AYK REGION
YUKON STOCK SEP. REPORT # 11

YUKON STOCK SEPARATION INVESTIGATIONS

1975

(From Yukon River Anadromous Fish Investigations)
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SPECIAL STUDIES

Introduction

Management personnel agree that major downstream Yukon fisheries are dependent upon mixed salmon stocks in respect to spawning grounds origin. If the fishery is to be managed on a maximum sustained yield basis it is essential that these stocks be identified within the fishery and abundance evaluated.

Age, length, and sex data have been collected for chum and king salmon by surveys of representative spawning streams, by sampling commercial catches, and from department test fishing catches. Data collected reflects year to year changes in age, sex, and size composition of stocks.

In the future, it may be possible to separate stocks of Yukon salmon by differences in scale characteristics or by electrophoresis analysis.

Fall and summer chum are currently separated out on the basis of morphological and run timing characteristics with some degree of confidence. It is theorized by management personnel that stocks destined for particular streams may move up river as relatively homogeneous units. The upstream movement of such a stock for a large system, as the Sheenjek would be reflected as a peak of abundance in commercial catches. The validity of this theory and the timing of the movement of respective stocks through the commercial fishery could likely be assessed by undertaking a major tagging study.

Sheenjek River

Although fall chum have comprised an increasingly important portion of the total Yukon River salmon catch, very little information regarding their life history, abundance, and distribution was available before 1972. All the known fall chum spawning areas in the Yukon drainage are located upstream of the mouth of the Tanana River. In most instances fall chum spawning areas are believed to be in areas of upwelling ground water with winter water temperatures above 34° F.

The spawning population of the Sheenjek (Figure 6) represents a major percentage of the entire Yukon fall chum spawning population (of the top ten production systems 28% observed in 1974 and 15% observed in 1975, Appendix Table 13). During the fall of 1975 a feasibility study was initiated

on the Sheenjek to determine: (1) suitability for a stream life study, and (2) practicality for counting tower enumeration. A total of four aerial surveys were made of this stream to document escapement and locate potential weir and study sites. Length and sex data, along with scales, were taken from spawned out salmon during the on-site study at Fish Slough and at Russell's cabin.

The 1975 peak aerial survey count of Sheenjek fall chums was 78,100 fish. In late September an ideal stream life study area, locally known as Fish Slough, was located some 50 miles upstream from the mouth of the Sheenjek (Plate 1). An estimated 5,000 to 8,000 chum salmon spawned in this old channel of the main river. Daily temperature records cited below showed this to be a typical example of a "warm water" chum fall spawning area.

Date	Time	Water Temperature °F Main Channel	Water Temperature °F Fish Slough	Air Temperature
10/29	1700	33	37	26
10/30	0930	34	39	31
10/30	1445	36	42	44

This area was easily accessible by wheeled aircraft from Fort Yukon.

Major Sheenjek spawning concentrations of chum salmon were identified in six areas. The first major area located was approximately 1 mile above the Bill Barnes cabin (20 minutes flying time upstream from River mouth). The farthest upstream area of major importance was approximately 2 miles above the haystacks area.

Several good potential counting tower sites were located in the lower River. During a low water fall, as 1975, it would appear feasible to establish an enumeration site at the River mouth.

Sheenjek River fall chum sampled were significantly larger (553 mm) in 1975 than were Anvik River summer chums sampled (590 mm, Appendix Table 24). However, in 1974 no significant difference was detected in the average lengths of these two stocks.

A highly significant difference in average length was found for Sheenjek fall chums sampled in 1974 and 1975 (562 mm and 590 mm respectively). Within the Sheenjek, no size difference was found between samples from the Fish Slough and Russell's Cabin area. Little difference was detected in the average lengths of fall chum of different origin as

Plate 1. Sheenjek - Fish Slough Study Area

shown by a comparison of Sheenjek and Delta length data for 1975. Delta River fall chums averaged 591 mm in length; Sheenjek River fall chums averaged 590 in length.

Age data from two major spawning areas (Fish Slough and Russell's Cabin) showed the Sheenjek sample to be 94.9% age 4_1 (see Table 14). In 1974 the Sheenjek River sample was predominantly of 3_1 fish (66%) with 4_1 fish comprising 30% of the sample. The Sheenjek River fall chum sample for 1975 was predominantly female (60%). The 1974 Delta River sample was composed of 54% 3_1 fish and 44% 4_1 fish (Trasky 1976).

Age, Length, and Sex Data for Miscellaneous Yukon Stocks

King Salmon: Table 11 provides the size composition of the 1975 Yukon River king salmon run as reflected by samples from commercial catches, limited samples from spawning grounds, observations of the Anvik tower, and by samples from the Whitehorse Fishway. In general discussion and analysis only distinct population segments will be dealt with here. A total of 2,205 kings were included in the sample.

The size structure of the Salcha River king salmon spawning ground carcass sample was 48% large (over 801 cm) and 33% medium (601 - 800 mm). For Anvik River kings (sizes visually estimated only), the dominant size category was medium, 35.4% of fish observed. All Yukon Territory's kings sampled at the Whitehorse fishway were in the medium (31.7%) and large (68.3%) size categories. The categories of jack (precocious males) and small kings were entirely lacking at this location.

Scale samples were aged from 203 king salmon sampled on the Salcha River spawning grounds. Of these 36.5% were age 6_2 and 32.5% were age 5_2. The 4_2 age class at 25% was well represented in samples (Table 12).

Scale samples were collected from king salmon in the Dawson gillnet and fishwheel fisheries. Fishwheel catches were 55.1% 4_2 fish and gillnet fish were older with 43.7% from the 5_2 age class which resulted from the differential size selectivity of the gear (see below). Insufficient numbers of scales were taken from Whitehorse kings during the 1975 season to give an indication of the age composition of that run.

A highly significant chi square value was found when a comparison was made between fishwheel catches by size category and all other king salmon size categorized (Appendix Table 25). Fishwheel selectivity for the smaller size classes is definitely indicated.

Table 11. Numbers and percentage of king salmon by size category, Yukon River system, 1975 1/

Location	Jack Under 500mm		Small 501-600		Medium 601-800mm		Large over 801mm		Total	
	n	%	n	%	n	%	n	%		
Anvik 2/	16	7.1	59	26.1	80	35.4	71	31.4	226	100
Emmonak Gillnet			46	5.3	243	27.9	581	66.8	870	100
Chena 8/11-12 Escapement			9	16.1	26	46.4	21	37.5	56	100
Salcha 8/12-14 Escapement	4	1.6	44	18.1	79	32.5	116	47.7	243	100
Galena Gillnet	3	2.7	39	34.5	31	27.4	40	35.4	113	100
Tanana Gillnet					1	6.7	14	93.3	15	100
Manley Hot Springs Gillnet	1	20.0	2	40.0	1	20.0	1	20.0	5	100
Nenana Fishwheel	11	6.1	86	48.0	59	33.0	23	12.8	179	100
Gillnet			5	9.4	17	32.1	31	58.5	53	100
Galena Fishwheel	2	2.9	37	53.6	15	21.7	15	21.7	69	100
Canada										
Dawson City Fishwheel	4	1.5	52	18.9	136	49.5	83	30.2	275	100
Whitehorse Fishway					32	31.7	69	68.3	101	100

1/ Length mid-eye to fork of tail.

2/ Estimated total length from Anvik tower observations.

Table 12. Age compositions of king salmon samples - Yukon drainage, 1975 1/

Study Area		3_2 No.	3_2 %	4_2 No.	4_2 %	5_2 No.	5_2 %	6_2 No.	6_2 %	7_2 No.	7_2 %	Total	
Anvik R.	carcass			1	12.5	5	62.5	2	25.0	0	0	8	100
Chena R.	carcass			13	26.0	24	48.0	10	20.0	3	6.0	50	100
Salcha R.	carcass	1	0.5	51	25.0	66	32.5	74	36.5	11	5.5	203	100
Emmonak	fishwheel			61	7.4	326	39.5	298	36.2	139	16.9	824	100
Galena	fishwheel	1	1.7	33	55.0	15	25.0	10	16.7	1	1.7	60	100
Tanana	gillnet					2	11.1	14	77.8	2	11.1	18	100
Nenana	setnet			6	12.8	30	63.8	9	19.1	2	4.3	47	100
Nenana	fishwheel	4	2.6	92	59.7	44	28.6	12	7.8	2	1.3	154	100
Canada Dawson City													
gillnet				19	20.2	41	43.7	24	25.5	10	10.6	94	100
fishwheel				108	55.1	70	35.7	14	7.1	4	2.0	196	100

1/ King salmon were aged by scale samples read by various region staff.

In the Salcha spawning ground sample male kings, 59.5% of kings examined, were found to be significantly more abundant in 1975 than were females (Table 13). Of 56 king carcasses sampled from the Chena system, males also predominated (54.5%). For Emmonak commercial gillnet samples there was no difference in numbers of male and female fish which probably was the result of the size selectivity of the gear, i.e., the smaller males not being harvested.

Table 13. Sex composition of king salmon sampled by study area - Yukon drainage, 1975.

		Males		Females		Total	
Chena	carcass	31	55.4	25	44.6	56	100
Salcha	escapement	135	59.5	92	40.5	227	100
Emmonak	gillnet	469	50.5	479	49.5	948	100
Galena	gillnet	24	40.0	36	60.0	60	100
Tanana	gillnet	11	61.1	7	38.9	18	100
Nenana	setnet - gillnet	26	55.3	21	44.7	47	100
Nenana	fishwheel	125	81.2	29	18.8	154	100
Whitehorse fishway		167	53.5	145	46.5	312	100
Dawson City	gillnet	82	87.2	12	12.8	94	100
	fishwheel	182	92.9	14	7.1	196	100

Chum Salmon: Emmonak summer chums from the gillnet fishery (cut off date July 16) were found to average larger than Anvik chum carcasses (respectively 576 and 553 mm, Appendix Table 24) which, again probably results from gear selectivity. No real length difference was noted for Emmonak summer chum when 1974 and 1975 data was compared. From spawning ground sampling a highly significant difference in length was found for Anvik 75 (553 mm) and Sheenjek 75 (590 mm) chums. Salcha River 1975 chums (564 mm) were found to be of a statistically significant greater

length than 1975 Anvik River chums, (554 mm), but this difference of just over a centimeter is likely of little real biological meaning.

Age data for chum salmon by study area and combined sampling methods is presented in Table 14. For 1975 the age category 4_1 was predominant in all samples ranging from a low of 77.8% (Chena River) to a high of 96.4% (Emmonak-July). Age 3_1 fish were at their highest percentage in the Manley (16.6%) and Nenana (16.9%) samples. Age 5_1 fish were at their highest percentage in Chena (19.4%) samples.

Table 14. Age comparisons for chum salmon by study area - Yukon drainage, 1975.

	AGE GROUP							
	3_1		4_1		5_1		Total	
Study Area	No.	Percent	No.	Percent	No.	Percent	No.	Percent
				Summer				
Anvik	21	3.6	541	92.6	22	3.8	584	100
Salcha	4	1.5	229	84.5	38	14.0	271	100
Emmonak-June	1	0.3	286	85.3	48	14.3	335	100
Subtotal	26	2.5	1,056	88.7	108	9.0	1,190	100
				Fall				
Emmonak-July	12	1.1	1,043	96.4	27	2.5	1,082	100
Sheenjek	7	5.1	187	94.9	3	1.5	197	100
Delta	8	3.0	253	93.0	10	4.0	271	100
Chena	1	2.8	28	77.8	7	19.4	36	100
Manley	67	16.6	319	78.8	19	4.6	405	100
Nenana	171	16.9	802	78.8	43	4.3	1,016	100
Dawson City	1	1.6	58	90.6	5	7.8	64	100
Subtotal	267	9.0	2,690	87.6	114	3.7	3,071	100

Sex composition of chum salmon samples by study area is presented in Table 15. Although for some 1975 samples, e.g., the Sheenjek sample, significant sex differences were found (Appendix Table 23), no difference was found in abundance of males and females in 1975 total run.

Table 15. Sex composition for chum salmon samples by study area - Yukon drainage, 1975

Study Area	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
Nenana	508	50.0	508	50.0	1,016	100
Manley	209	51.6	196	48.4	405	100
Anvik	6,698	50.0	6,741	50.0	13,439	100
Sheenjek	81	39.9	122	60.1	203	100
Lower Yukon - July	299	27.7	781	72.3	1,080	100
Delta	152	52.5	137	47.5	289	100
Chena	22	57.9	16	42.1	38	100
Salcha	154	49.5	152	50.5	306	100
Lower Yukon - June	198	59.1	137	40.9	198	100
Dawson City	35	54.7	29	45.3	64	100

SUMMARY

Commercial fishing effort within the Yukon area, best measured in terms of registered fishing vessels, has increased 103% since 1965 (487 vessels in 1965, 988 vessels in 1975). The gross value of the Yukon fishery to the fishermen increased 231% from 1965 to 1975. The wholesale value of the Yukon pack stood at $4,939,700 in 1975.

The 1975 commercial Yukon River chinook salmon catch of 66,740 was the lowest since statehood and was approximately 35,000 fish less than the previous 14 year average of 101,379 fish. The subsistence chinook catch for 1975 was 17,710 fish. The 15 year average subsistence chinook harvest (1960-1974) was 19,760 fish.

Low pre-season test fishing values and poor catch success of Japanese

high seas for immatures forewarned management personnel of an apparently poor chinook run for 1975. Due to the indicated poor strength of the king run, fishing time was reduced to 2 days a week during the greater portion of the run. The season in the lower river was closed during late June in an attempt to provide for adequate escapements.

Salmon migration into the Yukon and streams of spawning was generally very late during 1975. In 1975 king salmon upstream movement past the Anvik tower did not peak until July 27; peak Anvik tower king salmon counts were made on July 19th and July 10th for 1973 and 1974 respectively. Anvik River water temperatures did not reach 50 degrees until July 4th in 1975. In 1974, water temperatures of 51 degrees were recorded in the Anvik on June 16th; in 1973 and Anvik water temperature of 61 was recorded on June 27th.

The chinook escapement for the Anvik River in 1975 was estimated to be 730 fish. Anvik aerial survey counts for kings were very low when compared to weir and float counts. Aerial counts were believed to have been made too early to give a meaningful peak king index count. Some historical escapement indices (the 1972 weir count of 1,104 and aerial counts of 1,226 and 1,950 in 1961 and 1960 respectively) were much higher than 1975 indices.

Three-hundred and thirteen king salmon were enumerated at the Whitehorse fishway in 1975. This is the highest fishway king count since 1972, however, this count is only 42% of the average yearly count of 652 for the 16 year period beginning in 1958 and ending in 1974.

The average annual king salmon observed escapement for American waters of the Yukon has been 3,754 since 1972. For American and Canadian waters combined, this average has been 5,138 fish. Observed escapement for American kings in 1975 was 4,596 and for Canadian kings was 2,109. Aerial enumeration of American kings for 1975 was more comprehensive than in past years. Canadian king abundance as indicated by survey was at its highest level since 1971.

The High Seas Japanese Fisheries are believed to be, at least in part, responsible for the gradual decline in Yukon king salmon abundance. Japanese high seas gillnet catches of Bering Sea chinook have averaged 179,000 maturing fish annually since 1960. Many of these kings are believed to have been of Kuskokwim and Yukon River origin. Data recently made available, suggests that incidental catches of kings by foreign high seas bottom trawls may also be substantial.

A comparison was made of size composition for fishwheel king salmon catches in 1975 to size composition for all other king salmon measured in 1975. This comparison showed that fishwheels were highly selective for the smaller fish.

Preliminary figures on the chum commercial harvest for Alaska and Canada show a total of 987,360 summer and fall fish landed in 1975. Commercial catches for this species have averaged 257,000 a year for the period 1960-1975 (594,340 for period 71-75). A record total of 743,732 summer chum were included in chum taken commercially in the Yukon area. Seventy-five percent of the catch was made in lower Yukon subdistricts 1 and 2. For Alaskan waters, a fall commercial chum harvest of approximately 244,833 was recorded. Record commercial chum catches for 1974 and 1975 reflect very high run levels, increased commercial effort, and a generally decreased level of subsistence catches from historical levels.

In 1974 and again in 1975, chum salmon subsistence catches of 291,102 and 278,924 respectively have exceeded the previous 5 year average (1969-1973 of 222,330). Subsistence effort and catches in recent years have been generally down from historical levels.

Escapement documentation of the major Yukon spawning streams was poor prior to 1970. The 1975 chum salmon escapement of 2,151,880 was easily the high documented escapement for the Yukon. The total run index for 1975 (commercial catch, plus subsistence catch, plus escapement) was a record documented high of 3,418,160 fish. Annual observed chum escapement and total run index since 1971 have averaged respectively 704,020 and 1,520,700 fish.

The 1975 record expanded Anvik tower count of summer chums was 601,868, almost three times the 1974 count. The 1974 Anvik count was the previous historical high escapement for any stream in the Yukon system.

The top six Yukon summer chum streams for 1974: the Anvik, Andreafsky West, Nulato North and South Forks, Gisasa, and Rodo Rivers all recorded historically high observed escapements in 1975. Survey conditions for the Andreafsky East, third in escapement in 1975, were poor in 1974. Of the combined Yukon summer chum observed escapement for the top ten producing systems in 1974 and 1975, the Anvik system accounted for 54% and the Andreafsky system 27%.

The top three fall chum streams all had record escapements in 1975. Escapement enumeration of chum salmon by the Fishing Branch weir was an all-time high of 353,300 fish. The Sheenjek and Toklat Rivers had record levels of escapement during 1975 - 78,000 chums each. These three streams

have accounted for 90% of all fall chum observed escapement for the years 1974 and 1975.

Unfortunately, no good overall escapement data exists for the 1971 Yukon summer chum brood year which gave rise to the 1975 record return. The limited aerial survey data available indicates escapements in 1971 to have been generally good for Yukon summer chums. Based on a total utilization of 519,000 fish, the 1971 parent year was apparently strong (yearly average utilization 1960 - 1974 was 465,000).

Overall, there was no significant difference in the numbers of male and female chum in 1975 samples although for some individual samples, as the Sheenjek fall chum sample, significant sex differences occurred.

For the Yukon River as a whole for combined sampling methods, 87.9% of 4,261 chum salmon aged during 1975 were 4_1's. Age class 3_1 represented 6.9% of escapement and age class 5_1 represented 5.2% of escapement.

Anvik River chums averaged 565 mm mid-eye to fork of tail in 1974 and 553 mm mid-eye to fork of tail for 1975 - a statistically significant difference. No length difference was detected between the 1975 and 1973 runs. In 1975 Anvik River female chum averaged 534 mm and males 574 mm for a highly significant difference. No real length difference was noted for Emmonak summer chum when 1974 and 1975 data was compared. A highly significant difference in length was found for Anvik 1975 (553 mm) and Sheenjek 1975 (590 mm) chums. No size difference was found for Sheenjek 75 and Delta 75 fish (respectively 590 and 591 mm in length mid-eye to fork of tail).

Coho are generally of minor importance in Yukon River commercial catches and are taken incidentally to the more abundant fall chum. The 1975 commercial fishery in the lower Yukon was closed in mid-August with the filling of chum quotas. At this time the coho run was just beginning. A total commercial coho harvest of 2,340 was recorded (previous 5-year average 20,029). Coho salmon escapement documentation is still essentially in the developmental stage. Escapements, as indicated by surveys of the Clearwater Lake and Delta Clearwater systems, appeared excellent. A total of 10,730 coho were documented on the spawning grounds in 1975.

Escapement documentation for pink salmon has been poor. The Anvik River expanded total count for this species was 1,266 in 1975. A record total escapement of 50,960 pink salmon was documented during aerial surveys of the Andreafsky system in July of 1975.

RECOMMENDATIONS

Due to the site change, the sheer magnitude of the Anvik chum runs, and the lack of substantial base data for expansion techniques (expansion for counts currently in use based on 1973 data only), it is recommended that 24 hour counts be made during additional field seasons. Counting shifts should be no longer than 2 hours per observer. Conditions permitting, attempts should be made to assess the magnitude of chum and king escapements in the Yellow River during 1976.

Faced with funding limitations, it is recommended that aerial surveys be concentrated on major summer chum, king, and fall chum streams. A number of streams currently included in surveys could be deleted with little effect on total escapement counts. In view of budgetary considerations, exploratory flying will likely have to be reduced during 1976. More effort should go into interviewing persons with local knowledge of areas to be surveyed, possibly saving fruitless flights. Funding permitting, selected upper Yukon streams such as the Sheenjek should be surveyed in late July for possible occurrence of kings and summer chums.

More effort should be exerted towards the examination of king salmon carcasses in major spawning streams following die-off in August. Sex, length and age data is currently collected largely from commercial catches which are quite possibly biased samples. Size selectivity by fishwheels has been demonstrated statistically. The only major king salmon stream currently adequately sampled is the Salcha River.

Management personnel have emphasized the need for a major Yukon or Tanana fall chum tagging project aimed at stock identification. Funds do not currently exist for an undertaking of this magnitude. Other sources of additional funds are being explored and plans will be drawn up for tagging programs of various scopes. (See Appendix Table 26 for summary of historical Yukon tagging programs.)

In the event that additional funds are not forthcoming, it is recommended that an intensive documentation of a major fall spawning stream be undertaken. The logical choice would be the Sheenjek River. With the termination of the Fishing Branch study by the Canadians, no actual enumeration of a major producing fall stream will exist. It is suggested that a counting tower project be initiated on the Sheenjek to enumerate fall chum escapement and collect basic life history data.