8	-	0	0	-	0	0	0	-
6/9	-	0	0	-	0	0	0	-
6/10	-	0	0	-	0	0	0	-
6/11	-	0	0	-	0	0	0	-
6/12	-	0	0	-	1	1	1	0
6/13	-	0	0	-	0	0	0	0
6/14	-	0	0	-	1	1	1	0
6/15	-	1	1	-	0	0	1	0
6/16	-	2	2	-	2	2	4	0
6/17	-	2	2	-	8	8	10	0
6/18	-	0	0	-	5	5	5	0
6/19	-	5	5	-	7	7	12	2
6/20	-	4	4	-	12	12	16	0
6/21	-	3	3	-	14	14	17	0
6/22	6	0	6	1	11	12	18	0
6/23	30	8	38	0	15	15	53	2
6/24	88	23	111	10	75	85	196	10
6/25	32	0	32	21	11	32	64	6
6/26	105	0	105	7	14	21	126	4
6/27	72	2	74	10	0	10	84	6
6/28	1	0	1	142	24	166	167	0
6/29	154	1	155	109	16	125	280	9
6/30	126	0	126	74	15	89	215	9
7/1	73	4	77	22	12	34	111	5
7/2	48	2	50	11	5	16	66	2
7/3	89	0	89	28	7	35	124	8
7/4	107	0	107	67	17	84	191	10
7/5	125	3	128	51	19	70	198	5
7/6	56	2	58	22	13	35	93	8
7/7	34	4	38	31	16	47	135	5
7/8	38	3	41	31	14	45	136	6
7/9	23	1	24	80	3	83	112	0
7/10	61	1	62	32	20	52	114	4
7/11	41	3	44	35	12	47	91	2
7/12	25	-	25	11	-	11	36	1
Totals	1,434	74	1,508	795	374	1,169	2,677	104

APPENDIX E

Chum salmon tag-recovery data, Yukon River, 1969.

Tagging date	Tag number	Recovery area (mi.)	Recovery date	Miles traveled	Days out
6/19	667	317	6/23	132	4
	23368	453	6/26	268	7
6/23	23443	87	6/25	-98 ^{3/}	2
	23449 ^{1/}	711	8/15	526	53
6/24	23486	103	6/28	-82	4
	24051	336	7/10	151	16
	24074	279	7/2	94	8
	24105	185	7/6	0	12
	24109	161	7/7	-24	13
	24117	279	?	94	?
	24121	269	7/8	84	14
	24135	52	6/30	-133	6
	24140	104	7/5	-81	11
	24154	213	7/14	28	0
6/25	24166	181	6/26	-4	1
	24171	185	6/26	0	1
	24172	104	7/6	-81	11
	24178	87	7/5	-98	10
	24189	695	7/12	510	17
	24200	213	7/5	28	10
6/26	24213	269	7/5	84	9
	24224	283	7/8	98	12
	24257	317	7/3	132	7
	24298	279	7/3	94	7
6/27	24353	35	7/4	-150	7
	24363 ^{2/}	328	7/12	143	15
	24373	87	6/28	-98	1
	24394	336	7/2	151	5
	24434	283	7/7	98	10
	24458	104	7/?	-81	?
6/29	21953	336	7/9	151	10
	21967	103	7/?	-82	?
	21993	161	6/29	-24	0
	22022	161	7/5	-24	6
	22025	161	7/19	-24	20
	22041	317	7/20	132	21
	22043	185	7/1	0	2
	22060	161	6/29	-24	0
	24484	122	7/13	-63	14
6/30	22116	161	7/6	-24	6
	22124	122	7/6	-63	6
	22137	213	7/2	28	2
	22141	161	7/23	-24	23
	22143	269	7/6	84	6
	22155	35	7/7	-150	7
	22196	213	7/2	28	2

(Continued)

APPENDIX E (continued)

Tagging date	Tag number	Recovery area (mi.)	Recovery date	Miles traveled	Days out
6/30	22226	336	7/10	151	10
	22231	122	7/?	-63	?
7/1	22260	161	7/4	-24	3
	22264	122	7/15	-63	14
	22281	161	7/5	-24	4
	22296	283	7/2	98	1
	22302	336	7/10	151	9
7/2	22345	486	7/?	301	?
	22363	213	7/7	28	5
7/3	22385	161	7/15	-24	12
	22394	161	7/4	-24	1
	22396	269	7/9	84	6
	22410	161	7/5	-24	2
	22417	213	7/6	28	3
	22434	336	7/5	151	2
	22455	472	7/19	287	16
	22470	161	7/10	-24	7
7/4	21303	213	7/4	28	0
	21325	122	?	-63	?
	21330	170	7/?	-15	?
	21336	103	7/?	-82	?
	21344	489	7/20	304	16
	21346	185	7/5	185	1
	21370	122	7/15	-63	11
	21382	104	7/7	-81	3
	22491	213	7/7	28	3
	22499	317	7/14	132	10
7/5	11917	122	7/14	-63	9
	11931	261	7/10	76	5
	11949	161	7/11	-24	6
	11957	104	7/7	-81	2
	11958	123	7/10	-62	5
7/5	14764	170	?	-15	?
	14771	161	7/8	-24	2
	14780	123	7/?	-62	?
	14784	185	7/10	0	4
	14797	87	7/24	-98	13
	20104	161	7/11	-24	5
	20109	122	7/15	-63	9
	20135	122	7/11	-24	5
7/7	20302	161	7/15	-63	8
	20320	213	7/30	28	23
	20327	122	7/9	-63	2
	20332	213	7/12	28	5
	20398	122	7/11	-63	4

APPENDIX E (continued)

Tagging date	Tag number	Recovery area (mi.)	Recovery date	Miles traveled	Days out
7/8	00832	185	7/10	0	2
	00851	104	7/12	-81	4
	00855	122	7/19	-63	11
	00875	122	7/?	-63	?
	00912	213	7/10	28	2
	00920	170	7/?	-15	?
7/10	01000	161	7/10	-24	0
	02517	496	7/20	311	10
	02531	213	7/19	28	9
	02532	251	7/12	66	2
7/11	02567	213	7/14	28	3
	02597	487	7/?	302	?
7/12	02631	170	7/30	-15	18

1/ Koyukuk River.

2/ Innoko River.

3/ Negative values indicate miles below tagging site.