

1964 ANNUAL REPORT

ARCTIC-YUKON-KUSKOKWIM AREA

ALASKA DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

STAFF:

Area Management Biologist	Ronald I. Regnart
Assistant Area Management Biologist	Peter J. Fridgen
Assistant Area Management Biologist	Michael F. Geiger
Secretary (Anchorage)	Carolyn J. Homme
Secretary (Nome)	Delores L. Tinjum

Area Office: 1018 International Airport Road
Anchorage, Alaska 99502

Field Offices: Box 862
Nome, Alaska 99762

Bethel, Alaska (Summer Only)

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I N T R O D U C T I O N

The Arctic-Yukon-Kuskokwim Area, as shown in Figure 1, is that portion of the state north of the Alaska Range and the Bristol Bay drainage. This is the largest management area in the state and is equal to the combined areas of California, Oregon, Washington, and Idaho.

Prior to statehood, the only locality within this area having a sustained commercial fishery was the lower Yukon River. Regulations were liberalized and development of fisheries in other areas were encouraged by the Alaska Department of Fish and Game which assumed management of the fishery resource in 1960. As a result, in the last four years, commercial fisheries have been established in the following areas: Kuskokwim River, Quinhagak on Kuskokwim Bay, Unalakleet, Shaktoolik, Elim and Golovin in Norton Sound, and in Kotzebue.

Development of these commercial fisheries has had an important economic impact on many communities. During 1964, approximately \$536,500.00 was paid to fishermen in the Arctic-Yukon-Kuskokwim Area for salmon sold commercially. Wages earned by cannery workers, etc. also add considerably to the economic importance of the commercial fishery. In this area of low industrialization, such income is of major significance.

Chum salmon is the most abundant species of salmon in the Arctic-Yukon-Kuskokwim Area, with pink, coho, king, and red salmon following in order of abundance. The king salmon commercial catch is the most important in terms of direct economic value to the area, while chum salmon contribute heaviest to the important subsistence fishery.

In light of available spawning grounds, salmon productivity is relatively low compared to other areas of the state and the Pacific coast. Quality, not

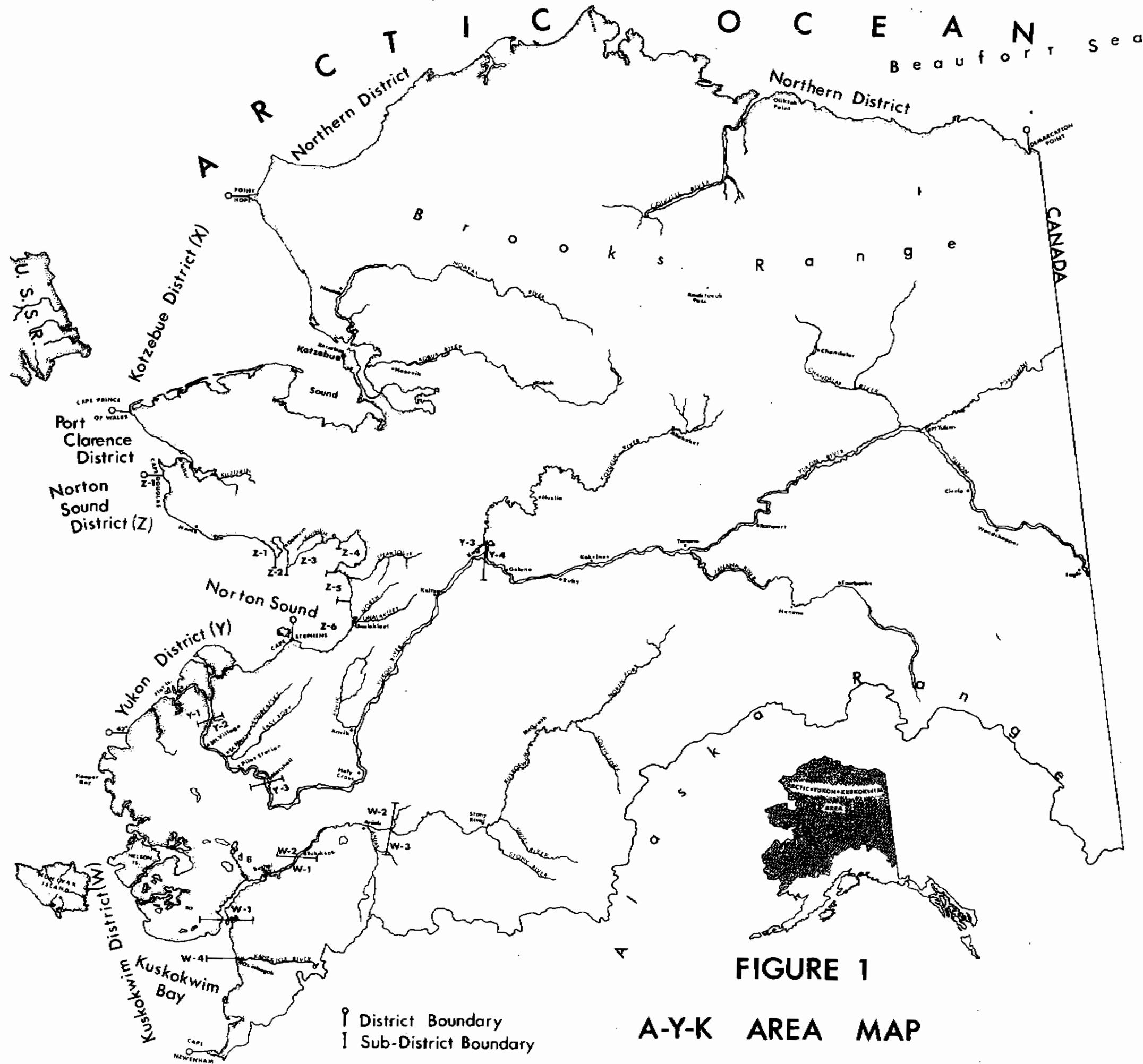


FIGURE 1

A-Y-K AREA MAP

quantity, is the asset of the A-Y-K fisheries. The king, coho, and chum salmon packs have been graded the highest quality. It is hoped that more A-Y-K salmon will find their way into speciality canned-cured packs and premium quality frozen-fresh fish markets. A trend of upgrading the pack is evident, especially in the Yukon District, and therefore the value of these fisheries to fishermen, processors, and the state is expected to increase in the future.

Table 1 shows the total numbers of salmon taken for commercial and subsistence purposes in each district during 1964; the total catch for the area is compared with 1963. Table 2 lists the Arctic-Yukon-Kuskokwim buyers, processors, and associated data. Table 3 presents the 1964 A-Y-K pack for each species.

S E C T I O N I

M A N A G E M E N T

TABLE 1

ARCTIC-YUKON-KUSKOKWIM AREA TOTAL SALMON CATCH BY DISTRICT ^{1/}, 1964

	Kings	Reds	Cohos	Pinks	Chums
KUSKOKWIM:					
Commercial	17,149	-	28,613	-	-
Subsistence	<u>29,017</u>	-	-	-	<u>190,190</u> ^{2/}
SUB-TOTAL	46,166	-	28,613	-	190,190
KANEKTOK:					
Commercial	4,081	13,422	379	939	707
Subsistence	<u>1,836</u>	<u>1,823</u>	<u>1,322</u>	<u>5,808</u>	<u>15,799</u>
SUB-TOTAL	5,917	15,245	1,701	6,747	16,506
YUKON:					
Commercial	93,587	-	2,446	-	8,347
Subsistence	<u>22,817</u>	-	<u>5,535</u>	<u>1,003</u>	<u>479,092</u>
SUB-TOTAL	116,404	-	7,981	1,003	487,439
NORTON SOUND:					
Commercial	2,018	126	98	13,567	148,862
Subsistence	<u>565</u>	-	<u>2,567</u>	<u>9,225</u>	<u>12,486</u>
SUB-TOTAL	2,583	126	2,665	22,792	161,348
PORT CLARENCE:					
Subsistence	-	1,475	227	371	1,049
KOTZEBUE:					
Commercial	-	-	-	5	76,499
Subsistence	-	-	-	-	<u>29,762</u>
SUB-TOTAL	-	-	-	5	106,261
GRAND TOTAL FOR A-Y-K AREA ^{3/}					
1964	171,070	16,846	41,187	30,918	962,793
1963	209,456	38	50,095	57,177	789,574

^{1/} The Kanektok Sub-District W-4 of the Kuskokwim District is shown separately.

^{2/} Chums and reds combined.

^{3/} 1963 subsistence catches not documented in Norton Sound District or Kanektok Sub-District.

TABLE 2

1964 ARCTIC-YUKON-KUSKOKWIM AREA PROCESSORS AND ASSOCIATED DATA

Commercial Operator	Product	Fish Per Case	Price Paid to Fishermen	District
Bering Sea Fisheries, Inc. 611 Lowman Building Seattle, Washington	Canned 1# Talls			
	Chums	12.2	\$.35 Per Fish	Norton Sound
	Pinks	32.0	.25 Per Fish	Norton Sound
	Chums	9.6	.45 Per Fish	Kotzebue
Grosvold Sea Foods Seward, Alaska	Fresh Salmon			
	Kings		.21 Per Pound	Norton Sound
	Chums		.35 Per Fish	
M/V Tanager, Inc. 2100 Westlake North Seattle, Washington	Fresh Salmon			
	Chums		.35 Per Fish	Norton Sound
	Frozen Salmon			
	Kings		4.50 Per Fish	
Rotman Seafoods, Inc. Kotzebue, Alaska	Fresh Salmon			
	Chums		.50 Per Fish	Kotzebue
Bruce Crow Bethel, Alaska	Fresh Salmon Cohos		.35 Per Fish	Kuskokwim
Kuskokwim Packing Company 1844 Westlake Avenue North Seattle, Washington	Mild Cured Salmon			
	Kings		3.25 Per Fish	Kuskokwim
	Fresh Salmon			Bethel
	Reds		.50 Per Fish	
	Cohos		.35 Per Fish	
Kuskokwim Enterprises, Inc. Box 3 Bethel, Alaska	Fresh Salmon Kings		3.25 Per Fish	Kuskokwim
George Schenk 2408 Peabody Street Bellingham, Washington	Fresh Salmon			
	Kings		3.25 Per Fish	Kuskokwim
	Reds		.50 Per Fish	
	Cohos		.35 Per Fish	

*Bill
Boddy*

*Steve
Salinas*

*Bruce
Crow,
Bethel*

*Mike Jacobson
Ed Parry
Howard Elliot*

*George Schenk
Ron Larson*

TABLE 2 (Cont'd)

Commercial Operator	Product	Fish Per Case	Price Paid to Fishermen	District
Swanson Brothers Bethel, Alaska	Frozen Salmon Kings Cohos		\$3.25 Per Fish .35 Per Fish	Kuskokwim <i>Dave + Pete Swanson</i>
Clark Fishing Enterprises Aniak, Alaska	Fresh Salmon Kings Cohos		3.25 Per Fish .25 Per Fish	Kuskokwim and Yukon <i>Harry Clark Andrewsby Strip</i>
Northern Commercial Company 419 Colman Building Seattle, Washington	Mild Cured Salmon Kings		3.75 Per Fish	Yukon
Yukon Fishing and Transportation Co. Box 487 Nenana, Alaska	Mild Cured Salmon Kings		3.75 Per Fish	Yukon
John Amukon Scammon Bay, Alaska	Mild Cured and Hard Salt Kings		3.75 Per Fish	Yukon
Heckman Hard Salting Pilot Station, Alaska	Hard Salt Salmon Kings		3.75 Per Fish	Yukon
Frank Coffee Fortuna Ledge, Alaska	Smoked Strips Kings		3.75 Per Fish	Yukon
Mountain Village Fish Company Mountain Village, Alaska	Mild Cured and Hard Salt Kings		4.00 Per Fish	Yukon <i>George + Doug Sheppard</i>
Peterson Navigation Company Box 1068 Fairbanks, Alaska	Frozen Salmon Kings Cohos Chums		4.50 Per Fish .50 Per Fish .25 Per Fish	Yukon <i>Don Peterson</i>
Point Adams Packing Company Hammond, Oregon	Canned 1/2# Salmon Kings	3.3	3.75 Per Fish	Yukon <i>Walt Emke Ed Beard Alakanuk Frank Olstrom</i>

George Butler, Hamilton

TABLE 2 (Cont'd)

Commercial Operator	Product	Fish Per Case	Price Paid to Fishermen	District
Yukon Packers 1032 Eighth Avenue Fairbanks, Alaska	Canned 1/2# Salmon Kings	3.3	\$4.00 Per Fish	Yukon
Weisner Trading Company Rampart, Alaska	Canned 1# Flats and Tails, Canned 1/2# Flats Kings	3.3	Unknown	Yukon
Safeway Store A402 Box 608 Fairbanks, Alaska	Fresh and Frozen Salmon Kings		Unknown	Yukon
Denali Grocery 1209 Ninth Avenue Fairbanks, Alaska	Fresh and Frozen Salmon Kings		Unknown	Yukon
Fred A. Pope Badger Road Fairbanks, Alaska	Fresh, Frozen, Mild Cured, and Smoked Salmon Kings Chums Cohos		Unknown Unknown Unknown	Yukon
Paul A. Disrochers 250 Charles Street Fairbanks, Alaska	Fresh and Smoked Salmon Kings		Unknown	Yukon
Northern Sea Foods Box 2191 Fairbanks, Alaska	Fresh and Frozen Salmon Kings		Unknown	Yukon

Harry Furford "Aleutian Reefers" Yukon (Emmonak)
Russ Jacobson Yukon (Pitkas Point)

TABLE 3

ARCTIC-YUKON-KUSKOKWIM AREA
PACK BY SPECIES, 1964

Species	Cases (48# Case)	Mild Cure and Hard Salt		Frozen Fish	Fresh Fish
		Full Tierces	Half Tierces		
King Salmon	12,367	719	499	-	12,068
Chum Salmon	14,778	-	-	8,341	55,502
Red Salmon	1,295	-	-	-	-
Coho Salmon	-	-	-	2,549	29,197
Pink Salmon	452	-	-	-	-

Aerial surveys made of this system in 1960 indicated that the run consisted of 77,000 to 100,000 fish. The highest recorded count made during 1961 through 1963 was 45,000 red salmon. Age determination studies, previously discussed, indicate that the vast majority of Kanektok River red salmon are four-year-olds. The similarity of the size of the 1960 and 1964 runs may indicate that large red runs will occur in this sub-district every four years.

Y U K O N D I S T R I C T

COMMERCIAL FISHERY

This district includes all waters of the Yukon River and tributaries and all coastal waters including Stuart Island from Cape Stephens southward to 62° N. Latitude. Commercial fishing for salmon is not permitted outside the mouths of the Yukon and Black Rivers.

A commercial fishery was first established in 1918 and has continued each year with the exception of the period 1925 to 1931. Prior to 1961, the commercial fishery was restricted to catch quotas of varying sizes; a quota of 50,000 kings was in effect during most years. During the period 1954 through 1960, a 65,000 king salmon quota was divided between the following areas of the river: 50,000 kings below the mouth of the Anuk River, 10,000 between the mouths of the Anuk and Anvik Rivers, and 5,000 above the mouth of the Anvik River. Commercial fishing was allowed for five and one-half days a week until the quota was taken.

Since 1961, quotas have been removed for that portion of the river below Owl Slough near Marshall and this fishery has been regulated by scheduled openings and closures each week. Limited quotas still are in effect for areas above Owl Slough.

A total of 93,587 king salmon, 2,446 coho salmon, and 8,347 chum salmon was commercially harvested in this district during 1964. The 1964 catch of king salmon was very similar to that of 1962 but was considerably smaller than that of 1961 and 1963. Comparative catch and effort data are shown for each sub-district for the years 1960 through 1964 in Table 13.

Approximately 12,041 cases (48 pounds per case) of king salmon were locally processed by three canneries. King salmon that were canned in Sub-Districts #1 and #2 averaged 3.36 fish to the case. The remainder of the king salmon catch was mild cured, hard salted or shipped to fresh fish markets. Coho and chum salmon were frozen locally and were sold in Fairbanks and other marketing areas.

Commercial fishermen who fished in this district during 1964 received a total of approximately \$354,383.00 for their salmon. The State received approximately \$35,000.00 in license revenues and processing taxes.

Tables 14 through 18 give pertinent catch and effort data by day for Sub-Districts #1 through #4. The following is a brief review of each sub-district fishery:

Sub-District #1: A total of 67,555 king salmon was commercially harvested during the 1964 season. Although the commercial season for king salmon was opened on June 1, ice and breakup conditions prevented any fishing effort until June 15. Commercial fishing was allowed for a total of four days a week from 6:00 a.m. Monday to 6:00 a.m. Wednesday and from 6:00 p.m. Thursday to 6:00 p.m. Saturday until July 8 when the season was closed by field announcement.

A majority of Sub-District #1 commercial fishermen operate set gill nets, although an increasing number of drift gill nets are being operated each year. Drift gill nets are commonly operated in the middle mouth and the 30 Mile Slough areas.

The 1964 season was unusual as the king salmon run entered the river approximately ten to twelve days later than normal. Breakup was late and there

TABLE 13
YUKON RIVER KING SALMON COMMERCIAL FISHERY
COMPARATIVE CATCH STATISTICS, 1960-1964

	Year	Y-1	Y-2	Y-3	Total	Y-4 ^{1/}
Total Boat Hours	1960	36,192	33,048	Not in Existence	69,240	
	1961	67,548	23,172	2,803	93,528	
	1962	68,736	29,016	2,520	100,272	
	1963	59,742	21,096	5,616	86,454	
	1964	49,476	17,358	3,432	70,266	
Catch	1960	50,713	15,994	Not in Existence	66,707	884
	1961	84,406	29,028	4,965	118,399	1,804
	1962	67,072	22,224	4,687	93,983	724
	1963	85,004	24,211	6,976	116,191	803
	1964	67,555	20,246	4,705	92,506	1,031
Catch Per Boat Hour	1960	1.4	0.5	-	1.0	
	1961	1.2	1.3	1.8	1.3	
	1962	1.0	0.8	1.9	0.9	
	1963	1.4	1.1	1.2	1.3	
	1964	1.4	1.2	1.4	1.3	
<u>Licenses</u>						
Commercial	1961	238	130	26	394	13
	1962	321	148	46	515	18
	1963	285	131	30	446	5
	1964	319	119	31	469	13
Vessel (Tenders)	1961	210 (15)	112 (3)	18	340	10
	1962	320 (20)	127 (3)	31	478	12
	1963	272 (17)	113 (5)	22	407	6
	1964	314 (12)	101 (5)	24	439	12
<u>Gear</u>						
Drift (Number Fathoms)	1961	17 (925)	86 (5,130)	-	6,055 F	0
	1962	55 (3,200)	98 (6,750)	24 (1,730)	11,680 F	0
	1963	24 (1,225)	85 (6,585)	5 (400)	8,210 F	0
	1964	65 (3,835)	89 (5,390)	5 (225)	9,450 F	0
Set (Number Fathoms)	1961	217 (25,560)	101 (6,050)	19 (691)	32,301 F	1 (30)
	1962	303 (35,470)	117 (6,465)	14 (900)	42,835 F	2 (100)
	1963	259 (30,975)	101 (5,445)	21 (1,350)	37,770 F	2 (90)
	1964	277 (32,090)	100 (5,105)	28 (2,080)	39,275 F	4 (235)

^{1/} Effort data in Y-4 is not accurate enough for analysis of the catch in this district.

TABLE 14

COMMERCIAL CATCHES OF KING SALMON FROM SUB-DISTRICT #1
YUKON DISTRICT, ALL GEAR COMBINED, 1964

Date of Landing	Hours Fished	Number of Fishing Boats	Total Catch	Catch Per Boat Hour	Accumulative Catch
June 15	18	3	4	.07	4
16	24	21	86	.17	90
17	6	40	155	.65	245
18					
19	30	166	3,870	.78	4,115
20	18	186	5,386	1.61	9,501
21					
22	18	180	8,386	2.59	17,887
23	24	204	12,282	2.51	30,169
24	6	202	6,792	5.60	36,961
25	6	23	342	2.48	37,303
26	24	203	5,648	1.16	42,951
27	18	226	5,508	1.35	48,459
28					
29	18	135	1,916	.79	50,375
30	24	180	2,970	.69	53,345
July 1	6	175	1,954	1.86	55,299
2	6	15	284	3.16	55,583
3	24	185	4,129	.93	59,712
4	18	198	5,590	1.65	65,302
5					
6	18	93	683	.41	65,985
7	24	148	1,010	.28	66,995
8	6	134	560	.75	67,555

TABLE 15

COMMERCIAL CATCHES OF KING SALMON FROM SUB-DISTRICT #2
YUKON DISTRICT, ALL GEAR COMBINED, 1964

Date of Landing	Hours Fished	Number of Fishing Boats	Total Catch	Catch Per Boat Hour	Accumulative Catch
June 19	24	9	57	.26	57
20	6	33	299	1.51	356
21					
22	30	45	822	.61	1,178
23	18	106	3,178	1.67	4,356
24					
25	18	49	1,412	1.60	5,768
26	24	74	2,965	1.67	8,733
27	6	60	2,382	6.62	11,115
28	6	14	654	7.79	11,769
29	24	77	1,584	.86	13,353
30	18	106	2,737	1.43	16,090
July 1					
2	18	47	485	.57	16,575
3	24	78	1,232	.66	17,807
4	6	59	673	1.90	18,480
5					
6	30	82	1,105	.45	19,585
7	18	72	661	.51	20,246

TABLE 16

COMMERCIAL CATCHES OF KING SALMON FROM SUB-DISTRICT #3
YUKON DISTRICT (SET GILL NETS), 1964

Date of Landing	Hours Fished	Number of Fishing Boats	Total Catch	Catch Per Boat Hour	Accumulative Catch
June 23	24	11	171	.6	171
24	24	13	225	.7	396
25	24	9	127	.6	523
26	18	22	1,055	2.7	1,578
27					
28					
29	6	5	148	4.9	1,726
30	24	30	1,095	1.5	2,821
July 1	24	24	841	1.5	3,662
2	24	21	491	1.0	4,153
3	18	23	552	1.3	4,705

TABLE 17

COMMERCIAL CATCHES OF KING SALMON FROM SUB-DISTRICT #4
YUKON DISTRICT, 1964 ^{1/}

Date of Catch	Number of Fish Caught	Total Catch	Accumulative Catch
July 7	2	10	10
8			
9	2	63	73
10			
11	2	134	207
12	1	134	341
13	1	15	356
14	2	169	525
15	1	14	539
16	1	22	561
17	1	74	635
18	2	78	713
19	1	16	729
20	1	20	749
21	1	25	774
22	2	37	811
23	2	80	891
24	2	50	941
25	2	84	1,025
26	1	56	1,081

^{1/} Majority of catch taken by fishwheels.

TABLE 18

COMMERCIAL CATCHES (AUGUST SEASON) OF COHO AND CHUM SALMON
 SUB-DISTRICT #1, YUKON DISTRICT, 1964

Date of Landing	Hours Fished	Number of Fishing Boats	Coho Salmon	Chum Salmon	Total Salmon
August 3	18	16	6	249	255
4	24	20	19	402	421
5	6	28	48	1,682	1,730
6					
7	30	36	110	1,480	1,590
8	18	30	88	638	726
9					
10	18	27	179	738	917
11					
12	6	12	87	362	449
13	6	1		1	1
14	24	18	210	199	409
15	18	32	241	1,238	1,479
16					
17	30	16	62	171	233
18	24	32	210	466	676
19	24	28	155	283	438
20	24	7	34	13	47
21	24	16	199	35	234
22	18	15	226	22	248
23					
24	30	10	94	76	170
25	24	17	245	148	393
26	24	18	155	99	254
27	24	14	78	45	123
TOTALS:			2,446	8,347	10,793

were ice jams in the south mouth as late as June 12; in most years, breakup has occurred and the river is running free of ice by June 1. Yukon king salmon probably behaved similarly to Kuskokwim king salmon in that the run milled off the mouth and entered the river only when water temperatures became normal. There were no indications that an early segment of the run, with the exception of a few fish, passed through Sub-District #1 prior to June 15.

The peak in the king salmon run, as indicated by commercial and tagging site catches, occurred in the south and middle mouths sometime during June 20 to June 24. During this time, very good catches were made and processing plants operated at full capacity. With the exception of a much smaller peak noted during July 3-4, the run entering the river declined steadily after June 24. Usually there are two, three, or more distinct peaks in the king salmon run.

Commercial fishing in this sub-district as well as in Sub-District #2 was not allowed during the period July 10 to August 2. This closure protects that portion of the chum salmon run that upriver subsistence fishermen depend upon. The commercial fishing season was re-opened on August 3 by field announcement. During this August season, 2,446 coho and 8,347 chum salmon were taken by commercial fishermen (see Table 18). Effective August 16, fishing time was increased from four to six days a week by field announcement as only a small portion of the run was being commercially harvested.

Sub-District #2: A total of 20,246 king salmon was taken for commercial purposes from June 19 to July 7. Similar to Sub-District #1, commercial fishing was allowed four days a week, from 6:00 p.m. Sunday to 6:00 p.m. Tuesday and from 5:00 a.m. Thursday to 6:00 a.m. Saturday. The king salmon season was closed effective July 7 in this sub-district. Peak catches were made during June 26 to June 30.

Near equal numbers of drift and set gill nets are operated in this sub-district. During 1964, a total of 9,021 and 11,225 king salmon were recorded as being captured by set and drift gill nets respectively.

Sub-District #3: The commercial catches in this sub-district are limited by a 3,000 king salmon quota and a 3,000 combined chum and coho salmon quota. During 1964, a total of 4,705 kings was taken for commercial purposes, 1,705 kings over the quota. Most Sub-District #3 fishermen reside in and fish near the villages of Russian Mission and Holy Cross. Only set gill nets were operated during the 1964 season.

Commercial fishing is allowed four days a week, from 6:00 p.m. Monday to 6:00 p.m. Friday. The three day closure was established for the purpose of allowing time for the king salmon run to spread throughout the fishing area so that the entire quota would not be taken in the lower portion of the sub-district. The closure also gives biologists an opportunity to tabulate catches in order to hold the catch to the quota limit. However, in 1964, the major portion of the run passed through the fishing area in such a short period of time that the quota was exceeded before catches could be tabulated. Although the king salmon season was closed on July 4, the main peak of the run had passed through the major fishing areas (Russian Mission, Holy Cross) by July 1. There was no commercial fishing effort upstream of Holy Cross in this sub-district during 1964.

Sub-District #4: A total of 1,081 kings was recorded as being taken in this sub-district. The salmon commercial fishery in this sub-district is limited to a 2,000 king salmon and a 2,000 combined chum and coho salmon quotas. Most of the commercial catches were taken by fishwheels operated in the Rampart, Tanana, Nenana, and Fort Yukon areas. Illegal fishing in

the form of unlicensed fishermen and unreported catches is prevalent in this sub-district. Most of the unreported catch, which may be larger than the reported catch, is believed to be flown in from various villages to Fairbanks.

Incidental Catch of Chum Salmon: Commercial fishing regulations presently do not allow the sale of chum salmon in the Yukon District until after August 1. Chums taken incidentally with king salmon gear during the commercial king salmon season must be utilized for subsistence purposes. Some of the Yukon fishermen and residents are of the opinion that this incidental catch is relatively great and that large numbers of chums are discarded. To prevent this wastage and to increase the area's economy, these persons would like to have regulations liberalized so that incidentally captured chum salmon could be sold commercially.

Two different methods were used to estimate the incidental catch of chum salmon in Sub-District #1. The first method involved the use of catch records that were maintained at the Flat Island tagging site during 1964. A total of 244 chum and 260 king salmon was captured by tagging site set gill nets, which were identical to a majority of the gear used by Sub-District #1 fishermen. Applying this catch ratio (1 chum:1.07 kings) to the commercial king salmon catch of Sub-District #1 indicates that approximately 63,000 chum salmon were taken incidentally during the king salmon season. For lack of better information, it is assumed an equal or near equal proportions of the king and chum salmon runs entered all mouths of the Yukon River.

Another method of estimating the incidental chum catch involved the use of catch records maintained by five Sub-District #1 commercial fishermen. A total of 707 chum salmon and 1,674 commercially caught king salmon was recorded as being taken by these fishermen during the king salmon season.

Applying this ratio (1 chum:2.47 kings) to the Sub-District #1 commercial king salmon catch indicates that approximately 28,000 chums were incidentally captured. Two of the five fishermen captured chum salmon in ratios similar to that of the Flat Island tagging site nets. It is probable that the fishermen did not record all chum salmon that were captured, but just recorded those salmon that were retained for subsistence purposes.

It is likely that the actual incidental chum catch lies somewhere between the 28,000 and the 63,000 estimate. Using tagging site records, the 1963 incidental chum catch in Sub-District #1 was estimated to be approximately 19,000. There is no information available to estimate the incidental chum catch in other sub-districts.

The staff does not recommend that the present regulations be changed to allow the sale of incidentally caught chum salmon for the following reasons:

1. Chum salmon are used for subsistence purposes by commercial fishermen and their families. In early August (1964), a Department survey crew tabulated 46,372 chums that were taken for subsistence by Sub-District #1 fishermen, most of which fish commercially during the king salmon season. Commercial fishermen commonly sell every salmon caught when it is legal to do so. In a few instances, this practice has led to a shortage of dry and smoked fish for winter use. Although some incidentally caught chum salmon are wasted, it is believed that considerable numbers are being used for subsistence.

2. Regulation liberalization may place emphasis on the capture of chum salmon. Upriver subsistence fishermen, especially in the area from Pilot Station to Galena, are greatly dependent on the summer run of chum salmon. Based on previous studies, it is estimated that 80 percent of the total annual subsistence chum catch is from the summer run. In 1964, this amounted to approximately 383,000 chums.

3. If regulations allowed the sale of incidentally captured chums, then minimum mesh regulations would have to be promulgated and enforced. The Department does not have sufficient funds or personnel to adequately enforce such regulations.

SUBSISTENCE FISHERY

As in previous years, a Department of Fish and Game survey crew, traveling by boat, counted fish on drying racks and in smokehouses in every fish camp and village from the river mouth to Fort Yukon. The survey also extended up the Tanana River as far as Nenana. In addition, catch calendars on which daily catches could be recorded were mailed to fishermen prior to the fishing season. Many fishermen completed and returned these forms to the Department. Catch calendar data recorded after the boat surveys were made are included in the total figures. Catches for Alaskan villages on the Koyukuk River, Porcupine River and above Fort Yukon were obtained from catch calendars or catch questionnaires. Finally, catches for fishing communities in Canada were obtained from records kept by the Canadian Department of Fisheries office at Whitehorse.

King, pink, and summer chum catches, as in previous surveys, more nearly represent actual catches as those runs had already passed through the villages at the times of the boat survey. The 1963 and 1964 surveys were conducted in a similar manner. The Annual Report for 1963 describes survey methods in detail.

As shown in Table 19, a total of 22,817 kings, 479,092 chums, 5,535 cohos and 1,003 pinks was recorded as being taken for subsistence. A total of 657 known fishing families were surveyed. A minimum total of 302 king salmon nets (8 1/2 inch mesh), 565 chum salmon nets (5 1/2 inch mesh), and 155 fishwheels were operated by subsistence fishermen.

TABLE 19

SUBSISTENCE CATCH (EXPANDED) BY VILLAGE
YUKON RIVER DRAINAGE, 1954

Dist.	Fishing Unit	Date of Survey	Fishing Families Surveyed	No. People In Fishing Families	Kings	Chums	Cohos	Pinks	Total Salmon	Units of Gear Used		
										Chum Net	King Net	Fish-Weirs
	Alakanuk	8/1, 8/2	54	309	87	11,225	70	33	11,420	40	70	0
	Sheldons Point	8/3	25	131	52	7,614	1,042	45	8,753	17	32	0
I	Kwiguk-Emmonak	8/4, 8/5	57	360	63	15,769	1,126	59	17,017	32	88	0
	Aproka Pass and Snotty Slough	8/5, 8/6	23	124	73	7,706	-	5	7,785	14	53	0
	Hamilton-Kotlik	8/5, 8/6	26	145	53	4,058	-	13	4,129	6	30	0
	Mountain Village <u>1/</u>	8/7, 8/9	54	343	985	13,027	133	433	14,578	41	50	0
	Pitkas Pt.-St. Marys	8/11, 8/13	35	205	521	12,368	-	140	13,029	19	34	0
II	Pilot Station	8/17	35	210	237	10,627	-	149	11,013	35	40	0
	Marshall	8/18	23	109	290	10,075	-	30	10,415	21	36	0
	Russian Mission	8/19	20	98	1,185	10,032	-	37	11,254	22	22	0
	Paimute-Holy Cross	8/20	32	213	2,243	31,425	-	22	33,690	26	28	7
	Anvik	8/25	19	106	153	34,336	-	5	34,494	1	14	9
III	Grayling	8/26	18	107	124	23,641	142	1	23,908	1	9	11
	Kaltag	8/27	24	167	330	35,961	-	0	35,291	2	14	12
	Nulato	8/28	32	192	355	62,446	-	0	62,801	2	13	12
	Koyukuk	8/29	18	101	209	36,167	-	0	36,376	0	3	20
AI	Galena	8/30	10	76	158	3,100	-	0	3,258	7	9	4
	Ruby	9/1	15	88	2,555	20,122	-	0	22,686	1	1	11
	Tanana	9/4	13	53	329	13,531	1,817	0	15,677	1	1	11
	Rampart	9/11	9	44	990	14,963	-	0	15,953	0	0	7
IA	Stevens Village	9/14	8	61	325	6,979	-	0	7,304	0	2	6
	Beaver	9/15	10	44	710	11,359	-	0	12,069	2	0	5
	Fort Yukon	9/16, 9/17	19	125	2,098	19,407	-	0	21,505	1	0	19

TABLE 14 (Cont'd)

Dist. Fishing Unit	Date of Survey	Fishing Families Surveyed	No. People In Fishing Families	Kings	Chums	Cohos	Pinks	Total Salmon	Units of Gear Employed		
									King Net	Chum Net	Fish-Wheels
Circle City	Catch Form	4	?	1,200	2,300	-	0	3,500	Fishwheel and/or Gill Nets		
Eagle	Catch Calendar	2	?	17	1,582	-	0	1,599	"		
Dawson	Canadian Dept. of Fisheries	5+	?	3,476	3,331	-	0	6,807	"		
Mayo	"	1+	?	150	-	-	0	150	"		
Belly River	"	10+	?	1,000	-	-	0	1,000	10	0	0
Minto	"	3+	?	600	600	-	0	1,200	Fishwheel and/or Gill Nets		
Carmacks	"	8+	?	700	250	-	0	950	"		
Johnson's Crossing	"	4+	?	720	-	-	0	720	"		
MAIN YUKON TOTALS:		616+	3,411+	21,987	432,577	4,339	999	459,902	301+	549+	134+
Huslia	Catch Calendar	11	?	112	13,913	-	0	14,025	1	11	0
Hughes	Catch Calendar	1	?	18	559	-	0	577	0	1	0
KOYUKUK RIVER TOTALS:		12	?	130	14,472	-	0	14,602	1	12	0
Manley Hot Springs and Minto	9/6	16	72	468	16,520	1,108	0	18,096	0	0	13
Kenana	9/10	7	41	194	11,041	88	0	11,323	0	0	28
TANANA RIVER TOTALS:		23	113	662	27,561	1,196	0	29,419	0	0	21
Canyon Village	Catch Calendar	3	?	35	2,316	-	0	2,351	0	1	0
Chalkytsik	Catch Calendar	3	?	2	742	-	0	744	0	3	0
PORCUPINE RIVER TOTALS:		6	?	37	3,058	-	0	3,095	0	4	0
YUKON DRAINAGE GRAND TOTAL:		657+	3,524+	22,817	479,092	5,535	1,003	508,447	302+	565+	134+

1/ Also includes families surveyed in the area between Fish Village and Mountain Village not included in previous years' studies.

In this section, subsistence catches will be compared for 1961 through 1964 in an attempt to determine relative run sizes and escapements to various sections of the Yukon drainage. It should be pointed out that such evaluations are subject to error, i.e. there is no way known to accurately assess the effect of differences in water conditions and fishing effort (other than number of fishermen, units of gear, etc.) on the catches. Tables 20 and 21 present comparative catches for king and chum salmon respectively for 1961 through 1964.

Due to differences in utilization of and dependence on fish resources, fishing methods, and topography, the Yukon drainage has been divided into seven (7) subsistence fishing districts. This grouping also facilitates making catch comparisons and determining the various factors that may influence catches. A description of each district is included in the Annual Report of 1962. Table 19 shows the villages grouped by district. Figure 2 shows the total catch and average number of kings and chums per fishing family for each district during 1961 through 1964.

King Salmon: As shown in Table 20, the 1964 catch was larger than that recorded in 1962 but smaller than the 1961 and 1963 catches. Due to the unusual timing pattern of the 1964 run, relatively poor catches were made in Districts I and II which are both located in the commercial fishery of the lower Yukon. In most years, fishermen from these districts make their largest subsistence catches of king salmon in early July after the commercial fishing season is closed. In 1964, the bulk of the king salmon run had passed through Districts I and II by the time the commercial season was closed on July 8.

As shown in Figure 2, the numbers of king salmon taken per fishing family in the other districts are similar to peak catches made in previous

KING SALMON SUBSISTENCE CATCHES BY VILLAGE
YUKON RIVER, 1961-1964

Village	K i n g s			
	1961	1962	1963	1964
Main Yukon:				
Black River	-	-	38	-
Sheldons Point-Kwikluak Pass	180	116	893	52
Alekanak	165	53	81	87
Kwiguk-Emmonak	137	21	120	63
Aproka Pass-Snotty Slough	179	181	293	73
Hamilton-Kotlik	111	35	195	53
Mountain Village	1,110	619	2,427	985
Pitkas Point-St. Marys	1,810	391	1,254	521
Pilot Station	753	219	801	237
Marshall	1,265	503	2,012	290
Russian Mission	1,563	641	1,392	1,185
Holy Cross	2,648	1,111	3,123	2,243
Anvik	22	51	163	153
Grayling (Including Shageluk fishermen)	25	37	197	124
Kaitag	33	224	102	330
Nulato	513	171	835	355
Koyukuk	483	423	629	209
Galena	626	123	282	158
Ruby-Kokrines	1,060	226	1,514	2,555
Tanana	2,379	332	1,414	329
Rampart	605	1,438	1,231	990
Stevens Village	650	831	1,073	325
Beaver	185	442	491	710
Fort Yukon	2,958	1,822	2,831	2,098
Circle City	496	393	250	1,200
Eagle	875	400	500	17
Dawson	2,231	2,000	1,500	3,476
Ross River	-	500	600	-
Mayo	-	300	250	150
Pelly River-Minto	-	2,000	2,000	1,600
Carmacks	-	3,000	2,500	700
Johnson's Crossing	-	1,000	900	720
Innoko River:				
Shageluk	-	(Few)	-	-
Holikachuk	-	-	-	-
Tanana River:				
Minto-Manley Hot Springs	347	92	325	468
Nenana	310	115	213	194

TABLE 20 (Cont'd)

Village	K i n g s			
	1961	1962	1963	1964
Other Tributaries:				
Huslia	-	100	32	112
Hughes	-	-	47	18
Allakaket	-	-	85	-
Venetie	-	(Few)	-	-
Canyon Village	-	0	17	35
Chalkyitsik	-	0	2	2
Old Crow	-	0	44	-
TOTALS:	23,719	19,910	32,656	22,817
TOTALS FOR EQUIVALENT AREAS:	23,719	13,010	26,141	19,480

TABLE 21

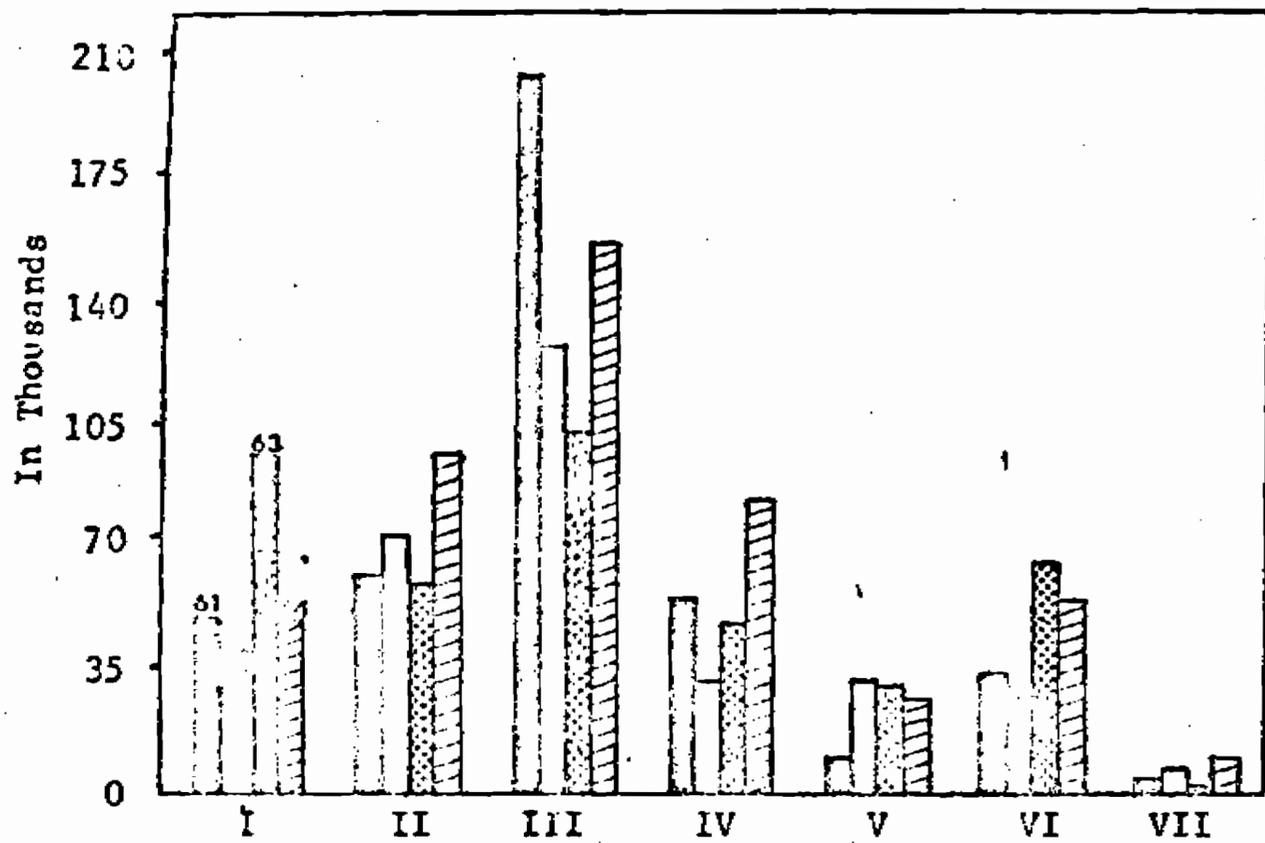
CHUM SALMON SUBSISTENCE CATCHES BY VILLAGE
YUKON RIVER, 1961-1964

Village	C h u m s			
	1961	1962	1963	1964
Main Yukon:				
Black River	-	-	1,779	-
Sheldons Point-Kwikluak Pass	12,683	10,899	30,168	7,614
Alakanuk	8,932	5,747	17,664	11,225
Kwiguk-Emmonak	15,670	9,074	26,104	15,769
Aproka Pass-Snotty Slough	8,409	6,071	8,721	7,706
Hamilton-Kotlik	3,931	5,362	8,543	4,058
Mountain Village	7,373	8,331	8,164	13,027
Pitkas Point-St. Marys	8,771	10,510	6,528	12,368
Pilot Station	5,605	13,926	4,737	10,627
Marshall	5,992	6,595	7,290	10,075
Russian Mission	4,098	9,994	5,022	10,032
Holy Cross	21,144	20,424	12,433	31,425
Anvik	61,406	43,404	27,981	34,336
Grayling (Including Shageluk fishermen)	56,284	32,737	18,358	23,641
Kaltag	23,395	25,824	23,088	35,961
Nulato	63,163	27,948	31,737	62,446
Koyukuk	13,544	6,282	7,901	36,167
Galena	10,585	1,673	6,692	3,100
Ruby-Kokrines	15,654	18,243	15,515	30,122
Tanana	12,775	7,245	16,196	13,531
Rampart	11,722	6,962	11,206	14,963
Stevens Village	3,490	4,355	8,236	6,979
Beaver	2,975	2,334	12,004	11,359
Fort Yukon	13,252	10,255	31,170	19,407
Circle City	992	800	100	2,300
Eagle	150	100	50	1,582
Dawson	725	3,000	1,500	3,331
Ross River	-	0	0	-
Mayo	-	0	0	-
Pelly River-Minto	-	1,500	1,500	600
Carmacks	-	2,000	2,500	250
Johnson's Crossing	-	0	0	-
Innoko River:				
Shageluk	-	3,500	-	-
Holikachuk	-	100	-	-
Tanana River:				
Minto-Manley Hot Springs	6,486	17,228	13,721	16,520
Nenana	6,426	13,821	11,749	11,041

TABLE 21 (Cont'd)

Village	C h u m s			
	1961	1962	1963	1964
Other Tributaries:				
Huslia	-	16,000	5,455	13,913
Hughes	-	-	767	559
Allakaket	-	(Few)	1,972	-
Venetie	-	1,000	200	-
Canyon Village	-	210	1,566	2,310
Chalkyitsik	-	500	64	742
Old Crow	-	<u>2,800</u>	<u>20,000</u>	<u>-</u>
TOTALS:	405,632	356,754	408,381	479,092
TOTALS FOR EQUIVALENT AREAS SURVEYED:	405,632	329,144	372,578	460,712

Total Salmon



Average Number of Salmon Per Family

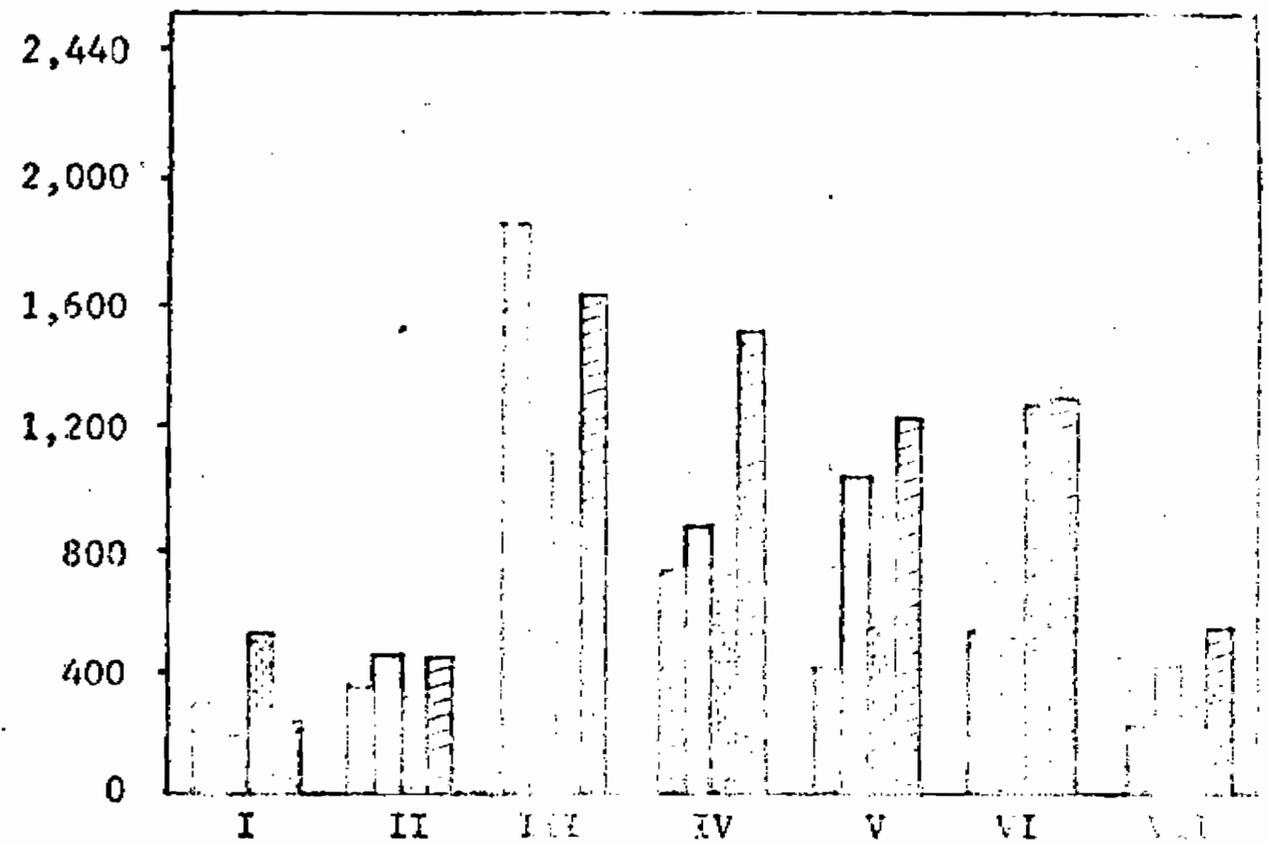
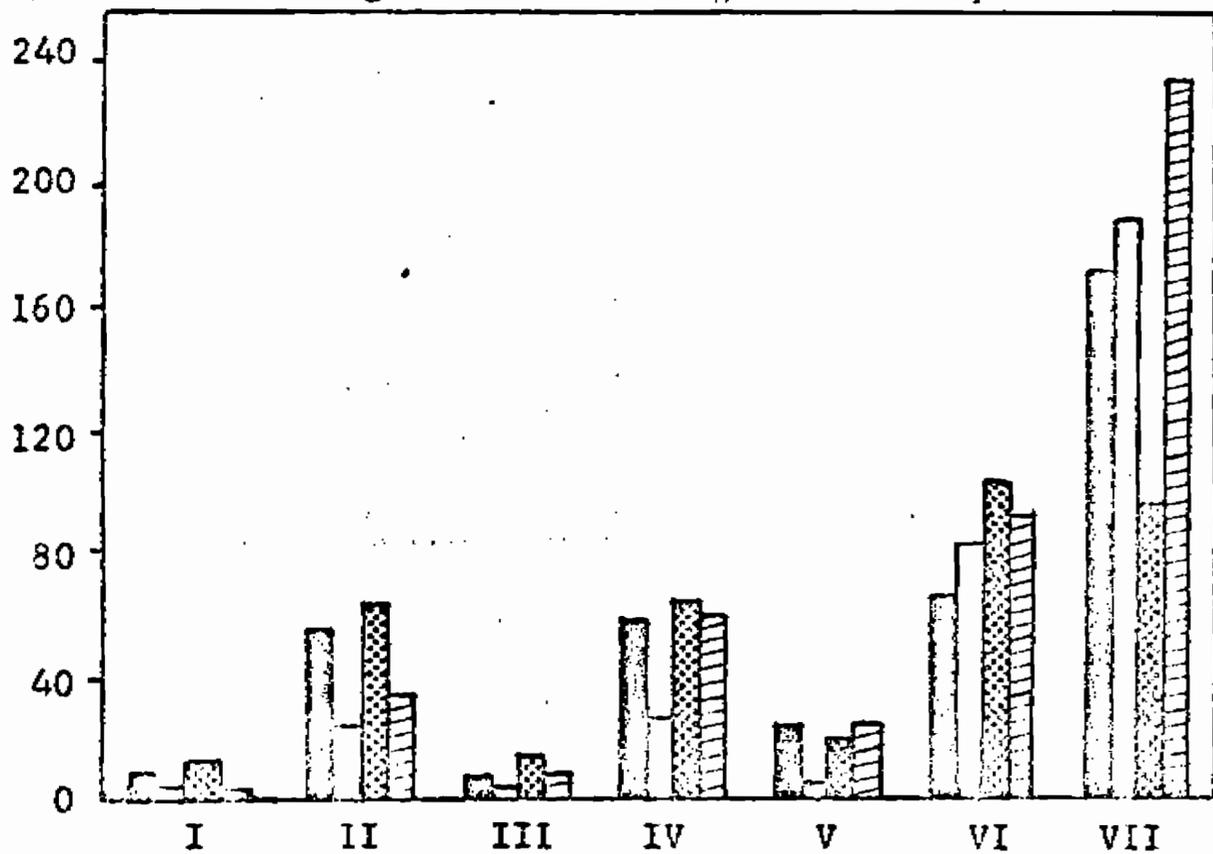
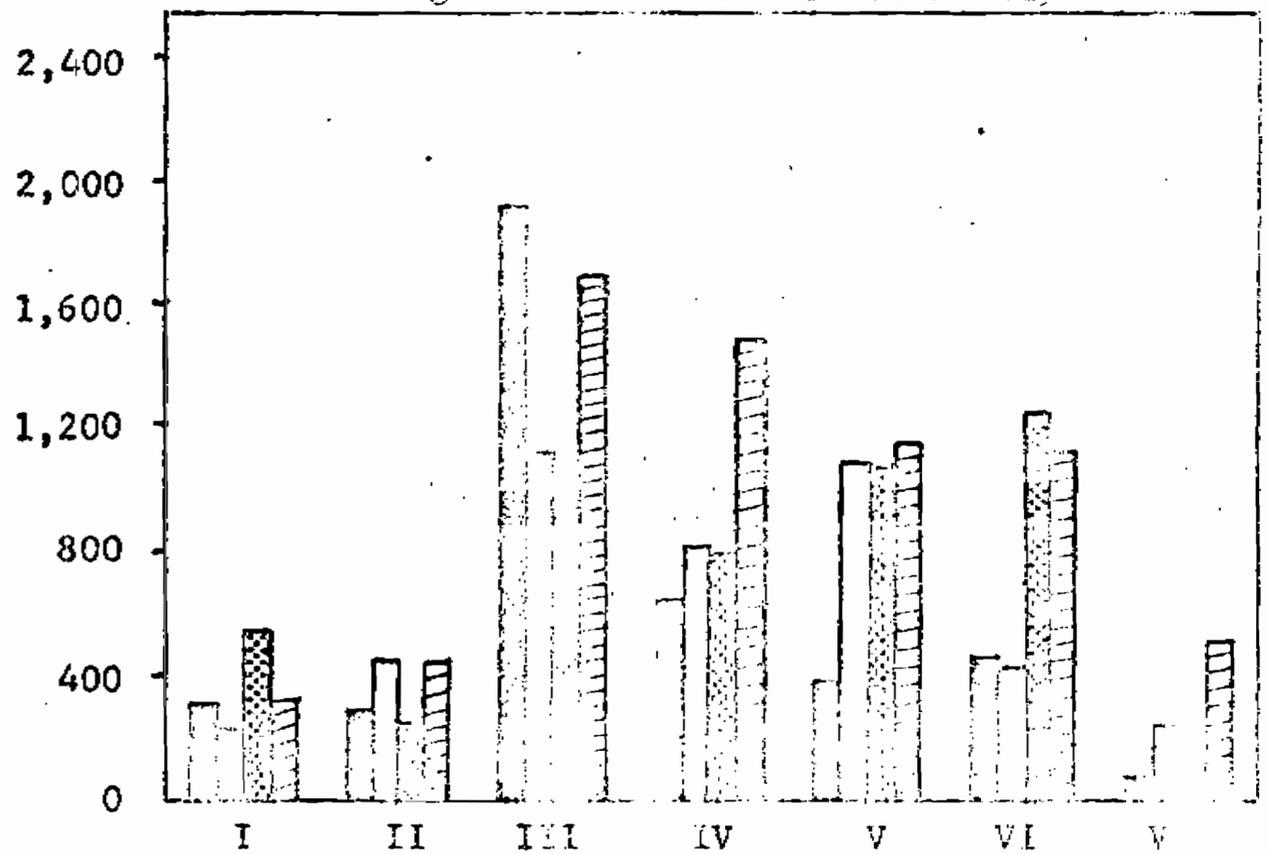


FIGURE 2. YUKON RIVER SUBSISTENCE CATCHES BY DISTRICT (EQUIVALENT AREAS), 1961 - 1964

Average Number of Kings Per Family



Average Number of Chums Per Family



years. King salmon catches for the villages of Kaltag, Ruby-Kokrines, Beaver, Circle City and Manley Hot Springs-Minto were the largest ever recorded during the 1961-1964 period.

Catches and fishing effort in Canadian communities are often based on rough estimates and are difficult to interpret. Most fishermen in areas above Dawson reported that the king run was "lighter than normal with a heavier than average catch of 'jacks'".

Chum Salmon: The total subsistence catch of chum salmon was the largest ever recorded during the 1961-1964 period. Extremely large catches were made in District IV villages, especially in Koyukuk and Ruby. The 1964 survey revealed that catches for twelve (12) villages were the largest ever recorded during the 1961-1964 period.

Summary: Based on the examination of the data found in Figure 2, the following generalizations can be made:

1. Utilization of chum salmon per family is the greatest in District III (Anvik to Kulato) following closely by Districts IV through VI. Dependence upon subsistence fishing, based on utilization of all species and fishing effort, is also the greatest in District III.
2. Utilization of king salmon per family is the greatest in District VII (above Fort Yukon). Fishermen in Districts II, IV, and VI make moderate utilization of this species.
3. As evidenced by subsistence catches, the 1964 chum salmon run is believed to be the largest run that has occurred during the past four years.
4. King salmon catches made in 1964 were somewhat inconsistent, i.e. some villages made very good catches and others made very poor catches.

TABLE 22

KING SALMON COMMERCIAL CATCHES AND SELECTED ESCAPEMENT DATA
FOR 1959-1964, YUKON RIVER DRAINAGE

Year	Commercial Catch ^{1/}	Andreafsky River			Salcha River	Whitehorse Dam
		Main River	East Fork	Total		
1959	78,632	-	-	-	-	1,054
1960	67,591	1,220	1,020	2,240	1,660	648
1961	120,203	-	1,003	-	2,878	1,068
1962	94,707	762	675	1,437	937	1,500 (Est.)
1963	116,994	-	-	-	-	483
1964	93,587	705	867	1,572	450	587

^{1/} Does not include commercial catches in Canada.

However, catches in upriver areas, when grouped by district, were similar to peak catches made in previous years.

ESCAPEMENT INDICES - KING SALMON

Table 22 compares escapement data for selected tributaries and areas with commercial catches for the years 1959 through 1964. Aerial survey counts are considered minimum estimates of spawning fish. If standard aerial survey methods are used, the counts obtained will indicate the relative size of the escapements from year to year which is usually sufficient for management needs. In some cases different observers made the aerial survey counts shown in Table 22, but surveys were flown of similar stream sections under good counting conditions each year.

The counts obtained for the Andreafsky River during 1964 compare favorably with counts made in previous years. The 1963 and 1964 surveys were made relatively late in the season, and for this reason the counts may be somewhat smaller when compared to surveys made in 1960 and 1961.

Division of Sport Fish personnel in Fairbanks conducted aerial surveys of the Salcha River during 1964 for the Division of Commercial Fisheries. Although this river was not surveyed in 1963, the data indicates that the escapement has steadily declined since 1961.

The Whitehorse Dam counts were made by direct enumeration of individual fish from the ground. The 1964 count of king salmon passing through the fish facilities at Whitehorse Rapids Dam (Mile 1,754) was slightly larger than that of 1963, but was considerably smaller than the peak count of 1,500 obtained during the 1962 season. It should be noted that the 1964 count was similar to the count made in 1960 when the commercial catch was limited by quota regulations.

Escapement levels in the Andreafsky River and above Whitehorse have generally been maintained with the expansion of the commercial fishery. The Salcha River run appears to be declining. It is not known if this is a result of overharvest or a normal cyclic fluctuation of the Salcha River run.

Attempts will be made in the future to survey certain "key" streams, e.g. Andreafsky, Anvik, Inlato, Salcha Rivers. The Yukon River drainage is too extensive for complete aerial survey coverage during any one year.

DISCUSSION

Because of the following reasons, the size of the 1964 king salmon run and escapement is judged average or above average when compared to previous runs:

1. The 1964 commercial catch probably does not accurately reflect the size of the run. The major portion of the run passed through the commercial fishing areas within a few days and catches were limited by the fact that the run was exposed to less fishing effort. For example, in 1964 a total of 49,476 boat hours were fished in Sub-District #1 as compared to 59,742 hours in 1963.

2. Catch per unit of effort figures (commercial and subsistence) were relatively high in upriver areas indicating that good escapements passed though the downriver commercial fishery.

Past Versus Present Management: The yearly commercial catch of king salmon in the district during 1953 through 1958 averaged approximately 60,000 fish. Age determination studies indicate that a majority of the commercial catch is composed of six-year-old king salmon. Therefore, the majority of

king salmon returning to spawna during 1959 through 1964 were the progeny of the 1953-1958 runs. Although there have been fluctuations in the size of the runs during 1959-1964, there is no indication that these runs were adversely affected by commercial fishing effort in previous years.

During the period 1961 through 1964, the yearly commercial king salmon catches have averaged 33,125 more than the yearly catches made during 1957 through 1960. As previously explained, the catch quota system of management was in effect prior to 1961; Table 23 compares catches made in Sub-Districts #1 and #2 during the 1959:1961 seasons and also for the 1960:1963 seasons. In each case, a quota regulated fishery is compared to a non-quota regulated fishery. The particular years presented in Table 23 were selected for comparison due to similar timing of peaks in the runs.

A total of 36,477 more king salmon were taken in 1961 when compared to 1959. In 1959, the commercial king salmon season was closed on June 19 in both sub-districts. Approximately 9,000 less kings were taken during the 1961 season through June 19 when compared to the 1959 season. This comparison shows that the increase in the 1961 catch was a result of fishing the latter segments of the run not fished in 1959. Both the 1959 and 1961 runs were considered to be above average in size.

A total of 42,528 more kings were taken in 1963 when compared to 1960. In 1960, Sub-District #1 was closed to commercial fishing on June 21 and Sub-District #2 was closed on June 25. Approximately 7,000 more salmon were taken during the 1963 season through June 21 in Sub-District #1 and June 25 in Sub-District #2. Increases in fishing effort and the size of the run are partly responsible for the catch increase noted in 1963.

The above comparisons illustrate that the timed fishery has "spread cut" the catches to include all segments of the run. The commercial

TABLE 23

CATCH COMPARISONS OF QUOTA AND NON-QUOTA
 REGULATED COMMERCIAL KING SALMON FISHERIES
 SUB-DISTRICTS #1 AND #2, YUKON DISTRICT

	1959		1961	
	Y-1	Y-2	Y-1	Y-2
Total Catch	61,018	15,939	84,406	29,028
Catch Through June 19	61,018	15,939	55,635	12,198

	1960		1963	
	Y-1	Y-2	Y-1	Y-2
Total Catch	50,713	15,994	85,104	24,131
Catch Through June 21	50,713	5,018	53,732	13,318
Catch Through June 25	-	15,994	-	20,189

exploitation of the early portion of the run during the past four years is probably only slightly greater than that of 1957 through 1960.

Until additional information regarding size and escapement of the run becomes available, increases in fishing effort or fishing time are not warranted. Fishing effort, based on fishing vessel licenses issued, doubled during the period 1958 to 1962. After a decline in effort during 1963, effort increased again in 1964 but was slightly less than that recorded in 1962 (see Table 13).

An increase in gear or fishing effort would be regarded as an undesirable condition, both from the standpoint of the fishermen and the run. Increases in gear will result in an increase in the total catch and at the same time will lower the catch per individual fisherman. If large gear increases occur in the next few years, the Department of Fish and Game will have to consider a reduction in fishing time as the only practical method of stabilizing catches.

N O R T O N S O U N D D I S T R I C T

COMMERCIAL FISHERY

The Norton Sound fishery is a collection of different fisheries that capture salmon from separate rivers or groups of rivers. To allow for more discriminate regulation of these fisheries, the Norton Sound District (Area Code Z) has been divided into six (6) sub-districts. Most of the sub-district fishing effort is located near the mouths of major salmon producing streams and gear is spatially separated in each of the sub-districts. It is assumed that a majority of the salmon caught in any one sub-district are

SECTION II

SPECIAL STUDIES

SALMON CATCH SAMPLING PROGRAM

1964

INTRODUCTION

The catch sampling program in the Arctic-Yukon-Kuskokwim Area was expanded during 1964. Fish and Game aides, under the supervision of fishery biologists, were assigned specifically to sample commercial and subsistence catches on the Yukon and Kuskokwim Rivers. Fishery biologists sampled commercial catches in Norton Sound and Kotzebue Districts as time allowed.

Objectives of this program were to provide such basic management information as age, lengths, weights, and sexual composition of the various salmon runs. Comparatively little is known concerning the life history of Arctic-Yukon-Kuskokwim salmon. Ironically, the king salmon populations, the most important economically, have been the least studied along these lines.

METHODS

Scale samples were taken from the area of the first or second scale row above the lateral line and located on a diagonal line down from the insertion of the dorsal fin. For purposes of this report, a 4_2 salmon is defined as having spent one winter in fresh water (one annulus), two winters in the ocean (two annuli) and is entering its fourth year of life. For example, a 4_2 salmon returning to spawn in 1964 would be the progeny of the 1960 run that migrated from fresh water to the ocean in 1962. Chum salmon do not overwinter in fresh water and so only their total ages are given. Length measurements were taken from the tip of the snout to the fork of the tail (snout length) and from mid-orbit of the eye to the fork of the tail (orbit length).

The two different lengths were taken for comparative purposes to compensate for fish exhibiting advanced spawning characters. Most of the tables in this section give orbit lengths only. Sex was determined in all cases by examining the gonads of individual fish. The occurrence of predator and lamprey markings was noted as was the relative stage of sexual maturity of each fish sampled. Fish classified as stage one were composed of immature, bright fish; stage two, consisting of fish of intermediate maturity; and stage three, consisting of relatively advanced mature salmon.

KUSKOKWIM DISTRICT KING SALMON

Age and Sex Composition: Table 38 gives the sex composition by age class as well as the overall sex ratio of combined age groups. Sampling was conducted throughout the run and a sample size of 681 fish obtained. Age composition of the sample consisted of 61.7 percent 6₂'s and 19.9 percent 5₂'s. Further percentage breakdown of the remaining age classes is available from the table.

Although the sex ratio of the sample favored the females by 4 percent, it is assumed, for the following reasons, that the run contained a larger percentage of males:

1. Mesh size selectivity. 8 1/2 inch stretched mesh is used by both drift and set net commercial fishermen. This mesh size is selective in capturing the larger adults allowing the smaller 3₂ and 4₂ age classes, which are known to be predominantly males, to pass through the fishery.

In tagging studies conducted on the upper Yukon River by fish-wheels (Table A-1), Sears (1962) ^{1/} in a similar size sample of king salmon

^{1/} Sears, Howard, Age Composition Data, U. S. Fish and Wildlife Service (Unpublished), 1962

TABLE 38

AGE COMPOSITION OF COMMERCIALY CAUGHT KING SALMON
 SAMPLED DURING JUNE 16-27, 1964
 KUSKOKWIM DISTRICT, SUB-DISTRICT #1

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Percentage	Number	Percentage	Number	Percentage
4 ₂	8	1.18	2	.29	10	1.47
5 ₂	86	12.61	50	7.34	136	19.95
5 ₃	1	.15	1	.15	2	.30
6 ₂	187	27.42	234	34.31	421	61.73
6 ₃	7	1.03	9	1.32	16	2.35
7 ₂	25	3.67	37	5.43	62	9.10
7 ₃	13	1.91	17	2.49	30	4.40
8 ₂	-	-	1	.15	1	.15
8 ₃	<u>1</u>	<u>.15</u>	<u>2</u>	<u>.44</u>	<u>3</u>	<u>.59</u>
TOTAL:	328	48.00	353	52.00	681	100.00

found a sex ratio in which males predominated, 68 percent to 32 percent, with males in the 3₂ and 4₂ age groups making up 35 percent of the total. Although fishwheels may be selective in capturing smaller fish, this study indicates that the smaller age classes, although exposed to a 8 1/2 inch mesh gill net fishery, pass through that fishery in numbers which could offset the near equal sex ratio found on the Kuskokwim River.

2. Buyer selectivity. Since a set price is in effect for all king salmon, regardless of size, buyers may select only larger fish eliminating the younger age classes from the sample.

Length Composition: The mean mid-eye lengths are given by sex and age class in Table 39. Invariably, females exhibited greater lengths with the exceptions being the 5₃ and 7₂ through 8₃ age class males. As can be expected, length measurements of fish spending an extra year in fresh water, e.g. 5₃, 6₃, 7₃, and 8₃'s, were similar in size to those fish of year younger age classes, e.g. 4₂, 5₂, 6₂, and 7₂'s, which left fresh water and entered the ocean during their second year.

Weight Composition: The mean weights are given by sex and age class in Table 39. As was found in the length measurements, females of the younger age classes were heavier than the males with the reverse existing in the older age classes.

Predator and Lamprey Mark Observations: Each king salmon sampled in 1964 was examined for the presence of lamprey and predator scars or wounds. Of the total sampled, 51 percent were so marked.

The high percentage of predator and lamprey marked fish may have been the result of the river's late breakup. Normally upon entering Kuskokwim Bay,

TABLE 39

LENGTHS AND WEIGHTS OF COMMERCIALLY CAUGHT KING SALMON
 SAMPLED DURING JUNE 16-27, 1964
 KUSKOKWIM DISTRICT, SUB-DISTRICT #1

Mean Orbit Lengths in Centimeters

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Length	Number	Mean Length	Number	Mean Length
4 ₂	8	59.4	2	67.7	10	61.6
5 ₂	86	76.7	50	76.8	136	76.7
5 ₃	1	71.0	1	67.0	2	69.0
6 ₂	187	85.4	234	86.9	421	86.2
6 ₃	7	77.7	9	78.8	16	78.3
7 ₂	25	91.1	37	90.6	62	90.8
7 ₃	13	87.8	17	86.4	30	87.0
8 ₂	-	-	1	100.0	1	100.0
8 ₃	1	92.0	2	90.5	3	91.0

Mean Weight in Pounds

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Weight	Number	Mean Weight	Number	Mean Weight
4 ₂	8	8.3	2	10.0	10	8.6
5 ₂	86	17.4	50	18.1	136	17.7
5 ₃	1	11.5	1	13.0	2	12.3
6 ₂	187	24.4	234	25.1	420	24.8
6 ₃	7	18.9	9	18.8	16	18.9
7 ₂	25	30.0	37	27.4	62	28.5
7 ₃	13	26.1	17	24.3	30	25.2
8 ₂	-	-	1	32.0	1	32.0
8 ₃	1	27.0	2	28.5	3	27.7

the king salmon run proceeds directly up the Kuskokwim River. In 1964, river ice and low water temperatures prevented this, delaying the run's entry into the river and caused a milling effect in Kuskokwim Bay, exposing the fish for a longer period of time to predation by seals and beluga and parasitism by lampreys.

Relative Maturity: Evidence of the milling effect of the king salmon in the Bay and the runs delayed entry into the river was verified by the high percentage of fish exhibiting advanced spawning characters, i.e. reddish color, hooked snout, etc. Approximately, 30 percent or 203 fish showed these characters. In a normal year, when the run is not delayed, fish taken in the Sub-District #1 commercial fishery show very little evidence of advanced maturity until late in the run, are usually bright silver in appearance, and may have sea lice clinging to the area around the anal fin.

KUSKOKWIM DISTRICT RED SALMON

Age and Sex Composition: Red salmon samples were obtained from air shipments made to Bethel from the commercial fishery at Quinhagak. Because of the nonscheduled nature of the deliveries, sampling could not be conducted periodically throughout the run.

Age and sex composition based on 397 samples is given in Table 40. The overall sex ratio favored the males by 15.8 percent. This unequal sex ratio may be the result of the samplers inability to sample the catch periodically for reasons already given.

Length Composition: Red salmon length measurements were recorded to the nearest centimeter with males averaging longer than females. Results are given in Table 40.

TABLE 40

AGES, LENGTHS, AND WEIGHTS OF COMMERCIALLY CAUGHT
RED SALMON SAMPLED DURING JULY 10-21, 1964
SUB-DISTRICT #4, KUSKOKWIM DISTRICT

Age Composition

Sex	Number (Per Cent)	Age (%)				
		4 ₂	5 ₂	5 ₃	6 ₂	6 ₃
Males	232 (57.9)	50.1	7.3	.5	-	-
Females	<u>167 (42.1)</u>	<u>38.1</u>	<u>3.3</u>	<u>-</u>	<u>.2</u>	<u>.5</u>
Combined Sexes	399 (100.0)	88.2	10.6	.5	.2	.5

Mean Orbit Lengths in Centimeters

Age Class	M A L E S		F E M A L E S		C O M B I N E D S E X E S	
	Number	Mean Length	Number	Mean Length	Number	Mean Length
4 ₂	200	53.48	152	51.10	352	52.43
5 ₂	29	56.27	13	52.92	42	55.24
5 ₃	2	51.50	0	-	2	51.50
6 ₂	0	-	1	-	1	-
6 ₃	0	-	2	56.00	2	56.00

Mean Orbit Length of combined sexes and ages: 52.8 centimeters.

Mean Weight in Pounds

Age Class	M A L E S		F E M A L E S		C O M B I N E D S E X E S	
	Number	Mean Weight	Number	Mean Weight	Number	Mean Weight
4 ₂	200	6.21	152	5.08	352	5.72
5 ₂	29	7.00	13	5.83	42	6.65
5 ₃	2	5.30	0	-	2	5.30
6 ₂	0	-	1	-	1	-
6 ₃	0	-	2	7.15	2	7.15

Mean weight of combined sexes and ages: 5.80 pounds.

Weight Composition: Weights of individual fish were recorded to the nearest half pound. As was found in the length measurements, males were heavier than females of the same age class. Weights increased with age, exceptions being the odd year fresh water fish which were similar in weight to even year fresh water fish of year younger age classes, e.g. 5₃'s were similar in weight to 4₂'s.

Predator-Lamprey Markings and Relative Maturity: Although each fish sampled was examined for the presence of lamprey and predator scars and wounds, less than 19 percent of the sample was so marked. When compared to king salmon, fewer lamprey and predator marked red salmon were observed. This may be due to the relatively short period of time the red salmon run spends in Kuskokwim Bay where the frequency of parasitism and predation is suspected to be the highest. Only eleven fish examined gave indications of advanced maturity.

KUSKOKWIM DISTRICT CHUM SALMON

Age and sex composition: In 1964, a total of 103 chum salmon was sampled. Sampling could not be conducted periodically and was curtailed by the following:

1. King salmon and chum salmon runs occur at the same time and sampling effort was directed toward the commercially important king salmon.
2. Since chum salmon are restricted for subsistence use only, sampling crews were required to obtain samples from various fish camps as time allowed. Coinciding trips to the fish camps with the availability of fresh fish was not always possible.

Table 41 gives the age composition by sex and the sex ratio of age groups. The age composition of the sample, sexes combined, was 68.1 percent three-year-olds, 31 percent four-year-olds, and 1 percent five-year-olds.

TABLE 41

AGES, LENGTHS, AND WEIGHTS OF KUSKOKWIM RIVER
CHUM SALMON SAMPLED DURING JULY 3-13, 1964

Age Composition

Sex	Number (Per Cent)	Age (%)		
		3	4	5
Males	56 (54.4)	35.0	18.4	1.0
Females	<u>47 (45.6)</u>	<u>33.0</u>	<u>12.6</u>	<u>0.0</u>
Combined Sexes	103 (100.0)	68.0	31.0	1.0

Mean Orbit Lengths in Centimeters

Age Class	M A L E S		F E M A L E S	
	Number	Mean Length	Number	Mean Length
3	36	53.31	34	52.44
4	19	57.89	13	55.53
5	1	62.00	0	--

Mean Weights in Pounds 1/

Age Class	M A L E S		F E M A L E S	
	Number	Mean Weight	Number	Mean Weight
3	36	5.68	34	5.13
4	19	7.59	13	5.77
5	1	9.50	0	--

1/ Average weight of sample: 6.05 pounds.

The sex ratio of the sample was 54.4 percent males and 45.6 percent females. Inadequate sample size and nonperiodic sampling may be responsible for the unequal sex ratio.

Length Composition: Mean mid-eye lengths are given by sex and age class in Table 41. In individual age classes, males were larger than females and lengths increased with age.

Weight Composition: Table 41 depicts the weights by age groups and sex of all chum salmon sampled. The average weight of the sample, sexes and ages combined, was 6.05 pounds. Males were heavier than females of the same age class and weights increased with age.

YUKON DISTRICT KING SALMON

A total of 487 king salmon were sampled for age, sex, and size composition. These salmon were captured with 8 1/2 inch gill nets operated by commercial fishermen in the vicinity of Flat Island (south mouth). Salmon were sampled during three different periods as follows: 101 sampled during June 19-22, 181 during June 24-30, and 205 during July 1-6. The main peak in the south mouth run occurred during June 20-22. Therefore, the majority of the catch samples were taken from the latter portions of the run.

A majority of the scales examined contained one fresh water check or annulus. This indicated that Yukon kings upon hatching overwinter in fresh water and migrated to sea in their second year of life. A few scales contained two fresh water annuli indicating that these fish had spent two winters in fresh water prior to migrating to the sea in their third year of life.

Most of the scales examined exhibited no or little growth of the current growing season. In most cases, the winter annulus of the previous year formed

the margin of the scale. This delay in resumption of growth during the spring is no doubt due to the low temperatures encountered in the Bering Sea.

The overall sample represented seven (7) different life histories or age classes as shown in Table 42. The 6_2 age group represented 57 percent of the sample with 5_2 , 7_2 , 4_2 and 7_3 age groups following in order of relative abundance. The two remaining age groups, 6_3 and 8_3 , were represented by only a few specimens.

The sample contained 57 percent males and 43 percent females. Males dominated the 4_2 and 5_2 age groups (87 males:20 females), but the older age groups were composed of a near equal sex ratio (189 males:191 females). Two age groups, 6_2 and 7_3 , contained a majority of females.

Apparently male Yukon king salmon have a tendency to mature earlier than females. This is borne out by the preponderance of males in the younger age groups and that of females in the older age groups.

The age and sex composition of each of the three sampling periods were compared. There was a trend of 4_2 age class increasing in abundance and the 7_2 age class decreasing in abundance as the season progressed. There were no other significant differences in the abundance of the other age groups. A near 1:1 sex ratio for all age groups was evident during all sampling periods with the exception of the June 24-30 period which contained a preponderance of males (112 males:69 females). During this period, males were especially abundant in the 6_2 and 7_2 age classes; the 6_2 age class contained a large majority of females during the other two sampling periods. This illustrates the marked changes that can take place in the age and sex composition of a salmon run during a single season.

TABLE 42

AGE COMPOSITION OF COMMERCIALY CAUGHT KING SALMON
 SAMPLED DURING JUNE 19 - JULY 7, 1964
 YUKON RIVER DISTRICT, SUB-DISTRICT #1

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Percentage	Number	Percentage	Number	Percentage
4 ₂	24 34	7.0	1	.2	35	7.2
5 ₂	53	10.9	19	3.9	72	14.8
5 ₃	-	-	-	-	-	-
6 ₂	133	27.3	145	29.8	278	57.1
6 ₃	2	.4	1	.2	3	.6
7 ₂	43	8.8	25	5.1	68	13.9
7 ₃	9	1.8	19	3.9	28	5.7
8 ₂	-	-	-	-	-	-
8 ₃	<u>2</u>	<u>.4</u>	<u>1</u>	<u>.2</u>	<u>3</u>	<u>.6</u>
TOTAL:	276	56.6	211	43.3	487	99.9

The actual sex ratio of a run of king salmon may vary considerably from 1:1 from year to year depending on the relative abundance of the various age groups. For example, an unusually high return of three and four-year-olds, mostly males, may produce an overall sex ratio in the run in favor of males. The sex ratio (and age composition) of the gill net catch is not representative of the run as the commercial gill nets are selective to older and larger fish. The preponderance of males in the 1964 sample may have been partly a result of unequal sampling of the run. For example, the catches from the latter part of the run, containing an abundance of 4_2 males, were sampled to a greater extent than the earlier catches.

Table 43 presents the mean orbit lengths and mean weights by sex for each age class. Males were larger than females in age groups 7_2 and 7_3 , but 5_2 females were larger. There was no significant difference in size between the sexes of the 6_2 age group. There were too few individuals of the other age groups to make similar comparisons. The mean weight of all sampled kings, irrespective of age, was 21.8 pounds for males and 23.4 pounds for females.

Table 44 presents data showing the relationship between orbit and snout to fork lengths of king salmon sampled in the Flat Island area during 1964. Data contained in this table were obtained by calculating regression line formulas separately for males and females. Studies of Yukon king salmon have dealt with either one or both of these length measurements. Tagging studies have incorporated the use of the snout to fork length measurement only. Knowledge of the conversion factors, as shown in Table 44, are necessary so that length comparisons can be made between the various studies. This conversion information should be used only in studies conducted in the lower Yukon River area. Differences between the two lengths are greater for male king salmon taken in upriver areas.

TABLE 43

LENGTHS AND WEIGHTS OF COMMERCIALY CAUGHT KING SALMON
 SAMPLED DURING JUNE 19 - JULY 7, 1964
 YUKON RIVER DISTRICT, SUB-DISTRICT #1

Mean Orbit Lengths in Centimeters

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Length	Number	Mean Length	Number	Mean Length
4 ₂	34	54.8	1	52.0	35	54.7
5 ₂	53	73.2	19	78.1	72	74.5
5 ₃	-	-	-	-	-	-
6 ₂	133	85.3	145	84.6	278	84.9
6 ₃	2	72.5	1	65.0	3	70.0
7 ₂	43	95.4	25	89.3	68	93.2
7 ₃	9	86.8	19	85.4	28	85.8
8 ₂	-	-	-	-	-	-
8 ₃	2	88.0	1	93.0	3	89.7

Mean Weight in Pounds

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Weight	Number	Mean Weight	Number	Mean Weight
4 ₂	34	6.6	1	5.0	35	6.5
5 ₂	53	16.2	19	18.3	72	16.8
5 ₃	-	-	-	-	-	-
6 ₂	133	24.3	145	24.1	278	24.2
6 ₃	2	16.5	1	10.5	3	14.5
7 ₂	43	34.4	25	27.7	68	31.9
7 ₃	9	27.3	19	24.0	28	25.1
8 ₂	-	-	-	-	-	-
8 ₃	2	23.0	1	29.5	3	25.2

TABLE 44

YUKON RIVER KING SALMON CONVERSION TABLE
SNOUT LENGTH TO ORBIT LENGTH

Snout to Fork Length	MALE		FEMALE		
	Mid-Eye to Fork Length	Mid-Eye to Fork Length	Mid-Eye to Fork Length	Mid-Eye to Fork Length	
45	41.9	-			
46	42.9	-			
47	43.8	-			
48	44.7	-			
49	45.6	-			
50	46.6	-			
51	47.5	-			
52	48.4	-			
53	49.3	-			
54	50.2	-			
55	51.1	52.9			
56	52.0	53.8			
57	52.9	54.7			
58	53.8	55.6			
59	54.7	56.5			
60	55.7	57.3			
61	56.6	58.2			
62	57.5	59.1			
63	58.4	60.0			
64	59.3	60.9			
65	60.2	61.8			
66	61.1	62.7			
67	62.0	63.6			
68	62.9	64.5			
69	63.9	65.3			
70	64.8	66.2			
71	65.7	67.1			
72	66.6	68.0			
73	67.5	68.9			
74	68.4	69.8			
75	69.3	70.7			
76	70.2	71.6			
77	71.1	72.5			
78	72.1	73.3			
79	73.0	74.2			
80	73.9	75.1			
81	74.8	76.0			
82	75.7	76.9			
83	76.6	77.8			
84	77.5	78.7			
85	78.4	79.6			
			86	79.3	80.5
			87	80.3	81.3
			88	81.2	82.2
			89	82.1	83.1
			90	83.0	84.0
			91	83.9	84.9
			92	84.8	85.8
			93	85.7	86.7
			94	86.6	87.6
			95	87.5	89.5
			96	88.5	89.3
			97	89.4	90.2
			98	90.3	91.1
			99	91.2	92.0
			100	92.1	92.9
			101	93.0	93.8
			102	93.9	94.7
			103	94.8	95.6
			104	95.7	96.5
			105	96.7	97.3
			106	97.7	98.2
			107	98.5	99.1
			108	99.4	100.0
			109	100.3	100.9
			110	101.2	101.8
			111	102.1	102.7
			112	103.0	103.6
			113	103.9	104.5
			114	104.9	105.3
			115	105.8	106.2
			116	106.7	107.1
			117	107.6	108.0
			118	108.5	108.9
			119	109.4	109.8
			120	110.3	110.7
			121	111.2	111.6
			122	112.1	112.5
			123	113.0	113.3
			124	113.9	114.2
			125	114.9	115.1

Comparisons with Other Yukon River Studies: Relatively few studies dealing with Yukon king salmon life histories have been made. Listed below is a brief review of the more important of these studies:

1. In 1920, C. H. Gilbert ^{2/} conducted the first life history study of Yukon River salmon. He noted that Yukon kings differed from southern stocks by reaching sexual maturity an average of one year later, by showing little or no growth made during the spring prior to entry into the river, and by all juveniles spending one winter in fresh water after hatching. Findings of the present study disagree with Gilbert's report in that a few kings were found having scale patterns indicating that two winters were spent in fresh water prior to the time of seaward migration. Gilbert sampled 398 kings from the commercial fishery. His catch sample was biased by the fact that unusually small sized kings were selected in an attempt to establish the minimum age that kings reached sexual maturity.

2. The U. S. Fish and Wildlife Service sampled 1,100 and 237 kings from the commercial fishery at Kwiguk during 1957 and 1958 respectively. The 1957 study represents the most comprehensive commercial catch sampling projects to date as fifty (50) kings a day were randomly sampled from the fishery.

3. During 1962, the U. S. Fish and Wildlife Service operated a tagging site at Texas Creek, Mile 724, on the Yukon River. King salmon were captured by fishwheels, and scales and measurements were taken during the tagging operation. The Auke Bay Laboratory (U. S. Fish and Wildlife Service) supplied the Department of Fish and Game with age, sex, and size data from 557 king salmon sampled at Texas Creek site. Age, sex, lengths, and weights of this sample are found in the Appendix (Tables A-1 and A-2)

^{2/} Gilbert, C. H., The Salmon of the Yukon River, Bulletin of the U. S. Bureau of Fisheries, Volume 38, 1922

4. A total of 61 kings, captured by a fishwheel located at Woodchopper, Mile 1155, was sampled by University of Alaska students for the Department during July 17 - August 7, 1964. Age, sex, lengths, and weights of this sample are found in the Appendix (Tables A-3 and A-4).

Figure 3 presents age and sex composition of the king salmon taken at three sites: Flat Island, Woodchopper, and Texas Creek. The data shows the differences in age/sex composition between fishwheel and 8 1/2 inch gill net catches. The information presented in the remainder of this section is based upon findings of the 1920, 1957, 1962, and 1964 studies.

There is a small run of 3_2 king salmon as indicated by their occurrence in fishwheel catches. In 1920, Gilbert found a 3_2 male, 16 inches in fork length, in the commercial catches. This is the only record of this age group entering catches of the commercial gill net fishery. Studies of other river systems have revealed that only male king salmon reach sexual maturity after spending one winter in the ocean. Therefore, it is likely that 3_2 age group in the Yukon is composed entirely of males.

Commercial catches sampled prior to 1964 did not contain any 4_2 females. However, the Flat Island and Texas Creek samples show that 4_2 females are present in the spawning run, but that they are in the minority when compared to males. Age 4_2 king salmon make very minor contributions to the 8 1/2 inch gill net catches but are abundant in fishwheel catches. The Texas Creek fishwheel catch was composed of 36 percent 4_2 king salmon, which were second in abundance to five-year-olds.

Samples of commercial catches have contained 15 to 18 percent five-year-old king salmon (5_2 and 5_3 age groups). All studies have shown that males are dominant in this age group. Woodchopper and Texas Creek fishwheel catches contained 52 percent and 41 percent respectively of the five-year-old age group.

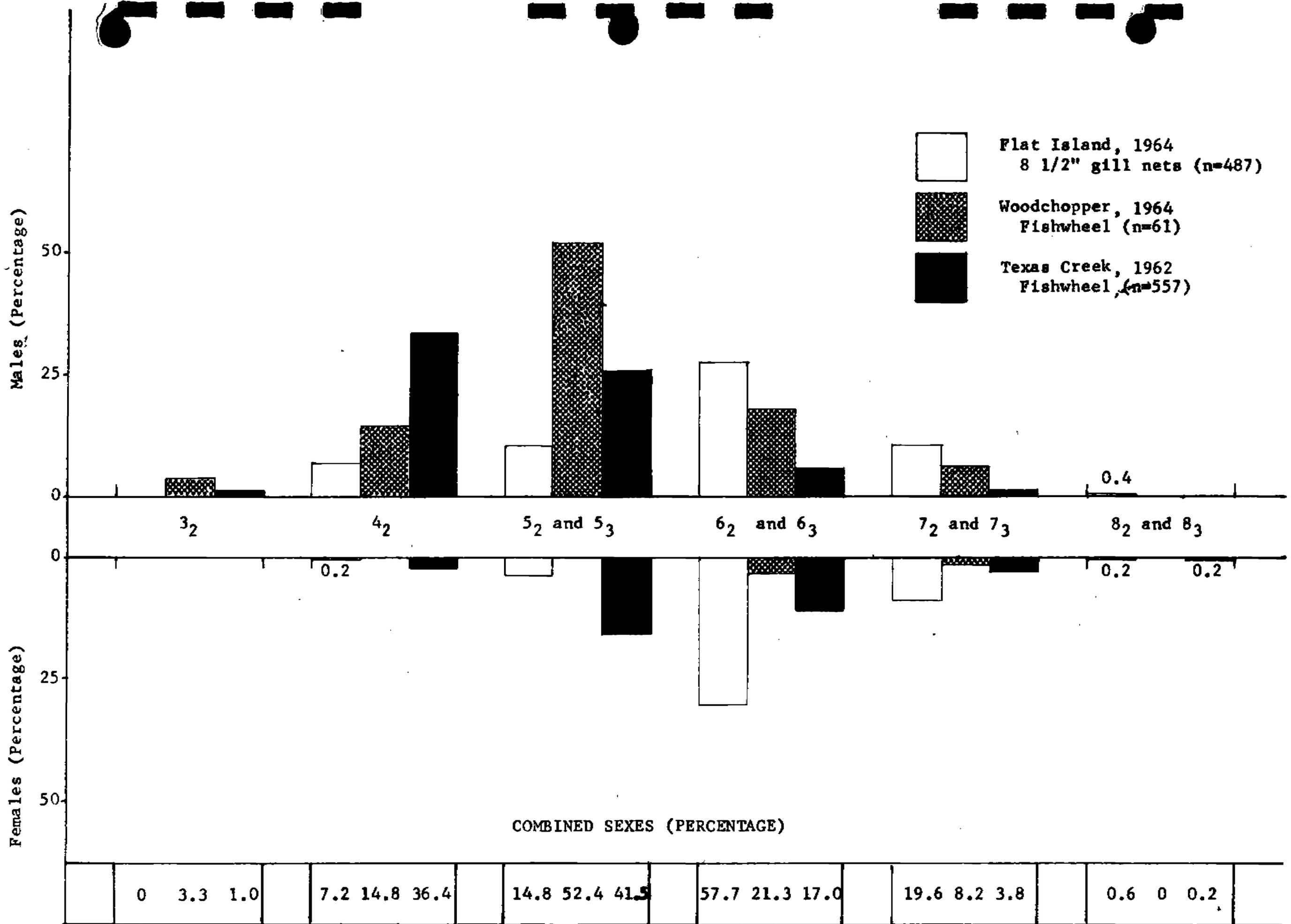


FIGURE 3

AGE COMPOSITION OF KING SALMON SAMPLED AT THREE DIFFERENT SITES, YUKON RIVER

The six-year-olds (6_2 and 6_3) are the dominant age group in catches made by the commercial gill net fishery, representing from 58 percent to 64 percent of those fish sampled. Most studies indicate that females are dominant in this age group. Fishwheel catches, on the other hand, contained 17 percent to 21 percent six-year-olds.

The percentage of seven-year-olds (7_2 and 7_3) ranged from 18 percent to 27 percent in the commercial catches and 4 percent to 8 percent in the fishwheel catches. The 1920 and 1957 studies indicated that females were dominant in this age group. The Flat Island sample contained a majority of males, especially in the 7_2 age class.

Eight-year-olds were recorded only during the Flat Island study. Only three specimens were sampled, all assigned to the 8_3 age class.

Gear Selectivity and Effects: The preponderance of younger age groups in fishwheel catches and that of older age groups in the 8 1/2 inch gill net catches illustrates that each type of gear is largely harvesting different age segments of the Yukon River king salmon run. The 8 1/2 inch gill nets are definitely selective to the older and larger kings. The smaller salmon are able to pass through the gill net webbing without gilling or entangling themselves. Consequently few three, four, and five-year-olds are taken in the commercial fishery located in the lower Yukon River.

Studies conducted of Taku River king salmon runs during 1958 have shown that fishwheels are selective to the smaller fish. The Department of Fisheries (Territory of Alaska) compared length measurements from salmon taken in their fishwheel to salmon that were sampled from upriver spawning grounds. Fishwheel captures had average lengths of 4.50 cm and 10.74 cm less for males and females respectively when compared to spawners. There is every reason to believe that Yukon River fishwheel catches are similarly biased. The removal

of older age groups by the downriver commercial fishery may be one of the reasons for the differences in age composition noted between gill net and fishwheel catches. However, fishwheels being selective to smaller sized salmon do not capture the larger king salmon in relation to their actual abundance. Therefore, population estimates based on a tag and recovery program involving the use of fishwheels will be similarly biased.

Due to the selectiveness of the intense commercial gill net fishery, the male escapement can be expected to outnumber females. Taku River studies show that the runs, after passing through 8 1/2 - 9 inch gill net fishery, may have sex ratios as high as seven males to one female. In terms of maximum productivity, a 1:1 sex ratio or even a majority of females on the spawning grounds would be best. There is evidence that king salmon males will fertilize the eggs of more than one female. At the present time, an unknown number of relatively unproductive three, four, and five-year-olds are probably not being harvested to any great degree. Use of smaller meshed gill nets would reduce the harvest of the comparatively more productive females of the older age groups and increase harvest of the younger age groups, which are predominantly males. Thus, the catch would be spread out to include harvest of all the available age groups.

One serious complication that would arise regarding the use of smaller meshed gill nets is that the present small incidental catch of chum salmon would be greatly increased. The run of summer chums is coincidental with most of the king salmon run. At the present time, an increase of this chum salmon catch is not warranted due to dependance upon this run by subsistence fishermen that live in upriver areas.

Fecundity: Four female salmon captured at Flat Island were examined for fecundity. The numbers of eggs (direct count) for the four females examined

are listed below:

<u>Orbit Length</u>	<u>Weight (Pounds)</u>	<u>Number of Eggs</u>
84.0	21.5	9,135
84.0	23.0	6,225
91.3	27.5	9,200
91.5	38.0	12,300

During 1965, a greater number of females will be examined in regard to this study.

YUKON DISTRICT CHUM SALMON

Table 45 presents the age, sex, and length composition of 268 chums sampled from catches obtained in the Flat Island area. Of the total sample, 95 chums were captured with gill nets having 8 1/2 inch stretched mesh and 173 were captured with gill nets having 5 1/2 inch stretched mesh. No attempt was made to periodically sample chum salmon catches during the season, and therefore, the sample obtained does not represent all segments of the run.

Four-year-olds were dominant in the sample (63 percent) with three-year-olds (33.2 percent) and five-year-olds (3.7 percent) following in order of relative abundance. The overall sex composition of the sample was 38.4 percent males and 61.6 percent females. Females were dominant in all of the age groups. This unequal sex ratio is thought to be largely a result of the non-random sampling of the run. Of interest is the fact that near equal numbers of females and males were captured by the 8 1/2 inch gill nets (55 percent males: 45 percent females). Most of the chums taken in the 8 1/2 inch gill net operated at the tagging site were not gilled but became entangled in the net by their maxillaries or teeth. Therefore, there was little selection of fish

TABLE 45

AGES AND MEAN LENGTHS OF YUKON RIVER CHUM SALMON
 SAMPLED DURING JUNE 21-22 AND JULY 10 - AUGUST 2, 1964

Summer *Summer & fall*

Age Composition

Sex	Number (Per Cent)	Age (%)		
		3	4	5
Males	103 (38.4)	12.3	24.6	1.5
Females	<u>165 (61.6)</u>	<u>20.9</u>	<u>38.4</u>	<u>2.2</u>
Combined Sexes	268 (100.0)	33.2	63.0	3.7

Mean Orbit Lengths in Centimeters ^{1/}

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Length	Number	Mean Length	Number	Mean Length
3	33	57.42	56	53.80	89	55.18
4	66	58.77	103	57.81	169	58.18
5	4	62.00	6	57.83	10	59.50

1/ Length from mid-eye to fork of caudal fin.

Mean length of combined sexes and ages: 57.15 centimeters

by size or sex by the larger mesh nets. Although definite evidence is lacking, the 5 1/2 inch gill nets may select out the smaller chums, the majority of which are females.

As shown in Tables 45 and 46, males have greater orbit lengths and weights than females for each age class. The mean orbit length and weight for the entire sample (sexes and ages combined) was 57.15 cm and 8.03 pounds respectively.

Comparison with Previous Studies: Samples of Yukon River chum salmon have been obtained by the Department since 1961 for the purpose of determining age, sex, and size composition. The 1964 sample differs from those of previous years by its greater percentage of three-year-olds and by the smaller percentage of five-year-olds. Six-year-old chum salmon were encountered only during the 1963 season. The high percentage of three-year-olds in the 1964 sample may indicate good survival of 1961 brood year salmon which will result in good return of four-year-olds during the 1965 season. (See section dealing with Kotzebue chum salmon studies.) Further comparison and analysis of the 1964 sample versus previous years' samples cannot be accurately made due to differences in sampling.

KOTZEBUE DISTRICT CHUM SALMON

Table 47 presents the age composition of 463 commercially caught chum salmon sampled during three different periods in 1964. These chums were captured with set gill nets having mesh sizes of 5 1/2 inch to 6 inch (stretched measure). The age composition for all samples consisted of 55.7 percent three-year-olds, 42.5 percent four-year-olds, and 1.8 percent five-year-olds. The percentage of three-year-olds increased with each sampling period.

TABLE 46

MEAN WEIGHT (IN POUNDS) OF
190 YUKON RIVER CHUM SALMON

Age Class	M A L E S		F E M A L E S		C O M B I N E D S E X E S	
	Number	Mean Weight	Number	Mean Weight	Number	Mean Weight
3	13	8.58	21	6.21	34	7.12
4	44	9.16	45	7.68	89	8.41
5	3	12.00	3	6.67	6	9.33

Mean weight of combined sexes and ages: 8.03 pounds

TABLE 47

AGE COMPOSITION OF COMMERCIALY CAUGHT CHUM SALMON
KOTZEBUE DISTRICT, 1964

Dates of Samples	Sex	Number (Percentage)	Age - Percentage		
			3	4	5
8/4-7	Males	84 (36.1)	17.6	17.6	.9
	Females	<u>149 (63.9)</u>	<u>24.0</u>	<u>39.1</u>	<u>.9</u>
	Combined Sexes:	233 (100.0)	41.6	56.7	1.8
8/13	Males	56 (65.9)	36.5	28.2	1.2
	Females	<u>29 (34.1)</u>	<u>17.6</u>	<u>15.3</u>	<u>1.2</u>
	Combined Sexes:	85 (100.0)	54.1	43.5	2.4
8/20	Males	62 (42.8)	34.5	7.8	.6
	Females	<u>83 (57.2)</u>	<u>44.8</u>	<u>11.7</u>	<u>.6</u>
	Combined Sexes:	145 (100.0)	79.3	19.5	1.2
TOTAL SAMPLE	Male	202 (43.6)	26.3	16.4	.9
	Females	<u>261 (56.4)</u>	<u>29.4</u>	<u>26.1</u>	<u>.9</u>
	Combined Sexes:	463 (100.0)	55.7	42.5	1.8

The total sample consisted of 43.6 percent males and 56.7 percent females. Males dominated the August 13 sample, but females were dominant in the other two larger samples. Assuming a 1:1 sex ratio in the population, the difference in the sex ratio of sampled chums may be a result of one or both of the following factors:

1. Studies have shown that the age and sex composition of chum salmon runs change markedly during the course of the season. It is possible that too few samples were taken during the season to accurately portray the actual sex and age composition.

2. The gill nets used are more selective for females than males. In each age class, male chum salmon are larger (length and weight) than females. The sex composition of each age group for both 1963 and 1964 shows that three-year-olds were composed of near equal sex ratios but four and five-year-olds were composed of a majority of females. Examination of commercial catches made during the 1962 and 1963 seasons revealed that many of the larger male chum salmon had net scars anterior to their operculums. This indicates that the larger males were not gilled and that the commercial nets were not efficient in the capture of these salmon.

Table 48 shows the mean lengths and weights for each age class of chum salmon sampled during 1964. As previously noted, males are larger for each age class than are females.

Comparison with Results of 1963 Study: Commercial catches were also sampled during three sampling periods in 1963 (see Annual Report for 1963). The 1963 sample consisted of 32.6 percent three-year-olds, 47.4 percent four-year-olds, 18.8 percent five-year-olds, and 1.2 percent six-year-olds. This sample differed from the 1964 sample as it contained considerably less three-year-olds and considerably more five-year-olds. Six-year-olds were not found in the 1964 sample.

TABLE 48

MEAN LENGTHS AND WEIGHTS OF COMMERCIALLY CAUGHT CHUM SALMON
KOTZEBUE DISTRICT, 1964

Mean Orbit Lengths in Centimeters

Age Class	M A L E S		F E M A L E S	
	Number	Mean Length	Number	Mean Length
3	122	58.13	136	56.80
4	76	61.90	121	60.20
5	4	64.00	4	61.66

Mean Weights in Pounds

Age Class	M A L E S		F E M A L E S	
	Number	Mean Weight	Number	Mean Weight
3	122	8.42	136	7.13
4	76	9.85	121	8.36
5	4	11.81	4	9.56

Average length of combined sexes and ages: 58.62 centimeters

Average weight of combined sexes and ages: 8.26 pounds

Use of Age Composition Studies in Run Predictions: Age composition studies may be of some value in making general predictions of run size. There may be a relationship between the occurrence of three-year-olds in one year and the size of the run during the following year. For example, the high percentage of three-year-olds noted in the 1964 study may indicate good survival of the offspring resulting from the 1961 run. Therefore, a large run of four-year-olds could be expected in 1965.

The 1963 sample exhibited a high percentage of three-year-olds by comparison with other samples taken in other sections of the Arctic-Yukon-Kuskokwim Area. This indicated a large run to the district in 1964 (see Annual Report for 1963). There is no doubt that the run in 1964 was considerably larger than that of the previous year, but it was somewhat smaller than that of 1962.

Continuing studies and observations of the Kotzebue chum salmon run will ultimately indicate the worth of this method in predicting run sizes.

N O R T O N S O U N D H E R R I N G
C A T C H S A M P L I N G P R O G R A M , 1 9 6 4

INTRODUCTION

A catch sampling program was conducted on commercially harvested herring stocks near Unalakleet. The sampling was carried out by the processors under procedures specified by Department of Fish and Game Biologists.

Objectives of this project were to provide age, lengths, weights, and sex compositions of the harvested herring stocks. Very little is known of the Norton Sound herring; the 1964 commercial fishery presented the opportunity to collect this basic information.

METHODS

Scale samples were taken from the area immediately behind the pectoral fin of each fish. Fewer regenerated or damaged scales are found in this area. Length measurements were taken from the tip of the snout to the hypural plate and recorded in centimeters. Weights of fresh caught fish were taken and recorded in grams. Sex was determined by examination of the gonads. Scales were placed in envelopes to be mounted on slides and read at a later date. Pertinent information was recorded on scale envelopes.

RESULTS

A total of 350 spawning herring was sampled from the commercial catch to determine age composition, length, weight, sex ratio, and effectiveness of fishing methods. Although these initial samples were very limited, some general statements of this herring population can be made. Also some interesting comparisons of this Norton Sound population to other Pacific coast stocks can be broadly stated in regard to age composition, length, and weight.

Age analysis of 339 readable slide-mounted scales showed this Norton Sound herring population was composed of the following age groups: four-year-old fish (6.49 percent), five-year-olds (14.45 percent), six-year-olds (32.45 percent), seven-year-olds (30.38 percent), eight-year-olds (12.98 percent), and nine to twelve-year-olds (3.24 percent) (see Table 49). The average age for all herring was 6.43 years. The high proportion of the older age groups and the low percentage of younger age groups is characteristic of an unexploited population. Also a spawning population, such as these Norton Sound herring, could be expected to be composed of fewer younger fish than a non-spawning population. Whether this age pattern is characteristic of all Norton Sound

TABLE 49

AGE COMPOSITION, AVERAGE LENGTHS AND WEIGHTS OF PACIFIC HERRING
NORTON SOUND, 1964

Age	Number (Per Cent Composition)			Average Length (mm)			Average Weight (g)		
	Males	Females	Combined	Males	Females	Combined	Males	Females	Combined
4	9 (4.61)	13 (9.03)	22 (6.49)	208.9	207.3	208.0	117.9	112.5	114.7
5	29 (14.87)	20 (13.89)	49 (14.45)	225.0	229.0	226.6	147.2	155.1	150.4
6	75 (38.46)	35 (24.30)	110 (32.45)	229.6	233.0	230.7	156.0	164.8	158.8
7	50 (25.64)	53 (36.81)	103 (30.38)	235.0	236.5	235.8	172.3	177.9	175.2
8	24 (12.31)	20 (13.89)	44 (12.98)	245.6	242.3	244.1	203.4	186.2	195.6
9	2 (1.03)	-	2 (0.59)	250.0	-	250.0	216.0	-	216.0
10	3 (1.54)	1 (0.69)	4 (1.18)	235.0	270.0	243.8	144.0	298.0	182.5
11	2 (1.03)	2 (1.39)	4 (1.18)	257.5	262.5	260.0	230.0	244.5	237.3
12	<u>1 (0.51)</u>	<u>-</u>	<u>1 (0.29)</u>	<u>275.0</u>	<u>-</u>	<u>275.0</u>	<u>283.0</u>	<u>-</u>	<u>283.0</u>
	195 (100.00)	144 (100.00)	339 (100.00)	232.1	233.4	232.7	164.8	168.6	166.4

Average Age: Males - 6.44 Years
 Females - 6.42 Years
 Combined - 6.43 Years

herring or only of this particular population would have to be determined by studying other local stocks.

In unexploited herring stocks elsewhere, older age groups compose a higher percentage when compared to exploited populations. For example, graphs number 4 and number 5 of Figure 4 illustrate the age composition differences between exploited and unexploited British Columbia herring populations. In an exploited population, the percentage of older age fish are quickly reduced and the fishery is dependent primarily on the younger age groups, i.e. the newly recruited fish. This is clearly demonstrated by the high proportion of two, three, and four-year-old fish and the reduced numbers of older age groups in the exploited British Columbia population (graph number 4). Conversely, the unexploited British Columbia population (graph number 5) is composed of a lower percentage of two, three, and four-year-old fish and a higher percentage of older age fish.

Along the Pacific Coast, there appears to be a north-south trend in the average age of herring, i.e. northern populations would be older. This tendency is demonstrated to some extent in Figure 4. These Norton Sound herring, the northern-most stock, are mainly six and seven-year-old fish. Kodiak and Southeastern Alaska populations (exploited) are composed of a higher proportion of older age groups than British Columbia herring (graph number 4). This north-south age trend varies, of course, with natural mortality and year-class strength. The trend appears more evident when comparing the two unexploited populations, Norton Sound and British Columbia (graph number 5), which represent the extreme geographic points of the north-south range. These Norton Sound herring are composed of a higher proportion of older fish than the unexploited British Columbia stock.

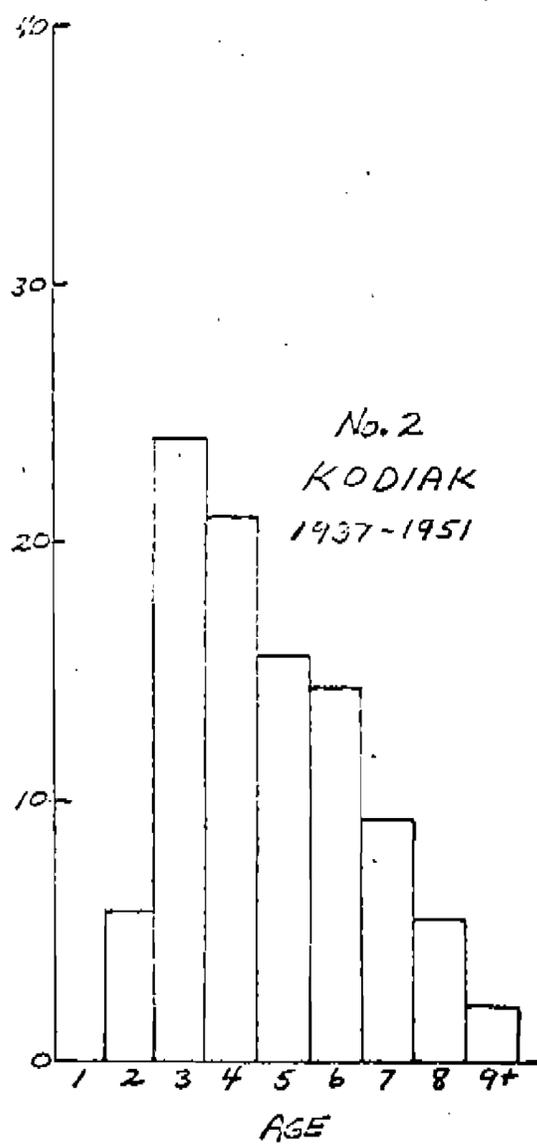
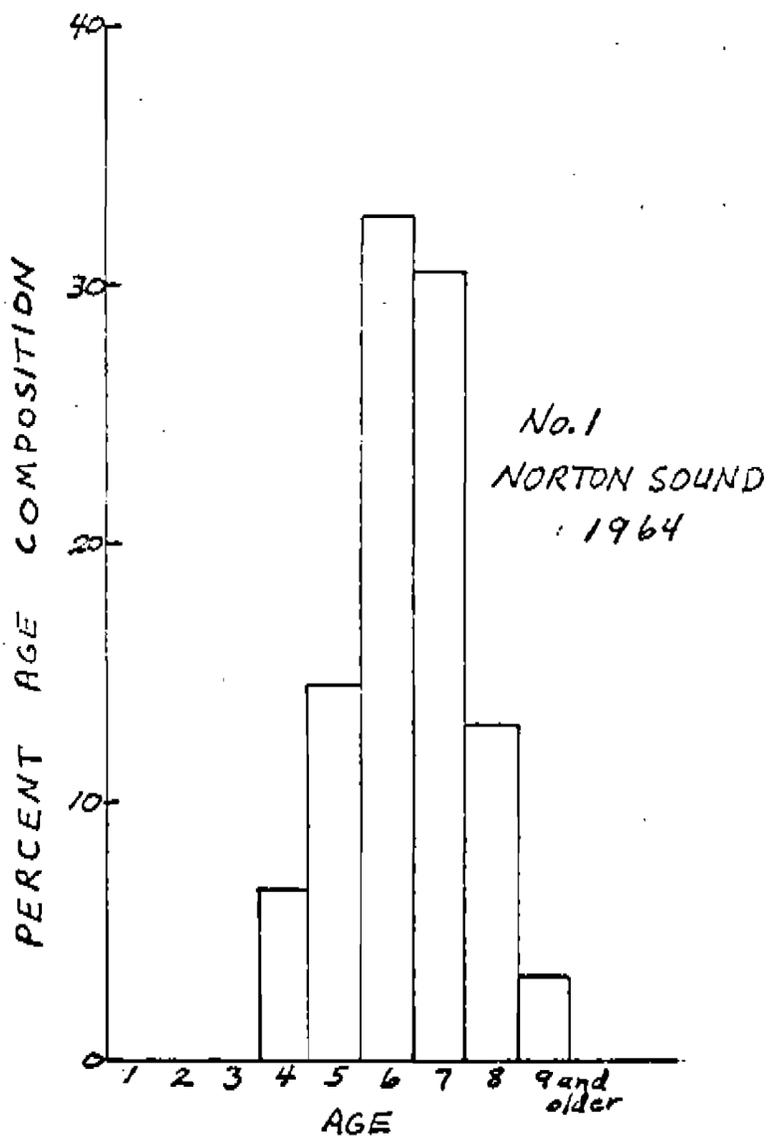
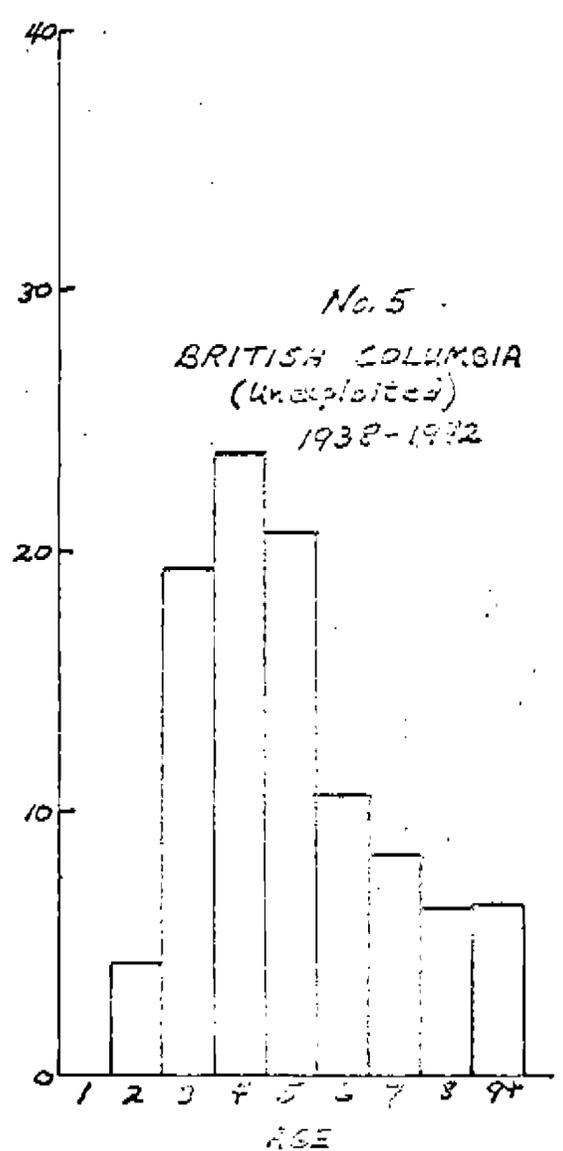
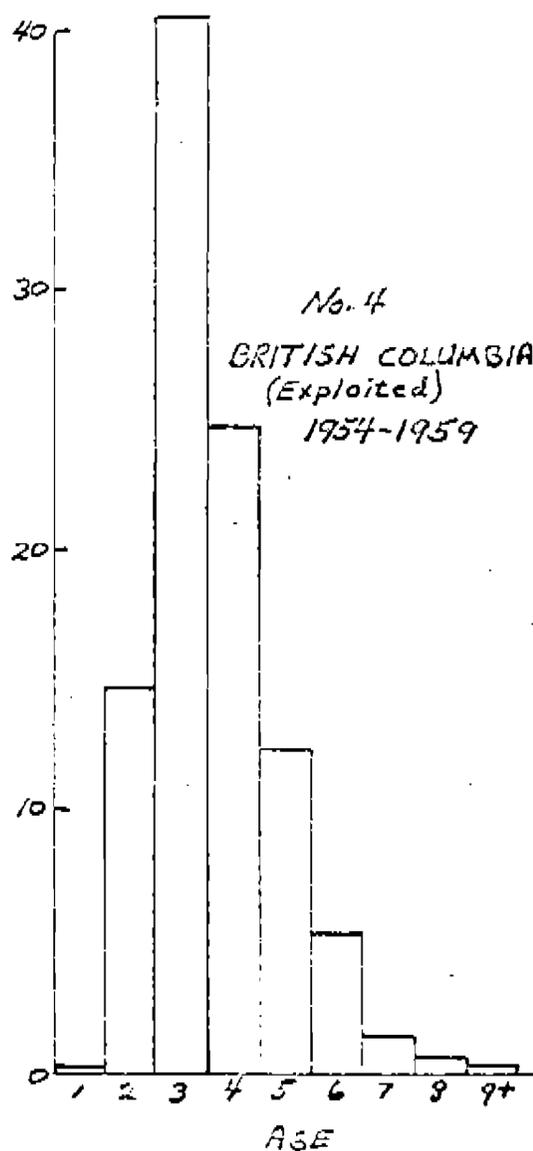
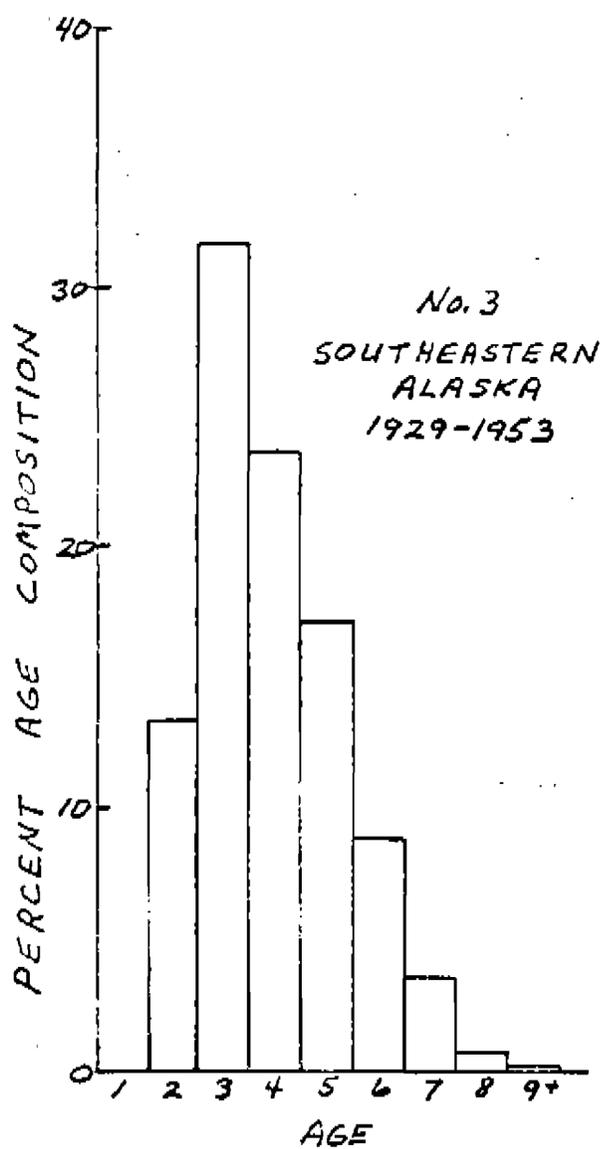


FIGURE 4
PERCENTAGE AGE
COMPOSITION OF
VARIOUS PACIFIC
HERRING
POPULATIONS



When compared to the North American populations, Norton Sound herring were found to be larger. Weights of Norton Sound herring range from 99 grams to 305 grams, while the lengths range from 195 mm to 275 mm. The average weight and length of these herring are 232.7 mm and 166.4 grams. Average weights and lengths for each age class of British Columbia and Southeastern Alaska herring, are presented for comparison with Norton Sound fish in Table 48.

Each sampled herring was examined for determination of sex. There were 144 females and 195 males or a female to male ratio of 1.00:1.35 in the sample. Since these samples were limited, it is not possible to state conclusively that the above sex ratio was representative of the entire population. The majority of other herring investigations are of post-spawning fish; therefore, the sex ratio of this Norton Sound sample could not be compared to other studies. There appears to be no significant difference in average age between sexes: Males 6.44 years) and females (6.42 years). Also variations in lengths and weights were negligible between sexes: Males (232.1 mm, 164.8 grams) and females (233.4 mm, 168.6 grams).

In the experimental commercial fishery, two types of fishing methods were employed: beach seine and gill net. It would be expected that the gill net selects a certain size range and age classes of herring. A beach seine, on the other hand, would be non-selective, i.e. all sizes and age classes would be representatively sampled. On June 19, both fishing methods were used and therefore, a comparison might be obtained. However, no definite statement regarding the selectivity of the gill net could be made because the sample size was very limited. Analysis of both catches showed no significant differences in average age, length, and weight: beach seine (5.71 years, 229.7 mm, and 153.1 grams) and gill net (5.81 years, 223.5 mm, and 154.8 grams).

TABLE 50

AVERAGE LENGTHS AND WEIGHTS OF VARIOUS
PACIFIC HERRING POPULATIONS

Age	British Columbia (1958-1959)		Norton Sound (1964)		Southeastern Alaska (1962)	
	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
1	118.2	18	-	-	-	-
2	152.6	42	-	-	167.6	37
3	179.1	75	-	-	188.3	74
4	192.2	98	208.0	115	195.6	101
5	203.9	118	226.6	150	203.2	120
6	208.7	137	230.7	159	209.0	137
7	217.3	152	235.8	175	215.3	149
8	217.8	162	244.1	195	215.7	161
9	222.7	172	250.0	216	221.5	-
10	222.2	178	243.8	183	-	-
11	239.0	-	260.0	237	-	-
12	-	-	275.0	283	-	-

YUKON RIVER KING SALMON
TAGGING STUDIES, 1963 - 1964

INTRODUCTION

A tag and recovery study of Yukon River chum salmon was initiated during the 1961 season. This project was financed by federal funds and was part of a program of emergency salmon investigations carried on by the Department under contract to the U. S. Fish and Wildlife Service. Fishwheels were used to capture salmon for tagging purposes, and although considerable numbers of chum salmon were captured, relatively few king salmon were taken.

This federally sponsored program was discontinued after the 1962 season and the Department assumed full responsibility for salmon investigations of the Yukon River. In 1963, the Department operated two tagging sites. One site, at Pilot Station, was an attempt to continue the chum salmon investigations. Three Fish and Game aides operated a single fishwheel at this site from mid-June to mid-August. Considerable numbers of king salmon were tagged at this site and so this data is included in this section. The Pilot Station site was not operated after the 1963 season.

The other tagging site was located at Flat Island on the south mouth of the Yukon River, located approximately five miles northwest of Sheldons Point. One of the advantages of this site is that it is located below most of the fishing effort. Salmon were captured with approximately 25 fathoms of set gill net with a mesh size of 8 1/2 inches (stretched measure). The Flat Island site was operated during both the 1963 and 1964 seasons.

The main objectives of these tagging studies were to determine run timing, differentiation of races, population size, and percentage utilization

by the commercial fishery of the king salmon run. These studies are also contributing much life history information as tagging site personnel periodically sample the commercial catches for age, size, sex and fecundity information. The Flat Island site is also expected to yield day to day management information regarding the effectiveness of weekly openings and closings of the fishery. During 1963 and 1964, considerable effort was expended in experimentation with fishing methods.

METHODS AND MATERIALS

Captured salmon were tagged with "spaghetti tags", consisting of 13 inch lengths of 1/16 inch diameter yellow plastic tubing. The tags were inserted with a needle applicator approximately one inch below and slightly forward of the insertion of the dorsal fin. The legend of each tag included reward information and the mailing address of the Anchorage office of the Alaska Department of Fish and Game. A one dollar reward was offered for each tag recovery. The majority of the recovered tags were obtained and paid for by Department biologists and subsistence survey crews.

When possible, the sex and fork length was recorded for every salmon tagged. Fork lengths were not recorded for king salmon tagged during 1963 at the Flat Island site. Each tagged salmon was classified as to its condition upon release. Fish classified as to Category 1 were considered in good condition, Category 2 consisted of fish of questionable condition, and Category 3 fish were considered to have been released in poor condition. Salmon that were taken from the net in very poor condition, i.e. bleeding from the gills, were not tagged. These fish were sampled for age, sex, and size information and then were given to local processors.

FINDINGS

The daily and seasonal catches of both tagging sites are presented in Table 51.

The Pilot Station fishwheel was put into operation after the king salmon run in that area had been in progress for an estimated ten days. Although missing the early segment of the run, the site was in operation during the peak of the king run. The fishwheel was fished 24 hours a day, but storms occasionally halted operation.

The gill net fished at Flat Island during 1963 was operated 24 hours a day. Analysis of catches made that year show that a majority of kings were captured at or near times of high tides. Therefore, during 1964, it was decided to operate the gill net approximately five hours prior and two hours following each high tide. This resulted in an average of seven-eight hours fished each day during 1964. There were indications that the run behaved differently in 1964 with more fish entering the river during low or outgoing tides. However, the small catch by the tagging site gear during 1964 is thought to be due largely to the fact that the king run was smaller or was exposed to fishing effort for a shorter period of time.

Sex and Size Composition of Tagged King Salmon

Flat Island: King salmon tagged at Flat Island in 1963 were predominantly males (55 percent males:45 percent females), but during the following year, females were in the majority (42 percent males:58 percent females). Males tagged in 1964 averaged 83.1 cm in fork length while females averaged 88.4 cm. Because of the relatively small sample sizes, it does not seem practical to compare sex ratios for the two years. No obvious changes in sex composition as the season progressed could be determined for either year.

TABLE 51

KING SALMON CATCHES AT YUKON RIVER
TAGGING SITES, 1963-1964

Date	Flat Island			Pilot Station					
	Number Tagged	1 9 6 3 Number Killed	Total Catch	Number Tagged	1 9 6 4 Number Killed	Total Catch	Number Tagged	1 9 6 3 Number Killed	Total Catch
June 8	10	1	11						
9	34	7	41						
10	6	0	6						
11	60	4	64						
12	87	8	95						
13	10	0	10						
14	2	0	2						
15	42	2	44						
16	55	6	61						
17	17	1	18						
18	6	1	7	1	1	2	11	2	13
19	59	9	68	9	2	11	7	15	22
20	11	5	16	38	7	45	19	2	21
21	2	0	2	45	13	58	5	2	7
22	4	0	4	18	6	24	Fishwheel did not operate		
23	14	95	109	1	2	3	Fishwheel did not operate		
24	23	2	25	0	0	0	Fishwheel did not operate		
25	2	1	3	7	0	7	4	0	4
26	18	33	51	9	3	12	49	3	52
27				11	5	16	3	0	3
28				6	13	19	6	0	6
29				0	0	0	12	0	12
30				1	0	1	4	0	4
July 1				1	0	1	8	0	8
2				1	17	18	5	0	5
3				5	0 ⁴	5 ⁹	3	0	3
4				9	4 ⁵	13 ⁹	1	0	1
5				3	0	3	1	0	1
6				3	0 ¹	3 ⁴	0	0	0
7				0	0	0	0	0	0
8				3	0	3	1	0	1
9				2	0	2	1	0	1
10				1	0	1	0	0	0
11				0	0	0	1	0	1
12				1	0	1	0	0	0
13				0	0	0	0	0	0
14				0	0	0	0	0	0
15				1	0	1	1	0	1
TOTALS:	462	175	637	175	73 ⁵	248 ⁷	142	24	166

Pilot Station: Tagged king salmon were composed of 69.7 percent males and 30.3 percent females. During the period from June 18 to June 25, females were dominant (37 percent males:63 percent females), but males dominated thereafter. In fact, during the period from June 27 to July 15, not a single female was captured. The mean fork lengths were 48.4 cm and 67.8 cm for males and females respectively.

Flat Island Versus Pilot Station: Comparison of sex and size data from the two tagging sites is considered important although data from two different years are being compared. Table 52 presents comparative sex and size data for the two tagging sites. The data indicates that the Pilot Station fishwheel was selective to fish of a smaller size when compared to the gill net catches of Flat Island. This would result in sex ratios in favor of males for Pilot Station kings. Age studies of Yukon River kings indicate that all age 3₂ and a majority of age 4₂ and 5₂ fish are composed of males. The age, sex, and size composition of the Pilot Station fishwheel catch is no doubt affected somewhat by the removal of larger and older fish by the gill net fishery, located downriver.

Recoveries of Tagged King Salmon

Flat Island: Recovery rates were similar for both 1963 and 1964. Of the total tags out, 30.7 percent and 33.1 percent were recovered in the commercial and subsistence fisheries during 1963 and 1964 respectively (see Table 52).

Table 53 compares recovery of tagged salmon according to their condition upon release. There was a relatively low recovery rate for salmon classified as Condition 3 for both years. As previously explained, these were

TABLE 52

KING SALMON TAGGING AND RECOVERY DATA
FOR YUKON RIVER TAGGING SITES, 1963-1964

	Flat Island		Pilot Station
	1963	1964	1963
Number Tagged	453	175	142
Sex Composition (Percentage Females)	45.4	58.0	30.3
Mean Fork Length (centimeters) - Males	-	83.1	48.4
Mean Fork Length (centimeters) - Females	-	88.4	67.8
Number of Recoveries	139	58	70
Percentage Recovery of Tags Out	30.7	33.1	49.3
Percentage Recovery by Gear:			
Gill Net (8 1/2" Mesh)	91.4	84.5	15.7
Gill Net (5 1/2" Mesh)	2.2	1.7	11.4
Gill Net (Mesh Unknown)	0.7	1.7	5.7
Fishwheel	0.7	10.3	55.7
Gear Unknown	5.0	1.7	11.4

TABLE 53

RECOVERY OF TAGGED KING SALMON CLASSIFIED
AS TO CONDITION, FLAT ISLAND, 1963-1964

	1 9 6 3			1 9 6 4		
	Number Tagged	Number Recovered	Percentage Recovered	Number Tagged	Number Recovered	Percentage Recovered
Condition 1	308	102	33.1	83	29	34.9
Condition 2	44	17	38.6	37	15	40.5
Condition 3	34	5	14.7	52	12	23.1
Unclassified	<u>67</u>	<u>15</u>	<u>22.4</u>	<u>3</u>	<u>2</u>	<u>66.7</u>
TOTAL:	453	139	30.7	175	58	33.1

RELATION BETWEEN TAG RECOVERIES TO COMMERCIAL KING SALMON CATCHES
FOR VARIOUS AREAS OF YUKON RIVER, 1963

Area	Number of Tag Recoveries	Commercial Catch	Ratio of Tag Recoveries To Commercial Catch
ST. 12-17 Area South Mouth: Flat Island to Sunshine Bay (0-24)	104	30,998	1:298
17-18 Aproka Pass to Anuk River (35-63)	13	22,284	1:1,714
36-42 4-7 Mountain Village to Holy Cross (71-279)	18	31,187	1:1,732

tagged fish that were considered to have been in poor condition upon release. The low recovery rates of fish of this category, 14.7 percent in 1963 and 23.1 percent in 1964, indicates a high mortality after release. Removal of Condition 3 salmon from recovery rate computations yields the adjusted rates of 33.8 percent and 36.7 percent for 1963 and 1964 respectively.

Table 52 shows the recovery rates made by various types of gear. The greatest percentage of recoveries were taken by 8 1/2 inch gill nets, 91.4 percent in 1963 and 84.5 percent in 1964.

Table 54 shows the number of recoveries made in various areas of the river for 1963 and 1964. Note that only 2.9 percent and 8.6 percent of the total recoveries were made above Holy Cross during 1963 and 1964 respectively. The following factors should be considered in evaluation of the distribution of these tag recoveries:

1. Kings captured with 8 1/2 inch gill net are less susceptible to capture by smaller meshed nets and by fishwheels. These latter types of gear are commonly used above Holy Cross.

2. Tagged fish, especially on days open to commercial fishing, were released near commercial gear. Also, some tagged fish may have milled in the Flat Island area before resuming normal upstream migration. Recovery rates would be expected to increase in these cases.

3. King salmon entering the middle and north mouths were not tagged. Therefore, fewer recoveries in relation to catch would be expected in areas upstream of the confluence of the three mouths. Table 53 also shows the relation between tag recoveries and commercial catches of king salmon for areas below and above the juncture of the three mouths. The ratio between tag recoveries and commercial catches was 1:298 for the south mouth and approximately 1:1,700 for areas upstream from the juncture of the three mouths.

TABLE 54

RECOVERIES OF TAGGED KING SALMON BY AREA
1963-1964

Area of Recovery	Mileage from Flat Island	Flat Island Tagged Kings		Pilot Station Tagged Kings
		1963	1964	1963
Below Flat Island (South Mouth)	-	11	3	
Flat Island and Vicinity	0	14	10	
South Mouth	1-11	32	6	
Alakanuk	17	13	11	
Kwiguk-Emmonak	24	11	12	
Aproka-Kwikipak Passes	30-43	17		
Fish Village to Anuk River	52-63	11	2	
Mountain Village and Vicinity	87-97	4	2	
Mouth of Andrafsky River	104	2	1	
Pilot Station and Vicinity	109-138	8	3	10
Marshall and Vicinity	149-170	2		4
Ohagamut	185	1		3
Russian Mission and Vicinity	212-226	1		6
Holy Cross	279		1	
Anvik and Vicinity	317-366			10
Kaltag	449			1
Nulato	484			5
Koyukuk	502	1		1
Ruby and Vicinity	553-581	1	2	10
Tanana and Vicinity	695			5
Rampart	763		1	2
Manley Hot Springs, Tanana River	765			1
Nenana, Tanana River	860			3
Allakaket, Koyukuk River	956		1	
Fort Yukon	1,002		1	6
Circle	1,061			2
Eagle	1,213			1
Dawson (Canada)	1,319	1		
Fort Selkirk and Vicinity (Canada)	1,439	1		
Area Unknown	-	<u>8</u>	<u>2</u>	<u>—</u>
TOTALS:		139	58	70

Pilot Station: A total of 49.3 percent of the tagged king salmon were recovered. The greatest percentage of recoveries were taken by fishwheels followed by 8 1/2 inch gill net and 5 1/2 inch gill net recoveries.

Because of the small numbers of king salmon tagged, the differences in recovery rates for the two sites are difficult to interpret. The different types of gear at each site were sampling various age, sex, and size segments of the population and may have an important bearing on the differences in recovery rates noted.

Determination of Races

Yukon River king salmon spawn in tributary streams located from 90 to over 2,000 miles upstream from the river mouth. There are spawning populations of king salmon within forty miles of Norton Sound (Bering Sea) and also within seventy-five miles of the Gulf of Alaska. It is possible, therefore, that the king salmon population is composed of different stocks or races that have developed in response to the diverse and widely separated environments of the Yukon drainage. Catch records show that there are generally two or more "peaks" in the run which may be an indication of the presence of these races. These races may differ from one another in their use of spawning grounds, time of migration, relative abundance, and productivity. Identification of these stocks would have important implications to fisheries management and especially in relation to determining the effects of the proposed Rampart Dam site.

A tag and recovery program is one possible way to identify and separate races of salmon. To date, there have been too few recoveries made in the upper reaches of the drainage to contribute much information relative to this study. With the exception of subsistence fisheries on the Tanana River,

Koyukuk River, and tributaries in Canada, there has been no practical way to recover tags on the other tributaries. During 1963, five (5) recoveries were made upstream of Mile 500 and all represent kings that were tagged during the period June 11-19 at Flat Island. There were two distinct peaks in the run that entered the south mouth, on June 12 and from June 22 to 24. This scant information suggests that the king salmon run that originates in the upper reaches of the drainage migrate during the first portion of the run.

There were thirty-one (31) recoveries of Pilot Station tagged kings made above Mile 500 in 1963. No pattern could be determined by comparing the area of recovery and tagging dates with the possible exception of Tanana River recoveries. Of the four recoveries made in the Tanana River, all were king salmon tagged at Pilot Station on June 26.

The 1964 run, as previously discussed, was late and of short duration. Since the run in 1964 was atypical and few kings were tagged, further discussion of this run will not be attempted in this analysis.

Migration Rates

Table 55 presents the migration rates (miles traveled per day) for recoveries in various areas of the river for king salmon tagged during 1963 and 1964. Average rates of travel for kings tagged at both sites and recovered above Mile 500 ranged between twenty-one to twenty-five miles a day. A few individual kings traveled an average of thirty or more miles a day.

Migration rates calculated from these upstream recoveries are thought to more nearly represent the actual rate of travel than rates calculated for recoveries made below Mile 500. Tagged fish may be released in a weakened or a disoriented condition, and in some cases, tagged salmon have been recovered considerable distances below the tagging site. Salmon in this

TABLE 55

MIGRATION RATES OF TAGGED KING SALMON, 1963-1964

Recovery Area	Flat Island (Mile 0)						Pilot Station (Mile 122)		
	Number of Recoveries	1 9 6 3 Migration Rates $\frac{1}{\text{day}}$		Number of Recoveries	1 9 6 4 Migration Rates $\frac{1}{\text{day}}$		Number of Recoveries	1 9 6 3 Migration Rates $\frac{1}{\text{day}}$	
Range		Average	Range		Average	Range		Average	
Alakanuk to Anuk River	50	5-35	11	23	2-24	6	-	-	-
Mountain Village to Koyukuk	13	3-42	10	5	8-15	10	24	3-36	14
Upstream from Koyukuk	3	18-22	21	5	19-31	25	29	11-60	22
ALL AREAS	66	3-42	14	33	2-31	16	53	3-60	20

1/ Miles traveled per day.

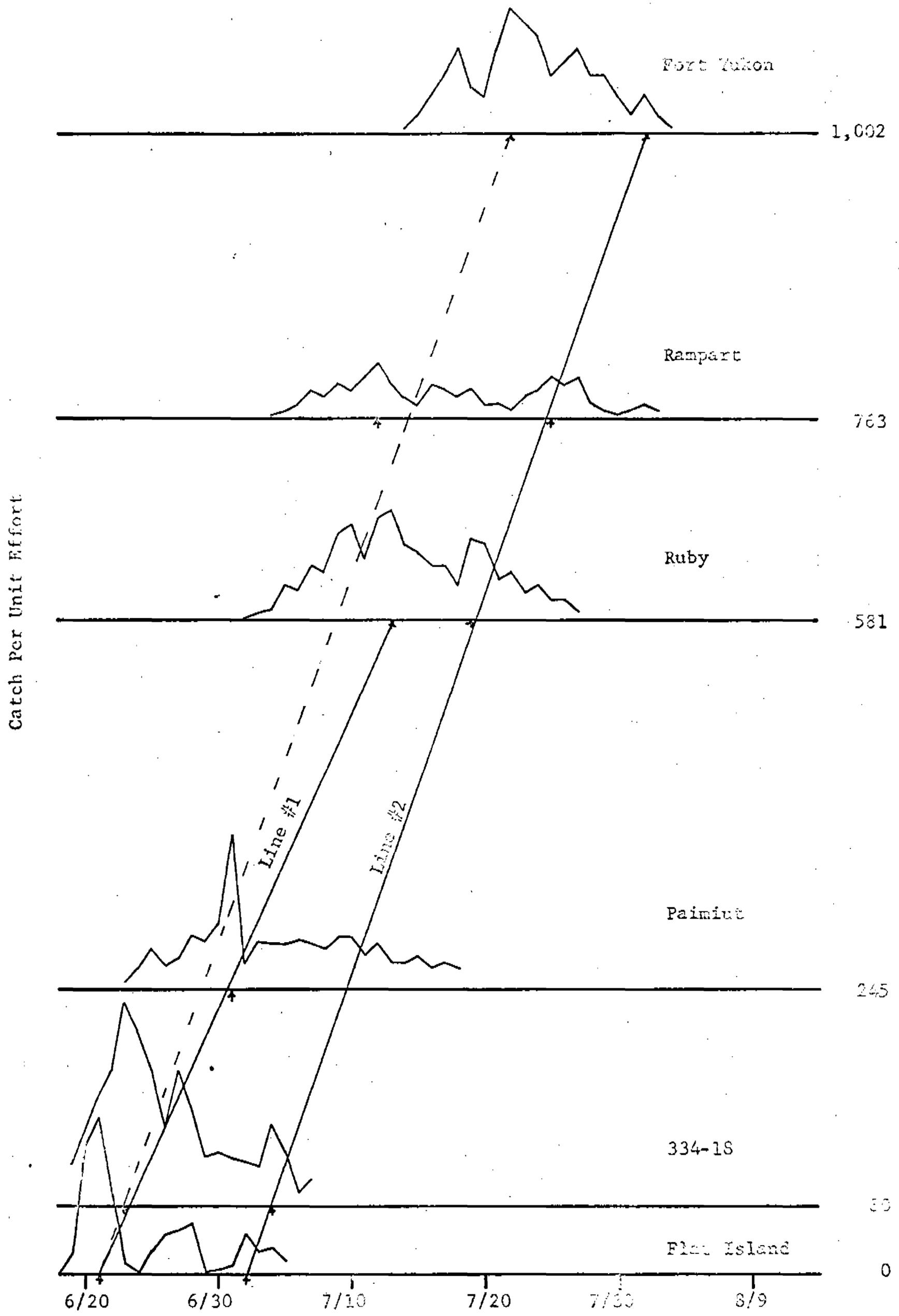
condition would be expected to travel at slower rates of speed than normal. The percentage of error in calculations of normal rates of travel is, in most cases, greater over the smaller the distance traveled before recovery was made. It could not be determined if the rate of travel increases as the run progresses upriver. Migration rates calculated from tag and recovery studies should be considered minimum figures. The following section discusses another method of determining migration rates which are thought to be more realistic.

R U N T I M I N G - Y U K O N K I N G S A L M O N

1 9 6 4

Figure 5 shows the daily catch per unit of effort for fishermen in various areas of the Yukon River drainage. The Flat Island (south mouth) catch was taken with gill nets operated by Department tagging crews. Catches from statistical area 334-18 were made by commercial fishermen in the area from Fish Village to the Anuk River. Catches from Paimiut, Ruby, Rampart, and Fort Yukon were obtained from catch calendars that were submitted by subsistence fishermen. Each village or fishing location is positioned according to its relative distance upstream from Flat Island (Mile 0). Peak catches are designated by arrows (↑). Finally, lines have been plotted from the x axes to connect the peak catches of each fishing location. These lines indicate the average migration rates for various segments of the king salmon run.

Subsistence fishing effort and efficiency may vary from day to day. Consequently, dates of peak catches were assigned on the basis of a general trend of increasing and then decreasing catches over a period of several



Miles Upriver from Flat Island

FIGURE 5 1964 KING SALMON CATCHES AT VARIOUS POINTS, YUKON RIVER

days. Rampart's subsistence catches do not show distinct peaks when compared to other villages probably because a large portion of the total catch was sold to commercial processors.

An approximate straight line can be fitted to the June 20 peak at Flat Island and peak catches as far upriver as Ruby (see Line number 1 in Figure 5). The slope of this line indicates the average migration rate for this segment of the run was twenty-five miles a day. Projection of this line does not fit the earlier peak catches made at Rampart and Fort Yukon. The dotted line, shown for comparative purposes, connects peak catches made at Fort Yukon, statistical area 334-18 and Flat Island. The slope of this line indicates a migration rate of approximately thirty miles a day. The much smaller peak in catches made at Flat Island on July 2 can be traced with a straight line as far upriver as Rampart or perhaps Fort Yukon. The slope of this line indicates an average migration rate of thirty-two miles a day for this segment of the run.

This study is very similar to the 1963 study in that the first or early peak at the mouth can be followed upstream only as far as Ruby or Tanana. Dates of peak catches in areas upstream from Ruby in 1964 were approximately six days earlier than that predicted by extending line number 1 in Figure 5.

There are at least three possible reasons why the run timing in areas upstream from the confluence of the Tanana and Yukon Rivers is different from that of downstream areas:

1. The rate of migration increases as the run progresses upriver. This trait has been noted in studies of salmon runs in other systems, but has not been fully studied in relation to Yukon River salmon. Only ten days separate the peak catches made at Ruby and Fort Yukon which indicates a migration rate of forty-two miles a day for this segment of the run.

2. Each village is fishing different stocks of king salmon. This may be a result of salmon entering spawning tributaries which are located between villages. For example, the peak catches made in Ruby on July 13 may have been mainly taken from king salmon stocks bound for the Tanana River and other tributaries located between Ruby and Rampart or Fort Yukon. The segment of the run that produced the peak catches at Fort Yukon may have passed through the village of Ruby prior to July 13 (see dotted line in the figure). It is also possible that each stock or segment of the run may differ in its rate of travel and accessibility to fishermen.

3. There is the remote possibility that an early segment of the run passed through the lower and middle Yukon areas prior to or during breakup when there was no fishing effort. This would account for the early catches made at Fort Yukon and Rampart. Apparently this has happened occasionally in the past, but there is no evidence to support this theory in regard to the 1964 run.

It is likely that an increase in migration rate and the fishing of different stocks both influence run timing to some extent.

The Canadian Department of Fisheries reported that king salmon were counted through the fish facility at Whitehorse Rapids Dam (Mile 1,754) from August 13 through August 29; the peak of the run occurred from August 19 through August 22. This peak occurred sixty-two days later than the June 20 peak at Flat Island which indicates that this segment of the run traveled approximately twenty-eight miles a day.

Based on dates of first arrival and peak catches, the 1964 run was seven to thirteen days late in arriving to various areas of the Yukon River drainage when compared to 1963. The above analysis indicates that king salmon travel an average of approximately thirty miles a day although their rate of travel is probably less in the lower Yukon and more in the upper Yukon areas.

B E A U F O R T S E A S S T U D I E S

1 9 6 4

A seismic exploration company was given permission by the Alaska Department of Fish and Game to conduct an aquatic seismic exploration program (Permit Number A-Y-K 64-105) in the Beaufort Sea between the Colville River and the Canning River from July 15, 1964 to September 15, 1964. Seismic operations were also conducted in the lower Colville River.

A Fish and Game observer was required to monitor seismic operations and it was his job to determine the extent of fish kill after each detonation (twenty-five pounds of nitro-carbo-nitrate). The observer, if necessary, could restrict or modify the seismic operation in order to prevent excessive fish kill.

There is little utilization of the fish stocks in this region. Subsistence fishing is negligible and commercial fishing of whitefish is conducted by one family that resides on the lower Colville River.

Fish specimens were collected and preserved in formalin for later identification. Monofilament gill nets were also fished in order to obtain a more representative sample of the Beaufort Sea fish population.

Shown on Table 56 is a list giving the scientific name, common name, and remarks for each species collected.

There were no substantial numbers of fish killed. A total of 678 shot points were detonated with an observable kill of 1.3 fish per shot point. Greater numbers of fish were killed in the Colville River where an average of 5.0 fish were observed killed per shot point.

TABLE 56

LIST OF FISHES COLLECTED IN THE BEAUFORT SEA AREA, 1964

Scientific Name	Common Name	Remarks
<u>Liopsetta glacialis</u> (Pallas)	Arctic Flounder	Few taken by gill nets - Beaufort Sea
<u>Myoxocephalus quadricornia</u> (Linnaeus)	Fourhorn Sculpin	Taken by gill nets - Estuaries of small streams
<u>Coregonus nasus</u> (Pallas)	Broadnose Whitefish	Common in fish kills - Beaufort Sea & Colville River
<u>Coregonus sardinella</u> Valenciennes	Least Cisco	Common in fish kills - Beaufort Sea & Colville River
<u>Coregonus autumnalis</u> (Pallas)	Arctic Cisco	Common in fish kills - Beaufort Sea & Colville River
<u>Coregonus pidschian</u> (Gmelin) and/or <u>Coregonus clupeaformis</u> (Mitchill)	"Humpback" variety of Whitefish	Common in fish kills - Beaufort Sea & Colville River
<u>Catostomus catostomus</u> (Forester)	Longnose Sucker	Few observed in fish kills - Colville River
<u>Salvelinus alpinus</u> (Linnaeus)	Arctic Char	Taken by gill net - Near Spy Islands
<u>Lota lota</u> (Linnaeus)	Burbot	A few in fish kills - Beaufort Sea & Colville River
<u>Theragra chalcogrammus</u> (Pallas) <i>Abol!</i>	Whiting Cod	One specimen - From Beaufort Sea fish kill

*Unidentified below to be
Gadus aeglefinus (Pallas)*

RECOVERIES OF ARCTIC - YUKON - KUSKOKWIM
AREA CHUM SALMON TAGGED AT SEA
1956 - 1964

INTRODUCTION

In this section, a brief summary will be presented of the high seas tagging recoveries of Arctic-Yukon-Kuskokwim Area chum salmon for the years 1956 to 1964. Information regarding A-Y-K chum recoveries has been compiled from publications ^{1/} of the International North Pacific Fisheries Commission which has been responsible for conducting high seas research on Asian and North American salmon. The objectives of the I.N.P.F.C. are to study the distribution, abundance, movements, timing, and area of origin of salmon in the North Pacific Ocean. In 1956, the United States and Japan began conducting high seas tagging operations primarily in the central and eastern Aleutian Islands area and the western North Pacific Ocean respectively. In recent years, the United States has also been tagging in the Gulf of Alaska. Canada, the third member nation of the I.N.P.F.C., began tagging in 1961 mainly in the Gulf of Alaska. Salmon have been captured for tagging by mostly purse seines and longlines with some catches being made by gill nets.

The following general analysis of the high seas tagging data has been made in regard to the A-Y-K Area and its management districts: Kuskokwim, Yukon, Norton Sound, and Kotzebue. Only the North American returns of chums

^{1/} Some data was obtained from a separate study conducted by the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service in 1961: Thorsteinson, Fredrik V. and Merrell, Theodore R. Jr., 1961. "Salmon tagging experiments along the south shore of Unimak Island and the southwestern shore of the Alaska Peninsula", U.S.F.W.S., Special Scientific Report, Fisheries No. 486

were evaluated in this summary and the proportion of these recoveries that were A-Y-K fish. Table 57 lists the total North American recoveries by year and the number and percentage of these that are A-Y-K Area returns; also shown is the breakdown of the A-Y-K Area returns into districts by number and percentage. Figure 6 is a map illustrating recovery distribution of A-Y-K chums tagged at sea from 1956 to 1964. Both the above table and figure include mature and immature (a very small minority) chum recoveries.

DISCUSSION

As shown by Table 57, a chief feature of the North American recoveries of tagged chum salmon is that a large percentage of these are A-Y-K Area fish. This percentage ranged from 20.00 percent in 1961 to 75.00 percent in 1958. For all years (1956 to 1964), the average is 36.35 percent. Tagging operations were sampling a large proportion of North American chum salmon that were bound for the A-Y-K Area. This sampling of a relatively high percentage of A-Y-K fish can be attributed primarily to the following:

1. Chum salmon of A-Y-K origin are predominant in various areas of the high seas during certain time periods.
2. Most of the A-Y-K chums recoveries have been from United States tagging operations which have concentrated their efforts in the central Aleutian area (165° W to 170° W) during May, June, and July. According to I.N.P.F.C. biologists, chum salmon bound for the Bering Sea coast (A-Y-K Area and Bristol Bay) are present in the mid-Aleutian area from the latter half of May to early July.
3. Also during June 15 to July 14 of 1961, the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, conducted a tagging operation off-shore of Unimak Island and the southwestern shore of the Alaska Peninsula. A

TABLE 57

HIGH SEAS TAGGING RECOVERIES OF ARCTIC-YUKON-KUSKOKWIM AREA CHUM SALMON
1956-1964

Year of Recovery	North American Recoveries	A-Y-K Recoveries No. (% North American)	Yukon River No. (% A-Y-K)	Kuskokwim River No. (% A-Y-K)	Norton Sound No. (% A-Y-K)	Kotzebue Sound No. (% A-Y-K)
1956	42	26 (61.95%)	13 (50.00%)	11 (42.30%)	1 (3.85%)	1 (3.85%)
1957	7	3 (42.86%)	1 (33.33%)	1 (33.33%)	1 (33.33%)	-
1958	4	3 (75.00%)	3 (100.00%)	-	-	-
1959	17	12 (70.59%)	8 (66.67%)	2 (16.67%)	1 (8.33%)	1 (8.33%)
1960	73	46 (63.01%)	24 (52.17%)	8 (17.39%)	2 (4.35%)	12 (26.09%)
1961	175	35 (20.00%)	18 (51.43%)	9 (25.71%)	5 (14.28%)	3 (8.57%)
1962	161	56 (34.78%)	36 (64.29%)	8 (14.28%)	8 (14.28%)	4 (7.14%)
1963	51	15 (29.42%)	14 (93.33%)	1 (6.67%)	-	-
1964 ^{1/}	<u>34</u> ³⁵	<u>9 (26.47%)</u>	<u>6 (66.67%)</u>	<u>3 (33.33%)</u>	<u>-</u>	<u>-</u>
TOTALS:	564	205 (36.35%)	123 (60.00%)	43 (20.98%)	18 (8.78%)	21 (10.24%)

^{1/} As of October 31, 1964.

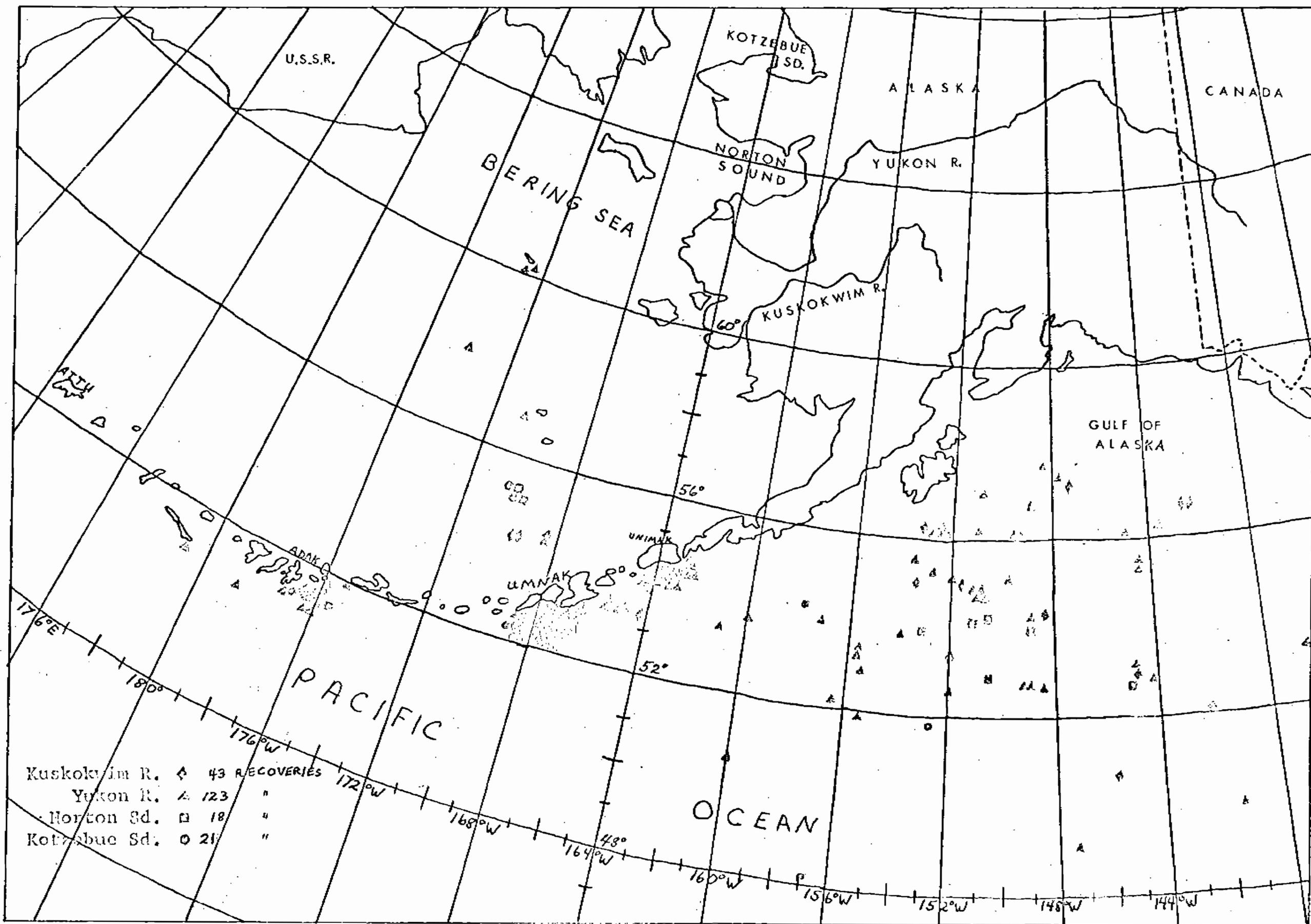


FIGURE 6 DISTRIBUTION OF RECOVERIES OF ARCTIC-YUKON-KUSKOKWIM AREA CHUM SALMON TAGGED AT SEA, 1956-1964

majority of the tagged chum salmon was recovered in the A-Y-K Area and Bristol Bay.

4. During 1962 and 1963, the majority of North American chum recoveries from Canadian tagging operations in April and May was from Bering Sea coast stocks. As mentioned before, Canada has been tagging only in the Gulf of Alaska. One of the recent findings of the I.N.P.F.C., based on high seas tagging studies, is that chum salmon destined for the Bering Sea coast appear to be concentrated in the central and westward areas of the Gulf of Alaska during April and May.

Also these high seas tagging studies reveal some insight in the general migration pattern of A-Y-K chum stocks. As noted above, the A-Y-K chums show the following movements:

1. Central and westward portion of the Gulf of Alaska - April and May.
2. Mid-Aleutian area - latter half of May to early July.

Other tagging studies by the United States in 1958 and Japan in 1960 and 1961 provided further evidence on the movements of the A-Y-K chum salmon. Japanese tagging in the southern Bering Sea showed A-Y-K chums to be present during the latter half of June. Tagging by the United States in mid-June of 1958 demonstrated the presence of A-Y-K chums in the Northern Bering Sea. Although these tagging efforts were limited in comparison to the operations in the Gulf of Alaska and Aleutian areas, the information obtained from these recoveries indicates generally when A-Y-K chums were passing through the Bering Sea. Overall then, a generalized picture of the movements of A-Y-K chums can be obtained by noting when the fish were tagged in the Gulf of Alaska, mid-Aleutian area, and the Bering Sea.

An inspection of the map (Figure 6) shows the extent of the movements of A-Y-K chum salmon based on the high seas tagging studies. (About 45 Kuskokwim

and Yukon River fish tagged south of Umnak Island could not be shown due to space limitations.) The chums ranged as far west as $179^{\circ}09'$ E to as far east as $138^{\circ}08'$ W and as far south as $44^{\circ}47'$ N to as far north as $60^{\circ}15'$ N (approximate). It is interesting to note that the above four recoveries, representing the extreme known ranges of A-Y-K chums, were from the Yukon River. Most of the A-Y-K recoveries were from the Yukon River (60.00 percent) followed in order by Kuskokwim River (20.98 percent), Kotzébue Sound (10.24 percent), and Norton Sound (8.78 percent).

A P P E N D I X

TABLE A-1

AGE COMPOSITION OF FISHWHEEL CAUGHT KING SALMON
 SAMPLED BY U. S. FISH AND WILDLIFE SERVICE
 JUNE 30 - AUGUST 6, 1962, MILE 724, YUKON RIVER

Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Percentage	Number	Percentage	Number	Percentage
3 ₂	6	1.1	-	-	6	1.1
4 ₂	189	33.9	14	2.5	203	36.4
5 ₂	135	24.2	88	15.7	223	39.9
5 ₃	9	1.6	-	-	9	1.6
6 ₂	26	4.7	55	9.9	81	14.6
6 ₃	7	1.3	6	1.1	13	2.4
7 ₂	2	.4	11	2.0	13	2.4
7 ₃	4	.7	4	.7	8	1.4
8 ₂	-	-	-	-	-	-
8 ₃	-	-	<u>1</u>	<u>.2</u>	<u>1</u>	<u>.2</u>
TOTAL:	378	67.9	179	32.1	557	100.0

TABLE A-2

SNOUT LENGTHS OF FISHWHEEL CAUGHT KING SALMON
 SAMPLED BY U. S. FISH AND WILDLIFE SERVICE
 JUNE 30 - AUGUST 6, 1962, MILE 724, YUKON RIVER

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Length	Number	Mean Length	Number	Mean Length
3 ₂	6	41.4	-	-	6	41.4
4 ₂	189	57.6	14	59.4	203	57.7
5 ₂	135	70.9	88	74.2	223	72.2
5 ₃	9	57.9	-	-	9	57.9
6 ₂	26	89.1	55	78.8	81	82.0
6 ₃	7	70.9	6	80.8	13	75.5
7 ₂	2	94.0	11	95.8	13	95.5
7 ₃	4	81.5	4	91.3	8	86.4
8 ₂	-	-	-	-	-	-
8 ₃	-	-	1	92.0	1	92.0

TABLE A-3

AGE COMPOSITION OF FISHWHEEL CAUGHT KING SALMON
 SAMPLED DURING JULY 17 - AUGUST 7, 1964
 AT WOODCHOPPER, MILE 1,155, YUKON RIVER

Age Class	M A L E S		F E M A L E S		C O M B I N E D S E X E S	
	Number	Percentage	Number	Percentage	Number	Percentage
3 ₂	2	3.3	-	-	2	3.3
4 ₂	9	14.8	-	-	9	14.8
5 ₂	32	52.4	-	-	32	52.4
5 ₃	Not found in sample.					
6 ₂	6	9.8	2	3.3	8	13.1
6 ₃	5	8.2	-	-	5	8.2
7 ₂	4	6.6	1	1.6	5	8.2
7 ₃	Not found in sample.					
8 ₂	Not found in sample.					
8 ₃	Not found in sample.					
	—	—	—	—	—	—
TOTAL:	58	95.1	3	4.9	61	100.0

TABLE A-4

LENGTHS AND WEIGHTS OF FISHWHEEL CAUGHT KING SALMON
 SAMPLED DURING JULY 17 - AUGUST 7, 1964
 AT WOODCHOPPER, MILE 1,155, YUKON RIVER

Mean Orbit Length in Centimeters

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Length	Number	Mean Length	Number	Mean Length
3 ₂	2	43.5	-	-	2	43.5
4 ₂	9	56.8	-	-	9	56.8
5 ₂	32	64.9	-	-	32	64.9
5 ₃	Not found in sample.					
6 ₂	6	77.0	2	87.0	8	79.5
6 ₃	5	66.2	-	-	5	66.2
7 ₂	4	91.8	1	101.0	5	93.6
7 ₃	Not found in sample.					
8 ₂	Not found in sample.					
8 ₃	Not found in sample.					

Mean Weight in Pounds

Age Class	M A L E S		F E M A L E S		COMBINED SEXES	
	Number	Mean Weight	Number	Mean Weight	Number	Mean Weight
3 ₂	2	2.5	-	-	2	2.5
4 ₂	9	5.3	-	-	9	5.3
5 ₂	32	8.0	-	-	32	8.0
5 ₃	Not found in sample.					
6 ₂	6	14.6	2	18.1	8	15.5
6 ₃	5	8.6	-	-	5	8.6
7 ₂	4	22.7	1	33.4	5	24.8
7 ₃	Not found in sample.					
8 ₂	Not found in sample.					
8 ₃	Not found in sample.					