AYK REGION
YUKON STATE/FED REPORT #11

YUKON RIVER ANADROMOUS FISH INVESTIGATIONS

COMPLETION REPORT
July 1, 1974 to June 30, 1977

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December 1977

Project No. AFC-54
Anadromous Fish Conservation Act

Yukon River Anadromous Fish Investigations

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December 1977
Completion Report for Period July 1, 1974 to June 30, 1977

Prepared for:

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Washington, D.C. 20235

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF PLATES

LIST OF APPENDIX TABLES

LIST OF APPENDIX TABLES (Continued)

LIST OF APPENDIX TABLES (Continued)

LIST OF APPENDIX TABLES (Continued)

ABSTRACT

The magnitude of salmon escapements into the Yukon system has been evaluated from year to year by surveys of selected spawning streams. Major in importance among these streams is the Anvik River which has accounted for 53% of observed escapement of summer chums for the period 1974-1976. The Anvik is one of the four Yukon tributaries which have been documented to have yearly escapements in excess of 1,000 king salmon.

Anvik River counting tower and sonar counter: The 1976 expanded count of 237,831 summer chums past the counting tower was the second highest since a project of salmon enumeration was initiated in 1972. A total of 406,166 chums was counted in the Anvik system in 1976 (including aerial survey of the Yellow River). The highest count recorded for this system was in 1975 when 845,485 summer chums were observed in the Anvik River (excluding the Yellow River). Ninety-eight percent of the chum salmon run passed the tower site between July 1 and 20. Run timing was essentially normal with an early daily peak on July 7.

An analysis of the two years (1973 and 1976) in which total 24 hour counts were made indicated that the time of least movement for chum salmon was between 5:00 and 11:00 a.m.

Nine-hundred and fifty-eight king salmon were also counted (expanded count) at the tower in 1976 giving the second highest count since 1972 when 1,104 were enumerated. A total River count (including the Yellow River) of 1,155 king salmon was recorded in 1976.

Ninety-five percent of the king salmon passed the tower between July 5 and July 24 in 1976. Run timing was normal in 1976 compared with past years. Comparison of the 2 years of total 24 hour counts (1973 and 1976) indicated that the lowest continuous 6 hour period of movement occurred from 2300-0400 hours.

Smolt: Chum salmon smolt were collected for the first time during the summer of 1976 from the Anvik with a beach seine on June 26 and July 14.

Sonar: An acoustic side scan salmon counter developed by Bendix Corporation was field tested at the tower site in 1976. Visual versus sonar count correlations of greater than 98% were attained during 2 days of testing in early July. Counting problems were encountered when significant numbers of salmon move downstream past the sonar counter.

Migration and stock identification: A tagging project was initiated in the Galena area of the Yukon to determine timing and pathways of movement for fall chum through the fisheries. Totals of 1,224 fall chums and 14 coho were tagged in 1976 from two fishwheels; one wheel was located on the north and one was located on the south bank of the Yukon near Galena. Tagging began on August 12. Five-hundred and seventy-four or approximately 47% of the chums and 6 or 42% of the coho tagged have been recovered to date. The percentage of recoveries from south bank tagged chums was significantly higher than from those tagged on the north bank.

Spatial separation of chum salmon stocks by bank in the Galena area was indicated. There were greater numbers of north bank tagged chum recovered than expected in upper Yukon-Porcupine system as compared to greater numbers of south bank tagged chum recovered then expected in the spawning tributaries of the Tanana River. Eighty-one percent of the recoveries in the upper Yukon, above the Tanana were tagged on the north bank while 87% of the chums recovered in the Tanana system were tagged on the south bank.

On the basis of 1976 data upper Yukon-Porcupine runs appeared to pass through the Galena area earlier than did the chums bound for the Tanana River spawning tributaries.

THE YUKON RIVER AND ITS FISHERIES

Introduction

The Yukon River, the largest river in Alaska, originates in British Columbia within 30 miles of the Gulf of Alaska and flows over 2,300 miles before emptying into the Bering Sea, draining an area of approximately 330,000 square miles (Figure 1). The Yukon area includes all waters of the Yukon River drainage in Alaska and all marine waters from Canal Point light southward to the Naskonat Peninsula.

All five species of eastern Pacific salmon are indigenous to the River with chum salmon the most abundant. King salmon rank second in abundance followed in order by coho, pink and sockeye salmon. It is believed that the Yukon River is the greatest single king and chum salmon producing system in Alaska. Pink and coho are found in lesser numbers and there is no major fishery for them. Sockeye salmon are extremely rare and only a few fish are taken annually.

Yukon River chum salmon are composed of distinct summer and fall stocks. The more abundant summer chums are distinguished in part by: earlier upstream migration and spawning, utilization of lower Yukon drainage spawning areas, generally smaller body size, and the earlier appearance of spawning coloration. Fall chums are distinguished by: later migration and spawning, utilization of spawning areas in the upper portion of the drainage, a generally larger body size, and lack of spawning color in the lower portion of the main river.

Salmon have long provided an important food supply to people living throughout the Yukon River drainage. Prior to statehood subsistence fishing was of prime importance. As subsistence fishing decline due to lesser dependence, regulations were relaxed to allow development of the commercial fishery. Annual Yukon River commercial and subsistence salmon catches are presented in Appendix Table 1. Presently the Yukon River commercial salmon fishery is scattered along 1,400 river miles. The bulk of the harvest is taken along the lower 300 river miles. The bulk of the harvest is taken along the lower 300 river miles where the majority of the gear is concentrated. As indicated in Figures 2 through 4, the Alaskan portion of the drainage is divided into six statistical areas for fishery management and regulatory purposes. Tributary streams of the Yukon and Tanana rivers are closed to commercial salmon fishing. The fishery is essentially composed of state residents - primarily natives (Eskimos and Indians) who use small (16-20 foot) outboard powered skiffs to operate gillnets and fishwheels.

Commercial fishing effort has increased sharply since 1961. License registration for set gill nets has more than doubled while drift gill net gear has tripled. In excess of 100 units of fishwheel gear are also fished (upper

Figure 1. Yukon River Map

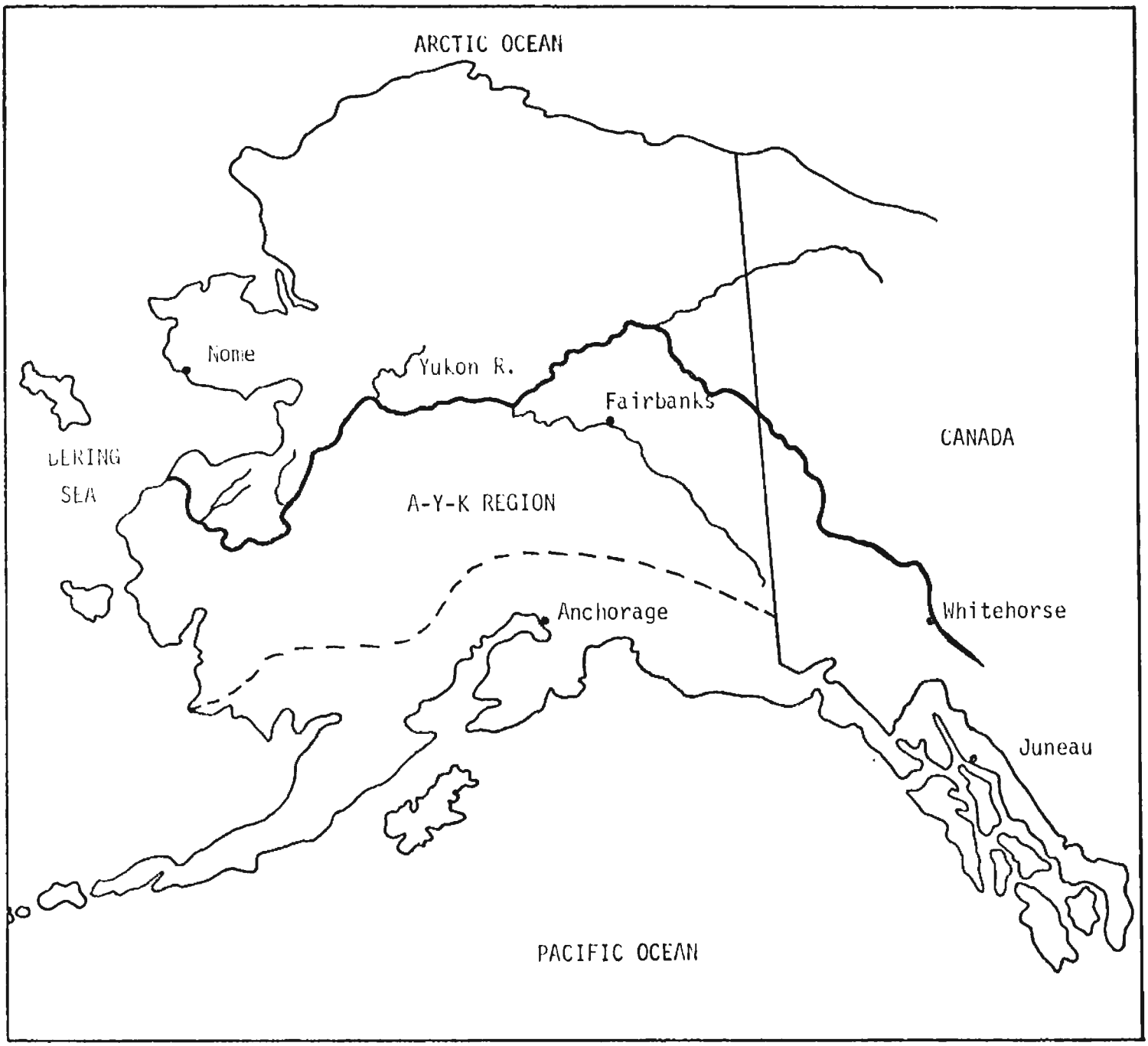


FIGURE 2. Lower Yukon River map.

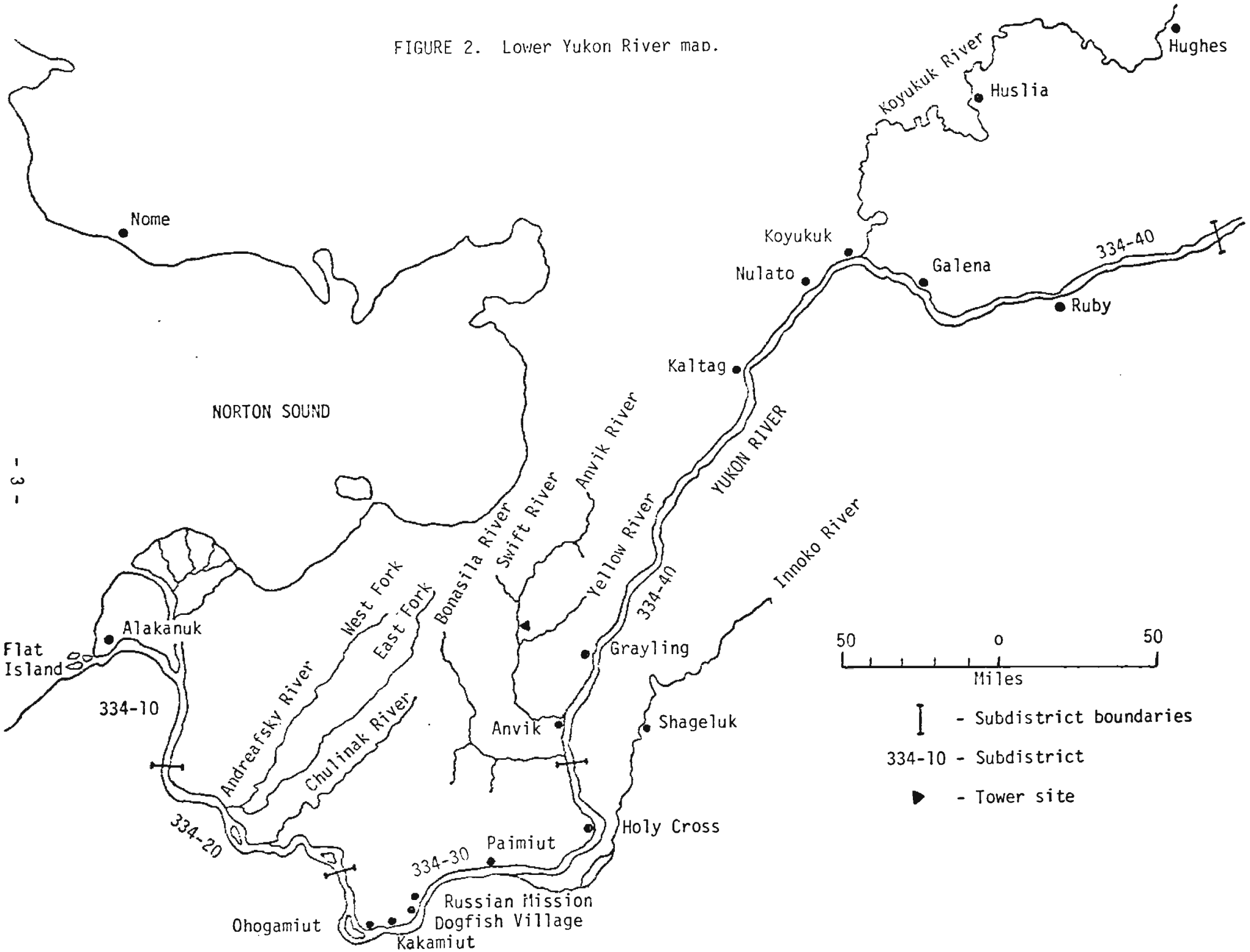


FIGURE 3. Mid-Yukon River map

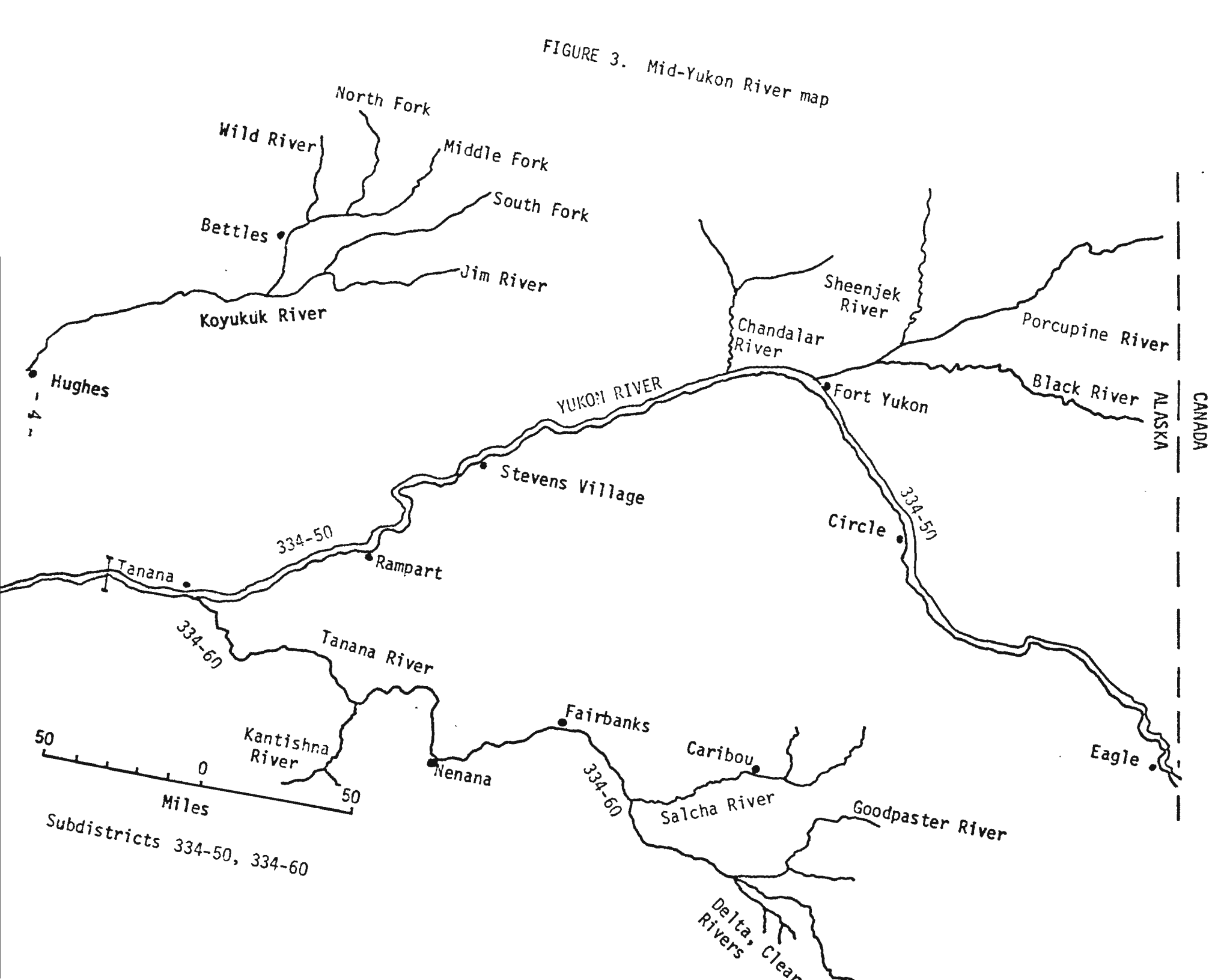
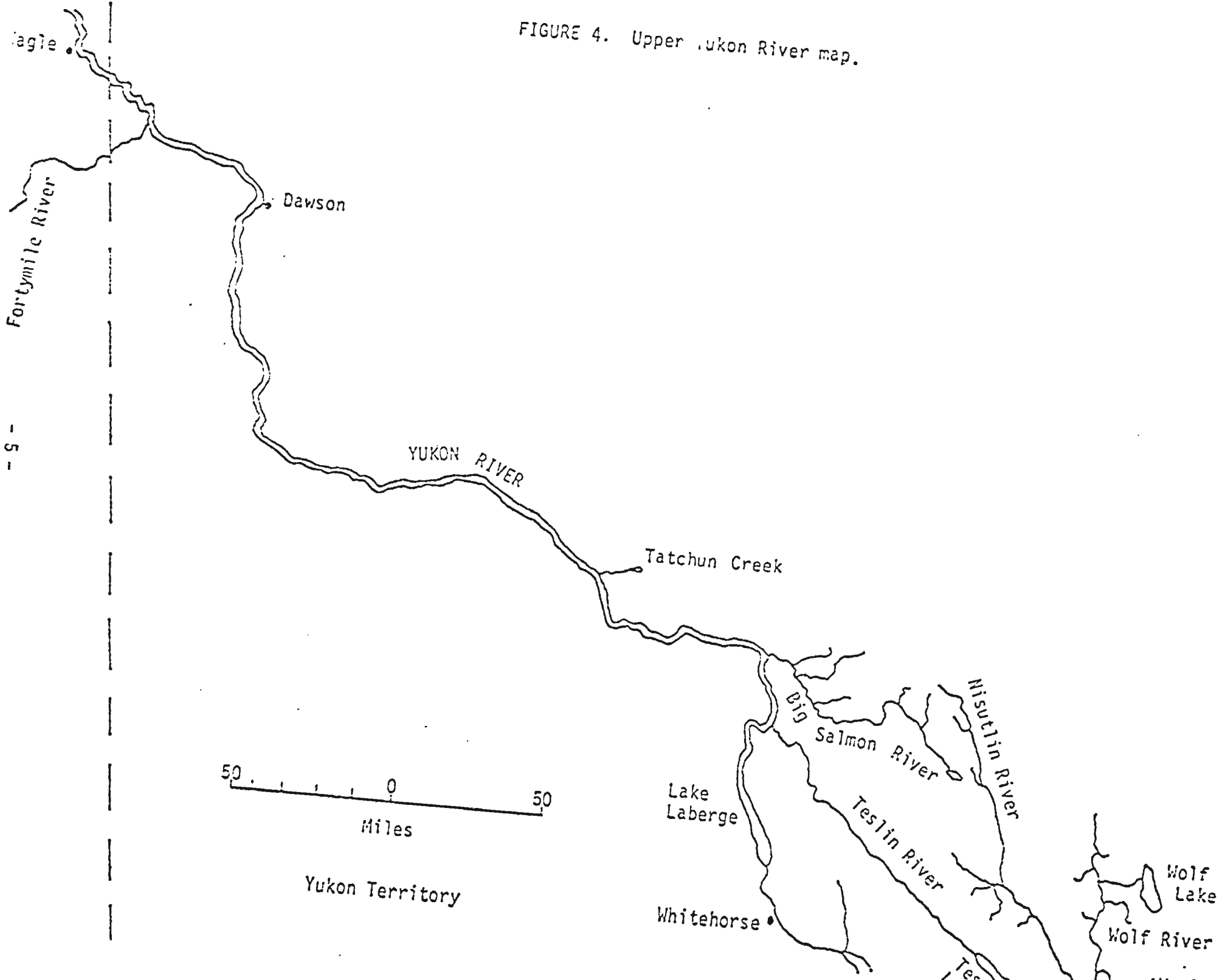


FIGURE 4. Upper Yukon River map.



Yukon area only). The best measurement of effort is the number of fishing vessels operated each year. Effort measured by this criteria has increased 98% since 1965 (Appendix Table 2). During the same period, the gross value of the catch to the fishermen increased nearly 400% ($2,151,000 in 1976). In 1976 the wholesale value of the pack was $6,815,500.

This study was initiated to: (1) determine the magnitude and effect of commercial and subsistence harvests on the various stocks of king and chum salmon; (2) develop estimates or indices of the magnitudes and quality of king and chum salmon runs and escapements; and (3) relate collected data to long-term trends in the salmon stocks and evaluate management procedures needed to maintain salmon at their level of maximum sustained yield.

This report primarily reviews data collected during the 1976 field season as results of the 1974 and 1975 field seasons have been previously submitted as annual technical reports (Trasky 1976; Mauney 1977). Comparative data collected prior to 1976 or by other projects, historical data, data developed by Canadian fisheries personnel in 1976 and statistical comparisons are also included when pertinent.

Status of Salmon Stocks

Summer chum salmon. Prior to the mid-1960s summer chums were used primarily for subsistence, as sled dog food. The snow machine replaced the dog sled and subsistence fishing for summer chums declined. Beginning in 1967 commercial fishing regulations regarding summer chums have been liberalized as the dependence on subsistence declined. As a result of regulation changes (e.g. mesh size specifications and earlier openings of the fishing season), increased fishing effort and processor facilities, development of Japanese markets, and the occurrence of very large runs in recent years, the Yukon River summer chum salmon commercial harvest has increased sharply. In 1967 only 11,000 summer chums were taken commercially while in 1975 a record 720,000 fish were harvested. The majority of the harvest has been in subdistricts 1, 2 and 4. In 1976 a total of 598,000 summer chums were taken commercially. Appendix Tables 1 and 3 present comparative Yukon River chum salmon data.

Summer chums exhibit run timing similar to the kings entering the lower River during June and early July. The major spawning tributaries include the Andreafsky and Anvik rivers and several others upstream to and including the Koyukuk River. Department tag and recovery population estimates indicated total runs of 3.2 and 1.6 million fish in 1970 and 1971, respectively. The 1975 total Yukon River run was estimated to be in excess of 5 million fish based on commercial and subsistence catch documentation

and aerial survey estimates. Anvik River escapement was estimated to be in excess of 1 million in 1975. Overall, Yukon River summer chum escapements have been good. However, escapements in that portion of the drainage upstream of the Koyukuk River mouth have been variable. Comparative summer chum salmon escapements are presented in Appendix Table 4.

Chum salmon (both summer and fall run) bound for the Yukon River are probably being intercepted by the Japanese mothership fishery in the Bering Sea. This fishery annually harvests 2-4 million fish of which significant numbers are believed to be of western Alaska (including Yukon River) origin. Yukon River chums, in addition to other western Alaska stocks, are intercepted by the U.S. South Unimak fishery as demonstrated by tagging studies. Annual catches of this interception fishery average 200,000-400,000 chums.

Fall chum salmon. The commercial fishery for fall chum salmon in the Yukon River began in the early 1960s. The fishery has undergone rapid expansion since 1968. During the 1961-1968 period, catches averaged 41,000 annually. Since 1968 catches have averaged 227,000 (Appendix Table 3). The recent development of the fall chum fishery is also reflected by corresponding increases in fishing effort and processing facilities. In 1975 more than 700 fishermen participated in the fall chum fishery. Because of their good quality (bright, silvery appearance, large size, robust body shape, and high oil content - which is related to their origins in upper portions of the drainage) fall chums are in great demand and are harvested in all fishing districts. The majority (approximately 80%) of the fall chum commercial catches are taken at present in the lower three subdistricts. Fall chums are of less importance for subsistence than summer chums for the Yukon River drainage as a whole except in that portion of the drainage upstream of the mouth of the Koyukuk River. In this area it is estimated that fall chums comprise 60-75% of the total subsistence harvest.

The basic management tool employed to regulate the Yukon River commercial fall chum salmon fishery is the catch quota system. Quotas of 200,000 chums in subdistricts 1, 2 and 3 combined and 50,000 chum and coho salmon combined (10,000 in subdistrict 4; 25,000 in subdistrict 5 and 15,000 in subdistrict 6) have been established by the Board of Fisheries. The overall 250,000 harvest quota for the River will be retained until future returns from current levels of harvest have been evaluated. These quotas represent the allowable harvest to be taken for an average or better than average run. In 1976 the fall chum run was below average and the total commercial catch was 163,282.

Fall chums enter the lower Yukon River beginning in mid-July and continue through early September. Major spawning areas are located in

the Tanana River (Toklat River, Delta River and the upper Tanana River near Big Delta) and the Procupine River (Sheenjek and Fishing Branch rivers) drainages.

The size magnitude of the runs, based on comparative catch data and limited escapement data, has fluctuated shaprly depending on the brood year strength. Good runs were experienced in 1970, 1971, 1974 and 1975 while below average runs occurred in 1972, 1973, and 1976. Aerial survey assessments of escapements began in 1972. Tanana River drainage escapements in general appear more stable and experience less fluctuation than the Porcupine River system. For example, escapements in the Fishing Branch River have ranged from 353,000 (1975) to 13,000 (1976). Comparative fall chum salmon escapement estimates are presented in Appendix Table 5.

King salmon. The Yukon River commercial king salmon fishery in Alaska dates back to 1918. During the period 1918-1959 catches were generally at a reduced level averaging approximately 30,000 fish annually. Catches increased during the period 1954-60, when a quota was in effect, averaging 65,000 kings. During 1961-70, as the fishery developed, annual catches further increased, averaging 104,000. A record 129,700 kings were harvested in 1967. Since 1970 average catches have declined to 88,000 because of below average runs and regulatory restrictions. In 1976 the commercial catch in Alaska totaled 88,700 kings. In addition to the Alaskan catch, the commercial fishery at Dawson (Yukon Territory) harvests 2,000-3,000 kings annually.

Throughout the Yukon River drainage approximately 15,000-25,000 kings are also taken annually for subsistence.

Based on the best available comparative catch and escapement data, the Yukon River king salmon runs have generally declined since 1971. During the same period, commercial fishing effort increased substantially. In 1975 the commercial catch of 63,000 was the smallest since 1960. Comparable Yukon River king salmon data is presented in Appendix Tables 1 and 3.

Restrictions placed on the commercial fishery during the 1970s have generally resulted in slightly improved escapements compared to the 1963-69 period. With the exception of 1971, escapements have not reached the levels observed during 1960-1961. Comparative king salmon escapement data is presented in Appendix Table 6.

In recent years the decline of the Yukon king salmon run is believed to be partially attributed to the Japanese high seas fishery. The high seas king salmon catches have averaged 284,000 fish annually during the period 1966-1976. A record 450,000 kings were taken in this fishery in 1969. In

some years the Japanese catch has exceeded the total western Alaskan catch (subsistence and commercial). Based on tagging and scale analysis studies it is estimated that in excess of 80% of the Japanese king salmon catches are of western Alaska origin (Yukon, Kuskokwim and Bristol Bay stocks). Japanese Bering Sea king salmon catch data is presented in Appendix Table 7.

Coho salmon. The coho salmon is of minor importance both in the commercial and subsistence fisheries. The annual commercial catch for the years 1961-1976 has averaged only 12,500 fish (Appendix Table 3). Subsistence catch data for this species is unavailable since most fishermen do not distinguish between coho and fall chum salmon. Cohos first enter the lower Yukon River about 1 week later than fall chums and the run peaks during late August. Spawning occurs discontinuously throughout the drainage. Major spawning concentrations have been documented in the tributaries of the upper Tanana River drainage. Limited escapement surveys indicated that the coho run in 1976 was below average. Comparative coho salmon escapement data is presented in Appendix Table 8.

The commercial harvest of cohos is dependent on fishing effort exerted for the more numerous fall chums; consequently, no specific management strategy has been developed for coho salmon. Future expansion of the coho fishery appears unlikely at this time.

Pink salmon. Few substantial spawning populations of pink salmon have been found within the Yukon drainage. The majority of the spawning areas are located downstream of the village of Grayling. Escapement documentation for this species has been relatively poor in the past.

YUKON RIVER FISHERIES MANAGEMENT AND RESEARCH

Introduction

The overall objective of the Yukon area research and management programs is to manage the various salmon runs on an optimum sustained yield basis. The commercial fishery is regulated on the assumption that a harvestable surplus is available after providing for escapements and subsistence requirements. Subsistence fishing has been designated by the Board of Fisheries as the highest priority use. Where the subsistence fishery has declined, the Department has liberalized regulations to allow development of commercial fisheries.

Management tasks are made difficult by the character of the salmon runs, the fisheries, and the River itself. Since most of the fisheries have

only developed in recent years there is a lack of adequate escapement and return data on which to fully evaluate the effects of increased commercial harvests. The various fisheries, scattered over 1,400 river miles, are harvesting mixed stocks usually several weeks and hundreds of miles from their spawning grounds. The Yukon River commercial fishery can be considered as essentially a "cape fishery". A result of fishing mixed stocks may be for some tributary populations to be under or overharvested in relation to their actual abundance. Due to the turbid water conditions of the main River, and the vast size of the drainage (one-third of which is in Canada), accurate in-season assessment of the escapement immediately past the intensive downriver fishery is very difficult with the presently available technology. Management of the runs is hampered by the variable run timing and patterns of entry into the lower fishery.

The result of the above, coupled with an increase in effort and efficiency of the commercial fishery and the need to provide for subsistence utilization, is that the management of the Yukon River salmon runs must take a conservative approach. This approach has been achieved by establishing harvest goals, mesh size restrictions, area catch quotas, reduced weekly fishing periods, fishing season closures, etc. If during the fishing season it becomes apparent that the run is substantially smaller or larger than needed for escapement and subsistence requirements, the commercial harvest rates are adjusted through the use of the emergency order or, less frequently, emergency regulation authority.

New research projects are underway and other programs are planned once additional funding becomes available to obtain the biological information necessary for better management of the salmon runs. A comprehensive tag-recovery program was begun in 1976 to determine the relative timing and distribution of fall chum stocks past the commercial fishery. If various stocks can be identified from this program and scale analysis studies, then the fishery can be effectively regulated in order to achieve the proper balance between catch and escapement. Future salmon studies proposed include expansion of the test fishing program, sonar assessment of salmon escapement in the main River, and upgrading escapement documentation in tributary streams.

At present the Department's management and research programs are conducted at various locations throughout the Yukon River drainage. A description of these ongoing programs is presented below.

Commercial Catch Data Analysis

Yukon River commercial fishery statistics (including date, location and numbers of fish) are recorded on fish tickets when the fish are purchased

from the fishermen. The tickets are collected from the processors by Department personnel after the end of each fishing period. From these tickets total catch, catch per unit effort, and numbers of fishermen are compiled and recorded on a master sheet. These data may reflect relative abundance and timing of the runs and are readily available to compare with previous years' catches. Management decisions for regulating the commercial fishery is partially based on the analysis of this data.

Subsistence Fishery Survey

Each year at the summer's end, Department personnel conduct a subsistence fishery survey of the entire River by boat and aircraft, stopping at each village and interviewing fishermen to obtain an estimate of the total number of each species of salmon taken and related effort data. Special catch calendars are mailed to most fishing families prior to the season and facilitate catch reporting. The few fishermen not interviewed are sent catch questionnaires after the fishing season ends. In 1976, 15,097 kings and 221,284 chums (includes other salmon species) were taken for subsistence from the Yukon River drainage.

Flat Island Test Fishing Site

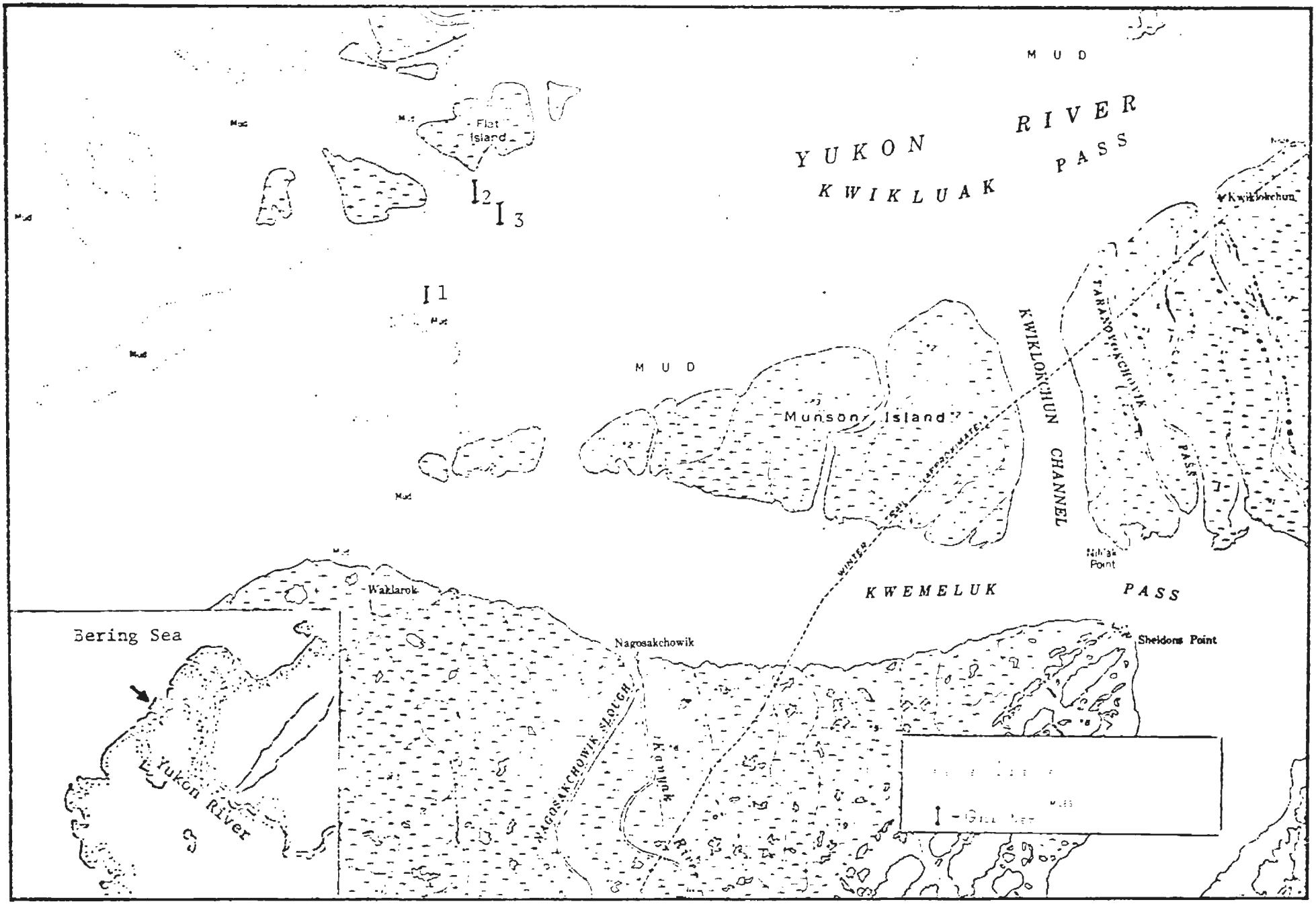
A test fishing site has been maintained at Flat Island in the south mouth of the Yukon River since 1963 (Figure 2 and 5). The Flat Island site is located downstream from most of the commercial fishing gear permitting the salmon run to be assessed before it reaches the commercial fishery. The data obtained from this site has been important for in-season management and in assessing the long-term effects of the commercial fishery on the king and summer chum salmon runs.

There are inherent interpretative problems, however, associated with the use of test fishing data. The present test fishing site is located in the south mouth of the Yukon River. Normally, the greatest numbers of salmon enter the River through this mouth (followed in importance by the middle and north mouths). The importance of the south mouth for migration is believed to shift quite substantially during some years altering catch per unit effort data.

There have been two primary objectives to this study:

1. To obtain information regarding relative abundance, species composition, and timing of the salmon runs.

Figure 5. Flat Island test fishing sites, Yukon River, 1976



2. To obtain information on the effect of the selectivity of 8-1/2" (king salmon gear) and 5-1/2" (chum salmon gear) stretched mesh gill nets on the age, sex and size composition of salmon runs.

Set gill nets of stretched mesh nylon webbing with standard floats and leadline have been used to capture salmon at this site. Each net is 25 fathoms long and the depths of the nets are 28 (8-1/2") and 45 (5-1/2") meshes. The nets were fished 24 hours a day at index locations during June to mid-July. Each net was checked three times each day and the numbers of salmon captured by species and the number of hours fished recorded. Periodically, a sample of the catch was taken to obtain age and sex composition.

Test fishing values presented in Appendix Table 9 for the past 10 years are not considered to be absolute indices of abundance but merely indicate trends. For 1976, the king salmon catch per gill net hour was 0.76 (9 yr. average of 0.62); chum salmon catch per gill net hour was 3.15 (9 yr. average 2.53).

Salcha River Studies

The Salcha River is the most important king and summer chum salmon producer of the Tanana River drainage and is the only major Yukon River system where comprehensive king salmon escapement information has been collected (Figure 3). Results of the Salcha studies are detailed in the commercial fish-technical evaluation study of the Trans Alaskan Pipeline (Francisco 1977).

The summer chum salmon escapement, as estimated by surveys in the Salcha River during 1976, totaled 6,474 fish. The annual escapements for this system, excluding poor or incomplete surveys, have ranged from 290 to 8,040 chums (Appendix Table 4).

In 1976 the estimated king salmon escapement for the Salcha River was 1,550. The annual escapement in this system has ranged from 249 to 2,878 kings, excluding poor or incomplete surveys, (Appendix Table 6).

Yukon Territory Salmon Escapement Studies

Environment Canada-Fisheries Service personnel enumerated and sampled king salmon migrating through the Whitehorse fishway in 1976 (Figure 4). The fishway is located at the Whitehorse Dam upstream of the

city of Whitehorse and is one of the farthest upstream king salmon escapement monitoring sites on the Yukon River. Since 1969 the annual fishway counts and the age and sex composition of the run have been used as a possible indicator of the effects of the downriver fishery on king salmon escapement in the Canadian portion of the Yukon drainage. The objectives of the study over the years have been to: (1) obtain a daily and seasonal count of king salmon escapement through the fishway and (2) determine the age, sex, and size composition of the Whitehorse escapement.

One-hundred and twenty-one king salmon were enumerated at the Whitehorse fishway in 1976. This count was the lowest ever recorded (Appendix Table 10). An examination of the annual escapement counts since 1959 indicates that the Whitehorse run has experienced a gradual decline. Possible reasons for the decline are discussed in detail in the 1973 Yukon River Anadromous Fish Investigations Report (Trasky 1974).

During 1976, aerial and foot surveys were conducted on major spawning streams with Alaska Department of Fish and Game personnel participating in some surveys.

Fall chum salmon escapements of the Fishing Branch River (tributary to the Porcupine River) in northern Yukon Territory were monitored by Canadian personnel (see Figure 13). A 10-mile spring fed section of the south fork of this River remains open overwinter and is heavily used by fall chums (Elson 1976). A total of 13,450 chums were estimated by aerial survey methods. This was the lowest escapement to have been documented in this system to date. During the years 1973-75, a weir was used to obtain a total escapement count. Numbers of chum salmon enumerated past the Fishing Branch weir in 1975 was an all-time recorded high of 353,000 fish (Appendix Table 5).

A total of 4,425 chum salmon were harvested by commercial and subsistence fishermen in the Yukon Territory during 1976 (Sweitzer 1977). These chums were largely fall fish. Five thousand king salmon were harvested in the Yukon Territory's commercial and subsistence fisheries combined during 1976.

Delta River Studies

Delta River studies were continued in 1976 (Figure 3). The objectives of the 1976 studies were:

1. Determine the distribution, abundance, and timing of fall chum salmon populations in the Delta River spawning areas.

2. Collect basic life history on the Delta River spawning population including age and sex composition of the run.

3. Monitor the spawning environment (water temperature and chemistry, sediments).

Data gathered would be useful to document gross changes in environment resulting from the Trans-Alaska Pipeline construction and related activities.

The fall chum salmon escapement for the Delta River was estimated to be 4,779 in 1976, similar to the 1972-75 average of 4,894. Results of the Delta River studies for 1976 are presented in a special associated report (Francisco 1977).

Aerial Surveys

Because of the vast distances involved and the large number of salmon spawning streams in the Yukon River system, salmon escapements are primarily assessed by aerial survey methods. Index streams are chosen which are felt to be indicative of overall Yukon River basin escapements. During the peak of spawning, and when water and light conditions are optimum for viewing, these streams are surveyed by Department biologists in single engine aircraft. While not precise, aerial surveys are an important management tool when no other means of assessing escapements are available. Escapement indices obtained from tower counts and aerial surveys give a post-season check of in-season management strategy in obtaining desired escapement levels.

In 1976, king salmon escapements into the major spawning areas ranged from below average to average. Escapements in the lower portion of the drainage were aided by restrictions placed on the commercial fishery at the mouth. Despite this escapements in the Yukon Territory were weak (Appendix Table 11).

Good comparative data is lacking for chum salmon escapements. Summer chum escapements in 1976 (based on selected surveys) were judged good throughout that portion of drainage downstream of the Koyukuk River. Both the Anvik and Andreafsky River systems, for which fair historical records exist, had large runs in 1976. In Table 1 the top ten summer chum salmon streams in the Yukon River system are ranked based on numbers of spawners.

Of the combined Yukon River summer chum observed escapement for the top ten producing streams in 1974 through 1976 the Anvik River system accounted for 53% and the Andreafsky system 27% (Appendix Table 12).

Table 1. Top ten Yukon River system summer chum salmon streams ranked by observed escapement 1974 through 1976. 1/.

Ranking	1976 Stream	1976 Escapement	1975 Stream	1975 Escapement	1974 Stream	1974 Escapement
1	Anvik 3 5/	406	Anvik 3/	813	Anvik 4/	201
2	Andreafsky West	118	Andreafsky West	236	Andreafsky West	33
3	Andreafsky East	105	Andreafsky East	223	Nulato South	28
4	Rodo	38	Nulato North	87	Nulato North	22
5	Chulinak	34	Gisasa	57	Gisasa	22
6	Nulato North	27	Nulato South	51	Rodo	16
7	Gisasa	21	Rodo	25	Salcha	8
8	Thompson Creek	17	Caribou Creek	15	Chena	4
9	Nulato South	12	South Fork Koyukuk	15	Andreafsky East 2/	3
10	Caribou Creek	11	Molozitna	9	Dishna 2/	3
Total		789		1,531		340

1/ Escapement in thousands of salmon.

2/ Streams surveyed under poor survey conditions.

3/ Includes sum of tower and aerial counts.

4/ Tower count only.

5/ Includes Yellow River.

Aerial surveys continued as the only method currently available to assess fall chum escapement in most Alaskan waters (see Figure 13 for major Yukon fall spawning areas). Environmental and light conditions during peak fall chum spawning - late September through mid-November are generally less conducive to reliable surveys than during the summer. Short periods of daylight, stream shadowing, streams running ice, and snow squalls are limiting factors encountered during fall surveys.

Aerial survey coverage of fall chum escapements was vastly improved in 1974 when the major Sheenjek and Chandalar populations were first documented. Survey coverage also greatly improved in 1975 with the discovery of additional Toklat River spawning areas.

Fall chum escapements were below average in the Toklat, Sheenjek and Fishing Branch rivers during 1976. These streams accounted for 89% of total documented fall chum escapements for the years 1974 through 1976 combined (Appendix Table 12). In Table 2 the top ten fall chum salmon streams for 1974 through 1976 are ranked based on numbers of spawners.

Table 2. Top ten Yukon system fall chum salmon streams ranked by observed escapement, 1974 through 1976. 1/

	1976 Stream	Escapement		1975 Stream	Escapement		1974 Stream	Escapement
1	Toklat	37	1	Fishing Branch	353	1	Sheenjek	41
2	Fishing Branch	13	2	Toklat 2/	78	2	Toklat	34
3	Sheenjek	12	3	Sheenjek	78	3	Fishing Branch	33
4	Delta	6	4	Yukon River (Mainstem, Canada)	7	4	Chandalar	17
5	Tanana	5	5	Chandalar	6	5	Bluff Cabin Sl.	5
6	Bluff Cabin	3	6	Bluff Cabin (Slough 2/)	6	6	Tanana	5
7	Delta Clwtr Slough	2	7	Delta	4	7	Delta	4
8	Benchmark 737 Sl.	3/	8	Bear Paw	2	8	Bear Paw	3
9	Richardson Clwtr 2/	3/	9	Black 2/	2	9	Black	2
10	Chandalar 2/	3/	10	Delta Clearwater (Slough 2/)	1	10	Seventeen Mile Slough	2
Total		78			536			146

1/ Escapement in thousands of salmon.

2/ Poor survey conditions.

3/ Less than 500 fish.

ANVIK RIVER SALMON ESCAPEMENT STUDIES

Introduction

A salmon enumeration project was conducted for the fifth consecutive year to obtain indices of the magnitude of king and summer chum salmon escapements in the Anvik River system. The objectives of this project were to: (1) determine the daily and seasonal timing and magnitude of the salmon escapements, (2) evaluate various enumeration methods by comparing aerial survey, boat survey, and tower counts, (3) determine age, sex, and size composition of the king and chum salmon escapements, (4) evaluate different counting tower schedules, (5) measure climatological and hydrological conditions, (6) undertake preliminary on-site evaluation of a Bendix Corporation acoustic side scan salmon counter.

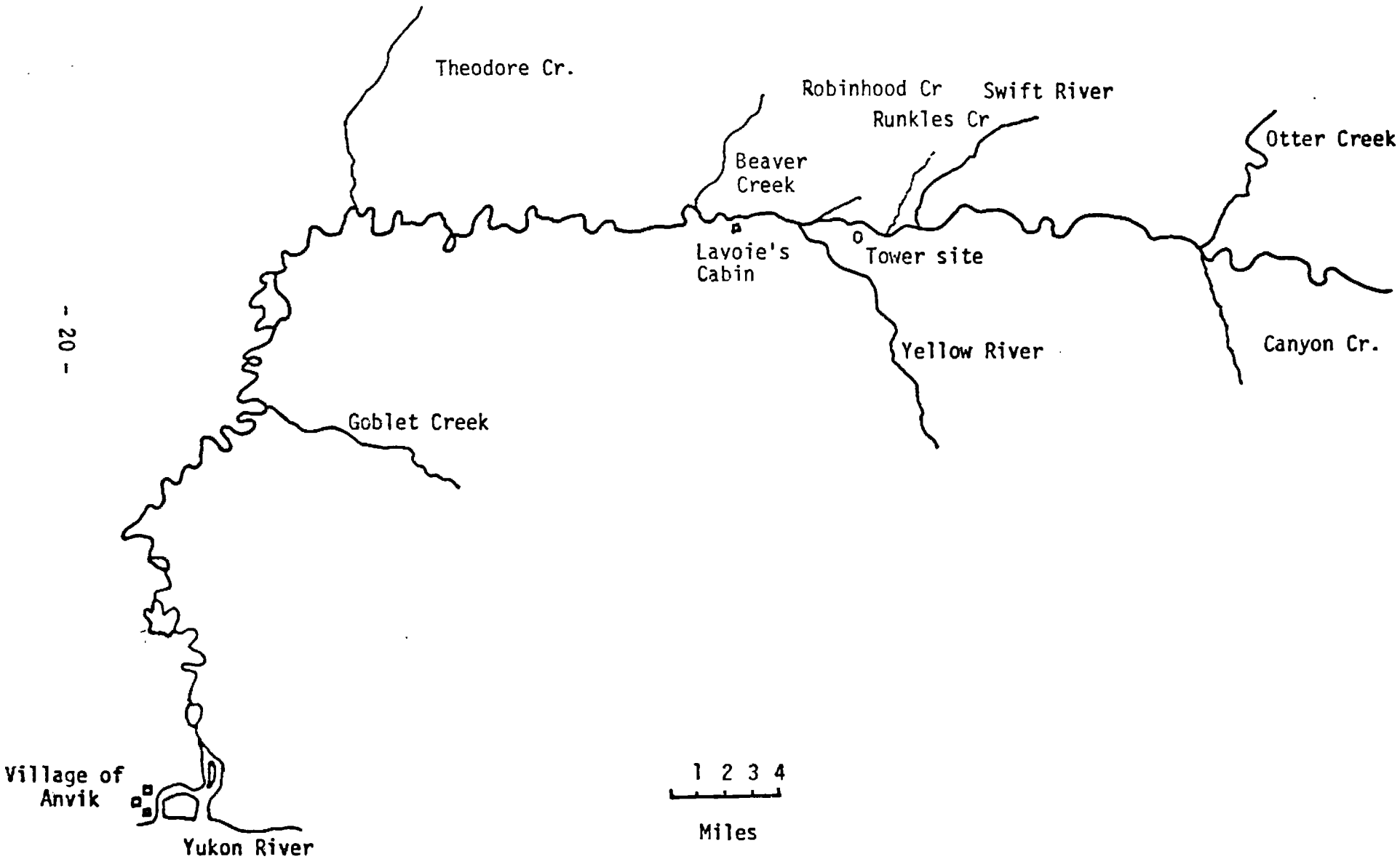
The Anvik River is the single most important chum salmon producer in the Yukon drainage. The Anvik system accounted for 53% of the observed escapement of summer chums in the Yukon's ten most productive streams for the combined years 1974-1976 (Appendix Table 12).

Other species present in this system include king salmon, coho salmon, pink salmon, Arctic char, Arctic grayling, broad whitefish, round whitefish, pike, slimy sculpin, stickleback, blackfish, and Arctic lamprey.

The Anvik River flows in a southeasterly direction from its headwaters for 140 miles to enter the Yukon River 1-1/2 miles north of the village of Anvik (Figures 2 and 6). The upper portion of the drainage is mountainous with elevations generally ranging from 1,000 to 2,500 feet. Toward the River mouth, the terrain decreases to an elevation of about 500 feet. Vegetation along the stream bank includes cottonwood, spruce, willow, tamarack, alder, grasses, and sedges. Throughout most of the length of its main channel the streambed is generally of gravel composition; above Swift River, much of the streambed is bedrock.

The U.S. Fish and Wildlife Service calculated the discharge in 1957 at 5,670 c.f.s. and the velocity at 4.5 ft/sec at a point 6 miles upstream of the mouth. The average depth and the width at this point were 7 feet and 225 feet respectively. Water levels were at flood stages when these measurements were taken during late August -early September. Department personnel in late July of 1975 calculated the discharge to be 2,403 c.f.s. at a point 3-1/2 miles below Theodore Creek. The River was at low stage during this time with an average depth of 2.15 feet, width of 250 feet, and midstream velocity of 4.47 ft/sec. Discharge at the Robinhood Creek Tower Site was estimated at 703 c.f.s. on July 30, 1976. The River width at this point was

Figure 6. Anvik River Map.



217 feet with an average water velocity and depth of 2.68 ft/sec and 1.12 feet, respectively. Longtime residents of the Anvik area stated that water levels during the late summer and early fall of 1976 were the lowest they had ever observed.

The upper Anvik is clear except during periods of high discharge. Clearwater conditions, which permit the visual enumeration of salmon, however, are the exception rather than the rule downstream of the Yellow River mouth.

In 1974 upstream temperatures had reached 51° F by June 16; in 1975 upstream water temperatures of 50° F were not recorded until July 4 (Appendix Table 13). Water temperatures in the mid-fifties were recorded as early as June 13 in 1976. During cold snaps in mid-June and early July, water temperatures dropped into the mid to high 40s.

A PH range of 7.5 to 8.5 was documented at the old tower site in 1974 (Trasky 1975). At the Robinhood Creek Tower Site in 1976, PH readings ranged from 8.5 to 9.

Dissolved oxygen measurements in 1975 ranged from 8.8 pm following the peak of salmon spawning on July 21 to 13.8 on July 6 prior to the beginning of spawning. Levels in 1976 ranged from 10 ppm on June 28 to saturation or slightly above.

Materials and Methods

Materials and methods used in 1976 were similar to those used by Trasky in 1974 (Trasky 1975). Materials for weir construction were transported to the Robinhood Creek site from Anvik village by riverboat and from Bethel by aircraft following ice out in early June (Figure 7). A permanent storage facility for gear and equipment was constructed at the site. Tents for living, mess quarters, and for equipment storage were erected on the west bank of the River immediately downstream from the planned weir site.

By June 24 the water level at the Robinhood Creek location had dropped sufficiently for weir construction to begin. The weir was essentially completed on June 27 following 3 days of installation. The entire width of the river was weired with the exception of a forty foot center section (Plate 1) where the maximum flow rate and water depth were located. Boats could pass up and downstream through the weir opening. The counting tower consisted of a 22-foot high prefabricated aluminum structure erected on a log raft anchored just upstream of the weir opening. The raft was composed of six large logs and was of similar design to those used to float fish wheels.

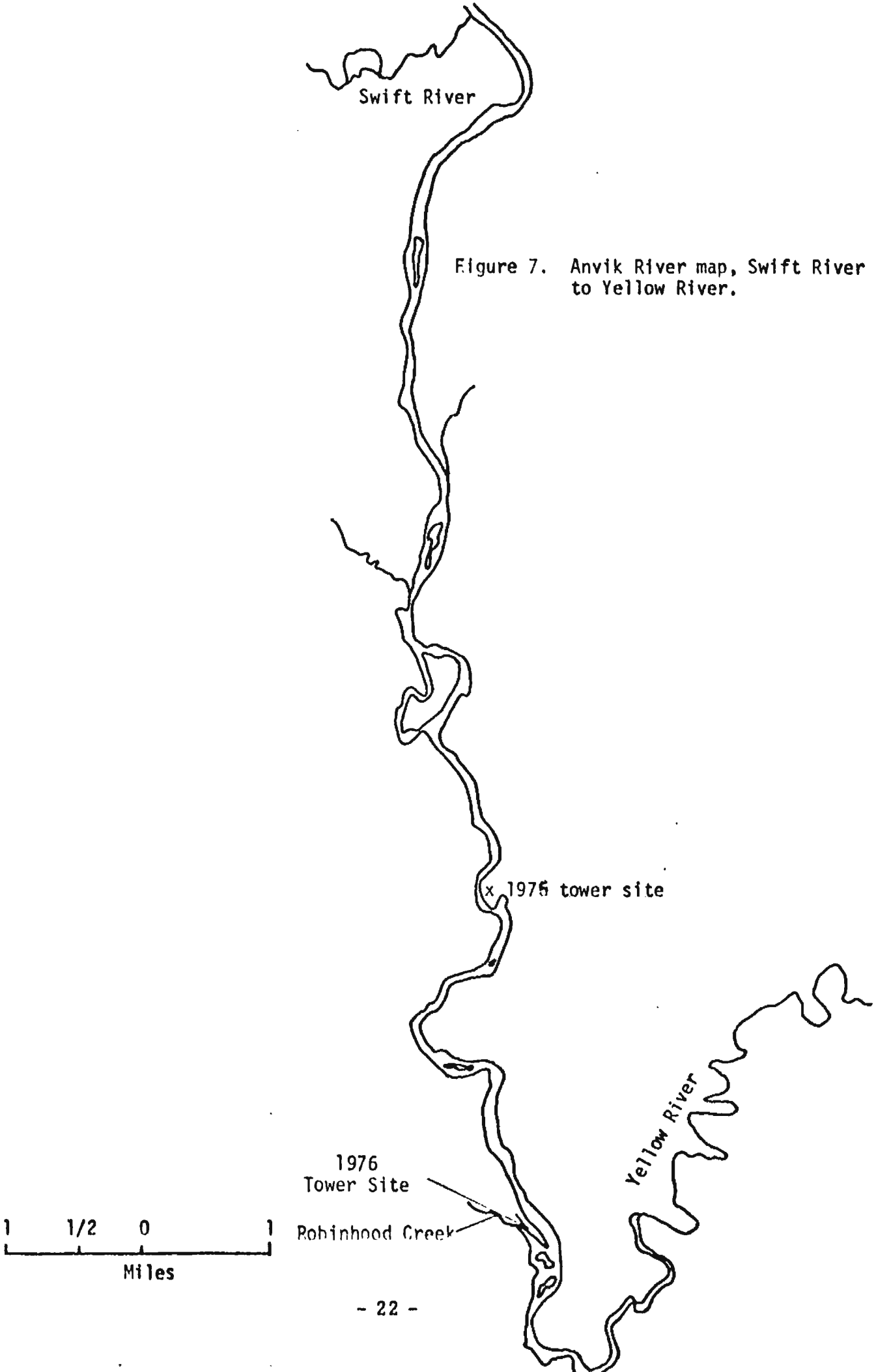
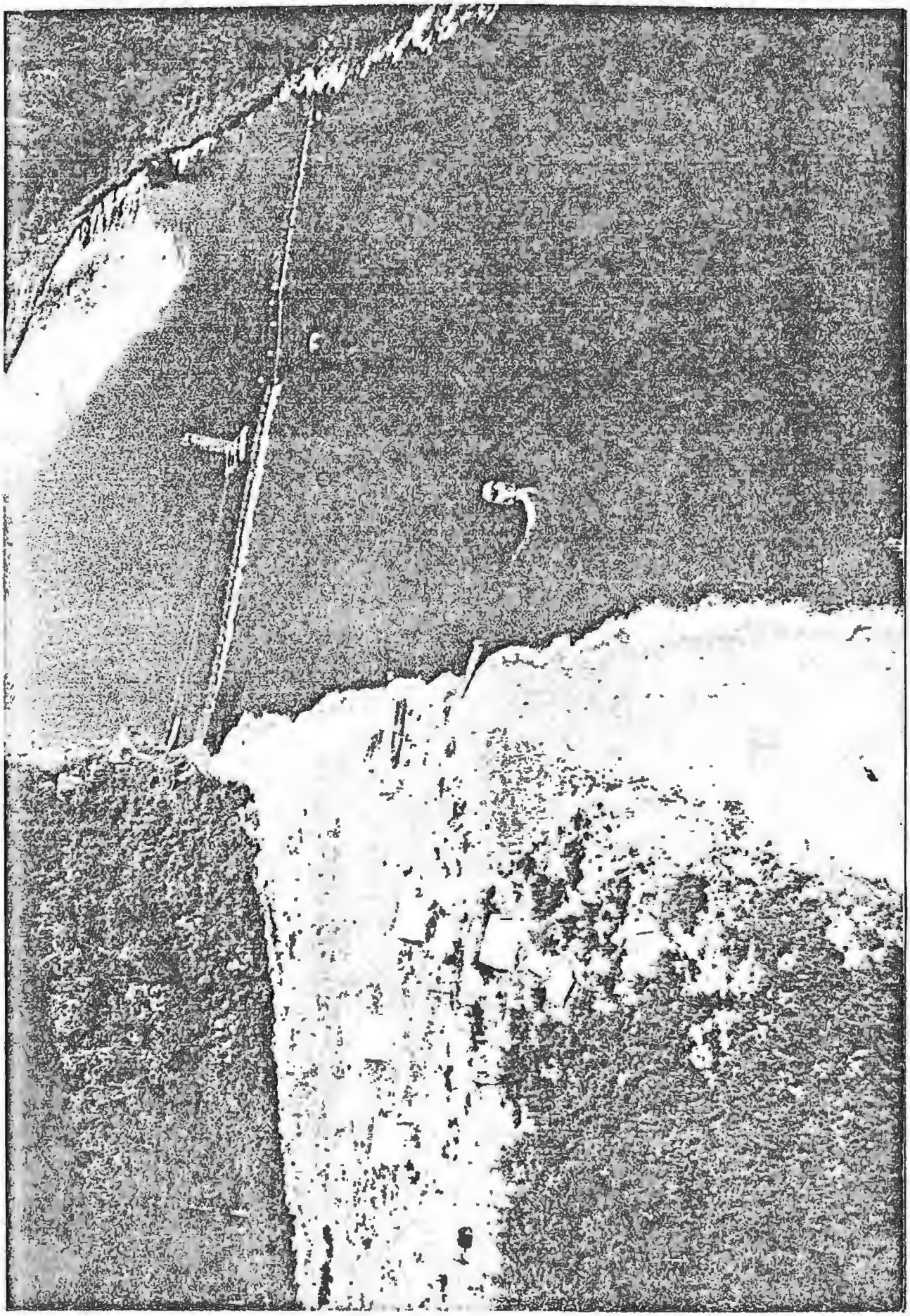


Figure 7. Anvik River map, Swift River to Yellow River.

Plate 1. Anvik River counting tower Robinhood Creek site.



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

Fish visibility was enhanced by a background panel (40 foot x 3 foot) of white herculite upholster cloth laid across the stream channel between channel ends of the weir. The panel was attached to a cable running across the bottom and weighted down with sandbags and steel beams.

Daily counts were begun on June 27, 1976. Char and grayling were also enumerated to gain information concerning the numbers of non-salmon fish species passing the weir site.

Char and grayling enumeration was continued until the appearance of the first chum salmon on June 30. After this date, counts were essentially limited to salmon. Weir counts terminated on July 28 when net upstream chum and king salmon migration was virtually zero. Counting shifts were normally of 2 hours duration at the maximum.

Salmon swimming downstream were subtracted from the upstream migrants to obtain a "net upstream count". Incomplete daily counts for chum and king salmon were estimated by computing the percentage (P) of total count made during the missing hours (s) for all other days over the entire season. This percentage was subtracted from 100% (1-P) and divided into the daily count (A) to produce an expanded daily total (E) or:

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

Hourly counts were calculated by taking the same percentage (P) of the expanded daily total and substituting it for the missing hourly counts. No conversion factor had been developed for pink salmon until the 1976 season. Hence, in 1974 and 1975 actual daily counts were expanded in direct proportion to the percent of the hours not counted to give an expanded total. (See Appendix Table 14 for illustration of the above and other calculations used in this report).

The size of king salmon passing the tower was estimated by comparison with the background panel. The size classifications were 500 mm (trout size), 501-600 mm (chum size), 601-800 mm (average king), and 801 mm (large king). These estimates were made to attempt the estimation of the size and age composition of the king salmon escapement.

Chum salmon carcass sampling and enumeration surveys were conducted from boats upstream and downstream of the tower site from July 22 to

July 27. A scale smear was taken from each fish examined, length (mideye to fork of tail) measured, and sex of each carcass recorded. King salmon carcass surveys were made of the main Anvik River above LaVoie's cabin from August 1 through 12. Data collected was the same as for chum salmon.

Aerial surveys of the Anvik were conducted on July 16 and July 21 to enumerate king and chum spawners and carcasses and to determine distribution within the River system. An aerial survey was conducted to enumerate king and chum salmon in the Yellow River on July 20. Aerial surveys were conducted on September 18 and 21 to enumerate coho salmon in major Anvik tributaries.

Drift surveys were made by boat to enumerate spawning king salmon on July 27 and 28. Surveys included the main River between the 1975 tower site and Beaver Creek (Figure 7).

Tissue samples were taken from approximately 100 chum salmon at the Anvik weir for electrophoretic analysis by the Fisheries Research Institute, University of Washington. The object of the analysis was to determine whether sufficient differences in poroteins exist to identify and separate discrete spawning stocks such as those of the Anvik River from other Yukon stocks. Results of the analysis will be presented in a later report.

A beach seine was used during July to locate and capture king, coho and chum juveniles for age/growth data. This was the second season of juvenile salmon collections in the Anvik River.

Climatological information was recorded daily. Stream flows and limnological data were taken periodically.

The Anvik Tower Site was moved in June of 1976 after counting difficulties were experienced due to water depth and to high water conditions continually experienced at the site used during 1974 and 1975. Stream reconnaissance surveys in the late summer and fall of 1975 had identified a suitable weir site immediately upstream from the mouth of Robinhood Creek (approximately 1 mile above the mouth of Yellow River). The River at this point, during most summer flows, ranges from 215 to 250 feet across with a maximum depth of 2 to 2.5 feet.

Because of the improved weir arrangement made possible by the move to the Robinhood Creek site, the 1976 Anvik tower count was probably the most accurate to date. Low, clear water conditions and the uniform light color of the streambed enhanced the accuracy of the 1976 counts.

Five personnel were needed to adequately operate both the tower and an experimental sonar counting installation in 1976. Three persons were used

in 1974 and 1975. During the early years, only the counting tower was in operation. Additional persons available for counting duties probably reduced the error that may have resulted when long counting periods were required of these individuals. The acoustic side scan salmon counter, developed by the Bendix Corporation and field tested at the Anvik site during 1976, was capable of counting non-salmon species at certain sensitivity settings. On the other hand, downstream salmon migrants, or those moving randomly downstream past the transducer were counted as if they have moved upstream or not at all. The counter is non-directional. Correction factors are being developed using tower information which will apply to the sonar counts. Mass downstream movement of salmon was observed on July 3 and 4, 1976 during an electrical storm.

Although costly, 24 hour tower counts were made for most of the 1976 season. Counts during the 1974 and 1975 seasons were confined to the hours in which the greatest percentage of the chum migration had been documented in 1973, i.e., 2400 to 0700 and 1300 to 2400 hours. Eighty-one percent of the chum and 73% of the king salmon daily migration past the tower in 1973 occurred during these time periods. Studies by Hurd (1970) indicated that the daily migration patterns for chum salmon in Norton Sound did not change significantly from year to year. Because of the tower site change and the lack of base data on which to construct expanded counts, Mauney (1976) recommended a 24-hour count schedule be run for at least one additional field season.

Partial hour counting schedules may be considered to reduce the number of man hours required during future seasons. Ten minute counts at the beginning of each hour were evaluated in 1974 by Trasky (1976). It was found that chum and king salmon expanded counts gave results that were 8 and 16% above the actual count, respectively, for the entire season. Fifteen minute counts were evaluated in 1976.

Results

Analysis of the 24-hour counts obtained in 1973 and 1976 showed that 19% of chum and 30% of king salmon movement occurred between 0700 and 1300 hours (Appendix Tables 15-19). The 6 hour period of least movement of chum salmon was from 0500-1000 (16.5%) and for kings from 2300 to 0500 (10%). The best "compromise" time period to omit counts would appear to be from 0300 to 0800 when only 19.7% of the chums and 20.4% of the kings were counted. The low period of pink salmon migration appeared to be between the hours of 0800 and 2200 when 15.2% of the movement occurred during 1973 and 1976 observations (Appendix Tables 20 and 21). The expansion factor used for chum in 1974 and 1975 was 1.19 and 1.27 for king.

In 1976, 15-minute counts were recorded at the beginning of each hour. The expanded daily chum salmon count for the season was 105% of the actual count (Appendix Table 22). Thus, the partial hour enumeration and expansion technique would appear quite satisfactory for chum salmon.

Chum salmon downstream movement is expressed as a percentage of upstream movement for Anvik field seasons 1972 through 1976 in Table 3. The percentage has fluctuated from a low of 3.4 in 1972 to a high of 19.5 in 1976 for a yearly average of 11.4. King salmon downstream movement has averaged 19.6% of upstream movement for the 3 years for which such data is available. Additional base data is needed to arrive at a factor for downstream movement that could be incorporated with confidence into side scanner count correction.

Table 3. Anvik River chum and king salmon movement upstream versus downstream compared for years 1973-1976.

Year	Number upstream	Number downstream	Net upstream	Downstream movement expressed as % of upstream
		Chum Salmon		
1972	65,202	2,239	62963	3.4
1973	76,904	6,483	70421	8.4
1974	149,753	14,629	135124	9.8
1975 1/	284,830	24,511	260319	8.6
1976	229,077	43,866	185211	19.5
Total	805,766	91,728	714038	11.4
		King Salmon		
1973	539	112	427	20.8
1974	338	30	308	8.9
1976	908	208	700	22.9
Total	1,785	350	1435	19.6

1/ Movement data available through 7/14 only for 1975. Movement data for actual counts.

Arctic Char and Arctic Grayling. A combined total of 1,499 char and grayling was counted past the Robinhood Creek tower site from June 27 through July 1, 1976 (Table 4). Char and grayling could not reliably be distinguished from each other from the counting tower height of 25 feet under varying light conditions. Three thousand six hundred and forty seven of these two species were counted (expanded count) over the 5 days of observation. Preliminary observations of the side scanner adjusted for salmon counting indicated that only exceptionally large individuals of these species were counted.

Table 4. Char and grayling counts past the Anvik Tower, 6/27-7/1, 1976. 1/

Date	Number Upstream	Number Downstream	Net Upstream	Downstream % Upstream	No. Hours	Expanded Daily Total
6/27	420	28	392	7.1	10	941
6/28	278	22	256	8.6	8	768
6/29	183	7	176	4.0	8	528
6/30	178	14	164	8.5	8	534
7/1	583	72	511	14.1	14	876
Total	1,642	143	1,499	9.5	48	3,647

1/ After July 1 only salmon were counted; char and grayling could not be reliably distinguished from each other from the counting tower.

Summer Chum Salmon

Timing: The first chum in 1976 was observed at the new tower site on June 30. In 1975, chum salmon were not observed in the vicinity of the tower until July 5 with counts beginning July 6 (Figure 8). Lateness of the 1975 chum run is believed to have been a function of extremely low, early summer, water temperatures as discussed earlier. Chum migration past the tower showed a normal pattern in 1976 until July 3 and 4 when water temperatures fell. Upstream movement picked up very rapidly starting July 5. On July 7 the peak daily count for the season of 46,156 was recorded. To date only 1974 has shown an earlier peak count for chum. The 98% level of the run was reached on July 20 (Appendix Table 23). Only in 1975 during an exceptionally large run, were chum still moving upstream in substantial numbers by this date.

Hourly migration patterns for the same 18-hour period during 1973, 1974, 1975, and 1976 are shown for chum salmon in Figure 9. Some variations in hourly migration patterns can be noted. Migration patterns in 1976, as in earlier years, indicated generally reduced movement between 0700 and 1300 hours. Least movement for chum salmon occurred between 0500 and 1100 A.M.

Abundance: The expanded Anvik tower count of 237,831 summer chums was the second highest count since the project was initiated in 1972, but was only 39.5% of the record 1975 count of 601,880 (Table 5). The 1974 count of 201,280 approached the 1976 count. The 1976 count is the most

Figure 8. Comparison of daily migration patterns for chum salmon, Anvik River, 1973-1976

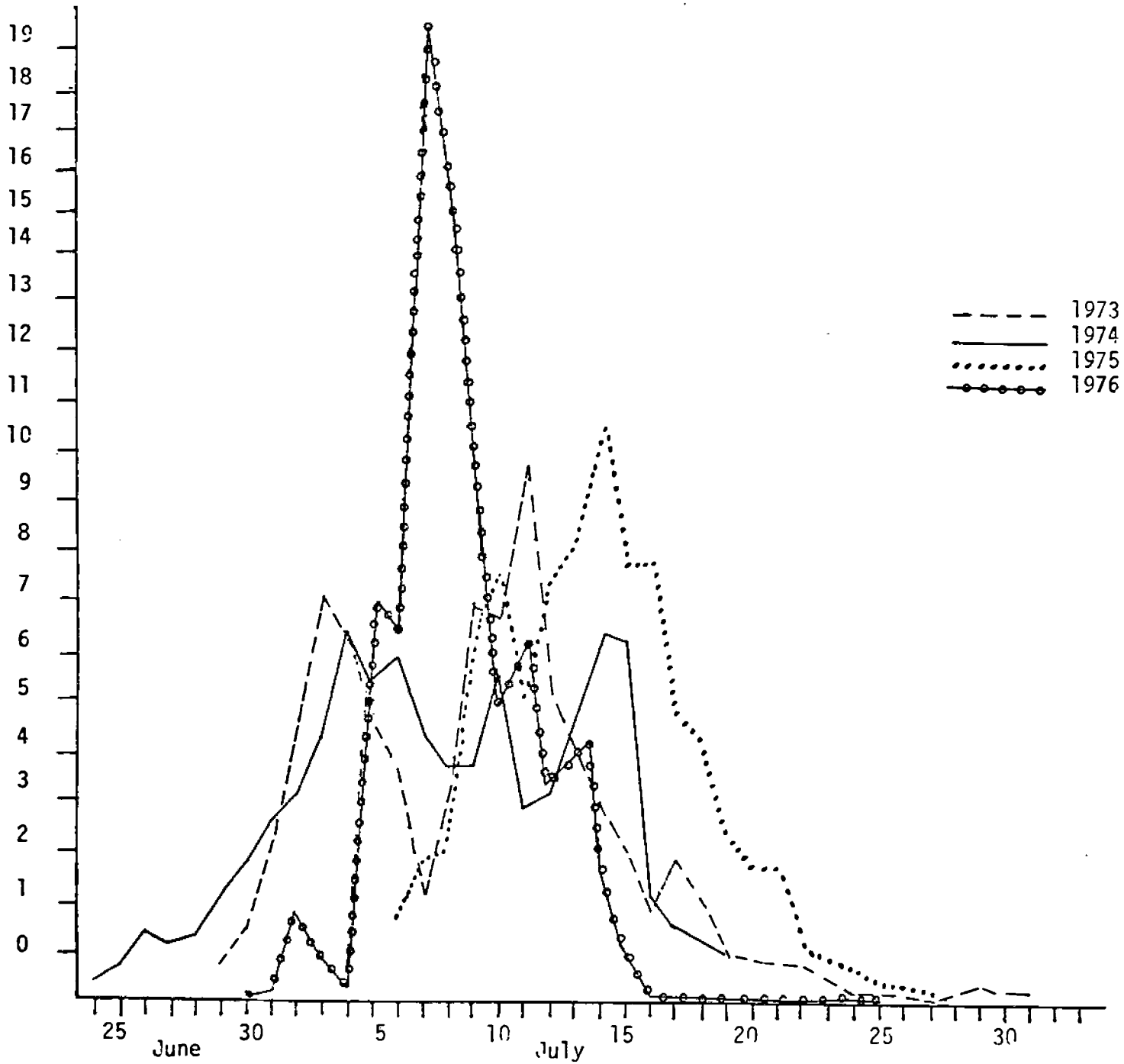
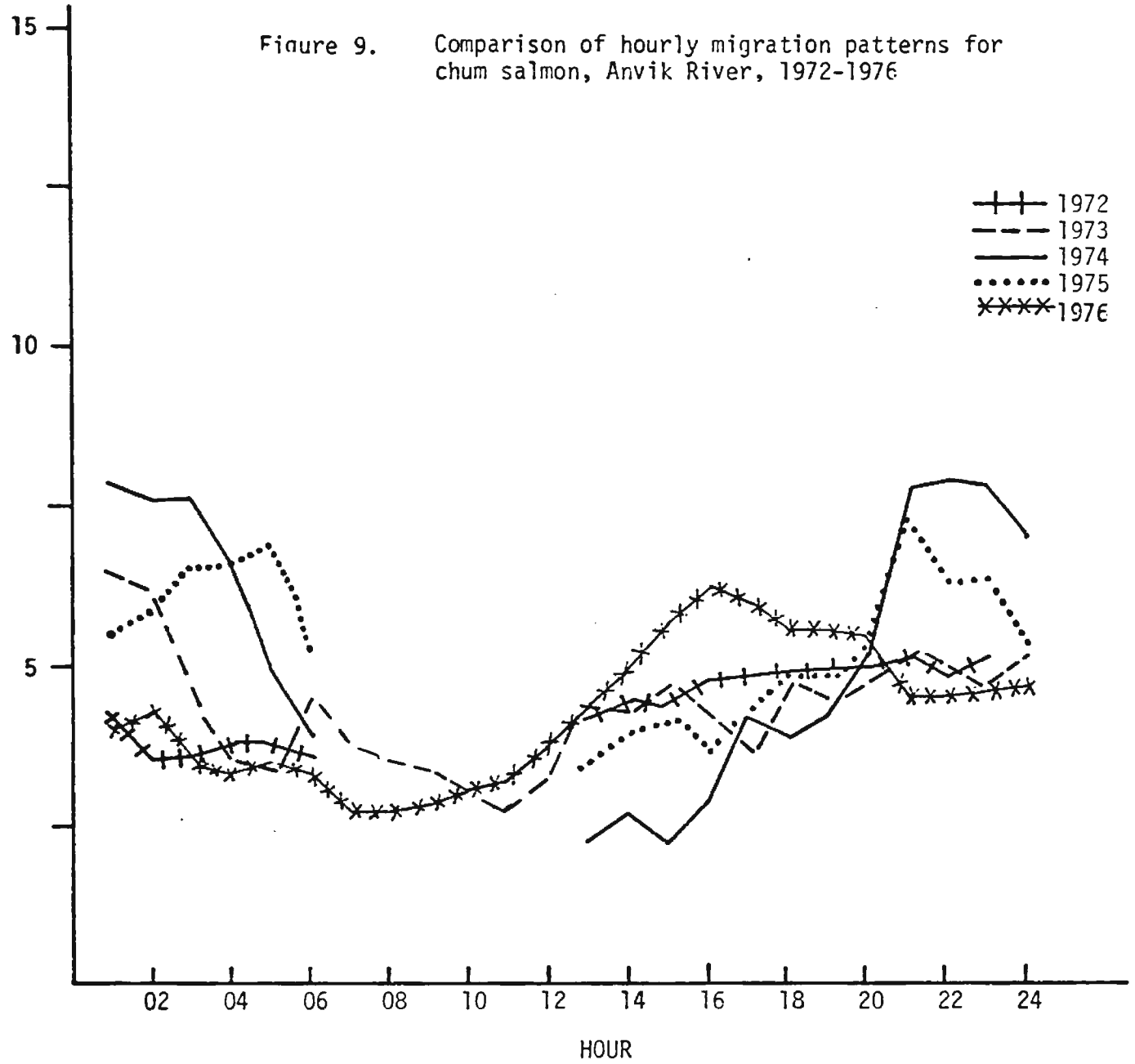


Figure 9. Comparison of hourly migration patterns for chum salmon, Anvik River, 1972-1976



1/ Based on expanded 18 hour percent.

accurate count conducted on the Anvik River to date due to the improved weir and tower arrangement and to low, clear water conditions which existed throughout the 1976 season giving ideal counting conditions.

Table 5. Historical estimates of Anvik River king and chum salmon escapements, 1958-1976 1/ 5/

Year	Chum Salmon Tower	Aerial	King Salmon Tower	Aerial
1976	237.85	382.49 2/	958 4/	195 2/ 3/
1975	601.88	845.24	548	845
1974	201.28	-	471	-
1973	71.48	26.16	517	222
1972	108.34	208.76	1,104	414
1971	-	-	-	-
	-	232.76	-	368
1969	-	-	-	296
1968	-	51.58	-	297
1967	-	116.00	-	336
1966	-	37.00	-	638
1965	-	100.00	-	650
1964	-	13.00	-	-
1963	-	-	-	-
1962	-	-	-	-
1961	-	20.60	-	1,226
1960	-	-	-	1,950
1959	-	200.00	-	350
1958	-	150.00	-	-
Total	1,220.83	2,383.59	3,598	1,676

		Chum	King
$\bar{X}$ Tower:	5 years	244.11	719.6
Aerial:	13 years	183.35	335.2

1/ Chum salmon in thousands of fish
2/ Aerial count in 1976 includes Yellow River
3/ Poor survey
4/ Count from new tower site
5/ Tower counts expanded to estimate numbers during non counted periods.

The best estimate of numbers of chum salmon in the Anvik system during 1976 is 406,166 (Table 6). This total includes a Yellow River aerial count of 38,680. This was the first year water conditions in the Yellow River made a count of this River practical, but even then water visibility was judged only fair to poor. The Yellow River estimate may represent only 30 to 40% of the chum salmon present with actual numbers approaching 100,000 in this tributary.

Table 6. Summary of Anvik River peak salmon escapement counts, 1976.

	King	Chum	Pink	Coho	Total
Tower (expanded)	958	237,851	519	-	239,328
Anvik below tower (aerial) 1/ 2/	1	129,635	-	81 3/	119,772
Yellow River (Aerial)	93	38,680	-	-	38,773
Boat survey below tower (kings only)	103	-	-	-	103
Total	1,155 4/	406,221 4/	519	81	397,976

1/ Aerial surveys of lower Anvik and Yellow Rivers generally rated as 50-60% effective for chum salmon. High counts used in totals. No attempt was made to separately count pink salmon.

2/ Includes Beaver Creek and Anvik-Yellow River to Robinhood Creek surveys of 7-16 and lower Anvik survey of 7-21. Tower count was 98% complete by 7-21. No attempt was made to determine numbers of kings during 7-21 survey.

3/ Coho documented, Beaver Creek only, during surveys 9-18 and 9-21.

4/ Aerial counts above tower: king-100
chum-267,845.

The escapement figure of 812,998 chum salmon (weir and aerial count) into the Anvik in 1975 [tower count upstream plus aerial count downstream (with fair to poor water conditions in the lower river and the Yellow River not surveyed)] was regarded as a minimal figure. It is probable that more than 1 million summer chums spawned in the Anvik system during 1975. The actual chum salmon escapement into the Anvik in 1976 probably approached 500,000.

Distribution: Anvik River spawning distribution of chum salmon for 1975 and 1976 is presented in Table 7. Spawner distribution within the system was much the same for 1975 and 1976. A somewhat greater percentage of spawning may have occurred in tributary streams in 1976 than in 1975 (examples: Beaver Creek 2.3% and 5.7% for 1975 and 1976 respectively; Swift River 2.6% and 8.7% for 1975 and 1976 respectively). The relative number of spawners above and below the Anvik tower changes from year to year and has ranged from a high of 77.1% above the tower in 1975 to a low of 34.1% above in 1972 (Table 8). Sixty-one point three percent of the salmon escapement observed in 1976 during aerial surveys was above the Robinhood Creek tower site. Comparisons of spawner distribution should take into account the fact that the Yellow River was surveyed in 1976 for the first time and included with the downstream escapement. This may compensate for the inclusion of escapement between the old and new tower sites for the first time in the upstream category. The 4 year upstream average escapement has been 66.1% of total escapement. Distribution of spawners in 1976, therefore, appears to be average.

The aerial survey estimate of 267,845 chums made on July 21 was higher than the weir count of 231,657 by 15.6%.

Carcass surveys were conducted by foot along major sandbars. Relative carcass density from area to area and from year to year may be used as an index to relative abundance. Four-thousand yards of beach were surveyed from the area of Beaver Creek to the area of Swift River in 1975. The carcass density was 4.07 chum salmon per linear yard (July 25-August 1). Two thousand yards were surveyed in this stretch of River in 1976 (July 25-27). The chum carcass count per linear yard was 1.60 (Appendix Table 24). Beach surveys of the lower 4 miles of Yellow River in 1976 revealed a much lower average density of 0.29 chum/linear yard in 1976.

Age, Sex, Size Composition: Anvik River chums in 1976 were predominantly (85.5%) 5_1 fish (1971 brood year). Age class 4_1, which accounted for 92.6% of chum examined in 1975 comprised only 13% of the 1976 sample (Table 9). This age composition shows the outstanding success of the 1971 brood year.

Appendix Table 25 shows that in 1976, as in 1975, Anvik male chums were significantly longer than Anvik female chum, (599 versus 560 mm). Anvik chum sampled in 1976 were also significantly longer than Anvik chum sampled in 1973, 1974, and in 1975 (respectively, 577, 552, 565 and 553 mm). This greater average length of 1976 Anvik chum is believed to be a function of the unusually large percentage of 5 year old fish present in the 1976 run (Table 9).

Table 7. Anvik River observed king and chum salmon escapement distributions as indicated by aerial survey 1975 and 1976 1/.

Stream Location	Chum				King			
	1975		1976		1975 2/		1976 2/	
	No.	%	No.	%	No.	%	No.	%
Below Goblet Creek	6,800	0.8	2,875	0.6	-	-	0	0.0
Goblet-Beaver	59,425	7.0	48,555	11.1	4/	-	1	0.5
Beaver Creek	19,005	2.3	25,700	5.7	1	0.4	0	0.0
Beaver-Yellow River	50,900	6.0	24,475	5.6	3	1.4	1	0.5
Yellow River	3/	-	38,680	8.8	3/	-	93	47.7
Subtotal lower River	136,130	16.1	140,285	32.0	4	1.8	95	48.7
Yellow River-Robinhood Creek	4/	-	25,200	5.8	4/	-	0	0.0
Robinhood Creek	3/	-	2,830	0.6	3/	-	0	0.0
Robinhood Creek-Old Tower Site	4/	-	24,150	5.6	4/	-	14	7.2
Yellow River-75 Tower	75,000	8.9	4/	-	24	10.8	4/	-
75 Tower-Runkles Creek	4/	-	18,700	4.3	4/	-	1	0.5
Runkles Creek-Swift River	4/	-	29,000	6.6	4/	-	26	13.3
Swift River	21,545	2.6	38,335	8.7	3	1.4	2	1.0
Swift River-Otter Creek	4/	-	56,375	12.9	4/	-	25	12.8
75 Tower-Otter Creek	345,200	40.9	4/	-	120	55.0	4/	-
Otter Creek	47,645	5.6	47,585	10.9	1		2	1.0
Canyon Creek	3/	-	3,855	0.9	3/	-	0	0.0
Otter Creek-McDonald Creek	215,250	25.5	47,375	10.9	70	31.5	30	15.4
McDonald Creek	2,470	0.3	4,465	1.0	0	0.0	0	0.0
Above McDonald	250	-	5/	-	0	0.0	0	0.0
Total River	843,490	100.0	438,155	100.0	222	100.0	195	100.0

1/ Aerial surveys: 1976 dates, 7-16, 7-20, 7-21, 7-21; 1975 date, 7-23.
2/ Counts not representative of actual numbers of king salmon in system.
3/ Not surveyed.
4/ Survey not broken down in this manner.
5/ Fewer than 200 chum.

Table 8. Chum salmon spawning distributions upstream and downstream of Anvik tower by year.

Year	Aerial Count below tower	%	above tower	%	Total
72	137,520	65.9	71,243	34.1	208,763
73	15,190	58.1	10,966	51.9	26,156
75	192,130	22.7	653,355	77.1	845,485
76	168,315	38.7	267,845	61.3	436,160
Total	513,155	33.9	1,003.409	66.1	1,516,564

Table 9. Age composition of Anvik River chum salmon escapement sample, 1972-1976.

Age	1972 No.	1972 %	1973 No.	1973 %	1974 No.	1974 %	1975 No.	1975 %	1976 No.	1976 %	All Years No.	All Years %
3_1	0		48	6	36	9	21	4.6	7	1.1	112	4.1
4_1	62	19	605	77	217	79	541	93.6	81	12.9	1606	59.2
5_1	253	79	128	16	46	12	22	4.8	537	85.8	986	36.3
6_1	5	2	2	1	3	1	0	0.0	1	0.0	11	0.4
Total	320	100	783	100	402	100	584	100.0	626	100.0	2715	100.0

Sex composition of 3,762 chum salmon carcasses was determined during beach surveys in 1976, resulting in a male/female ratio of 36/61. Thirteen thousand four hundred and thirty nine carcasses were sexed during 1975 beach surveys with a resulting male/female ratio of 49.8/50.2, statistically an insignificant difference. Age and sex composition data for the years 1972-1976 is presented in Table 10. Samples were gathered by carcass survey and by weir capture. The resulting male to female ratio of 46.8/53.2 indicated a slight bias favoring females. The cause of the skewed 1976 sex ratio of carcasses has not been determined at this time.

Table 10. Age and sex composition of chums sampled by post-spawning crew surveys, and at Robinhood Creek weir, 1972-1976. 1/

Age	Male No.	%	Female No.	%	Total No.	Total
3_1	5	0.8	4	0.7	9	1.5
4_1	43	7.2	35	5.8	78	13.0
5_1	233	38.8	281	46.8	514	85.5
6_1	0		0	0	0	
Total	281	46.8	320	53.2	601	100

1/ Percent of total sample.

1977 chum salmon returns to the Anvik will probably be fewer than those of the last 3 years. The 4_1 age class is usually dominant for the Anvik, and in the 1973 parent year, only 71,480 passed the tower. The 1972 5_1 year class was dominant for the Anvik in 1976. The 1972 tower escapement which would give rise to the 1977 5_1 return was 108,340. The Anvik return in 1977 should be in the neighborhood of 100,000 chums, based on these figures and assuming average freshwater and marine survival.

King Salmon

Timing: The 1976 season's first king salmon was observed at the Robinhood Creek Counting Tower on July 5. A peak count of 107 indi-

viduals was obtained on July 17 (Table 11 and Figure 10). Ninety-five percent of the run had passed the tower by midnight of July 24 (Appendix Table 26). Net daily upstream counts were fewer than 20 king salmon by July 26.

King salmon migration timing shown in Figure 10 during 1976 was generally intermediate between that of a very late year (1975) and an early year (1974). The 95% level was not reached until July 28 in 1975, 1 day prior to termination of counting. On this date 43 kings were counted past the tower. A substantial portion of the king run may have occurred after the termination of counting activities in 1975. King salmon movement past the Anvik tower in 1974 began early (6-24) and had peaked by July 15. High water took out the weir on July 19 of 1974, terminated counting, and left the last stages of the run undocumented. The spawning run was somewhat more protracted in 1973 than in 1975.

Hourly upstream migration patterns for the standard 18 hour count period are shown in Figure 11 for the years 1972 through 1976. This measurement of movement is expressed as the percent of total seasonal migration to pass the counting tower in a given hour of the day. Migration peaked at 1500 hours in 1976. Two peaks, at 0500 and 1400 hours, occurred in 1975. The highest counts in 1972 and 1974 occurred between the hours of 1300 and 1700. Based on 24 hour counts conducted in 1973 and 1976 (combined data) the lowest continuous 6 hour period of king salmon movement is from 2300-0400.

Abundance: The 1976 Anvik tower expanded count of 958 kings was the second highest since the record count of 1,104 in 1972, the year the project was initiated (Table 5).

The best escapement estimate of Anvik system kings in 1975 combines the upper River weir, lower River float, and Beaver Creek aerial survey estimates for a total of 730 (Mauney 1976). The king escapement estimate for this system in 1976 was 1,155 (Table 6). The 1976 estimate also includes 93 kings seen in the Yellow River which was not surveyed in 1975.

The 1975 count is probably low, due to the lateness of the run, with substantial numbers of fish moving past the tower when operations were terminated, and also due to frequently poor counting conditions. The 1974 count of 471 is also judged low by approximately 40 fish, due to high water conditions which forced early project termination on July 19 (Trasky 1975).

Despite poor survey conditions, the Yellow River aerial count of 93 kings on July 26, 1976 was close to that of the Anvik above Robinhood Creek on July 21 (100 fish) which had good survey conditions. The king salmon

Table 11. Daily net upstream salmon counts (expanded), Anvik River Tower (1976).

Date	King		Pink		Chum	
	Number	%	Number	%	Number	%
6-30					2	0.0
7-1					932	0.4
7-2					4,219	1.8
7-3					1,806	0.8
7-4					603	0.3
7-5	3	0.3	5	1.0	18,504	7.8
7-6	7	0.7	5	1.0	17,365	7.3
7-7	12	1.3	22	4.3	46,156	19.4
7-8	29	3.0	13	2.5	37,580	15.8
7-9	30	3.1	18	3.5	24,569	10.3
7-10	34	3.5	33	6.4	14,386	6.0
7-11	44	4.6	35	6.7	17,046	7.2
7-12	58	6.1	23	4.4	10,468	4.4
7-13	85	8.9	100	19.2	12,370	5.2
7-14	41	4.3	39	7.5	6,147	2.6
7-15	60	6.2	22	4.3	3,805	1.6
7-16	77	8.0	28	5.3	4,533	1.9
7-17	107	11.2	44	8.5	3,879	1.6
7-18	68	7.1	18	3.5	2,866	1.2
7-19	39	4.1	16	3.1	2,518	1.1
7-20	29	3.0	33	6.4	1,904	0.8
7-21	15	1.6	12	2.3	1,391	0.6
7-22	67	7.0	23	4.4	1,290	0.5
7-23	46	4.8	11	2.1	1,354	0.6
7-24	42	4.4	3	0.6	857	0.4
7-25	27	2.8	4	0.8	413	0.2
7-26	18	1.9	9	1.7	345	0.1
7-27	18	1.9	3	0.6	279	0.1
7-28	2	0.2			264	0.1
Total	958	100	519	100	237,851	100

Figure 10. Comparison of daily migration patterns for king salmon, Anvik River, 1973-1976

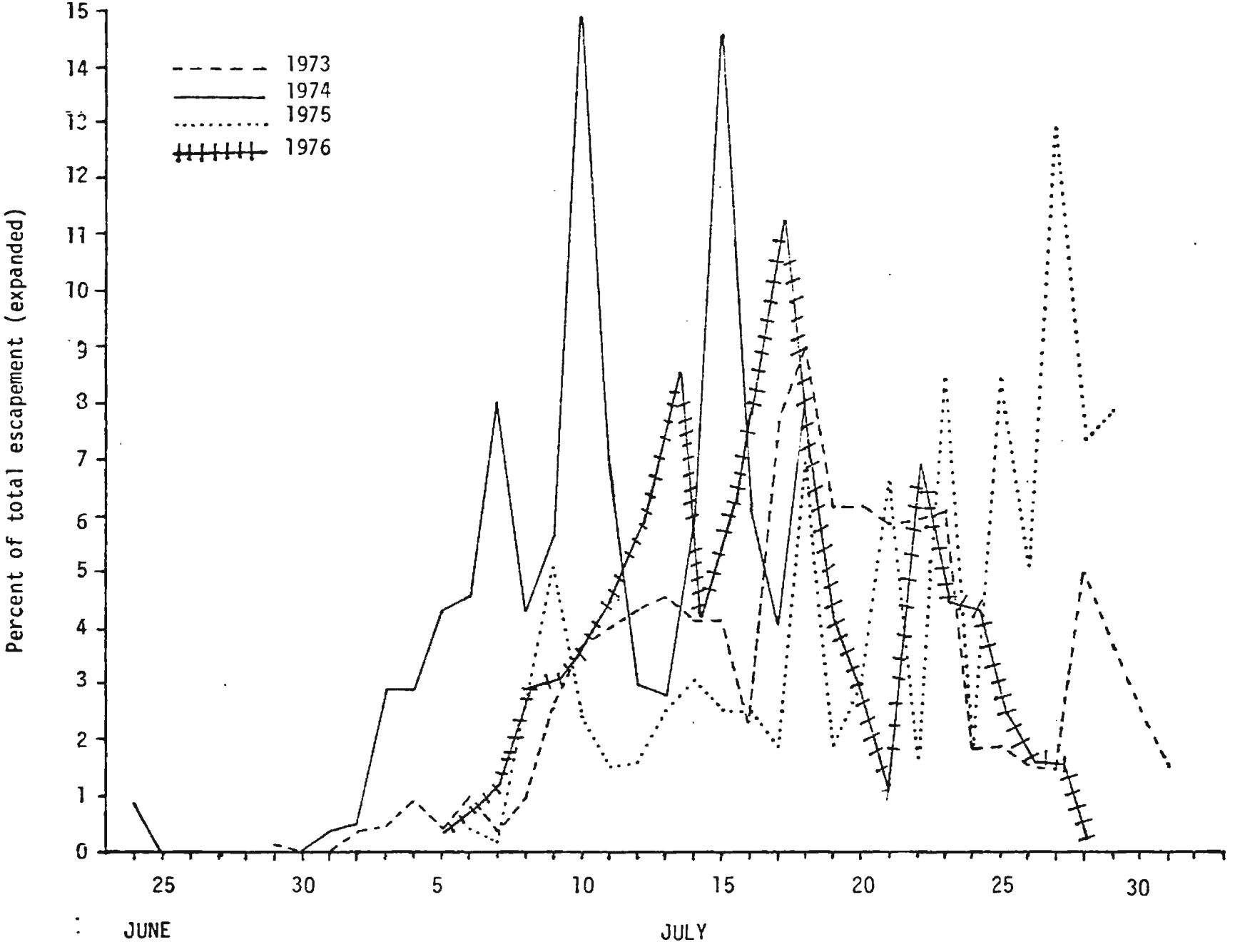
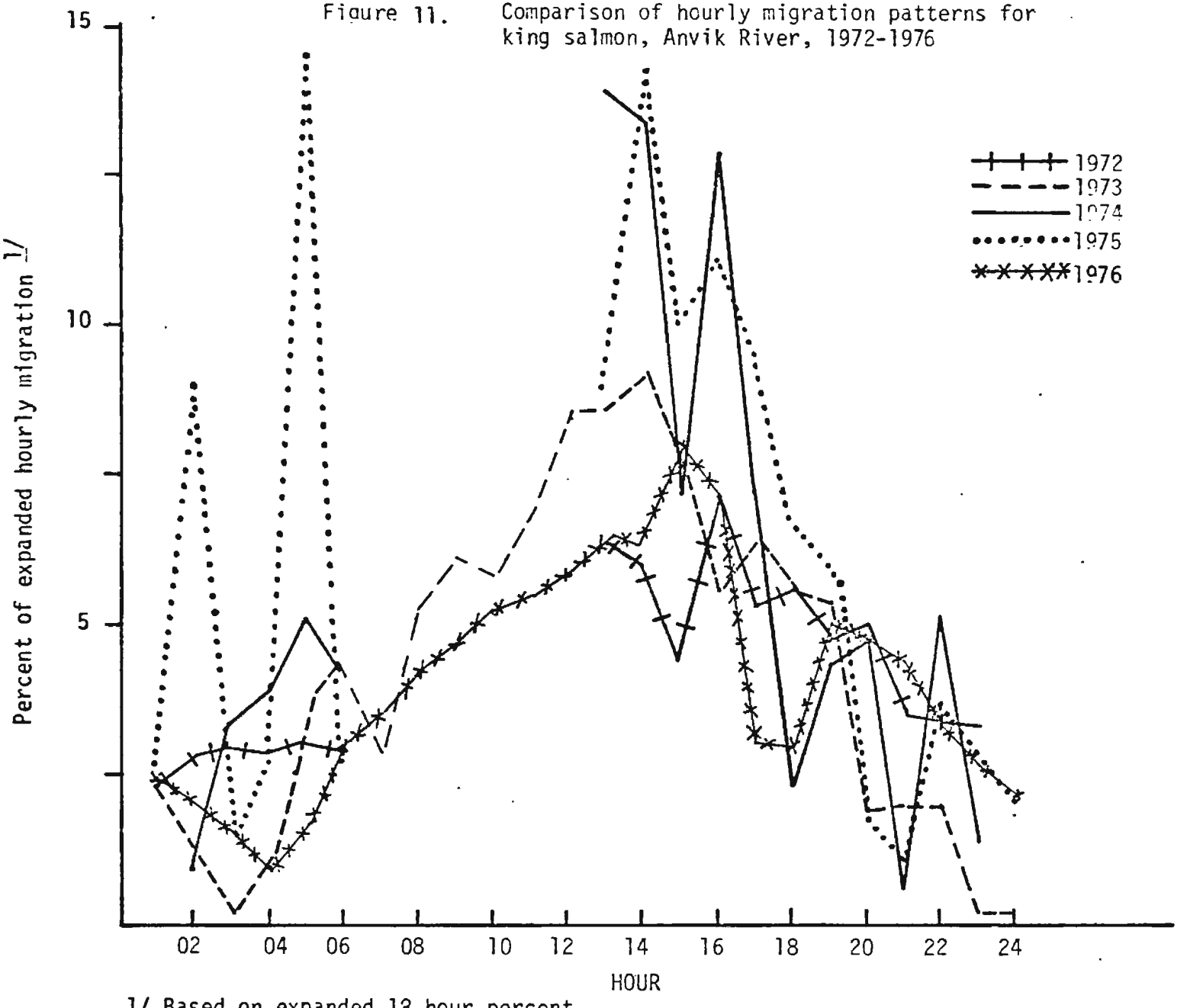


Figure 11. Comparison of hourly migration patterns for king salmon, Anvik River, 1972-1976



1/ Based on expanded 18 hour percent.

escapement past the tower site was 723 by this date. Greater numbers of chum salmon in the main Anvik may reduce the accuracy of king salmon counts. The impression was that kings were as abundant in the Yellow River as in the Upper Anvik. If the effectiveness of the aerial survey on the Yellow was similar to that on the main Anvik, where roughly one salmon was observed out of seven known to be in the escapement, then the Yellow River king escapement would have been nearly 700 by July 21 when the Anvik tower escapement was 77% complete. Using these assumptions as a basis, the total Anvik River drainage system king spawning escapement probably approached 2,000 fish in 1976.

Distribution: One hundred twenty three kings were counted during a boat survey on July 28 from the old tower site to the new tower site, a distance of about 3 miles. King salmon migration past the Robinhood Creek site had virtually ceased by this date. Hence, it is likely that most of the salmon between the tower sites were spawning.

Most king salmon spawning within the main Anvik and tributaries (with the exception of Yellow River) occurs upstream of the Robinhood Creek Tower Site (Table 7). Relatively few king salmon have been observed in the major upstream tributaries.

Age, Sex, Size Composition: Since 1972, few king salmon carcasses of the Anvik River run had been sampled for age, sex, and size composition until the 1976 field season, mostly because carcasses are not readily available until the first week in August.

Additional king salmon age-weight-length (AWL) data is needed for the following reasons: (1) Sex, length and age data for the Yukon are currently collected largely from commercial catches and are probably biased because of the selective nature of the fishery. Size and age selectivity by fishwheels and gillnets has been demonstrated statistically. (2) The only major king salmon stream in the Yukon drainage that is currently adequately sampled is the Salcha River. A carcass sampling crew remained on the Anvik into mid-August to collect king salmon data in 1976.

Forty-five king carcasses were examined for age and sex in 1976; 73% were male and 26% were female. The predominant age represented was 5_2 (67% of kings sampled); age 6_2 and 4_2 fish comprised 20 and 13% of fish sampled respectively (Table 12).

Table 12. Sex and age composition of 1976 Anvik River king salmon scale samples. 1/2/

Age	Male No.	Male %	Female No.	Female %	Total No.	Total %
4_2	6	13.3	0	0	6	13.3
5_2	25	50.0	5	8.9	30	66.7
6_2	2	4.4	7	15.6	9	20.0
Total	33	73.3	12	26.7	45	100.0

1/ Dates of collection August 11 and 12.
2/ Percent of total sample.

Based on total length estimates made from the tower, the dominant size category in 1975 was 601-800 mm (35% of those estimated). Abundance by size category was similar in 1974 (Table 13), while the larger size category of over 800 mm was predominant in 1973. The size categories of 501-600 mm and 601-800 mm were equally represented in the 1976 sample.

Table 13. Estimated size of king salmon migrating upstream past the Anvik River tower, 1973 through 1976.

	Estimated Size 1/									
	Under 500 mm		501-600 mm		601-800 mm		800mm		Total	
Year	No.	%	No.	%	No.	%	No.	%	No.	%
1973	19	4.1	46	9.7	112	23.6	297	62.6	474	100
1974	5	1.4	123	34.4	150	41.9	80	22.3	358	100
1975 2/	16	7.1	59	26.1	80	35.4	71	31.4	226	100
1976 2/	3	12.0	359	39.0	336	37.0	105	12.0	911	100
Carcasses										
1976 3/	1	2.0	8	16.0	33	66.0	8	16.0	50	100

1/ Total length.
2/ Does not include salmon seen but not clearly discernible.
3/ Lengths mideye to fork of tail.

The average male carcass measured in 1976 was 665 mm (38 fish); for 13 females the average length was 794 mm (Appendix Table 25). Both averages are within the 601-800 mm range into which 37% of the tower observations fall. By comparison, Emmonak commercial catch samples of 1,050 kings taken with 8-1/2 inch gillnets in 1976 averaged 825 mm. However, it is recognized that gillnets of this mesh size are selective for large fish. It is probable that a larger carcass sample size is needed from the Anvik to provide an accurate estimate of actual population age and size. Usual estimates of size by tower observers may have been at variance from the actual.

Based on the record high count of king salmon observed for the 1972 brood year of 1,104 fish, it is anticipated that the king salmon returns of 5 year old fish to the Anvik in 1977 could be at a high level with an escapement of 1,000 or more. The king salmon harvest in the Yukon was also at a relatively high level in 1972. An incompletely assessed, but apparently significant factor in king salmon returns, is the impact of the Japanese high seas fishery on survival of immatures. Low king catch per unit of effort by the Japanese fleet in 1975 may indicate poor returns to the Yukon in 1977.

Pink Salmon. An expanded total of 493 pink salmon was counted past the Anvik tower during 1976 (Appendix Table 20). A record high of 1,366 pink salmon was counted in 1975. Pink salmon tower counts for 1973 and 1974 were 286 and 197, respectively. The Anvik River apparently is close to the upstream spawning limit for this species in the Yukon River system and sustains only a marginal population. During years of large chum escapements as in 1974, 1975, and 1976, pink salmon are probably obscured by the much greater numbers of chum salmon present and counts are likely much lower than actual numbers. No pink salmon were observed during either 1976 aerial or beach surveys.

Coho Salmon. Aerial surveys were attempted of the Anvik River and its major tributaries on September 18 and 21 of 1976 to enumerate coho salmon escapement. The weather during this time period was generally overcast with poor light conditions. Eighty-one coho were observed, all in Beaver Creek. On September 22, 1975, 467 spawning coho were observed largely within Beaver Creek and Swift River. A high percentage of the coho salmon observed were still bright and silvery in appearance at the time of the survey. The surveys may have been conducted too early to accurately assess coho abundance. In general, coho salmon abundance in the Yukon River for 1976 as indicated by escapements observed in the Tanana River system appeared to be reduced from past levels.

Juvenile Salmon. Experimental beach seine operations were begun in late July of 1975 and revealed the presence of juvenile king and coho salmon in riffle and pool areas near the tower site and Lavoie's cabin (Figure 6). Eighteen juveniles were captured on September 24 in the area of Robinhood Creek. Eleven of these juveniles were examined; six were king salmon (age 0, total length range 64-74 mm), and 5 were coho salmon (age 0, total length range 53-97 mm).

Beach seining was continued and expanded in 1976. In addition to king and coho, numbers of chum salmon juveniles were also taken in the Anvik 1976 collections (Table 14). It is the opinion of the collector that juvenile chums, not initially recognized in collections, were present in very large numbers at the Robinhood Creek and Runkles Creek areas. Collections in the latter area were made as late as July 14. Chum salmon juveniles had not been documented in the Anvik during past summer seasons. The fact that their presence was observed in 1976 may in some way to be a function of the extremely large escapement in 1975.

With an earlier capture date in 1976, king juveniles were generally of a smaller size than those taken in the September 1975 collection. A single Age 1 coho was found in 1976 collections.

Table 14. Length analysis by species of juvenile salmon taken by seine, Anvik River - July, 1976. 1/

Species	Date	n	$\bar{x}$	S^2	Range	Age
King	6-26	7	36.3	6.24	34-41	0
King	7-14	51	52.5	13.10	44-60	0
King	7-15	1	56			0
Coho	7-15	1	92	-	-	1
Chum	6-26	21	44.1	22.75	31-55	0
Chum	7-14	15	46.4	28-26	38-57	0

1/ King and chum samples for 6-26 taken from Robinhood Creek; king and chum collected on 7-14 from Old Tower Site to Runkles Creek; king and coho samples for 7-15 from Lavoie's cabin sites.

Acoustic Side Scan Salmon Counter. Bendix Electrodynamics Division has been developing acoustic salmon and smolt counters since 1964. The utilization of such counters can result in considerable savings in manpower, relieving staff of the often expensive, monotonous, and tedious work of counting fish. The utilization of sonar counting can make possible the counting of fish under conditions of turbid and/or deep water and poor light conditions at locations where counting would be visually impossible.

Total Anvik River salmon escapement can only be ascertained by the establishment of a counting system in the lower River well below the Yellow River and other important lower River spawning areas. Due to the predominantly turbid water conditions in the Yellow River and other lower River tributaries, clear water conditions which would permit the visual enumeration of salmon in the lower Anvik are rare. The Bendix acoustic salmon counter, if successful, will greatly improve salmon enumeration capabilities in the Anvik.

A suitable site for the establishment of a side scanner installation and for visual comparative counts was located in the lower Anvik in 1975. Bendix redesigned existing acoustic fish enumeration systems resulting in a "side looking" acoustic salmon counter utilizing a single transducer. This system became available for field testing during the 1976 field season. The Bendix Corporation acoustic side salmon counter is described in detail by Menin (1976).

Initial tests of the side scanner were to be held in areas of clear water, where salmon movement is fairly uniform. The Anvik River Robinhood Creek site was ideal for this purpose. The side scanner had not been employed to count chum salmon prior to the Anvik test. Design of this unit assumes that the salmon migrate just above the streambed at a relatively uniform rate.

Al Menin of the Bendix Corporation brought the side scanner to the Anvik site on July 1, 1976. After calibration, some satisfactory test counts were made (Table 15). Over one 5.4 hour test period 99% correlation was achieved between acoustic and visual counts for chum salmon.

The water in the counting channel was approximately 2 feet deep, very clear, and flowing at 3.2 ft/sec. Chum salmon tended to avoid the the artificial counting substratum utilized in 1976. King salmon passed in very low numbers during the test period, but based on limited observations the side scanner will probably not enumerate kings reliably, particularly when set up to enumerate chums. Counting error due to grayling and char during the Anvik 1976 test was minimal.

Table 15. Side scanner versus visual chum salmon count, Anvik tower July 5 and 6, 1976.

	Visual Count	Electronic Count	Duration	Observer	% Accuracy
	1183	1197	1.5 hours	R. Bain	99%
	500	490	0.5 hours	R. Bain	98%
	659	675	1 hour	T. Namtvedt	98%
	504	436	0.5 hours	T. Namtvedt	87%
	332	337	1 hour	J. Mauney	99%
	772	758	0.9 hours	J. Mauney	99%
Total	3950	3893	5.4 hours		99%

Summary

During the 1976 field season, the Anvik River counting tower operation was moved from the 1975 site. The 1976 tower site was at the mouth of Robinhood Creek approximately 3 miles below the 1975 site. The new site, a shallow riffle area, proved to be ideal for weir installation and counting tower operation. Water conditions throughout the 1976 field season were extremely low and generally very clear.

The first chum salmon observed passing the Robinhood Creek tower site in 1976 was on July 1. The 98% level of the run past the tower was reached on July 20. Only in 1975, an extremely late, cold water year, were chum observed to still be moving upstream in substantial numbers by this date.

Based on the analysis of 1973 and 1976, 24 hour counts, the time of least movement for chum salmon is between 0500 and 1100 A.M.

The expanded Anvik tower count of 237,831 summer chums was the second highest count since the project was initiated in 1972. The 1974 count of 201,280 approached the 1976 count; and the 1976 count was only 40% of the record 1975 count. The total observed count, including the Yellow River, for chums during 1976 was 406,166 fish. It is likely that the actual total chum escapement into the Anvik in 1976 approached 500,000. The total observed count in 1975 was 812,998 with actual escapement believed to be in the neighborhood of 1,000,000 chum salmon.

In 1976, 61% of the chum escapement observed during aerial surveys was above Robinhood Creek. For the years 1972, 1973, 1975, and 1976

combined an average of 66.1% of total escapement observed has been in the upper River.

Carcass sampling of chums in 1976 indicated a preponderance of females to males; 61 to 39% respectively. No difference was found in 1975 in relative abundance of males and females. Age class 4_1 chums dominated escapements from 1973 through 1975. Age class 4_1 chums comprised only 13% of the samples and age class 5_1 from the strong 1971 brood year comprised 86% of samples in 1976.

Anvik River chums sampled in 1976 were significantly longer than those sampled in 1973, 1974, and in 1975 averaging respectively: 577, 552, 565, and 553 (lengths in mm, mid-eye to fork of tail).

The first king salmon observed at the counting tower was on July 5 in 1976. The 95% level of the migration was reached on July 24. Timing of the 1976 runs was normal.

Based on 24 hour counts conducted in 1973 and 1976 the lowest continuous 6 hour period of king salmon movement is from 2300-0400 (10.0% of migration observed).

The 1976 Anvik River tower expanded count of 958 king salmon was the second highest since the high count of 1,104 in 1972. The total Anvik River count in 1976, including the Yellow River was 1,155 fish. Most observed king salmon spawning occurs within the main Anvik River above the Robinhood Creek and within the Yellow River.

A total of 45 king salmon carcasses were examined in 1976; 73% were male and 27% were female. The predominant age class represented was 5_2.

An expanded total of 483 pink salmon was counted past the Anvik tower in 1976. A record high of 1,366 pinks were counted in 1975.

Recommendations

Visual counts should be continued on a 24 hour basis through the 1977 season to provide cross checks between side scanner and visual counts on the following: (1) chum avoidance of the scanner artificial substratum, (2) detection of downstream chum movement by scanner, (3) enumeration of char and grayling by scanner, (4) enumeration of king salmon by scanner.

Continued 24 hour counts will better define the expansion factors needed if shorter periods of visual observation are used along with side scanner counts at a downstream site.

Based on the analysis of 24 hour counts conducted during 1973 and 1976 it has been found that the best compromise 18 hour daily counting period for king and chum salmon is 2400 to 0300 and 0900 through 2400. Background information indicates that 20.4% of the kings and 19.7% of the chums would not have been counted during the six hour non-counting period. The low 6 hour continuous period for chum salmon was from 0500-1100 with only 17% of the total count. The period of least king salmon movement was from 2300 through 0500 which included only 10% of observed movement. During late July, as the chum run terminates, counts should be made during the period of maximum king passage.

A side scanner will be operated at the Robinhood Creek site throughout the 1977 field season. Visual counts will be continued on a 24 hour schedule to check the reliability of the unit. The side scanner will be moved to the lower Anvik site during the 1978 field season if successful at the Robinhood Creek site in 1977. Enumeration of the total Anvik River chum salmon escapement will be the goal at the lower River site.

Aerial survey counts for kings within the Anvik system continue to be very low compared to weir or float counts. Aerial king counts in this system can be regarded as index counts only and not as a measure of actual abundance.

The fair aerial survey made of the Yellow River in 1976 showed it to be a major contributor to total Anvik chum and king production. During most summers, this River will not be surveyable by air; but a survey should be attempted in 1977. Aerial surveys need to be continued downstream of the Robinhood Creek tower in 1977 to determine lower Anvik River escapement levels.

A weir counting tower system should be established in 1978 at the lower River site. The weir will essentially control fish movement for counting by side scanner. As conditions permit, visual observations of chum salmon should continue on a 12 to 18 hour a day basis to give correlation with scanner counts. King salmon counts will probably be possible by visual method only. The Robinhood Creek tower operation should be continued in 1978 to give a check on lower river counting success. The upriver operation will be at a reduced level of 18 hours a day.

Sampling effort for juvenile salmon should be increased. Chum salmon smolt abundance and downstream migration timing should be especially noted.

FALL TAGGING AT GALENA

Introduction

Fall chums are a unique race characterized by their large size, silvery appearance, late runs, and spawning only in areas of spring water. The commercial fall chum salmon fishery has expanded from an insignificant harvest in 1961 to a record catch of more than 276,168 fish in 1974 (Table 16). Since 1969 when this fishery began rapid expansion, the commercial harvest has averaged 228,985. The greatest harvest (commercial plus subsistence) was 348,944 in 1974.

Table 16. Yukon River fall chum salmon subsistence and commercial catches, 1961-1976 1/

Year	Subsistence	Commercial	Total
1961	107,572	45,739	153,311
1962	82,620	54,052	136,672
1963	124,519	2,192	126,711
1964	124,543	10,276	135,819
1965	122,015	25,388	147,403
1966	61,897	74,202	136,099
1967	82,344	41,617	123,961
1968	56,356	53,360	109,716
1969	58,193	152,018	210,211
1970	57,582	243,591	301,173
1971	64,383	248,145	312,528
1972	41,276	209,897	251,173
1973	46,544	267,127	313,671
1974	72,776	276,168	348,944
1975	69,732	267,656	337,388
1976	55,321	167,282	222,603

1/ Includes Yukon Territory catches.

Yukon River fall chums are fished intensively throughout the main River, especially at the mouth where the largest concentrations of gear is located. The commercial fishery is essentially similar to a "cape fishery", i.e., various stocks of fall chums are harvested indiscriminately several hundred miles and often several weeks before reaching spawning tributaries. It is unknown at this time whether spatial and temporal stock separation occurs as the stocks enter the commercial fishery.

Prior to 1974 there was very little information 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 not been identified and information is accruing on escapements. Table 2 lists major fall chum systems with escapements for 1974 through 1976 (see also Appendix Table 5).

The Department has taken a conservative approach toward managing the Yukon River fall chum salmon fishery until further knowledge of stock numbers, spawning areas, and optimum harvest rates becomes available. A 250,000 maximum harvest limit has been established by the Board of Fish and Game until returns from current levels of harvest can be evaluated. Quotas of 200,000 for the lower Yukon and 50,000 for upper Yukon have been set for fall chum and coho salmon combined. The 1975 commercial harvest was curtailed when it approached the 250,000 level. An apparent weak run of fall fish in 1976 was protected by fishing time reductions and complete closure of subdistrict 5; a total commercial harvest of 167,282 fall chums resulted.

Chum moving into the lower Yukon River after July 15 are predominantly fall fish. Fall chum salmon runs in the lower River are characterized by extreme fluctuation in abundance as they enter the River. Fluctuations in abundance may represent discrete stocks.

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. For example, it would be beneficial to determine the point upriver where fall chum salmon stocks bound for the Tanana River system and the upper Yukon drainage above the mouth of the Tanana River become spatially separated. A tag and recovery program could demonstrate, for example, that Tanana River stocks become spatially separated at a particular location downriver from its mouth. 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 only 16,825 fish. Early closures of the fall chum fishery in 1974 and 1976 resulted in reduced coho commercial harvests. Information obtained from a tag and recovery project for fall chum salmon would be applicable to coho 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 3 year tag-recovery program on Yukon River

fall chum salmon with the following objectives:

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 of the major stocks.

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

Materials and Methods

The Galena area was chosen as the location for the tagging site (Figure 12). Information gained from the Galena tagging project would be applicable toward management of the lower River fall chum salmon fishery. The advantages of tagging at an upriver location are:

1. Fishwheels can be used as capture gear instead of gill nets, thereby greatly reducing mortality due to capture and handling.

2. The large number of fishery recoveries in the lower Yukon River that would result from tagging in the delta area would be eliminated. Recoveries in the lower River would not provide information on stock separation since spawning areas are located several hundred miles upstream.

Advantages of fishwheels as capture gear include: (1) fishwheels catch salmon which may be held in a livebox in good condition for tagging, (2) a fishwheel can be fished daily throughout the run to sample stocks in proportion to their passage rate in the area on a day-to-day basis giving a naturally weighed tag distribution, and (3) suitable fishwheel fishing sites had been located and fished previously by local fishermen.

Tagging was conducted on both north and south banks of the River and two fishwheels were rented on a contract basis from Galena area fishermen. Fishwheels rented in 1976 were of the standard large Yukon design (Plate 2). The north bank wheel incorporated a three "bag" system and could fish in about 15 feet of water; the south bank wheel was of the two

Figure 12. Fall Yukon tagging and recovery areas, 1976.

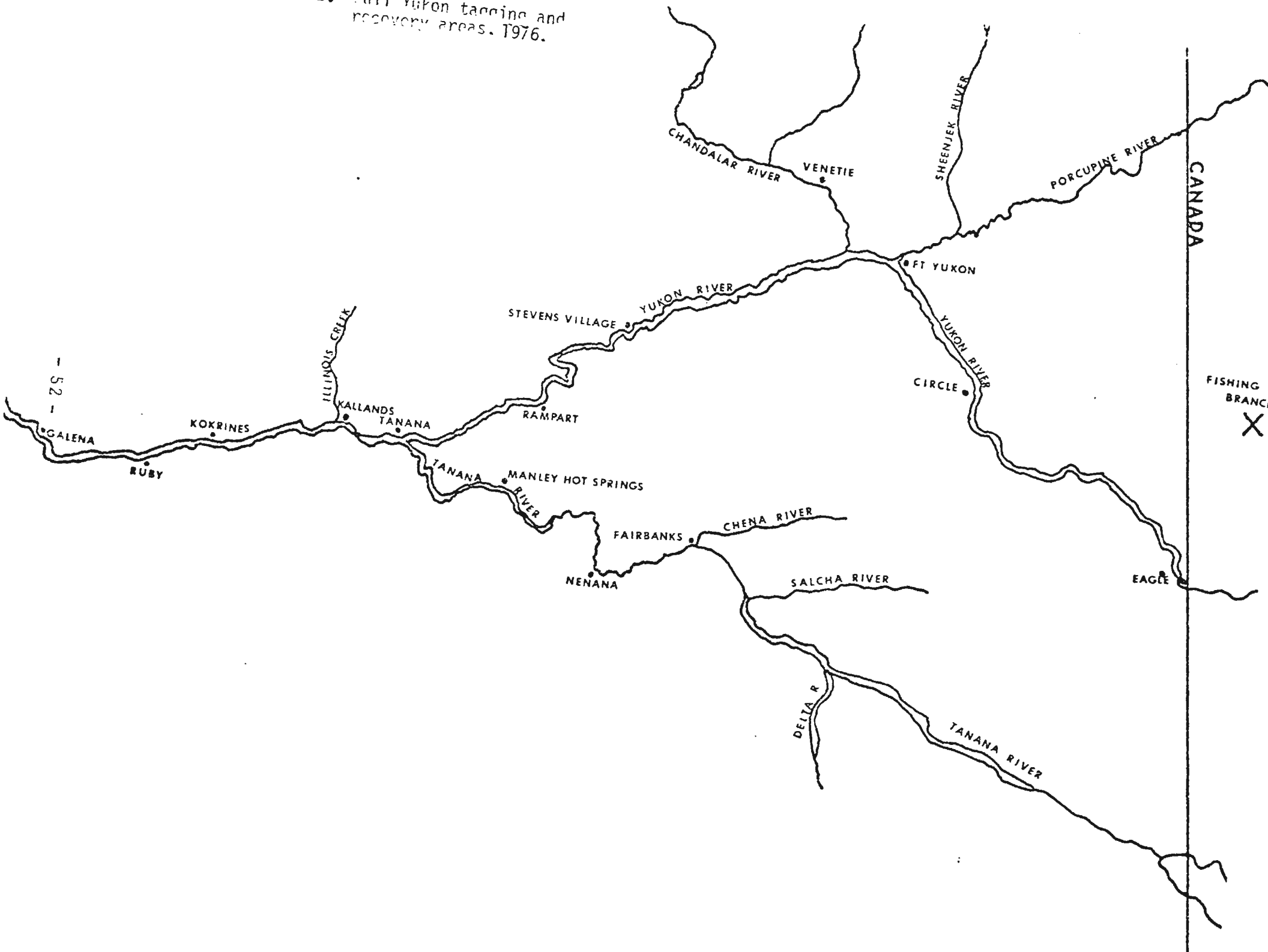
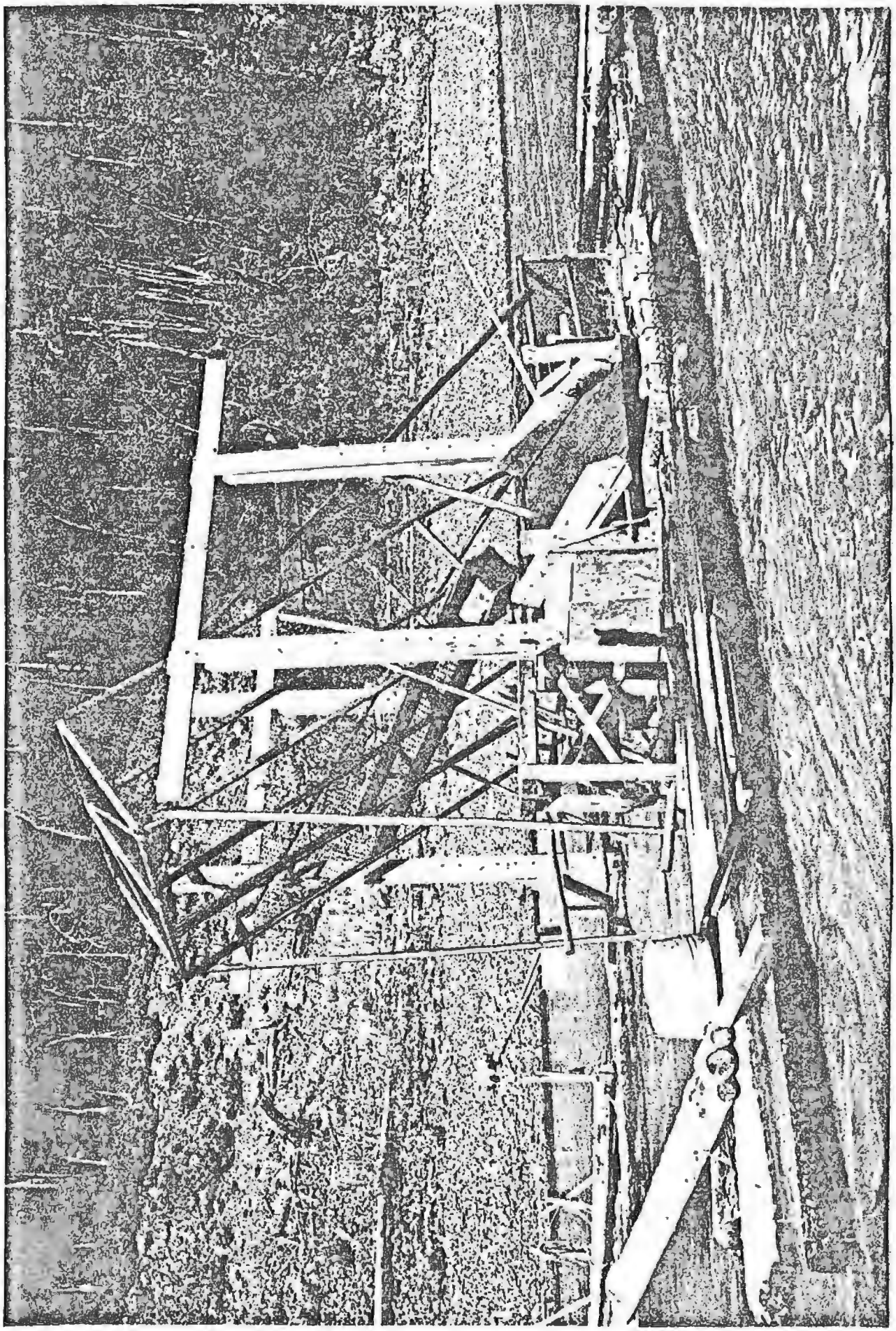


Plate 2. Galena fall tagging north bank fishwheel.



"bagger" type. Both wheels had leads out from shore to funnel salmon into the wheel.

Fishwheel number one was fished along the north bank upstream from Galena (River mile 555). Fishwheel number two was fished along the south bank upstream from Galena (River mile 540). Tagging was initiated at the north bank wheel August 12, and at the south bank wheel August 14. Tagging was terminated at the north bank site September 14 and the south bank site September 17. To allow ready field separation as to tagging location, north bank tagging was done with odd-numbered tags, south bank tagging was done with even-numbered tags, with a few exceptions.

Commercial fishermen utilizing fishwheels generally assume that most chum salmon migrate along the banks of the river during migration. This has been generally confirmed during observations of migration behavior in clearwater tributary streams. There is evidence, however, that some fish may follow sandbars in midstream during their migration up the Yukon River. If a fishwheel is fishing effectively, the basket turns immediately above the streambed. Fluctuations in water level require fishwheel adjustment. Comparisons of catch per unit effort between fishwheels at various locations or of various types to give an indication of run abundance may therefore be very imprecise. Catch is very much 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 run throughout most of the 1976 run within 200 yards downstream of the wheel at the south bank tagging site.

Base camps were established within the immediate vicinity of each fishwheel. The south bank wheel was reachable by way of a walkway from the bank. Communication was maintained between camps by radio. As the season progressed, daily fishwheel catches were used by management personnel as an index to run strength to assist in making decisions regarding fishing season openings upriver. Communication of catches to headquarters was accomplished by either ham radio or telephone from Galena.

According to the contract agreements issued, each tagged salmon was purchased from the fishwheel operator at the current market price; an additional $10.00 a day was paid for boat usage. The experienced Fish and Game crew was able to keep the wheels running with little problem in the absence of the operator. Detailed tagging procedures are listed in Appendix Table 27. 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. The reward check, along with information concerning the returned tag(s), was mailed to those returning tag(s).

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 initiated in the Sheenjek, Toklat, and Fishing Branch rivers (Figure 13). Transportation to the Toklat and Sheenjek were 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. Tags were recovered from carcasses or from spawning fish retrieved by means of spear or shotgun. The upper Tanana River spawning areas were canvassed for tags by observers on foot. 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, Toklat, and Delta areas throughout the period of on-site investigations. Data taken included sex and length (mid-eye to fork of tail). Scale and electrophoretic tissue samples were taken for later analysis.

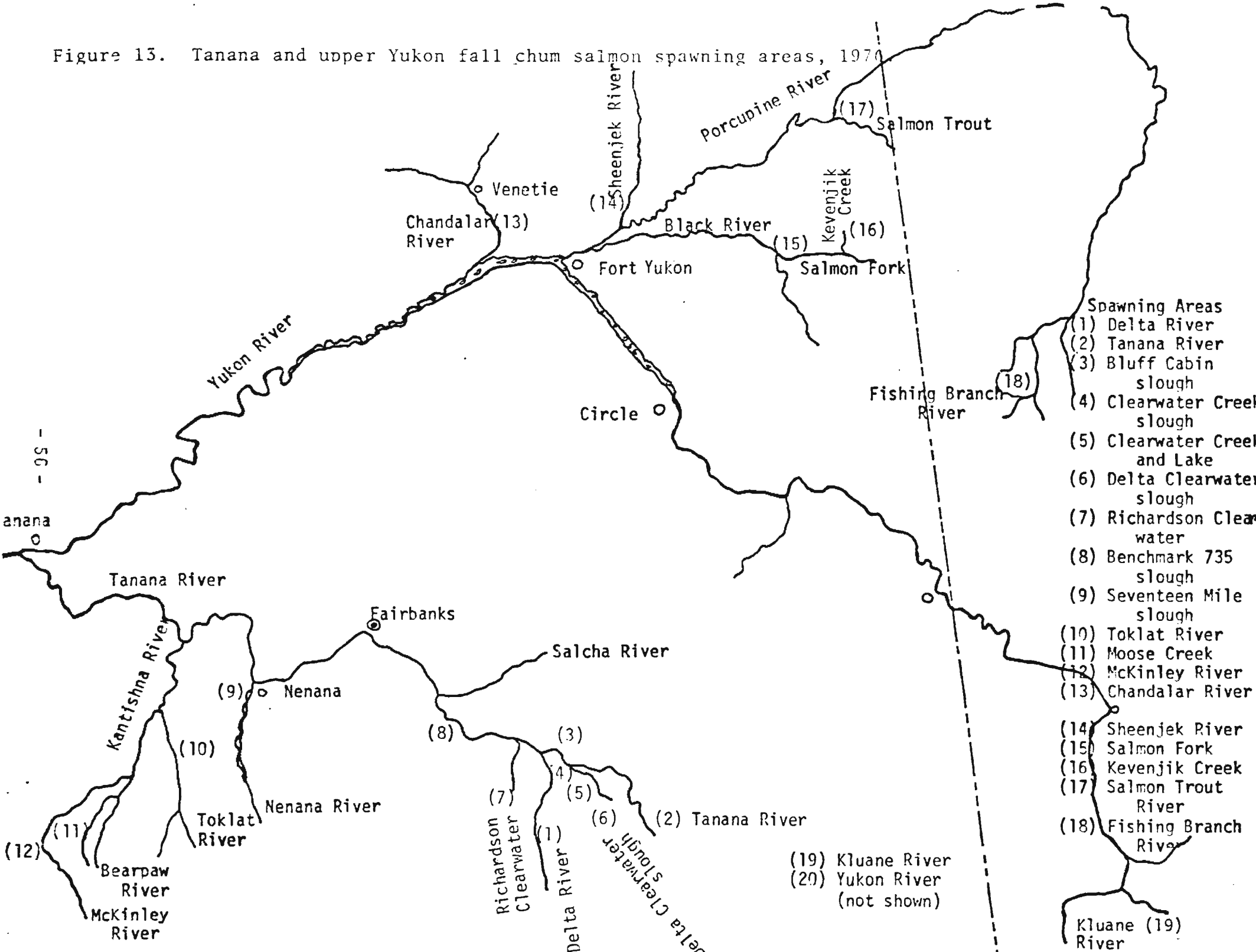
Basic keypunching, programming, and analysis of the 1976 data has been accomplished. In addition, data from earlier studies conducted in 1972 and 1973, but not as yet analyzed, has been programmed. A summary of earlier Yukon tagging projects is presented in Appendix Table 28.

Results and Discussion

One thousand two hundred and seventeen chum salmon and 14 coho were tagged. Five hundred forty-five (45%) were tagged along the north bank and 672 (55%) along the south bank.

According to the observations of Galena area fishermen, the north bank fall run as indicated by catch generally begins and peaks first followed by a later surge in south bank catches. This pattern was verified in the

Figure 13. Tanana and upper Yukon fall chum salmon spawning areas, 1970.



1976 tagging effort (see Figure 14 and Appendix Table 29). Galena fishermen also believe that the highest catch per fishwheel for the season occurs at south bank sites; this held true for the 1976 tagging. The "high daily number" tagged by the north bank site was 54 on August 30; the "high daily number" tagged by the south bank site was 61 on September 1. Ninety percent of the chums had been tagged by September 2 and September 6 for the north and south banks, respectively. Fifty-six percent of the tagged chums were male and 44% were female.

Five hundred seventy-four or 47% of chum salmon and 6 or 42% of coho salmon tagged have been recovered to date (Table 17). Percentage recovery by sex was similar to percentage tagged 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 (Appendix Table 30).

One hundred ninety-eight north bank tagged chum were recovered by the upper Yukon fishery; the south bank tagged chum recovery was 337. The number of south bank recoveries weighed by numbers tagged was significantly higher than would be expected (Appendix Table 30). Most of the Ruby area commercial fishery (some 30 miles upstream from the tagging sites) is along the south bank, and probably accounts for the discrepancy in numbers of tags recovered by bank or tagging.

The commercial fishery accounted for 66% of tagged chum recovered, the subsistence fishery 28%, spawning grounds 5% (Appendix Table 31). All but three of the spawning grounds recoveries were made by Fish and Game survey crews.

The fishwheel, heavily used in upper Yukon fisheries, accounted for 59% of chum recovered. Gillnet gear took 28% of tagged salmon recovered (Table 17).

Tag recoveries are listed by date of tagging in Appendix Table 32 with major areas of recovery given. Appendix Tables 33 and 34 and Figure 15 summarize tag recoveries by major recovery areas. Twelve percent of the recoveries were made by the local Galena fishery. The Ruby area fishery, which is the first major fishery upstream of the tagging sites, accounted for 26% of all tag returns. Forty-four percent of the chum salmon recovered in the Yukon River below the mouth of Tanana were tagged along the north bank and 56% were tagged along the south bank. This follows closely the percentage actually tagged by bank.

It is interesting to note that 27 (5% of total) recoveries were made from the Toklat River spawning grounds. Surveying effort on the Toklat was

Table 17. Recoveries of fall chum by gear, tagging location, and fishery activity, 1976.

	Gear				
	Fish Wheel	Gillnet	Stream Survey	Unknown	Total
No. Recov	340	160	29	45	574
%	59.2	27.9	5.1	7.8	100

Fishery Activity

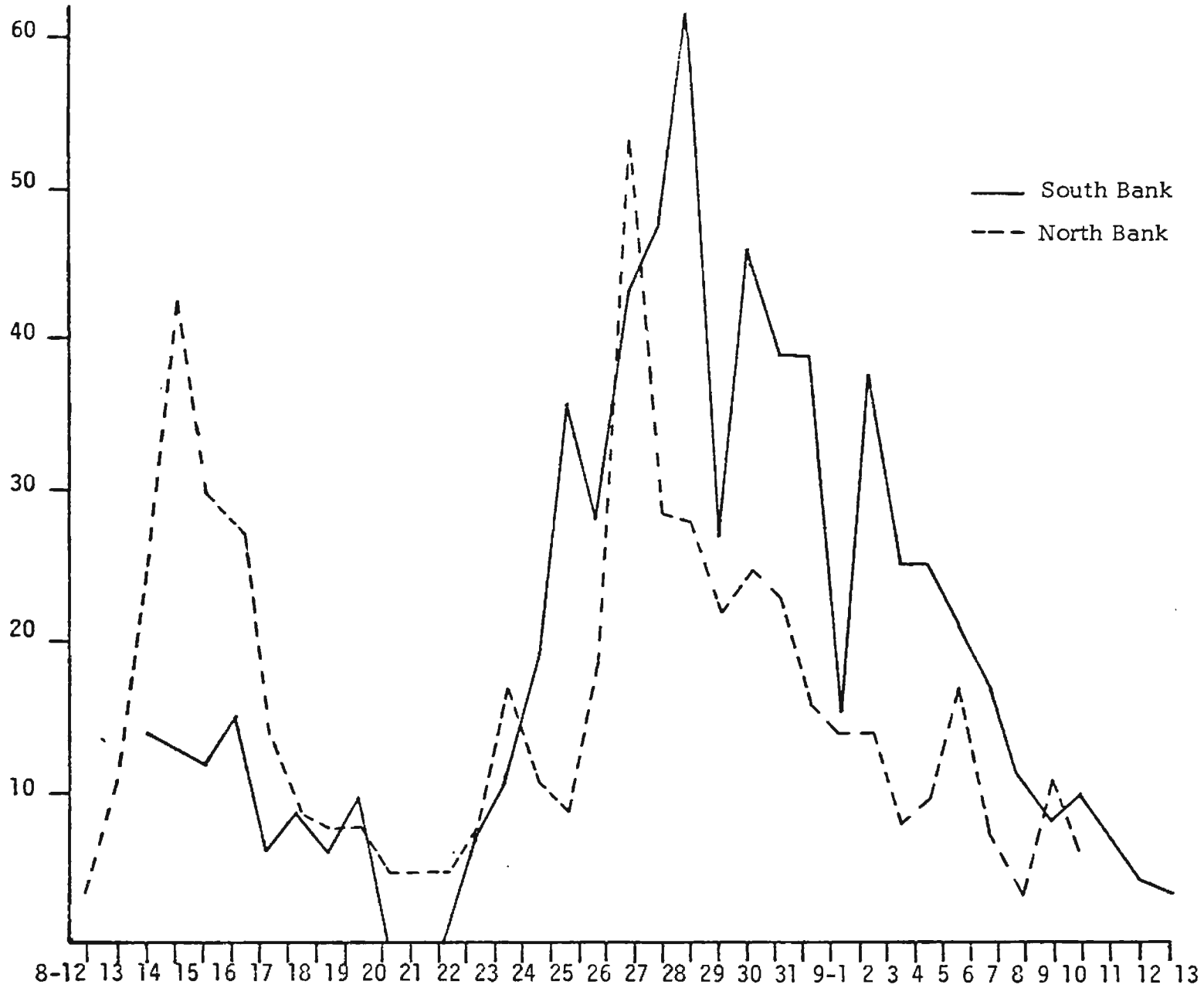
North Bank

Comm	Subsistence	Stream Survey	Unknown	Subtotal
139	78	1	7	225

South Bank

Comm	Subsistence	Stream Survey	Unknown	Subtotal
230	76	25	5	336
369	154	26	12	561
65.8	27.5	4.6	2.1	100

Figure 14. Numbers of fall chum salmon tagged by bank of tagging, Galena 1976.



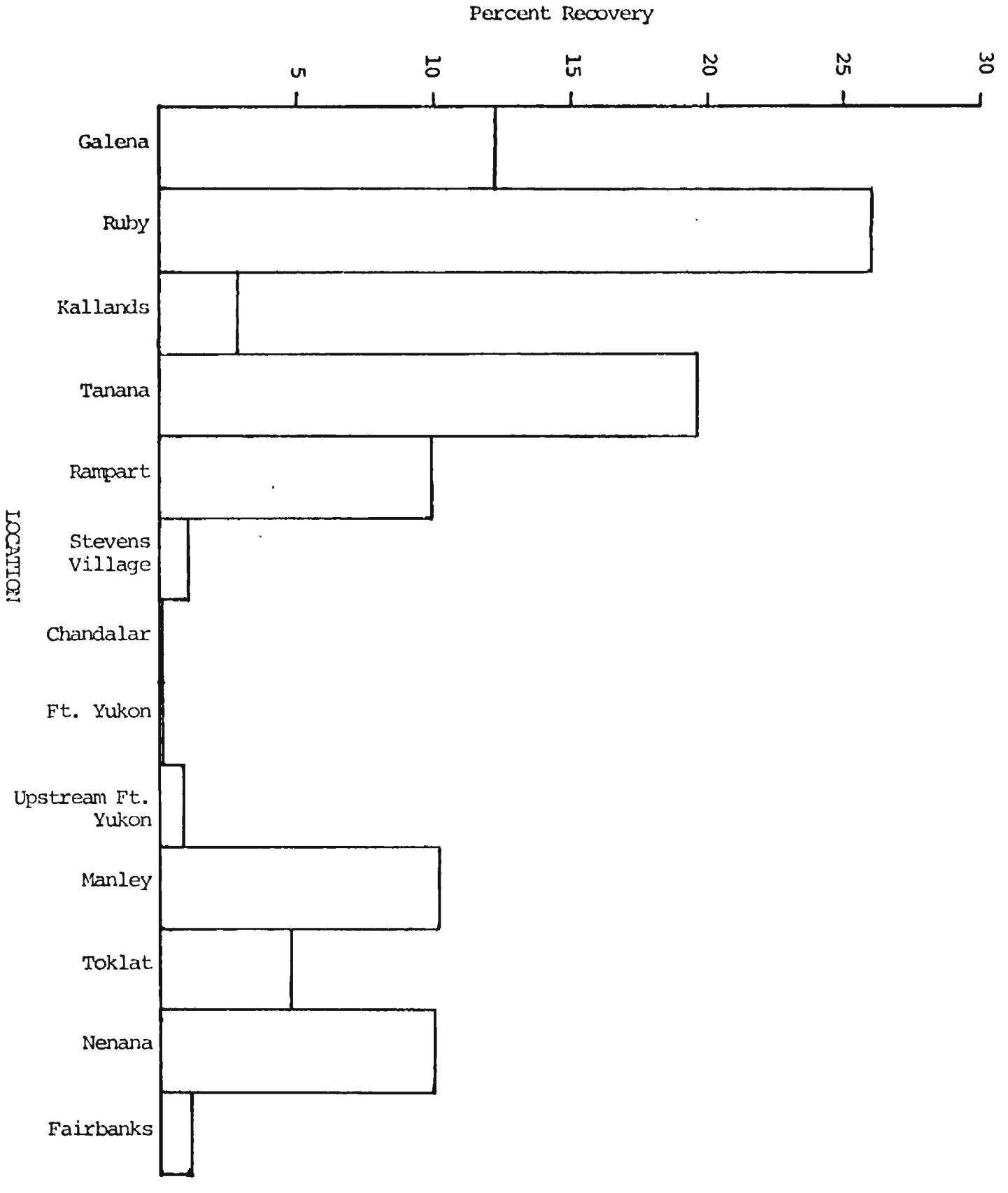


Figure 15. Percent of total Yukon chum salmon tag recoveries by area, 1976.

within the period of October 12 and 21. An estimated 6 to 12 thousand chum were observed from the ground in spawning areas covered on foot (roughly from 3 miles above to 3 miles below Knights Roadhouse). Die-off of spawning chums was estimated at 30-60% during surveys. Tags were recovered at the rate of 1 to every 250 to 500 salmon seen. This area proved to be ideal for covering by foot and raft surveys. Much of the major spawning area was clear water tributary streams or side channels. Tag spotting, recovery, and spawner density estimation proved difficult for main channel spawning areas where water was rendered turbid by glacial runoff.

Recoveries from the other major spawning grounds were disappointingly few. Considerable logistical problems were encountered on the Sheenjek River. Spawning areas were up to 30 miles apart, dieoff of spawners was late, freezeup preceded a good portion of dieoff making raft transportation to these areas impossible, and bears and other predators were observed to pick up carcasses almost as quickly as they died making few available for examination. Most Sheenjek spawning is in deep pool, spring type areas making observation of spawning salmon difficult. During the 1976 study, conducted between September 22 and October 19, operations were basically centered in Russell's cabin area. No tagged salmon were seen or recovered though an estimated 3,000 to 6,000 salmon were observed from the ground.

The lack of tag recoveries from Sheenjek spawning grounds may also be attributed to: (1) Failure to initially tag stock due to different pathways of upstream migration, and (2) heavy fishing mortality in the lower River could have removed most of the tagged stock - particularly true with small numbers of salmon tagged.

Initial transportation to the Fishing Branch was possible only by helicopter due to its remoteness and lack of possible fixed wing landing sites. Once on-site, the stream proved to be comparatively easy to cover by raft. Much of the spawning is in deep pools or spring areas making tag spotting and recovery difficult. Only two tagged salmon were observed and both were recovered. Fishing Branch observations were made between October 3 and 13 when an estimated 8,500 and 9,000 chums were observed by the crew. Only 10% die-off was estimated to have occurred by survey termination.

A single tag was recovered on Delta River surveys where an estimated 6,000 chum spawned. Most spawning was in shallow, clear water channels. Almost all carcasses were examined by Fish and Game crews or retrieved by subsistence fishermen following dieoff.

From the above discussion it seems apparent that the stocks of chum salmon tagged in the fall of 1976 were not tagged in proportion to their actual numbers; the Toklat chums were tagged at a high rate and Sheenjek chums were tagged lightly or not at all. On the basis of 1976 catch data, knowledge of local fishermen, and timing of spawning grounds die-off, tagging is believed to have been conducted through the period of maximum fall chum migration past Galena. It is therefore likely that movement of fall chums up the Yukon (at least during the 1976 season) follows distinctive, separate spatial pathways.

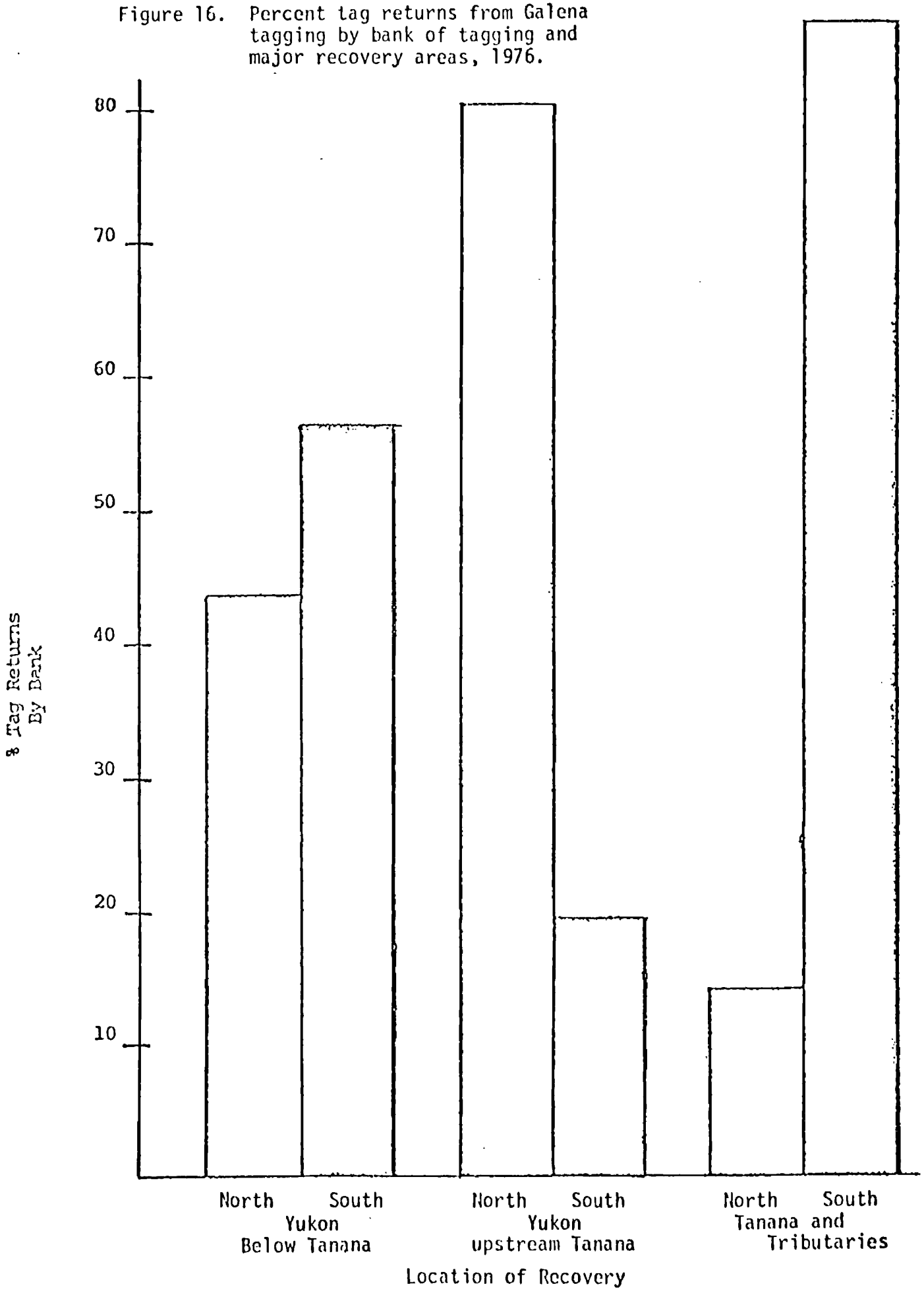
On the basis of the 1976 tagging there would appear to be a definite separation of salmon stocks by bank in the Galena area in respect to spawning destination (Figure 16). Eighty-one percent of the tagged salmon recovered in the upper Yukon above the Tanana were of north bank origin. Eighty-seven percent of tagged salmon recovered in the Tanana were tagged along the south bank. Twenty-six of the 28 tag recoveries from the Toklat spawning grounds were tagged on the south bank. The single Delta River tag recovered was of south bank origin. Of two tags recovered from the Fishing Branch, one was of south bank and one of north bank origin. The single tag recovered in the Chandalar was of north bank origin.

Tag recoveries gave some evidence of different cross-over patterns of Yukon chums from between Galena and Tanana. The highest cross over rate was found in the Galena area. The Galena fishery is largely north bank and 90% of the 69 tags recovered at this location were recovered along the north bank. Twenty-five or 40% of north bank recoveries were tagged on the south bank. The Ruby fishery is largely south bank and 87% of the 147 tags recovered were taken from the south bank. Nineteen or 16% of the south bank recoveries were of north bank origin. In the fishing areas near the village of Tanana a total of 110 tags were recovered; 66% were of north bank origin. At this location 14 or 18% of north bank recoveries were of south bank origin.

The general conclusion can be drawn from 1976 tag returns that chum salmon from Galena upstream seemed to be oriented to either the north or south bank of the Yukon. Tanana River or southern spawning fish seem to have been strongly south bank oriented; upper Yukon-Porcupine spawning fish seem to have been strongly north bank oriented.

On the average, chums tagged (155 fish) at the north bank site were recovered after 11.1 days and had covered 182.2 miles averaging 16.5 miles per day. Chums tagged (231 fish) at the south bank site were recovered after an average of 19.0 days and had covered an average of 168.2 miles for an average speed of 8.9 miles per day. For all recoveries (386 chum) the average time out was 15.8 days and average distance migrated

Figure 16. Percent tag returns from Galena tagging by bank of tagging and major recovery areas, 1976.



was 173.8 miles for an average of 11.0 miles/day. Chum recoveries below Galena or with incomplete data were omitted from this analysis. Trasky found a migration rate of 21.1 mi/day (Appendix Table 28).

Figure 17 gives the number of tag recoveries by date for the upper Yukon and Tanana recovery areas (fish tagged at both north and south banks included here). From this data is would appear that the majority of chums passing Galena before 8-28 were upper Yukon stocks. Toklat chum were the last stock to show up at the Galena site initially appearing on August 31.

Evidence of distinct stock pathways in the Galena area is found in comparative size data (Figure 18). Chum salmon tagged at the Galena north bank site average 581 mm. Sheenjek River fall chums average 601 mm. Chum salmon tagged at the Galena south bank site averaged 547 mm; Toklat fall chum salmon averaged 537 mm. The difference in average lengths of Toklat and Sheenjek River chums was significant at the 10% level (Appendix Table 25).

The age composition of Toklat and Sheenjek River fall chum escapements for 1976 as indicated by spawning ground samples is found in Figure 19. The larger Sheenjek chums were of older age representation - 42% age 4_1 and 53% age 5_1; the smaller Toklat chums were of younger age classes - 52% age 4_1 and 42% age 3_1.

Female comprised 64% and 73% respectively of the Sheenjek and Toklat escapement samples (Appendix Table 35). Males were predominant at the Delta River spawning areas (62%).

No significant difference was found in the average length of Sheenjek River chums sampled in 1975 and 1976. Sheenjek fall chums at 562 mm averaged smaller in 1974 than in 1976. Toklat sampling was not conducted in 1975, but 1974 chums sampled were significantly larger than 1976 chums sampled (562 mm vs 537 mm).

A population estimate of the 1976 fall chum run above Galena is possible based on tag return data and harvest data - (Appendix Tables 36 and 37). The total calculated population using a simple marked recovery estimation is approximately 164,700 salmon (95% confidence coefficient; low - 155,500; high 174,000). It is interesting to note that the sum of total harvest and total observed escapement at 150,400 very closely approach this figure (total harvest 72,400; observed escapement 78,000). If this population figure is accurate, only some 14,000 fall chums were undocumented as to utilization or spawning location. The rate of known exploitation of fall chums in the upper Yukon would be 44% (72,000/165,000 on the basis of this population projection). The total Yukon harvest rate of fall chums in 1976

Figure 17. Tanana and upper Yukon tag recoveries by date of tagging.

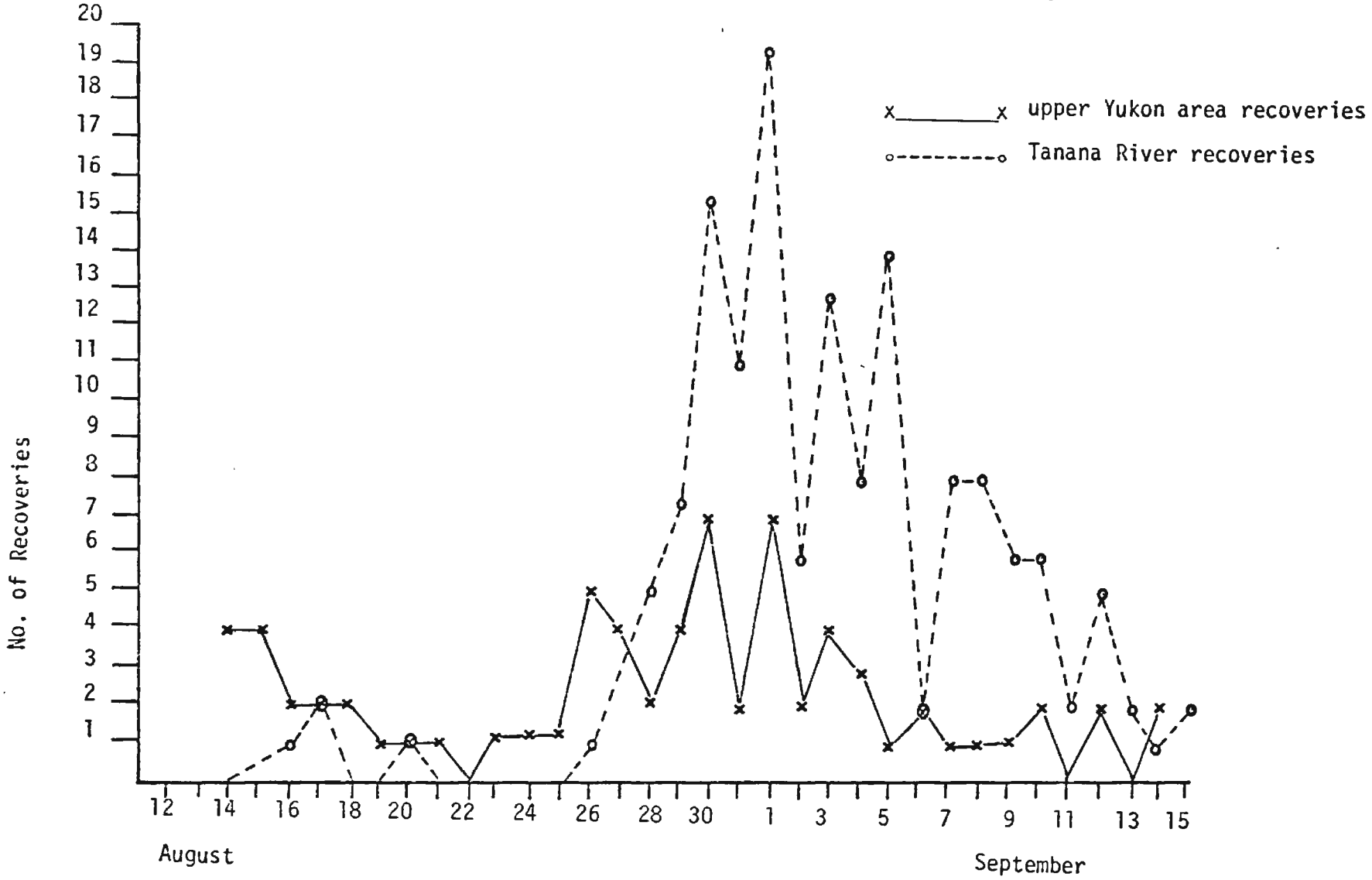


Figure 18. Comparative lengths of Yukon fall chum salmon populations.

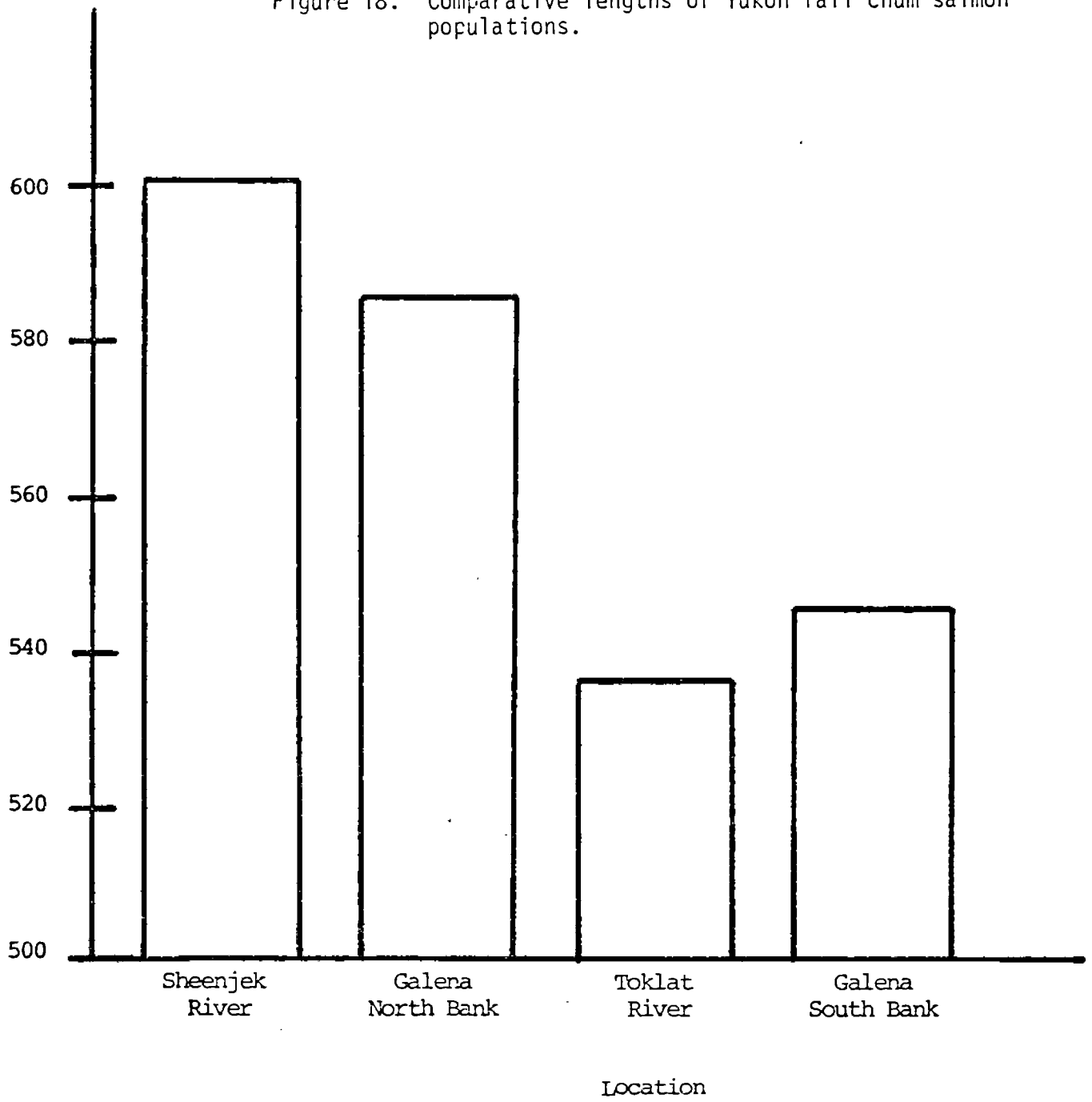
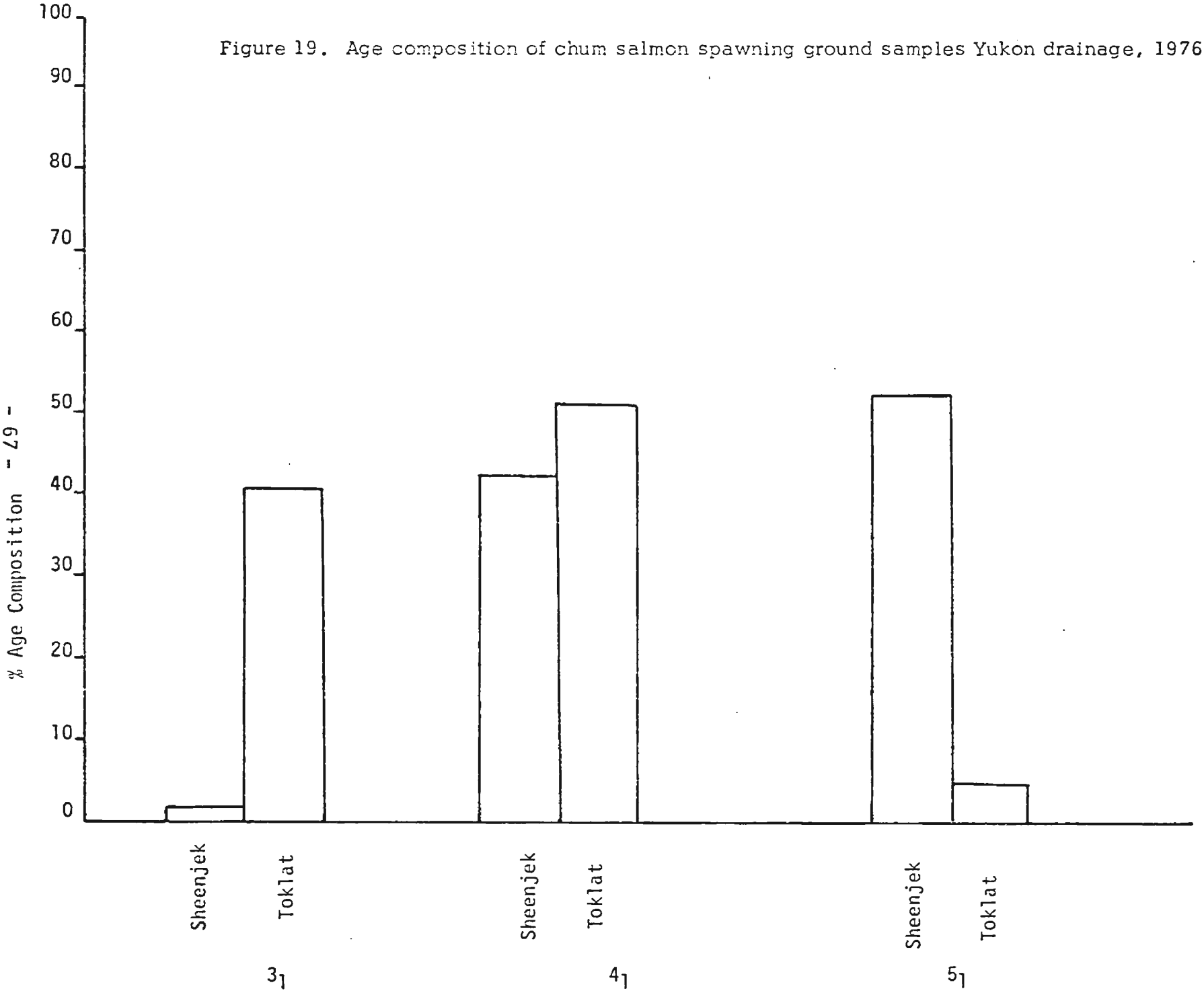


Figure 19. Age composition of chum salmon spawning ground samples Yukon drainage, 1976.



based on a lower Yukon catch of 166,282, upper Yukon utilization of 72,412, and upper Yukon population of 165,000 would approach 72.2% (238,000/331,000).

No results are available from the electrophorectic analysis studies at this time. Preliminary analysis of scale characteristics gives definite promise that separation and identification of Toklat and Sheenjek stocks will be possible.

Summary

Fishwheels were used to tag a total of 1,224 fall chums and 14 coho in 1976. Fishwheel number one was fished upstream of Galena along the north bank of the Yukon at River mile 555. Fishwheel number two was fished upstream of Galena along the south bank of the Yukon at River mile 540. Tagging was initiated at the north wheel site on August 12 and at the south wheel site on August 17.

Tagging peaked at the north bank site on July 30 and at the south bank site on August 1. Of total chums tagged, 44.8 and 55.2% were of north and south bank origin, respectively.

To date a total of 574 or 47% of chum and 6 or 42% of coho salmon tagged have been recovered. No difference in the rate of recovery of male and female chums was seen. The number of south bank recoveries weighed by numbers of salmon tagged was significantly higher than it would be expected to be by chance alone.

The commercial fishery accounted for 66% of tagged chums recovered; the subsistence fishery took 28% of tagged chum recovered. A total of 5% of the recoveries were from the major spawning grounds. The fishwheel was the major recovery gear accounting for 59% of tags recovered followed by gillnets at 28%.

Twelve percent of total recoveries were by the local Galena fishery. The Ruby fishery, accounted for 26% of all tag returns. Other important fisheries are listed by order of ranking in numbers of tag returns: Tanana Village 20%, Rampart 10%, Manley 10% and Nenana 10%.

Inherent weakness in the above calculations would include: the failure to tag all segments of the population equally; and the unequal exploitation of some population segments by the fisheries.

By tagging only salmon in a good condition, mortality should have been held to a minimum, but unknown figure. Tag shedding has been found to be a serious problem in some tagging studies. Utilization of the Petersen

disc tag should have held shedding to a minimum level. In studies involving gillnets as the primary recovery gear, Petersen disc tagged fish may be snagged and recovered at a disproportionally high rate in comparison to untagged fish. The loss of a number of tagged fish from the pool of recoverable salmon would tend to increase calculated population size.

In the early phases of the 1976 tagging a small number of summer chums may have been tagged. The separation of summer and fall stocks this far up the Yukon may be very difficult to impossible in border-line cases.

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

A listing of other fish species taken during fishwheel tagging operation is given in Appendix Table 38. Whitefish species were predominant in numbers with humpback whitefish comprising up to 30% of catches. Whitefish are utilized by local subsistence fishermen.

On the basis of the 1976 tagging there would appear to be a definite separation of chum salmon stocks by bank in respect to spawning destination in the Galena area. Eighty-one percent of the tagged chum recovered in the upper Yukon above the Tanana, were of north bank origin. Eighty-seven percent of tagged chums recovered in the Tanana system were of south bank origin.

Chum salmon tagged at the north bank site were of a significantly greater average length than chums tagged at the south bank site. Sheenjek River spawning ground chums sampled were older, comprising 53% 5_1 age fish and of a greater length than the Toklat fish which were comprised of 42% age 3_1 and 52% age 4_1 classes.

A simple population estimation of 164,700 fall chums was made for the upper Yukon based on the 1976 tagging and harvest. A high rate of fall chum utilization of 44% by the upstream fisheries was indicated. An exploitation rate of 72% of the entire Yukon River fall chum salmon run was indicated for 1976 (lower Yukon harvest included).

The lack of tag recoveries from Sheenjek spawning grounds could be attributed to a number of factors: (1) failure to initially tag the stock due to different migration pathways such as along midriver sandbars, (2)

heavy fishing mortality downstream in the main River could remove most of the tagged stock - especially since small numbers of salmon were tagged, (3) failure to spot tagged salmon in the stream due to deep water and logistical problems in canvassing the stream, and (4) predation of tagged fish before recovery.

Recommendations

A minimum of 3,000-4,000 fall chums should be tagged during the 1977 field season to increase spawning ground recoveries. The outlook for the 1977 return of fall chum to the Yukon, based on brood year escapement, is poor. The 1973 brood year for the Fishing Branch River, which would give rise to the age 4_1 return in 1977, was a historically low return of 15,989 (fish weir count). The 1973 observed Toklat River escapement was approximately 6,000.

More productive fishing locations should be found than those fished in 1976. Indications are that the catch per unit effort in Ruby is much higher than in the Galena area. Preliminary interviews show fishwheels to be available in this area for charter on both banks.

Tagging in a new area would also permit determination as to whether stocks are separated in time.

It is recommended that recovery efforts in the Fishing Branch River be initiated approximately a week later than in 1976 - preferably October 10-20. The timing of recovery efforts in the Toklat River were satisfactory in 1976, October 12 through October 21.

No ready solution is apparent for enhancing Sheenjek recoveries. The 1976 efforts were initiated earlier than necessary. Probably the most feasible program to follow would be the utilization of aircraft based in Ft. Yukon. Major spawning areas could be canvassed by landing on gravel bars. The aircraft would be either held or crews could stay overnight before pickup and moving to a new site the next day. Rafting following dieoff is not practical in the Sheenjek River. Sheenjek operations should take place between October 5 and 15. Another approach to the Sheenjek recovery program would be to weir the lower river and recover tagging fish as they move upstream.

During Fishing Branch and Sheenjek River operations in 1976, conflicts arose between grizzly bear and Department Zodiac rafts with the rafts being damaged. Rafts or tents should never be left at spawning ground sites unattended. Rafts may have to be hauled up into trees when not in

use on the Fishing Branch and Sheenjek rivers. It may prove to be effective to spray the rafts with some type of mace or canine repellent.

Remote recovery crews should be equipped with an emergency signal broadcast system.

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APPENDIX

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903 - 1976

Commercial Catch

Year	Alaska King	Alaska Coho	Alaska Chum	Alaska Total	Yukon Territory King	Yukon Territory Chum	Yukon Territory Total	Total King	Total Coho	Total Chum	Total Total
1903							4,666 8/				4,666
1904											
1905											
1906											
1907											
1908							7,000				7,000
1909							9,238				9,238
1910											
1911											
1912											
1913							12,133				12,133
1914							12,573				12,573
1915							10,466				10,456
1916							9,566				9,566
1917											
1918	12,239	26,144	73,921	112,304			7,066	12,239	26,144	73,921	119,370
1919	104,822	37,070	327,898	469,790			1,800	104,822	37,070	327,898	471,590
1920	58,467		155,655	214,122			12,000	58,467		155,655	266,122
1921	69,646	1,000	111,098	181,744			10,840	69,646	1,000	111,098	192,584
1922	16,825			16,825			2,420	16,825			19,245
1923	13,393			13,393			1,833	13,393			15,226
1924	27,375			27,375			4,560	27,375			31,935
1925							3,900				3,900
1926							4,373				4,373
1927							5,366				5,366
1928							5,733				5,733
1929							5,226				5,226
1930							3,660				3,660
1931							3,473				3,473
1932	4,739			4,739			4,200	4,739			8,939
1933	8,829			8,829			3,333	8,829			12,162
1934	25,365			25,365			2,000	25,365			27,365
1935	7,265			7,265			3,466	7,265			10,731
1936	20,963			20,963			3,400	20,963			24,363
1937	6,226			6,226			3,746	6,226			9,972
1938	13,727			13,727			860	13,727			14,587
1939	9,987			9,987			720	9,987			10,707
1940	18,053			18,053			1,153	18,053			19,206
1941	29,905			29,905			2,806	29,905			32,711
1942	22,487			22,487			713	22,487			23,200
1943	27,650			27,650			609	27,650			28,259
1944	14,232			14,232			986	14,232			15,218
1945	19,727			19,727			1,333	19,727			21,060
1946	22,782			22,782			353	22,782			23,135
1947	54,026			54,026			120	54,026			54,146
1948	33,342			33,342				33,342			33,342
1949	36,379			36,379				36,379			36,379
1950	41,808			41,808				41,808			41,808
1951 3/	56,278			56,278				56,278			56,278
1952	38,637	10,868		49,505				38,637	10,868		49,505
1953	58,959		5,377	64,336				58,959		5,377	64,336
1954	64,545		14,375 4/	78,920				64,545		14,375	78,920
1955	55,925			55,925				55,925			55,925
1956	62,208	1	10,742 5/	72,951				62,208	1	10,742	72,951
1957	63,623			63,623				63,623			63,623
1958	63,735			63,735	3,000	1,500	4,500 7/	66,735		1,500	68,235
1959	78,370			78,370	2,477	1,098	3,575	80,847		1,098	81,945
1960 6/	67,597			67,597	4,085	5,493	9,578	71,682		5,493	77,175
1961	120,250	2,855	42,577 6/	165,682	3,456	3,278	6,734	123,706	2,855	45,855	172,416
1962	94,734	22,926 6/	53,160 6/	170,820	4,037	926	4,963	98,771	22,926	54,086	175,783
1963	116,994	5,572 6/		122,566	2,283	2,192	4,475	119,277	5,572	2,192	127,041
1964	93,587	2,446	8,347	104,380	3,208	1,929	5,137	96,795	2,446	10,276	109,517
1965	118,098	350	23,317 6/	141,765	2,265	2,071	4,336	120,363	350	25,388	146,101
1966	93,315	19,254	71,065 6/	183,634	1,942	3,137	5,079	95,257	19,254	74,202	188,713
1967	129,766	11,047	49,393 6/	190,206	2,187	3,343	5,530	131,953	11,047	52,736	195,736
1968	103,526	13,303	67,395 6/	187,224	2,212	435	2,647	105,738	13,303	67,830	189,871
1969	91,027	14,949	191,860 6/	297,304	1,643	2,279	3,922	92,670	14,949	194,139	330,973
1970	79,145	13,245	344,736 6/	437,126	2,610	2,479	5,089	82,000	13,245	347,203	444,373
1971	110,507	12,203	279,464	402,174	3,276	1,761	4,979	113,615	12,203	281,445	407,303
1972	92,840	22,233	277,446 6/	392,517	1,769	2,532	4,301	94,609	22,233	280,376	407,218
1973	75,353	36,641	513,035 6/	625,033	1,877	2,278	4,039	77,274	36,641	515,263	634,728
1974	97,919	16,243	879,243	993,422	2,214	3,010	5,224	100,133	16,240	882,253	996,676
1975	63,749	2,346	984,850	1,050,945	3,000	2,500	5,500	66,740	2,346	987,359	1056,445
1976	88,671	5,187	761,529	855,377	3,500	1,000	4,500	92,171	5,197	762,505	859,877

Subsistence Catch

Year	Alaska King	Alaska Other Salmon 2/	Alaska Total	Yukon Territory King	Yukon Territory Other Salmon	Yukon Territory Total	Total King	Total Other Salmon	Total Total
1903									
1904									
1905									
1906									
1907									
1908									
1909									
1910									
1911									
1912									
1913									
1914									
1915									
1916									
1917									
1918		1,400,000	1,400,000					1,400,000	1,400,000
1919		269,000	269,000					269,000	269,000
1920	20,000	860,000	880,000				20,000	860,000	880,000
1921									
1922	15,000	330,000	345,000				15,000	330,000	345,000
1923	17,500	435,000	452,500				17,500	435,000	452,500
1924		1,130,000	1,130,000					1,130,000	1,130,000
1925	15,000	259,000	274,000				15,000	259,000	274,000
1926	20,500	555,000	575,500				20,500	555,000	575,500
1927		520,000	520,000					520,000	520,000
1928		670,000	670,000					670,000	670,000
1929		537,000	537,000					537,000	537,000
1930		633,000	633,000					633,000	633,000
1931	26,693	565,000	591,693				26,693	565,000	591,693
1932	23,160	1,092,000	1,115,160				23,160	1,092,000	1,115,160
1933	19,950	603,000	622,950				19,950	603,000	622,950
1934		474,000	474,000					474,000	474,000
1935	20,400	537,000	557,400				20,400	537,000	557,400
1936	22,750	560,000	582,750				22,750	560,000	582,750
1937	5,528	346,000	351,528				5,528	346,000	351,528
1938	19,244	340,450	359,694				19,244	340,450	359,694
1939	18,050	327,650	345,700				18,050	327,650	345,700
1940	14,400	1,029,000	1,043,400				14,400	1,029,000	1,043,400
1941	17,703	438,000	455,703				17,703	438,000	455,703
1942		197,000	197,000					197,000	197,000
1943		200,000	200,000					200,000	200,000
1944									
1945									
1946									
1947									
1948									
1949									
1950									
1951 3/									
1952									
1953		380,000	380,000					380,000	380,000
1954									
1955									
1956									
1957									
1958	11,890	337,500	349,390	8,000		8,000	19,890	337,500	357,390
1959				5,957	2,000 7/	7,957	5,957	2,000	7,957
1960 6/				6,965	8,429	15,394	6,965	8,429	15,394
1961	21,488	407,089	428,577	10,376	5,500	15,876	31,864	412,589	444,453
1962	11,110	343,141	354,251	10,500	9,300	19,800	21,610	352,441	374,051
1963	24,862	396,125	420,987	8,108	25,500	33,608	32,970	421,625	454,595
1964	16,231	481,440	497,671	6,645	4,181	10,826	22,876	485,621	508,497
1965	16,608	449,131	465,739	3,115	9,800	12,915	19,723	458,931	478,654
1966	11,572	206,011	217,583	2,700	8,600	11,300	14,272	214,611	228,883
1967	16,448	274,977	291,425	3,213	13,600	16,813	19,661	288,577	308,238
1968	12,106	178,507	190,613	2,900	11,100	14,000	15,006	189,607	204,613
1969	14,000	208,254	222,254	1,000	5,500	6,500	15,000	213,754	228,754
1970	13,374	222,305	235,679	2,100	1,200	3,300	15,474	223,505	238,979
1971	22,386	200,368	222,754	2,800	14,000	16,800	25,186	214,368	239,554
1972	17,931	133,102	151,033	1,657	8,000	9,657	19,588	141,102	160,690
1973	20,099	175,238	195,337	2,116	6,938	9,054	22,215	182,176	204,391
1974	17,186	282,466	299,652	3,379	8,636	12,015	20,565	291,102	311,667
1975	14,709	260,824	275,533	3,000	18,100	21,100	17,709	278,924	296,633
1976	13,597	217,859	231,456	1,500	3,425	4,925	15,097	221,284	236,381

Total Utilization

Year	Alaska King	Alaska Other Salmon	Alaska Total	Yukon Territory King	Yukon Territory Other Salmon	Yukon Territory Total	Total King	Total Other Salmon 2/	Total Total
1903						4,666			4,666
1904									
1905									
1906									
1907									
1908						7,000			7,000
1909						9,238			9,238
1910									
1911									
1912									
1913						12,133			12,133
1914						12,573			12,573
1915						10,466			10,466
1916						9,566			9,566
1917									
1918	12,239	1,500,065	1,512,304			7,066	12,239	1,500,065	1,519,370
1919	104,822	738,790				1,800	104,822	633,968	740,590
1920	78,467	1,015,655	1,094,122			12,000	78,467	1,015,655	1,106,122
1921	69,646	112,098	181,744			12,840	69,646	112,098	194,584
1922	31,825	330,000	361,825			2,420	31,825	330,000	364,245
1923	30,893	435,000	465,893			1,833	30,893	435,000	467,726
1924	27,375	1,130,000	1,157,375			4,560	27,375	1,130,000	1,161,935
1925	15,000	259,000	274,000			3,900	15,000	259,000	277,900
1926	20,500	555,000	575,500			4,373	20,500	555,000	579,873
1927		520,000	520,000			5,366		520,000	525,366
1928		670,000	670,000			5,733		670,000	675,733
1929		537,000	537,000			5,226		537,000	542,226
1930		633,000	633,000			3,660		633,000	636,660
1931	26,693	565,000	591,693			3,473	26,693	565,000	595,166
1932	27,899	1,092,000	1,119,899			4,200	27,899	1,092,000	1,124,099
1933	28,779	603,000	631,779			3,333	28,779	603,000	635,112
1934	23,365	474,000	497,365			2,000	23,365	474,000	499,365
1935	27,665	537,000	564,665			3,466	27,665	537,000	568,131
1936	43,713	560,000	603,713			3,400	43,713	560,000	607,113
1937	12,154	346,000	358,154			3,746	12,154	346,000	361,900
1938	32,971	340,450	373,421			860	32,971	340,450	374,281
1939	28,037	327,650	355,687			720	28,037	327,650	356,407
1940	32,453	1,029,000	1,061,453			1,153	32,453	1,029,000	1,062,606
1941	47,608	438,000	485,608			2,806	47,608	438,000	488,414
1942	22,487	197,000	219,487			713	22,487	197,000	220,200
1943	27,650	200,000	227,650			609	27,650	200,000	228,259
1944	14,232		14,232			986	14,232		15,218
1945	19,727		19,727			1,333	19,727		21,060
1946	22,782		22,782			353	22,782		23,135
1947	54,026		54,026			120	54,026		54,146
1948	33,342		33,342				33,342		33,342
1949	36,379		36,379				36,379		36,379
1950	41,808		41,808				41,808		41,808
1951 3/	56,278		56,278				56,278		56,278
1952	38,637	10,868	49,505				38,637	10,868	49,505
1953	58,959	385,377	444,336				58,959	385,377	444,336
1954	64,545	14,375	78,920				64,545	14,375	78,920
1955	55,925		55,925				55,925		55,925
1956	62,208	10,743	72,951				62,208	10,743	72,951
1957	63,623		63,623				63,623		63,623
1958	75,625	337,500	413,125	11,000	1,500	12,500	86,625	339,000	[illegible]
1959	78,370		78,370	8,434	3,098	11,532	86,804	3,098	[illegible]
1960 6/	67,597		67,597	11,050	13,922	24,972	78,647	13,922	[illegible]
1961	141,746	452,523	594,269	13,322	9,078	22,400	155,068	461,601	[illegible]
1962	105,844	425,227	531,071	14,537	10,236	24,773	120,381	435,463	[illegible]
1963	141,856	401,697	543,553	10,391	27,692	38,083	152,247	429,389	[illegible]
1964	109,818	492,233	602,051	9,854	6,110	15,964	119,672	498,343	[illegible]
1965	134,736	472,778	607,514	5,330	11,871	17,251	140,066	484,649	[illegible]
1966	104,887	295,356	400,157	4,642	11,757	16,379	109,529	307,107	[illegible]
1967	146,754	335,477	481,631	5,400	16,943	22,343	151,554	352,420	[illegible]
1968	115,632	255,276	377,817	5,112	11,535	16,647	123,744	270,749	[illegible]
1969	105,230	415,045	519,348	2,640	7,779	10,419	106,893	422,874	[illegible]
1970	94,143	578,974	675,117	4,711	3,679	8,390	95,554	584,653	[illegible]
1971	132,793	502,255	635,148	5,976	15,761	21,739	138,071	515,016	[illegible]
1972	110,771	443,179	553,950	3,426	10,532	13,958	114,197	453,711	[illegible]
1973	95,452	733,914	829,376	3,997	9,166	13,153	99,439	743,080	[illegible]
1974	115,305	1,177,349	1,293,054	5,593	11,646	17,239	120,898	1,188,995	[illegible]
1975	78,449	1,247,029	1,325,478	6,000	20,600	26,600	84,449	1,267,629	[illegible]
1976	102,258	904,575	1,006,833	5,000	4,425	9,425	107,268	909,000	1,016,2[illegible]

1/ Does not include subsistence catches from the village of [illegible], a coastal village located northeast of the Yukon River mouth.
2/ Mostly chum salmon, but includes small numbers of pink and coho salmon.
3/ Data source for Alaska commercial catches: USFWS Stat. Digest No. 50 for the years 1951-59 unless otherwise indicated.
4/ Data source: Alaska Fisheries and Fur-Seal Industry Report for 1954.
5/ Includes small numbers of pink or red salmon (less than 300).
6/ Data source for Alaska commercial catches: ADF&G Stat. Leaflets for years since 1960.
7/ Data source: Environment Canada, Fisheries Service (Whitehorse).
8/ Catch data for years 1903-1947 obtained by dividing total poundage of mixed salmon by an arbitrary weight of 15 pounds. Species breakdown is unknown. Figures are considered conservative (data collected by Royal Canadian Mounted Police).

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976 (continued).

	COMMERCIAL CATCH										
	Alaska				Yukon Territory			Total			
Year	King	Coho	Chum	Total	King	Chum	Total	King	Coho	Chum	Total
1903							4,666[8/]				4,666
1904											
1905											
1906											
1907											
1908							7,000				7,000
1909							9,238				9,238
1910											
1911											
1912											
1913							12,133				12,133
1914							12,573				12,573
1915							10,466				10,466
1916							9,566				9,566
1917											
1918	12,239	26,144	73,921	112,304			7,066	12,239	26,144	73,921	119,370
1919	104,822	37,070	327,898	469,790			1,800	104,822	37,070	327,898	471,590
1920	58,467		155,655	214,122			12,000	58,467		155,655	266,122
1921	69,646	1,000	111,098	181,744			10,840	69,646	1,000	111,098	192,584
1922	16,825			16,825			2,420	16,825			19,245
1923	13,393			13,393			1,833	13,393			15,226
1924	27,375			27,375			4,560	27,375			31,935
1925							3,900				3,900
1926							4,373				4,373
1927							5,366				5,366
1928							5,733				5,733
1929							5,226				5,226
1930							3,660				3,660
1931							3,473				3,473
1932	4,739			4,739			4,200	4,739			8,939
1933	8,829			8,829			3,333	8,829			12,162
1934	25,365			25,365			2,000	25,365			27,365
1935	7,265			7,265			3,466	7,265			10,731

(Continued)

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976 (continued).

	COMMERCIAL CATCH										
	Alaska				Yukon Territory			Total			
Year	King	Coho	Chum	Total	King	Chum	Total	King	Coho	Chum	Total
1936	20,963			20,963			3,400	20,963			24,363
1937	6,226			6,226			3,746	6,226			9,972
1938	13,727			13,727			860	13,727			14,587
1939	9,987			9,987			720	9,987			10,707
1940	18,053			18,053			1,153	18,053			19,206
1941	29,905			29,905			2,806	29,905			32,711
1942	22,487			22,487			713	22,487			23,200
1943	27,650			27,650			609	27,650			28,259
1944	14,232			14,232			986	14,232			15,218
1945	19,727			19,727			1,333	19,727			21,000
1946	22,782			22,782			353	22,782			23,135
1947	54,026			54,026			120	54,026			54,146
1948	33,842			33,842				33,842			33,842
1949	36,379			36,379				36,379			36,379
1950	41,808			41,808				41,808			41,808
1951[3]	56,278			56,278				56,278			56,278
1952	38,637	10,868		49,505				38,637	10,868		49,505
1953	58,859		5,977	64,836				58,859		5,977	64,836
1954	64,545		14,375[4]	78,920				64,545		14,375	78,920
1955	55,925			55,925				55,925			55,925
1956	62,208	1	10,742[5]	72,951				62,208	1	10,742	72,951
1957	63,623			63,623				63,623			63,623
1958	63,375			63,375	3,000	1,500	4,500[7]	66,735		1,500	68,235
1959	78,370			78,370	2,477	1,098	3,575	80,847		1,098	81,945
1960[6]	67,597			67,597	4,085	5,493	9,578	71,682		5,493	77,175
1961	120,260	2,855	42,577[5]	165,692	3,446	3,278	6,724	123,706	2,855	45,895	172,416
1962	94,734	22,926	53,160[5]	170,820	4,037	936	4,973	98,771	22,926	54,096	175,793
1963	116,994	5,572[5]		122,566	2,283	2,192	4,475	119,277	5,572	2,192	127,041
1964	93,587	2,446	8,347	104,380	3,208	1,929	5,137	96,795	2,446	10,276	109,517
1965	118,093	350	23,317	141,765	2,265	2,071	4,336	120,363	350	25,388	146,101
1966	93,315	19,254	71,045[5]	183,614	1,942	3,157	5,099	95,257	19,254	74,202	188,713
1967	129,706	11,047	49,453[5]	190,206	2,187	3,343	5,530	131,893	11,047	52,796	195,736

(Continued)

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976 (continued).

	COMMERCIAL CATCH										
	Alaska				Yukon Territory			Total			
Year	King	Coho	Chum	Total	King	Chum	Total	King	Coho	Chum	Total
1968	106,526	13,303	67,397 5/	187,224	2,212	435	2,647	103,738	13,303	67,830	189,871
1969	90,223	14,981	191,860	297,064	1,640	2,279	3,919	91,863	14,981	194,139	300,983
1970	80,269	12,245	356,724 5/	439,238	2,611	2,479	5,090	82,880	12,245	349,203	444,328
1971	110,507	12,203	239,684 5/	412,394	3,178	1,761	4,939	113,685	12,203	291,445	417,333
1972	92,840	22,233	287,844	402,917	1,769	2,532	4,301	94,609	22,233	290,376	407,218
1973	75,353	36,641	518,035 5/	640,039	1,871	2,228	4,099	77,224	36,641	520,263	634,128
1974	97,919	16,240	879,243	993,402	2,214	3,010	5,224	100,133	16,240	882,253	998,626
1975	63,740	2,346	984,859	1,050,945	3,000	2,500	5,500	66,740	2,346	987,359	1,056,445
1976	88,671	5,197	761,509	855,377	3,500	1,000	4,500	92,171	5,197	762,509	859,877

1/ Does not include subsistence catches from the village of Stebbins, a coast village located northeast of the Yukon River mouth.
2/ Mostly chum salmon, but includes small numbers of pink and coho salmon.
3/ Data source for Alaska commercial catches: USFWS Stat. Digest No. 50 for the years 1951-59 unless otherwise indicated.
4/ Data source: Alaska Fisheries and Fur Seal Industry Report for 1954.
5/ Includes small numbers of pink or red salmon (less than 300).
6/ Data source for Alaska commercial catches: ADF&G Stat. Leaflets for years since 1960.
7/ Data source: Environment Canada, Fisheries Service (Whitehorse).
8/ Catch data for years 1903-1947 obtained by dividing total poundage of mixed salmon by an arbitrary weight of 15 pounds. Species breakdown is unknown. Figures are considered conservative (data collected by Royal Canadian Mounted Police).

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976.

	SUBSISTENCE CATCH								
	Alaska 1/			Yukon Territory			Total		
Year	King	Other Salmon 2/	Total	King	Other Salmon	Total	King	Other Salmon	Total
1903									
1904									
1905									
1906									
1907									
1908									
1909									
1910									
1911									
1912									
1913									
1914									
1915									
1916									
1917									
1918		1,400,000	1,400,000					1,400,000	1,400,000
1919		269,000	269,000					269,000	269,000
1920	20,000	860,000	880,000				20,000	860,000	880,000
1921									
1922	15,000	330,000	345,000				15,000	330,000	345,000
1923	17,500	435,000	452,500				17,500	435,000	452,500
1924		1,130,000	1,130,000					1,130,000	1,130,000
1925	15,000	259,000	274,000				15,000	259,000	274,000
1926	20,500	555,000	575,500				20,500	555,000	575,500
1927		520,000	520,000					520,000	520,000
1928		670,000	670,000					670,000	670,000
1929		537,000	537,000					537,000	537,000
1930		633,000	633,000					633,000	633,000
1931	26,693	565,000	591,693				26,693	565,000	591,693
1932	23,160	1,092,000	1,115,160				23,160	1,092,000	1,115,160
1933	19,950	603,000	622,950				19,950	603,000	622,950
1934		474,000	474,000					474,000	474,000
1935	20,400	537,000	557,400				20,400	537,000	557,400

(Continued)

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976 (continued).

	SUBSISTENCE CATCH								
	Alaska[1]			Yukon Territory			Total		
Year	King	Other Salmon[2]	Total	King	Other Salmon	Total	King	Other Salmon	Total
1936	22,750	560,000	582,750				22,750	560,000	582,750
1937	5,528	346,000	351,528				5,528	346,000	351,528
1938	19,244	340,450	359,694				19,244	340,450	359,694
1939	18,050	327,650	345,700				18,050	327,650	345,700
1940	14,400	1,029,999	1,043,400				14,400	1,029,999	1,043,400
1941	17,703	438,000	455,703				17,703	438,000	455,703
1942		197,000	197,000					197,000	197,000
1943		200,000	200,000					200,000	200,000
1944									
1945									
1946									
1947									
1948									
1949									
1950									
1951[3]									
1952									
1953		380,000	380,000					380,000	380,000
1954									
1955									
1956									
1957									
1958	11,890	337,500	349,390	8,000		8,000	19,890	337,500	357,390
1959				5,957	2,000[7]	7,957	5,957	2,000	7,957
1960[6]				6,965	8,429	15,394	6,965	8,429	15,394
1961	21,488	407,089	428,577	10,376	5,800	16,176	31,864	412,889	444,753
1962	11,110	349,141	360,251	10,500	9,300	19,800	21,610	358,441	380,051
1963	24,862	396,125	420,987	8,108	25,500	33,608	32,970	421,625	454,595
1964	16,231	481,440	497,671	6,646	4,181	10,827	22,877	485,621	508,498
1965	16,608	449,131	465,739	3,115	9,800	12,915	19,723	458,931	478,654
1966	11,572	206,011	217,583	2,700	8,600	11,300	14,272	214,611	228,883
1967	16,448	274,977	291,425	3,213	13,600	16,813	19,661	288,577	308,238

(Continued)

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976 (continued).

	SUBSISTENCE CATCH								
	Alaska 1/			Yukon Territory			Total		
Year	King	Other Salmon 2/	Total	King	Other Salmon	Total	King	Other Salmon	Total
1968	12,106	178,507	198,613	2,900	11,100	14,000	15,006	189,607	204,613
1969	14,000	208,254	222,254	1,000	5,500	6,500	15,000	213,754	228,754
1970	13,874	222,005	235,879	2,100	1,200	3,300	15,974	223,205	239,179
1971	22,386	200,368	222,754	2,800	14,000	16,800	25,186	214,368	239,554
1972	17,931	133,102	151,033	1,657	8,000	9,657	19,588	141,102	160,690
1973	20,099	179,238	199,337	2,116	6,938	9,054	22,215	186,176	208,391
1974	17,186	282,466	299,652	3,379	8,636	12,015	20,565	291,102	311,667
1975	14,709	260,824	275,533	3,000	18,100	21,100	17,709	278,924	296,633
1976	13,597	217,859	231,456	1,500	3,425	4,925	15,097	221,284	236,381

1/ Does not include subsistence catches from the village of Stebbins, a coast village located northeast of the Yukon River mouth.
2/ Mostly chum salmon, but includes small numbers of pink and coho salmon.
3/ Data source for Alaska commercial catches: USFWS Stat. Digest No. 50 for the years 1951-59 unless otherwise indicated.
4/ Data source: Alaska Fisheries and Fur Seal Industry Report for 1954.
5/ Includes small numbers of pink or red salmon (less than 300).
6/ Data source for Alaska commercial catches: ADF&G Stat. Leaflets for years since 1960.
7/ Data source: Environment Canada, Fisheries Service (Whitehorse).
8/ Catch data for years 1903-1947 obtained by dividing total poundage of mixed salmon by an arbitrary weight of 15 pounds. Species breakdown is unknown. Figures are considered conservative (data collected by Royal Canadian Mounted Police).

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976.

Year	TOTAL UTILIZATION								
	Alaska			Yukon Territory			Total		
	King	Other Salmon	Total	King	Other Salmon	Total	King	Other Salmon[2]	Total
1903						4,666			4,666
1904									
1905									
1906									
1907									
1908						7,000			7,000
1909						9,238			9,238
1910									
1911									
1912									
1913						12,133			12,133
1914						12,573			12,573
1915						10,466			10,466
1916						9,566			9,566
1917									
1918	12,239	1,500,065	1,512,304			7,066	12,239	1,500,065	1,519,370
1919	104,822	738,790	843,612			1,800	104,822	738,790	845,412
1920	78,467	1,015,655	1,094,122			12,000	78,467	1,015,655	1,106,122
1921	69,646	112,098	181,744			12,840	69,646	112,098	194,584
1922	31,825	330,000	361,825			2,420	31,825	330,000	364,245
1923	30,893	435,000	465,893			1,833	30,893	435,000	467,726
1924	27,375	1,130,000	1,157,375			4,560	27,375	1,130,000	1,161,935
1925	15,000	259,000	274,000			3,900	15,000	259,000	277,900
1926	20,500	555,000	575,500			4,373	20,500	555,000	579,873
1927		520,000	520,000			5,366		520,000	525,366
1928		670,000	670,000			5,733		670,000	675,733
1929		537,000	537,000			5,226		537,000	542,226
1930		633,000	633,000			3,660		633,000	636,660
1931	26,693	565,000	591,693			3,473	26,693	565,000	595,166
1932	27,899	1,092,000	1,119,889			4,200	27,899	1,092,000	1,124,099
1933	28,779	603,000	631,779			3,333	28,779	603,000	635,112
1934	23,365	474,000	497,365			2,000	23,365	474,000	499,365
1935	27,665	537,000	564,665			3,466	27,665	537,000	568,131

(Continued)

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976 (continued).

Year	TOTAL UTILIZATION								
	Alaska			Yukon Territory			Grand Total		
	King	Other Salmon	Total	King	Other Salmon	Total	King	Other Salmon[2]	Total
1936	43,713	560,000	603,713			3,400	43,713	560,000	607,113
1937	12,154	346,000	358,154			3,746	12,154	346,000	361,900
1938	32,971	340,450	373,421			860	32,971	340,450	374,281
1939	28,037	327,650	355,687			720	28,037	327,650	356,407
1940	32,453	1,029,999	1,061,453			1,153	32,453	1,029,999	1,062,606
1941	47,608	438,000	485,608			2,806	47,608	438,000	488,414
1942	22,487	197,000	219,487			713	22,487	197,000	220,200
1943	27,650	200,000	227,650			609	27,650	200,000	228,259
1944	14,232		14,232			986	14,232		15,218
1945	19,727		19,727			1,333	19,727		21,060
1946	22,782		22,782			353	22,782		23,135
1947	54,026		54,026			120	54,026		54,146
1948	33,842		33,842				33,842		33,842
1949	36,379		36,379				36,379		36,379
1950	41,808		41,808				41,808		41,808
1951[3]	56,278		56,278				56,278		56,278
1952	38,637	10,868	49,505				38,637	10,868	49,505
1953	58,859	385,977	444,836				58,859	385,977	444,836
1954	64,545	14,375	78,920				64,545	14,375	78,920
1955	55,925		55,925				55,925		55,925
1956	62,208	10,743	72,951				62,208	10,743	72,951
1957	63,623		63,623				63,623		63,623
1958	75,625	337,500	413,125	11,000	1,500	12,500	86,625	339,000	425,625
1959	78,370		78,370	8,434	3,098	11,532	86,804	3,098	89,902
1960[6]	67,597		67,597	11,050	13,922	24,972	78,647	13,922	92,569
1961	141,748	452,521	594,269	13,822	9,078	22,900	155,570	461,599	617,169
1962	105,844	425,227	531,071	14,537	10,236	24,773	120,381	435,463	555,844
1963	141,856	401,697	543,553	10,931	27,692	38,083	152,247	429,389	581,636
1964	109,818	492,233	602,051	9,854	6,110	15,964	119,672	498,343	518,015
1965	134,706	472,798	607,504	5,380	11,871	17,251	140,086	484,669	624,755
1966	104,887	296,310	401,197	4,642	11,757	16,399	109,529	308,067	417,596
1967	146,154	335,477	481,631	5,400	16,943	22,343	151,554	352,420	503,974

(Continued)

Appendix Table 1. Yukon River drainage commercial and subsistence salmon catches, 1903-1976 (continued).

	TOTAL UTILIZATION								
	Alaska			Yukon Territory			Grand Total		
Year	King	Other Salmon	Total	King	Other Salmon	Total	King	Other Salmon 2/	Total
1968	118,632	259,205	377,837	5,112	11,535	16,647	123,744	270,740	394,484
1969	104,223	415,095	519,318	2,640	7,779	10,419	106,863	422,874	529,737
1970	94,143	580,974	675,117	4,711	3,679	8,390	98,854	584,653	683,507
1971	132,893	502,255	635,148	5,978	15,761	21,739	138,871	516,016	656,887
1972	110,771	443,179	553,950	3,426	10,532	13,958	114,197	453,711	567,908
1973	95,452	733,914	829,366	3,987	9,166	13,153	99,439	743,080	842,519
1974	115,105	1,177,949	1,293,054	5,593	11,646	17,239	120,698	1,189,595	1,310,293
1975	78,449	1,248,029	1,326,478	6,000	20,600	26,600	84,449	1,268,629	1,353,078
1976	102,268	984,565	1,086,833	5,000	4,425	9,425	107,268	988,990	1,096,258

1/ Does not include subsistence catches from the village of Stebbins, a coast village located northeast of the Yukon River mouth.

2/ Mostly chum salmon, but includes small numbers of pink and coho salmon.
3/ Data source for Alaska commercial catches: USFWS Stat. Digest No. 50 for the years 1951-59 unless otherwise indicated.
4/ Data source: Alaska Fisheries and Fur Seal Industry Report for 1954.
5/ Includes small numbers of pink or red salmon (less than 300).
6/ Data source for Alaska commercial catches: ADF&G Stat. Leaflets for years since 1960.
7/ Data source: Environment Canada, Fisheries Service (Whitehorse).
8/ Catch data for years 1903-1947 obtained by dividing total poundage of mixed salmon by an arbitrary weight of 15 pounds. Species breakdown is unknown. Figures are considered conservative (data collected by Royal Canadian Mounted Police).

Appendix Table 2. Vessel license registration and dollar value estimates of the Yukon district commercial fishery, 1965-1976. 1/

Year	No. Licensed Fishing Vessels 2/	Gross value to fishermen	Wholesale value of pack
1965	487	$542,300	$1,412,700
1966	517	454,500	1,308,100
1967	549	606,400	1,864,800
1968	512	535,000	1,655,156
1969	503	519,200	1,976,179
1970	549	623,100	2,113,100
1971	634	783,000	2,106,600
1972	661	784,000	2,405,200
1973	740	1,217,000	4,453,900
1974	771	1,921,000	6,035,900
1975	988	1,793,900	4,939,700
1976	962	2,151,000	6,815,500

1/ Data from files - AYK Regional Office - Annual Management Reports.

2/ Number of fishing vessels is believed to be the best expression of fishing effort.

Appendix Table 3. Commercial salmon catches, Yukon area, 1961-1976.

	Kings	Summer Chums	Fall Chums	Total Chums	Coho
1961	120,260		42,577	42,577	2,855
1962	94,374		53,160	53,160	22,926
1963	116,994				5,572
1964	93,587		8,347	8,347	2,446
1965	118,098		23,317	23,317	350
1966	93,315		71,045	71,045	19,254
1967	129,706	11,179	38,274	49,453	11,047
1968	106,526	14,470	52,925	67,395	13,303
1969	90,223	42,121	149,739	191,860	14,981
1970	80,269	105,612	241,112	346,724	12,245
1971	110,507	43,300	246,384	289,684	12,203
1972	92,840	80,479	207,365	287,844	22,233
1973	75,353	253,136	264,899	518,035	36,641
1974	97,919	606,085	273,158	879,243	16,240
1975	63,740	719,703	265,156	984,859	2,346
1976	88,671	598,227	163,282	761,509	5,197

Appendix Table 4. Comparative Yukon River drainage summer chum salmon escapement estimates, 1958-1976 [1/]

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Andreafsky River																			
East Fork			3,830	8,110	18,040				25,619		17,600 [4/]	119,000	84,090	98,095	41,460	10,149 [2/]	3,215 [2/]	223,485	105,347
West Fork					19,530		12,810	14,670 [2/]	18,145	14,495 [4/]	74,600 [4/]	159,500	91,710 [2/]	71,745	25,573	51,835	33,258	235,954	118,420
Total					37,570				43,764		92,200	278,500	175,800	169,840	67,033			459,439	223,767
Anvik River Drainage																			
Tower Count															108,342	71,475	201,277	601,880	237,851
Below Tower Site (indicates tributaries)															137,515	15,190		211,130	168,315
Above Tower Site (includes tributaries)															74,118	10,966		634,355	243,695
Subtotal	100-200,000	200,000	11,100		20,600		12-14,000 [2/]	100,000	37,500	116,000	51,580 [2/]		232,780		208,763	26,156		845,485	412,010
Total (Best estimate of escapement combined tower, aerial & boat surveys)	100-200,000	200,000	11,100		20,600		12-14,000 [2/]	100,000	37,500	116,000	51,580 [2/]		232,780		245,857	86,665	201,277	812,958	406,166
Poko River		3,000	3,483														16,137	25,335	38,258
Melozitna River																			
North Fork (including main river)	50,000																22,144	87,280	39,690
South Fork	2,500			1,560													29,016	51,215	9,230
Total	52,500																51,160	138,495	48,920
Risasa River			400														22,022	56,904	21,342
Tozitna River																	1,823	3,512	725 [2/]
Chena River					469 [3/]	898									670	79	4,350 [3/]	2,702 [3/]	685
Salcha River				670	1,152	1,161	250 [2/]	2,375	2,200		3,790	425 [2/]	7,879	306 [2/]	947 [2/]	290	8,040 [5/]	7,573	6,474

1/ Data obtained from aerial surveys unless otherwise indicated. Peak estimates listed only.
2/ Incomplete or poor survey conditions resulting in a very minimal count.
3/ Boat survey.
4/ Includes pink salmon.
5/ Combined aerial and boat surveys.

Appendix Table 5. Comparative Yukon River drainage fall chum salmon aerial survey escapement estimates, 1971-1976.[1/]

	1971	1972	1973	1974	1975	1976
Tanana River drainage						
Bear Paw River	--	--	1,530	2,996	1,657	--
Toklat River drainage						
Upper Toklat River[3/]	--	1,000[2/]	6,957	34,310	42,418	35,224
Lower Toklat River	--	--	--	--	35,867	2,000[2/]
					78,285	37,224
Benchmark #735 Slough	--	5,255	127[2/]	1,450	--	336
Delta River	--	3,650	7,971	4,010	3,946[7/]	5,526
Upper Tanana River[4/]	--	8,350	5,635	4,567	--	4,979
Bluff Cabin Slough	--	6,040	3,450	4,840	5,000[2/]	3,197
Delta Clearwater Slough (1 Mile Slough)	--	--	1,720	1,235	745[2/]	1,552
Chandalar River	--	--	--	17,455	6,345[2/]	58[2/]
Porcupine River drainage						
Sheenjek River	--	--	1,175	40,507	78,060	12,023
Fishing Branch River (Yukon Territory)	250-300,000	35,125[5/]	15,987[6/]	32,525[6/]	353,282[6/]	13,450

1/ All surveys rated fair-good unless rated otherwise. Only peak estimates listed.
2/ Poor or incomplete survey; very minimal and/or rough estimate.
3/ Includes following areas: Toklat River in vicinity of roadhouse, Shushana River and Geiger Creek.
4/ Richardson Highway Bridge to Blue Creek.
5/ Combined tagging population estimate and weir count.
6/ Weir count.
7/ Foot survey.

Appendix Table 6. Comparative Yukon River drainage king salmon escapement estimates, 1959-1976 [1]

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Andreafsky River																		
East Fork		1,020	1,003	675 [2]		867		361		380	231 [2]	665	1,904	799	825		993	818
West Fork		1,220		762 [2]		705	355 [2]	303	276 [2]	383	274 [2]	574 [2]	1,284	582 [2]	788	285	421	643
Total		2,240		1,437		1,572		664		763	505	1,239	3,188	1,380	1,613		1,414	1,461
Anvik River Drainage																		
Tower Count														1,104	517	471	548	958
Below Tower Site (includes tributaries)														68	96 [2]		172 [3]	198 [3/4]
Above Tower Site (includes tributaries)														346	126 [2]		190	98
Subtotal		1,550	1,226				650 [2]	638	336 [2]	297 [2]	296 [2]	368		414	222 [2]		362	296
Total (Best estimate of escapements; combined tower, aerial and boat surveys).		1,550	1,226				650 [2]	638	336 [2]	297 [2]	296 [2]	368		1,172	613	471	720	1,155
Nulato River																		
North Fork (including main river)		433	376													55	123	471
South Fork		273	157													23	81	177
Total		756	543													78	204	648
Gisasa River		300	266 [2]													161	385	332
Tozitna River		106 [2]															202	42 [2]
Chena River		132			137								193 [2/3]	138 [2/3]	21	1,035 [3]	316 [3]	531
Salcha River		1,650	2,878	937		450	408	800		735	461 [2]	1,882	159 [2]	1,193	249	1,857	1,055	1,691
Tatchun Creek												100 [2]	100	97		192	175	52
Pisutlin River (Sidney Creek-100 Mile Cr.)										407	105	615	640	317	36 [2]	48 [2]	249	102
Whitehorse Dam (Fishway Counts)	1,054	660	1,068	1,500	484	587	903	563	533	407	334	625	856	392	228	273	313	121

1/ Data obtained from aerial surveys unless otherwise indicated. Peak estimates listed only.
2/ Incomplete or poor survey conditions resulting in a very minimal count.
3/ Boat survey.
4/ Also includes 94 kings observed in Yellow River.
5/ Foot survey.

Appendix Table 7. Western Alaska king salmon catch compared to Japanese mothership catch in the Bering Sea, 1960-1976. 1/

Year	Yukon River	A-Y-K Region 3/	Total Western Alaska 4/	Japanese Mothership Bering Sea
1960	78,647	93,017	220,031	142,000
1961	155,570	201,358	295,514	10,000
1962	120,381	156,413	245,960	-
1963	152,247	209,456	279,426	42,000
1964	119,672	171,070	317,598	204,000
1965	140,086	189,888	314,086	116,000
1966	109,529	184,268	275,382	122,000
1967	151,554	243,328	370,244	70,000
1968	123,744	201,319	316,625	293,000
1969	106,863	214,606	351,860	450,000
1970	98,854	235,510	387,125	404,000
1971	138,871	229,379	359,223	157,000
1972	114,197	216,428	291,798	220,000
1973	99,439	193,069	248,872	32,000
1974	120,698	177,988	238,789	234,000
1975	84,449	161,909	196,709	200,000 5/
1976 5/		221,300		6/

1/ Catch data presented in numbers of fish.

2/ Commercial and subsistence catch data combined (includes Canadian catches).

3/ Commercial and subsistance catch data combined.

4/ Combined commercial and subsistence catches of AYK region and Bristol Bay area plus North Alaska Peninsula commercial catches.

5/ Preliminary data.

Appendix Table 8. Comparative Yukon River drainage coho salmon aerial survey escapement estimates, 1971-1976 [1/]

	1971	1972	1973	1974	1975	1976
Nenana River drainage						
Lost Slough						
East Bank 1 mile below Anderson	-	-	-	900	116	118
East Bank 3 miles below Anderson	-	-	-	488	827	-
	-	-	-	-	-	-
Clear Creek	-	-	-	-	-	13
Seventeen Mile Slough	-	-	-	27	956	229
Delta Clearwater River	3,000	632 [3/]	1,982	3,950	5,100 [3/]	1,920
Clearwater Lake and Outlet	-	417	249 [2/]	560	1,530	460 [3/]
Richardson Clearwater R.	-	527 [2/]	175	235	4 [2/]	80 [2/]

1/ Peak estimates presented only
2/ Poor or incomplete survey
3/ Boat survey

Appendix Table 9. Yukon River comparative king and chum salmon catch data for Flat Island test fishery, 1967-1976. 1/ 2/

Year	Catch per gillnet hour	
	King Salmon	Chum Salmon
1967	0.64	1.46
1968	0.44	0.30
1969	0.70	4.18
1970	0.70	2.94
1971	0.83	1.96
1972	0.41	0.83
1973	0.67	2.76
1974	0.95	4.14
1975	0.29	4.21
1976	0.76	3.15
Average 1967-75	0.62	2.53

1/ Index gear: king salmon - two 25 fathom 8 1/2" set gillnets, chum salmon - one 25 fathom 5 1/2" set gillnet.

2/ Reimer, Andrew, 1976. Flat Island Test Fishing Study, 1976. AYK Region Data Report No. 19.

Appendix Table 10. Cumulative daily Whitehorse fishway king salmon counts, Yukon River, 1965-1976.

Date	1965	1966	1967 2/	1968	1969 1/	1970	1971	1972	1973	1974 3/	1975	1976
8/1	5	4	38	4						18		
2	9	10	53	5	8	1			1	31		
3 16	24		67	11	16	4		2		36		
4 30	40		87	18	28	5	1	3		43		
5 49	54		106	43	43	6	3	3		57		
6 58	74		121	70	99	12	9	8		70		
7 93	97		136	107	118	18	3	20	20	79		
8 124	120		172	152	149	24	5	24	24	94		
9 150	136		196	173	181	47	7	31	29	103	15	
10 197	188		233	173	187	77	10	33	41	115	26	8
11 282	214		263	174	210	108	27	47	50	123	47	9
12 382	248		306	180	239	6	36	61	56	149	55	12
13 510	304		344	205	260	202	60	105	64	189	66	15
14 542	357		397	239	273	284	87	139	84	199	78	18
15 583	388		417	267	297	313	127	184	97	211	100	23
16 630	427		429	290	316	346	195	233	110	231	122	30
17 670	478		454	339	322	415	287	269	120	243	138	35
18 688	500		478	359	324	436	358	293	130	258	169	55
19 728	518		494	363	324	511	447	300	150	260	184	63
20 785	532		506	369	324	560	493	316	167	265	197	71
21 817	536		516	376	328	576	534	347	187	267	214	84
22 843	548		520	389	328	595	607	355	203	270	239	92
23 864	554		526	392	328	610	643	369	211	270	254	102
24 883	557		530	405	328	617	683	382	214	271	280	103
25 893	560		532	405	331	622	727	386	220	271	298	104
26 898	562		532	405	334	624	762	386	220	273	307	112
27 902	562		533	405		625	788	388	224		311	113
28 903	562			405			812	392	224		0	114
29	563			406			835		224		313	115
30				406			841		227			116
31				406			842		228			117
9/1				406			849					117
2				407			855					120
3							856					121
4												
5												
Totals	(903)		(563)	(533)	(407)	(334)	(625)	(856)	(392)	(228)	(273)	(121)

1/ First fish on 7/23

2/ First fish on 7/25

3/ First fish on 7/26

Appendix Table II. Aerial survey salmon escapement estimates 1/, Yukon River.

Stream (drainage)	Date	Survey Rating	Kings	Cohos	Summer Chums	Fall Chums	Pinks
Andreafsky River							
West Fork	7/16-22	fair-good	643	-	118,420	-	16,050
East Fork	7/16-22	good	818	-	105,347	-	150
			1,461	-	223,767	-	16,200
Atchuelinguk (Chulinak) R.	7/22	fair-good	394	-	33,616	-	-
Bonasilla River	7/21	poor	2	-	7,690	-	-
Anvik River drainage							
Anvik River Tower Count	6/30-7/28		958	-	237,851	-	519
Robinhood Creek	7/16	good	-	-	2,830	-	-
Yellow R. to tower	7/16	good	-	-	25,200	-	-
Yellow River	7/20	fair	93	-	38,680	-	-
Beaver Cr. to Yellow R.	7/16	poor	-	-	24,475	-	-
Beaver Creek	7/16-9/21	fair-good	1	81	25,700	-	-
Below Beaver Creek	7/21	poor	-	-	51,430	-	-
Boat survey below tower			103	-		-	
			1,155	81	406,166	-	519
Grayling Creek	7/20	fair	-	-	394	-	-
Thompson Creek	7/20	fair	-	-	17,190	-	-
Blackburn Creek	7/17	fair	-	-	4,267	-	-
Bear Creek	7/17	good	8	-	4,267	-	-
Stink Creek	7/17	poor	-	-	1,736	-	-
Rodo River	7/18	good	56	-	38,258	-	-
Mulato River (main stem)	7/18-25	good-excell.	2	-	12,225	-	-
North Fork	7/18-25	good-excell.	469	-	27,465	-	-
South Fork	7/18-25	good-excell.	177	-	9,230	-	-
Subtotal Mulato R.			648		48,920		
Koyukuk River drainage							
Gisasa River	7/24	fair	332	-	21,342	-	-
Kateel River	7/24	poor	4	-	119	-	-
Dakli River	7/24	excell.	4	-	4,468	-	-
Wheeler Creek	7/24	good	5	-	7,564	-	-
			9		12,032		
Hogatza River							
Caribou Creek	7/24	good	-	-	11,388	-	-
Clear Creek	7/24	good	-	-	9,356	-	-
					20,744		
Henshaw Creek	8/4	good	47	-	312	-	-
South Fork	8/4	good	101	-	3,333	-	-
Jim River	8/4	good	88	-	1,484	-	-
			189		4,817		
Total Koyukuk R. drainage			589	-	59,366	-	-
Melozitna R. drainage	7/25	fair	13	-	2,650	-	-
Tozitna River	7/28	poor	42	-	725	-	-
Tanana River drainage							
Kantishna River drainage			-	-	-	-	-
Toklat River	10/5	fair	-	-	-	30,490	-
Shushana R.	10/21	good	-	1	-	5,434	-
Geiger Cr.	10/13	poor	-	25	-	1,300	-
Subtotal				26		37,224	
Nenana River	10/18	good	-	118	-	-	-
Seventeen Mile Slough	10/18	good	-	281	-	-	-
Clear Creek	10/21	fair	-	13	-	-	-
Subtotal				412			
Chatanika River	8/6		18	-	169	-	-
Chena River	8/6	excell.	531	-	685	-	-
Salcha River	8/6-16	fair	1,691	-	6,474	-	-
Goodpaster River	7/29	excell.	65	-	78	-	-
Upper Tanana R. drainage							
Benchmark #735 Slough	11/4	poor-fair	-	-	-	336	-
Five Mile Clearwater	10/28	very poor	-	3	-	-	-
Richardson Clearwater	10/19-11/4	poor	-	80	-	228	-
Delta River			-	-	-	5,526	-
Blue Creek	10/28	poor	-	5	-	-	-
Tanana River							
Little Delta R. to Delta Creek			1	-	-	4	-
Bridge to Blue Creek	10/19	fair	-	-	-	4,979	-
Bluff Cabin outlet to Clwtr. Lake Outlet	10/19	fair-poor	-	-	-	225	-
Clwtr. Lake Outlet to Delta clearwater R.	10/28	poor	-	-	-	180	-
Subtotal Tanana River			1	88	-	11,478	-
Bluff Cabin Slough	10/19	good	-	-	-	3,197	-
Clearwater Lake & Outlet 4/	10/21-22		-	460	-	-	-
Delta Clearwater River 4/	10/21-22		-	1,920	-	-	-

Appendix Table 11. (Continued)

Stream (drainage)	Date	Survey Rating	Kings	Cohos	Summer Chums	Fall Chums	Pinks
Delta Clearwater Slough	10/19		-	-	-	1,552	-
Subtotal Upper Tanana R. Drainage			1	2,468	-	16,227	-
Subtotal Tanana River Drainage			2,306	2,906	7,406	53,451	
Chandalar River	9/25	very poor	-	-	-	58	-
Porcupine River drainage							
Sheenjek River	9/25	fair	-	-	-	12,023	-
Black R.-Salmon Fork	10/6	poor-fair	-	-	-	7	-
Salmon Trout R.	10/20	fair	-	-	-	20	-
Fishing Branch R.	10/3	fair	-	-	-	13,450	-
Subtotal						25,500	
Yukon Territory Streams							
Tatchun Creek 2/ 3/			52	-	-	-	-
Big Salmon River	8/24	poor	86	-	-	-	-
Nisutlin River	8/24	fair	152	-	-	-	-
Takhini River	8/24	poor	6	-	-	-	-
Yukon River (boat) 3/	9/15		15	-	-	-	-
Kluane River 3/	10/24		-	-	-	20	-
Duke River 3/	10/25		-	-	-	1	-
Whitehorse Fishway Count 3/			120	-	-	-	-
Subtotal			431	-	-	21	-
TOTAL YUKON RIVER DRAINAGE			7,105	2,987	856,418	116,254	16,719

1/ Only peak estimates listed; salmon carcasses included.

2/ Foot survey.

3/ Data supplied by Environment Canada - Fisheries Service, Whitehorse.

4/ Boat survey by Division of Sport Fish.

Appendix Table 12. Percent of observed escapement of top ten known Yukon chum spawning streams accounted for by the three most productive summer and fall systems for 1974 through 1976.

Summer Chum

Year	Total Yukon River	%	Anvik System No.	%	Andreafsky System No.	%	Mulato System No.	%	Total No.	%
1974	340	12.8	201	59.1	37	10.9	50	14.7	288	84.7
1975	1,531	57.6	813	53.1	459	30.0	138	9.0	1,410	92.1
1976	789	29.7	406	51.4	223	28.3	39	4.9	668	84.6
Total	2,660	100.0	1,420	53.4	719	27.0	227	8.5	2,366	89.0

Fall Chum

Year	Total Yukon River	%	Sheenjek No.	%	Toklat No.	%	Fishing Branch No.	%	Total No.	%
1974	149	19.5	41	27.5	34	22.8	33	22.1	108	72.5
1975	536	70.2	78	14.6	78	14.6	353	65.9	509	94.9
1976	78	10.2	12	15.4	37	47.4	13	16.7	62	79.5
Total	763	100.0	131	16.8	149	19.1	399	52.2	679	89.0

Appendix Table 13. Daily water temperatures - Anvik River, 1973-1976.

Date		Year - Water temperature °F			
		1976	1975	1974	1973
June	13	54			
	14	56			
	15	54			
	16	55		51	
	17	48		51	
	18	41.5		52	
	19	49		44	
	20	49		56	
	21	49		58	
	22	45		58	
	23	49		60	
	24	52	43	56	
	25	56	43	56	
	26	57	44	58	-
	27	60	47	-	61
	28	55	46	60	59
	29	55	49	62	56
	30	58	44	62	58
July	1	55	43	61	59
	2	54	43	65	62
	3	53	45	64	59
	4	49	50	66	59
	5	48	55	64	59
	6	55	50	-	56
	7	55	55	60	50
	8	55	50	58	50
	9	58	50	60	51
	10	58	54	57	56
	11	59	54	-	56
	12	58	59	54	54
	13	62	58	56	54
	14	60	53	60	55
	15	60	55	60	59
	16	63	54	59	59
	17	61	50	52	54
	18	60	52	52	51
	19	58	62	52	54
	20	55	57	52	55
	21	55	54	52	55
	22	63	61		54
	23	62	61		53
	24	65	58		50
	25	64	57		55
	26	62	58		50
	27	62	52		55
	28	58			51
	29	56			51
	30	54			

C = 5/9 (F -32)
F = (9/5C) +32

Appendix Table 14. Model calculations and formulas used in analysis.

Expansion of Anvik River tower counts: (1) incomplete daily counts, (2) missing hourly counts, (3) expanded daily counts. 1/

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(1) A = Actual Daily Count
E = Incomplete daily count for 6-24 chum salmon
P = Percent of total count 1/

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

Example for July 6 expansion for missing hours:

$E = \frac{4,892}{1-0.426}$ or $4,892 \times \frac{1}{.574}$ or $4,892 \times 1.74 = 8,523$

P = Sum of missing percentages

(2) Hourly (example hour one) = 8,523 x 5.4 = 460

(3) Daily total chum salmon 76 = 18 hour count x expansion factor = 8,523 x 1.19 = 10,145

Mean $\bar{x} = \frac{\Sigma x}{n}$ Variance $S^2 = \frac{\Sigma x^2 - \frac{(\Sigma x^2)}{n}}{n-1}$ Standard Deviation $S = \sqrt{s^2}$

HO: There is no difference between expected and observed numbers.

Chi Square test: $\chi^2 = \frac{\Sigma(\text{observed} - \text{expected})^2}{\text{expected}}$ df = (rows-1)(columns-1)

---

t Test of difference $H_0: m_1 = m_2$

$$t = \frac{(\bar{x}_1 - x_2) - (m_1 - m_2)}{s\bar{d}} \qquad t = \frac{\bar{x}_1 - \bar{x}_2}{s\bar{d}}$$

$$s\bar{d} = \sqrt{s^2\left(\frac{n_1 + n_2}{n_1 n_2}\right)} \quad \text{pooled} \quad s^2 = \frac{\Sigma x_1 - \frac{(\Sigma x_1)^2}{n_1} + \Sigma x_2^2 - \frac{(\Sigma x_2)^2}{n_2}}{(n_1 - 1) + (n_2 - 1)}$$

Where n_1 or n_2 are greater than 30: $df = (n_1 - 1) + (n_2 - 1)$

$$s\bar{d} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Where n_1 or n_2 is less than 30:

$$t_s = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2}\left(\frac{n_1 + n_2}{n_1 n_2}\right)}}$$

F test $F = \frac{\text{the larger } S^2}{\text{the smaller } S^2}$

1/See text page 28 and Appendix Table 8 for further explanation and base data.

Appendix Table 15. Anvik River chum salmon hourly enumeration log - including actual, estimated hourly, and daily expanded counts, 1976.1/2/3/4/

Date	Hours Counted	00	01	02	03	04	05	06	07	08	09	10	11	12	13
6-30		4/	0	0	4/	4/	4/	4/	0	4/	0	4/	4/	4/	4/
7-1	18	0	3	6	0	3	10	3	(22)	(25)	(26)	(26)	(35)	(42)	9
2	18	37	87	19	25	27	27	7	(101)	(114)	(118)	(118)	(160)	(186)	6
3	21	490	411	341	180	258	193	50	42	25	21	15	4	2	0
4	24	-286	-354	-359	-231	-120	-60	-9	-8	-9	-7	2	-1	2	8
5	24	548	549	537	550	407	426	424	302	361	393	326	480	459	629
6	24	615	550	455	305	266	478	466	616	521	543	452	908	1,261	1,222
7	23	1,151	1,289	1,057	1,219	1,167	1,148	1,079	1,328	1,610	1,561	1,471	1,525	1,908	2,084
8	24	1,689	1,572	1,460	1,196	1,285	759	760	742	826	1,072	663	989	1,683	1,790
9	24	1,717	1,807	1,290	1,304	1,076	793	553	431	607	678	423	576	508	656
10	24	782	681	504	493	474	525	405	364	347	442	559	739	701	1,023
11	22	826	1,186	654	532	839	570	594	597	310	404	619	522	973	1,055
12	24	545	774	520	508	504	741	494	450	303	306	405	457	526	570
13	22	140	263	264	362	455	480	505	473	465	461	650	667	599	576
14	24	-22	25	67	162	185	218	269	241	343	132	420	489	512	512
15	24	187	264	246	176	318	245	139	111	136	113	119	117	157	177
16	24	139	127	90	52	118	159	150	61	128	137	260	336	289	224
17	24	94	143	57	83	83	94	100	84	185	148	216	187	139	233
18	24	160	86	81	83	76	90	88	81	105	80	111	120	152	151
19	24	185	101	80	118	82	92	83	114	56	89	120	132	104	110
20	24	80	116	91	85	108	80	86	52	54	65	59	97	81	76
21	18	(65)	(70)	(58)	(51)	(49)	56	50	52	47	30	28	44	50	55
22	18	(60)	(64)	(54)	(49)	(45)	24	25	32	48	43	67	41	43	56
23	18	(64)	(68)	(57)	(50)	(47)	47	70	70	65	25	53	55	59	48
24	18	(40)	(43)	(36)	(32)	(30)	29	30	35	41	48	27	51	37	35
25	18	(19)	(21)	(17)	(15)	(14)	23	27	26	18	16	27	22	16	12
26	18	(16)	(18)	(14)	(13)	(11)	19	20	13	16	12	16	17	16	18
27	18	(13)	(14)	(12)	(10)	(10)	10	10	16	12	10	15	12	13	12
28	3	(11)	(11)	(9)	(9)	(9)	5	7	12	(7)	(7)	(7)	(10)	(12)	(13)
Actual Total		9,077	9,630	7,460	7,202	7,611	7,281	6,485	6,339	6,620	6,822	7,123	8,566	10,290	11,347
Expanded Total		(9,365)	(9,989)	(7,717)	(7,431)	(7,826)	7,281	6,485	(6,462)	(6,766)	(6,973)	(7,274)	(8,791)	(10,530)	(11,360)

1/ Net counts: Upstream migrants minus downstream migrants.
2/ Estimated daily counts in parenthesis. Expansion based on 1976 data analysis of complete 24 hr counts, Appendix Table
3/ Negative figures represent net downstream migration.
4/ Estimated figure less than 0.05. Not included in total.
5/ Counting was begun on June 27 and terminated on July 28.

Appendix Table 15. Anvik River chum salmon hourly enumeration log - including actual, estimated hourly, and daily expanded counts, 1976 (cont.).1/2/3/4/

14	15	16	17	18	19	20	21	22	23	Actual Total	24 Hour Expanded Total	Daily Cum. Total	%
0	0	4/	4/	4/	2	0	4/	4/	4/	2	2	2	
9	35	20	60	69	136	81	92	116	104	756	(932)	934	0.4
35	98	75	119	309	499	631	447	504	470	3,422	(4,219)	5,153	2.2
4	(121)	(108)	(104)	-22	-81	-33	-67	-151	-209	1,473	(1,806)	6,959	2.9
14	18	43	80	82	194	323	410	445	426	603	603	7,562	3.2
999	883	1,672	1,408	1,382	1,713	1,142	1,037	766	1,111	18,504	18,504	26,066	10.9
1,343	1,294	980	796	1,201	199	282	708	826	1,078	17,365	17,365	43,431	18.3
2,578	2,997	3,484	2,872	(2,657)	3,423	2,083	2,200	2,051	2,214	43,499	(46,156)	89,587	37.7
2,022	2,247	1,966	2,269	2,319	2,463	2,108	1,959	1,682	2,059	37,580	37,580	127,167	53.5
798	1,237	1,519	1,401	1,426	1,426	1,404	1,128	1,082	729	24,569	24,569	151,763	63.8
1,259	1,110	753	402	11	48	403	733	755	873	14,386	14,386	166,121	69.8
912	1,037	791	(818)	(870)	555	533	434	815	600	15,358	(17,046)	183,167	77.0
769	571	363	553	317	275	174	-11	116	238	10,468	10,468	193,635	81.4
(655)	(693)	431	692	853	652	651	566	530	287	11,022	(12,370)	206,005	86.6
525	755	291	363	189	112	-41	-29	208	221	6,147	6,147	212,152	89.2
200	195	131	97	132	139	7	26	222	151	3,805	3,805	215,957	90.8
372	436	304	235	366	144	120	109	92	85	4,533	4,533	220,490	92.7
244	392	142	228	221	176	125	139	139	227	3,879	3,879	224,369	94.3
140	113	110	160	187	146	139	150	132	125	2,866	2,866	227,235	95.5
125	118	89	113	119	106	111	94	100	77	2,518	2,518	229,753	96.6
63	93	91	96	93	93	65	49	70	61	1,904	1,904	231,657	97.3
100	68	55	85	60	63	57	71	60	(67)	1,031	(1,391)	233,048	98.0
48	79	80	75	81	71	48	47	48	(62)	956	(1,290)	234,338	98.5
61	64	61	41	60	46	51	56	71	(65)	1,003	(1,354)	235,692	99.0
36	33	43	54	29	30	26	21	30	(41)	635	(857)	236,549	99.5
14	11	20	15	11	15	14	13	6	(21)	306	(413)	236,962	99.6
13	10	12	13	11	9	14	9	18	(17)	256	(345)	237,307	99.8
11	9	12	10	15	11	10	11	8	(13)	207	(279)	237,586	99.9
(15)	(16)	(14)	(15)	(14)	(13)	(11)	(12)	(12)	(13)	24	(264)	237,851	100.0
12,694	13,093	13,538	12,237	9,521	12,663	10,528	10,402	10,741	10,927	229,077			
(13,364)	(14,733)	(13,660)	(13,174)	(13,062)	(12,676)	(10,539(	(10,414)	(10,753)	(11,226)		(237,851)		

Appendix Table 16. An analysis of Anvik River chum salmon net upstream 24 hour counts by date and hour for 1973 and 1976.

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	Percent Total
1973																										
6-29	24	33	24	0	4	27	15	2	14	15	1	8	4	16	31	24	15	29	147	4	20	48	39	87	639	0.9
30	68	90	94	107	18	21	19	4	7	2	2	1	12	66	26	27	60	38	11	33	153	127	118	123	1,227	1.7
7-1	143	212	218	138	65	116	48	52	37	57	18	19	24	37	68	86	110	106	80	33	57	109	225	371	2,425	3.4
2	383	423	533	164	115	81	43	18	47	38	39	21	29	86	125	250	322	325	208	16	60	153	252	227	3,966	5.6
3	279	260	195	156	149	97	106	68	59	76	85	47	72	168	227	332	353	392	563	465	497	637	519	225	6,100	8.7
4	253	251	232	160	189	179	249	332	191	195	146	209	252	275	270	343	249	200	286	346	20	61	86	176	5,150	7.3
5	230	300	241	175	169	74	93	65	50	120	37	90	102	108	100	156	243	122	202	331	311	243	201	244	4,101	5.8
6	245	275	196	215	151	161	213	188	193	95	118	103	129	142	165	93	95	62	92	79	139	121	104	59	3,413	4.8
7	98	113	118	86	88	70	71	50	17	41	23	35	34	58	21	38	44	16	50	64	67	78	135	144	1,559	-2.2
8	105	116	128	137	120	139	181	171	101	105	72	51	77	106	122	131	106	100	155	103	154	152	161	210	3,023	4.3
9	272	326	253	253	202	167	181	164	137	202	235	148	162	243	139	216	222	303	271	303	431	319	414	137	5,720	8.1
10	246	354	331	230	224	241	237	322	389	308	284	185	216	232	166	2	-251	-23	1	80	87	142	191	111	4,305	6.1
11	192	213	375	344	230	351	569	538	464	317	315	273	363	357	316	369	461	301	263	295	271	233	321	320	8,152	11.6
12	342	408	333	370	265	255	260	271	140	140	140	140	149	160	157	164	122	62	145	123	75	165	115	100	4,600	6.5
13	194	169	147	119	191	182	201	145	135	166	108	124	105	242	237	240	97	59	161	106	180	171	173	77	3,729	5.3
14	133	206	133	138	127	141	273	73	65	66	58	66	125	143	146	113	64	78	80	83	131	163	89	116	2,705	4.0
15	154	131	68	110	119	123	91	95	74	78	55	72	119	108	133	99	51	83	114	99	76	75	89	60	2,277	3.2
16	62	64	66	39	48	68	39	27	33	26	45	20	19	8	27	22	32	29	60	72	35	157	93	52	1,144	1.6
17	113	152	180	145	123	97	121	63	109	67	30	35	71	74	43	22	33	24	35	85	84	66	64	28	1,863	2.7
18	101	124	53	54	68	57	78	65	58	62	54	64	46	77	61	85	36	23	34	85	20	32	32	30	1,400	2.0
19	65	38	36	37	41	31	21	21	33	26	33	31	36	28	31	15	24	18	29	28	37	48	72	55	829	1.2
20	38	46	34	30	20	17	27	11	10	6	19	11	17	20	8	11	9	9	18	40	36	57	18	25	535	0.8
21	66	34	36	20	27	11	23	14	13	12	11	14	6	8	6	17	7	21	43	20	35	44	42	47	577	0.8
22	35	32	32	37	21	13	11	17	22	31	30	15	10	8	18	6	11	13	25	17	16	11	22	29	482	0.7
23	23	15	24	14	10	7	14	24	15	12	9	11	8	11	16	12	5	16	14	8	8	11	6	14	307	0.4
Subtotal	3,854	4,465	4,080	3,248	2,764	2,790	3,220	2,791	2,413	2,488	1,977	1,797	2,187	2,805	2,659	2,882	2,520	2,406	3,087	2,919	3,038	3,533	3,682	3,067	70,394	100.00
Percent Subtotal	5.5	6.3	5.8	4.6	3.9	3.9	4.6	3.9	3.4	3.2	2.8	2.5	3.1	4.0	3.8	4.1	3.6	3.4	4.4	4.1	4.3	5.0	5.2	4.4	100	
1976																										
7-4	-286	-354	-359	-231	-180	-60	-9	-8	-9	-7	2	-1	2	8	14	18	43	80	82	194	323	410	445	426	603	0.4
5	548	549	537	550	407	426	424	302	361	393	326	480	459	629	999	883	1,672	1,403	1,382	1,713	1,142	1,037	766	1,111	18,504	12.4
6	615	550	455	335	286	478	466	616	521	543	452	908	1,261	1,222	1,343	1,294	980	796	1,201	199	282	708	826	1,073	17,385	11.6
8	1,669	1,572	1,460	1,196	1,205	759	760	742	826	1,072	663	969	1,063	1,790	2,022	2,247	1,966	2,269	2,319	2,463	2,108	1,959	1,602	2,059	37,630	25.2
9	1,717	1,607	1,290	1,304	1,076	793	553	431	607	678	423	576	508	656	798	1,237	1,519	1,401	1,426	1,426	1,404	1,128	1,082	729	24,589	16.5
10	782	681	504	493	474	525	405	364	317	442	559	739	721	1,023	1,259	1,110	753	492	11	48	405	733	755	873	14,386	9.6
12	545	774	520	508	504	741	494	450	303	305	405	457	526	670	769	671	363	553	317	275	174	-11	116	230	10,463	7.0
14	-22	25	67	162	165	218	269	241	343	332	420	409	512	512	525	755	291	363	189	112	-41	-29	203	221	6,147	4.1
15	187	264	246	176	318	245	139	111	136	113	119	117	157	177	200	195	131	97	132	139	7	26	222	151	3,885	2.6
16	139	127	90	52	118	159	150	61	128	137	260	336	289	224	372	436	304	235	366	144	120	109	92	85	4,533	3.0
17	94	143	57	83	83	94	100	84	165	148	216	187	139	233	244	392	142	227	221	176	126	139	139	227	3,879	2.6
18	160	86	81	83	76	90	88	81	105	80	111	120	152	151	140	113	110	160	187	146	139	150	132	125	2,866	1.9
19	185	101	80	115	82	92	83	114	56	89	120	132	104	110	125	118	89	113	119	106	111	94	100	77	2,518	1.7
20	80	116	91	85	108	80	86	52	54	65	59	97	81	76	63	93	91	96	93	93	65	49	70	61	1,094	1.3
Subtotal	6,433	6,441	5,119	4,824	4,882	4,840	4,058	3,841	3,963	4,191	4,135	5,626	6,974	7,881	8,873	9,482	8,484	8,201	8,045	7,234	6,302	6,502	6,635	7,461	149,127	100.0
Percent Subtotal	4.3	4.3	3.4	3.3	3.3	3.1	2.7	2.4	2.7	2.8	2.8	3.8	4.4	4.9	5.9	6.3	5.7	5.5	5.4	4.9	4.3	4.4	4.4	5.0	100	
Grand Total	10,287	10,096	9,199	8,123	7,646	7,330	7,228	6,432	6,376	6,454	6,112	7,423	8,761	10,186	11,532	12,344	10,974	10,607	11,132	10,153	9,370	10,035	10,317	10,523	219,521	
Percent Grand Total	4.7	5.0	4.2	3.7	3.5	3.4	3.3	2.9	2.9	2.9	2.8	3.4	4.0	4.6	5.3	5.6	5.0	4.8	5.1	4.6	4.3	4.6	4.7	4.8	100	

Appendix Table 17. Anvik River king salmon hourly enumeration log - including actual, estimated hourly, and daily expanded counts, 1976 1/ 2/ 3/

Date	Hours Counted	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Actual Total	24 Hour Expanded Total	Cumulative Total No.	Cumulative Total %
7-5	24	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	003
7-6	24	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	1	1	0	0	1	7	7	10	01
7-7	23	0	0	0	0	0	0	1	0	0	1	1	1	0	3	3	0	1	0	(1)	0	0	0	0	0	11	(12)	22	02
7-8	24	0	0	1	0	0	0	0	0	1	2	0	3	1	6	4	1	2	0	0	1	3	1	1	2	29	29	51	05
7-9	24	0	0	1	0	0	1	1	0	2	0	1	1	2	0	4	3	2	2	5	4	0	0	0	1	30	30	81	09
7-10	24	0	0	1	0	0	0	1	0	0	1	4	2	0	2	3	0	6	0	7	2	2	0	2	1	34	34	115	12
7-11	22	3	7	0	0	2	1	1	0	2	2	2	6	0	2	0	0	1	(1)	(2)	5	0	4	3	0	41	(44)	159	17
7-12	24	1	0	0	1	1	2	4	5	3	3	4	3	2	7	5	0	2	2	2	3	3	2	3	0	58	58	217	23
7-13	22	0	0	0	0	0	3	4	6	6	6	7	3	3	8	(7)	(6)	(6)	3	2	5	3	4	2	1	66	(85)	302	32
7-14	24	0	0	0	0	0	3	0	0	7	3	3	4	1	2	1	6	4	3	0	1	0	0	2	1	41	41	343	35
7-15	24	2	0	2	1	3	3	3	0	0	4	5	5	3	10	3	6	4	0	1	0	1	0	3	1	60	60	403	43
7-16	24	6	4	4	3	2	3	1	7	1	0	5	4	11	3	11	4	1	1	0	2	4	0	0	0	77	77	480	51
7-17	24	2	0	0	0	3	1	9	7	7	4	7	10	10	0	9	12	3	3	2	1	3	8	2	4	107	107	587	62
7-18	24	1	4	2	2	0	3	3	2	3	4	0	1	2	5	10	6	5	1	4	5	3	1	0	1	68	68	655	69
7-19	24	2	0	0	0	0	0	0	0	0	0	5	5	6	2	4	1	2	5	3	1	2	1	0	0	39	39	694	74
7-20	24	0	0	0	0	0	1	0	0	0	0	0	0	4	0	2	3	6	0	4	1	3	1	2	2	29	29	723	77
7-21	18	(1)	3/(1)	3/(1)	3/(1)	3/(1)	2	0	0	0	0	0	0	0	0	0	3	3	0	1	0	1	2	1	(1)	13	(15)	738	78
7-22	18	(2)	(1)	(1)	(1)	(1)	3	2	1	1	6	3	1	1	3	2	7	5	4	7	3	6	4	0	(2)	59	(67)	805	85
7-23	18	(1)	(1)	(1)	3/(1)	(1)	1	2	7	3	1	0	0	6	3	2	4	1	2	3	2	2	1	1	(1)	41	(46)	851	90
7-24	18	(1)	(1)	(1)	3/(1)	(1)	0	0	0	1	6	2	5	6	3	2	1	0	1	1	3	2	2	2	(1)	37	(42)	893	95
7-25	18	(1)	3/(1)	(1)	3/(1)	3/(1)	0	0	0	1	6	3	1	2	1	1	1	2	1	2	1	1	1	0	(1)	24	(27)	920	98
7-26	17	(1)	3/(1)	3/(1)	3/(1)	3/(1)	1	1	1	2	1	0	0	0	1	2	2	0	0	0	2	1	1	1	(1)	16	(18)	938	99
7-27	18	(1)	3/(1)	3/(1)	3/(1)	3/(1)	0	0	3	3	0	0	0	3	0	0	0	3	1	1	2	0	0	0	(1)	16	(18)	956	99
7-28	3	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	1	1	0	0	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	3/(1)	2	2	958	100
Actual Total		17	15	12	7	12	29	34	40	43	50	53	56	63	61	70	60	53	29	45	45	41	33	25	15	908			
Expanded Total		24	18	16	8	15	29	34	40	43	50	53	56	63	61	77	66	59	30	48	45	41	33	25	22		(958)		

1/ Net Counts: Upstream migrants minus downstream migrants.
2/ Estimated daily counts in parenthesis.
Expansion based on 1976 data analysis of complete 24 hour counts, Appendix Table 18.
3/ Less than 1; not used in total.

Appendix Table 18. An analysis of Anvik River king salmon net upstream 24 hour counts by date and hour for 1973 and 1976 1/.

	HOUR																								
Date 1973	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	% Total
6-29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.2
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	2	0.5
3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3	0.7
4	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	4	0.9
5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0.5
6	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	6	1.4
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	5	1.2
9	0	2	0	0	0	1	0	1	1	0	0	0	2	3	2	0	0	1	2	0	1	0	0	0	16	3.7
10	0	3	0	0	0	1	1	0	3	2	2	3	1	0	0	0	0	0	1	0	0	0	0	0	17	3.9
11	0	0	1	1	2	0	2	2	1	2	2	1	1	2	3	0	1	1	1	1	0	0	1	0	25	5.8
12	0	1	0	0	1	0	1	1	2	2	2	0	1	3	2	8	0	1	0	0	0	0	0	0	25	5.8
13	0	1	0	0	1	0	2	3	0	0	0	0	0	5	4	3	0	0	2	1	1	0	0	0	23	5.3
14	0	0	0	0	0	0	3	0	0	3	1	3	1	4	2	2	2	2	0	1	0	1	0	0	25	5.8
15	1	1	0	0	1	1	2	0	0	0	0	3	2	2	0	0	1	1	0	1	0	1	2	2	21	4.9
16	0	0	0	0	0	0	0	1	0	0	0	0	0	2	1	1	3	1	0	1	0	0	0	0	10	2.3
17	1	0	0	1	0	0	1	1	2	2	3	0	6	7	9	3	1	1	0	0	0	0	1	0	39	9.0
18	0	3	0	0	1	1	0	1	1	0	6	5	3	3	5	3	3	8	3	2	1	1	0	0	50	11.6
19	0	0	0	0	0	0	0	0	0	1	2	2	1	6	4	1	0	1	1	3	1	3	3	2	31	7.2
20	0	1	0	0	0	3	1	3	0	0	2	1	2	3	1	1	3	4	3	2	2	1	0	0	33	7.6
21	0	0	0	0	0	2	1	0	0	6	3	0	0	4	3	0	4	2	1	1	0	0	0	0	27	6.3
22	0	1	0	0	2	0	3	1	2	1	0	2	2	0	7	4	1	2	2	3	1	2	0	0	36	8.3
23	0	0	2	0	1	2	0	0	2	3	0	0	2	0	1	2	1	4	3	6	1	0	1	0	31	7.2
Sub-total	2	14	3	3	9	11	17	14	15	24	23	21	26	45	45	31	20	30	21	22	9	12	11	4	432	100
% Total	0.5	3.2	0.7	0.7	2.0	2.5	3.9	3.2	3.5	5.6	5.3	4.9	6.0	10.4	10.4	7.2	4.6	6.9	4.9	5.1	2.0	2.8	2.5	0.9	100	26.2
1976																										
7-5	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.5
6	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	1	1	0	0	1	7	1.2
8	0	0	1	0	0	0	0	0	1	2	0	3	1	6	4	1	2	0	0	1	3	1	1	2	29	4.9
9	0	0	1	0	0	1	1	0	2	0	1	1	2	0	4	3	2	2	5	4	0	0	0	1	30	5.2
10	0	0	1	0	0	0	1	0	0	1	4	2	0	2	3	0	6	0	7	2	2	0	2	1	34	5.8
12	1	0	0	1	1	2	4	5	3	3	4	3	2	7	5	0	2	2	2	3	3	2	3	0	58	10.0
14	0	0	0	0	0	3	0	0	7	3	3	4	1	2	1	6	4	3	0	1	0	0	2	1	41	7.0
15	2	0	2	1	3	3	3	0	0	4	5	5	3	10	3	6	4	0	1	0	1	0	3	1	60	10.3
16	6	4	4	3	2	3	1	7	1	0	5	4	11	3	11	4	1	1	0	2	4	0	0	0	77	13.2
17	2	0	0	0	3	1	9	7	7	4	7	10	10	0	9	12	3	3	2	1	3	8	2	4	107	18.4
18	1	4	2	2	0	3	3	2	3	4	0	1	2	5	10	6	5	1	4	5	3	1	0	1	68	11.7
19	2	0	0	0	0	0	0	0	0	0	5	5	6	2	4	1	2	5	3	1	2	1	0	0	39	6.7
20	0	0	0	0	0	1	0	0	0	0	0	0	4	0	2	3	6	0	4	1	3	1	2	2	29	4.9
Sub-total	14	8	12	7	10	17	22	22	24	21	35	39	42	37	58	42	37	17	28	22	23	14	13	14	582	100
% Sub-Total	2.4	1.4	2.1	1.2	1.7	2.9	3.8	3.8	4.1	3.6	6.0	6.7	7.2	6.4	10.0	7.2	6.4	2.9	4.8	3.8	4.3	2.4	2.6	2.4	100	
Grand Total	16	22	15	10	19	28	39	36	39	45	58	60	68	82	103	73	57	47	49	44	34	26	26	18	1014	
% Grand Total	1.6	2.2	1.5	1.0	1.9	2.8	3.8	3.6	3.8	4.4	5.7	5.9	6.7	8.1	10.2	7.2	5.6	4.6	4.8	4.3	3.4	2.6	2.6	1.8	100	

1/ Net counts: Upstream migrants minus downstream migrants.

Appendix Table 19. An analysis of expansion factors for Anvik River chum and king salmon counts based on 1973 and 1976 data. 1/

Hours Deleted	Criteria	Percent 3/
0700-1300	Hours used 74, 75 2/	18.9 chum
0700-1300	Hours used 74, 75 2/	30.1 king
0500-1100	Lowest chum count	16.5 chum
2300-0500	Lowest king count	10.0 king
0300-0900	Best combined count	19.7 chum
0300-0900	Best combined count	20.4 king

1/ Based on lowest six continuous hours of fish counts.

2/ Hours deleted 1974 and 1975 were 0700-1300 based on 1973 data.

3/ Percent of salmon which were counted during deleted six hours; based on 24 hour counts only for 1973 and 1976 data combined. See Appendix Table 16 and 18.

Appendix Table 20. Anvik River pink salmon hourly enumeration ion including actual, estimated hourly, and daily expanded counts, 1976.

Date	Hours Counted	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Actual Count	24 Hour Expanded Total	Daily Cum. Total
7-5	24	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5
6	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	2	0	5	5	10
7	23	0	0	2	2	2	0	0	0	1	5	2	2	5	0	0	0	0	0	(1)	0	0	0	0	0	21	(22)	32
8	24	0	0	0	0	0	0	1	0	-1	0	0	3	3	1	3	1	2	-3	1	2	2	-2	0	0	13	13	45
9	24	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	2	1	3	2	2	1	0	1	18	18	63
10	24	2	1	2	0	2	2	0	0	0	0	0	0	1	0	1	2	3	3	3	4	1	2	4	0	33	33	96
11	22	2	3	2	0	1	0	0	5	0	1	1	1	2	0	3	4	0	(1)	(2)	1	-1	5	2	0	32	(35)	131
12	24	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2	1	8	4	3	0	0	23	23	154
13	22	17	15	0	1	5	4	2	2	3	6	21	9	6	0	(4)	(1)	2	0	2	0	0	-1	0	1	95	(100)	254
14	24	3	0	5	1	6	0	1	1	2	1	2	1	1	0	1	5	2	0	1	2	0	0	2	2	39	39	293
15	24	0	0	1	0	2	3	0	0	0	6	2	1	1	-1	0	0	0	1	1	1	2	0	2	0	22	22	315
16	24	-1	0	1	2	2	3	0	-1	0	0	1	2	4	1	1	3	0	2	0	1	0	2	4	1	28	28	343
17	24	1	2	2	0	2	0	1	0	3	2	-1	3	2	3	5	3	0	3	2	3	0	3	3	2	44	44	387
18	24	0	0	1	0	-1	0	2	1	0	1	-2	-1	4	1	0	0	0	3	1	4	0	3	0	1	18	18	405
19	24	0	1	1	6	0	0	-1	4	-1	1	-1	1	1	0	0	2	0	1	0	0	0	0	1	0	16	16	411
20	24	0	0	1	2	1	0	1	3	0	1	2	6	2	1	2	0	4	2	1	1	2	0	1	0	33	33	444
21	18	4/	4/	(1)	(1)	(1)	1	0	1	0	0	3	1	0	0	1	0	0	0	0	1	1	0	0	4/	9	(12)	456
22	18	(1)	(1)	(1)	(1)	(1)	0	1	3	0	0	1	1	0	0	0	1	0	2	3	1	3	1	0	(1)	17	(23)	479
23	18	4	4/	(1)	(1)	(1)	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	1	2	1	4/	8	(11)	500
24	18	2/	4/	4/	(1)	4/	0	0	0	0	-1	-1	1	0	0	0	0	1	0	0	0	1	0	1	4/	2	(3)	503
25	18	4/	4/	4/	(1)	4/	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	-1	0	0	4/	3	(4)	507
26	18	4/	4/	4/	(1)	(1)	0	2	0	0	0	0	0	1	0	0	0	3	0	0	1	0	0	0	4/	7	(9)	516
27	18	4/	4/	4/	(1)	4/	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4/	2	(3)	519
Actual Total		25	23	19	14	22	14	16	19	9	23	30	34	35	6	17	26	21	20	20	32	17	20	23	8	493	519	
Expanded Total		(26)	(24)	(22)	(21)	(25)	(14)	(16)	(19)	(9)	(23)	(30)	(34)	(35)	(6)	(21)	(27)	(21)	(21)	(23)	(32)	(17)	(20)	(23)	(9)		(519)	

1/ Net counts: Upstream migrants minus downstream migrants.
2/ Estimated daily counts in parenthesis. Expansion based on 1976 data analysis of complete 24 hour counts, Appendix Table 21.
3/ Negative figures represent net downstream migration.
4/ Estimated figure less than 1. Not included in total.
5/ Counting was begun on June 27 and terminated on July 28.

APPENDIX TABLE 21. An analysis of Anvik River pink salmon net upstream 24 hour counts by date and hour for 1973 and 1976

	HOUR																									
1976 DATE	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	% Total
7-5	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	2	0	5	2
8	0	0	0	0	0	0	1	0	-1	0	0	3	3	1	3	1	2	-3	1	2	2	-2	0	0	13	4
9	0	0	0	0	0	0	0	0		0	0	3	0	0	0	3	2	1	3	2	2	1	0	1	18	6
10	2	1	2	0	2	2	0	0	0	0	0	0	1	0	1	2	3	3	3	4	1	2	4	0	33	11
12	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2	1	8	4	3	0	0	23	8
13																										
14	3	0	5	1	6	0	1	1	2	1	2	1	1	0	1	5	2	0	1	2	0	0	2	2	39	13
15	0	0	1	0	2	3	0	0	0	6	2	1	1	-1	0	0	0	1	1	1	2	0	2	0	22	7
16	-1	0	1	2	2	3	0	-1	0	0	1	2	4	1	1	3	0	2	0	1	0	2	4	1	28	9
17	1	2	2	0	2	0	1	0	3	2	-1	3	2	3	5	3	0	3	2	3	0	3	3	2	44	15
18	0	0	1	0	-1	0	2	1	0	1	-2	-1	4	1	0	0	0	3	1	4	0	3		1	18	6
19	0	1	1	6	0	0	-1	4	-1	1	-1	1	1	0	0	2	0	1	0	0	0	0	1	0	16	5
20	0	0	1	2	1	0	1	3	0	1	2	6	2	1	2	0	4	2	1	1	2	0	1	0	33	11
Sub-total	6	5	15	11	14	9	10	8	3	12	3	19	19	6	13	20	13	17	14	28	13	13	19	7	297	100
% Total	2.0	1.7	5.1	3.3	4.7	3.0	3.4	2.7	1.0	4.0	1.0	6.4	6.4	2.0	4.4	6.7	4.4	5.7	4.7	9.4	4.4	4.4	6.4	2.4		
1973																										
7-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1
4	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1
6	0	1	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6	2
7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	0
8	0	1	0	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	6	1	14	5
9	3	0	1	0	0	1	0	0	0	2	1	1	0	1	0	0	0	0	3	3	1	0	2	1	20	7
10	1	0	1	5	3	3	4	0	0	0	0	0	0	0	0	0	0	1	1	2	0	1	1	2	25	9
11	0	0	2	4	4	7	6	4	1	1	1	0	0	0	2	4	1	1	0	5	2	0	2	2	49	17
12	3	1	2	5	0	3	1	1	0	0	0	2	0	0	3	1	0	0	2	2	0	2	2	0	30	11
13	5	1	0	0	3	3	2	3	1	1	1	0	1	1	2	4	1	2	1	0	1	0	2	0	35	12
14	3	0	0	1	0	1	-1	0	0	1	1	0	2	0	2	0	0	0	0	0	0	1	2	1	14	5
15	1	0	1	0	0	1	0	1	1	0	1	0	1	1	1	2	0	1	0	1	1	0	1	2	17	6
16	0	0	0	0	0	1	0	0	0	0	1	-1	0	0	1	0	0	0	3	1	2	4	3	2	17	6
17	1	0	2	2	0	1	1	0	1	3	0	1	2	0	0	1	0	0	1	0	1	0	1	0	18	6
18	1	2	0	2	1	-1	-3	2	1	0	0	0	0	1	-3	0	0	0	0	0	0	2	1	0	6	2
19	0	2	0	0	1	0	1	-1	-1	0	0	2	0	0	0	1	0	0	0	1	2	0	0	0	8	3
20	1	2	0	0	1	0	-1	0	0	0	0	-1	0	0	-1	0	0	0	0	-1	0	-1	0	0	-1	—
21	0	1	0	0	0	1	1	0	0	1	0	1	0	2	0	0	1	1	-1	1	-1	1	1	0	10	4
22	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	-4	0	0	0	0	0	0	0	0	1	0
23	1	0	0	1	0	1	-1	-1	0	1	0	0	0	2	0	-1	0	0	1	0	0	2	0	0	6	2
Sub-total																										
% Sub-total	21	12	13	21	13	23	15	10	4	10	6	5	6	8	10	8	3	6	12	16	12	13	25	12	284	100
Grand Total	27	17	28	32	27	32	25	18	7	22	9	24	25	14	23	28	16	23	26	44	25	26	44	19	581	100
% Grand Total	4.6	2.9	4.8	5.5	4.8	4.8	4.3	3.0	1.2	3.8	1.5	4.1	4.3	0.3	4.0	0.9	0.5	4.0	4.5	7.6	4.3	4.5	7.6	3.3	100	

Appendix Table 22.
Evaluation of fifteen minute counts as an index to hourly counts of chum salmon, Anvik tower, 1976. 1/

Date	Daily Total of 15 minute counts	15 minute counts expanded to hourly	Daily total of hourly counts	o/o 15 minute hourly
7-2	718	2,872	3,422	84
7-3	422	1,688	1,452	116
7-4	-6	-24	603	-
7-5	4,698	18,792	18,504	102
7-6	4,749	18,996	17,365	109
7-7	12,508	50,032	46,591	107
7-8	9,689	38,756	37,580	103
7-9	7,050	28,200	24,569	115
7-10	3,970	15,880	14,386	110
7-11	4,482	17,928	16,704	107
7-12	2,749	10,996	10,469	105
7-13	2,994	11,976	12,232	98
7-14	1,815	7,260	6,147	118
7-15	985	3,940	3,805	104
7-16	1,173	4,692	4,533	104
7-17	1,052	4,208	3,779	111
7-18	672	2,688	2,866	94
7-19	613	2,452	2,518	97
7-20	495	1,980	1,904	104
7-21	281	1,124	1,031	109
7-22	291	1,164	959	121
7-23	265	1,060	1,003	106
7-24	163	652	635	103
7-25	80	320	306	105
7-26	59	236	256	92
7-27	60	240	207	116
7-28	1	4	24	17
Total	62,028	245,424	233,850	105

1/ Net upstream counts. Total of 15 minute counts for season downstream or 105 % of upstream.

Appendix Table 23. Anvik River tower chum salmon cumulative immigration percentage by date (expanded count) for years 1973-1976.

Date	1976	1975	1974	1973
6-23				
24			0.6	
25			1.4	
26			2.8	
27			4.1	0.1
28			5.5	
29			7.6	0.9
30	0.1		10.4	2.5
7-1	0.4		14.0	5.7
2	2.2		18.1	11.0
3	2.9		23.5	19.1
4	3.2		30.9	26.1
5	10.9		37.2	31.7
6	18.3	1.7	44.1	36.5
7	37.7	4.5	49.5	38.8
8	53.5	7.6	54.2	42.8
9	63.8	15.0	58.9	50.8
10	69.8	23.4	65.6	58.4
11	77.0	29.3	69.2	69.1
12	81.4	37.7	73.4	75.4
13	86.6	46.8	79.3	80.4
14	89.2	58.1	87.0	84.4
15	90.8	66.9	94.1	87.6
16	92.7	75.7	96.4	89.4
17	94.3	81.9	97.6	92.2
18	95.5	86.9	99.4	94.3
19	97.3	90.2	100.0	95.5
20	98.0	93.0		96.3
21	98.5	95.3		97.2
22	99.0	96.7		98.0
23	99.5	97.8		98.3
24	99.6	98.8		98.6
25	99.8	99.3		98.9
26	99.9	99.7		99.0
27	100.0	100.0		100.0

Appendix Table 24. Anvik River chum salmon carcass enumeration 1976. 1/

Date	Location	Distance Surveyed	No. Male	No. Female	Un-Identified	Total	Bear Predation
			Above 1976 Weir				
7-22	Immediately above Swift R.	200 yds	95	114	0	209	13
7-22	3/4 mi. below Swift River	200 yds	46	95	0	141	9
7-22	2 mi. above Runkles Cr.	200 yds	39	57	1	97	7
7-22	1/2 mi. below Runkles Cr.	200 yds	221	470	9	700	42
7-23	1 mi. above Yoders Cabin	200 yds	175	290	5	470	11
Total above 76 tower		1000 yds	576	1026	15	1617	82
		Av. chum salmon/yd beach surveyed 1.62					
			Below 1976 Weir				
7-23	1/4 mi. below Robinhood Cr.	200 yds	181	113	0	294	0
7-23	1-1/3 mi. below Yellow R.	200 yds	180	210	3	393	6
7-23	1 mi. above Yellow R.	200 yds	104	120	0	224	1
7-24	1-1/2 mi. above Lavoie's	200 yds	177	215	0	392	3
7-24	1-1/4 mi above Beaver	200 yds	115	179	4	298	24
Total below 76 tower		1000 yds	757	837	7	1601	34
		Av. chum salmon/yd beach surveyed 1.60					
			Yellow River				
7-27	4 mi. up from mouth	100 yds	17	17	2	36	7
7-27	3-1/2 mi. up from mouth	100 yds	14	25	2	41	15
7-27	3 mi. up from mouth	100 yds	17	26	10	53	24
7-27	2-1/2 mi. up from mouth	100 yds	13	21	3	37	16
7-27	2 mi. up from mouth	100 yds	14	13	4	31	19
7-27	1-1/4 mi. up from mouth	100 yds	6	9	0	15	9
7-27	1 mile up from mouth	100 yds	13	10	2	25	6
7-27	3/4 mi. up from mouth	100 yds	10	9	2	21	2
7-27	Middlemouth	100 yds	9	6	1	16	4
7-27	North mouth	100 yds	10	7	1	18	5
Total		1000 yds	123	143	27	293	107
		Av. chum salmon/yd. beach surveyed 0.29					

APPENDIX TABLE 25. Yukon drainage salmon length comparisons. 1/ 2/ 3/.

Category			(n) No. Fish	$\bar{x}$ Ave. Length	s^2 Variance	Range		dt	t	
Emmonak	5 1/2 Fall chum pooled	76	629	594.77	1,686.74	501	698			
"	" " " "	74	458	575.52	1,284.51			1,085	8.23	**
Sheenjek	Fall Chum ♂	76	38	630.21	730.08	560	671			
"	" " ♀	76	51	579.37	824.84	525	632	87	8.26	**
"	Fall Chum pooled	76	89	601.08	1,419.03	525	671			
"	" " "	75	196	590.09	1,219.20	504	682	283	1.85	NS
"	" " "	76	89	601.08	1,419.03	525	671			
"	" " "	74	139	561.69	2,187.43	481	708	226	7.1	**
Toklak	Fall Chum ♂	76	102	540.24	1,028.48	492	618			
"	" " ♀	76	73	531.59	1,101.58	450	684	173	1.6	
Sheenjek	Fall Chum pooled	76	89	601.08	1,419.03	525	671			
Toklat	" " "	76	175	536.63	1,071	450	684	262	13.62	**
Sheenjek	Fall Chum pooled	76	89	601.08	1,419.03	525	671			
Anvik	" " "	76	660	576.85	1,021.96	498	645	973	15.72	**
Anvik	Summer pooled	76	660	576.85	1,021.96	498	645			
Toklak	Fall pooled	76	175	536.63	1,071.00	450	684	833	14.5	**
Galena	Fall Chum ♂	76	41	603.41	1,363.01	520	685			
"	" " ♀	76	39	590.25	934.16	535	665	78	1.74	NS
Galena	Fall chum pooled	76	80	597.00	1,183.29	520	685			
Toklak	" " "	76	175	536.63	1,071 00	450	684	253	13.21	**
Galena	" " "	76	80	597.00	1,183.29	520	685			
Sheenjek	" " "	76	89	601.08	1,419.03	525	671	168	0.74	NS
Manley	Fall chum pooled	76	452	575.04	1,583.86	415	680			
Galena	" " "	76	80	597.00	1,183.29	520	685	530	5.13	**
Emmonak	Fall chum pooled 5 1/2	76	629	594.77	1,686.74	501	698			
Sheenjek	" " "	76	89	601.08	1,419.03	525	671	716	1.47	NS
Emmonak	Fall chum pooled 5 1/2	76	629	594.77	1,686.74	501	698			
Toklak	" " "	76	175	536.63	1,071.00	450	684	802	19.59	**
Toklat	Fall chum pooled	74	220	562.52	1,285.05	490	650			
Toklak	Fall chum pooled	76	175	536.63	1,071.00	450	684	393	7.92	**
Anvik River	Chum ♂	76	285	598.60	839.26	520	645			
" "	" ♀	76	375	560.31	529.00	498	629	658	18.41	**
Emmonak	Summer chum 5-1/2 ♂	76	148	586.27	1,052.35	509	676			
"	" " " ♀	76	130	576.94	874.98	500	706	276	2.49	
Anvik	Summer chum pooled	76	660	576.85	1,021.96	498	645			
Emmonak	Summer chum pooled 5-1/2	"	278	581.91	987.79	500	706	936	2.23	
Anvik	Summer chum pooled	76	660	576.85	1,021.96	498	645			
"	" " "	75	584	552.95	1,178.46	475	660	1,202	12.0	**
Anvik	" " "	76	660	576.85	1,021.96	498	645			
"	" " "	74	442	564.78	1,681.82	480	640	1,100	5.1	**
"	" " "	74	660	576.85	1,021.96	498	645			**
"	" " "	73	886	551.59	1,178.46	475	660	1,544	14.95	
Emmonak	Summer chum 8-1/2	76	328	598.21	1,045.23	505	722			
"		76	238	580.32	541.96	530	662	564	7.65	**
Emmonak	Summer chum 5 1/2	76	148	586.27	1,052.35	509	676			
"	Pooled 8 1/2"	76	566	590.69	910.67	505	722	712	1.49	
Emmonak	Summer 5 1/2 chum	76	148	586.27	1,052.35	509	676			
"	GN 8 1/2"	76	328	598.21	1,045.23	505	722	474	3.95	**
Emmonak	Fall chum 5 1/2 ♂	76	271	594.77	1,686.74	501	698			
"	♀	76	358	591.02	1,158.04	494	652	627	1.21	
Emmonak	Summer chum pooled 5 1/2	76	278	581.91	987.79	500	706			
"	Fall chum pooled 5 1/2	76	629	594.77	1,686.74	501	698	905	5.16	**

Appendix Table 25. (Continued) Yukon drainage salmon length comparisons. 1/ 2/ 3/.

Emmonak	Fall pooled 5 1/2	76	629	594.77	1,686.74	501	698			
"	" " "	75	712	589.52	827.71			989	2.69	
Nenana	Fall pooled 5 1/2	76	373	575.72	1,787.32	440	685			
Galena	Fall pooled 5 1/2	76	80	597.00	1,183.29	520	685	451	4.81	**
Toklat			175	536.63	1,071.0	450	684			
Delta			654	554.45	589.2	450	682	827	6.72	**
Delta			654	554.45	589.2	450	682			
Galena			80	597.0	1,183.29	520	685	732	10.74	**
Galena Tagging 3/	S. Bank ♂		383	548.21						
" "	" " ♀		296	538.04						
	Both Sex		679	546.54						
Galena Tagging	N. Bank ♂		312	598.83						
" "	" " ♀		244	564.40						
	Both Sex		556	586.88						
Galena Tagging	Pooled ♂		695	570.71						
" "	" ♀		540	549.75						
	Both Sex		1,235	564.43						
Salcha	Chum pooled	76	433	565.96	1,625.06	473	843			
Anvik	Chum pooled	76	660	576.85	1,021.96	498	645	1,091	4.73	**
Tanana (village) chum	♂	76	188	618.62	1,952.76	515	715			
	♀	76	162	589.53	1,658.93	501	668	348	6.41	**
	pooled	76	350	605.15	2,022.58	501	715			
				KING SALMON						
Emmonak	8 1/2" GN ♂	76	561	780.81	11,623.00	494	1,073			
"	" " ♀	76	489	876.22	3,100.26	730	1,045	1,048	18.3	**
Emmonak	5 1/2" GN ♂	76	79	786.44	19,754.30	530	1,071			
"	" " ♀	76	82	874.23	3,019.50	722	980	159	5.18	**
Emmonak	Pooled 5 1/2	76	161	806.18	33,003	530	1,071			
"	" 8 1/2	76	1,050	825.25	9,914.9	414	1,073	1,209	0.43	NS
Anvik River	♂	76	38	665.34	7,518.62	505	895			
" "	♀	76	13	794.38	3,307.40	710	865	49	5.02	**
Anvik	Pooled	76	51	698.27	9,528.52	505	895			
Salcha	Pooled	76	165	786.35	18,343.96	515	1,055	214	5.10	**
Salcha	Pooled	76	165	786.35	18,343.96	515	1,055			
Emmonak	Pooled 8 1/2	76	1,050	825.08	9,921.76	494	1,073	1,213	3.53	**
Anvik	Pooled	76	51	698.27	9,528.52	505	895			
Emmonak	Pooled 8 1/2	76	1,050	825.25	9,914.9	494	1,073	1,099	9.07	*
Dawson Yukon King	♂	76	120	726.36	19,257.11	474	1,295			
	♀		27	905.67	16,610.05	553	1,210	145	5.85	**
	pooled		147	759.29	23,506.59	474	11,295			

1/ Length in mm mid-eye to fork of tail.
2/ Chums taken at Emmonak 7/15 and earlier considered summer and later considered fall.
3/ Lengths were taken in mm tip of snout to fork of tail. Have been adjusted by conversion factors developed Emmonak 75. Ratio standard length (mid-eye) 1.008: (mid-eye) 1.083; both sexes (mid-eye) 1.086.

Appendix Table 26. Anvik River king salmon cumulative immigration percentage past counting tower by date 1973-1976.

Date	1976	1975	1974	1973
6-24			0.6	
6-25			-	
6-26			-	
6-27			-	
6-28			-	0.1
6-29			-	0
6-30			-	0
7-1			0.9	0.5
7-2			1.5	1.0
7-3			4.4	1.9
7-4			7.3	2.5
7-5	0.3		11.9	3.6
7-6	1.0	0.1	16.9	3.9
7-7	2.3	0.1	25.7	5.1
7-8	5.3	3.1	30.3	7.9
7-9	8.5	8.2	36.4	11.8
7-10	12.0	10.6	52.5	16.3
7-11	16.6	12.0	56.6	21.1
7-12	22.7	13.7	59.8	26.0
7-13	31.5	16.4	62.7	30.5
7-14	35.8	19.5	65.6	35.2
7-15	42.1	22.1	81.3	37.7
7-16	50.1	24.6	88.0	45.9
7-17	61.3	26.6	92.4	55.8
7-18	68.4	33.6	100	62.5
7-19	72.4	36.5		69.2
7-20	75.5	39.8		75.5
7-21	77.0	46.4		81.9
7-22	84.0	48.1		88.7
7-23	88.8	56.6		90.5
7-24	93.2	58.6		90.6
7-25	96.0	67.0		90.6
7-26	97.9	72.1		91.8
7-27	99.8	84.9		98.4
7-28	100	92.2		99.5
7-29		100		100
7-30				
7-31				
8-1				

Appendix Table 27. Tagging procedures, Yukon tagging, 1976

1. Only salmon in good condition (lively and uninjured) will be tagged.
2. The total number of tagged and untagged fish will be recorded each day. Untagged fish during the open commercial fishing periods will become the property of the chartered fishermen. During the closed periods the untagged fish will be retained by the Department and sold to local buyers.
3. Salmon will be tagged using the modified Petersen tag (consisting of one numbered red disc, one blank red disc as a backer, one small transparent baffle disc and a 3-inch nickel pin).
   a. Insert pin through baffle disc followed by numbered disc (legend facing outward). Use consecutive numbered tags in order of lowest number first.
   b. Insert pin with attached discs through musculature below the anterior portion of the dorsal fin insertion.
   c. Attach blank red disc to the end of the pin protruding through the flesh on the opposite side.
   d. Cut the protruding pin to the proper length with a needle nose plier.
   e. Using the needle nose pliers grip the pin near the end and twist it to form a double knot against the blank disc.
   f. Be careful that the tags are not applied too snugly in a manner that would result in continued strain on the discs.
   g. For each fish record the following information on daily tagging forms:
      1. Species

Appendix Table 27 (continued).

2. Tag number
3. Sex
4. Fork length in millimeters
5. Stage of relative maturity:
    a. Chums
        1. Silvery bright - teeth small, no pronounced hooking of snout.
        2. Intermediate - may have faint bars on side.
        3. Hooked snout, pronounced teeth, definite bars on side along with red, green and black coloration.
    b. Cohos
        1. Silvery bright - teeth small, no pronounced hooking of snout.
        2. Intermediate - may have faint red color on side.
        3. Hooked snout, pronounced teeth, dark red color on side, black head.

Appendix Table 28. Summary of Yukon River salmon tagging projects.

				Tagging					Recovery					
Author	Year	Study Period	Species	No.	Method	Location	No.	%	Method	Location	Rate Movement	Population Estimate	Tag Type	Comments
Geiger	68	68	king	376	gillnet	Flat Island		29.6	ADFG crew			83,600	Yellow Spaghetti Tag	
			chum	591	"	"		7.6	CF, GN		29.6mi/day		"	
Lebida	71	70	summer chum	3,000	GN, FW	above Andreafsky	129		FW, GN	River mi 251	12.3mi/day	3,176,000	Floy and Spaghetti	
			king		GN,FW	"			FW, GN	below Anvik	23.9mi/day	226,740	"	
Lebida	69	69	king	293		above Andreafsky		26.3	CF	CF	24.2mi/day	160,564	Floy and Spaghetti	
			chum	1,506				6.9			22mi/day		"	
Lebida	72	71	summer chum	6,333	GN, FW		131	2.1	CF		11.0mi/day			
			fall chum	485	GN, FW		17	3.5	GN, FW		21.1mi/day			
Hayes	61	61	chum	9,768		Texas Creek	3,705		CF, Crew	6Mi. Island			1" Peterson Disk Tag	selectivity for tag type by gillnet found
Regnart	63	61	fall chum	1,097	FW	River Mi. 87	322	31.9					"	
		62	chum	3,967									"	
Regnart	64	63	king	453	GN	Flat Island		30.7			14mi/day		Spaghetti	
		63	king	142	FW	Pilot St.		49.2			20mi/day		"	
		64	King	175	FW	Flat Island		33.1			16mi/day		"	
Regnart	65	64	chum	Study of migration as indicated by peak catches tower to river.							25-32mi/day			
		65									31mi/day			
Trasky	73	70	chum	3,049	FW, GN	River mi.85 Ohogamint		4.2	ADFG crew	River mi 251	11.2mi/day	above site 3,133,628 3,629,594	Floy Spaghetti	
		70	king	340	FW, GN	"		14.4	"	"		146,041 above site 226,740 below site		Spaghetti
		71	chum	6,153		Mile 185		2.1				1,560,157 below site		
		71	fall chum	420							21.1mi/day	1,047,080 above site		
U.S.F.W.S.	64	61	chum									131,000 above dam site		
			king									17,000 above dam site		
			coho									50,000		

Appendix Table 29. Yukon River fall chum tagging: numbers of chum salmon tagged and recovered by date of tagging with major recovery areas.

Tagging Date	North Bank Number Tagged	North Bank Number Recov.	North Bank River (Mi. 555) % Total Tagged	North Bank % which were recov.	North Bank River Location	South Bank Number Tagged	South Bank Number Recov.	South Bank River (Mi. 540) % Total Tagged	South Bank % which were recov.	South Bank River Location	Total Tagged Number Tagged	Total Tagged Number Recov.	Total Tagged Number Females	Total Tagged Number Females
8/12	4	1	1	33.0							4	1	0	0
13	9	1	2	9.1							9	1	9	47
14	26	12	5	44.4	4 Tanana 4 Ruby	13	6	2	42.8	2 Stevens 2 Galena	39	18	16	39
15	43	22	8	51.2	8 Galena	13	5	2	38.5	2 Ruby 2 Tanana	56	27	20	36
16	30	20	5	66.7	10 Galena	12	3	2	25.0		42	23	13	31
17	28	14	5	50.0	5 Galena	15	4	2	26.7		43	18	12	28
18	14	1	3	7.1		6	2	1	33.3		20	3	9	45
19	9	3	2	33.3		9	3	1	33.3	3 Tanana	18	6	4	22
20	8	1	1	12.5		6	2	1	33.3		14	3	6	43
21	8	2	1	25.0		10	2	2	20.0	2 Tanana	18	4	7	34
22	5	0	1	0.0		2	0	0	0.0		7	0	3	43
23	5	2	1	40.0		0	0	0	0.0		5	2	3	60
24	5	1	1	20.0		0	0	0	0.0		5	1	1	20
25	8	4	1	50.0	3 Tanana	7	4	1	57.1	2 Tanana	15	8	8	53
26	17	8	3	47.0	3 Rampart	11	5	2	45.5		28	13	14	50
27	11	6	2	54.5		19	12	3	63.1	4 Ruby 3 Galena	30	18	14	47
28	9	6	2	66.6	3 Tanana	36	21	5	58.3	12 Ruby	45	27	24	53
29	20	13	4	65.0	5 Tanana	27	19	4	67.8	5 Ruby	47	32	25	52
30	54	19	10	35.2	7 Tanana 5 Rampart	43	30	6	69.8	10 Ruby	97	49	51	53
31	29	10	6	33.3	5 Tanana	48	30	7	62.5	10 Ruby	77	40	36	46
9/1	28	15	5	53.6	5 Ruby 5 Tanana	61	38	9	61.3	13 Ruby	89	53	40	44
2	22	8	4	36.4	6 Tanana	27	12	4	44.4	5 Manley	49	20	23	47
3	25	11	5	44.0	5 Tanana	45	22	7	47.8	6 Ruby	70	33	29	41
4	22	7	4	30.4	3 Tanana	39	19	6	48.7	6 Ruby	61	26	24	39
5	16	7	3	43.6	3 Tanana 6 Manley	39	23	6	59.0	6 Ruby 6 Manley	55	30	18	33
6	14	3	3	21.4	2 Rampart	15	7	2	46.7	5 Ruby	29	10	16	55
7	14	4	3	28.6		38	13	6	34.2	4 Nenana	52	17	19	37
8	8	5	1	62.5		25	13	4	52.0	4 Ruby	33	18	19	58
9	10	3	2	30.0		25	9	4	36.0	3 Nenana	35	12	18	51
10	17	7	3	41.0		21	8	3	38.0		38	15	17	45
11	7	1	1	14.3		17	4	3	23.5		24	5	7	29
12	3	3	1	100.0		11	8	2	72.7	3 Manley 3 Ruby	14	11	6	43
13	11	2	2	18.2		8	5	1	62.5	3 Ruby	19	7	12	63
14	6	3	1	50.0	2 Rampart	10	5	1	50.0	4 Ruby	16	8	10	63
15						7	2	1	28.6		7	2	4	57
16						4	1	1	25.0		4	1	2	50
17						3	2	0	66.6		3	2	1	33
Total	545	225				672	339				1,217	564	540	44

Appendix Table 30. Observed versus expected numbers of tag returns by sex and by bank of tagging.1/

SEX

No. Tagged		No. Recov.	Expected No. Recov.	Chi Square
Male	684	303	299	
Female	540	232	236	
Total	1,224	535	535	0.12 df=1

BANK

No. Tagged		No. Recov.	Expected No. Recov.	Chi Square
North	548	198	240	
South	676	337	295	
Total	1,224	535	535	13.33 df=1

1/ Numbers recovered are assumed to be directly proportional to numbers tagged. Recoveries below Galena and spawning ground recoveries omitted: 20 males and 9 females for sex; 27 north bank and 2 south bank for bank.

Appendix Table 31. Tagged chum salmon recovery by method and activity.

	Method				
No. Recov	Wheel	G.N.	Stream	Unknown	Total
%	340	160	29	45	574
	59.2	27.9	5.1	7.8	100

North Bank Chum

	Comm	Subsistence	Unknown	Stream Survey	Subtotal
	139	78	7	1	225

South Bank Chum

	Comm	Subsistence	Unknown	Stream Survey	Subtotal
	230	76	5	25	336
Total Banks	369	154	12	26	561
%	65.8	27.5	2.1	4.6	

Appendix Table 32. Yukon fall chum recoveries by bank and date of tagging and location of recovery, 1976.

North Bank				South Bank			
Tagging Date	Number Tagged	Number Recovered	Location	Tagging Date	Number Tagged	Number Recovered	Location
8/12	3	1					
8/13	11	1					
8/14	27	12	4 Tanana 2 Galena 4 Ruby 1 Stevens Village 1 Rampart	8/14	14	6	2 Stevens Village 2 Galena 1 Ruby 1 Downstream Galena
8/15	43	22	6 Ruby 8 Galena 4 Tanana 3 Hess Creek 1 Stevens Village	8/15	13	5	1 Galena 2 Ruby 2 Tanana
8/16	30	20	10 Galena 2 Tanana 2 Hess Creek 5 Ruby 1 Downstream Galena	8/16	12	3	1 Fairbanks 1 Tanana 1 Ruby
8/17	28	14	1 Hess Creek 5 Galena 4 Tanana 1 Rampart 1 Downstream Galena 2 Ruby	8/17	15	4	1 Downstream Galena 1 Nenana 1 Manley 1 Galena
8/18	14	1	1 Hess Creek	8/18	6	2	1 Tanana River 1 Rampart
8/19	9	3	1 Galena 1 Hess Creek 1 Tanana	8/19	9	3	3 Tanana
8/20	8	1	1 Rampart	8/20	6	2	1 Ruby 1 Manley
8/21	8	2	1 Downstream Galena 1 Rampart	8/21	10	2	2 Tanana
8/22	5	0		8/22	0	0	
8/23	5	3	1 Tanana 1 Ruby 1 Fish Branch, Canada	8/23	0	0	
8/24	5	1	1 Rampart	8/24	0	0	
8/25	8	4	3 Tanana 1 Rampart	8/25	7	4	1 Galena 2 Tanana 1 Ruby
8/26	17	8	3 Rampart 2 Tanana 1 Hess Creek 2 Ruby	8/26	11	5	1 Rampart 1 Ruby 1 Nenana 1 Galena 1 Tanana
8/27	11	6	1 Rampart 1 Galena 2 Ruby 1 Tanana	8/27	19	12	4 Ruby 2 Rampart 2 Tanana 3 Galena 1 Fish Branch, Canada
8/28	9	6	3 Tanana 1 Ruby 1 Hess Creek 1 Rampart	8/28	36	21	12 Ruby 1 Fairbanks 3 Nenana 2 Galena 2 Tanana 1 Manley
8/29	20	13	1 Ft. Yukon 3 Galena 3 Rampart 5 Tanana 1 Ruby	8/29	28	19	4 Nenana 3 Tanana 3 Manley 5 Ruby 4 Galena

Appendix Table 32 (continued).

8/30	54	19	7 Tanana 1 Ft. Yukon 5 Rampart 3 Galena 1 Nenana 2 Ruby	8/30	43	30	10 Ruby 1 Tanana 2 Galena 4 Nenana 1 Rampart 4 Manley 1 Fairbanks 4 Toklat 1 Big Delta
8/31	29	10	5 Tanana 1 Nenana 2 Rampart 2 Ruby	8/31	48	30	3 Manley 5 Tanana 4 Galena 1 Toklat 1 Fairbanks 5 Nenana 10 Ruby 1 Downstream Galena
9/1	28	15	5 Ruby 4 Rampart 5 Tanana 1 Chandalar	9/1	61	38	5 Nenana 13 Ruby 2 Tanana 2 Fairbanks 3 Toklat 9 Manley 2 Galena 1 Rampart 1 mouth Chandalar
9/2	22	8	1 Hess Creek 6 Tanana 1 Galena	9/2	27	12	5 Manley 2 Ruby 2 Tanana 1 Galena 1 Toklat 1 Ft. Yukon
9/3	25	11	1 Manley 5 Tanana 3 Rampart 1 Downstream Galena 1 Chandalar	9/3	46	22	3 Tanana 6 Ruby 5 Nenana 4 Toklat 3 Manley 1 Galena
9/4	23	7	3 Tanana 1 Downstream Galena 1 Rampart 1 Nenana 1 Ft. Yukon	9/4	39	19	3 Kallands 6 Ruby 4 Toklat 1 Nenana 2 Manley 2 Galena 1 Rampart
9/5	16	7	3 Tanana 1 Stevens Village 1 Nenana 1 Manley 1 Galena	9/5	39	23	6 Manley 5 Nenana 6 Ruby 1 Toklat 2 Tanana 1 Galena 2 Kallands
9/6	14	3	2 Rampart 1 Nenana	9/6	15	7	5 Ruby 1 Nenana 1 Tanana
9/7	14	4	1 Rampart 1 Ruby 1 Manley 1 Nenana	9/7	38	13	4 Nenana 3 Ruby 2 Toklat 1 Kallands 1 Galena 2 Tanana

Appendix Table 32 (continued).

9/8	8	5	1 Rampart 1 Downstream Galena 1 Manley 1 Tanana 1 Nenana	9/8	25	13	2 Tanana 3 Nenana 4 Ruby 1 Galena 2 Toklat 1 Manley
9/9	10	3	1 Downstream Galena 1 Ft. Yukon 1 Tanana	9/9	25	9	2 Toklat 3 Nenana 2 Ruby 1 Tanana 1 Kallands
9/10	17	7	1 Ruby 2 Rampart 2 Galena 2 Nenana	9/10	21	8	2 Manley 2 Nenena 2 Ruby 2 Galena
9/11	7	1	1 Kallands	9/11	17	4	2 Manley 1 Kallands 1 Ruby
9/12	3	3	1 Rampart 1 Ft. Yukon 1 Nenana	9/12	11	8	3 Manley 1 Nenana 1 Tanana 3 Ruby
9/13	11	2	1 Nenana 1 Tanana	9/13	8	5	3 Ruby 1 Galena 1 Manley
9/14	6	3	2 Rampart 1 Tanana	9/14	10	5	4 Ruby 1 Nenana
				9/15	7	2	1 Manley 1 Nenana
				9/16	4	1	1 Galena
				9/17	3	2	1 Ruby

Appendix Table 33. Chum salmon tag recoveries by area and bank of River, 1976.[1/]

Tag Recovery Area	Recovery Bank	Recoveries No.	Recoveries %	Origin of Tags Recovered No.	Origin of Tags Recovered %	Crossover[3/] No.	Crossover[3/] %
Galena	North	62	89.9	37	53.6	25	40.3
	South	7	1.0	32	46.4	0	0.0
	Subtotal	69	100.0	69	100.0	25	40.3
	Unknown						
	Total	69		69			
Ruby	North	18	12.9	37	25.4	4	22.2
	South	121	87.1	110	74.8	19	15.7
	Subtotal	139	100.0	147	100.0	23	17.3
	Unknown	8	5.4				
	Total	147		147			
Kallands	North	0	0.0	2	12.5	0	0.0
Boneyard	South	16	100.0	14	87.5	2	12.5
	Subtotal	16	100.0	16	100.0	2	12.5
	Unknown						
	Total	16		16			
Tanana	North	79	73.8	74	66.7	14	17.7
	South	28	26.2	37	33.0	7	25.0
	Subtotal	107	100.0	111	100.0	21	19.6
	Unknown	4	3.6				
	Total	111		111			
Subtotal	North	159	48.0	150	43.7	43	27.0
Yukon Tagging	South	172	52.0	193	56.3	28	16.3
Site-Tanana River	Subtotal	331	100.0	343	100.0	71	21.5
	Unknown	12	3.5				
	Total	343		343			
Rampart	North	43	36.0	46	82.1		
	South	7	14.0	10	17.9		
	Subtotal	50	100.0	56	100.0	10	17.9
	Unknown	6	10.7				
	Total	56		56			
Stevens Village	North	5	83.3	3	50.0		
	South	1	16.7	3	50.0		
	Subtotal	6	100.0	6	100.0	3	50.0
	Unknown	0					
	Total	6		6			
Chandalar	North			2	100.0		
	South			0	0.0		
	Subtotal	0	0.0	2	100.0		
	Unknown	2	100.0	0	0.0		
	Total	2		2			
Ft. Yukon	North	1	33.3	3	100.0		
	South	2	66.7	0	0.0		
	Subtotal	3	100.0	3	100.0		
	Unknown						
	Total	3		3			
Yukon River	North	1	50.0	4	80.0		
Upstream	South	1	50.0	1	20.0		
Ft. Yukon	Subtotal	2	100.0	5	100.0	1	20.0
	Unknown	3	60.0				
	Total	5		5			
Subtotal	North	50	82.0	58	80.6		
Yukon	South	11	18.0	14	19.4		
Mouth Tanana	Subtotal	61	100.0	72	100.0	14	19.4
to Headwaters	Unknown	11	15.3				
Canada	Total	72		72			

Appendix Table 33 (continued)

Fishing Branch Porcupine	North			1	50		3/
	South			1	50		
	Subtotal	0	0.0	2	100.0	1	50.0
	Unknown	2	100.0				
	Total	2		2			
Manley	North	42	84.4	10	17.2		
	South	5	10.6	48	82.8		
	Subtotal	47	100.0	58	100.0	10	17.2
	Unknown	11	19.0	0	0.0		
	Total	58		58			
Toklat Spawning Grounds	North			1	3.8		
	South			26	96.2	1	3.8
	Subtotal			27	100.0		
	Unknown	27	100.0				
	Total	27		27			
Nenana	North	55	96.5	10	17.5		
	South	2	3.5	47	82.5		
	Subtotal	57	100.0	57	100.0	10	17.5
	Unknown						
	Total	57		57			
Fairbanks	North	6	85.7				
	South	1	14.3	7	100.0		
	Subtotal	7		7	100.0		
	Unknown						
	Total	7		7			
Tanana Tributaries	North	103	92.8	21	14.1		
	South	8	7.2	128	85.9		
	Subtotal	111	100.0	149	100.0	21	14.1
	Unknown	38	2.6				
	Total	149		149			
Total Recovery	North	312	62.0	230	40.6		
	South	191	38.0	336	59.4		
	Subtotal	503	100.0	566	100.0	107	18.9
	Unknown	63	11.1				
	Total	566					

1/ Percent recovery by bank based on tag returns from known locations or subtotal.
2/ Crossover North: Number fish of south origin recovered north bank.
Crossover South: Number fish of north origin recovered south bank.
Percent based on number fish recovered each category.
3/ Crossover: Any south bank fish recovered.
4/ Crossover: Any north bank fish recovered.

Appendix Table 34. Percent of total tag recoveries by recovery area and by tagging location 1/

Recovery Location	Bank of Tagging: North No.	North % 2/	South No.	South % 2/	Total No.	Total % 3/
Galena	36	53.2	32	46.4	68	11.9
Ruby	36	25.2	111	74.8	147	25.9
Kallands	2	12.5	14	87.5	16	2.8
Tanana	72	66.0	38	33.9	110	19.7
Subtotal L.Y	146	43.6	195	56.4	341	60.1
Rampart	45	82.1	10	17.9	55	9.7
Stevens Village	3	50.0	3	50.0	6	1.1
Venetie	2	100	0	0	2	0.4
Ft. Yukon	3	100	0	0	3	0.5
Yukon R. Ft Yukon up	4	80.0	1	20.0	5	0.8
Subtotal U.Y.	57	80.6	14	19.4	71	12.5
Fishing Br.	1	50	1	50	2	0.4
Manley	10	17.2	49	82.8	59	10.4
Toklat	2	7.1	26	92.9	28	4.9
Nenana	11	19	49	82.5	60	10.6
Fairbanks	0	0	7	100.0	7	1.2
Delta	0	0	1	100	1	
Subtotal Tanana	22	14.7	130	86.6	155	27.3
Total	225	40.7	339	59.3	567	100

1/ Based on total tagging:

	North	South	Total
No.	549	676	1,225
%	44.8	55.2	100

2/ Percent of location total

3/ Percent of total Yukon chum tag returns - 564 (Does not include returns from below tagging site (8) which give grand total of 574 or 46.9%).

Appendix Table 35. Age and sex composition of Yukon River fall chum salmon escapement samples for the Sheenjek, Toklat, and Delta Rivers, 1976 1/

Sheenjek River

Dates of Samples	Sex	Combined Age Classes No.	%	Age 3₁ No.	%	Age 4₁ No.	%	Age 5₁ No.	%
9/25-10/19	Male	54	45.8	0	0.0	18	15.3	36	30.5
	Female	64	54.2	2	1.7	34	28.8	28	23.7
	Total	118	100.0	2	1.7	52	44.1	64	54.2

Toklat River

Dates of Samples	Sex	Combined Age Classes No.	%	Age 3₁ No.	%	Age 4₁ No.	%	Age 5₁ No.	%
10/14-20	Male	99	57.6	49	28.5	45	26.2	5	2.9
	Female	73	42.4	24	14.0	46	26.7	3	1.7
	Total	172	100.0	73	42.5	91	52.9	8	4.6

Delta River

Date	Sex	Combined Age Classes No.	%	Age 3₁ No.	%	Age 4₁ No.	%	Age 5₁ No.	%	Age 6₁ No.	%
10/22-11/16	Male	219	62.4	4	1.1	204	58.2	11	3.1	0	0.0
	Female	132	37.6	1	0.3	121	34.4	9	2.6	1	0.3
	Total	351	100.0	5	1.4	325	92.6	20	5.7	1	0.3

1/ Carcass sample

Appendix Table 36. Yukon River commercial and subsistence fall chum salmon harvests by area. 1/

Village	Subsistence Catch
Galena	5,477
Ruby	4,631
Tanana	9,649
Rampart	2,430
Stevens	530
Beaver	153
Fort Yukon	500
Circle	55
Eagle	467
Manley	3,948
Nenana	12,670
Fairbanks	1,696

	Commercial	Total	42,206
District 4	1,742		
5	5,387		
6	17,948		
Total	25,077		

1/ Subsistence fall chums from survey data. Based on assumption that 60% of subsistence chum harvest is composed of the fall run.

Appendix Table 37. Estimation of 1976 upper Yukon fall chum run 1/ 2/

	Harvest	Number Chums Tagged	Number Chums Recovered 4/	Population Estimation
Subsistence	42,900			
Commercial 3/	25,100			
Canada Subsistence and commercial	4,400			
Total	72,400	1,200	538	164,700

1/ Population estimation for Galena upstream.

2/ Subsistence catch of fall chums from Yukon management data. Total subsistence chum catch Galena upriver was 70,345. Considered 60% fall chums.

3/ Commercial catch from AYK surveys of commercial fishermen.

4/ Does not include recoveries below Galena or spawning ground recoveries.

Appendix Table 38. Miscellaneous fish species captured by the Galena fishwheels fall of 1976. 1/ 2/

Date	Sheefish Site 1	Sheefish Site 2	Sheefish Total	Whitefish Sp. Site 1	Whitefish Sp. Site 2	Whitefish Sp. Total	Sucker Site 1	Sucker Site 2	Sucker Total	Burbot Site 1	Burbot Site 2	Burbot Total
8-18					3	3						
19					2	2		1	1			
20					3	3						
21					7	7						
22					3	3		1	1			
23					1	1						
24					5	5		1	1			
25					3	3						
26					4	4						
27					7	7						
28					9	9		1	1			
29					2	2						
30					2	2		1	1		1	1
31					5	5						
9-1					3	3		1	1		1	1
2					2	2		2	2			
3					4	4					1	1
4					2	2		1	1			
5					2	2						
6					2	2						
		1	1		3	3						
8				15	6	21		2	2			
9				12	4	16					1	1
10				35	6	41	1				1	1
11	1		1	25	23	48					1	1
12				10	22	32					1	1
13				4	17	21					3	3
14	1		1	22	14	36		2	2		1	1
15					13	13					1	1
16					5	5						
17					8	8					1	1
Total	2	1	3	123	192	315	1	13	14		13	13

1/ Site 1 fishwheel records of miscellaneous catches kept only after 9-7.

2/ One char taken site 2, 9-14-76.