

A-Y-K REGION YUKON STOCK SEPARATION REPORT

#14

A SUMMARY OF 1972, 1973, 1976 and 1977

MID-YUKON TAGGING PROJECTS

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ABSTRACT

During 1976 and 1977, 6,575 fall chum salmon were tagged in the area of the mid-Yukon villages of Galena and Ruby. To date 2,518 or 38% have been recovered. Two-hundred and forty-two coho were also tagged during these operations. The current tag recovery for coho stands at 24%.

Recoveries of tagged fall chum in the upper Yukon above the Tanana confluence and in the Tanana have shown chum to be bank oriented in the Galena - Ruby areas. Eighty-six percent of the recoveries for south bank tagged chums recovered upstream of the Tanana confluence have been made in the Tanana drainage while 94% of chums tagged along the north bank and recovered upstream of the Tanana confluence have been recovered in the upper Yukon drainage.

In the Galena area 80% of the north bank fall chums taken in project fishwheels had been captured by August 30 in 1977 and by August 31 in 1976; the corresponding south bank catch level was reached on September 15 in 1977 and on September 3 in 1976. Based on tag return data for 1976 and 1977 combined, 80% of chums tagged and recovered had passed these respective sites by September 2 and 11.

An average swimming speed of 21.6 miles/day was found for 23 fall chums traveling between Galena and Ruby tagging sites. Nine individuals migrated at a rate of 30 miles per day.

Twenty-three percent of the tag recoveries were by gillnet, 69% by fishwheel, and 5% were recovered from spawning grounds.

Simple Petersen population estimates of the upper Yukon fall chum run are: 1977, 520,000; 1976, 149,000. An exploitation rate of 0.644 was calculated for 1977 and 0.756 for 1976.

INTRODUCTION

Prior to 1974 very little information was available on fall chums in the Alaskan portion of the Yukon River with regard to the magnitude of the run, numbers of salmon needed for adequate escapement, or spawning locations. Through extensive aerial surveys conducted in recent years the major spawning areas have now been identified and information is accruing on escapements. Table 1 lists major fall chum systems with escapements for 1974 through 1977.

Chum moving into the lower Yukon River after July 15 are predominantly fall fish. The fall fishery in the lower river is characterized by extreme fluctuations in catches as fish enter the river. Fluctuations in abundance may represent the discontinuous entry of discrete stocks in the lower river.

If the timing or origin of these stocks could be distinguished, prior to, or during the fishery then the management program could be modified to allow for a more equitable harvest of the various stocks in relation to their relative abundance. Stock identification which will allow the separate management of as many discrete spawning stocks as possible is the goal of this program.

Coho salmon are of minor importance compared to the more abundant fall chums. The 1974 commercial harvest of coho was 16,825. Early closures of the fall chum fishery in 1974 and 1976 resulted in reduced coho commercial harvests, the 1977 coho harvest was a record level 38,000. Some of the information obtained from a tag and recovery project for fall chum salmon would be applicable to cohos since both species exhibit similar run timing and spawn in the same general areas.

As part of a statewide stock separation study, funds became available July 1, 1976 to conduct a three year tag-recovery program on Yukon River fall chum salmon with the following objectives:

Table 1. Yukon district fall chum salmon harvests, 1970-1977. 1/ 2/ 3/ 4/

Year	Subsistence Harvest	- %	Commercial Harvest	- %	Total Harvest
1970	58,450	19%	241,655	81%	300,106
1971	70,525	22%	247,021	78%	317,546
1972	40,444	16%	208,117	84%	248,561
1973	54,153	17%	264,899	83%	319,052
1974	68,035	20%	273,558	80%	341,593
1975	81,846	24%	265,156	76%	347,002
1976	69,082	30%	163,282	70%	232,364
1977	79,801	24%	249,500	76%	329,301
Total	522,336	21%	1,913,189	79%	2,435,525
Average	65,292		239,149		304,441

1/ Based on 25% chum and coho subsistence harvest mouth to & including Hogatza.

2/ Essentially no subsistence harvest of fall chums Anvik to Koyukuk.

3/ Based on 60% fall chum and coho sub-catch Galena upstream.

4/ Includes Yukon Territory catches.

1. Determine the timing of separate stocks through the fishery.
2. Determine the pathways of movement of separate stocks through the fishery.
3. Determine the relative contribution of major spawning stocks to the fishery.
4. Estimate population size and exploitation rate of the major stocks.

The first year of the tagging project (1976) was considered experimental with emphasis placed on the development of suitable methods of capture, tagging, and tag recovery.

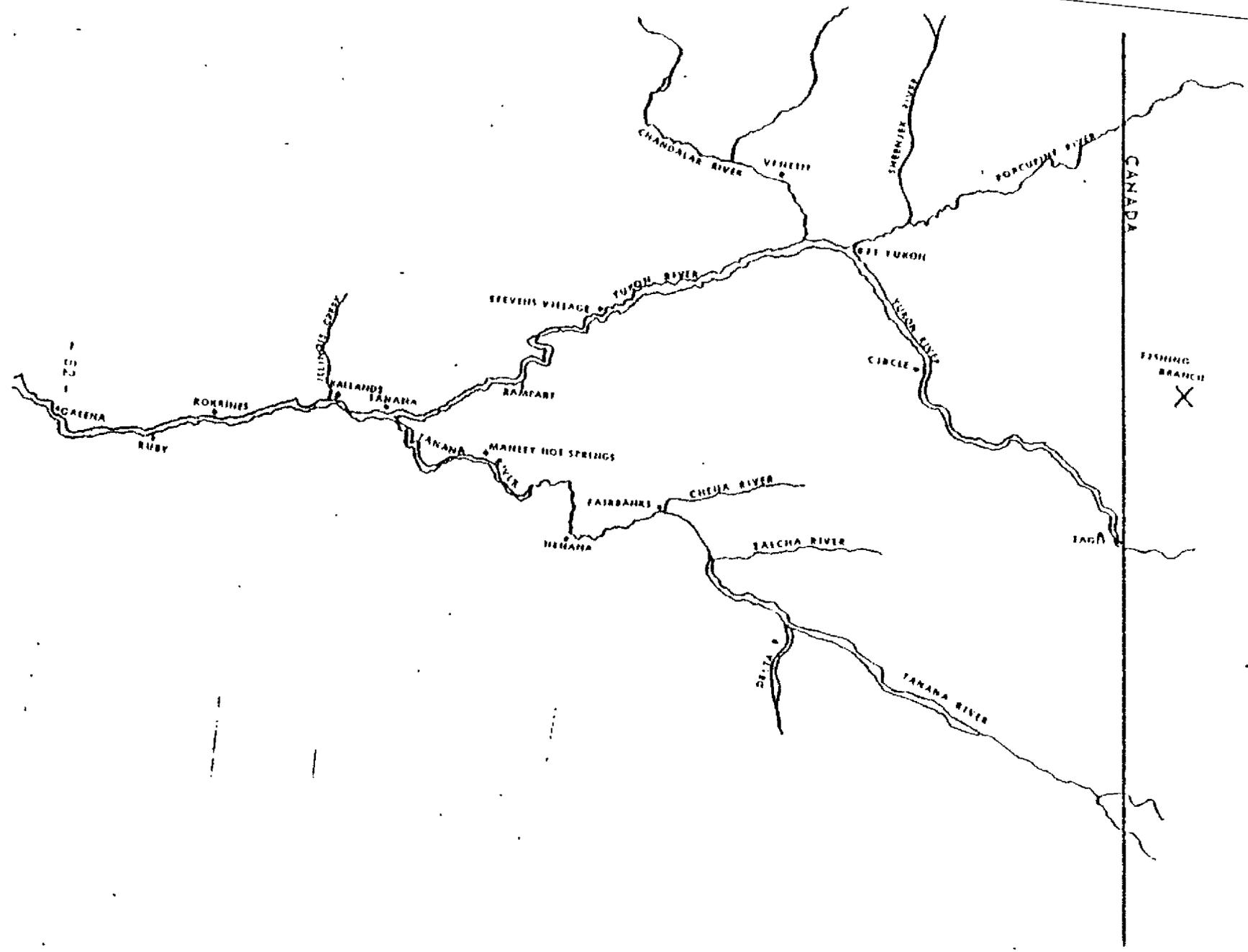
MATERIALS AND METHODS

As in 1976, the Galena area was chosen as the location for two fishwheel tagging sites in 1977 (Figure 1). A second south bank tagging wheel was operated upstream of Ruby.

Fishwheels were rented on contract from fishermen. Fishwheels rented in 1977 were of the standard large Yukon design (see 1976 report for illustration). Fishwheel number one was fished on the north bank (River mile 555, Galena north) upstream from Galena. Fishwheel number two was fished on the south bank (River mile 540, Galena south) upstream from Galena. Fishwheel number three was fished on the south bank (River mile 601; Ruby south) approximately 20 miles upstream of Ruby.

Tagging was initiated at the Galena north bank wheel August 5, and at the Galena south bank wheel August 6. Tagging was terminated on September 17, September 21 at north and south bank sites respectively. The first day of tagging at the Ruby site was August 10 with tagging terminated on September 30. To allow ready field separation as to tagging location, north bank tags were odd numbered, south bank tags were even numbered with a few exceptions.

Figure 1. Fall Yukon tagging and recovery areas, 1977.



Detailed tagging procedures were listed in the 1976 Annual Technical Report (Mauney, 1976). Numbers of other fish species in fishwheel catches were recorded by date of capture.

Rewards of \$2.00 were offered for each returned tag. Posters publicizing the tagging program were mailed to upriver villages (stores and post offices). News notices were sent out to be circulated in the villages. Fishermen were requested to supply date of recovery, river location, bank of recovery and fishing method.

Frequent visits were made to villages to personally contact fishermen and processors for tags recovered. Recoveries in the Yukon Territory were to be collected by personnel from the Whitehorse office of Environment Canada-Fisheries Service.

Tag recovery efforts were undertaken in the Sheenjek, Toklat, Delta and Fishing Branch Rivers (Figure 1). Transportation to the Toklat and Sheenjek was by fixed-wing aircraft. The Fishing Branch River was accessible only by helicopter. Rubber rafts were utilized by recovery crews for transportation within the Fishing Branch and Sheenjek Rivers. The upper Tanana River spawning areas were canvassed for tags by observers on foot. Tags were recovered from carcasses or from spawning fish retrieved by means of spear or shotgun. Spawning ground observations included:

1. The ratio of tagged to untagged fish.
2. Tag recoveries by date.
3. Air and water conditions and temperatures.

Carcasses and living fish were sampled in the Sheenjek, Fishing Branch, Toklat, and Delta areas throughout the period of on-site investigations. Data taken included sex and length (mideye to fork of tail). Scale and tissue samples were taken for later aging and analysis.

Key punching, programming, and analysis of the 1977 data has been completed and has been detailed below. In addition, data from earlier studies conducted in 1972 and 1973 has been presented; results of the 1976 tagging has been undated. A summary of earlier Yukon tagging projects was presented in the 1976 report (Mauney, 1977).

1972 AND 1973 TAGGING AT RAMPART

The 1972 and 1973 tagging of fall chums was conducted from a contracted fishwheel in the Rampart area of the Yukon, south bank, river mile 763. A summary of information gained by this study is presented here for the first time. Tagging began on August 26 both years and terminated on September 25 in 1972 and September 21 in 1973. The 85% level of tagging was reached on September 22, 1972 and on September 9 in 1973 (Appendix Table 1).

A total of 811 chums and 776 chums were tagged in 1972 and 1973 respectively. In 1973, 134 or 17% of the tagged fish were recovered; for 1972 recoveries totaled 61 or 7% (updated through Nov. 30, 1978).

Average migration speed was calculated for 33 recoveries in 1972 and 46 in 1973. The rates found were respectively 13.7 and 18.2 miles per day (Appendix Table 2).

Major tag recovery areas by year are listed in Table 2. Recoveries were made largely by commercial and subsistence fishermen of upper Yukon villages. Spawning grounds recovery efforts were made only on the Fishing Branch which yielded a total of four tags. Major harvest areas included Rampart, Ray River area, Dall River area, Fort Yukon, Eagle and Old Crow.

Table 2. Major tag recovery areas for 1972 and 1973 tagging. ^{1/}

River Mile	Location	No. Recoveries		Total
		1972	1973	
1600	Fishing Branch	1	3	4
1259	Old Crow		14	14
1213	Eagle	7	5	12
1186	Tatondak	8		8
1002	Ft. Yukon		13	13
932	Beaver	5		5
847	Dall	15	18	33
835	Pipeline Crossing		8	8
805	Ray River		16	16
763	Rampart	12	27	39

^{1/} Except for Fishing Branch includes only those areas with 5 or more recoveries.

1976 and 1977 TAGGING AT GALENA

One-thousand, two-hundred and ^{1,217, in Tables 5} twenty-four chum salmon and 14 coho were tagged at the Galena sites in 1976. Five-hundred, forty-five (45%) of the chum were tagged along the north bank and 672 (55%) along the south bank.

Forty-six additional chum salmon tags have been returned since the completion of the 1976 Annual Technical Report (Mauney, 1977). As of December 1978 a total of 613 or 50% of the 1976 tagged chums have been recovered. The number of tagged coho recovered has remained unchanged at 6 (42%). Percentage recovery by sex remains unchanged at 57% and 43% male and female respectively. Chi Square analysis of observed versus expected numbers of recoveries by sex (weighed by numbers tagged by sex) shows there to be no real difference ($P < .05$). The number of south bank recoveries (weighted by numbers tagged by site) was significantly higher than would be expected (Table 3) which may be explained in part by greater fishing effort along the south bank of the Yukon and Tanana Rivers, than along the north bank of the Yukon above Tanana. Also,

Table 3. Observed versus expected numbers of tag returns by bank and by sex of tagging for 1976 and 1977. 1/ 2/.

Site of Tagging	<u>Bank</u>			Chi Square	df
	<u>No. Tagged</u>	<u>No. Recoveries</u>	<u>Expected No. Recoveries</u>		
1976					
1	567	244	285		
2	650	365	324		
Total	1,217	609	609	11.38**	1
1977					
1	1,841	830	684		
2	1,208	421	448		
3	2,309	739	858		
Total	5,358	1,990	1,990	50.00**	2
	<u>Sex</u>				
1976					
Male	680	341	341		
Female	537	267	267		
Total	1,217	608	608	1.51NS	1
1977					
Male	3,240	1,228	1,202		
Female	1,986	711	737		
Total	5,226	1,939	1,939	1.45NS	1

1/ Numbers recovered are assumed to be directly proportional to numbers tagged. For 1977 data 45 chums which were recovered were not identified as to sex at the time of tagging; 102 of the total chum tagged were not identified as to sex.

2/ Recoveries through September, 1978.

south bank fish possibly have different migratory habits such as moving upstream close to the bank which would make them more vulnerable to fishwheel capture.

The commercial fishery accounted for 64%, the subsistence fishery 31%, and spawning ground searches surveys for 5% of recoveries. All but three of the spawning ground recoveries were made by Fish and Game survey crews. Fishwheels, used extensively in upper Yukon fisheries, accounted for 69% of chum recovered. Set gillnets took 26% of the tagged chum salmon recovered.

1976 AND 1977 TAGGING AT GALENA AND RUBY COMPARED AND COMBINED

Chum Salmon

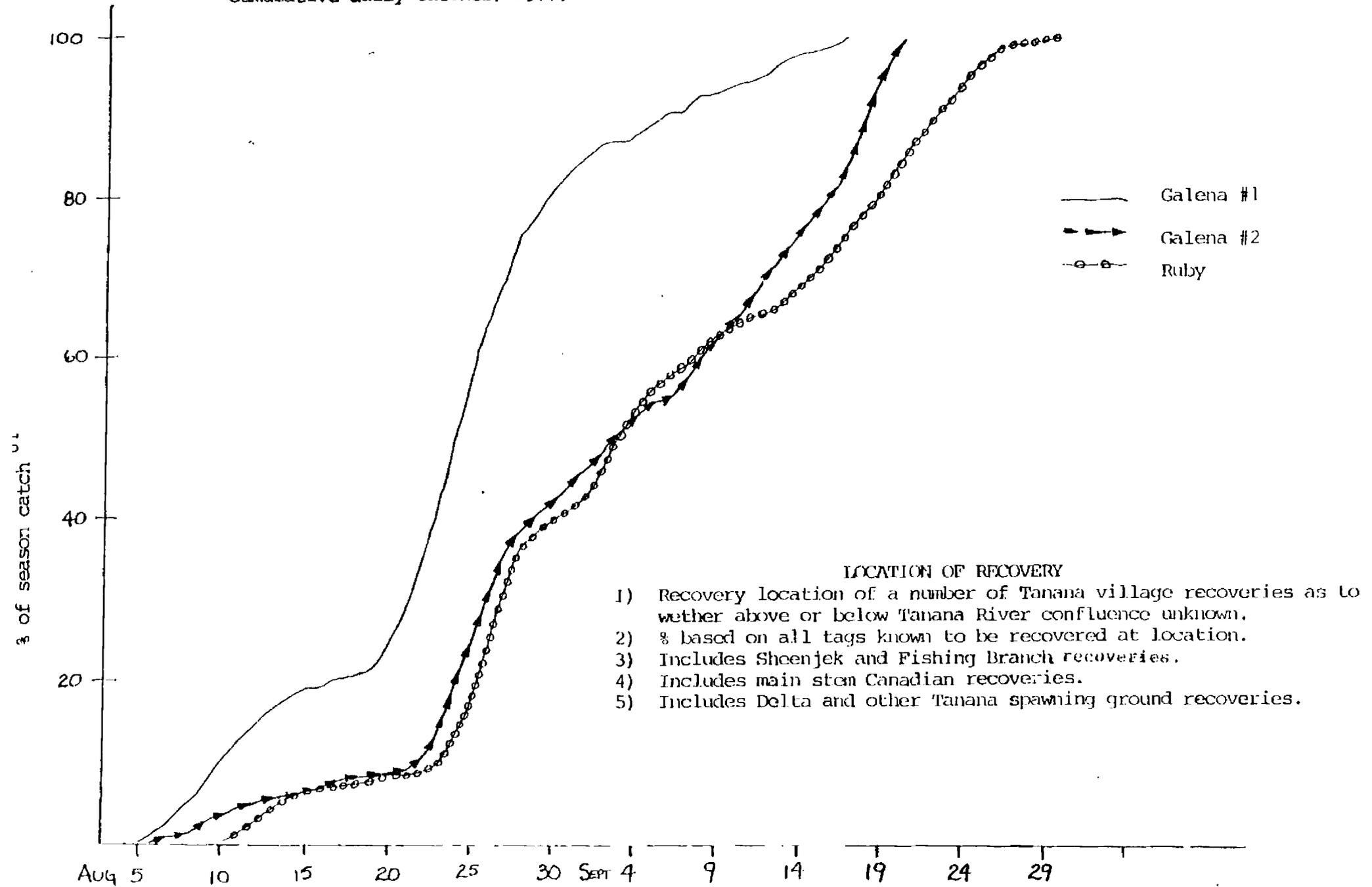
Abundance: A total of 5,358 chum salmon was tagged in 1977. A breakdown by location indicates that 1,841 (34%) were tagged at Galena north bank wheel; 1,208 (23%) were tagged at Galena south bank and 2,309 (43%) were tagged at the Ruby site (Appendix Table 3). This gave a total of 3,517 (66%) chums tagged along the south bank of the Yukon. The Ruby south bank site was more productive for both chum and coho than the Galena south bank site. Catch is dependent on site location and the number and proximity of other fishwheels immediately downstream. This latter is probably a major factor in the Galena area where most productive sites are heavily fished. Two other wheels were operated throughout most of the 1976 and 1977 runs within 200 yards downstream of the wheel at the south bank tagging site. Comparisons of catch per unit effort between fishwheels at various locations to give an indication of run abundance may therefore be misleading.

Project fishwheel catch success, subsistence catch levels, escapements, and the trends of commercial harvests indicate that fall chums were more abundant in 1977 than in 1976. Numbers of chums tagged at the Galena wheels in 1977 increased substantially over 1976 levels. North bank or Galena 1 tagging increased overall by 325% over 1976 levels; the Galena south bank tagging rate increased by 186%. It is believed that tagging was conducted over most of the fall run in both years.

Timing: Eighty percent of the chums had been tagged at Galena north by August 30, Galena south by September 16, and Ruby south by September 19 (Figure 2). Peak catches by date and fishwheel were: 146, August 24; 74 August 24; and 165, August 27 for wheels 1, 2 and 3 respectively. The 1977 chum run appeared earlier and peaked earlier than did the 1976

Figure 2.

Comparative run timing of fall chums by the Galena and Ruby fishwheels as shown by cumulative daily catches, 1977



run. Tagging peaked at the north bank site on August 30 and at the south bank on September 1 in 1976.

Sex composition: The percentage of males tagged was greater than females for both years at all tagging sites. Percent tagged in 1976 was 55 and 56 for the south and north banks respectively. Respective figures for 1977 were 61 and 59 (Table 4).

Table 4. Age and sex composition of Yukon fall chum salmon, fishwheel captures, 1977.

Dates of Samples	Combined Sex	1977 Galena north bank site (#1)							
		Age Classes		Age 3 ₁		Age 4 ₁		Age 5 ₁	
		No.	%	No.	%	No.	%	No.	%
8/15-9/1	Male	49	72.	3	4.	36	53.	10	15.
	Female	19	28.	3	4.	15	22.	1	1.
	Total	68	100.	6	9.	51	75.	11	16.
1977 Ruby south bank site (#3)									
Dates of Samples	Combined Sex	Age Classes							
				Age 3 ₁		Age 4 ₁		Age 5 ₁	
		No.	%	No.	%	No.	%	No.	%
8/10-9/21	Male	102	61.	19	11.	72	43.	11	7.
	Female	65	39.	17	10.	41	24.	7	4.
	Total	167	100.	36	21.	113	68.	18	11.

Size: Length data for chum salmon by sex and fishwheel of tagging is presented in Appendix Table 4. No significant difference in length by tagging location was noted for 1977.

Age composition: Both Galena north and Ruby south catches were composed mostly of four year old fish in 1977 running 75 and 68% respectively (Table 4). Scales taken from spawning grounds also indicated a preponderance of four year old fish in 1977 (Appendix Table 5). The percentage of four year old fish in 1977 ranged from 65% for the Fishing Branch River to 88% for the Delta River. More three year old chums were caught at the Ruby south site (36%) than at the Galena north site 6% in 1977.

Samples of fall chums from the Sheenjek in 1976 ran 53% age 5₁, while Toklat samples were 52% age 4₁, and 42% age 3₁.

Coho Salmon

Abundance: Two-hundred and twenty-eight coho were tagged in 1977, a preponderance of 91% were tagged at the Ruby site (Appendix Table 6). Percent of total coho tagged for sites 1 and 2 ran 5.3 and 4.0 respectively.

Timing: Eighty percent of the coho caught by project fishwheels were taken by September 15. The peak coho daily catch was 21 on September 3. Approximately 67% of those tagged were males (total of 152). In 1976 only 14 coho were tagged. Personal communication with fishermen gives evidence that coho may run under the ice after all fishwheel operation has closed. Some of these late coho are taken by gillnet.

Non-Salmon Species

Project fishwheel catches of non-salmon fish species are presented in Appendix Table 7. Appendix Table 8 lists non-salmon species tagged by wheel and date.

RATE OF TAG RETURNS BY TAGGING SITE, RECOVERY SITE, YEAR AND SEX

Recoveries of 1977 chum tags through November of 1978 were 2,015 or 38% of those at large. Percent recovery by location of tagging for Galena north, Galena south, and Ruby south was respectively 45, 35, and 32. Recoveries of north bank tags have been higher than expected; recoveries of Ruby south bank tags were lower than expected (Appendix Table 3). Actual and expected numbers of returns of south bank tagged Galena chums in 1977 were similar. By contrast in 1976, Galena north bank chum were recovered at a lower rate than expected while Galena south bank chum were recovered at a higher rate than expected.

This difference in the rate of observed and expected returns by site of tagging may be explained in part by differences in the distribution

to the 1976 run with increased catch success. This village accounted for approximately 20% of all tag returns in 1976 and approximately 24% in 1977. Tanana village moved to first place in a ranking of numbers of tag returns; Ruby, first in tag returns in 1976, was second in relative ranking for 1977 (Figure 3).

No difference has been observed in the numbers of observed and expected male and female tagged chum recovered for either 1976 or 1977 (Table 3).

A total of 51 or 22% of the coho tagged in 1977 have been recovered to date. The percent recovery for this species in 1976 was 42 (6 out of 14 tagged). Recoveries by sex were 38 male and 13 female indicating a selective rate of recovery for males.

TAG RETURNS BY METHOD OF RECOVERY AND FISHING ACTIVITY

Returns by fishing activity and year indicate that the commercial fishery accounted for 62% of the recoveries in 1976 and 30% in 1977 (Table 5). Subsistence fisheries accounted for 30% of recovered tagged chum in 1976 and 56% in 1977. The 250,000 quota of commercial fall chum in 1976 was not attained by the fishery due to the below average size of the run. The substantially stronger 1977 run resulted in commercial quotas being quickly attained. A larger percentage of the 1977 harvest thus was utilized in the satisfaction of subsistence needs. Eggs from salmon caught for subsistence purposes could be legally sold in 1977.

Tag recoveries of chum salmon by gear type are presented in Table 6. There is little difference between years in the relative importance of the major harvest gears in the capture of tagged salmon for 1976 and 1977. Gillnets accounted 23% of the recoveries; fishwheels accounted for 69% of recoveries. The fishwheel is the primary gear used in upper Yukon fisheries. Spawning ground recoveries, made primarily by Fish and Game crews, accounted for 5.4% of recoveries.

Percent of Total Tags Recovered

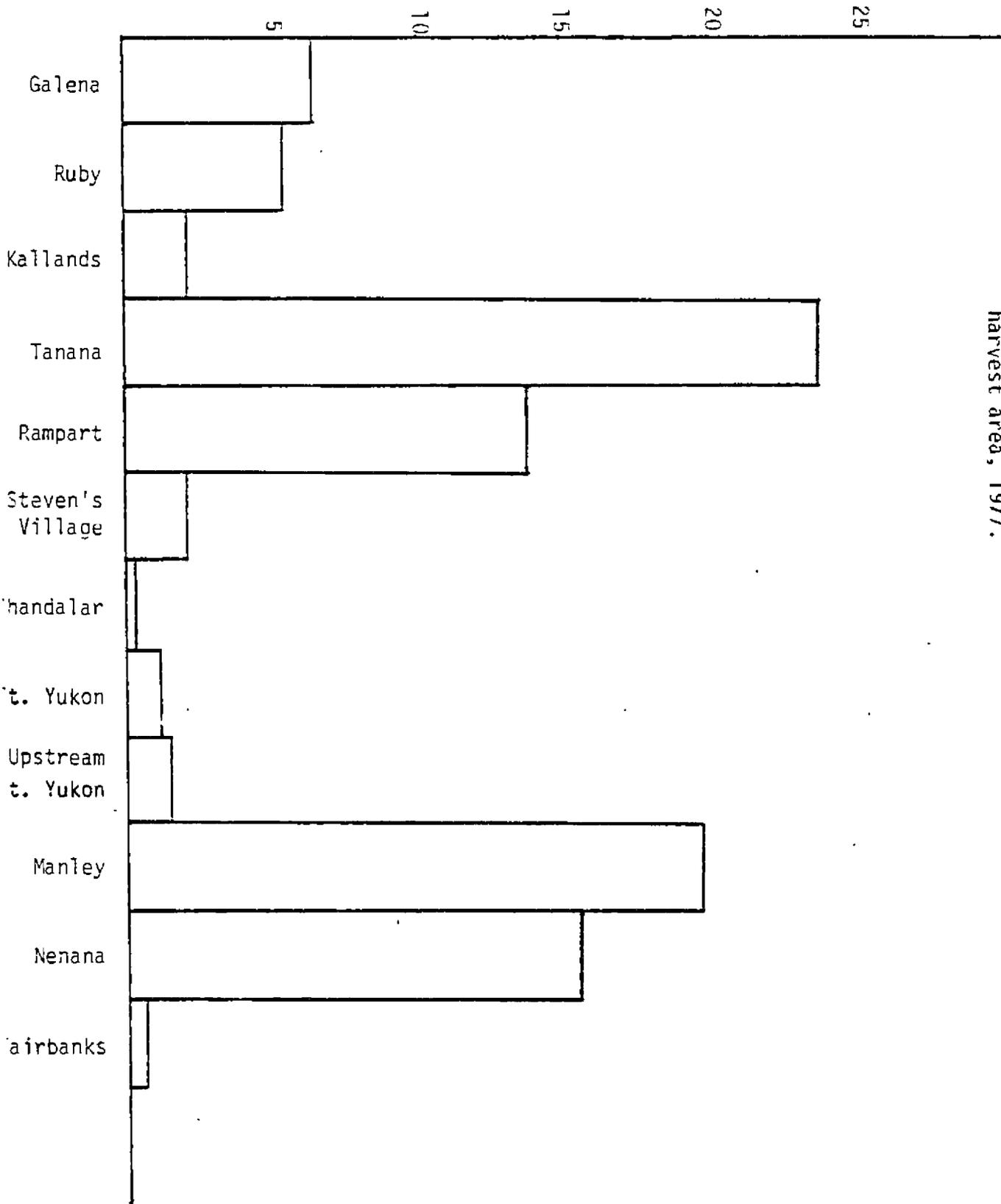


Figure 3. Percent of total Yukon chum salmon tag recoveries by major harvest area, 1977.

Yukon fisheries. Spawning ground recoveries, made primarily by Fish and Game crews, accounted for 5.4% of recoveries.

Table 5. Numbers of tagged chum salmon recovered by activity and year.

Year	Unknown		Commercial		Activity Subsistence		Sport		Spawning G.		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1976	16	2.8	376	61.8	185	30.4			31	5.1	608	100
1977	146	7.5	594	30.4	1100	56.4	3	0.2	108	5.5	1951	100
1976 & 1977	162	6.3	970	37.9	1285	50.2	3	0.1	139	5.4	2559	100

Table 6. Numbers of tagged salmon recovered by gear by year.

		Unknown	Beach Seine	Drift Gillnet	Gear		Fishwheel	Spawning G.	Total
					Set Gillnet				
1976	No.	24	0	0	153	400	31	608	
	%	3.9	0	0	25.2	65.8	5.1	100	
1977	No.	64	4	3	429	1384	107	1999	
	%	4.6	0.2	0.2	21.6	69.5	5.4	100	
1977 & 1976	No.	88	4	3	582	1784	138	2599	
	%	3.3	0.2	0.1	22.4	67.4	5.3	100	

Tagged coho recoveries followed in general the same pattern seen for chum recoveries.

STOCK SEPARATION BY PATHWAYS OF MIGRATION

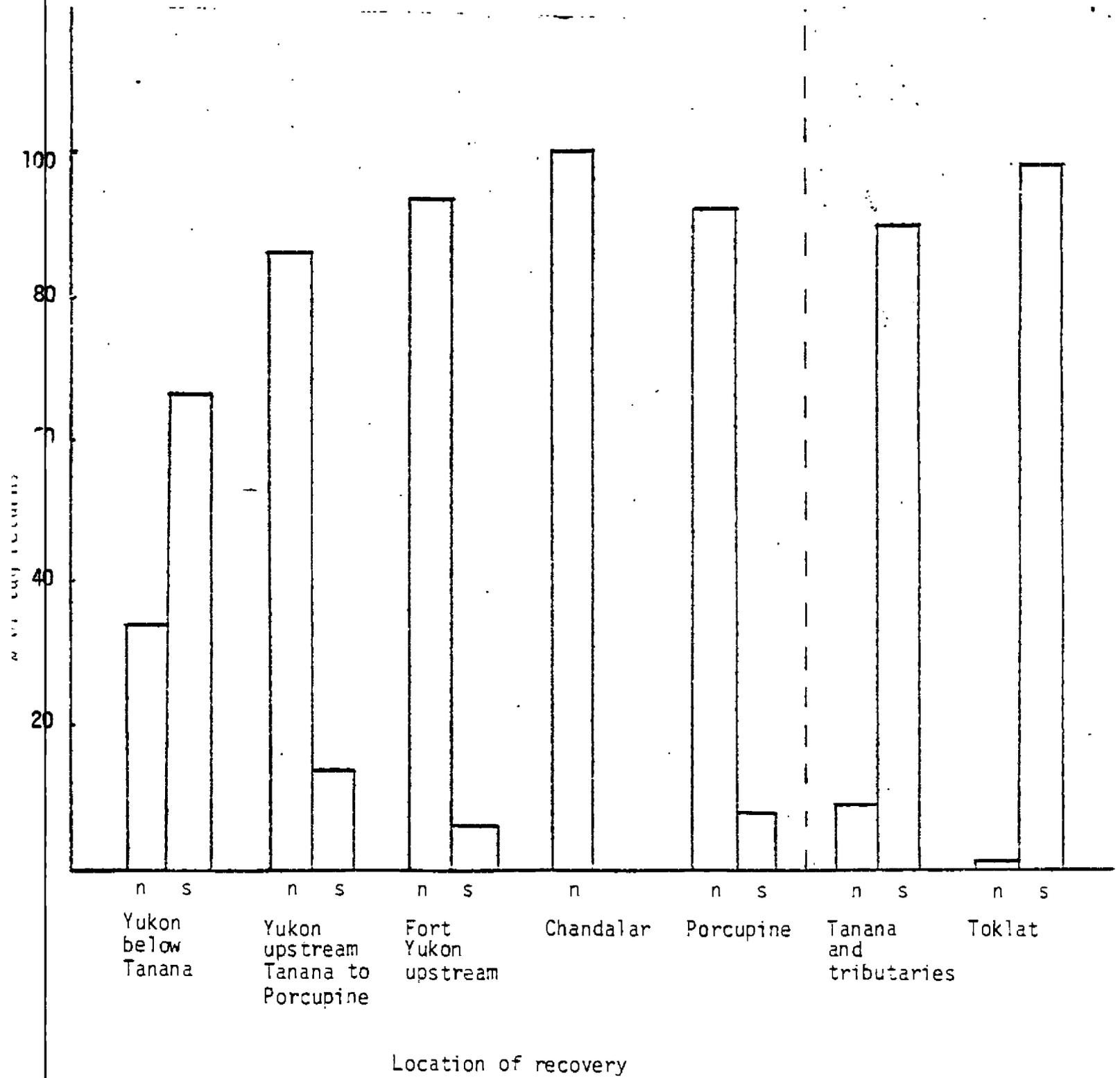
The numbers of fall chum recoveries by river mile and by major area of recovery for 1977 are given in Appendix Table 9. These recoveries are further summarized in Appendix Table 10 in combination with 1976 returns. Primarily, the combined data will be discussed.

The main Yukon below Tanana has accounted for 953 or 36% of the 2,590 1976 and 1977 tags recovered to date. Approximately 41% of the recoveries were tagged originally at the Galena north bank wheel, 39% were originally tagged at the Galena south bank wheel and 20% were tagged at the Ruby south bank wheel. The Ruby wheel site is above most of the Ruby fishery. This fishery accounted for 27% of 1976 recoveries.

For purposes of analysis, salmon recovered in the Yukon above Yukon River mile 695 are regarded as upper Yukon River stocks. Salmon recovered in the Tanana above mile 695 are regarded as Tanana River stocks. Only tag returns thus identified by major spawning tributary are presented in Appendix Table 10. This table shows that 76% of chum tagged at Galena fishwheel number one on the north bank in 1976 and recovered above the Tanana confluence were recovered in upper Yukon areas; 94% of chums tag recoveries for this site in 1977 were in upper Yukon areas. Eighty-seven percent of the 1976 Galena south bank recoveries and 88% of the 1977 recoveries made in the upper river were in the Tanana system. A total of 250 Ruby south bank tagged chums were recovered in 1977 in the upper Yukon or Tanana 86% of these were in the Tanana. Therefore, it appears that chum salmon migrating up the north bank of the Yukon from the Galena area upstream can be regarded as upper Yukon stocks; those salmon along the south bank can be regarded as Tanana stocks. Further, based on the Ruby and Galena south percentage returns in the Tanana of

Figure 4.

Percent of tag returns from 1977 fall chum by bank of tagging and major river area.



93 and 87% respectively, bank separation appears to become more distinct further upstream.

The separation of Yukon and Tanana stocks by north and south bank at time of tagging is shown in Figure 4. The important Toklat River spawning grounds produced 110 recoveries of which 107 (97.3%) were tagged at south bank sites.

Recoveries by major spawning areas compared to the respective escapements in 1977 are listed below:

<u>Spawning Stream</u>	<u>No. Recoveries</u>	<u>Total Escapements in thousands</u>	<u>Ratio</u> ^{1/}
Chandalar	6	5	1.2
Toklat	110	62	1.8
Fishing Branch	3	46	0.07
Delta	20	23	0.9
Sheenjek	3	33	0.09

1/ Ratio: Number tagged salmon recovered/thousand spawners estimated.

The paucity of recoveries from the Sheenjek and Fishing Branch rivers could be attributed to: 1) Failure to tag these stocks in proportion to their abundance due to different migration pathways such as along midriver sandbars or due to differences in migration timing; 2) Fishing mortality below spawning tributaries removed a higher percentage of these stocks than others; 3) Twice as many tagged chums were released on the south bank as on the north bank which reduces the chance of tag recovery by a similar percentage. [Based on tag returns from the fishery it is estimated that 2,700 tagged chums remained in the Tanana at the Kantishna River confluence; only 800 of the upper Yukon tagged chum still survived upon reaching the Porcupine confluence]; 4) Failure to spot tagged salmon during recovery efforts; 5) differential predation of tagged fish before recovery.

Most documented coho spawning in the upper Yukon drainage has been within Tanana tributaries. As discussed earlier, coho catches by project fishwheels seem to show that most coho follow the south bank. Tag

returns support this with 86% of tagged coho recovered (51 recoveries) coming from the Tanana system. Returns thus indicate that coho as well as chum become bank oriented well downstream from the Tanana confluence. Low catches of coho at the Galena south bank site with high catches at the Ruby south site indicate that salmon migratory patterns in respect to proximity to the bank may alter from one river location to another.

SWIMMING SPEED

Rate of chum salmon movement has been variously determined at 21 miles/day by Trasky (1971), 13.7 to 18.2 miles/day by Rampart studies (1972, 1973), and 13.7 to 16.2 miles/day in the 1976 and 1977 mid-Yukon studies. Perhaps the most realistic estimate of actual swimming rates to date is based on 23 chum salmon tagged at Galena tagging wheel two and recovered at the Ruby tagging wheel. The average rate of travel was 21.6 miles/day; nine individuals covered the distance between wheels at the rate of 30.5 miles/day. The average time at large for 1,560 chums tagged and recovered during 1976 and 1977, was 15.5 days; the average distance traveled for these fish was 197 miles (Appendix Tables 11 and 12).

RUN TIMING

According to the observations of Galena area fishermen, north bank catches generally peak earlier than south bank catches. This pattern was verified in the 1976 tagging effort. Tagging and tag return data for 1976 and 1977 were combined in a computer analysis to see if differences in run timing for discrete stocks could be detected.

Tag recoveries have been analyzed by date of tagging and location of recovery and expressed as a percentage of total season tag recoveries (unpublished data files AYK research). Appendix Tables 13, 14 and 15 shows the pattern of passage of salmon at a tagging site through time. Stocks were identified by location of tag recoveries. As an example,

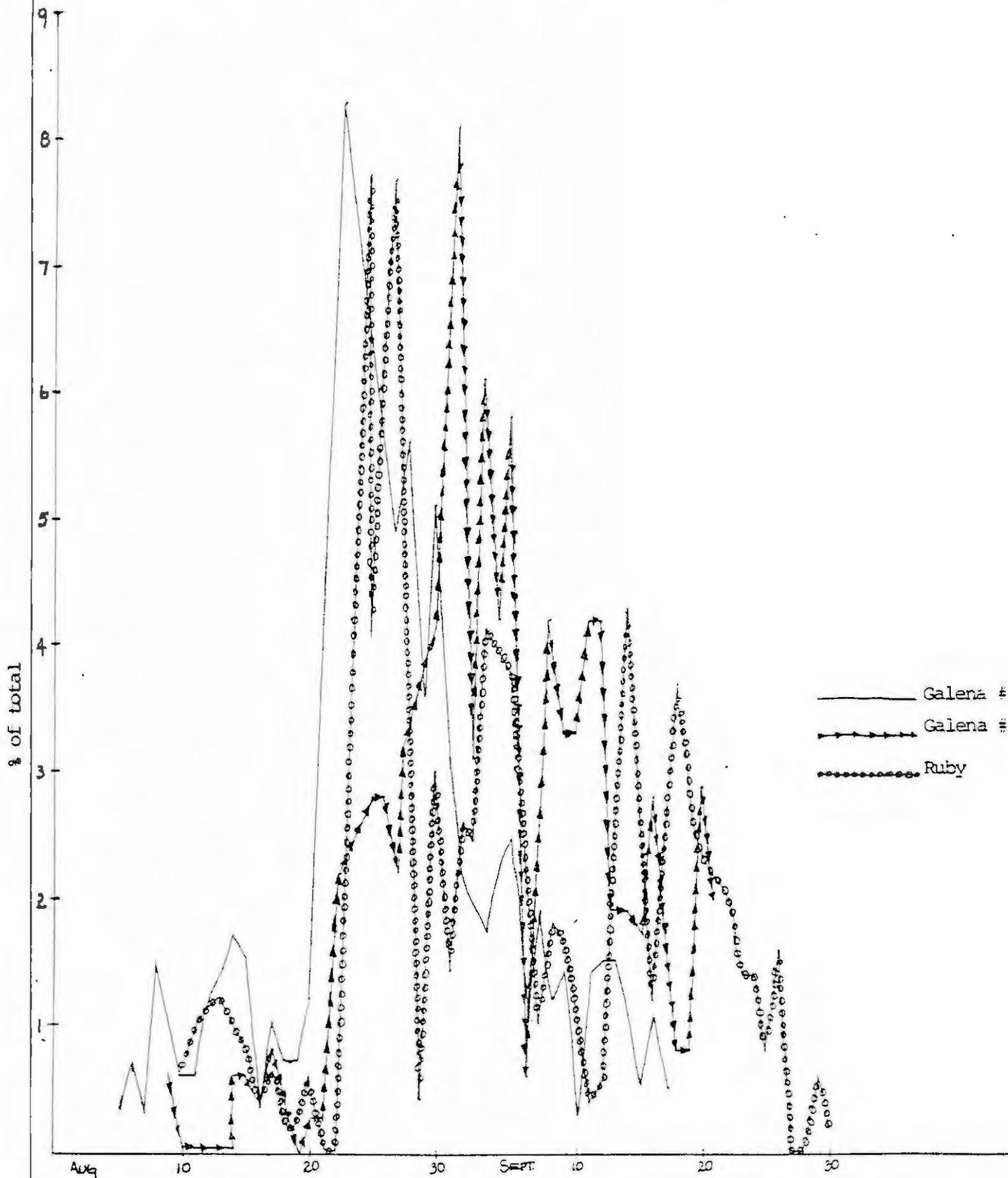
for the tagging, at fishwheel No. 1 Rampart rapids recovery location 119 or 64% of recoveries were from chums tagged in the eleven days from August 21 through 31.

The existing data do not allow temporal identification of specific stocks at the tagging sites. However, combining Tanana and upper Yukon stocks shows distinctive temporal patterns by major drainage systems. Seventy percent of the Galena north tags recovered in the upper Yukon were tagged between August 21 and September 5. Seventy-two percent of the Galena south tags recovered in the Tanana were tagged between August 25 and September 12. The period of peak chum migration past the Ruby site is much longer. Seventy-two percent of the tags recovered from this wheel in the Tanana River were tagged between August 24 and September 18. Data pertaining to run timing is summarized in graphic form in Figure 5 by fishwheel tagging site. It is seen that Galena north run timing, identified as largely upper Yukon by recoveries, peaked August 23, the earliest of the three sites. Two similar high peaks on August 25 and 27 are evident at the Ruby site. Tanana stocks at the Galena south, identified by recoveries, peaked on September 1. The indicated temporal separation of Tanana and upper Yukon stocks at the Galena wheels is approximately nine days.

The timing of passage of fall chum stocks destined for the upper Yukon and Tanana systems by the tagging sites is presented in Figure 6. Eighty percent of the upper Yukon stocks had passed the Galena north site by September 2; 80% of Tanana stocks had passed the Galena south wheel by September 11; 80% run of Tanana stocks had passed the Ruby south wheel by September 16.

It thus appears that upper Yukon and Tanana stocks appear to move upriver by the Galena tagging sites as temporally distinct and identifiable runs. The bulk of the upper Yukon run may have passed the Galena area

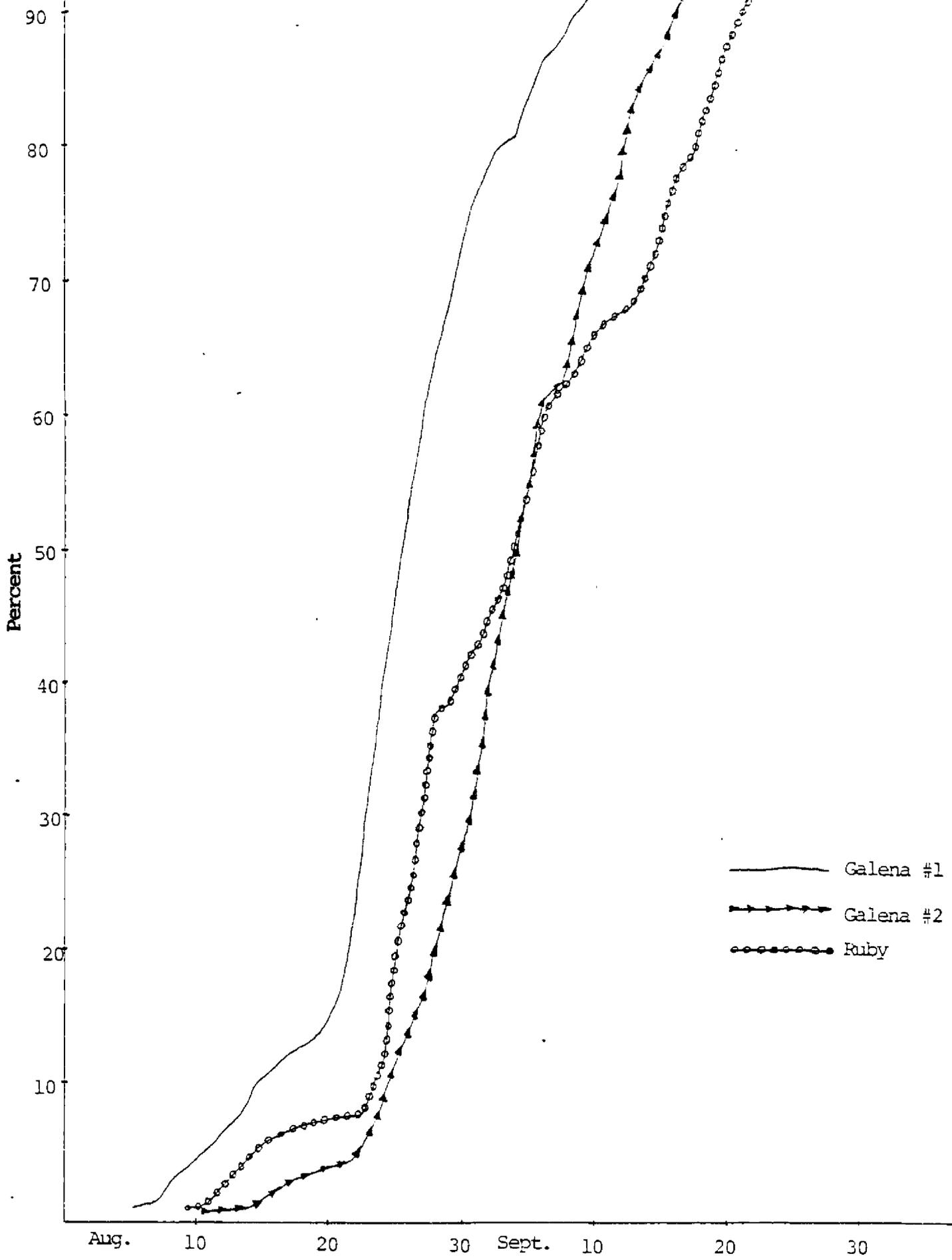
Figure 5. Comparative run timing of fall salmon by the Galena and Ruby fishwheels as indicated by daily tag returns in river areas of harvest for 1976 and 1977.



Based on recoveries in the Tanana for wheels 2 and 3 and the upper Yukon for wheel 1.

Comparative run timing of fall chum salmon by the Galena and Ruby fishwheels as indicated by cumulative daily tag returns in river areas of harvest for 1976 and 1977.

Figure 6.



Based on occurrence in returns for wheels 1 and 2 and in the upper Yukon for wheel 1

as much as nine days prior to the passage of a corresponding level in the Tanana run. Little difference in timing between the Galena north and Ruby sites was seen. Relative timing of runs has been demonstrated to fluctuate rather widely between years; this makes an average date of passage for north bank and south bank runs difficult to estimate for the purposes of practical fisheries management.

The fall chum entry pattern into the lower Yukon appears, from test fishing data, to exhibit more pronounced and distinct peaks than in the upstream fisheries (Figure 7). It is likely that these high peaks in abundance are modified by the cropping effect of the fisheries. The correlation of peaks in abundance in the lower Yukon and mid-Yukon would appear to be very difficult to make on the basis of existing data.

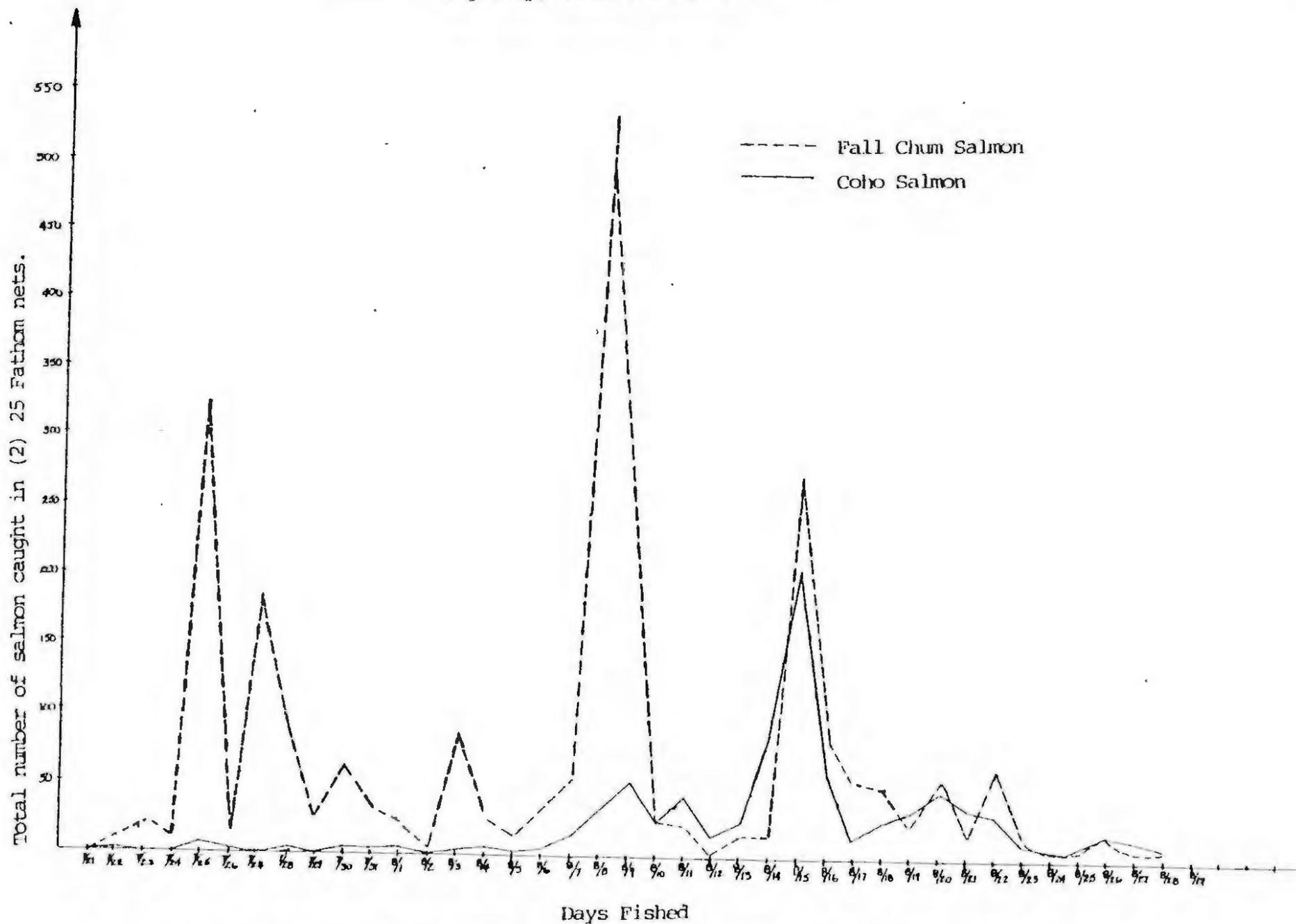
RUN POPULATION ESTIMATION

Hayes (1964) estimated the fall chum population above Rampart to be 131,000 in 1962. The best indexes available to total fall chum abundance in the Yukon system for 1974 and 1975 combines observed escapement and commercial and subsistence harvests and were, respectively, 492 and 971 thousand (Mauney, 1976).

A simple Petersen population estimate of 149,000 fall chums was made for the upper Yukon, above Galena, based on the 1976 tagging and harvest (Mauney, 1977). A 51% rate of exploitation by the upstream fisheries was indicated. The overall rate of exploitation reached 76% in 1976 with the lower Yukon harvest included (Appendix Table 16).

A Petersen estimate of the 1977 fall chum run for the upper Yukon (above Galena) and Tanana combined was 287,849. The rate of exploitation for this population was 37%. The 1977 population estimate for the entire Yukon was 513,000 and rate of exploitation was 65%.

Figure 7. Chum and Coho salmon run timing at Big Eddy, Yukon River, 1977.



1) Alaska Department of Fish and Game test fishing 24 hours a day.

Observed escapement in 1977 totaled to 116,000. The sum of total harvest and escapement for this year was 71,000 less than the calculated total population level.

Surveys of the upper Klwane River (Y.T.) area by staff personnel in late October found several thousand spawning chum in this area. Other areas of potentially substantial, undocumented populations include the Minor Branch of the Porcpine^u, the White, and the Black rivers.

A simple Petersen population estimate was made of the Tanana fall chum population from salmon tagged at Galena wheel number 1 and recovered at the Ruby wheel number 3. The population estimate was 115,000. The Tanana system known harvest and escapement for 1977 totals ~~was~~ 117,000.

The 1977 return of fall chums was substantially above that expected^b.
Based on parent year (1974) strength.

SUMMARY

Fall chum and coho salmon were captured by fishwheel and tagged upstream of Galena at River Mile 555 on the north bank of the Yukon and at River Mile 540 on the south bank of the Yukon in 1976 and again 1977. An additional tagging wheel was operated in 1977 upstream of Ruby at River Mile 601.

Tagging was initiated at the Galena north bank wheel on August 5 and terminated at the Ruby south wheel on September 30 in 1977. Initial tagging in 1976 was on August 10 and termination was on September 17. The 80% run level for 1977 as indicated by numbers of chum tagged was reached on August 30, fishwheel 1; September 15, fishwheel 2; and September 19, fishwheel 3. In 1976 the 80% level of chums tagged was reached on August 31 and September 3 for wheels 1 and 2 respectively. The 80% run level for coho tagged in 1977 was reached on September 16.

Total numbers of salmon tagged by species and location of tagging for 1976 and 1977 combined were:

		1976	1977	Total
Chum				
Wheel 1	Galena N.	545	1,841	2,386
2	Galena S.	672	1,208	1,880
3	Ruby S.	<u>0</u>	<u>2,309</u>	<u>2,309</u>
	Total	1,217	5,358	6,575
Coho				
Wheel 1	Galena N.	9	12	17
2	Galena S.	5	9	14
3	Ruby S.	<u>0</u>	<u>207</u>	<u>207</u>
	Total	14	228	242

A total of 776 and 811 chums was tagged in 1973 and 1972 respectively in a Rampart based tagging study.

The rate of returns for the 1972 and 1973 tagged chum totaled 7% and 16% respectively. Tag returns for 1976 to date have totaled 50% for chum and 42% for coho salmon. Tag returns for 1977 to date have totaled 37% and 22 for chum and coho respectively.

Within the Tanana system, the Manley fishery has accounted for 42%, and Nenana 33% of chums tagged at the Galena south site. For the Ruby south site, recoveries in the Tanana system have been 51% Manley and 29% Nenana.

The main harvest areas and corresponding percent of returned tags in the upper Yukon include: Rampart Rapids (31%), Rampart Village (29%), Hess Creek (7%) and Stevens Village (7%).

For 1976 and 1977 data combined 62% of chum tagged have been male and 38% have been female. No difference has been observed in the numbers of observed and expected returns by sex.

Approximately 67% of coho tagged in 1977 were males. Males have accounted for a disproportionate 77% of recoveries for this species.

Fall chums were predominantly 4₁ in 1977 ranging from a high of 88% for Delta spawning ground samples to a low of 65% for Fishing Branch samples. Spawning ground samples in 1976 showed ages 5₁ and 3₁ to be well represented comprising 53 and 42% of Sheenjek and Toklat samples respectively.

Recoveries of tagged salmon by recovery activity for 1976 and 1977 combined were 38% commercial, 50% subsistence, and 5% spawning grounds. Recoveries by gear, years combined, were 23% set gillnet, 69% fishwheel, and 5% spawning grounds.

For the years 1976 and 1977 combined an average of 94% of the Galena north bank tag recoveries identified as to drainage destination were recovered within the upper Yukon above the Tanana confluence. Tags recovered from Galena south and Ruby, identified as to drainage destination, ran 86 and 94% Tanana recoveries over this two year period.

Combined spawning ground recoveries for both years:

Chandalar 6
Sheenjek 6
Fishing Branch 3
Toklat 110
Delta 20

Toklat recoveries have been 97% of south bank tagging origin.

An average swimming rate of 21.6 miles/day was found for fall chums in 1977. A significant number of chums were shown to migrate at a rate of up to 30 miles/day.

On the basis of tag return data upper Yukon and Tanana stocks appear to pass through the Galena tagging areas at different times. Combined 1976 and 1977 data indicated that 80% of upper Yukon stocks had

passed by the Galena north wheel by September 2; the 80% run level of Tanana stocks by the Galena south wheel was reached on September 11.

Forty-four percent of the coho recovered in 1977 were from the Tanana system. Coho recovery below the Tanana-Yukon confluence totaled seven.

Population estimates of Yukon stocks were made using the 1976 and 1977 tagging studies. The simple Petersen method was used to estimate total numbers in the upper Yukon and Tanana. Total drainage populations were derived by adding lower river harvests to the upper river estimates and are as follows:

Year	Total Harvest	Observed Escapement	Calculated Population	Undocumented Escapement	Rate of Exploitation
Upper Yukon (Including Tanana)					
1976	72,000	78,000	149,000	0	0.51
1977	106,000	116,000	288,000	67,000	0.37
Tanana					
1977	61,000	56,000	115,000	-	0.53
Entire Yukon					
1976	238,000	78,000	316,000	0	0.756
1977	333,000	116,000	513,000	71,000	0.65

Based on strong 1974 parent year escapements a strong return of fall chums is anticipated in 1979.

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APPENDIX

Appendix Table 1. Yukon fall chum tagging 1972 and 1973, at Rampart.

Date	1973			1972		
	No. Tag	Cum. No.	Cum. %	No. Tag	Cum. No.	Cum %
8-25	2	2	0			
26	18	20	3	3	3	0
27	39	59	8	12	15	2
28	62	121	16	18	30	4
29	43	164	21	20	50	6
30	60	224	29	3	53	6
31	85	309	40	15	68	8
9-1	64	373	48	22	90	11
2	8	381	49	41	131	16
3	46	427	55	22	153	19
4	31	458	59	29	182	22
5	53	511	66	21	203	25
6	46	557	72	20	223	27
7	17	574	74	25	248	31
8	30	604	78	21	269	33
9	39	643	83	20	289	36
10	49	692	89	18	307	38
11	12	704	91	12	319	39
12	9	713	92	19	338	42
13	9	722	93	22	360	44
14	24	746	96	16	376	46
15	7	753	97	-	376	46
16	2	755	97	-	376	46
17	4	759	98	19	395	49
18	3	762	98	52	447	55
19	0	762	98	52	499	62
20	2	764	98	73	572	71
21	7	771	99	52	624	77
22	3	774	99	48	672	83
23	1	775	99	51	723	89
24	0	775	99	50	773	95
25	2	777	100	35	808	99
26				3	811	100
27						
Total	777			811		

Appendix Table 2. Rate of chum salmon movement ^{1/}

Wheel	Year	Av. No. Days at Large	Av. No. Miles Traveled	Miles per Day	n
1	1977	12.3	199.1	16.2	472
2	1977	13.1	193.6	14.7	223
3	1977	12.3	173.5	14.2	332
1,2,3	1977	12.5	189.6	15.2	1,027
1	1976	12.4	169.5	13.7	157
2	1976	10.3	162.9	15.8	239
1,2,3	76,77	12.1	182.9	15.1	1,423
1,2	1976	11.1	165.6	14.9	396
2,3	1977	12.6	181.6	14.4	555
1,2 recov at wheel 3	1977	3.2	69.0	21.6	23
Rampart	1973	19.9	362	18.2	46
Rampart	1972	23.0	316	13.7	33

^{1/} Excludes spawning ground recoveries and negative miles traveled.

Appendix Table 3. Numbers of chum salmon tagged by wheel and date.

Date	1977		Wheel No. 2		Wheel No. 3	
	Wheel No. 1 No.	%	No.	%	No.	%
Aug 5	8	0.4				
6	26	1.8	2	0.2		
7	27	3.3	8	0.8		
8	33	5.1	5	1.2		
9	49	7.8	16	2.6		
10	46	10.3	3	2.8	12	0.5
11	36	12.2	15	4.0	22	1.5
12	36	14.2	11	5.0	36	3.0
13	37	16.2	6	5.5	24	4.1
14	30	17.8	7	6.0	24	5.1
15	22	19.0	4	6.4	27	6.3
16	11	19.6	5	6.8	15	6.9
17	12	20.2	3	7.0	11	7.4
18	11	20.8	-	-	3	7.5
19	19	21.9	2	7.2	4	7.7
20	41	24.1	13	7.4	9	8.1
21	81	28.5	10	8.3	7	8.4
22	111	34.5	22	10.1	6	8.7
23	134	41.8	39	13.3	29	9.9
24	146	49.7	74	19.4	70	13.0
25	129	56.7	60	24.4	110	17.7
26	125	63.5	57	29.1	132	23.5
27	112	69.6	62	34.2	165	30.6
28	95	74.8	48	38.2	139	36.6
29	52	77.6	35	41.1	38	38.3
30	51	80.3	17	42.5	51	40.5
31	47	82.9	20	44.1	25	41.6
Sep 1	31	84.6	34	46.9	50	43.7
2	33	86.4	22	48.8	67	46.6
3	10	86.9	35	51.7	79	50.1
4	17	87.8	19	53.2	72	53.2
5	36	89.8	19	54.8	72	56.3
6	12	90.4	-	-	40	55.0
7	28	92.0	29	57.2	30	59.3
8	12	92.6	35	60.1	43	61.2
9	13	93.3	28	62.4	36	62.8
10	0	93.3	25	64.5	32	64.2
11	24	94.6	40	67.8	19	65.0
12	23	95.9	39	71.0	15	65.6
13	25	97.2	28	73.3	30	65.9
14	14	98.0	32	76.0	59	69.5
15	11	98.6	27	78.2	47	71.5
16	13	99.3	43	81.7	42	73.3
17	13	100.0	43	85.3	64	76.1
18		100.0	38	88.4	55	78.5
19		100.0	26	90.6	41	80.3
20		100.0	66	96.0	92	84.3
Oct 1		100.0	48	100.0	52	82.0
2		100.0			68	89.9
3		100.0			53	92.2
4		100.0			17	94.2
5					51	96.4
6					43	98.3
7		100.0			16	99.0
8		100.0			6	99.3
9		100.0			9	99.7
30		100.0			3	100.0
Total	1,341	100.0	1,208	100.0	2,309	100.0

Appendix Table 4. Yukon drainage salmon lengths, 1977^{1/}

Area	Sex	n	\bar{x}	s^2	Range	df	t
<u>Chum Salmon</u>							
Anvik 1977	Male	151	544	977	514-697	180	7.84**
	Female	31	547	888	474-606		
Toklat 1977	Male	133	605	767	530-657	205	5.46**
	Female	74	577	1,225	505-657		
Sheenjek 1977	Male	85	613	1,225	520-687	210	7.27**
	Female	127	579	708	513-685		
Fishing Branch 1977	Male	37	608	882	530-664	83	6.3 **
	Female	48	567	859	502-622		
Galena #2 1977 ^{2/}	Male	761	654	1,862	532-674	1,206	16.7 **
	Female	447	618	1,601	522-670		
Galena #1 1977 ^{2/}	Male	1,077	666	1,478	549-686	1,722	21.4 **
	Female	647	626	1,394	502-660		
Ruby 1977 ^{2/}	Male	1,397	664	1,572	584-800	2,287	26.9 **
	Female	892	621	1,332	534-760		

Measurement comparisons of Fall Chum^{3/}

Tip of snout to fork of tail	456	667	Ratio 1.101
Mid-eye to fork of tail	456	606	

Coho Salmon

Ruby	Male	71	626	2,560	480-724	108
Ruby	Female	39	627	829	530-673	

^{1/} Length comparisons to nearest mm mid-eye to fork of tail unless otherwise indicated.

^{2/} Length measurement tip of snout to fork of tail.

^{3/} Measurements taken from catches of fishwheels adjacent to wheels of tagging.

Appendix Table 5. Age and sex composition of Yukon fall chum salmon escapement samples for the Sheenjek, Toklat, Fishing Branch and Delta Rivers, 1977 ^{1/}

Fishing Branch										
Dates of Samples of	Combined Age Classes Sex	Age Classes		Age 3 ₁		Age 4 ₁		Age 5 ₁		
		No.	%	No.	%	No.	%	No.	%	
10/12-14	Male	37	46.	11	14.	23	29.	3	4.	
	Female	43	54.	14	17.	29	36.	0	0.	
	Total	80	100.	25	31.	52	65.	3	4.	
Sheenjek										
Dates of Samples of	Combined Age Classes Sex	Age Classes		Age 3 ₁		Age 4 ₁		Age 5 ₁		
		No.	%	No.	%	No.	%	No.	%	
10/3-10/27	Male	80	45.	6	3.	55	31.	19	11.	
	Female	98	55.	14	8.	74	42.	10	6.	
	Total	178	100.	20	11.	129	73.	29	17.	
Toklat										
Dates of Samples of	Combined Age Classes Sex	Age Classes		Age 3 ₁		Age 4 ₁		Age 5 ₁		
		No.	%	No.	%	No.	%	No.	%	
10/26-11/4	Male	131	66.	25	13.	96	49.	10	5.	
	Female	66	34.	27	14.	39	20.	0	0.	
	Total	197	100.	52	27.	135	69.	10	5.	
Delta										
Dates of Samples of	Combined Age Classes Sex	Age Classes		Age 3 ₁		Age 4 ₁		Age 5 ₁		
		No.	%	No.	%	No.	%	No.	%	
10/6-11/16	Male	233	53.	31	7.	200	45.	2	1.	
	Female	209	47.	16	4.	190	43.	3	1.	
	Total	442	100.	47	11.	390	88.	5	1.	

^{1/} Carcass sample.

Appendix Table 6. Numbers of coho salmon tagged by date, 1977.

<u>Date</u>	<u>No.</u>	<u>No. Cum</u>	<u>% Cum</u>
Aug 22	1	1	71
23	1	2	71
24	1	3	1
25	1	4	2
26	5	9	4
27	6	15	7
28	11	26	11
29	7	33	14
30	4	37	16
31	4	41	18
Sept 1	4	45	20
2	14	59	26
3	21	80	35
4	14	94	41
5	22	116	51
6	4	120	53
7	10	130	57
8	15	145	64
9	14	159	70
10	3	162	71
11	0	162	71
12	2	164	72
13	7	171	75
14	2	173	76
15	5	178	78
16	8	186	82
17	7	193	85
18	3	196	86
19	3	199	87
20	12	211	93
21	5	216	95
22	2	218	96
23	0	218	96
24	3	221	97
25	0	221	97
26	2	223	98
27	3	226	99
28	1	227	99
29	0	227	99
30	<u>1</u>	228	100
Total	228		

1/ Numbers of coho tagged by fishwheel run: Site 1 12
 Site 2 9
 Site 3 207

Appendix Table 7. Miscellaneous fish species taken by project fishwheels listed by wheel of capture, 1977 1/

<u>Fish Species</u>	<u>Wheel</u>			<u>Total</u>	<u>% 3/</u>
	<u>Galena 1</u>	<u>Galena 2</u>	<u>Ruby</u>		
Cisco (<u>Coregonus sp.</u>)	273	195	-	468	33
Broad whitefish (<u>Coregonus nasus</u>)	43	95	-	138	10
Humpback (<u>Coregonus clupeaformis</u>)	332	460	-	792	57
Unidentified <u>2/</u>	-	-	639	639	
Total	648	750	639	2,037	
Sheefish (<u>Stenodus lencichthys nelma</u>)	9	2	1	12	
Burbot (<u>Lofa lota</u>)	12	5	18	35	
Sucker (<u>Catostomus catostomus</u>)	0	1	68	69	
Char (<u>Salvelinus alpinus</u>)	44	59	40	143	

1/ For daily totals for wheel see data files.

2/ Ruby whitefish catches not broken down by species.

3/ For whitefish species percent of knowns only (1,398).

Appendix Table 8. List of non-salmon species tagged by project fishwheels, 1977.

Tagging Site	Date Tagged	Species	Tag #
Galena #1	9/17/77	Sheefish	25659
. . .	9/17/77	Burbot	25671
. . .	9/9/77	Whitefish	25401
Galena #2	9/4/77	Sheefish	16950
. . .	9/15/77	. . .	20306
. . .	9/18/77	. . .	
Ruby	8/18/77	Sheefish	23,348

Appendix Table 9. Fall chum tag recoveries by wheel of tagging, river, and river mile of recovery for 1976 and 1977 combined, ^{1/}/_{2/}/_{3/}

Location	Mile	Wheel 1		Wheel 2		Wheel 3		Total	
		No.	% ^{1/}	No.	% ^{1/}	No.	% ^{1/}	No.	%
Yukon									
Unknown	0							9	
Downstream	1-529								
Galena		20	1.9	7	0.9	6	0.8	33	1.3
Galena Lower	530-554	57	5.5	43	5.5	2	0.3	102	4.0
Galena Upper	555-579	62	6.0	15	1.9	0	0	77	3.0
Ruby	580-601	46	4.5	175	22.3	29	3.9	250	9.7
Birches	602-663	4	0.4	1	0.1	1	0.1	6	0.2
Kallands	664-684	55	5.3	62	7.9	67	9.1	184	7.2
Tozitna	685-692	13	1.3	34	4.3	74	10.1	121	4.7
Tanana Village	693-695	129	12.5	33	4.2	12	1.6	174	6.8
Innoko		1	0.1	0	0	1	0.1	2	0.1
Koyukuk		2	0.2	1	0.1	1	0.1	4	0.2
Subtotal Lower Yukon		389	40.8 ^{2/}	371	38.9 ^{2/}	193	20.2 ^{2/}	953	100
Downstream Rampart Rapids	696-719	89	8.6	8	1.0	5	0.7	102	4.0
Rampart Rapids	720-740	200	19.4	8	1.0	16	2.2	224	8.6
Rampart Village	741-774	199	19.3	15	1.9	12	1.5	2.6	8.3
Hess Creek	775-800	40	3.9	9	1.0	0	0	48	1.9
Stevens Village	801-862	41	4.0	6	0.8	2	0.3	49	1.9
Beaver	863-950	0	0	3	0.4	0	0	3	0.1
Ft. Yukon	951-1050	18	1.7	2	0.3	0	0	20	0.8
Circle	1051-1110	4	0.4	0	0	0	0	4	0.2
Woodchooper	1111-1200	5	0.4	0	0	0	0	5	0.2
Eagle	1201-1224	13	1.3	1	0.1	0	0	14	0.5
Dawson City	1225-1835	12	1.2	0	0	0	0	12	0.5
Chandler	982	6	0.6	0	0	0	0	6	0.2
Porcupine	1002	5	0.5	0	0	0	0	5	0.2
Sheenjek	1954	3	0.3	1	0.1	0	0	4	0.2
Fishing Branch	1600	2	0.2	1	0.1	0	0	3	0.1
Subtotal Upper Yukon		590	87.2 ^{2/}	53	7.8 ^{2/}	34	5.0 ^{2/}	677	100
Tanana									
Lower Tanana	695-715	0	0	2	0.3	12	1.6	14	0.5
Manley Hot Springs	716-775	20	1.9	162	20.7	260	35.4	442	17.3
Kantishna River	776-783	0	0	4	0.5	12	1.6	16	0.6
Hinto	784-850	2	0.2	4	0.5	6	0.8	12	0.5
Menana	851-866	26	2.5	119	15.2	146	19.9	291	11.4
Wood River	867-900	1	0.1	3	0.4	0	0	4	0.2
Fairbanks	901-950	0	0	4	0.5	5	0.7	9	0.4
Upstream Fairbanks	951-1297	0	0	1	0.1	1	0.1	2	0.1
Toklat		3	0.3	57	7.3	50	6.8	110	4.3
Delta		0	0	4	0.5	16	2.2	20	0.8
Subtotal Tanana		52	5.7 ^{2/}	360	39.1 ^{2/}	508	55.2 ^{2/}	920	100
Grand Total		1,031	40.4	784	30.7	735	28.9	2,590	100

^{1/} Percent of grand total recoveries excluding unknowns

^{2/} Percent of subtotal

^{3/} Revised through September, 1978

Appendix Table 10. Yukon fall chum salmon tag recovery locations by wheel of tagging for 1976 and 1977.

Recovery Location	1976		1977	
	No. Recov.	% of Recov.	No. Recov.	% of Recov.
UPPER YUKON				
North Bank Tagging				
Downstream				
Rampart Rapids	5	5	84	15
Rampart Rapids	10	10	190	32
Rampart Village	38	39	151	25
Hess Creek	11	11	29	5
Stevens Village	3	3	38	7.0
Beaver	0	0	0	0
Ft. Yukon	2	2	16	2.9
Circle	2	2	2	0.4
Woodchopper	0		5	0.4
Eagle	1	1	12	2.0
Dawson City	1	1	12	1.7
Chandalar	2	2	4	0.6
Porcupine	0		5	0.9
Sheenjek	0		3	0.6
Fishing Branch	1	.1	1	0.1
Subtotal	76	76	553	94
South Bank Tagging				
Downstream				
Rampart Rapids	3	2	5	2
Rampart Rapids	2	1	6	2
Rampart Village	8	5	8	3
Hess Creek	1	.5	7	3
Stevens Village	1	.5	5	2
Beaver	3	2	0	0
Ft. Yukon	0	0	2	1
Circle	0	0	0	0
Woodchopper	0	0	0	0
Eagle	1	5	0	0
Dawson City	0	0	0	0
Chandalar	0	0	0	0
Porcupine	0	0	0	0
Sheenjek	0	0	1	.5
Fishing Branch	1	.5	0	0
Subtotal	20	24	34	6
TOTAL	96	100	587	100

Appendix Table 10. (Cont'd) Yukon fall chum salmon tag recovery locations by wheel of tagging for 1976 and 1977

Recovery Location	1976		1977	
	No. Recov.	% of Recov.	No. Recov.	% of Recov.
TANANA RIVER				
North Bank Tagging				
Lower Tanana	0	0	0	0
Manley Hot Springs	9	9	11	2.0
Kantishna River	12	12	0	0
Minto	0	0	2	0.4
Nenana	0	0	14	3.0
Wood River	0	0	1	0.1
Fairbanks	0	0	0	0
Upstream Fairbanks	0	0	0	0
Toklat	1	1	2	0.4
Delta	0	0	0	0
Subtotal	22	13	30	12
South Bank Tagging				
Lower Tanana	0	0	2	1
Manley Hot Springs	52	31	110	44
Kantishna River	58	35	4	2
Minto	0	0	4	2
Nenana	0	0	61	24
Wood River	3	2	0	0
Fairbanks	3	2	1	.5
Upstream Fairbanks	0	0	1	.5
Toklat	27	16	30	12
Delta	1	.5	3	1
Subtotal	144	87	216	88
TOTAL	166	100	246	100

Appendix Table 11. Average number of days at large by location of recovery
Yukon fall streams 1976 and 1977. 1/

<u>Recovery Area</u>	<u>Mean Days</u>	<u>Variance</u>	<u>N</u>
Galena	5.67	57.18	(18)
Galena	4.75	37.31	(28)
Ruby	6.36	44.34	(134)
Birches	8.67	9.87	(6)
Kallands	8.33	52.08	(112)
Tozitna	7.37	15.48	(30)
Tanana Vil	9.06	22.71	(160)
Dwnsr. R. Rapids	9.71	22.84	(99)
Rampart Rapids	10.16	22.46	(150)
Rampart Vil.	15.47	99.66	(116)
Hess Creek	11.57	8.70	(28)
Stevens Vil.	20.25	103.76	(24)
Beaver	18.33	32.33	(3)
Ft. Yukon	29.92	104.24	(13)
Circle	22.00	8.00	(2)
Eagle	26.10	38.54	(10)
Dawson City	36.11	30.11	(9)
Innoko	63.00	0.00	(1)
Koyukuk	18.33	72.33	(3)
Lower Tanana	4.00	0.00	(1)
Manley Hot Spr.	11.83	19.64	(240)
Kantishna Riv.	11.44	16.00	(16)
Minto	16.50	6.33	(4)
Nenana	18.80	39.31	(193)
Wood River	18.75	47.58	(4)
Fairbanks	19.78	29.94	(9)
Upstream Fbks	58.50	1200.50	(2)
Toklat	50.55	74.29	(108)
Delta	54.40	211.73	(20)
Chandalar	29.00	11.50	(5)
Porcupine	19.80	11.20	(5)
Sheenjek	31.50	57.67	(4)
Fishing Branch	45.00	7.00	(3)
Combined	15.49	187.59	(1,560)

1/ Excluding negative recovery data and spawning ground recoveries.

Appendix Table 12. Average numbers of miles traveled by location of recovery Yukon fall chums 1976 and 1977. 1/

<u>Recovery Area</u>	<u>Mean Miles</u>	<u>Variance</u>	<u>N</u>
Galena	9.00	7.41	(18)
Galena	12.96	97.59	(28)
Ruby	45.23	139.32	(134)
Birches	70.17	410.17	(6)
Kallands	110.51	721.59	(112)
Tozitna	105.80	757.75	(30)
Tanana Vil	139.46	187.91	(160)
Dwnsr. R. Rapids	145.20	170.51	(99)
Rampart Rapids	171.13	221.04	(150)
Rampart Vil	204.37	150.25	(116)
Hess Creek	231.39	33.80	(28)
Stevens Vil	290.71	249.09	(24)
Beaver	372.33	176.33	(3)
Ft. Yukon	447.08	40.24	(13)
Circle	530.50	1200.50	(2)
Eagle	662.20	21.29	(10)
Dawson City	742.89	461.11	(9)
Innoko	279.00	0.00	(1)
Koyokuk	202.33	12400.33	(3)
Lower Tanana	96.00	0.00	(1)
Manley Hot Spg	194.53	877.37	(240)
Kantishna Riv	197.25	744.20	(16)
Minto	210.00	484.00	(4)
Nenana	288.75	923.42	(193)
Wood River	354.75	110.25	(4)
Fairbanks	339.00	1108.50	(9)
Upstream Fbks	427.50	8064.50	(2)
Toklat	304.35	657.82	(108)
Delta	442.20	626.69	(20)
Chandalar	465.60	76.30	(5)
Porcupine	451.80	19.20	(5)
Sheenjok	542.75	56.25	(4)
Fishing Branch	1050.00	75.00	(3)
Combined	197.26	13828.41	(1560)

1/ Excluding negative and spawning ground recovery data.

* Appendix Table 13. Yukon tagged chum recovery summary, Yukon watershed above Tanana, 1976 and 1977, wheel 1

Area	Downsr. Rampart Rapids	Rampart Rapids	Rampart Village	Hess Creek	Stevens Village	Ft. Yukon	Circle	Wood- chopper	Eagle	Dawson City	Chanda- jar	Porcu- pine	Sheen- jak	Fishing Branch	%	Cum. %
5 Aug	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3
6 Aug	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0.7	1.0
7 Aug	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.3
8 Aug	1	0	8	0	0	0	0	0	0	0	0	0	0	0	1.5	2.8
9 Aug	0	3	1	1	0	1	0	0	0	0	0	0	0	0	1.0	3.8
10 Aug	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0.8	4.6
11 Aug	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0.5	5.1
12 Aug	0	5	2	0	0	0	0	0	0	0	0	0	0	0	1.2	6.3
13 Aug	2	1	4	0	0	1	0	0	0	0	0	0	0	0	1.4	7.7
14 Aug	3	3	3	0	1	0	0	0	0	0	0	0	0	0	1.7	9.4
15 Aug	0	2	2	3	1	0	0	0	0	0	0	1	0	0	1.5	10.9
16 Aug	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.3	11.2
17 Aug	1	3	1	1	0	0	0	0	0	0	0	0	0	0	1.0	12.2
18 Aug	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0.7	12.9
19 Aug	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0.7	13.6
20 Aug	4	2	0	0	1	0	0	0	0	0	0	0	0	0	1.2	14.8
21 Aug	6	5	3	0	2	1	0	0	1	1	1	3	0	0	3.9	18.7
22 Aug	5	11	8	1	2	2	0	1	1	1	0	0	0	0	5.4	24.1
23 Aug	4	19	14	1	6	1	0	0	1	0	0	0	1	2	8.3	32.4
24 Aug	12	16	10	1	6	0	0	0	1	0	0	0	0	0	7.8	40.2
25 Aug	12	13	5	2	6	0	1	0	1	3	2	0	0	0	7.6	47.8
26 Aug	5	12	9	3	3	1	0	0	2	0	0	0	0	0	5.9	53.7
27 Aug	5	9	8	1	2	1	0	0	1	0	0	0	1	0	4.9	58.6
28 Aug	4	10	9	3	0	2	0	0	2	2	1	0	0	0	5.6	64.2

Appendix Table 13. Yukon tagged chum recovery summary, Yukon watershed above Tanana, 1976 and 1977, wheel 1 (Continued).

Area	Downsr. Rampart Rapids	Rampart Rapids	Rampart Village	Hess Creek	Stevens Village	Ft. Yukon	Circle	Wood- chopper	Eagle	Dawson City	Chanda- lar	Porcu- pine	Sheen jek	Fishing Branch	%	Cum.
Date																
29 Aug	2	4	7	2	3	0	0	0	1	1	0	1	0	0	3.6	67.8
30 Aug	2	11	8	2	2	1	1	1	1	1	0	0	0	0	5.1	72.9
31 Aug	2	9	7	0	0	1	0	0	0	0	0	0	0	0	3.2	76.1
1 Sep	0	4	5	2	0	0	0	0	0	1	1	0	0	0	2.2	78.3
2 Sep	4	2	1	1	2	1	0	0	0	0	0	0	0	0	1.9	80.2
3 Sep	2	1	5	1	0	0	0	0	0	0	1	0	0	0	1.7	81.9
4 Sep	2	3	6	0	0	1	1	0	0	0	0	0	0	0	2.2	84.1
5 Sep	1	1	5	3	3	1	0	0	0	0	0	0	1	0	2.5	86.6
6 Sep	0	0	5	1	0	0	0	0	0	0	0	0	0	0	1.0	87.6
7 Sep	1	1	8	0	0	0	0	0	1	0	0	0	0	0	1.9	89.5
8 Sep	0	4	2	0	0	1	0	0	0	0	0	0	0	0	1.2	90.7
9 Sep	1	2	3	1	0	1	0	0	0	0	0	0	0	0	1.4	92.1
10 Sep	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.3	92.4
11 Sep	0	4	3	1	0	0	0	0	0	0	0	0	0	0	1.4	93.8
12 Sep	0	3	4	1	0	0	1	0	0	0	0	0	0	0	1.5	95.3
13 Sep	0	2	4	2	0	1	0	0	0	0	0	0	0	0	1.5	96.8
14 Sep	0	2	3	1	0	0	0	0	0	0	0	0	0	0	1.0	97.8
15 Sep	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0.5	98.3
16 Sep	0	3	2	0	1	0	0	0	0	0	0	0	0	0	1.0	99.3
17 Sep	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0.5	100.0
Column Total	15.1	31.4	29.2	6.8	6.9	3.1	0.7	0.3	2.2	1.7	1.0	0.8	0.5	0.3	100.0	

Appendix Table 14. Yakos tagged chum recovery summary, Tanana watershed, 1976 and 1977, wheel #2.

Area	Lower Tanana	Miley Hot Springs	Kantishna River	Hlato	Kenana	Kood River	Fairbanks	Upstream Fairbanks	Totlat	Delta	%	Cum %
<u>Data</u>												
09 Aug	0	0	0	0	0	0	0	0	2	0	0.6	0.6
14 Aug	0	1	1	0	0	0	0	0	0	0	0.6	1.2
15 Aug	0	1	0	0	1	0	0	0	0	0	0.6	1.8
16 Aug	0	0	0	0	0	0	1	0	0	0	0.3	2.1
17 Aug	0	2	0	0	0	0	0	0	1	0	0.8	2.9
18 Aug	0	1	0	0	0	0	0	0	0	0	0.3	3.2
20 Aug	0	1	0	0	0	0	0	0	0	0	0.3	3.5
21 Aug	0	0	0	0	1	0	0	0	0	0	0.3	3.8
22 Aug	0	2	0	0	1	0	0	0	0	0	0.8	4.6
23 Aug	0	6	0	0	2	0	0	0	0	0	2.2	6.8
24 Aug	0	3	0	0	4	0	0	0	1	1	2.5	9.3
25 Aug	0	4	0	0	1	0	1	0	3	1	2.8	12.1
26 Aug	0	7	0	0	3	0	0	0	0	0	2.8	14.9
27 Aug	0	6	0	0	2	0	0	0	0	0	2.2	17.1
28 Aug	0	5	0	1	3	0	1	0	2	0	3.3	20.4
29 Aug	0	6	0	0	7	0	0	0	0	1	3.9	24.3
30 Aug	0	3	0	0	5	1	0	0	5	1	4.2	28.5
31 Aug	0	6	0	0	7	1	0	0	5	0	5.3	33.8
1 Sep	0	13	0	0	8	1	1	0	6	0	8.1	41.9
2 Sep	0	6	0	0	4	0	0	0	1	0	3.1	45.0

Appendix Table 14. Yukon tagged chum recovery summary, Tenana watershed, 1976 and 1977, wheel #2 (Continued).

Area	Lower Tenana	Manley Hot Springs	Kantishna River	Minto	Nenana	Wood River	Fairbanks	Upstream Fairbanks	Toklat	Delta	%	Cum %
<u>Date</u>												
03 Sep	0	7	0	0	8	0	0	0	7	0	6.1	51.1
04 Sep	0	3	0	0	6	0	0	1	5	0	4.2	55.3
05 Sep	0	10	1	0	7	0	0	0	3	0	5.8	61.1
06 Sep	0	0	0	0	2	0	0	0	0	0	0.6	61.7
07 Sep	0	2	0	0	6	0	0	0	3	0	3.1	64.8
08 Sep	0	5	0	0	8	0	0	0	2	0	4.2	69.0
09 Sep	0	3	1	0	6	0	0	0	2	0	3.3	72.3
10 Sep	0	6	0	0	9	0	0	0	1	0	3.3	75.6
11 Sep	0	9	1	0	2	0	0	0	3	0	4.2	79.8
12 Sep	0	10	0	0	2	0	0	0	3	0	4.2	84.0
13 Sep	0	5	0	0	2	0	0	0	0	0	1.9	85.9
14 Sep	0	4	0	1	1	0	0	0	1	0	1.9	87.8
15 Sep	1	3	0	0	2	0	0	0	0	0	1.7	89.5
16 Sep	0	4	0	2	3	0	0	0	1	0	2.8	92.3
17 Sep	0	5	0	0	1	0	0	0	0	0	1.7	94.0
18 Sep	0	1	0	0	2	0	0	0	0	0	0.8	94.8
19 Sep	0	1	0	0	2	0	0	0	0	0	0.8	95.6
20 Sep	0	7	0	0	3	0	0	0	0	0	2.8	98.4
27 Sep	1	4	0	0	2	0	0	0	0	0	1.9	100.0
<u>Column Total</u>	2	162	4	4	119	3	4	1	57	4	360	

Appendix Table 15. Yukon tagged chum recovery summary, Tanana watershed, 1977, wheel #3.

Area	Lower Tanana	Manley Hot Springs	Kantishna River	Minto	Kenema	Fairbanks	Upstream Fairbanks	Tokitk	Delta	%	Cum %
<u>Date</u>											
10 Aug	0	2	0	0	1	0	0	0	0	0.6	0.6
11 Aug	0	3	0	0	2	0	0	0	0	1.0	1.6
12 Aug	0	4	1	0	0	0	0	0	0	1.0	2.6
13 Aug	0	3	0	0	3	0	0	0	0	1.2	3.8
14 Aug	1	2	0	0	1	0	1	0	0	1.0	4.8
15 Aug	0	0	0	0	2	2	0	0	0	0.8	5.6
16 Aug	0	1	0	0	0	1	0	0	0	0.4	6.0
17 Aug	0	2	0	0	0	0	0	1	0	0.6	6.6
18 Aug	0	1	0	0	0	0	0	0	0	0.2	6.8
19 Aug	0	1	0	0	0	0	0	0	0	0.2	7.0
20 Aug	0	3	0	0	0	0	0	0	0	0.6	7.6
23 Aug	0	3	0	0	3	1	0	0	0	1.4	9.0
24 Aug	0	10	0	1	6	0	0	0	0	3.3	12.3
25 Aug	0	19	1	1	15	0	0	2	1	7.7	20.0
27 Aug	0	24	0	0	8	0	0	3	4	7.7	31.8
28 Aug	1	14	2	0	9	0	0	3	2	6.1	37.9
29 Aug	0	0	0	1	0	1	0	0	0	0.4	38.3
30 Aug	0	7	0	0	2	0	0	4	2	3.0	41.3
31 Aug	0	5	0	0	1	0	0	0	1	1.4	42.7
01 Sep	0	3	0	0	8	0	0	1	1	2.6	45.3
02 Sep	0	4	1	0	5	0	0	2	0	2.4	47.7
03 Sep	0	7	1	0	7	0	0	4	2	4.1	51.8
04 Sep	0	10	0	0	7	0	0	3	0	3.9	55.7

Appendix Table 15. Yukon tagged chum recovery summary, Tanana watershed, 1977, wheel #3 (Continued).

Area	Lower Tanana	Manley Hot Springs	Kantishna River	Minto	Nenana	Fairbanks	Upstream Fairbanks	Toklat	Delta	%	Cum %
Date											
05 Sep	0	10	0	0	6	0	0	3	0	3.7	59.4
06 Sep	0	4	1	0	5	0	0	1	0	2.2	61.6
07 Sep	1	1	0	0	2	0	0	1	0	1.0	62.6
08 Sep	0	1	0	1	4	0	0	3	0	1.8	64.4
09 Sep	0	2	0	0	2	0	0	4	0	1.6	66.0
10 Sep	0	2	0	0	3	0	0	1	0	1.2	67.2
11 Sep	0	0	0	0	1	0	0	1	0	0.4	67.6
12 Sep	0	1	0	0	2	0	0	0	0	0.6	68.2
13 Sep	0	6	1	0	4	0	0	0	0	2.2	70.4
14 Sep	0	12	3	0	1	0	0	6	0	4.3	74.7
15 Sep	3	8	0	0	2	0	0	2	0	3.0	77.7
16 Sep	1	3	0	0	1	0	0	1	0	1.2	78.9
17 Sep	1	6	0	0	5	0	0	0	0	2.4	81.3
18 Sep	0	10	0	1	6	0	0	2	0	3.7	85.0
19 Sep	0	9	0	1	4	0	0	0	0	2.8	87.8
20 Sep	0	9	0	0	3	0	0	0	0	2.4	90.2
21 Sep	0	7	0	0	4	0	0	0	0	2.2	92.4
22 Sep	0	10	0	0	0	0	0	0	0	2.0	94.4
23 Sep	1	4	0	0	2	0	0	0	0	1.4	95.8
24 Sep	1	4	0	0	2	0	0	0	0	1.4	97.2
25 Sep	1	2	0	0	1	0	1	0	0	0.8	98.0
26 Sep	0	7	0	0	1	0	0	0	0	1.6	99.6
29 Sep	1	2	0	0	0	0	0	0	0	0.6	99.9
30 Sep	0	1	0	0	0	0	0	0	0	0.2	100.0
Column Total	12	260	12	6	146	5	1	50	16	100.0	

Appendix Table 16. Yukon River population estimations of fall chum salmon.

Upper Yukon including Tanana <u>1/</u>					
	Total Harvest <u>2/</u>	Observed Escapement	Calculated Population	Undocumented Escapement <u>3/</u>	Rate of Exploitation
1976	72,000	78,000	149,000	0	0.51
1977	106,000	116,000	287,849	67,000	0.37
Entire Yukon					
1974 <u>4/</u>	349,000	143,000	492,000		0.710
1975 <u>4/</u>	337,000	634,000	971,000		0.347
1976	238,000	78,000	316,000	0	0.756
1977	333,000	116,000	513,039	71,000	0.649
1964 <u>5/</u>	136,000	-	131,000	-	-

1/ Above Galena tagging sites 1976, 1977 Galena and Ruby; revised 2/15/78.

2/ Total harvest includes both commercial and subsistence catches.

3/ Assumed to be difference in total harvest plus observed escapement and population estimation.

4/ No tagging program available for record level 1974 and 1975 runs on which to base pop. est. Calculated population given = sum of harvest and observed escapements.

5/ Hayes, 1964. For Main Yukon above Rampart only.